Record Of Updates

UPDATE NUMBER	DATE ENTERED
66	Sep 18, 1999
67	Sep 18, 1999
68	Sep 18, 1999
69	Sep 18, 1999
70	Sep 18, 1999
71	Sep 18, 1999
72	Sep 18, 1999
73	Sep 18, 1999
74	Sep 18, 1999
75	Sep 18, 1999
76	Sep 18, 1999
77	Sep 18, 1999
78	Sep 18, 1999
79	Sep 18, 1999
80	Sep 18, 1999
81	Sep 18, 1999
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List of Effective Pages
(Note: Updates are not included in this list)

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Transmittal Letter for Update Number 69

1. **General:** This letter transmits Update Number 69 to the Canard Pusher Digest For The Long-EZ. Update Number 69 updates the Digest with pertinent information from Canard Pusher Newsletter Number 69. The criteria for determining whether information from CP69 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 2, Bill of Materials
   Chapter 9, Main Gear/Landing Brake
   Chapter 10, Canard
   Chapter 13, Nose and Nose Gear
   Chapter 18, Canopy
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 20, Winglets/Rudders
   Chapter 21, Strakes - Fuel/Baggage
   Chapter 22, Electrical System
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 31, Optional Special Performance Canard Plans
   Supplemental Chapter 35, Builder Support
   Supplemental Chapter 39, Accidents/Incidents
   Supplemental Chapter 41, Additional Reading

3. CP69 includes a listing of all mandatory grounds for all Rutan aircraft. I was asked by RAF to develop the list for the Long-EZ, and the Digest was used as the reference. In this Update, I did not distribute each entry given in the mandatory ground listing into each applicable Digest chapter as I normally do with the usual type of articles from the CP's. That is because the information is contained in the Digest chapters already - that is where the information came from in the first place! I have, however, reprinted the listing as a whole in this Update. I suggest you keep it with this Letter of Transmittal.

4. In developing the mandatory ground listing for RAF, I discovered a minor error in the 2nd Edition of the Digest: CP62-7 included a Mandatory/Ground plans change that should have been listed in the "Long-EZ Plans Changes" section of Supplemental Chapter 30. Instead, it was placed in the "Exhaust System/Heat Muff/Turbochargers" section of Supplemental Chapter 30. The plans change is regarding mandatory inspection of the exhaust system whenever the cowls are removed. This plans change is located at the top of Digest Chapter 30, Page 51. Please make a note in your "Long-EZ Plans Changes" section of Supplemental Chapter 30 to refer to Chapter 30, Page 51 for this Mandatory/Ground. Again, this only applies to those of you holding the 2nd Edition of the Digest. How can you tell which one you have? The very first page of the 2nd Edition is a cover page, and in the lower right corner of the page is printed "2ND EDITION".

5. **Instructions:**

a. Place this Letter of Transmittal (along with the listing of Mandatory Grounds) behind the Letter of Transmittal for Update 68.

b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

d. **Don't forget to check the updates during the building process!**

6. **Questions?** Drop me a line or give me a call.

Stet Elliott
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(213) 499-5253 (Work)

****From CP69-5,6&7 (Keep with Update 69 Letter of Transmittal)****

THE FOLLOWING IS A LIST OF MANDATORY GROUND CHANGES FOR RUTAN DESIGNED AIRCRAFT. PLEASE NOTE THAT THERE ARE ALSO MANDATORY CHANGES WITHIN A GIVEN NUMBER OF HOURS THAT ARE NOT INCLUDED AS WELL AS MANY HUNDREDS OF SIGNIFICANT CHANGES THAT AFFECT THE SAFETY AND FLIGHT QUALITIES OF THE AIRCRAFT. WE HIGHLY RECOMMEND THAT YOU REVIEW ALL PLANS CHANGES TO INSURE THE SAFEST FLYING PLANE POSSIBLE.

LONG-EZ MANDATORY GROUND PLANS CHANGES

CHAPTER 9, MAIN GEAR/LANDING BRAKE

CP30-8
LPC #75
Ensure a minimum of 1/16" clearance between gear strut and brake caliper.

CP48-5
LPC #127
A mandatory inspection of your nylon brake lines is required before next flight. If these brake lines have been directly exposed to radiating heat from the brake discs, or to sunlight (UV) they must be replaced.

CHAPTER 11, ELEVATORS

CP57-8
MAN GRD
Inspect or certify that elevators meet specifications in regard to weight, stiffness and shape.

CP66-9
MAN INSPECTION
Inspect elevator torque tubes for corrosion.

CHAPTER 13, NOSE AND NOSE GEAR

CP30-9
LPC #86, MAN/10HRS
Reinforcement of top tab welded to the rudder pedal.

CHAPTER 14, CENTERSECTION SPAR

CP28-9
LPC #56, MAN GRD
Long-EZ spar cap thickness

CHAPTER 16, Control System

CP49-6
LPC #131 MAN-GRD
Substitution of 4130 steel or stainless for aluminum roll and yaw control components in cowling area. Use Ocean Intumescent fireproof coating.

CHAPTER 19, WINGS, AILERONS/WING ATTACH

CP28-9
LPC #56, MAN GRD
Long-EZ spar cap thickness

CP30-9
LPC #81
Rodend attachment to CS 132L belhorn.

CP47-7
LPC #126, MAN
Vortilons on each main wing are mandatory.

CP58-10
MAN-GRD
Replace aileron belhorns within next 25 hours. Rebalance vibrating ailerons.

CHAPTER 21, STRAKES - FUEL/BAGGAGE

CP24-6
LCP #4, DES, Chap 7 & 21
See Safe-T-Poxy recommendation below for fuel areas.
The interior fuel tank layup and fuselage side layup should be done using only Safe-T-Poxy.

CP65-7
MAN/GND
Mandatory inspection of polyurethane fuel and vent lines.
Mandatory inspection of throttle/mixture springs.

LONG-EZ SECTION VI, LANDING BRAKE PLANS

CP29-7
LCP #65, MAN GRD
Modification of LB9 to allow it to collapse in a crash without piercing the seat bulkhead.

CP68-6
MAN GRD
Modify the LB-9 bracket and install a plywood doubler on forward face of front seat bulkhead.

SECTION IIL, LYCOMING O-235 ENGINE INSTALLATION

CP24-6
LCP #1, MAN GRD
Safetying Bendix fuel pump bottom cap.

CP31-5
LCP #94, MAN GRD, 25 HOUR
Replacement of aluminum fittings with steel.

CP49-6
LCP #131, MAN GRD
Inspection of all fuel system plumbing and components for approved fireproof components. Use fireproof sleeves on all hose components.

CP51-7
LCP #132, MAN-GRD
Inspection of engine mixture control system.

CP62-7
MAN GRD
Inspect exhaust system every time cowl is removed or every 50 hours.

CP65-7
MAN/GRD
Mandatory inspection of polyurethane fuel and vent lines.
Mandatory inspection within next 10 hours of throttle/mixture springs.

OPTIONAL SPECIAL PERFORMANCE CANARD PLANS

CP57-8
MAN GRD
Inspect or certify that elevators meet specifications in regard to weight, stiffness and shape.

CP66-9
MAN INSPECTION
Inspect elevator torque tubes for corrosion.

LONG-EZ OWNER'S MANUAL

CP26-6
LPC #41, MAN GRD
Added pressure range for 6 ply tires.

CP36-6
LPC #115, MAN-GRD
Long-EZ may spin when at or aft of aft CG limit.

CP37-4
LPC #116, MAN GRD
Aft CG limit moved from 104 to 103.
(This plans change was made mandatory in CP 39.)

CP49-6
LPC #130, MAN GRD
Clear idling engine every 15 seconds or so on approach. Always fly final with speed brake extended.

CP57-7
MAN GRD
Placard aircraft with notice that amateur built aircraft are more likely to have an accident.

CP63-10
MAN GRD
Always fuel aircraft in level attitude when needing full fuel tanks.

RUTAN AIRCRAFT WOULD LIKE TO THANK STET ELLIOTT AND BILL GREER FOR THEIR HELP IN PUTTING TOGETHER THIS NEWSLETTER. THEIR DIGESTS ARE INVALUABLE.

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Transmittal Letter for Update Number 70

1. **General:** This letter transmits Update Number 70 to the Canard Pusher Digest For The Long-EZ. Update Number 70 updates the Digest with pertinent information from Canard Pusher Newsletter Number 70. The criteria for determining whether information from CP70 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 3, Education
   Chapter 9, Main Gear/Landing Brake
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 20, Winglets/Rudders
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 32, Optional High Performance Rudders
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents

3. A reminder - As mentioned in paragraph 5.c of the Digest Letter of Introduction, identical advertisements that have been replicated from one CP to the next are not included in the Digest or Updates. I do ensure that at least one of each of these advertisements is included. I omit these duplicative ads to keep your Digests from becoming cluttered with unnecessary information. I mention this now because the more recent CP's contain more ads and less information of substance than those of a year or so ago. So if you are wondering why the Updates are getting thinner, that's the reason.

4. I've mentioned before the advantage of a linking arm prong binder to hold the Digest. I didn't realize until recently how difficult these binders are to find. The only manufacturer I know of that produces these binders is the McBee Loose Leaf Binder Corp. While they prefer to deal in bulk purchases, I've found that they can be persuaded to sell to individuals. Call them at 800-888-0823, or 213-660-8511, and ask for Item Number 315. You'll get a 3" binder that absolutely will not pop open (even if dropped). The design makes entering updates a breeze, and it will end ripped out pages forever. Specify white(01) or black(02). They come with a clear overlay on the front, back and spine to make labeling a snap. At $15.90 (plus shipping) they're certainly not cheap, but if you're building a Long-EZ you're accustomed to shelling out big bucks, so what's a little more??

5. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 69.

b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

d. **Don't forget to check the updates during the building process!**

6. **Questions?** Drop me a line or give me a call.

Stet Elliott
5322 W. Melric Dr.
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Transmittal Letter for Update Number 71

1. **General:** This letter transmits Update Number 71 to the Canard Pusher Digest For The Long-EZ. Update Number 71 updates the Digest with pertinent information from Canard Pusher Newsletter Number 71. The criteria for determining whether information from CP71 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 2, Bill of Materials
   Chapter 3, Education
   Chapter 10, Canard
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 20, Winglets/Rudders
   Chapter 25, Finishing
   Supplemental Chapter 31, Optional Special Performance Canard Plans
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 35, Builder Support
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents

3. A reminder - As mentioned in paragraph 5.c of the Digest Letter of Introduction, identical advertisements that have been replicated from one CP to the next are not included in the Digest or Updates. I do ensure that at least one of each of these advertisements is included. I omit these duplicative ads to keep your Digests from becoming cluttered with unnecessary information. I mention this now because the more recent CP's contain more ads and less information of substance than those of a year or so ago. So if you are wondering why the Updates are getting thinner, that's the reason.

4. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 70.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

   d. **Don't forget to check the updates during the building process!**

5 **Questions?** Drop me a line or give me a call.

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Transmittal Letter for Update Number 72

1. **General:** This letter transmits Update Number 72 to the Canard Pusher Digest For The Long-EZ. Update Number 72 updates the Digest with pertinent information from Canard Pusher Newsletter Number 72. The criteria for determining whether information from CP72 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

Chapter 2, Bill of Materials
Chapter 3, Education
Chapter 25, Finishing
Supplemental Chapter 29, Long-EZ Section VI, Landing Brake Plans
Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
Supplemental Chapter 33, Long-EZ Owner's Manual
Supplemental Chapter 35, Builder Support
Supplemental Chapter 38, Maintenance and Inspections

3. A reminder - As mentioned in paragraph 5.c of the Digest Letter of Introduction, identical advertisements that have been replicated from one CP to the next are not included in the Digest or Updates. I do ensure that at least one of each of these advertisements is included. I omit these duplicative ads to keep your Digests from becoming cluttered with unnecessary information. I mention this now because the more recent CP's contain more ads and less information of substance than those of a year or so ago. So if you are wondering why the Updates are getting thinner, that's the reason.

4. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 71.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

   d. **Don't forget to check the updates during the building process!**

5 **Questions?** Drop me a line or give me a call.

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-4156 (Home)
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Transmittal Letter for Update Number 73

1. **General:** This letter transmits Update Number 73 to the Canard Pusher Digest For The Long-EZ. Update Number 73 updates the Digest with pertinent information from Canard Pusher Newsletter Number 73. The criteria for determining whether information from CP73 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 9, Main Gear/Landing Brake
   Chapter 16, Control System
   Chapter 18, Canopy
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 20, Winglets/Rudders
   Chapter 22, Electrical System
   Chapter 24, Covers/Fairings/Consoles
   Chapter 26, Upholstery
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 35, Builder Support
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents
   Supplemental Chapter 41, Additional Reading

3. A reminder - As mentioned in paragraph 5 and 9 of the Digest Letter of Introduction, some articles given in the Canard Pusher Newsletters have been omitted from the Digest and the subsequent Updates. Review these paragraphs for the type of information omitted. I know that some of you are relying on my Update service exclusively and have let your subscriptions to the CP newsletter lapse. I don't think that is a good idea. While I try to provide in the Updates all information critical to building and flying a Long-EZ, there is alot of interesting information in the newsletters that I don't provide. As an example, advertisements for "one each" items that individuals are offering for sale are not included in the Digest or Updates. There were several items in CP73 offered for sale (such as cowlings, wheel pants, carb, King and Edo Aire Nav-com's, ect.) that you would not know about if you didn't receive the CP newsletters. At $14.00 per year the newsletters are a pretty good deal and I strongly encourage those not currently receiving the CP newsletters to subscribe. For those of you who don't have RAF's address, it is:

   Rutan Aircraft Factory, Inc.
   Building 13 - Airport
   Mojave, CA 93501
   805-824-2645

4. I discovered a minor omission in both the 1st and 2nd edition of the Digest. CP48-3 provides a method for gluing sandpaper to your sanding blocks. I placed this article in Chapter 3, Education, as per the Digest Letter of Introduction. However, since much of the sanding is done during the finishing stages, the article should also be included in Chapter 25, Finishing. Please make a note on the first page of Chapter 25 of your Digest that this article can be found in Chapter 3. A minor error to be sure, but it took me a frustrating 10 minutes to find the article as I needed the information for my own project!

5. **Instructions:**

a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 72.

b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

d. **Don't forget to check the updates during the building process!**

6 **Questions?** Drop me a line or give me a call.

Stet Elliott
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Transmittal Letter for Update Number 74

1. **General:** This letter transmits Update Number 74 to the Canard Pusher Digest For The Long-EZ. Update Number 74 updates the Digest with pertinent information from Canard Pusher Newsletter Number 74. The criteria for determining whether information from CP74 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 2, Bill of Materials
   Chapter 3, Education
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 20, Winglets/Rudders
   Chapter 22, Electrical System
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 35, Builder Support
   Supplemental Chapter 37, Long-EZ General
   Supplemental Chapter 38, Maintenance and Inspections

3. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 73.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

   d. **Don't forget to check the updates during the building process!**

4. **Questions?** Drop me a line or give me a call.

Stet Elliott
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Transmittal Letter for Update Number 75

1. **General:** This letter transmits Update Number 75 to the Canard Pusher Digest For The Long-EZ. Update Number 75 updates the Digest with pertinent information from Canard Pusher Newsletter Number 75. The criteria for determining whether information from CP75 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

Chapter 2, Bill of Materials
Chapter 3, Education
Chapter 13, Nose and Nose Gear
Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
Supplemental Chapter 38, Maintenance and Inspections
Supplemental Chapter 39, Accidents/Incidents

3. **Instructions:**

a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 74.

b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

d. **Don't forget to check the updates during the building process!**

4. **Questions?** Drop me a line or give me a call.

Stet Elliott
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Transmittal Letter for Update Number 76

1. **General:** This letter transmits Update Number 76 to the Canard Pusher Digest For The Long-EZ. Update Number 76 updates the Digest with pertinent information from Canard Pusher Newsletter Number 76. The criteria for determining whether information from CP76 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

Chapter 2, Bill of Materials
Chapter 3, Education
Chapter 9, Main Gear/Landing Brake
Chapter 13, Nose and Nose Gear
Chapter 21, Strakes - Fuel/Baggage
Chapter 22, Electrical System
Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
Supplemental Chapter 33, Long-EZ Owner's Manual
Supplemental Chapter 35, Builder Support
Supplemental Chapter 36, Builder Modifications
Supplemental Chapter 37, Long-EZ General
Supplemental Chapter 38, Maintenance and Inspections
Supplemental Chapter 39, Accidents/Incidents

3. **Instructions:**

a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 75.

b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

d. **Don't forget to check the updates during the building process!**

4. I had an opportunity to speak with Joan Richey a few weeks ago. As most of you know, she's the person that types the CP Newsletters, answers the phone (when you don't get a recording) and generally handles the administration for Rutan Aircraft Factory (what's left of it). In our conversation she confirmed that RAF is continuing to sell supplemental plans for their aircraft designs. Of course, RAF stopped selling basic airframe plans back in 1985. But the supplemental plans such as Engine Installation, Special Performance Canard, High Performance Rudders, and Flush Rudder Belhorns are still available through

RAF. Thought I'd throw this tidbit in the Update. I've had a few new builders and potential builders call me with this question, and now we know the answer with certainty.

5. **Please note my change of home and work numbers given below.** My work number changed because I've been transferred to another unit (Coast Guard) in my area. I'm pretty well guaranteed another 4 years in this area, so I'm no longer sweating a geographic relocation and the hassle of moving the pieces-parts of my Long-EZ project across the country (for the third time)! I hope to have her finished in another year or so, (but I've been saying that for 3 years).... I changed my home number (now unlisted) because I became tired of having 5 calls a day from companies trying to sell me a new mortgage on my house - aggravating, isn't it??

6. If you have any questions about the Digest, please don't hesitate to drop me a line or give me a call. In addition, if you are a builder working off of a second-hand set of plans (and therefore can't call RAF for support), and you also don't have someone locally to help with questions, feel free to call. In no way do I profess to be an expert, especially since I have yet to complete my project. But I do have access to many accomplished builders whose judgement I trust, and who are willing to help out with builder questions. I'm sure I can put you in touch with someone who can help.

Stet Elliott
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Transmittal Letter for Update Number 77

1. **General:** This letter transmits Update Number 77 to the Canard Pusher Digest For The Long-EZ. Update Number 77 updates the Digest with pertinent information from Canard Pusher Newsletter Number 77, published by Rutan Aircraft Factory in January 1994. The criteria for determining whether information from CP77 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 2, Bill of Materials
   Chapter 3, Education
   Chapter 9, Main Gear/Landing Brake
   Chapter 25, Finishing
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 35, Builder Support
   Supplemental Chapter 38, Maintenance and Inspections

3. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 76.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

   d. **Don't forget to check the updates during the building process!**

4. Most of you are probably now aware that RAF didn't publish an October CP. This is the first time since RAF's inception (almost 20 years ago!) that they missed a quarterly newsletter. See their explanation given in Chapter 35 of this Update. Since they countinued with the sequential numbering of the CP's (i.e. didn't skip a number) all subscriptions to the CP, and my Update service, won't be affected. You'll still get the same number of CP's and Updates you paid for.

5. If you have any questions about the Digest or Updates, please don't hesitate to drop me a line or give me a call.

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(310) 514-6460, (Work)

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Transmittal Letter for Update Number 78

1. **General:** This letter transmits Update Number 78 to the Canard Pusher Digest For The Long-EZ. Update Number 78 updates the Digest with pertinent information from Canard Pusher Newsletter Number 78, published by Rutan Aircraft Factory for April & July 1994. The criteria for determining whether information from CP78 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 9, Main Gear/Landing Brake
   Chapter 13, Nose and Nose Gear
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 20, Winglets/Rudders
   Chapter 21, Strakes - Fuel/Baggage
   Chapter 22, Electrical System
   Chapter 25, Finishing
   Supplemental Chapter 29, Long-EZ Section VI, Landing Brake Plans
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents

3. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 77.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

   d. **Don't forget to check the updates during the building process!**

4. If you have any questions about the Digest or Updates, please don't hesitate to drop me a line or give me a call.

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Transmittal Letter
for
Update Number 79

1. **General:** This letter transmits Update Number 79 to the Canard Pusher Digest For The Long-EZ. Update Number 79 updates the Digest with pertinent information from Canard Pusher Newsletter Number 79, published by Rutan Aircraft Factory October 1994. The criteria for determining whether information from CP79 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 9, Main Gear/Landing Brake
   Chapter 16, Control System
   Chapter 21, Strakes - Fuel/Baggage
   Chapter 22, Electrical System
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents

3. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 78.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this update has been entered into the Digest.

   d. **Don't forget to check the updates during the building process!**

4. If you have any questions about the Digest or Updates, please don't hesitate to drop me a line or give me a call.

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-8233 (Home)
(310) 514-6460, (Work)

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Transmittal Letter for Update Number 80

1. **General:** This letter transmits Update Number 80 to the Canard Pusher Digest For The Long-EZ. Update Number 80 updates the Digest with pertinent information from Canard Pusher Newsletter Number 80, published by Rutan Aircraft Factory in January 1995. The criteria for determining whether information from CP80 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 10, Canard
   Chapter 16, Control System
   Chapter 19, Wings, Ailerons/Wing Attach
   Chapter 21, Strakes - Fuel/Baggage
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 31, Optional Special Performance Canard Plans
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 35, Builder Support
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents
   Supplemental Chapter 41, Additional Reading

3. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 79.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this Update has been entered into the Digest.

   d. **Don't forget to check the Updates during the building process!**

4. If you have any questions about the Digest or Updates, please don't hesitate to drop me a line or give me a call.

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Transmittal Letter for Update Number 81 April and July 1995

1. **General:** This letter transmits Update Number 81 to the Canard Pusher Digest For The Long-EZ. Update Number 81 updates the Digest with pertinent information from Canard Pusher Newsletter Number 81, published by Rutan Aircraft Factory for April and July 1995. The criteria for determining whether information from CP81 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

   Chapter 8, Roll Over/Seat Belts
   Chapter 13, Nose and Nose Gear
   Chapter 21, Strakes - Fuel/Baggage
   Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
   Supplemental Chapter 33, Long-EZ Owner's Manual
   Supplemental Chapter 38, Maintenance and Inspections
   Supplemental Chapter 39, Accidents/Incidents
   Supplemental Chapter 41, Additional Reading

3. **Instructions:**

   a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 80.

   b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

   c. Annotate the Record of Updates page to reflect the fact that this Update has been entered into the Digest.

   d. **Don't forget to check the Updates during the building process!**

4. If you have any questions about the Digest or Updates, please don't hesitate to drop me a line, send me an Internet Email message, or give me a call.

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Transmittal Letter for Update Number 82 October 1995

1. **General:** This letter transmits Update Number 82 to the Canard Pusher Digest For The Long-EZ. Update Number 82 updates the Digest with pertinent information from Canard Pusher Newsletter Number 82, published by Rutan Aircraft Factory in October 1995. The criteria for determining whether information from CP82 would be included in this Update is the same criteria used to compile the Digest. For a review of this criteria, see paragraph 5 of the Digest Letter of Introduction.

2. **Summary of the Update:** This Update contains information to update the following:

Chapter 3, Education
Chapter 10, Canard
Chapter 16, Control System
Chapter 18, Canopy
Chapter 19, Wings, Ailerons/Wing Attach
Chapter 20, Winglets/Rudders
Supplemental Chapter 29, Long-EZ Section VI, Landing Brake Plans
Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation
Supplemental Chapter 31, Optional Special Performance Canard Plans
Supplemental Chapter 32, Optional High Performance Rudders
Supplemental Chapter 33, Long-EZ Owner's Manual
Supplemental Chapter 35, Builder Support
Supplemental Chapter 36, Builder Modifications
Supplemental Chapter 37, Long-EZ General
Supplemental Chapter 38, Maintenance and Inspections
Supplemental Chapter 39, Accidents/Incidents

3. I have to apologize for the delay in getting this Update to you! Much has happened over the last 2 months that has kept me from preparing the Update. The Christmas holidays found the U.S. Coast Guard going through a major streamlining effort, and the elimination of 800 positions service-wide. My position has been eliminated in Long Beach, CA, and I was informed I was being transferred to Topeka KS! Not wanting to truck my Long-EZ project across the country for yet the third time, I threw all my holiday efforts into finishing the project before my projected rotation date. For over a month I practically killed myself trying to make significant progress, putting 8 hours per day on the plane after work, and 18 hours per day on days off. Thankfully, the service (bless it's heart!) recently decided to leave me in the area for one more year, so I've been able to slow down my building tempo a little. Nevertheless, I'm seeing the light at the end of the tunnel, and hope to have her flying by summer. With tremendous relief, I have nearly all of the dry micro contouring behind me now, and with the exception of the left wing, the structure is finished through primer. My O-320D2J is hung, all avionics and instruments have been purchased, and I'm looking forward with relish to electrical system and avionics installation.

4. **Alas, this will be the last Update I will prepare for you.** While Digest sales were strong, I needed to continue to prepare Updates so that I could include them with the sale of new Digests. But now there are only 14 of you on regular subscription, and I no longer sell sufficient copies of the Digest to warrant continuing the Update service. All of you are receiving the CP's direct from RAF, right!? If not, you really need to subscribe. That will be the only way you can get the information you need to finish your projects. See Chapter 35 of this Update for subscription rates and such.

5. Although preparing the Updates on a quarterly basis has often been difficult with my busy schedule, this project has given me the opportunity to interact with the greatest people in the world - Long-EZ builders! I have met and talked with many of you, and I greatly value the friendships I have made through this project over the years. Please continue to keep in touch!

6. Within the next month or so I'll send checks to all of you for the balance of your subscriptions.

7. **Instructions:**

a. Place this Letter of Transmittal behind the Letter of Transmittal for Update 81.

b. Place the enclosed chapter updates at the beginning of the appropriate Digest Chapter. Place them behind any previous chapter updates if they exist, or behind the Chapter Table of Contents if that chapter has no previous chapter updates.

c. Annotate the Record of Updates page to reflect the fact that this Update has been entered into the Digest.

d. **Don't forget to check the Updates during the building process!**

8. If you have any questions about the Digest or Updates, please don't hesitate to drop me a line, send me an Internet Email message, or give me a call.

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Chapter 1, Description/Introduction

From CP24-3 (CH1,CH37)

LONG-EZ UPDATE

(See also Long-EZ flyer, "Which one?" and "Sun-'n-Fun" in this issue, and CP #23).
Long-EZ plans are now available!!
The major benefits of the Long-EZ over the VariEze are listed below:

(1) Lower (65 kts) landing approach speed, can touch down at 50 kts with full aft stick.
(2) Better visibility for takeoff, approach and landing.
(3) Higher roll rate, lighter and more responsive ailerons.
(4) Stiffer elevator forces, more solid feel in pitch.
(5) Increased useful load, cabin size and instrument panel space.
(6) More baggage area. Cabin-accessible area in wing strakes.
(7) 60% more range and less runway required.
(8) Better high-altitude performance.
(9) Better maneuverability, yet more docile for low proficiency pilots.
(10) Greater stall margin.
(11) Ability to use 100 to 118 hp engines without nose ballast.
(12) Ability to use lighting, alternator and starter.
(13) Ability to use 500 x 5 tires.
(14) Improved structural materials.
(15) Improved structural methods and easier jigging.
(16) Overlap, incidence - adjustable wing attach (no wing fittings).
(17) Improved trim, electrical, and fuel systems.

The major benefits of the VariEze over the Long-EZ are listed below:

(1) Lower cost - materials are approximately $500 less due to smaller size and cheaper type foam.
(2) Ability to use the A75, A80 and C85 engines.
(3) Easier to trailer (Long-EZ must be tilted to meet the 8 ft width requirement).
(4) Faster to build (Long-EZ requires about 15% more work).

Note that there is only a minor difference in speed. Our Long-EZ outran half the VariEzes in the Sun-'n-Fun race.

The adjacent photos show Johnny Murphy of Cape Canaveral with his Long-EZ. This is the #2 ship, started last year. Johnny's project was built from the plans before they went to the printer, thus he provided assistance in debugging the plans. The Long-EZ plans are layed-out and detailed very clearly and completely. They are drawn based on our experience providing support for over 2000 VariEze builders. Thus, we expect far fewer changes and building problems than with the VariEze.

The Long-EZ design has taken advantage of the numerous improvements noted based on over 250 EZ first flights. Testing has been more extensive. When the VariEze plans first went to print in 1976 the prototype had 100 hours flying in 4 months and had been flown by about 6 pilots. Long-EZ prototype has over 250 hours flying in 10 months and has been flown by 25 pilots (front seat).

Our original plan of a addendum rather than a new set of plans was foolish, since even the unchanged canard and elevators were redrawn to improve their clarity and to eliminate common builder errors. The Long-EZ plans Section I include finishing instructions and complete electrical system drawings. Section IV is required and IIA or IIC are needed for engine installation. The Long-EZ Section I includes all updates for these Sections. Thus, Long-EZ builders do not need newsletters previous to CP #24.

The fact that the Long-EZ plans are completely new rather than an addendum eliminates the confusion of plans editing. However, some of you have purchased VariEze plans with the intent to build a Long-EZ when the addendum was published. Thus, we are providing a plans trade-in program so those people can get credit toward the Long-EZ plans. If you bought a VariEze Section I from RAF after July 15, 1979 with the intent to build a Long-EZ, contact RAF for terms for trading them for the Long-EZ plans.

We are just now finishing the Long-EZ Owners Manual. It should be printed and available by the end of May.

From CP24-12 (CH1,CH37)

WHICH ONE?

Rutan Aircraft Factory Inc., markets homebuilt plans for three different aircraft - The VariViggen, VariEze and Long-EZ. All three are two-place. The following information is intended to help you decide which is best for you.

PERFORMANCE AND UTILITY

The Long-EZ is the best in this category with range, altitude capability and performance way above the other two. Operation from high density-altitude airports at heavy weights is also best with the Long. The Long-EZ has the highest ceiling - a demonstrated 26,900 at light weights! Takeoff and landing distance of the Long is better than the VariEze and roughly similar to the VariViggen. Neither of the three are suited to unprepared fields, soft surfaces, gravel or small airports (less than 2000 ft, or 2400 ft with obstacles). Only the Long and Viggen are capable of night or IFR flying and only when properly equipped and flown by pilots with appropriate competence.

EFFICIENCY

The VariEze has the best miles per gallon, the Long coming in a close second and the VariViggen last. MPG at 75% power for the three are 35, 29, and 16 respectively.

CABIN/BAGGAGE

All three airplanes are soloed from front seat only. The VariViggen has two, similar, large, spacious cockpits with relatively upright seating. Large enough for 6 ft-5 in pilots. Two or three average-size normal suitcases fit the large baggage area aft of the rear seat. The cabin size and baggage room is much larger than the VariEze or the Long.

The VariEze and Long have two cockpits that are not similar. The front seat allows stretch-out comfort for pilots up to 6 ft-5 in, with carefully engineered thigh, lumbar, armrest and head support. The VariEze and the Long-EZ front seats are better suited to long-range comfort than the VariViggen seats. However, the VariEze and Long-EZ rear seats are smaller and less comfortable than the VariViggen. They can fit a 6 ft-4 in person, but comfort is compromised above 5 ft-10 in.

The Long-EZ baggage areas include two special suitcases, two cabin-accessible wing strake areas and additional room over the rear seat and in the wing spar. Total volume is nearly 10 cubic feet, however soft-type luggage must be used. Normal, hard suitcases do not fit. The VariEze has baggage room limited to the two special suitcases, approximately 3 cubic feet.

The VariViggen has center control sticks, rudder pedals and throttle in both cockpits, arranged much like a modern fighter. Conventional toe brakes are used. The VariEze and Long-EZ have side-stick controllers in both cockpits, but rudder pedals and engine controls only in front. Their rudder pedals work the two rudders independently and actuate the wheel brakes after full rudder is reached, i.e., one simple pedal for rudder and wheel brake.

CONSTRUCTION

None of the three require special skills or elaborate tools, since prefab parts are available for complex components. The VariViggen is by far the most demanding to build for several reasons: retractable landing gear, electric aileron reflex controls, full dual cockpit controls add a considerable number of parts to build. The mix of wood and composite structure requires different skills and tools. Control system includes many parts. Total building time can run from 3000 to 4000 hours, approximately 3 to 5 years of spare time effort.

The VariEze has been built by homebuilders in as little as 550 man hours and 4 months. However, projects on the average run closer to 900 to 1200 man-hours and 1 to 1.5 years spare time. The Long-EZ requires about 10 to 20 percent more work than a VariEze.

Any of the composite work (complete Long-EZ, VariEze and VariViggen outer wings) requires a clean shop that is controlled to a temperature range of 70 to 90 degrees and that allows work without direct sunlight on the part being built. Minimum shop size for Viggen, Long and VariEze is 400, 300, and 250 sq. ft. respectively.

ENGINE SIZE

The VariViggen, designed for the 273 lb 150 hp Lycoming is limited to the 150, 160, and 180 hp Lycoming engines. The lightweight, fatigue-free fixed pitch wooden props must be used. Heavy metal props make it (and the VariEze and Long) tailheavy, and increase risk of prop failure. Use of the 180 hp or injected 160 hp Lycomings on a VariViggen will result in a requirement to carry nose-ballast.

The Long-EZ is limited to the Lycoming O-235 (108 to 125 hp) and Continental O-200 (100 hp) with any accessories. The Lycoming is preferred, since it has a fuel pump and longer overhaul life.

The VariEze is intended for the lightweight Continental A75 and A80 engines. The C-85, C-90 and O-200 can be adapted, but they must be stripped of accessories to avoid an overweight, tailheavy airplane.

STALL CHARACTERISTICS

All three aircraft are designed to be "stall proof", i.e., they can safety maneuver up to, and including, full-aft-stick without experiencing a stall break, departure, or loss of altitude. They can all climb at the full-aft-stick speed, Long-EZ being the best (900 ft/mn at gross), Viggen the least at about 400 ft/mn. Homebuilder experience has shown that most VariEzes have excellent stall characteristics but a few experience wing rocking and roll-off at the stall. This is not expected with any of the Long-EZs, since they were designed with a greater margin of stall for the rear wing. Our prototype Long has proved to have exceptionally docile high angle attack characteristics, resisting departure for any maneuvers including tailslide stall entries, and application of all combinations of rudder and aileron. The VariViggen also has a good stall margin, with its standard wing configuration, however, with its special performance-wing its stall margin is low, resulting in more conventional characteristics, i.e., at minimum speed the S.P. wing will drop if the pilot sideslips.

MANEUVERABILITY
The VariViggen excels here, with its high roll rate and tight turning capability. However, due to its low aspect ratio, the Viggen looses speed in maneuvering. Thus, for sustained maneuvering, the Long is the best - it can climb over 400 ft per minute while maintaining 2-g at gross weight! The VariEze has the lowest roll rate. All three types are noted for their good maneuverability, as compared to conventional aircraft.

PILOT SKILL REQUIRED
The VariEze's high approach and landing speeds and responsive controls put more demands on pilot proficiency than the Viggen or Long-EZ. The Viggen has a relatively large trim change with power application. (nose up when power is reduced), requiring pilots attention. The VariEze and Long-EZ have very small trim changes for power, gear extension and landing brake extension. A VariEze or Long-EZ can fly for extended periods with "hands-off" controls. A Viggen must be continually flown. For those reasons the Long is the most docile, easiest for fly, and safest for the low-proficiency pilot.

Crosswinds - due to its responsive roll rate, high available sideslip and wide landing gear, the Viggen can handle the most crosswind. Takeoff and landing in wind components well above the capabilities of conventional airplanes are relatively easy. The Long-EZ is next, capable of handling a 20-knot component. Due to lower roll rate and lower wing tip clearance, the VariEze is last for crosswinds.

VISIBILITY
In order of preference - Viggen, Long and VariEze.

COST
Refer to the respective sheets for a breakdown of costs to build each airplane.

From CP64-3 (CH1,CH39)
CAUTION
How do you know what you are getting when you buy a complete, or even a partially complete, composite aircraft?

RAF gets this question more often than we care to relate. It's a tough question and we honestly don't know the answer. Perhaps the most logical approach would be to look at one with plenty of hours on it. At least, the structure is proven. The other thing to look at is the structural weight. Beware of an unusually lightweight EZ (might have some lay-ups missing, also, watch out for an excessively heavy airplane. It will probably fail at a lower "G" than a normal weight EZ).

We recently heard of a nasty accident in a VariEze that really drives home the point we are trying to make here.

The buyer purchased a structurally complete VariEze. Most of the contouring was done but not the engine installation or the wiring/instrumentation. This person spent a couple of years of hard work and lots of dollars until he was finally ready to try out his new bird. On the first high speed taxi run, with the nose wheel off the ground, he started to get it light on the main tires when suddenly the left wing folded. The right wing was lifting quite strongly and, without the left wing to balance the lift, the airplane abruptly rolled over and left the runway. It slid to a stop inverted, and although the damage to the airplane was fairly minimal, the pilot was seriously injured and spent several months in the hospital recovering.

Close examination of the wing attach area disclosed the fact that the wing fitting attach screws had never been installed! Since the micro used to contour the wings was already installed, the buyer had no way of knowing. This is just one way you could get in trouble when you buy a composite homebuilt. RAF has always been a strong advocate for build-it-yourself. If you want an airplane, build it yourself. Follow the plans as closely as you can. Have your friends or fellow EAA chapter members look at it over your shoulder as often as possible. Be conscientious and accept only your very best workmanship.

There are currently somewhere between 1200 and 2000 Rutan designs flying. By far, the majority fly well and safely because their builders took care to build their creations as perfectly as they were capable of doing. By all means, build it yourself, but if you decide to buy one, keep this true story in mind, you cannot be too careful.

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Table of Contents for Chapter 2, Bill of Materials

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Update Number 66 to Chapter 2, Bill of Materials

****From CP66-3&4 (CH2,CH21,CH30,CH38)****
CAUTION
Check that what you order is what you get! Plastic fuel lines must be checked - often.

"Just re-read an article in the *Canard Pusher* about fuel lines in VariEzes. These "original call-out" urethane, flexible fuel lines have been reported to deteriorate over time and should be carefully inspected and replaced periodically. Unless the material for these fuel lines is the correct material, deterioration can be very rapid. Visually examining plastic tubing when it arrives from the supplier may not tell the builder/flyer that it is, in fact, the correct material. Even when the correct material is used, deterioration can occur and be invisible to all but an extremely thorough examination. Here is my experience:

Recently, I brought my VariEze home on a trailer and had it in the carport, nose down. It had been sitting there for quite some time awaiting my attention. When I finally got around to it and opened the canopy, I smelled fuel but could find no sign of liquid fuel. Later, I was checking fuel lines under the rear seat by squeezing them with my fingers to determine hardness or brittleness when the header tank fuel line fell off in my hand! This was the source of the fuel smell. With the nose down, fuel had slowly leaked behind the rear seat bulkhead and into the rear cockpit. All of the other fuel lines were discolored to a dark brown but still felt pliable. In removing them from the fitting, to my horror, they easily split and crumbled.

I had always assumed that deterioration would occur in low spots in the fuel lines where water may collect. These failures, however, were up high at the aluminum fittings. They had been installed in July of 1983 and flown for a total of 750 hours, so they were seven year old. I have used auto fuel, regular, when at home and 100LL Avgas when traveling. Lately, regular auto fuel is no longer available locally so I have been using auto unleaded (no alcohol). I have, on occasions, used Marvel Mystery oil as a fuel additive and, many years ago, I used TCP.

I believe that VariEze fuel lines should be changed at least every three years and great care should be taken to order the correct material. Also, make sure you receive the correct material. As a further safeguard, cut a few small pieces of the new fuel line and submerge some in a bottle of gasoline and some in a bottle of acetone. I check these samples from time to time for any obvious signs of deterioration.

Byron McKean"

Editors comment: Thanks for your report, Byron. We agree wholeheartedly with the suggestion to change plastic fuel lines at least every three years. Also, we have found that buying polyurethane-type tubing from a supplier like McMaster Carr (locations in Chicago, Los Angeles and New Brunswick, NJ) will get you a receipt that spells out part numbers. For example, according to McMaster Carr's catalog, Tygon tubing comes in at least two material types, one called out for fuel and lubricants, another for food and beverage! Each material has its own part number. Tygothane, the material originally called out in the VariEze plans, is recommended for fuels and lubricants. Using McMaster Carr, at least you have the verification of the part number on the receipt. We highly recommend this company as a source of an unbelievable variety of materials, tools, etc. Their catalog is an awesome tome!

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Update Number 68 to Chapter 2, Bill of Materials

From CP68-5 (CH2)

LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
pre-cut wing &winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
P.O. Box 781
Boonville, CA 95415
707-895-2718

From CP68-5 (CH2)

RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
P.O. Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

Feather Lite
P.O. Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

These suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

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Update Number 75 to Chapter 2, Bill of Materials

****From CP75-1 (CH2,CH3)****
CORRECTION
The telephone number given in Canard Pusher 74 for OSHA in Washington, DC was incorrect. The OSHA operator phone number is 202-219-8148. However, callers can save time (and money) by calling the publications office, direct, at 202-219-4667.

****From CP75-11 (CH2,CH3)****
SOME OBSERVATIONS ON THE PTM&W EPOXY SYSTEM
RAF has already received a few complaints about the newly recommended replacement for Hexcel's Safety-Poxy. Now hear this, People: When RAF learned that Safety-Poxy contained an unacceptable level of MDA, a known carcinogen, we immediately began testing various epoxy systems. The goals were as follows: 1) Must contain no known carcinogen. 2) Must have as good, or better, performance characteristics. 3) Should contain no styrene (causes allergies).

Close to 100 different epoxies have been looked at and, at this pint in time, the only system meeting all goals is PTM&W. In some ways, PTM&W is a little less desirable. It is more viscous and it takes more effort to wet out the glass. We have found that it works well when using a squeegee, but not quite as well when stippling with a brush. However, the PTM&W epoxy is as strong and slightly exceeds the "T_G" or heat distortion point of Safety-Poxy.

It is not perfect. Unfortunately, we live in an imperfect world but, the facts are that you do have a choice. Safety-Poxy will be available for the foreseeable future and no one is holding a gun to your head. If you prefer to use Safety-Poxy, that is your prerogative. RAF does not recommend using Safety-Poxy. If, for your own reasons, you must use Safety-Poxy, protect yourself from skin contact (wear protective clothing, gloves, etc.). Also, wear a respirator.

In spite of the workability of PTM&W being a little different, we are using it and getting used to it. We strongly recommend that you use it, too.

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Update Number 76 to Chapter 2, Bill of Materials

****From CP76-7 (CH2,CH3)****
EPOXY
RAF continues to look at new epoxy resin systems, as time permits. Hexcel has developed a replacement for Safety Poxy and Safety Poxy II that contains <u>no</u> MDA and <u>no</u> styrene. This epoxy system looks quite promising since it has reportedly almost identical physical properties to the Safety Poxy systems. The mix ratio is also the same as Safety Poxy so the same ratio pumps can be used.

We hope to be able to approve this Hexcel epoxy system soon. Stay tuned.

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Update Number 77 to Chapter 2, Bill of Materials

Information derived from CP77 published by RAF Jan 1994

****From CP77-6 (CH2,CH3)****

EPOXY UPDATE

The dust is beginning to clear after the initial confusion caused by the State of California making the use of MDA illegal, at least, in the industrial environment. Since Scaled Composites does not subject its employees to MDA or styrene (contained in Safety-Poxy) RAF reasoned that homebuilders should have the same benefits. A lot of frantic testing was conducted and, as a result, PTM&W (PR2770/PH366C) was recommended. Many builders complained about the workability of this rather thick (viscous) epoxy system so the tests and evaluations continued. Today, we have an improved, thinner PTM&W (PR2032/PH3660) which has even better physical properties than the original PTM&W and we have Hexcel's 2427 system which has the advantage of using the Safety-Poxy ratio pump "as is"., that is to say, the mix ratio is 44:100. The workability and "wet out" qualities of Hexcel 2427 are excellent and the physical properties are adequate.

<u>Caution</u>: Both of the above epoxy systems have higher exotherm problems than Safety-Poxy. The only place this can cause a problem is when you join foam blocks. This is <u>very important.</u> You cannot have a micro joint between two foam blocks any thicker than 1/8". You must be absolutely certain that your micro joint, or the space between the foam blocks, is less that 1/8" (1/16" is best). Any more than 1/8" <u>will</u> cause an exothermic reaction, due to the high insulating properties of the foam, and serious damage to the foam and <u>loss of structural integrity</u> of the foam joint <u>will</u> result.

This is not as good as Safety-Poxy (which allowed a safe foam block joint up to 1/4" thick), but both of these epoxy systems are completely free of MDA (a known carcinogen) and styrene (highly allergenic). Soooo..... you have your choice.

Please let us have your observations as feedback for the CP. We, and all of our readers, are interested to hear about personal experiences, good and bad!

****From CP77-8 (CH2,CH3)****

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

ALL RAF DESIGNS - CAUTION: EXOTHERM PROBLEMS. SEE ARTICLE "EPOXY UPDATE" PAGE 6 THIS ISSUE.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason. we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

****From CP77-12 (CH2)****

HARD TO FIND BELLCRANK BEARINGS

Bellcrank bearings for control systems are now in stock again. Due to a nation wide shortage, Wicks has contracted with a local manufacturer to provide a s many as needed. They just received 5000 of the BC4W10 bellcrank bearings which are used on many experimental aircraft.

****From CP77-12 (CH2,CH3)****

THE LATEST IN LAMINATING EPOXY

In stock - a large supply of the newest laminating epoxy available. PTM&W Industries 2032 Epoxy Resin and 3660 Hardener is designed for all types of structural applications and for all your laminating needs.

PTM&W Industries, working with respected aircraft designers, has developed this new epoxy laminating system to be the safest to use, and to have the best chemical adhesion on fiberglass, carbon fiber, Kevlar, etc.

Contact: Wicks Aircraft Supply Co
Bill Weder
618-654-7447 or
1-800-221-9425 for a free
catalog.

Chapter 2, Bill of Materials

Long-EZ Plans Changes

****From CP25-6 (CH2)****
LPC #14, MEO, Page 2-2.
Airframe bolts AN3-11 should be AN3-11A

****From CP25-6 (CH2)****
LPC #15, MEO, Page 2-1 Tools.
Change "2 pcs 16 x 48" to "One piece 1/16" or 1/8" thick x 24" x 48"

****From CP25-6 (CH2)****
LPC #21, MEO, Page 2-4 Metal.
"3 ft of 1.8 x 1" x 1" should be "3 ft of 1/8" x 1" x 1" aluminum angle"

****From CP25-6 (CH2,CH4,CH15,CH30)****
LPC #25, DES, Page 4-3 and Page 2-2.
Aluminum can be substituted for the steel firewall, don't install fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and aluminum. Install fiberfrax with silicone rubber, <u>not</u> epoxy.

****From CP26-6 (CH2)****
LPC #34, MEO, page 2-1.
LMGA is used in Chapter 5 not Chapter 9.

****From CP27-7 (CH2,CH10,CH13,CH31)****
LPC #53 MEO Page 2-1
Add CLI and NG5 to Brock list.

****From CP28-9 (CH2)****
LPC #55, MEO
Bill of Materials Page 2-2 AN970-4 Washers, should be 11 not 5.

****From CP29-7 (CH2,CH9)****
LPC #71,MEO
Section I, Page 2-1, add to Ken Brock parts list - 4 spacers A4-84 and 2 nuts J1.25 (axle spacers and nuts).

****From CP30-9 (CH2)****
LPC #79 Section I, page 2-4. Chapter 13 material list.
SC fiberglass strut cover is listed twice.

****From CP30-9 (CH2,CH9)****
LPC #83 Section I, page 9-4.
The AN960-1018 washers called out should be AN960-1016 and are not called out in the bill of materials on page 2-4. Add 4 more AN960-1016 to the 2 washers called out.

****From CP35-9 (CH2)****
LPC #109, MEO
Add the following to the parts listed on page 2-1 of the Long-EZ plans under "custom prefab parts" by Ken Brock Mfg.

Lycoming exhaust system
Dynafocal engine mounts
Conical engine mounts
A484 back up rings (4 required 2 each)
JI.25 axle nuts (2 required)
LE2-LL landing light mount kit
LMBG1 forward main gear attach brackets (2)
LMBG2 aft main gear attach brackets (2)

From CP27-8 (CH2,CH25)
Aircraft Spruce would like to request that overseas customers order all finishing materials that they may require (featherfill, primer, surfacer etc.) with their initial order, so that all of it may be shipped by surface vessel. Flammable materials cannot be shipped by air due to regulations. So if you wait until you need finishing materials, you will not be able to get them very quickly, as they will have to go by surface vessel.

From CP27-8 (CH2)
Ken Brock Manufacturing catalogs are $3.00 and this is not refundable with an order. Catalogs cannot be sent out C.O.D.

From CP31-5 (CH2,CH30)
Caution - Nat Puffer would like to share a problem that he has run into. He bought an engine mount and a cross over exhaust system from a supplier (not one of RAF's designated suppliers) and has had problems. The supplier has refused to make good or to refund. Nat is a member of the VariEze Hospitality Club, and anyone interested in the exact nature of his problems should contact Nat Puffer.

From CP38-8 (CH2)
European Builders - Dane Kurth has lots of EZ materials in stock, PVC foam, urethane and styrofoam. Fiberglass, UND and BID. Dane can translate plans into german. Also, one Continental C-90 engine. Regular orders to the USA.

Contact: Dane Kurth-Rowe
CH 3292 Busswil
Switzerland
032-842289

From CP44-4 (CH2)
Aircraft Spruce is pleased to announce that they are now open on Saturday mornings from 9 am to 12 pm. This is a convenience for builders who are visiting Los Angeles or for those who live there. Due to personal limitations, they do ask that you call in your order during the week for pickup at the "will call" desk on Saturday.

From CP46-2 (CH2,CH35)
RAF BUILDER SUPPORT
The most asked question these days is how long will RAF remain in existence to support the homebuilder? The answer to that question depends largely on you the homebuilders. We will be here as long as you support RAF, that is to say, you send in information on your project, photos, builder hints, safety/maintenance related information on your aircraft and you continue to subscribe to the Canard Pusher newsletter. Now that RAF has zero income from plan sales, its important that you support RAF by buying your raw materials, prefabricated metal parts, or prefab glass parts from RAF approved suppliers, such as Aircraft Spruce, Wicks Aircraft, Ken Brock, Lombard's and Dayton Airplane Factory. This will go a long way to making sure RAF is around for many years since RAF gets a small percentage of your cost from each of these suppliers. If you elect to buy your part or supplies from one of the "bootleggers", you are contributing to the demise of RAF and we will not be here to support you should you have a problem while building or flying your RAF design.

If you buy from non-recommended suppliers, you are not only not supporting RAF financially, but you also do not know if you are getting correct materials or safe parts. When you buy from RAF recommended suppliers, you are absolutely getting RAF recommended materials and parts we have tested and are happy with.

It is up to you the licensed homebuilder. If you want RAF to be around to publish the Canard Pusher, to help when you have a problem, support RAF. Send in your builder hints, your photos and flight reports. We will be here as long as we possibly can to assimilate and disseminate safety information and to try to promote the safe building and flying of our various RAF designed airplanes.

From CP62-7 (CH2)
RAF RECOMMENDED SUPPLIERS

Aircraft Spruce
PO Box 424
Fullerton, CA 92632
714-870-7551

Wicks Aircraft
410 Pine Street
Highland, IL 62249
618-654-7447

FeatherLite
PO Box 781
Boonville, CA 95415
707-895-2718

Brock Mfg.
11852 Western Ave.
Stanton, CA 90680
714-898-4366

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

Prefabricated Parts

Also see LPC #79 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #109 in the "Long-EZ Plans Changes" section of this chapter.

From CP34-4 (CH2)
PREFAB PARTS FROM OTHER THAN DESIGNATED DISTRIBUTORS
RAF has received many requests concerning the so-called pre-fab parts occasionally seen advertised in Sport Aviation or Trade-a-Plane. RAF categorically does not recommend any of these suppliers. Our experience has been negative in every case. In fact, there are currently at least two builders involved in legal action in an attempt to recover their money. We have seen a canard supplied to a Long-EZ builder by one of these companies. It was the worst example of workmanship we have seen. Beware of these suppliers, they may or may not provide you with the parts you require and if you do receive any part, you may never know if the parts are correctly built or structurally sound. Once a part such as a canard or a centersection spar or a wing is built, there is no way to verify if in fact all of the layups have been included and if they were done correctly.

From CP40-4 (CH2,CH13,CH21)
CAUTION - Unauthorized Prefab Parts For The Long-EZ
It has recently come to our attention that there are some prefabricated nose cones for Long-EZs, as well as other parts, such as fuel/baggage strakes, that are being misrepresented as being approved by RAF. The only RAF approved prefab Long-EZ parts, are manufactured by Task Research of Santa Paula, California. These parts are sold through Wicks, Aircraft Spruce and Task Research.

The prefab nose cone in particular is manufactured from non approved glass and polyester resin. It is not a sandwich construction, is heavy and would be difficult to incorporate safely into a Long-EZ. The nose section of a Long has to be able to support the loads taken by the nose gear. In order to do this safely, we believe the plans should be followed as closely as possible. The Long-EZ nose is not simply a fairing, it is a structural sandwich, composite design that should not be compromised.

From CP44-4 (CH2)
PREFABRICATED GLASS PARTS
Task Research Inc. is no longer an approved RAF manufacturer/ distributor. Due to a contractual disagreement, RAF has exercised our option and cancelled all of our contracts with Task Research. We have placed all of our tooling with a new company.

Aircraft Spruce and Wicks Aircraft still have many items such as cowlings, wheel pants, nose gear boxes, strut covers and sump blisters in stock. If you need any of these parts, contact Spruce or Wicks. If you are unable to get the parts you need, contact RAF and we will place your name and requirement on a priority list. The Long-EZ and Defiant main gear struts are not available at this time and it will be June 1, 1985 before our new supplier will be on line and producing gear. If you are to the point where you will be needing a main gear (or Long-EZ nose gear) strut, call us at RAF and we will place you on the priority list. Do let us know your requirements, it will help a great deal to know what the demand is. Our new supplier is an EZ builder himself and a very experienced man, who has worked with composites for years. We are confident that he can do the job, and we feel certain that anyone receiving one of his parts, be it cowlings or landing gear struts, will be pleased with the workmanship.

A major change over such as this, is always upsetting and can cause delays. Please bear with us on this one. Give us a month or two to get our new supplier up to speed. We would really appreciate it if you could try to work around, for example, the main gear. You can in fact go on and build winglets, main wings and centersections. You do not absolutely have to have a main gear until you have essentially completed construction.

RAF will work with you as a go between and will do our best to accommodate those of you who simply have to have a particular part. For the time being we ask your patience. Just as soon as the new supplier is up to speed, we will announce his name, phone number etc. and you will work directly with him.

From CP45-6 (CH2,CH9,CH13,CH30)
PREFAB GLASS PARTS
Larry Lombard, owner/builder of VariEze N15LL, one of the highest time EZs we know of with over 1200 hours, is now on line and is making Long-EZ main and nose gears and is set up to make Defiant gear.

Larry is working on tooling for Defiant cowlings and fuel strakes and would appreciate hearing from Defiant builders who would be interested in these parts.

He has available tooling for Long-EZ cowlings and wheel pants, VariEze cowlings and wheel pants and can take orders for these parts. We would request however, that if you are ready and need a cowling or a pair of wheel pants, that you contact either Aircraft Spruce and Wicks Aircraft first, since they may still have a few of these parts in stock and we would like to deplete their stock before Larry starts.

Mike Melvill and Michael Dilley flew up to northern California and spent the day with Larry, checking out his equipment and also helped him run the first Long-EZ gear. Larry has built a really nice hanger/shop right on the Boonville airport which is north of San Francisco and west of Ukaiah. He has just completed a first class oven in which to cure the gear. All of the equipment worked well and he is now ready to accept orders.

Larry will be handling all of these parts directly and you should contact him at:

P.O. Box 781
13451 Airport Road,
Boonville, CA 95415
707-895-2718

Larry has a very extensive background in working with composites. He had built several homebuilt aircraft including his own VariEze, and worked here at RAF for two years during which time he helped build the Grizzly and Solitaire. Larry will be working in close conjunction with RAF and we are confident that he will produce high quality parts at reasonable prices.

****From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****

PRE-FABRICATED COMPOSITE PARTS

Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS

Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING

From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE

For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS

We are pleased to announce three new products to our line.

1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.

Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415
(707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

From CP47-5 (CH2,CH30)

"LOMBARD'S" UPDATE

Larry Lombard and Michael Dilley have been turning out EZ cowlings and shipping them as fast as the orders come in. EZ cowlings have always been a bit of a "beast" to install. It seems that they never fit quite right. Michael is building a Long-EZ and he studied the problem. He came up with the theory that the aft rib was stiffening the cowl halves so much torsionally that the cowling could not be forced to fit the shape of your airplane. As a result, the job of installing a cowling has developed rather a bad reputation.

The decision has been made to ship cowlings with the aft rib not installed. The best method is to completely install the cowling, then flox the prefab rib into the upper and lower cowl. After it cures, lay up one ply of BID at 45 degrees over the whole rib, lapping onto the cowling 1" all around.

Using this method, the cowling is much easier to install and you get a nice fitting cowling into the bargain. All cowlings shipped by Lombard's since January 1, 1986, have been and will be, shipped with the aft rib loose and you will install it yourself per the above.

Larry was down here at RAF taking all the measurements on Burt's Defiant necessary to enable to them to build cowlings that will fit a homebuilt Defiant using any combination of 150hp, 160hp, or 180hp engines with either fixed pitch wood props or constant speed feathering props such as the Hoffmann propellers installed on Burt's Defiant. Due to the almost infinite possibilities of engine/mount/prop extension/prop and spinner, the chances of building one cowling (especially the front cowling) to fair perfectly from the spinner to the firewall are essentially zero. Therefore, Larry and Michael will be supplying the front cowling about 4 to 6 inches short of the spinner. The builder will mount his or her engine/mount/prop extension/prop and spinner, then the cowling will be jigged and mounted. The spinner and prop will be protected with gray tape. Foam blocks will be cut and fitted between the cowl and spinner and carved to a perfect faired fit. Four plies of BID will be layed up to lap onto the cowl. After cure, the cowl will be split, the foam cleaned out and one ply of BID will be layed up on the inside of the cowls to tie things together and, presto! you have a perfect fit, no matter what combination of prop, extension and spinner you may have. The rear cowl does not have the same design constraints and will be shipped ready to install. The only change that may be necessary, depending on your particular engine/prop/spinner combination, would be to trim the trailing edge or shorten the cowling to match to your spinner.

Larry and Michael are also working on a pair of low-drag main wheel pants for the Defiant. These will probably look like something between Burt's prototype and Fred's Defiant.

Last, but not least, Larry and Michael have formed their small company into a corporation. As of now, this corporation will be known as FEATHERLITE PRODUCTS, INC., P.O. BOX 781, 13451 AIRPORT ROAD, BOONVILLE, CA 95415. Be sure to write or call for a quote and compare prices and quality with any of the bootlegger outfits. Keep in mind that Larry and Michael are the only RAF approved and recommended manufacturers of prefab glass parts for all of the RAF designs.

****From CP50-3 (CH2,CH3,CH21)****

BOONVILLE, CA, UPDATE

Larry and Michael (Featherlite Products, Inc.) have been busy since Oshkosh where they shared the RAF booth and had on display a number of their products. They really enjoyed talking to so many of their customers and to be able to get out of their shop and talk airplanes for a whole week.

The Long-EZ leading edge fuel strake kit is now out and quite a few have already been installed. The leading edge "D" section is slightly oversize to enable you, the builder, to custom trim to perfectly fit the fuselage and wing. To identify the proper position, B.L. 23 rib must be located at the jink or bend, then you can trim to fit the fuselage, then the wing. Don't forget to remove the peel ply from the top and bottom lips before installing the flat panels.

After much scrutiny, Defiant cowlings are now on line. Cheeks have been enlarged to accommodate the O-320, as well at the O-360 Lycomings. The rear cowls will fit most prop/spinner combinations with little or no trimming required. The front cowlings may require some homebuilder "blending" for the various combinations of props, spinners and prop extensions.

Defiant wheel pants are under development and will soon be available. These are based on Fred Keller's beautiful Defiant's wheel pants.

Several builders have asked about removing mold release. After waxing, PVA (poly vinyl alcohol), a thin, green film, is applied to the molds. This film is water soluble, so use a wet sponge and lots of water to wash it off your parts. Allow parts to dry thoroughly before scuff sanding for finish.

For more information, contact Larry or Michael at:

Featherlite Products, Inc.
P.O. Box 781
13451 Airport Rd.
Boonville, CA 95415
(707)895-2718

****From CP50-4 (CH2)****

FEATHERLITE PRODUCTS, INC.
P.O.Box 781
13451 Airport Road
Boonville, CA 95415
(707)895-2718

Be sure to write or call for a quote and compare prices and quality with any of the other outfits. Keep in mind that Larry and Michael are the only RAF approved and recommended manufacturers of prefab parts for all of RAF designs.

****From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)****

FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom) weight saved, approx. 6 lbs.	448.00
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert.500 x 5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85

Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.
Contact: Michael or Larry at: FeatherLite, Inc., P.O. Box 781, Boonville, CA 95415, (707)895-2718

Foam

From CP26-3 (CH2)
LONG-EZ HIGH DENSITY FOAM SUBSTITUTES
Due to excessive cost increases, the dark red, 0.2" R250 PV core foam is no longer being used in Long-EZ kits. For a while this summer and fall, 3/16" thick plywood was supplied in its place. We have recently approved a high density urethane/polyester foam (white in color, 18lb/cubic ft density) for this use also. If you receive the white foam it will be in four pieces, 12" x 48" 0.2" thick. This requires a micro joint for the instrument panel and F22. This joint need not be a separate cure, it can cure with the first skin.

Regardless of whether you are using the red or white foam or plywood, do not change any of the layups of fiberglass or any of the core carving shown on page 13-5 of plans.

Due to excessive costs of the aircraft grade of the R45 dark blue PV core foam, marine grade is being substituted for two of the eight pieces of 0.35" thick R45. The marine grade is identified by a slightly different thickness and an occasional void. Use the marine for the consoles and the aircraft grade for the tank skins. (see page 2-3 of plans).

Also, due to excessive cost increase, the 0.8" and 1.6" thick pieces of R45 are now being supplied in marine grade. The marine grade is available 32" wide rather than the 24" wide as shown on page 2-3. Even though you are getting some excess foam you are paying only half to two-thirds the price of the previous aircraft grade.

Marine grade and aircraft grade PV foam are similar in formula and structural characteristics. The differences are in the occasional voids and thickness tolerance. Fill any small voids with dry micro. Fill voids larger than 1/2" dia. with a foam chip and wet micro.

From CP27-7 (CH2)
More foam substitutes - CP #26 listed a high density (18 lbs. per cubic foot) white urethane foam as an allowable substitute for the 16 lbs per cubic foot R250 PV foam previously listed for the VariEze and Long-EZ. We are now listing a medium-density Clark white urethane foam as an allowable substitute for the 6 lbs. per cubic foot PV R100 (light red) foam. See the table below. The distributors may be suppling either type for a temporary period. We have no plans for any substitution of the PV R45 dark blue foam in the Long-EZ list. Its superior peel strength and damage resistance justify its higher cost.

VariEze **OMITTED**

Long-EZ
Old Specifications
R100 6 lbs. per cubic foot (light red)
1 pc. - 1" x 6" x 10"
New allowable substitute
6 lbs. per cubic foot Clark (white)
1 pc. - 1" x 6" x 12"

Old Specifications
6 lbs. per cubic foot R100 (light red)
2pcs. - 0.25" x 35" x 44"
New allowable substitute
6 lbs. per cubic foot Clark (white)
3 pcs. - 1/4" x 24" x 48"

From CP34-7 (CH2)
FOAM SUBSTITUTES
We have approved a new PVC foam, Divinycel, which is various shades of tan to light brown. It is a good quality and also cheaper. This foam is a direct substitute for all of the Klegecel PVC foam called out in the bill of materials. If your kit contains tan colored PVC foam, check carefully to be sure that you are making parts from the correct density foam.

Old Specs	New approved substitute
Type R45, 3 lb/cubic ft 8 pcs. 32x48x.35" dark blue	Type H45, 3 lb/cubic ft 8 pcs. 34x47x3/8" tan
Type R45, 3 lb/cubic ft 5 pcs. 24x48x.8" dark blue	Type H45, 3 lb/cubic ft 5 pcs. 26x47x3/4" tan
Type R45, 3 lb/cubic ft 2 pcs. 24x48x1.6" dark blue	Type H45, 3 lb/cubic ft 2 pcs. 26x47x1 3/4" tan
Type R100, 6 lb/cubic ft 2 pcs. 35x44x1/4" red	Type H100, 6 lb/cubic ft 2 pcs. 34x37x1/4" tan
Type R100, 6 lb/cubic ft 1 pc. 6x10x1" red	Type H100, 6 lb/cubic ft 1 pc. 6x10x1" tan
Type R250, 16 lb/cubic ft 2 pcs. 26x37x2" red	Type H250, 16 lb/cubic ft 2 pcs. 26x30x1/4" tan

From CP62-11 (CH2)
Divinycel PVC foam will be light blue instead of tan in the future. Some sheet sizes will change slightly. If these size changes mean having to piece foam together, that's OK - a micro joint in PVC foam is much stronger than the foam. The new blue foam will be stocked and sold by Aircraft Spruce and Wicks.

Safe-T-Poxy

From CP28-4 (CH2,CH3)
Safe-T-Poxy and Humidity.
Good news! The manufacturer of Safe-T-Poxy has confirmed that this type of epoxy can be used in up to 90 percent humidity with no problem. This will be a big help to those of you who live in areas with high humidity. Of course temperature is still very important and although it is possible to make a satisfactory layup in temperatures as low as 65 degrees F, and as high as 100 degrees F., the ideal temperature is 75 to 85 degrees F. Safe-T-Poxy is relatively insensitive to moisture and that is why it can be used in an environment with high humidity. This also a tremendous advantage over the life of your airframe, since the cured laminate is also more immune to water absorption than normal epoxies. This reduces the possibilities of weight gain through water absorption, a common problem with most epoxy laminating systems.

Caution. **We have been approached lately by builders wanting to use Ciba Araldite 506/507 epoxy to build their Long-EZ or VariEze. We cannot recommend the use of this material.** The heat distortion point of this laminating system is low and can cause long term "creep" problems. The water absorption is high, which will hurt the life expectancy of the airframe. The chemical make up of this material is such that many builders will become sensitized due to high irritation factor.

Remember, Rutan Aircraft Factory, Inc., has spent many thousands of hours, building, testing and flight testing the prototype aircraft that we sell plans for. For us to recommend any material that we have not tested in an aircraft that we are currently flying would be unethical. We have learned that another plans distributor has shifted their recommendation to a cheaper epoxy even though their prototype is not build from the cheaper material. This practice is, in effect, asking homebuilders to test something new to see if it is adequate. This practice is acceptable because each homebuilder is the manufacturer of his own aircraft. However, we feel that ethics require that if a homebuilder is breaking new ground he should be notified that he is being recommended to use something that has not been tested on a prototype.

From CP40-2&3 (CH2,CH3)
SAFE-T-POXY II
We have had a lot of requests for information on this material. RAF has been using it in our shop for over a year. We did some direct comparison tests of laminates using regular Safe-T-Poxy and Safe-T-Poxy II. The results of these tests verified the manufacturers claim that the new material was as good or slightly better in every respect from a structural standpoint. In addition to this, this epoxy is thinner (less viscous) and tends to wet out the glass more rapidly with less effort. It should therefore be easier to work with in a cooler environment. The single biggest advantage is the reported lower likelihood of experiencing an allergic reaction from Safe-T-Poxy II, even compared with the regular Safe-T-Poxy. This is not an easy thing for us to test, since no one who has ever been employed at RAF has had an allergic reaction to any of the epoxies that we have used.

Our experience with the material has shown some advantages and some disadvantages. The opinions of the folk that work at RAF vary, but the general consensus is that it does wet out better, especially if the shop is cool. Safe-T-Poxy II has more tendency to "run out" or "bleed out" of a given layup, especially if that layup is not perfectly horizontal. On a vertical surface or even a sloping surface, run out is more of a problem than it is with regular Safe-T-Poxy. The worst complaint is a considerably shorter pot life, especially in a shop that is heated to the recommended 77 degrees F.

Safe-T-Poxy II in our experience starts to gel and become "stringy" in the cup in about half the time that this occurs with regular Safe-T-Poxy. Once out of the cup and on the part, this is not a problem. If this "stringyness" occurs in the cup, this batch must be thrown away, since it will not wet out the glass once this has happened.

In conclusion, we recommend that you try Safe-T-Poxy II, perhaps a small kit and see how you like it. See if it suits your individual work habits. Both Safe-T-Poxies are excellent structural materials and are suitable for building any of the Rutan composite designs. Both materials are also better than any other epoxy we know of for fuel compatibility.

****From CP43-5 (CH2,CH3)****
Long-EZ - Builder feed back indicates that most builders are finding that they need more epoxy than what is called out in the plans. Keep this in mind, and when you order your epoxy, order only what you think you can use in the next 12 months. Be realistic with yourself, there is no sense in buying 15 kits of epoxy, using only 5 in the first year and being stuck with 10 kits of out of date epoxy. The manufacturer has put a 12 month shelf life on the Safe-T-Poxy. You are the aircraft manufacturer and you have to be responsible to make the right decision when a primary structural material goes over its shelf life. Stay away from this problem by buying only as you need, keeping only fresh epoxy to build the structure of your aircraft.

Fasteners

****Also see LPC #14 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #55 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #71 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #83 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP31-8 (CH2,CH3)****
Due to some confusion over AN versus MS hardware, we have compiled a conversion chart which should help clarify things. Our thanks to Bud Meyer of Wicks Aircraft for assistance in getting this chart together.

AN509------MS24694	AN819------MS20819
AN364------MS20364	AN822------MS20822
AN365------MS20365	AN823------MS20823
K1000------MS21047	AN500------MS35265
AN380------MS24665	AN936------MS35333
AN393------MS20392	AN931------MS35489

Solid aluminum rivets:
AN_ _ _AD_ _ = MS20_ _ _AD_ _

Fiberglass Cloth

****From CP36-3 (CH2)****
Caution! - Pseudo Fiberglass Cloth
It has recently come to our attention that a cheaper 'version' of our UND #7715 cloth is available from a different major weaver. We obtained a sample of this glass and admit that our first impression was favorable. By just looking at it, it was virtually identical to the original #7715. We cut equal size pieces and weighed them on a gram scale. Weight was identical. We did a few sample layups to check wet out and the ability to layup around a tight radius. Again essentially the same performance. We felt we had something we could recommend.

We then decided to do a simple flexure test of this new cloth comparing it directly with our original UND. The test consisted of 24 coupons of each type. We failed all of them and plotted the results. We faired a line through the 24 points to obtain an average. The result was startling. The new cloth was 19 percent weaker at ultimate load and 31 percent weaker at initial failure. See the graph below. **GRAPH OMITTED**

NOTE: The really confusing aspect of this is the fact that the weaver of this cheaper material saw fit to call it by the same part number #7715.

This means that if you were to use this material to build your VariEze or Long-EZ, even though you may have excellent workmanship with optimum resin to glass ratios, you would still have an airplane that could suffer a structural failure at only 81 percent of the expected load capability. Worse than that, the initial failure point (first noise) would occur at only 69 percent of the normal expected load. This is not acceptable since it would be impossible to detect initial failure occurring in flight. It could sneak up on you. Do not take this lightly. If you have purchased UND glass from any source other than Wicks Aircraft and Aircraft Spruce, you almost certainly have the wrong glass. Spruce and Wicks have been the only source of the correct UND, due to proprietary rights. If you have built any major structural parts (wings, winglets, centersection or canard) from this glass, you should discard them.

Also see LPC #21 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #25 in the "Long-EZ Plans Changes" section of this chapter.

From CP42-7 (CH2,CH3)
DEFIANT GENERAL
Note: **Wherever aluminum material is called out such as 2024T3, you may substitute with 2024T4 or 2024T351. This is true anywhere in a Defiant, Long-EZ or VariEze.**

Note: Aluminum tubing called out as 1200 versatube is the same as 3003-0.

Note: Wherever Nylon sheet is called out, phenolic sheet or Delrin sheet can be used with no problem.

Table of Contents for Chapter 3, Education

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Update Number 66 to Chapter 3, Education

(Corrected Page)

****From CP66-3 (CH3,CH11,CH31,CH38)****

ALERT! POSSIBLE CORROSION IN ELEVATOR TORQUE TUBES IN EZS.

We have one report from a VariEze builder/flyer who lives and hangars his EZ in Ohio. He noticed small bumps rising up on the top of each elevator along the aluminum torque tube. He could depress these bumps a little with his finger. He has removed each elevator and cut the glass and foam away along the top of each elevator, exposing the aluminum torque tubes. He reports that he has found "severe corrosion pits where each bump was located." We have not seen this corrosion yet - he is sending us a sample of the affected tube. We will report further in the next CP. He says that this corrosion occurs only under the foam and glass. These is no corrosion at all on the exposed ends of the elevator torque tubes.

Pitch control is absolutely critical to safe flight. For this reason, any report such as this must be taken seriously. All EZ, Defiant and Solitaire flyers should inspect the leading edges, the tops and the bottoms of both elevators for bumps such as we have described here, before next flight. If any evidence of bumps or corrosion is found, ground the airplane and remove foam and glass locally. Inspect the aluminium tubing under a bright light. Please report any problems found to RAF as soon as possible.

Any builders who have not yet built the elevators should treat the aluminum tubing with Alodine before starting on the foam and glass elevators. Do not omit this step! Remember, the corrosion, if it exists, is not visible on the exposed part of the tubing. It is under the foam and glass and cannot be seen without removing the foam and glass. Do not remove foam and glass without evidence of bumps or swellings that may or may not be soft. Do let RAF know of any evidence of corrosion.

The above report came out of Ohio where it is hot and humid in summer and cold and damp in winter. Anyone who lives where there is much humidity and/or near the coast should be especially concerned and should check the area called out before each flight.

We have checked all of the EZs at Mojave with no sign of any problems but that probably was to be expected, this being a desert with only a few inches of rainfall in a good year.

****From CP66-8&9 (CH3)****

I am using a high tension hot wire designed by Tom Berkley who also supplied some components including the wire. The last known address I have for him is:
A Berkley Design
PO Box 6184
Tehachapi, CA 93561
805-822-5065

I have sent him money for replacement wire, follow-up letters and phone calls. Tom does not seem to exist anymore. Does anyone out there know his whereabouts? Can anyone supply .041 diameter 17-7PH spring temper wire or its equivalent? I have been unable to find anything like it and all substitutes I have tried have failed - Help!

Contact:
Randy Blanchard
2307 98th Ave., SW
Calgary, Alberta T2V 4S7
Canada

ED: RAF has received a number of requests similar to the one above. Anyone knowing of Tom's whereabouts or of a supply of the wire, please let RAF know.

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Update Number 67
to
Chapter 3,
Education

****From CP67-8 (CH3)****

REQUEST FOR INFO ON TOM BERKLEY'S HOT WIRE SAW

Per our request in CP66, we have had one response from John Di Milia who has purchased a 220 foot roll of the .041 diameter high temp, high tensile wire from the manufacturer.

The 220 feet was a minimum order and John is willing to sell his extra wire. He purchased his wire from The National Standard Co., Los Angeles Warehouse, 14700 S. Marquardt Ave., Santa Fe Springs, CA. 213-921-9683.

Contact: John Di Milia
92 Park Ave.
West Caldwell, NJ 07006
201-206-4282

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Update Number 70
to
Chapter 3,
Education

From CP70-8 (CH3)

TOM BERKLEY'S HOT WIRE SAW

John has purchased a roll of the .041 diameter high temp, high tensile wire from the manufacturer as called out for Tom Berkley's saw.

Two hundred and twenty feet was a minimum order and John is willing to sell his extra wire. He purchased his wire from The National Standard Co., Los Angeles Warehouse, 14700 S. Marquardt Ave., Santa Fe Springs, CA. 213-921-9683.

Contact: John Di Milia
92 Park Ave.
West Caldwell, NJ 07006
201-228-8966 (NEW NUMBER)

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Update Number 71 to Chapter 3, Education

****From CP71-1 (CH2,CH3,CH25,CH33,CH38)****
WARNING - STRUCTURAL DEGRADATION OF FOAM CORES
We have noted that many of you have not been adequately inspecting your structure and may not be aware of how seriously the structure can be affected by a degradation or defect in the underlying foam core. For example, a 3-inch diameter depression or bulge in the skin due to damage in the foam (void, crush or de-lam) can weaken a winglet or wing (particularly a VariEze outboard wing that has no discrete spar) by as much as 50% or more! A skin dis-bond on an elevator or aileron can result in flutter failure even within the allowable flight envelope.

We have recently found foam damage to several of our own aircraft structures. One was due to the inadvertent intrusion of an agent used to clean a wing before it was primed and painted. Another was traced to a stress crack that was in the foam block, a flotation billet, not the proper fabrication billet. Never substitute a different material even if it seems to work okay. We have also had dis-bonds in control surfaces. These can grow rapidly when exposed to high altitude flight. (The void is trapped and expands at altitude).

The solvent-susceptible and easily-damaged cores we use need constant attention to maintain safety. We know of no accidents due to this problem, however, the potential is high if you are careless with the maintenance of your airplane. Please let us know what you find on your inspections so we can pass this on to everyone. Since these types of structures are used on non-RAF types, we are asking Sport Aviation to also publish this caution.

****From CP71-5 (CH3,CH25,CH33,CH38)****
MAN-GND
ADD THE FOLLOWING TO THE MAINTENANCE/INSPECTION SECTION OF VARI-VIGGEN, VARIEZE, LONG-EZ, DEFIANT AND SOLITAIRE OWNERS MANUALS.

PREFLIGHT CHECKLIST

Check all skin surfaces of wings, canard, winglets and control surfaces for cracks, dents, or bulges and for evidence of interior foam damage (skin moves when you push on it or has a dull thud if tapped with a coin). Do not fly if structure is damaged beyond the limits noted in the 25-hour inspection (page 46).

COMPOSITE STRUCTURE

WARNING - The foam core in composite control surfaces, wings, canard and winglets is easily damaged by solvents, including solvents found in paint primer, most cleaning products and, of course, oils and fuel. Never wash the structure with anything but soap and water. The smallest invisible pinhole through the epoxy surface structure can allow intrusion of liquids or vapors that will attack the styrofoam core. A void or dis-bond (separation from the skin) will weaken the structure and can result in a fatal accident. The foam core can also be damaged by local concentrated loads such as a dropped tool or by using your shoulder to set the gear. Never use a wing as a workbench or to stack luggage. Treat all composite skins like eggshells.

EACH 25 HOURS Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or if it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re-painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping with a 25-cent coin. Good core is indicated by a sharp "tap" or "knock" noise. Bad core is indicated by a "dull thud". Listen carefully as you tap and mark with a grease pen directly on the skin the boundary of any suspected dis-bond area. Ground the aircraft if any core damage area is larger than the following:
  Fuselage, wing/canard - 3" diameter.
  Winglet, control surface or VariEze outboard wing - 2" diameter.
Repair per instructions in the annual/100 hour below.

ANNUAL/100 HOUR Conduct a very careful 100% skin surface coin tap, surface stiffness and contour smoothness inspection. Include interior areas in fuselage, cowl and wing with wings removed. Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge (any

divergence from the intended smooth contour) must also be repaired and reinforced per the standard repair methods in the plans.

****From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)****

<u>SHOP AIR AND FOAM CORE WINGS</u>

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

Update Number 72 to Chapter 3, Education

From CP72-2&3 (CH2,CH3,CH25,CH33,CH38))

FOLLOW-UP ON CP71 DISBOND/DELAM CAUTION

So far, we have received only one letter from a builder with a problem in this area. This aircraft is a Q-2 and, normally, we would not presume to comment on someone else's design but this particular problem could so easily have resulted in an in-flight structural failure that we felt morally obligated to say something about it.

During a landing that the pilot said was not any harder than other landings he had made, the canard (also the landing gear since the main wheels are mounted on the tips of the canard) failed. The top skin just inboard of the fuselage side, buckled and the canard folded. Subsequent sectioning of this area showed a large percentage of the foam had "melted". This builder/pilot suspected that this melting damage was caused by excessive heat from the sun while tied down outside in Florida. He included three photographs of the section of damaged canard.

We at RAF have not seen this canard, only the photos, but we have a different opinion. We believe this damage may have been caused by fuel leaking out of the fuel tank (above the canard) and seeping through tiny pinholes in the top skin and melting the foam. Styrofoam, be it blue or orange, fabrication billets or floatation billets, will melt when it comes in contact with any fuel, solvent, etc. Put a scrap of foam in a container of fuel and, in a short period of time, the foam will disappear. Pour a little fuel, avgas or mo-gas onto a block of foam and you will be amazed at the damage. The three photos supplied to us by this Q-2 builder/pilot, in our opinion, show classic fuel or solvent damage. One of Scaled's employees who has built a Quickie and a Q-2 informed us that the fuel tank is, in fact, mounted directly over the canard and that he had heard of this type of foam damage before.

All of the RAF designs have a fuel-proof barrier between fuel and Styrofoam. This barrier can be a sandwich panel of glass/PVC foam/glass, or glass/urethane foam/glass, but RAF feels it is absolutely essential to completely protect any Styrofoam core structure from exposure to fuel or any kind of solvent. In some cases, even the fumes of fuel or a solvent such as MEK or acetone can degrade a foam core to the point of causing a possible structural failure.

We have written a letter to this particular Q-2 owner and will be passing this information on to Jack Cox, editor of *Sport Aviation.* We are not criticizing anyone, it's just that this kind of damage is many times invisible and may not easily be spotted in a normal preflight. Any foam core, glass structure, while perfectly safe with an undamaged core, can become prone to catastrophic failure if the foam core is damaged. This kind of hidden damage could cause a serious accident. This is our only reason to bring this to everyone's attention.

To protect yourself from this kind of failure, it is critically important to prevent fuel from coming into contact with a glass structure that has a Styrofoam core. The same goes for any form of solvent, be it MEK, acetone, Prep-Sol, Acrylikleen, or whatever.

To check your structure for possible delamination or dis-bonds, move the airplane into the sun or, at least, to where it is warm. This will cause any disbonded areas to bubble up due to the air or gas in the void heating up and expanding. Carefully tap the entire area using a quarter (25-cent piece). Listen carefully for the telltale "hollow" sound when you tap an area that is disbonded or delaminated as opposed to the solid "click" sound of normal structure. By carefully tapping and using a felt tip pen to mark the perimeter of the damaged area, you can outline any areas that need repair then you can repair these areas, in most cases, simply by injecting a mixture of epoxy and micro-balloons, using a syringe. You will have to drill a number of small holes (to closely fit the needle) and inject the epoxy mix into one hole until it comes out of adjacent holes. Keep moving the syringe around until forcing it into any hole will make it come out of the holes closest to that one. Now, move the airplane out of the sun into a cooler area. Place some plastic (Visqueen) over the area, cover that with a piece of flexible material (.032 aluminum) and place a lead shot bag on top of that. As soon as the epoxy in the cup has kicked off, remove the lead shot bag, the aluminum and the plastic. Carefully scrape the excess epoxy off the paint using a plastic putty knife. After a full cure, you can carefully polish this area and repaint. Sometimes the visual damage is so little it does not require repainting. Recheck the area by tapping with a quarter to assure that you completely filled all void areas.

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Update Number 74 to Chapter 3, Education

****From CP74-4&5 (CH2,CH3)****
SAFETY-POXY SAFETY BULLETIN
The Occupational Safety and Health Administration (OSHA) has issued a ruling on exposure to 4,4'-methylene Dianilen (MDA). This ruling was published as 29 CFR (Code of Federal Regulations) and 1910.1050 (Applicable to General Industry). MDA is contained in Hexcel's product, Safety-Poxy Hardner (2183 or 2184) in sufficient quantities to be toxic to the human liver as well as being suspect as a human carcinogen.

To obtain copies of the appropriate standard from OSHA's national office, call 202-523-9667, or obtain from any regional or area OSHA office.

Fully cured articles made with MDA are exempt from this regulation.

Based on all of the information available to Scaled Composites, it is our opinion that all but a very few manufacturers will find the requirements for safe use of products containing MDA to be so restrictive and expensive as to necessitate the replacement of these products with alternative materials containing no MDA but which serve essentially the same function.

To this end, Scaled Composites has recently tested more than 70 possible alternate epoxies and has found at least one which satisfies all structural, pot life and wet-out characteristics. Fuel compatibility tests are now in process. It contains no MDA and all chemicals incorporated in it meet, or exceed, current OSHA requirements for safe use. The resin is PR2032 and the hardener is PH3660-2. The mix ratio is 100 parts resin to 27 parts (by weight) hardener. By volume, the mix ratio is 3.2 to 1 (resin to hardener). As you will all be aware, this is not the same as Safety Poxy which is 100 parts resin to 44 parts hardener. Michael's Engineering is working on a method to convert your current Safety Poxy ratio pump to correctly ratio the new epoxy. Send a SASE to RAF for a copy of this simple conversion.

In order to be able to mix this new epoxy using your ratio balance, you should re-configure your ratio balance to place the hardener cup at 3.7 inches from the pivot (dimension B) and the resin cup at 13.7 inches from the pivot (dimension A). This will give an accurate 100:27 ratio, by weight.

Our suppliers, Aircraft Spruce and Wicks, are presently proceeding to stock this material.

Our safety regulations for use at Scaled allow us to continue to use our remaining supply of 2410/2183 provided satisfactory precautions on skin contact are used. Refer to OSHA's MDA standard for further information.

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Update Number 75 to Chapter 3, Education

From CP75-1 (CH2,CH3)
CORRECTION
The telephone number given in Canard Pusher 74 for OSHA in Washington, DC was incorrect. The OSHA operator phone number is 202-219-8148. However, callers can save time (and money) by calling the publications office, direct, at 202-219-4667.

From CP75-11 (CH2,CH3)
SOME OBSERVATIONS ON THE PTM&W EPOXY SYSTEM
RAF has already received a few complaints about the newly recommended replacement for Hexcel's Safety-Poxy. Now hear this, People: When RAF learned that Safety-Poxy contained an unacceptable level of MDA, a known carcinogen, we immediately began testing various epoxy systems. The goals were as follows: 1) Must contain no known carcinogen. 2) Must have as good, or better, performance characteristics. 3) Should contain no styrene (causes allergies).

Close to 100 different epoxies have been looked at and, at this pint in time, the only system meeting all goals is PTM&W. In some ways, PTM&W is a little less desirable. It is more viscous and it takes more effort to wet out the glass. We have found that it works well when using a squeegee, but not quite as well when stippling with a brush. However, the PTM&W epoxy is as strong and slightly exceeds the "T_G" or heat distortion point of Safety-Poxy.

It is not perfect. Unfortunately, we live in an imperfect world but, the facts are that you do have a choice. Safety-Poxy will be available for the foreseeable future and no one is holding a gun to your head. If you prefer to use Safety-Poxy, that is your prerogative. RAF does not recommend using Safety-Poxy. If, for your own reasons, you must use Safety-Poxy, protect yourself from skin contact (wear protective clothing, gloves, etc.). Also, wear a respirator.

In spite of the workability of PTM&W being a little different, we are using it and getting used to it. We strongly recommend that you use it, too.

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Update Number 76 to Chapter 3, Education

****From CP76-7 (CH2,CH3)****
EPOXY
RAF continues to look at new epoxy resin systems, as time permits. Hexcel has developed a replacement for Safety Poxy and Safety Poxy II that contains no MDA and no styrene. This epoxy system looks quite promising since it has reportedly almost identical physical properties to the Safety Poxy systems. The mix ratio is also the same as Safety Poxy so the same ratio pumps can be used.

We hope to be able to approve this Hexcel epoxy system soon. Stay tuned.

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Update Number 82 to Chapter 3, Education

Information derived from CP82 published by RAF Oct 1995

****From CP82-2 (CH3)****
'95 Oshkosh tapes for sale
Shuttle pilot Charlie Precourt and the Atlantis crew were a few of our aviation favorites who shared the microphone on stage with Burt at his infamous Oshkosh tent talks this summer.

Mike Melvill joined Burt for a history of the Rutan canards and John Roncz shared the mic for the annual John and Burt Tent Talk Show.

The following audio tapes are available for your listening enjoyment:

Tent Talk Show by Burt Rutan and John Roncz; July 30, 10 am, Tent 3.

Future Concepts for Personal Aircraft by Burt Rutan; July 29, 8:30am, Tent 2.

Life the Universe and Everything Else by Burt Rutan and John Roncz; July 29, 10am, Tent 3

Can Dragons Fly? by John Roncz; July 30, 8:30am, Tent 2.

VariEze, Long EZ, Defiant and VariViggen by Mike Melvill and Burt Rutan; Friday, July 28, 10am, Tent 3.

Human Elements on Long Duration Flights by Dick Rutan; July 30, 11:30am, Tent 3.

Copies of these tapes and others are available for $8 each from Forum Recordings, 3410 St. Peters Rd, Marion, Iowa 52302, or telephone (319) 377-4188.

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****
Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00

Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00

Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	10.00
Moldless Composites manual	**14.50**

Postage & handling included in price.

Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

Chapter 3, Education

Long-EZ Plans Changes

****From CP25-6 (CH3)****
LPC #18, MEO, Page 3-3.
Jig table size omitted - add 3 ft x 11 ft.

****From CP28-9 (CH3)****
LPC #57, MEO. Page 3-23, Number 6. Wet out
Delete this paragraph entirely and add the following: WET OUT - Squeegee cloth from center outward aligning the the fibers straight and removing wrinkles. Pull the outside edges to straighten any wrinkles. Brush or stipple epoxy into any dry areas or pour on additional epoxy and squeegee out uniformly. Check for excess epoxy "ridge" with the squeegee. (page 3-11).

****From CP29-7 (CH3,CH4)****
LPC #68,MEO
Section I Page 4-1, note at the foot of the page. Remove "NOT" so that it reads, "micro slurry is used on this type R45 foam. We do recommend slurry to be used on all of the various foams in a Long-EZ.

****From CP30-9 (CH3,CH19)****
LPC #81 Section I, page 19-14. Section E-E.
Detail A shows the rodend bolt on the CS 132L belhorn reversed. Anytime a rodend is cantilevered off one side of a belhorn, the bolt head must be on the belhorn side, see sketches below:
SKETCHES OMITTED

Canard Pusher, General

****From CP29-6 (CH3)****
CAUTION!
We are getting an alarming number of calls from builders asking questions that have been clearly answered in a previous newsletter. The information contained in the CP is more important than the plans, since it is more current.

When you receive your CP, read it very carefully, and read all of it, not just the plans changes. Jot down comments, builder hints, etc. on the appropriate plans pages, and of course all plans changes must be written into your plans.

Remember, the only way we at RAF can get updated information, plans changes, or mandatory safety changes, to each builder, is through the Canard Pusher newsletter.

****From CP32-5 (CH3)****
CAUTION CP is the latest and best information. We still have questions on this subject. If we put information in the Canard Pusher, it supercedes the information in the plans, and is the correct information to use.

Fiberglass Aging

****From CP25-12 (CH3)****
TESTS PROVE OLD FIBERGLASS AS GOOD AS NEW
Fiberglass composites were introduced 40 years ago, but only now have their service aging properties been tested. And the results are a revelation.

Real-life tests on fiberglass samples were carried out by two scientists at the Grumman Aerospace Corp., George Lubin and Peter Donohue. With a bit of scientific detection work, they tracked down fiberglass components from 11 to 19 years old that had flown on Grumman aircraft and that had been extensively tested prior to being put into service.

Before this effort, the only published data on aging of fiberglass composites were those based on accelerated testing performed in the laboratory, which is the standard tool in use for testing both fiberglass and other composites for in-service structural degradation.

According to Lubin, "hard work, luck, and the fact that Grumman wasn't quick to change fiberglass formulation" played a part in the unique opportunity to be the first to document actual before-and-after results on fiberglass components.

In their paper, "Real Life Aging Properties of Composites" --- selected best in its class at the 35th annual conference, Reinforced Plastics/Composites Institute, Society for the Plastics Industry---presented last month, Lubin and Donohue detail the testing results on fiberglass components that flew aboard Grumman aircraft and were subject to extremes of climatic conditions and to combat. Without exception, all components tested showed virtually no degradation as long as they were properly protected by paint coatings.

Their conclusions dispel the myth that fiberglass degrades with age. More significantly, they throw into doubt the validity of accelerated laboratory aging, which invariably causes considerable degradation of samples tested---a result not supported by Lubin and Donohue's findings.

A reassessment of the criteria currently used for testing fiberglass composites is needed, the two scientists believe. They feel it is certain that current specifications based on such testing result in overdesigned and, therefore, overweight fiberglass structures. More realistic accelerated aging specifications would, they say, result in structures of fiberglass composites being lighter in weight. For aircraft, especially, this would permit significant savings.

The two also tested graphite composites, but owing to their relatively recent arrival on the composites scene, the results for these materials were not as conclusive as those for fiberglass.

****From CP25-12 (CH3)****

ANCIENT AIRCRAFT PARTS PROVE DURABILITY OF FRP

Fiberglass composites don't degrade with age, provided they are protected by paint coatings, tests of 11 to 19 year-old aircraft components show. The tests also throw into doubt the validity of accelerated laboratory aging.

Moldless Construction, General

****From CP29-2 (CH3,CH19)****

FULL-CORE COMPOSITE SANDWICH WINGS

RAF pioneered the structural method of using the hot-wire styro block to form full-depth foam core wings in 1974. We have built over 60 flight-hardware flying surfaces using this method in the development of the S.P. VariViggen, VariEze, Quickie, Defiant, Long-EZ, AD-1 and other aircraft.

The method has since been used on other types, including an STC'ed vertical fin for the older Mooneys. It is estimated that approximately 500 full-core aircraft are now flying, logging over 100,000 flying hours.

The major advantages of full-core are the ease of moldless construction, the accurate contour maintenance under airloads, and elimination of moisture traps. Critics have claimed that full-core is heavier than the hollow wing with standard skins. Our analysis has shown the weights to be very close. However, we have built and tested wings designed to the same criterias (hollow vs. full core) and have found the hollow wings to be heavier. In addition, the hollow structural configuration is more susceptible to workmanship errors that can result in structural failure. This is due to the presence of peel loads and blind rib closeouts. In addition, the hollow structure flexes, has more points of concentrated stress and is more prone to catastrophic failure should a joint open up (leading or trailing edge).

A builder who had built a VariEze, Quickie, Long-EZ and Adventure is now building a homebuilt with molded wing skins. He reports that despite the large molded parts, the man hours in the wing are at least 50% more than for both full-core Long-EZ wings. This is due to the many ribs, jigs, control system parts etc.

****From CP33-6 (CH3,CH41)****

Moldless vs Prefab shells for Homebuilt Construction.

We often get requests to provide molded shells of the Long-EZ to make it "easier to build". Our experience with molded shells has indicated that the full-core moldless structures provide more reliable structures without compromising building time. The most meaningful demonstration of this though, is actual homebuilder experience. Johnny Murphy, who has built four different moldless aircraft, recently completed a molded Glasair. His comments on relative simplicity are printed in the Spring '82 issue of Sportsman Pilot magazine. Sportsman Pilot is a quarterly with very quick response publishing of current homebuilt news. Each issue has a wealth of the latest happenings in the experimental world. Subscriptions are $7.50 a year, Box 485, Hales Corners, WI 53130.

From CP25-9 (CH3)
CAN I BUILD A COMPOSITE AIRPLANE? WILL I ENJOY WORKING WITH GLASS & FOAM? IS MY WORKMANSHIP ADEQUATE TO BUILD AN AIRPLANE? WHAT ARE THE TECHNIQUES USED IN VARIEZE & QUICKIE CONSTRUCTION?

There is now available an introductory kit to answer these questions for you. The kit consists of a book and sample materials, or the book can be purchased separately. The book, "Moldless Composite Sandwich Homebuilt Aircraft Construction" consists of 26, 11x17 pages (equal to 52 pages) describing how the material is applied, education on the materials, tools required, inspection and repair methods. Sample materials include: foam (2 types), fiberglass (2 types), epoxy, microspheres, flox, peel ply, wire for hotwire saw, etc.

The book is $14.50, and is available from Aircraft Spruce, Wicks Aircraft Supply, and Rutan Aircraft. (Add state tax, if resident).

The kit (book and materials) is $45.00, plus postage, and is available from Aircraft Spruce and Wicks, <u>not</u> from Rutan Aircraft. (Add state tax, if resident).

Aircraft Spruce & Specialty
201 W. Truslow, Box 424
Fullerton, CA 92632

Wicks Aircraft Supply
410 Pine
Highland, IL 62249

Rutan Aircraft Factory
Airport #13
Mojave, CA 93501

From CP27-8 (CH3)
<u>Video tape of Moldless Composite Construction</u>
RAF had a crude preliminary version of an educational video tape on glass/foam construction at the booth last year at Oshkosh. Many have asked for copies of the tape when it has been shown at our weekly Saturday demonstrations. We have investigated the cost of producing an improved version for sale in the 1/2" home video formats of VHS and Beta II. We currently plan to have the tapes available by late February, contact us at that time for prices.

From CP28-1 (CH3)
<u>Video Tape</u>
We recently completed our video tape on construction techniques used in building moldless foam/fiberglass aircraft structures. This video tape should be a valuable tool for the first time builder as well as the experienced builder. It runs for 96 minutes and thoroughly covers every phase of construction including health precautions, foam preparations, hot wiring, foam damage repair, epoxy mixing, the use of micro balloons, flox, fiberglass, both UNI-directional and BI-directional, wing shear webs, wing spars, wing skins, leading and trailing edge treatments, corner tapes, peel ply and much more. This tape is available from RAF for $49.95 in either Beta II or VHS (half inch format).

From CP28-2 (CH3)
<u>Video Tape</u> (See Page 1) Add $4.00 for postage and packaging for mail orders. The $49.95 price is for walk-in customers at RAF.

From CP30-1 (CH3,CH33)
<u>Video Tapes available from RAF</u>
We are pleased to announce the addition of a new video tape. This tape was premiered at Oshkosh '81 and was made by Ferde Grofe. It is called "Go-a-Long-EZ" and we sell it here at RAF (VHS or BETA) for $49.95 plus $4.00 handling and postage. Go-a-Long-EZ is an audio-visual presentation of the subjects covered in Appendix I and Appendix II of the VariEze and Long-EZ Owners Manual: Preparation for initial testing, including weight and balance and initial flight testing. **We also have the building seminar tape called, "Building the Rutan Composite". This tape sells for $59.95 plus $4.00 for handling and postage.** Both of these tapes were shown daily at Oshkosh and proved to be very popular.

From CP31-1 (CH3,CH33)
Video Tapes - <u>**Building the Rutan Composites**</u>.
This tape shows you the "how to" with composites. It is a great help for first timers as well as experienced builders. When ordering your tape, please specify whether it is VHS or Beta II. $59.95 plus $4.00 for postage.

<u>Go-A-Long-EZ</u> is a tape that covers the checkout, weight and balance of your aircraft, how to conduct the taxi tests and first flight.
$49.95 plus $4.00 for postage.

Orders for the Construction tape from overseas customers should be sent directly to the address below. Ferde will convert the VHS or BETA to the PAL system for you. At present he is only doing the construction tape.
Ferde Grofe Films,
702 Washington St.,
Suite 168,
Marina Del Rey, CA 90291

From CP32-8 (CH3,CH33)
VIDEO TAPES
RAF now has available a two cassette volume that contains the original "**Building The Rutan Composites**" as well as "Flying Is VariEze", "Defiant" and "Go-A-Long-EZ". All four programs run for a total time of 2:41. All of the above for $99.95.

We still have the single cassette of "Building The Rutan Composites", running time is 1:36 for $59.95.

California residents should add 6% sales tax and shipping to anywhere in the U.S. and Canada is $4.00, all foreign orders, add $8.00. Both of the above are available in the European PAL system.

From CP42-11 (CH3)(Photo Caption)
Yes Sir! Some builders out there really do the bookend practice layup. This one is from Herb Abrams, Solitaire builder.

From CP47-13 (CH3,CH33,CH41)
SHOPPING AT RAF
The following items are available from RAF. Of course, all the additional plans (meaning engine installation, owner's manuals, speed brake etc) are also available.

Moldless Composite Construction Book	14.50
VHS and Beta Tapes	
Moldless Construction	**59.95***
Weight and Balance	59.95*
Both tapes bought as set	99.95*
*Plus $4.00 postage	
Gold and Silver VariEze and Long-EZ tie tacs	6.50
Books:	
The Complete Guide to Rutan Aircraft	
by Don & Julia Downie	13.95
Canard - a Revolution in Flight	
by Andy Lennon	17.95
T-Shirts:	
Blue - Long-EZ logo with "Laughter silvered	
wings" - small, medium, large, Xlarge	8.00
White Polo shirts - Long-EZ logo with "RAF"	14.00
Caps - blue with white front and any aircraft	
patch of your choice	7.00
Patches-VariEze, Long-EZ, Defiant, Solitaire	3.00
Rutan Aircraft patch	3.00
Aircraft name patches	1.50
Some assorted belt buckles, mainly VariEze and	
Defiant and Solitaire	25.00
Posters:	
Long-EZ two ship	2.00
Defiant on Water	8.00
3-ship Defiant, VariEze and VariViggen	2.75
8 x 10 color Long-EZ	1.25
8 x 10 color Defiant	1.25

Foam

Also see CP25-4 in the "Lay-up Techniques" section of this chapter.
Also see CP31-3 in the "Lay-up Techniques" section of this chapter.

From CP49-4 (CH3,CH14)
CAUTION
We heard from a builder the other day who was preparing to build his centersection spar and was planning to substitute blue styrofoam (wing foam) for the urethane! This is an absolute NO-NO. The centersection spar box is the aft wall of the fuel tanks and one tiny pinhole leak in the glass facing would allow fuel to permeate into the styrofoam which would then dissolve. Once

the foam, which supports the glass spar caps was gone, the spar would fail. Don't even think about substituting styrofoam anywhere where it may come in contact with fuel.

If it ever crosses your mind to do so, do yourself a favor and pour a little gasoline onto a styrofoam scrap and watch what happens!! PVC foam and urethane foams are not affected by fuel.

From CP49-6 (CH3)
PVC foam, Divinycel or Klegecel can be joined with micro at any time. For example, for the bulkheads, NG-30's F-22, F-28, etc., if your PVC foam is too small, you can micro pieces together in order to make the piece large enough to cut a bulkhead out of. The micro joint is stronger than the foam itself and, therefore, this technique can be used anywhere. The only disadvantage is, of course, that the more micro joints you have, the heavier the part and, therefore, the airplane will be.

Fiberglass Cloth

From CP25-5 (CH3)
Long-EZ hints
Whenever BID tape is called out in the plans, this refers to a given width of BID cloth cut off the roll at 45 degrees to the selvage edge. This "tape" then works into a corner "variesily" as compared to 90 degree tape. Pre woven BID tape at 45 degrees is not available to purchase anywhere to our knowledge. It is ok to lap 1/2" where a long piece is required. Do not confuse these "tapes" with the spar cap material (3" wide unidirectional tape).

From CP27-6 (CH3,CH14,CH19,CH31)
Long-EZ builder hints.
Heavy Unidirectional Fiberglass Tape - The 3" wide roll of unidirectional glass is used only for the spar caps of the wing and centersection spar. "BID tapes" called out are cut from BID cloth (generally 45 degree orientation). Other UND pieces or strips are cut from UND cloth. Be sure fiber orientation is correct.

From CP29-8 (CH3,CH6)
BID TAPES
There is still some confusion as to what BID tape is and where and how it is used. BID tape in not a purchased item. You can not buy a roll of BID tape. You cut it from your 38" wide roll of BID glass. BID tape should be cut in 2" or 2 1/2" wide strips at 45 degrees to the selvage edge. In most places where you will use BID tapes (eg. fuselage sides to bulkheads) you need to lap 1" onto the bulkhead and 1" onto the fuselage side. Therefore you need a 2" wide tape. In actual practice it is wiser to cut the tape 2 1/2" wide, because it will stretch and get narrower between the cutting table and the airplane.

If you need a longer BID tape than you can cut off a 38" wide roll, it is ok to join the tape by lapping 1/2".

Since you cannot squeegee the BID tapes very easily you should wet them out with a brush, then peel ply the edges to give a neat smooth finish and also to help dry out the layup. Add a minimum of epoxy to wet out the peel ply, rather use the peel ply to soak excess epoxy out of the BID tape layup. Always peel-ply all edges of tapes.

From CP32-6 (CH3)
Jim Heir, Colorado Springs, CO sent in an excellent suggestion for maximum utilization of space. He built a storage cabinet on the wall of his garage, with a large door hinged at the bottom. He stores his rolls of UND and BID glass inside and when he needs to cut glass, he pulls down the door, which has two legs hinged on it, and it becomes his cutting table. He also marked the surface of this table with a magic marker with 45 degree and 30 degree and 90 degree lines every 6 inches. This makes it real simple to cut the necessary glass pieces, then close and latch the door, which keeps the rolls of glass from becoming contaminated. **SKETCH OMITTED**

From CP33-6 (CH3)
Christopher Brichamban suggests you try sticking a 1/4" wide strip of masking tape along the cut lines on your BID. Cut down the center of the 1/4' wide masking tape, carry it to the plane and lay it up. The masking tape comes off quite easily and this allows you to maintain the shape of the BID between the cutting table and the plane.

From CP35-7 (CH3)
Cutting Glass Cloth
Marc Boram sent in this hint for easy cutting of glass cloth, both UND and BID. Marc uses a regular utility knife which is sharpened on emery paper before and during each use. The key to success is a large piece of sheet rock as a backing board for the fiberglass. The knife is pulled across the glass at a very shallow (5 degree) angle, with just enough pressure to cut slightly into the surface of the sheet rock board.

A straight edge is useful for holding the glass in place for straight cuts, but is not absolutely necessary. For curved cuts, lay out the patterns on the cloth with a felt tip pen, then cut them out with the utility knife. Good conservation of cloth and extremely rapid cuts are the result. Sharpen the knife blade often, and remember you can use both sides of the sheet rock.

Caution: Small strips of the cutting surface may contaminate your cloth, so inspect carefully and change your cutting surface often. Glass cloth must be kept absolutely clean. If it is ever exposed to water it must be discarded.

From CP36-7 (CH3,CH22)

Aircraft Spruce has the following new items available:
Electric cockpit heaters, same as Mike has in Long-EZ, N26MS, see CP35.

12V 14 Amp manifolded batteries Yuasha #YB14LAZ as called out in CP35.

B & D Tachometers, expensive but the best you can get, 2 1/4" electric, accurate, reliable, same as in Mike's Long-EZ N26MS.

Pizza Cutters, for cutting fiberglass, excellent. But must be used against a resilient material.

From CP38-4 (CH3)

Cutting BID Tapes
Try rolling the BID cloth into a 1" diameter roll at 45 degrees to the selvage edge, having previously carefully straightened the fibers. Now use a large sharp pair of shears to cut off 2" wide rolls. Presto! Your 2" wide tapes are ready to use and even rolled up for you.

From CP38-5 (CH3)

Corner Tapes - VariEze and Long-EZ
Installation of BID corner tapes, such as in corners between fuselage sides and bulkheads can be a time consuming job. Try this: spread out a piece of aluminum foil (such as Reynolds). Layup the BID cloth, usually two plies, large enough to cut all the tapes you are going to need, onto the foil. Squeegee this layup out to a good layup. Now cut your 2" wide tapes out of this layup, cut through the glass and aluminum foil. Sand and paint a coat of epoxy onto the area to be layed up over, then with your fingers, bend the aluminum foil to form the "tape" into an angle to fit into the corner. Carefully position it and lightly squeegee or stipple it into place. Peel the aluminum foil off, stipple to eliminate any small air bubbles, peel ply the edges and presto, a perfect tape. Really works well.

From CP39-7&8 (CH3,CH22,CH30)

B & C Specialty Products new Linear Regulator will be available in February. The regulator will work with their 35 amp alternator or your standard aircraft alternator. Also included are the following features:
1. Will work with standard aircraft alternators, or automotive type 14 or 28 volts.
2. Over-voltage protection with built-in logic to prevent nuisance tripping from inductive loads.
3. Flashing high-low voltage warning lights with 100 percent press-to-test of associated circuitry.
4. Uses linear type regulation to reduce RFI.
5. Ideal for use in composite aircraft with Loran C or ADF.
6. Regulator output is short circuit protected.

B & C is also selling the Apollo I Loran C for $1,590.00, which includes the preamp and radio tray. The Loran C is only 2" high, 6 1/4" wide and 11" deep.

If you want to save a lot of time when you are cutting your fiberglass cloth, try a heavy duty rotary cutter (similar to a pizza cutter). B & C has a special price of $11.00 for one knife with one extra blade. Additional blades are available for $2.50 each.

The Lightweight 12 amp gear driven alternator that B & C has been making for the Continental 0-200 is still available.

If you would like more information on any of these products please send your aircraft and engine type along with a long SASE to:

B & C Speciality
518 Sunnyside Court
Newton, KS 67114

From CP51-10 (CH3)

Bob Walmiller, while helping Joe Mullendorf and Claes Lundgren build their Defiant, came up with this simple method to eliminate the distortion that takes place when you cut BID glass then pick it up, carry it to your plane, and lay it on the foam. Thank you, Bob, for sharing this idea with us and for the excellent photos which so clearly show what is going on:

"TAPED-FIBERGLASS CUTTING TECHNIQUE
To minimize the distortion of fiberglass cloth when cutting, handling or doing a layup, place a 1/2 or 3/4 inch wide masking tape directly onto the cloth wherever a cut is to be made (1). The tape should be placed around the entire perimeter of the piece being cut out. After all the tape is in place, cut through the middle of the tape and the fiberglass cloth simultaneously. The presence of the tape allows the fabric to be cut more easily with either standard shears (2) or a circular "pizza" cutter (3). After the cut is made, the tape helps the fiberglass hold its shape while it is handled (4a). This is a big improvement over fiberglass without taped edges (4b). Likewise, the free edge of the fabric stock remains straight and will not unravel (5). This greatly reduces the amount of time spent straightening fibers before making a cut or during a layup (especially with BID).

Since the masking tape adheres to the fiberglass extremely well, many fibers will be pulled out of alignment if any attempt is made to remove it. Therefore, trim the taped edge from the layup after it is correctly positioned and still dry, then complete the layup as usual (6). It is not necessary to trim the taped edge anywhere it will be trimmed after the layup has cured, provided it does not interfere with good layup practices (7).

This technique requires very little time to implement and saves much aggravation during the layup."
Robert J. Waldmiller. **PHOTOGRAPHS OMITTED**

Safe-T-Poxy

From CP28-4 (CH2,CH3)
Safe-T-Poxy and Humidity.
Good news! The manufacturer of Safe-T-Poxy has confirmed that this type of epoxy can be used in up to 90 percent humidity with no problem. This will be a big help to those of you who live in areas with high humidity. Of course temperature is still very important and although it is possible to make a satisfactory layup in temperatures as low as 65 degrees F, and as high as 100 degrees F., the ideal temperature is 75 to 85 degrees F. Safe-T-Poxy is relatively insensitive to moisture and that is why it can be used in an environment with high humidity. This also a tremendous advantage over the life of your airframe, since the cured laminate is also more immune to water absorption than normal epoxies. This reduces the possibilities of weight gain through water absorption, a common problem with most epoxy laminating systems.

Caution. We have been approached lately by builders wanting to use Ciba Araldite 506/507 epoxy to build their Long-EZ or VariEze. We cannot recommend the use of this material. The heat distortion point of this laminating system is low and can cause long term "creep" problems. The water absorption is high, which will hurt the life expectancy of the airframe. The chemical make up of this material is such that many builders will become sensitized due to high irritation factor.

Remember, Rutan Aircraft Factory, Inc., has spent many thousands of hours, building, testing and flight testing the prototype aircraft that we sell plans for. For us to recommend any material that we have not tested in an aircraft that we are currently flying would be unethical. We have learned that another plans distributor has shifted their recommendation to a cheaper epoxy even though their prototype is not build from the cheaper material. This practice is, in effect, asking homebuilders to test something new to see if it is adequate. This practice is acceptable because each homebuilder is the manufacturer of his own aircraft. However, we feel that ethics require that if a homebuilder is breaking new ground he should be notified that he is being recommended to use something that has not been tested on a prototype.

From CP29-3&4 (CH3)
SAFE-T-POXY WORKING TEMPERATURE.
Builder feed-back has indicated some difficulty using the Safe-T-Poxy in cold climates. Typical situations are where most EZs are built in garages that are difficult to heat in the winter. Problems are where the builder will heat up the room/garage (air only) and go directly to work but the epoxy, glass, parts, tools etc are still cold-soaked. In use, cold epoxy wets slowly and greatly extends the time to wet the cloth properly.

The Safe-T-Poxy has a higher viscosity than the previous resins, thus requiring a higher working temperature to use, especially on the larger layups. The high viscosity was selected for the Safe-T-Poxy to eliminate the tendency of the previous material to bleed-out (inducing air in the layup during cure).

If you are building in a cold garage in the winter you can still use the new Safe-T-Poxy if you take the following precautions:

1) Warm the resin and hardner evenly to 85-90 degrees F prior to mixing. Don't try to hurry this. We use a light bulb under the ratio pump 3-4 hours prior to use, or keep you resin jugs in a cabinet with a light bulb inside.

2) It's important to have everything thoroughly warm prior to starting to work. This also cannot be rushed. It takes time to get the parts (wings, foam blocks, etc) up to a stable temperature throughout. If you are starting from a very cold garage the warming process could take 4 hours or more. Don't think just because the air is warm that all the material is warm.

3) Use an electric hair dryer to warm the area as you work, being careful not to over-heat the part or epoxy. When, due to cool temperatures, a part is slow to wet out, a few quick passes with a hair dryer will greatly speed the layup time. Do not use a hair dryer to heat a cup of epoxy. This can give local hot spots and ruin pot life.

What shop temperature is satisfactory? That has a lot to do with the size of the job. Small jobs can be worked to as low as 65 degrees F but the working time will be excessive. It will also be more difficult to remove excess epoxy, resulting in a heavier part. On large lay-ups like the fuselage, wings, etc., where there is a lot of epoxy to drag around, 77 degrees F should be considered the minimum. That's epoxy prewarmed to 85-90 F and all parts, glass, foam, tools, table - everything up to 77 F for 4 hours then go to work. Those temperatures are minimums - add 5 to 10 F and your working time will be greatly reduced and parts built lighter. Optimum working temperature range for the Safe-T-Poxy is 77 - 95 F.

From CP29-5 (CH3)
Resin/Hardner Storage.
Several builders have reported that their resin or hardner or both have settled out or crystallized. Do not use your resin or hardner while is is in this condition. This problem is caused by temperature cycling. Never keep your resin or hardner in a cold place or on a cold cement floor. It should be stored up on a shelf at room temperature. If you see your resin or hardner start to crystallize

and settle out, is it important that it be returned to it's normal clear state as soon as possible, even if you don't plan on using it right away.

To return crystallized or separated resin or hardner to it's normal state, place the jugs (caps on tight!) in hot water (160 F to 190 F) until the crystallized material goes back into solution. Be patient, and occasionally agitate the jugs. The longer you leave the jugs in hot water, the less likely this is to occur again. Depending on how badly the material gas crystalized the process could take 30 minutes to 3 hours.

If after 5 hours at 160 F - 190 F your resin or hardner has not become clear, return it to your distributor. Once it is clear and provided you store it at room temperature, it should remain clear, and the structural qualities of the epoxy will not be impaired.

****From CP29-6 (CH3)****
Questions: I have built part of my aircraft using Safe-T-Poxy without checking my ratio pump. I now find that the pump is for the older epoxy with 20:100 ratio. What now?

Answer: You must discard all parts built with the wrong ratio. Epoxies should be mixed as accurately as possible. Errors as much as 10% can be accepted but definitely no higher. Structural integrity, particularly long-term will be unsatisfactory with the enormous error in ratio you have been using. Note that it is a good idea to occasionally check the delivered ratio of your pump. Check that the valves are clean. You can modify the ratio of these pumps by drilling a new pivot hole for the handle. If the pivot is moved to the left the ratio of hardner to resin is increased. The 20:100 pump will deliver 43:100 if the pivot is remote, about 30 inches to the left of the pump. If you use a remote pivot be sure to clamp the pump base securely to the workbench and provide a stop to prevent piston over travel. (see CP #).

****From CP30-7 (CH3)****
Epoxy Balance
Paul Burch had improved his balance by glueing a Sears line and surface utility level (around $3.00) to the beam. This allows you to see when you are getting close with the hardener, and also makes certain that the whole balance is level. Parallax errors are also eliminated.

****From CP32-6 (CH3)****
CAUTION - SEDIMENT IN THE RESIN OR HARDENER
Hardener - This is a result of temperature cycling and is not acceptable. Do NOT use hardener or resin that has a cloudy sediment, or solid lumps at the bottom of the container. You must not strain these lumps out, rather you must heat the material as described in CP 29-5 until it goes back into a clear solution, before attempting to use it.

****From CP33-6 (CH3)****
Terry Crow suggests an insulated box to keep your epoxy pump and epoxy warm. Build it out of styrofoam. (bead board ok). Glue it together with epoxy, make hinges out of BID, epoxy them on. Leave them dry at the hinge line. Terry keeps his at 85 degrees + or - 3 degrees with a cheap fish tank heater in a plastic bottle filled with water. Parts cost $8.00 and one hour of time. Terry also suggests that if you have not used your pump for a week or more that you discard the first squirt, as the ratio can be off.

****From CP33-6 (CH3)****
Dan Wicklund says a 20 gallon styrofoam ice chest (24" x 14" x 14") makes a great storage area for keeping resin, hardner etc. at 85 degrees. Use a 40 watt light bulb and a dimmer switch, run the chord through the drain hole and set the whole works on 2 scrap 2x4s to keep it up off the floor.

****From CP35-7 (CH3)****
Epoxy Ratio Pumps - The manufacturer of the ratio pumps Michael Engineering, has asked us to pass on the following information regarding regular maintenance.

The check ball on the hardener side should be cleaned every 6 to 12 months. It is located just behind the brass fitting on the front of the pump body. The hardener tends to 'plate' onto the ball, which causes it not to seat perfectly. This allows hardener to drain slowly back and it may not flow on the first stroke of the pump at the next use. Simply take the fitting off, clean the ball, spring and fitting. Another option is to "coin" the seat by putting the ball in place and striking it gently with a brass punch and hammer. This will assure a perfect seal. Be careful that the spring does not caught in the threads when reassembling pre-1981 models.

Remember to subtract the weight of your containers before calculating the ratio, when checking your pump ratio.

****From CP40-2&3 (CH2,CH3)****
SAFE-T-POXY II
We have had a lot of requests for information on this material. RAF has been using it in our shop for over a year. We did some direct comparison tests of laminates using regular Safe-T-Poxy and Safe-T-Poxy II. The results of these tests verified the manufacturers claim that the new material was as good or slighdy better in every respect from a structural standpoint. In addition to this, this epoxy is thinner (less viscous) and tends to wet out the glass more rapidly with less effort. It should therefore be easier to work with in a cooler environment. The single biggest advantage is the reported lower likelihood of experiencing an allergic reaction from Safe-T-Poxy II, even compared with the regular Safe-T-Poxy. This is not an easy thing for us to test, since no one who has ever been employed at RAF has had an allergic reaction to any of the epoxies that we have used.

Our experience with the material has shown some advantages and some disadvantages. The opinions of the folk that work at RAF vary, but the general consensus is that it does wet out better, especially if the shop is cool. Safe-T-Poxy II has more tendency to "run out" or "bleed out" of a given layup, especially if that layup is not perfectly horizontal. On a vertical surface or even a sloping surface, run out is more of a problem than it is with regular Safe-T-Poxy. The worst complaint is a considerably shorter pot life, especially in a shop that is heated to the recommended 77 degrees F.

Safe-T-Poxy II in our experience starts to gel and become "stringy" in the cup in about half the time that this occurs with regular Safe-T-Poxy. Once out of the cup and on the part, this is not a problem. If this "stringyness" occurs in the cup, this batch must be thrown away, since it will not wet out the glass once this has happened.

In conclusion, we recommend that you try Safe-T-Poxy II, perhaps a small kit and see how you like it. See if it suits your individual work habits. Both Safe-T-Poxies are excellent structural materials and are suitable for building any of the Rutan composite designs. Both materials are also better than any other epoxy we know of for fuel compatibility.

****From CP43-5 (CH2,CH3)****
Long-EZ - Builder feed back indicates that most builders are finding that they need more epoxy than what is called out in the plans. Keep this in mind, and when you order your epoxy, order only what you think you can use in the next 12 months. Be realistic with yourself, there is no sense in buying 15 kits of epoxy, using only 5 in the first year and being stuck with 10 kits of out of date epoxy. The manufacturer has put a 12 month shelf life on the Safe-T-Poxy. You are the aircraft manufacturer and you have to be responsible to make the right decision when a primary structural material goes over its shelf life. Stay away from this problem by buying only as you need, keeping only fresh epoxy to build the structure of your aircraft.

****From CP43-5 (CH3)****
CAUTION
A possible 'bad' batch of Safe-T-Poxy hardener may be out in the field. Only two reports have been received to date. Symptoms are slow curing or no cure at all. Be sure and ALWAYS check yesterdays mixing cup with the classic scratch test. 24 hours after mixing epoxy in a cup, the surface of the residue can be scratched with a sharp object, such as a pocket knife or a nail and this scratch should look white and the cured surface should not feel gummy. Do this test 24 hours after every layup. This is the same test that is used throughout the industry and will guarantee that you never use a bad batch of epoxy. It will also show up a poorly mixed batch or a batch mixed using an incorrect ratio.

Lay-up Techniques

****Also see LPC #57 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #68 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP29-3&4 in the "Safe-T-Poxy" section of this chapter.****
****Also see CP29-8 in the "Fiberglass Cloth" section of this chapter.****
****Also see CP38-5 in the "Fiberglass Cloth" section of this chapter.****
****Also see CP40-2&3 in the "Safe-T-Poxy" section of this chapter.****

****From CP25-4 (CH3,CH34)****
PV FOAM AND WEIGHT CONTROL
The original PV core foam, type R45 dark blue, that we tested here at RAF, layed up absolutely perfectly without using slurry. Based on this series of tests, we called out no slurry on type R45 PV foam in Long-EZ plans. The production type R45 PV foam in most cases is representative of our test samples, however in a few cases larger cell foam is being delivered in the kits. This large cell foam is structurally excellent, and can be layed up without slurry with real acceptable physicals, however it is a lot easier to accomplish the layup if you slurry the type R45 PV foam. The glass wets out quicker and you get less air or dry looking areas. There is little or no difference structurally, but our test have shown a slightly lighter part if you use slurry. The best thing to do is conduct your own test as you build and decide for yourself which way works best for you.

In all cases your glassing time should not exceed 2 minutes per square foot per ply, i.e., front side of front seat bulkhead, is two plies, and should take no more than half hour. If you are working slower than this you are doing something wrong, and you will end up with poor work, heavy parts etc., due to epoxy gel. Above all, don't leave excess epoxy in a layup. If a squeegee can remove epoxy, do remove it. Use numerous squeegee passes to wet out as well as to remove excess. Remove the grams of excess epoxy from every layup, and your airplane will be many pounds lighter and stronger.

Do not add extra glass anywhere. One VariEze builder wanted his airplane "extra strong" so he added a ply here and there. His airplane is over 100 lb. overweight and his strength for flight and landing loads is less.

Chase after grams, and the pounds will take care of themselves. Bill Lear once said he would kill his grandmother for a pound. While this measure is not recommended, it is possible if you are not diligent on weight control throughout your project you will be building a sluggish, single-place airplane.

From CP27-5 (CH3,CH34)
FIBERGLASS LAYUPS
We have recently inspected some layups with unacceptable epoxy-to-glass ratios and improper fiber orientation. Aircraft structure, whether its fiberglass, aluminum, or welded steel must be built properly or must be rejected. It is not satisfactory to accept any critical part that has excess epoxy. On every part, be sure to do the squeegee test for a "ridge" - see page 3-11 step 7. Pull the squeegee along, stop and remove it and see if you have piled the excess epoxy up into a ridge. You must spend time with the squeegee pulling all excess off the sides if the test reveals a ridge. Do not attempt any layup (except small corner tapes) unless you have a clean, flexible, smooth squeegee to use. It is not possible to smoothly remove excess or determine correct ratio with a brush. When building any type of aircraft structure, your very best workmanship is just barely adequate. Do not accept anything less. Practice on your Chapter 3 flat layups until it is perfect before building aircraft parts. If in doubt on how a given layup should look, duplicate it on a small piece and send it to RAF for our comment. It is difficult to access the acceptability or dry or wet layups on the phone.

From CP27-5 (CH3)
BUILDER HINTS - LONG-EZ AND VARIEZE
Do not use peel ply over the entire structure. This starves epoxy from lower foam surface, makes inspection difficult, gives an erroneous impression of good surface smoothness, makes it easy to unknowingly damage structure during finishing and adds weight. For example - if the elevators are peel-plied they will be too heavy to balance and must be discarded. Do peel ply surface edges of glass plys whenever they exist and, of course, whenever a layup will be later made over a cured surface.

From CP28-8 (CH3)
Hints from builder.
1) It will save time in building and finishing if you are neat in everything you do. For example, protect foam and finished parts from slopping or dripping epoxy on them. Example, when laying up spar caps, do like a surgeon and cover and tape off adjacent foam areas to protect them from epoxy. **SKETCH OMITTED**

In a similar fashion, protect finished parts by covering and taping them against drips, runs etc.

2) When gluing foam cores together, use minimum micro to prevent large excess from oozing out. Tape edges of cores first, so you can clean off excess without smearing it across the foam. **SKETCHES OMITTED**

3) Before sanding cores, undercut seams to avoid high spots, or breaking loose micro or 5 minute epoxy which will damage foam. Its easy to fill undercut areas again before skinning.

From CP29-6 (CH3)
CAUTION
There is some bad information circulating around about painting styrofoam with Latex house paint before glassing. This is totally false, and should not be done under any circumstances. The foam is there not only to give the correct shape to a part, but to provide buckling support to the stressed skin structure. In order for this support to be adequate, the glass skins must be bonded very strongly to the foam core. If you have a coat of house paint between the glass skin and foam core, this bond cannot be any stronger than the coat of paint. This is a serious structural problem and could very easily lead to a structural failure. If you have built any parts using this method, consider these parts unairworthy, and discard them.

Rebuild them using the correct method, as described in the plans.

From CP31-3 (CH3)
FOAM PREPARATION
Although we have had this correction in at least two previous newsletters, some builders are still not using micro slurry. ALL foam should be slurried. Disregard ANY and ALL statements in the Long-EZ plans that say not to use slurry. By slurring the foam, you will be able to do a better quality, lighter layup, in less time.

Slurry fills the broken cells on the foam surface. After spreading slurry on, wipe off excess with the squeegee to that only a thin film is uniformly spread over the entire part. The construction video tape is a good reference for good slurry technique. If in doubt, send RAF a sample of your work for our comment (include a SASE, of course).

If you have already made some of your parts without slurry, it is not necessary to remake them, provided you have met the dryness criteria. If they are very wet, or too heavy, you might consider doing them again, however lack of slurrying is not cause for structural disqualification.

From CP31-4 (CH3)
When knife trimming, hold a strong light under the glass overhanging to more clearly show where the edge of the foam is.

****Also see CP25-5 in the "Tools" section of this chapter.****
****Also see CP29-8 in the "Tools" section of this chapter.****
****Also see CP31-8 in the "Tools" section of this chapter.****
****Also see CP42-8 (Power Supply) in the "Tools" section of this chapter.****
****Also see CP42-8 (High Tension Hotwire Cutter) in the "Tools" section of this chapter.****

****From CP24-4 (CH3,CH10,CH11,CH19,CH20,CH31)****
Hotwire Templates-
An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood, available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

****From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)****
BUILDER HINTS
You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. **This works great for hotwire templates too.**

****From CP27-5 (CH3,CH10,CH19)****
Hot wire troughs - Use the following method to separately cut the troughs. This gives more accurate, sharper cuts. Nail a temporary template (a popsicle stick works fine) to guide the wire straight across over the trough. Then, remove the stick, and in a separate pass, cut the trough. Be careful to not let your core move between the cuts. **SKETCH OMITTED**

****From CP30-7 (CH3,CH10,CH11,CH31)****
Hotwire Templates
When making identical templates, (canard, elevators, etc.) clamp them together, and use your Disston abrader to sand them to exactly the same shape. This is also valid for canard jigs.

****From CP36-6 (CH3,CH10,CH11,CH19,CH20,CH31)****
V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

Jigging Techniques

From CP26-4 (CH3)

FROM IVAN SHAW, ENGLAND - "I use modeling clay to hold jigs temporarily before applying the Bondo, real helpful and easier than playing about with shims. I bettered the wing layup times by using two 2-inch brushes, it doubled efficiency. I'm a drummer and can get 16 stipples a second! While this works well for a professional drummer, we at RAF still recommend minimum use of brushes. By pouring on epoxy and spending most of the time with many light passes with the rubber squeegee, most people will do fast, accurate, quality layups.

From CP42-4 (CH3,CH20)

Bondo for jigging - When you position your winglet onto the tip of your wing, be careful to sand the wing and the winglet locally where you apply the bondo that will jig it into position for the structural layup. If you do not sand the glass, the bondo may not hold, and it is possible that the bondo will fail in the middle of the cure cycle of the structural glass layup. This can cause the winglet to be misaligned incidence wise. This has happened before and it can happen to you. **Sand the glass wherever you intend to apply bondo for accurate jigging purposes.**

From CP43-5 (CH3,CH20)

VariEze and Long-EZ - Hot Stuff model airplane "instant" glue. A cyanoacrolate glue, Hot Stuff can be extremely handy to "tack" pieces in place, to essentially give you a third hand, by almost instantly glueing small parts and firmly holding them in position. Hot Shot, a spray accelerator that speeds up the curing time of Hot Stuff glue can also be used to great advantage. We like the thick glue as opposed to thin, and when used with Hot Shot accelerator, can produce an unbelievably strong bond between glass pieces, plywood or even PVC foam pieces (do not use on Styrofoam). We have tacked winglets to wings with Hot Stuff, instead of Bondo. The advantage is, it cures instantly and you can layup glass right over the tiny drops of Hot Stuff. We also have found it a great time saver when jigging parts. Experiment and you will find all kinds of places you can use this material.

Finishing

From CP26-7 (CH3,CH25)

FINISHING - CAUTION! Do not ever wipe paint thinners on any part of your structure. Minute pin holes in the epoxy/glass skin can allow the thinners to penetrate down to the styrofoam, which dissolves in thinners. This can cause the skin to debond from the core. For the same reason, care should be taken to fill any possibly dry areas (presence of air voids) or areas with pin holes, with epoxy, before applying featherfill or primer, both of which contain solvents that can attack the styrofoam. Epoxy wiped onto the surface with a rag should be sufficient to seal layups that otherwise maybe dry enough to allow thinners or primers to penetrate. The surface must be sanded after epoxy cure.

From CP55-9 (CH3,CH25)

All RAF designs - While waiting on cure cycles or parts to arrive, or while you are delayed for whatever reason, do little bits of finishing work on the parts you have done. Keep a one gallon kit of West System Epoxy handy. This is obtainable from Gougeon Brothers, PO Box X908, 706 Martin Street, Bay City, Michigan, 48706. Call 517-684-7286 or 6881 (orders only). Ask for 105-B resin, 205-B hardener (fast) and a 301-B mini mump set to pump the correct ratio out of a one gallon resin can and a one quart hardener can. They also sell a slow hardner 206-B but we believe the fast, 205-B, is more useful for mixing dry micro. (You will probably use about 2 gallon on a Long-EZ.)

We mix it as follows: One stroke of each pump into an 8 ounce paper cup, mix thoroughly. Add one heaped 3 ounce paper cup of micro balloons and stir thoroughly. Spread this mix of dry micro and West onto your wings or winglets, canard or whatever you have done, particularly in any low spots like next to a spar cap, etc. Trowel it on a bit thicker than you need and allow it to cure. A full cure normally takes less than 12 hours depending on the ambient temperature. Here in the desert, we can spread it on in the morning and sand it to contour in the afternoon. It is a good idea to dampen a handful of paper towels with West epoxy and moisten the part prior to troweling on the micro. Of course, the bare glass should be scuff-sanded with 36 or 40 grit sandpaper prior to wetting with West epoxy. Don't get it too wet, just moist for a good bond. The West system epoxy and micro will bond very well to Safe-T-Poxy and will be easy to sand (unlike Safe-T-Poxy and micro!!).

Doing a little finishing all the while as you are building will make the finishing process at the end of your project a lot easier to stomach! After all the parts are built, the engine and wiring and systems are all in and done, it is usually quite demoralizing to suddenly find yourself faced with the enormous task of sanding, filling, contouring, sanding, filling and sanding and painting all at once. A little filling done once or twice a week will leave you with a much smaller job at the end of the project. Try it, you will be glad you did!

From CP27-8 (CH3)

Aircraft Spruce and Wicks stock a safety kit which includes:

50 gloves
1 pair goggles
12 dust masks
1 can hand cleaner.

The kit costs approximately $25.00 and we have found them to be most useful.

From CP31-2 (CH3)

SAFE-T-POXY - REACTIONS, ALLERGIES

It has come to our notice that quite a number of builders seem to be suffering from some form of reaction to the Safe-T-Poxy. We are very interested to know the present scope of this problem, since initial results in 1978 showed that reactions were very rare. If you have had any kind of reaction to the Safe-T-Poxy, please send us a report with a brief description of the reaction, and how long you had been working with the material before you noticed the reaction, whether or not you were using any form of protection, gloves, Ply 9, respirator etc. We will correlate this information and work closely with the manufacturer to see if a change has occurred or if improvement is indicated. We will report on our findings in a future C.P.

From CP32-4 (CH3)

SAFE-T-POXY REACTIONS

In CP 31, we asked for reports from anyone who has experienced a reaction while using the SAFE-T-POXY. To date (April 4) we have received 47 letters, all of which have been sent onto Applied Plastics, the manufacturer.

It is still difficult for us to access the extent of the epoxy sensitization. Less than 3% of the builders sent reports of problems, but we must assume that many of you did not bother to write. Applied Plastics are presently reviewing your reports and investigating the problem. They recently sent in a random SAFE-T-POXY sample for testing and it again came back a zero on the SPI scale from zero through 10. For perspective, a common industrial epoxy. 815 has an SPI 6, while RAE epoxy has an SPI 3. SAFE-T-POXY is an SPI 0.

Applied Plastics is developing a very through pamphlet covering the use of SAFE-T-POXY and precautions to take to avoid the reaction in the first place. They also have suggestions to help you get around the problem. If you are having a slight reaction and are using SAFE-T-POXY, be absolutely certain that you do NOT have MEK or acetone or lacquer thinner in the shop at all. Just breathing the fumes of these solvents can render you vulnerable to the epoxy. Getting these solvents on your skin is asking for trouble. If you are using gloves (NEVER use Ply 9 and gloves together, it is either gloves or Ply 9) try using different types of gloves, even surgeons have allergic reactions to some gloves. Try using thin cotton liners under your gloves, this soaks up sweat, and will show you if you get a break or tear in the glove. While sweating you can sometimes be more vulnerable to allergies. A method that has worked well for some builders is to use only Ply 9, and to stop at least every two hours, wash your hands and arms thoroughly with a good borax soap (Lava) paying particular attention to scrubbing under finger nails and around your cuticles. Dry your hands, reapply Ply 9 and return to the layup. Do not exceed the two hour period. Wash up as often as necessary during a long layup. If your sensitivity to breathing the fumes is severe, full-face respirator can provide a solution. (W. W. Grainger #5X803 is an example).

To summarize, cleanliness is the 'biggy'. Do not allow epoxy, solvents or any industrial type materials, to come in contact with your skin, not ever. Wash thoroughly, often. Use a good respirator and/or ensure that you have adequate ventilation. If you still have problems you might consider switching to the RAE epoxy system. This may sound silly, (an SPI 0 to an SPI 3), but the fact is you may be reacting to a particular chemical in SAFE-T-POXY, that may not be in the RAE system. This has worked for several builders. The allergic reaction healed and they were not bothered again. Beware though, RAE is definitely more toxic. Take all possible precautions when using either of these systems. Finally, if you still have problems, let us know so that we can keep giving the manufacturer this data. Plastics good feed back.

From CP33-7 (CH3,CH22,CH30,CH38)

Aircraft Spruce is now stocking the AOA oil analysis kits for $8.95. The David Hoffman cockpit lights are in stock for $12.50 each. **They are changing to Latex gloves instead of vinyl, same price and they will also be stocking cotton liner for the Latex gloves.**

From CP36-3 (CH3)

EPOXY REACTIONS

A small percentage of our builders continue to develop allergic reactions to the Safe-T-Poxy. Applied Plastics, the manufacturers of the epoxy continue to try to isolate whatever it is that causes this problem. It is not an easy task. Safe-T-Poxy was recently retested by an independent lab and again came up with an SPI rating of zero, on a scale of 0-10. Applied Plastics has published an excellent brochure covering all aspects of using epoxy, precautions to take and what to do if you react to it. They also evaluated the various types of gloves that are on the market. They have a brochure that very thoroughly covers this subject. It turns out that the only glove that is an absolute 100 percent barrier is one made of Butyl. Butyl gloves are expensive but Applied Plastics has found a reasonable one that will last a long time with care and still gives good feel. Some people are effected by contact with the material, others by inhaling the fumes. A good quality respirator with charcoal filters will go a long way toward curing the latter problem. Again Applied Plastics have found a very nice disposable charcoal filter which they have in stock.

Write to Applied Plastics and enclose a SASE for the brochures and prices of the Butyl gloves and respirator. See page 7 of this CP.

No one at RAF has developed an allergic reaction to either the old RAE epoxy or the Safe-T-Poxy. We are always careful and after every layup we wash our hands and arms very thoroughly using Lava soap. Mike Melvill has been using Vaseline brand "Dermatology Formula Lotion". He uses it morning and evening whether or not he has worked with the epoxy. Mike has been working with the various epoxies RAF has recommended for 9 years and is a firm believer in washing after short layups and even during large layups. Different techniques may be required for different individuals. Cotton liners under vinyl, rubber, latex or butyl gloves are an excellent idea. These absorb the sweat. Do not apply Ply 9 as well as wearing gloves. Ply 9 works quite well by itself, but the barrier it forms, (which is impenetrable by epoxy) can be ruptured while working. If you suspect this has happened or if a glove is torn, stop. Take the time to wash your hands, dry them and reapply Ply 9 or a new pair of gloves.

Take care of yourself while building. A few builders have simply had to give up their projects due to severe reactions. Do not think it won't happen to you. Everyone has a level of tolerance at which their body will cry 'uncle', don't try your luck.

From CP36-7 (CH3)

Applied Plastics of El Segundo, California, (213)322-8050 has a supply of an excellent disposable charcoal filter respirators. Also pure Butyl gloves, a bit expensive but if you are having problems with epoxy reactions, this is your way out. Butyl is the only 100% barrier to all of the chemical components in Safe-T-Poxy.

From CP37-4 (CH3)

The following letter is from a builder who had an epoxy reaction.

"Dear RAF,

I am writing this letter to express my appreciation to you and Applied Plastics for "saving" my composite homebuilt Long-EZ project! About two months ago, I called you to get your advise re: how to prevent any further or worsening of the dermatological (rash, burning, itching hands and arms) reaction I had experienced after a six hour session with Safe-T-Poxy and acetone.

I followed you advice and changed my shop routine as follows:

a) Started using Norton Butyl rubber gloves exclusively..

b) Stopped using acetone (I now discard brushes and just wipe down squeegees).

Since I was already using a charcoal filter respirator, no change required there. I did improve the ventilation in my shop.

I have had some lengthy lay ups since with no sign of a problem. While they are relatively expensive, I think you should strongly recommend the use of the Butyl gloves.

Thank you again for your professional, prompt and sincere response to a problem, which very easily could have "shot down" a project which is very important to me.

Sincerely, Gary Holmes."

From CP42-4 (CH3)

CAUTION

When mixing epoxy and micro balloons, wear a dust mask and keep your face away from the balloons that may float up into the air. Although these glass balloons are inert, they can lodge in your eyes or in your lungs and can cause problems. Handle with care.

From CP45-6 (CH3)

Aircraft Spruce and Wicks have several new items for sale. The new PR-88 protective hand cream is in stock and sells for $18.50 per liter. Also available is an excellent line of aircushioned drum sanders and flex disc sanders. Contact these distributors for information and prices.

Please note that the catalogs from Aircraft Spruce and Wick Aircraft are now $5.00.

From CP45-6 (CH3)

NEW BARRIER CREAM TESTED

We recently obtained a new product called PR-88. This is a hand cream designed to act as a barrier against virtually anything the homebuilder might work with. We have found it to be absolutely excellent particularly when working on a dirty, greasy engine, or when painting or working with epoxy. We find it works best if you wash your hands quite often, say once per hour, during a particular job. This also gives you a break and you will find that the work will usually go quicker and better. This barrier cream is the best we have used. It goes on easily and is not sticky and in fact once it has dried, you do not know you have it on. It is available from both Spruce and Wicks.

From CP47-13 (CH3)

PR-88 Barrier Cream is still the best we have ever tried. We use it every day at RAF and a can goes an amazingly long way. Available from WICKS AIRCRAFT and AIRCRAFT SPRUCE.

From CP64-5 (CH3,CH25)

WARNING- MODERN PAINTS CAN KILL

Scott Finnigan, a real up-and-coming aerobatic contender in a Pitts S-1-S died suddenly last December. There is a lesson that can be learned from this tragedy and you should be aware of what it is.

Last year, Scott painted some airplane parts in a small, unvented paint booth without using protective breathing equipment. Scott was spraying Imron. This material can be quite lethal and some of it got into his lungs. The damage was great and, sadly, incurable.

Be sure to use protective equipment whenever it is required by the manufacturer. Follow all safety guidelines - many of the modern painting materials are dangerous if not used in accordance with the manufacturers instructions. Modern polyurethane paint is just not like the old butyrate dope and enamels so many of us used to use.

Tools

Also see LPC #18 in the "Long-EZ Plans Changes" section of this chapter.

**From CP25-5 (CH3,CH10,CH11,CH19,CH20,CH31)

HOT WIRING

Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

From CP29-8 (CH3)

A cheap automotive battery cable terminal cleaner (approximately 85 cents) makes an excellent foam carving tool, and works great in small corners.

From CP29-8 (CH3)

Small sanding discs made by Merit Abrasive Products, Inc, P.O. Box 5448, Compton, CA 90224, work very well on a dremel tool. This company sells holders and sanding discs and calls them 1 1/2" diameter power lock holder and disc.

From CP29-8 (CH3)

Vince Golden (Long-EZ builder) sent us a really neat homebuilt hot wire alternative to the Variac. Vince built one and sent it to us and we have been using it for a couple of months and find it to be excellent.

Part required:

1 Hardware store dimmer switch	$4.59
(We used an 'ener-g-save' push on/off single pole)	
1 Capacitor .22UF 200 VDC	.35c
1 Resistor 220 OHM 1/2W	.20c
1 Transformer 28 VAc 4 Amp Tranex 24-10024	$7.50
	$12.64

You will have to modify the dimmer switch, by installing the capacitor and the resistor inside the dimmer switch box. This will also give you the ability to run a single speed dremel tool as a variable speed.**SKETCHES OMITTED**

Note! By disconnecting the transformer the dimmer can be used to run a dremel or electric drill.

From CP31-4 (CH3,CH6)

A 3M part #7770 Clean'n'Strip brush, mounted on your drill really does a super job of carving the R45 dark blue foam. As an example the bottom can be carved and ready to glass in only 45 minutes. Thanks to Don Jehlik for this one.

From CP31-8 (CH3)

HOT WIRE SET UP - The homebuilt hot wire set up that was described in CP 29, page 8, works fine, but many have had problems locating the parts. Vince Golden has kindly agreed to provide the transformers for those who can not locate them locally. Contact Vince at: Mike Quinn Electronics,
Bldg. 727 Langley Street,
Oakland Airport, CA 94614
415-569-1539

Vince will send you the transformers and modification parts by UPS for $7.50 plus $3.50 shipping.

From CP38-8 (CH3,CH18,CH22)

Aircraft Spruce now has in stock the electric cockpit heaters as tested by Mike Melvill in N26MS. **Also a substitute for the now extinct Disston Abrader, a handy little tool for sanding and filing glass and foam.** Also a new type of spray-lat for protecting plexiglass canopies. We tried it and it works great.

From CP39-7 (CH3)

VariEze, Long-EZ and Solitaire - Epoxy brushes may be used several times over without washing them out, if you wipe most of the epoxy out of the bristles with a paper towel, then place it in a freezer. The low temperature slows the cure cycle dramatically. The next day, you can take it out of the freezer, stir it around in a fresh cup of "ready to use" epoxy and within a few seconds, the brush will soften until it is like new. We have reused a single brush many times using this technique. The only problem will be if you don't need the brush for a couple of weeks. Then it will have cured. The freezer slows down the cure. It does not stop it! As long as you are busy doing layups every day or every two or three days, this trick works.

From CP42-8 (CH3)

Excellent hotwire power supply for $12.50

Contact: Mike Quinn Electronics,
Bldg 727 Langley Street,
Oakland airport,
Oakland, CA 94614
415-569-1539 (ask for Vinnie)

From CP42-8 (CH3)

At last, for the composite fanatic, a high tension hot wire cutter! Seriously, while the standard plans built hot wire cutter is an adequate tool, which with care will produce very nice foam cores, this high tension hot wire tool essentially eliminates wire lag. A Long-EZ builder, Tom Berkley, designed, built and tested this hot wire tool. Now that he has perfected it, he has put out a well done set of plans and is offering them to homebuilders. A hot wire tool of this caliber is probably not for everyone, but for the persnickerty builder who likes perfection, why not get him or her a set of plans for Christmas?

Contact: Tom Berkley,
P.O. Box 6184
Tehachapi, CA 93561
805-822-5065

From CP48-3 (CH3)

A leveling device that is very useful is a water level. This consists of a 30 foot long piece of hardware store type plastic or vinyl tubing with 1/2" I.D. Fill the tubing with colored water (food coloring), hold the two ends together and mark the water level at each end. Now, to use the water level to check, for example, the wing tips for relative height, hold or tape one end of the tubing on the reference wingtip with a water level mark on the reference point. Go the the other wingtip and raise and lower the other end of the tubing until the water is at the mark you put on the tube. This works great and does not have any sag in it like a tight string does.

Don't get the tubing too small in I.D. because the capillary action of the water will disturb the accuracy. Don't fill the tubing too full! Allow at least 12" from water level to top of tube. Do not cap the tubing! When you are not using the water level, twist a loop of safety wire around each end and hang them on a wall or door frame to prevent spilling.

From CP48-3 (CH3)

Sanding blocks. We all know what a pain it can be to glue sandpaper to a hard block. Contact cement gets lumpy. It is difficult to remove "used up" sandpaper, etc. Well, this it it. The time tested method used by the sailplane wing contouring experts. FEATHERING DISC ADHESIVE, part #51135. number 08044, made by 3M. This is a spray can of glue - accept no substitute. Reportedly, no other product, regardless of their claims, works as well. Follow the instructions on the can to the letter to stick your piece of sandpaper to your block of wood. Now, when the sandpaper is worn out and you need to remove it, use a fingernail to pry up one corner and, using a small (cheap) paint brush, brush a little Dupont fast dry enamel reducer, part#3812S under the sandpaper. Just a few drops will allow the brush to almost miraculously peel the sandpaper off. Again, accept no substitute.

This combination was arrived at after literally years of experimenting and testing. Usually you can reuse the glue for 3 or 4 sheets of sandpaper. If you start to build up too much glue and get lumps, use the 3812S to remove excess glue. This system works really great and can make the contouring, finishing, priming and painting process a lot less frustrating. Try it, you'll like it!

From CP49-7 (CH3)

EPOXY BRUSHES

Yet another method to get the most out of your brushes. Rinse the brush in acetone, wrap it still wet with acetone in a folded paper towel. Put the brush in a plastic sandwich bag and wrap it with a rubber band to hold the paper towel against the bristles. As the brush dries, the paper towel leeches out the epoxy/acetone leaving a clean reusable brush, Don't be discouraged by the stiff paper towel, just peel it off and press on the bristles to restore the bristles to good shape.

From CP50-3 (CH3)

Nick Ruys has found a fine heat gun, one we have tried and like. It has two heat settings and gets hot enough to heat-form PCV foam, and also does a great job of shrinking heat-shrink tubing onto your wiring. Lots of uses for any composite airplane builder. Contact:

Nick Ruys	Send $40.00 (US)
P.O.Box 10	(519)539-9886 (work)
Ontario, N4S 7W5	(519)423-6322 (home)
Canada	

****Also see LPC #81 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP27-13 (CH3,CH16,CH38,CH39)****
The following letter was received just at press time for this newsletter. With Victor's permission we are printing it:

Dear Burt and Company,
Thank you for your Christmas card. It found me recovering from a crash landing of my VariEze and with even more respect for the design. On November 11, 1980 I was working to take off the 40 hours a bit at a time. We had about 30 minutes before dark after work (my second mistake) to get a few trips around the patch. Mary-Kate and I had decided to install the new Long-EZ elevator trim but I over-ruled and decided to put it off until certification (my first mistake). I wanted to complete the 8 hours remaining to my certification as soon as I could.

After one touch and go I was climbing out about 600-700 AGL when I eased the stick forward to level off at 800 and nothing happened. The bolt between BC4W10 and CS136 had come off. I immediately called "mayday" and requested emergency equipment. I thought I was dead. However, I realized 62MV was still climbing so I began to analyze my possibilities. I could not reach past my right leg to reach CS136 so I experimented with power changes. I found that at about 80 MPH indicated the nose would begin to drop and about 120 MPH it would pick up. The initial oscillations must have been 200-300 feet up and down. I found by careful throttle changes and by moving my body forward and backward I could greatly reduce the up/down changes, but I still was faced with only gross control. I flew 3 patterns, about 15 minutes, and on the last down wind discovered I could touch the elevator balance weight with my right toe. Holding about 100-110 MPH and using the toe technique to give progressive downward dips I made my final approach to runway 10 (4000' long) into a 5 degree right wind of 5 to 10 knots. At about 30 to 50 feet AGL, darkness made judgement poor, I was almost to the runway when the nose began its upward cycle at about 80 MPH. Knowing I would not stand another cycle, especially the 120 mile per hour dive I cut power and dropped it in. At the same time I cut power I deployed my landing brake, I probably should not have used the landing brake since it does tend to increase the sink rate.

The landing was just about 20 feet short of runway 10 in a slight left turn so that I skidded across the corner of the runway and onto the grass beside the runway. I came to a stop in the newly planted wheat field about 20 feet from the runway. I had lowered the nose gear to take up shock as well as the possibility I could make a controlled landing. The nose gear push rod bolt sheared, the main gear attach tabs on the gear sheared or split , and the lower cowl was crushed. The intake spider broke and the carb separated as did the gascolator and intake hose. The oil pan was crushed and the bottom 3" of the firewall cracked and bent aft about 15 degrees. We hit so hard that the pilot's seat area broke and combined with skidding across the runway made a hole clear through the pilot compartment floor about 3" from the left console and about 9" wide by 20" long. I was able to turn everything off, release my harness and climb out. I noticed severe pain in my back so decided to lie down because the ambulance was pulling up. I next woke up in the ambulance on the way to the hospital. I suffered shock and two cracked vertebra #L2 and L3. After 11 days in the hospital and a month at home I am feeling pretty well. I will wear a back brace for at least another month but should not have any future problems.

Why did the nut (MS210042-4) come off? I don't know. I may not have had it on all of the way but I am sure I did because I had developed the habit of checking for 2-3 threads through the nut. The canard and of course this nut had been off about 10 times for work on the electrical and instrument systems. Do such nuts wear out? The nut and bolt are included for your inspection. I find I can get it on to almost one thread with just my fingers. The FAA inspector was Glenn Martin of Wichita GADO. He was just as surprised as I to find out the a VariEze will fly without elevator control.

N62MV normally trimmed out level with a slight nose down force required. I was able to correct it with the original spring trim system. At the time of this flight I had 2 gal in the fuselage tank and about 7 gal total in the wing tanks. The engine is an A80-8 and the original long canard is installed.

I expect to wait about a year before repairing the plane. What do you think of having the main gear strut and wing attach areas x-rayed? There doesn't appear to be any damage to the wing or canard attach fittings or surrounding areas. Both lower winglets were ripped off, right rudder was destroyed and of course the gear and gear attachment area. The enclosed photos were taken by Glenn Martin. I would like to have them back because they are all I have. Enclosed find SASE.

Thanks again for an outstanding design. If you would want to question me please feel free to call.

Sincerely,
Victor Sullivan

It should be emphasized that an elevator disconnect downstream of the trim system will not necessarily result in the amount of control Victor was able to achieve. Any small inconsistency in elevator shape could result in a very low or very high trim speed. Victor had rejected his original elevators and build new ones to a more accurate shape - he probably could not have survived a control disconnect with the original ones. The new trim system, of course, could have allowed a satisfactory amount of control and safe landing.

We have inspected the bolt and nut and found it is of the proper length and that the locking friction, though reduced from new condition, seems adequate for proper safetying. It appears improbable that it could have been tightened properly. Victor agrees that it may be possible that he was distracted during canard installation and might not have tightened the nut beyond finger tight. Even the most critical items can be overlooked by the most competent mechanic. For example, one VariEze attempted a takeoff without the 2 bolts that hold the canard on - the canard flew off when the pilot pulled the stick back for rotation. **Builders should follow the accepted practice of replacing critical locknuts after several repeated installations (discard any <u>fiber-lock</u> nuts after <u>one</u> use). Also, discard any bolt or nut that has any sign of reduced locking friction.**

****From CP30-4 (CH3,CH38)****
<u>Low-profile Locknuts</u>
The VariEze and Long-EZ extensively use the MS21042 locknuts. These are a high quality all metal aircraft approved type locknut. One builder has reported cracks in several of his MS21042-4 nuts during installation. Our tests have shown that we can torque these nuts to several times the recommended limits and even abuse them enough to round the flats without failure. We have seen no failures in service. If you have had any failure of theses nuts contact RAF describing the conditions of failure, purchase date and vendor.

****From CP31-8 (CH2,CH3)****
Due to some confusion over AN versus MS hardware, we have compiled a conversion chart which should help clarify things. Our thanks to Bud Meyer of Wicks Aircraft for assistance in getting this chart together.

AN509------MS24694	AN819------MS20819
AN364------MS20364	AN822------MS20822
AN365------MS20365	AN823------MS20823
K1000------MS21047	AN500------MS35265
AN380------MS24665	AN936------MS35333
AN393------MS20392	AN931------MS35489

Solid aluminum rivets:
AN_ _ _AD_ _ = MS20_ _ _AD_ _

****From CP32-6 (CH3,CH11,CH19,CH20)****
<u>BUILDER HINTS</u>
Clarification on use of various pop rivets. Anywhere on the airframe where you are installing nutplates, on hinges, access panel, use 3/32" diameter <u>flush</u> pop rivets, or solid aluminum rivets. When installing aileron hinges onto the ailerons, use 1/8" <u>round</u> head pop rivets (Avex 1601-0410, or cherry MSP 43) rudder hinges are installed into the rudder using <u>flush</u> pop rivets (Avex 1604-0412 or cherry MSC 43). CS2 elevator hinges are installed on the elevator using <u>flush</u> pop rivets (Avex 1604-04 or cherry MSC 43).

****From CP37-3 (CH3)****
<u>CAUTION - SWAGING NICOPRESS SLEEVES</u>
A properly installed nicopress sleeve will hold beyond the point where the cable breaks. Be certain that you are swaging your cables correctly. The "cheap" nicopress swaging tools that commonly sell for around $15.00 and work by tightening two bolts, are fine. That is what we use here at RAF. **SKETCH OMITTED**

It is important to use the tool correctly. The sleeve should be oriented <u>vertically</u> per the sketch with the cables as shown. Tighten both bolts equally, about a half turn at a time until the two steel faces of the swaging tool are firmly together.

****From CP61-10&11 (CH3)****
<u>IMPORTANT</u>
All VariEze builders and flyers should be aware of the seriousness of this situation. If you know of anyone flying a VariEze who may not be receiving the Canard Pusher, please pass on the following critical information:

1) A mandatory inspection of the long AN-4, 1/4" diameter bolts and nuts that secure the steel tapered plugs into the wing fittings. There are four (4) of these bolts, each must be removed and carefully examined for any evidence of over-torquing (stretched threads, necked down diameter anywhere on the length of the bolt). Double check to see that the threads on each bolt are not bottoming in the threaded lower taper plugs. You may have to use thin shim washers under the head of each bolt to assure a proper fit with no bottoming of threads. Check that the jam nuts have at least 1-1/2 to 2 threads showing after they are tight. If you purchased your VariEze wing fitting from Ken Brock Manufacturing, you will notice that the AN-4 bolts have a longer than standard thread. **These threads as they are on any AN bolt are <u>not</u> cut threads, they are rolled threads. If you see any evidence of the threads having been cut with a threading die, discard them and install new bolts.**

Look for any corrosion on these bolts. Any corrosion should be carefully cleaned off and the bolts should be greased before re-installing them. Excessive corrosion is cause to discard the bolts.

If you did not personally install the bolts, you may have to assume that they might have been over-torqued. Any suspicion of over-torquing is cause to discard these bolts.

If your wing attach fittings were not manufactured by Ken Brock Mfg., you will need to carefully inspect the tapered plugs for perfect fit in the tapered holes. If in doubt, you may have to carefully lap each plug into its tapered hole, checking for perfect fit with engineering blue. Check to be certain that the tapered plugs do not go too deeply into the tapered holes. The top of the plugs must not go below flush with the top of the wing fittings.

The design of a wing fitting such as the VariEze calls for the tapered steel plugs to take all flight loads. The AN-4 bolts should never see flight loads. All they are for is to retain the tapered plugs. If the tapered plus are a perfect fit, these bolts will require only a very light torque to snug the plugs into their respective holes. Three (3) foot/lbs. (36 inch/lbs.) of torque are all that should be required. If you need more torque to pull the tapered plugs into their tapered holes, your tapered plugs do not fit correctly. Do not fly until you have corrected this situation.

Two people have died because of improperly fitting wing attach taper plugs. Do not take this lightly. Your life depends on these wing attach fittings. You owe it to yourself and your passengers to do absolutely the very best work you are capable of here. This is especially true if your wing fittings are homemade. The Brock fittings are very accurately machined and all the tapered plugs are hand lapped and fit perfectly.

Once you have installed a pair of tapered plugs and torqued the bolt (3 ft./lbs), as a double check, remove the bolt and check for a tight fit of each taper plug. It should take a sharp blow with a wood drift to loosen each plug. If the plugs fall out or are not tight, they do not fit correctly. Fix this problem before next flight.

From CP65-1&2 (CH3,CH35)

TOUGH SLEDDING AHEAD FOR RAF

In general, I have been very pleased with the business performance of RAF since we discontinued the sale of plans and the licensing of individuals to build aircraft based on RAF design information. RAF made these moves in mid-1985 partially because of severe conflicts with other aircraft development projects at Scaled Composites which were taking all of my time and because of the expanding threat of lawsuits which often occur after an accident, regardless of the cause of the accident.

In 1985, I decided to keep RAF's doors open in spite of the fact that we had lost our primary source of income. The remaining assets of RAF would be used to continue to provide technical and safety support to those licensed individuals still building and flying their RAF designs. In order to provide the best service to those customers who were licensed by RAF, we discontinued the policy of allowing transfer of license and, in effect, promised support only to our direct customers. Those who bought a project or completed aircraft from "Joe Smith" must be supported by "Joe Smith". We would maintain, to the best of our ability, our support of Joe, as our licensee.

In 1985, we believed that we would be able to continue support for 2 to 3 years in this way and thus, not strand any builder who had recently begun his project. Little did we know that 5-1/2 years later RAF would still be alive and well, providing support, continuing newsletters, continuing our talks and booth at Oshkosh, even helping new starts for those licensed in the early 80's and only now laying up the front seat fuselage bulkhead! Our survival has had a lot to do with a few key items:

1. Great support from our family of builders who helped police the cheaters (those who sought RAF support even though working without a RAF license). Understanding from builders when we raised our newsletter price from $7 to $14 and cut down on our hours of direct builder support. Support from those who still stop by our Oshkosh booth and load up on goodies.

2. Patience, dedication and sacrifice from people like Mike and Sally Melvill and Joan Richey who hung in there even though it was obvious that the ship was beginning to sink. Their continuing dedication was because they love working with this wonderful group of EAAers who truly enjoy our hobby.

3. The donation to RAF of the income from paid lectures that I gave from '87 to '89 telling the exciting story of Voyager, RAF's most famous design (developed at RAF from 1982 to 1984).

The good news is that RAF still has potential to provide a few years more of support to builders - to maximize their chances of building a safe airplane and operating it safely.

The bad news is that RAF now is plagued by two lawsuits, both of which seem ridiculous, and both of which are proving to be very expensive distractions.

1. RAF contracted with Colin Chapman, the Lotus car founder, in 1982 to develop a proof-of-concept prototype to assess the feasibility of an ultralite-category light plane. The result (RAF model 97 Microlite) completed its contracted initial test program in 1983. The program was shelved by Lotus, primarily due to the death of Mr. Chapman. Rights to the concept were later sold to another English Company, Aviation Composites, which used the design's features as a basis for a different aircraft, the Mercury. The Mercury's development program suffered a number of developmental problems, among them, the failure to obtain an acceptable engine (the Lotus engine was dropped and others were too heavy for the configuration), and the discovery that changes would be necessary to obtain adequate spin recovery characteristics. Aviation Composites then discontinued further development and sued RAF claiming that we should have more thoroughly tested the model 97 in 1983 to find a possible flaw in spin recovery. This case is scheduled for trial in federal court during January '91. Of course there seems to be no basis, however, these exercises have an enormous effect on our time and distract from our ability to concentrate on things more productive and enjoyable.

2. The latest lawsuit to be brought against RAF concerns the VariEze accident described in CP61 page 9. We did a thorough investigation of that accident and came to the conclusion that the wing attach taper pins, which were home-made, were a poor fit. The bolts that secure these taper pins were too long and all had had a threading die run onto them to increase the length of threads on each bolt! Aircraft bolts are roll threaded and heat treated. **Under no circumstances should an aircraft bolt have threads extended or cut using a die!** One of these bolts was missing as were the two taper pins. The three remaining bolts had been over-torqued allowing a wing to swing aft. The VariEze was seen to be doing aerobatic maneuvers by at least one eyewitness just prior to crashing. The pilot was found to have alcohol in his bloodstream. In spite of these facts, RAF and the builders estate are being sued by the relatives of the passenger.
It seems unreasonable that these suits are allowed to threaten the viability of RAF and, thus, its ability to continue to provide support to EZ builders/flyers. We, of course, do not plan to accept any settlement offers on these suits since bowing to extortion in order to avoid the hassle only attracts other frivolous suits.

Metal Parts

****From CP38-4 (CH3)****
Aluminum Corrosion
Out here in the desert corrosion is not a problem. Some builders however, do live in highly corrosive environments. Rodie Rodewald is one. On the north shore of Oahu Island in Hawaii, where the biggest surf in the world breaks is where Rodie keeps his VariEze and Long-EZ. The air is literally heavy with salt spray all the time and Rodie has found exposed aluminum parts, not anodized, will corrode. He strongly recommends anodizing and insists that it is easy and fun to do. All you need:
1 gallon plastic jug cut off to make a bucket.
1 gallon of battery acid (H_2SO_4) at a specific gravity of 1.10.
A lead plate a little larger than the parts to be anodized.
12 volt battery charger (6 amps is best).
Pure, soft aluminum wire.
Trisodium phosphate (TSP) available at hardware stores, diluted .80 ounces per gallon of water.

Cleanliness is very important to success. He used wooden tongs and chop sticks to handle all parts after cleaning and proceeded in the following way:

Degrease all parts to be anodized.
Heat TSP to boiling, cool to just under boiling, immerse parts 3 minutes.
Water rinse avoiding touching the parts.

To anodize:
Positive lead to parts.
Negative lead to lead plate. Use the aluminum wire. A good contact is the secret to success.
Gas bubbles evolving from the lead plate proves that anodizing is occurring.
Leave parts in the anodize process 25 to 30 minutes.
Water rinse.
Boil parts for 10 minutes in tap water to seal the anodizing.

The only caution note is to be careful with the acid. It is not a strong acid, but acid is acid and can burn, therefore use personal protection of skin and clothing and in event of an acid spill, wash thoroughly in baking soda and water.

****From CP42-7 (CH2,CH3)****
DEFIANT GENERAL
Note: Wherever aluminum material is called out such as 2024T3, you may substitute with 2024T4 or 2024T351. This is true anywhere in a Defiant, Long-EZ or VariEze.

Note: Aluminum tubing called out as 1200 versatube is the same as 3003-0.

Note: Wherever Nylon sheet is called out, phenolic sheet or Delrin sheet can be used with no problem.

****From CP53-7 (CH3,CH38)****
CAUTION: CORROSION IN VARIEZE WING ATTACH FITTINGS
A VariEze which had spent most of its life outdoors in the eastern US, but significantly, not on the coast, was found to have severe intergranular corrosion in the top plates of the wing attach fittings as well as in the two aluminum tubes between the top and bottom plates. Very little evidence of this was visible upon casual inspection. However, when the UND wrap on each end of the centersection spar was lifted, the corrosion was rampant and this EZ builder said he would not have flown this airplane knowing how bad the corrosion was.

All VariEze owners should make a very careful inspection of the aluminum wing attach fittings, especially under the glass that laps onto the aluminum plates, particularly if there is evidence that the glass has peeled or delaminated from the wing attach plates, both on the wings and the centersection spar.

For new construction, all aluminum parts, including wing attach fitting, should be cleaned in Alumiprep33 or metal prep #79 and then soaked in Alodine 1201 which is a visible (golden brown) moisture barrier, greatly increasing resistance to corrosion. This also acts as an excellent surface to bond epoxy or paint.

Do not anodize wing attach fittings since this finish, if not done exactly right, can cause embrittlement in the highly stressed wing attach parts.

Alodine is a common aluminum preparation and can be obtained from RAF-approved suppliers such as Aircraft Spruce or Wicks Aircraft.

****From CP55-5 (CH3,CH19,CH38)****

VARIEZE MAIN WING ATTACH - CORROSION

Since we first reported the corrosion problem in VariEze main wing attach plates in CP53, page 7, we have heard from only two or three builder/flyers who had found signs of corrosion. Just this week, we received a letter from a VariEze owner/pilot who found corrosion in the WA-2-2 plate. He has spent a considerable amount of time and energy removing this plate, in fact, he said he almost resorted to using dynamite! He sent us the WA-2-2 plate, the lower plate of the top two plates mounted to the centersection spar. By far the toughest plate to remove and replace. This plate (see photo) has one of the worst cases of intergranular corrosion we have seen. It is absolutely not safe to fly and must be replaced. Unfortunately, this is probably going to be very difficult, and we honestly do not have any simple fix for this. Just removing the WA-2- plate could do serious damage to the centersection spar. The UND wrap around the end of the centersection spar may have to be cut and removed. The foam under the WA-2-2 plate must be dug out, the 8 AN525 (or AN509) screws must be removed (drilling them out may be the easiest method). A replacement plate must be fabricated, duplicating exactly all of the holes in the plate. This is a difficult job and will require an expert machinist and a lot of patience. Brock will not be able to help you with this. Each case will have to be dealt with on an individual basis. The new piece should be alodined and then floxed and screwed back into place. If the UND wrap was damaged, it must be replaced, which requires cutting into the fuel tank (we did say it would be tough!).

This is major work, not anything that could not be done by a person who has built a VariEze, but very tedious, difficult work. And it must be done right. There is no short cut, no easy way. If you find more than simple white powder surface corrosion, stuff you can easily polish off with 320 grit sandpaper, you must ground your VariEze and replace the corroded parts.

A mandatory inspection is required before next flight for all VariEzes. So not take this problem lightly, it could kill you and anyone who may be with you. Remove both wings. Clean all visible aluminum parts at the wing root and centersection spar. Look at the edges of all the WA plates on the centersection spar. Look for a thinner edge or a swollen appearance under the glass. Look in between these plates (where the WA-3 tongue slides in). A white powder appearance that can be completely removed and polished out with 320 grit is OK, but the plates should be very thoroughly cleaned and sprayed with zinc chromate. LPS or a good quality grease as used in marine applications should be generously applied everywhere before re-installing the wings. Check the WA-4 pins and the AN4 bolts and grease both thoroughly. Replace the AN4 bolts if they show any sign of corrosion.

New construction VariEzes, or anyone replacing wing attach fittings with new ones, should clean all aluminum parts with Alumiprep 33 or Metal Prep #79 then alodine them with Alodine 1201 which puts a tough, corrosion-resistant, visible, golden finish on. We are reluctant to try alodining parts in place due to the acid etch (Alumiprep 33) possibly getting under the glass onto the aluminum.

When you inspect your VariEze, be very conscientious. Check very carefully, it is difficult to find, you may have to probe under the glass over the WA-2-2 plates. Look hard and long at it before you decide it is safe to fly.

The only good news about this is that where the epoxy was bonded to this WA-2-2 plate which we have, there is no corrosion. The surface of the metal is as new. Intergrandular corrosion is very common in airplanes that live near the ocean.

Sea planes are especially prone and require constant inspection and maintenance aimed at preventing just this problem. The salt in the air plus water from rain or condensation, plus heat and aluminum and, presto!, you have a battery! Galvanic reaction and you have corrosion. Keep the aluminum parts clean, grease them often, and you will have no problems. People who live far from the ocean may not see this problem but they must check for it just the same.

This problem is confined to the VariEze. The Long-EZ wing attachment is completely different and this same problem should not occur. **Of course, all metal parts must be protected from corrosion - aluminum with alodine or zinc chromate, steel with zinc chromate (after cleaning in metal Prep).** Wing attach bolts and parts should be generously covered with a good grease in VariEze and Long-EZs. Replace any rusty bolts and nuts.

****From CP55-11 (CH3,CH19,CH38)(Photo Caption)****

VariEze wing attach fitting WA-2-2 removed from a Harlingen, TX based VariEze. Note extensive flaking typical of severe intergranular corrosion.

Wooden Parts

****From CP41-7 (CH3,CH30,CH39)****

VARIVIGGEN NEWS

We have heard from two Viggen builders this time. Wayne Wilkins reports that his Viggen is rapidly approaching completion, but that although he had high hopes of flying to Oshkosh 1984, it is just too soon. Too bad Wayne, last year we had 3 Viggens at Oshkosh, it would be nice to get a few more all parked in a row.

Arthur Schwartz has repaired his Viggen "Birdie" after his gear failure and subsequent trip off the runway and says that this year he will be at Oshkosh. He plans to fly in the company of his friend Sid Stiber who will be flying his recently completed Long-EZ. We are looking forward to seeing both aircraft at Oshkosh.

We recently heard second hand, of an incident with a VariViggen in southern California. Charles Cowan reportedly took off with a friend from Rialto airport with the intention of visiting the island airport in the sky on Catalina Island. As he overflew the airport at Corona, he experienced a severe vibration, a loud bang and the engine quit abruptly. He whipped his Viggen around and landed successfully on the Corona runway. The Viggen was not damaged, but the engine was shot. Apparently the cylinder base nuts had worked loose, due to excessive paint on the flanges. One cylinder actually fell off, and the resulting damage essentially destroyed the engine. This is a potentially serious problem and all of us should check all nuts, bolts and screws on our engines for correct torque.

This VariViggen was dismantled and trailered back to the shop, there builder Bill Campbell did a very thorough inspection of the airframe. No damage was found. However, this inspection did turn up a few cracks in the end grain of the composite outboard wing stub spar. These were caused by shrinkage of the spruce. In this case the exposed end grain of the stub spar had no moisture protection at all and the dry desert air had caused the exposed portion of the end grain to shrink and develop several cracks. The fix was to "wick" warm epoxy into these cracks and paint several good wet coats of epoxy over all of the wood that was exposed.

Wood aircraft are subject to changes in humidity and it is very important to protect every bit of wood by coating it with a moisture barrier. In the past this was usually spar varnish or something similar. We believe that the best possible protection is Safe-T-Poxy. All exposed wood surfaces should be coated with a good moisture barrier. Inspect your VariViggen carefully all over for any signs of wood shrinkage or surface cracking. Sand all such surfaces and coat liberally with Safe-T-Poxy.

FAA, General

****From CP34-4 (CH3)****

FAA CHECKS WHILE BUILDING YOUR EZ

It has recently come to our attention that several builders are building VariEzes and Long-EZs and have not contacted their local FAA. This is not the way to do it! It is very important that you inform the FAA that you will be building an airplane, and they in turn, will tell you when they will need to inspect it and how often. You cannot expect the FAA to come out and sign off your finished aircraft if they have never had the opportunity to periodically inspect it during it's construction. Each FAA inspector will have slightly different methods, some will want to see shear webs, and other specific parts, while others will not. You need to get to know your individual FAA inspector and work with him so that he can be helpful to you. This should be done before you ever start construction. If you are already building and have not yet contacted your FAA, stop where you are until you have made contact and have received instructions from them as to what it is they want to inspect. Do not fool around with this, it is entirely possible for you to end up with a very expensive static display model.

****From CP38-8 (CH3)****

Aero Record - This is a builders logbook which covers all current requirements for record keeping during construction and can be used as an engine, airframe, propeller log book after the aircraft is flying. The logbook is in ring binder form and new pages can be added as needed. The book was designed by a homebuilder who also happens to work for the FAA inspecting aircraft. This book has been set up so you fill in the blanks and all the information the FAA wants to see is there.

Contact: Aero Record,
6854 Antiqua Way
Sacramento, CA 95831

****From CP42-8 (CH3)****

For Defiant builders, the Aerorecord Log Book gives you an excellent place to record your progress, includes space for photos of important structure, space to record materials used, engines, props etc. A section on weight and balance, specifically as this relates to your Defiant. A section on AD notes, literally a builders log that will greatly simplify FAA final inspection and years from building will let you look back and see what you in fact actually used, such as paint type and color. This builders log is designed by a former FAA aviation safety inspector and meets all current FAA requirements. We recommend this vinyl bound, loose leaf builders log.

Contact: Gerald R. Redman
2778 Waverly Ave,
Camarillo, CA 93010
805-482-8081

Defiant Log - $27.50
Long-EZ Log - 20.00

From CP43-2 (CH3,CH30,CH35,CH41)

HOMEBUILDER RESPONSIBILITY

Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you the homebuilder should be aware of what you are taking on when you build your own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft, is in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues a airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meetings, talk with other EZ builders. Many good books are available from EAA. Supplement your plans with a few, such as Tony Bingalis' "Firewall Forward". After you have got something built, get as many people as you can, to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them only from the recommended suppliers.

The same philosophy is also true for engines. Almost daily we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ we recommend any model of the Lycoming 0-235. If you wish to install some other engine, please do not call us. We can not help you. As an experimenter, you can of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You the builder have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what material, power plants, etc. go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials and therefore cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer, is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

From CP50-5&6 (CH3,CH30,CH40)

MAJOR CHANGES - YOU AND THE FAA

Quite a number of EZ builders have been making "major" changes to their EZ's and not working with the FAA, either because they don't realize they are required to or because they don't realize that what they have done is a major change. A classic example is an engine change to a larger engine. Now RAF cannot recommend a change such as this, but we don't like to see our builders getting into trouble.

If you decide to make such a change after you have already had the airplane licensed and signed off, you must contact your local FAA and work with them to keep yourself and your aircraft legal. "Who will ever know?", you may say! "We did not even change the cowling.", you say! Well, here is the straight skinny. As soon as your make a major change as defined by the FAA, your airworthiness certificate is automatically invalid. Worse than that, your insurance is also invalid.

If you should have an accident that would damage someone else's property, your insurance will not pay - you or your survivors will pay. That could be a really nasty problem. On top of that, the FAA takes a very dim view of this sort of thing and they will prosecute you. The penalty is not some little thing to laugh off, either. The fine is $1,000.00 per flight!!

As you can see, very obviously, it is not worth the risk, especially since it is so easy to comply and keep everything above board and legal. All you have to do is to inform your local FAA what it is that you are planning to do. They in turn, will issue you a new, temporary, airworthiness certificate which will again limit you to within a 25 mile radius of your airport for a certain number of hours. Normally, this will be from 5 to 25 hours depending on the change and on the local FAA official. After you have successfully completed your test flying in the local area, or have flown off the hours, the FAA will issue a new "permanent" airworthiness certificate, and you are back in business, and your insurance is valid.

Do yourself and the homebuilt movement a favor, comply with the regulations and keep yourself and your airplane legal. It is an inconvenience and may take a week or two but, in the long run, you will be much better off and you may save yourself or your family untold grief.

From CP55-6 (CH3,CH25)
FAA REGULATION CHANGES
Builder identification placards must be installed on your aircraft after March 7, 1988 (if you are flying now without one, you could be violated). According to the FAA, we aircraft owners must have a plate or placard on the exterior of the fuselage adjacent to the rear-most part of the canopy (door!), and it must be legible to a person on the ground. There are no letter or number size requirements and the information must agree with your stainless steel information plate in your cockpit. You are required to display your aircraft make and model designation, (Smith, Long-EZ or a Jones, VariEze, etc.). The serial number must also be shown. You can have a sign writer simply paint this information on the fuselage, or you could stamp it onto metal plate and bond/rivet it onto the fuselage.

If you plan on visiting a foreign country, even Canada, Mexico or the Bahamas as an example, you will be flying through an Air Defense Identification Zone (ADIZ). After March 7, 1988, you will be required to install 12" high registration marks for this trip. These can be temporary marks provided they do not come off during the flight. These are new Federal Aviation Regulations and all aircraft owners, including homebuilders, must comply after March 7, 1988.

Static Loading

From CP40-3 (CH3,CH10,CH19,CH31)
TO STATIC LOAD OR NOT TO STATIC LOAD
RAF has been receiving more and more requests from builders who would like to static load their newly constructed VariEze or Long-EZ. We are concerned that many of these builders may not fully understand what a static load entails and what the consequences of an incorrectly done static load can be.

Anyone who absolutely insists on doing a static load, can obtain a copy of the load schedule from RAF. We strongly recommend that you have a qualified structural engineer present during the load tests. Perfectly good parts can easily be failed by poorly or incorrectly done static load tests. This has occurred to some of the builders from overseas. Unfortunately, for some of the countries, their equivalent to our FAA has a requirement for a static load to be done. We know of two builders who have had their wings (on completed aircraft) destroyed. Do not allow some government official to decide on a load schedule for your airplane. Write to RAF and get a copy of the correct load schedule.

Before you rush off and static load your brand new EZ, consider this. When you purchased your plans from RAF, you paid for the benefit of all the aerodynamic and structural design capability that Burt and RAF has. RAF does an extremely thorough job of structural analysis, as well as conducting any static load test deemed necessary by Burt. Once the airplane is flying and the flying qualities are to Burt's liking, the airplane is put through an extremely thorough flight test program. Prior to the prototype being built, the amount of testing of various materials to be used in the aircraft is unsurpassed.

We believe that if you build your aircraft structurally and aerodynamically in accordance with the plans, and you layup the correct number of plies of the appropriate glass, (no less, and certainly no more), in the correct orientation, and you do a reasonable job of wetting out the glass with the appropriate epoxy, you will have an airplane that is more than adequately strong enough.

Miscellaneous

From CP28-8 (CH3)
Wherever you have a glass-to-glass laminate (trailing edge of wings, winglets, canard etc.) do not leave the overlapped skins unsymmetrical. Always clean up the edges (see sketch) to a smooth surface without a joggle. It is poor practice to leave areas joggled even during construction, since a blow on the untrimmed edge can result in delamination. **SKETCH OMITTED**

From CP47-10 (CH3,CH38)
DELAMINATIONS
Repairing small areas of delaminated skin, can best be done by drilling several small holes around the effected area and injecting epoxy into one or all these holes until it comes out of the rest of the holes. Cover the area with Saran wrap, a flat board and a heavy weight. Allow to cure. One of the problems with this type of repair is finding a hypodermic syringe. Try this: go to a sporting goods store, buy a cheap plastic repair kit for a leaking basketball.

Drain the tube of glue, wash it out thoroughly with water, dry it and fill it with epoxy. Make your repair and throw it away. Works great. Best way to check for a suspected delamination is to tap the area with a quarter. You will hear a solid clear ringing sound if it is a good layup, but as you cross over a delaminated area, it will sound hollow.

From CP48-6 (CH3,CH19)

CAUTION

Very recently while reading copies of the various EZ support newsletters that are currently being produced all over the US, we came across a couple of bad suggestions. One of these is of great concern, a suggestion to use WD-40 Silicone lubricant to lube and cool the counterbore tool while drilling the wing attach holes in the wings and centersection of a Long-EZ. NO WAY, NO HOW, NOT FOR ANY REASON must you use WD-40 or ANY similar silicone type lubricant to help you drill these holes. Plain water is as much as you can do. Getting silicone lubricant onto any glass surface will absolutely guarantee that you will never be able to get anything to stick to that area again. Epoxy will not stick, nor will primer or paint. In short, you have a major problem on your hands. The wing attach bushings must be glued into these holes securely with flox. WD-40 will not allow you to get a bond in this area. This is a very foolish and dangerous suggestion - do not even think about doing it.

The other suggestion which was printed in the EAA Designee newsletter, was to use a salt shaker to sprinkle micro balloons onto an uncured layup for future contouring. We do not like this idea for two reasons: It makes it impossible to inspect the layup after it cures, which is unacceptable and in order for the dry micro balloons to wet out they must be leaching epoxy out of your layup.

If you have already done a good job on the layup, which you obviously should have done, if you are following the instructions in the plans, you are then causing what might have been an excellent layup with the correct epoxy to glass ratio to become a starved, dry layup, which you would never be able to check.

Be very careful about getting away from the basic plans and instructions. These methods have been developed and tested over a number of years and hundreds of airplanes. Fooling around with the structural integrity of your EZ could result in a serious accident.

From CP50-3 (CH2,CH3,CH21)

BOONVILLE, CA, UPDATE

Larry and Michael (Featherlite Products, Inc.) have been busy since Oshkosh where they shared the RAF booth and had on display a number of their products. They really enjoyed talking to so many of their customers and to be able to get out of their shop and talk airplanes for a whole week.

The Long-EZ leading edge fuel strake kit is now out and quite a few have already been installed. The leading edge "D" section is slightly oversize to enable you, the builder, to custom trim to perfectly fit the fuselage and wing. To identify the proper position, B.L. 23 rib must be located at the jink or bend, then you can trim to fit the fuselage, then the wing. Don't forget to remove the peel ply from the top and bottom lips before installing the flat panels.

After much scrutiny, Defiant cowlings are now on line. Cheeks have been enlarged to accommodate the O-320, as well at the O-360 Lycomings. The rear cowls will fit most prop/spinner combinations with little or no trimming required. The front cowlings may require some homebuilder "blending" for the various combinations of props, spinners and prop extensions.

Defiant wheel pants are under development and will soon be available. These are based on Fred Keller's beautiful Defiant's wheel pants.

Several builders have asked about removing mold release. After waxing, PVA (poly vinyl alcohol), a thin, green film, is applied to the molds. This film is water soluble, so use a wet sponge and lots of water to wash it off your parts. Allow parts to dry thoroughly before scuff sanding for finish.

For more information, contact Larry or Michael at:

Featherlite Products, Inc.
P.O. Box 781
13451 Airport Rd.
Boonville, CA 95415
(707)895-2718

From CP53-6 (CH3)

How to remove a stuck Phillips head screw.

Leo Dringoli, Long-EZ builder/flyer, sends in this helpful hint: The next time you are faced with a stubborn Phillips head screw where your screw driver begins to rotate out of the screw head - STOP!! Apply a small amount of OIL BASED valve grinding compound to the screwdriver bit and you will be astounded when the screw is effortlessly removed. "I now keep a small amount of this compound in my airplane tool kit", says Leo.

From CP56-5 (CH3)

CAUTION

Do not substitute micro for flox where it calls out to use flox in the plans. Flox is an extremely strong structural-type filler and is quite heavy. If it is called out instead of micro, it is because we require the additional strength in spite of the small weight penalty. Where micro is called out as a filler, do not use flox since the strength requirement is not needed and you will only pick up unnecessary weight.

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Update Number 68 to Chapter 4, Fuselage Bulkheads

****From CP68-6 (CH4,CH29)****
VARIEZE, LONG-EZ, DEFIANT MANDATORY GROUND
MODIFY THE LB-9 BRACKET AND INSTALL A 1/4" BIRCH PLYWOOD DOUBLER PER THE DESCRIPTION ON PAGE 8 OF THIS NEWSLETTER. ALSO, A MANDATORY WEIGHT AND BALANCE MUST BE DONE. NOTE: VORTILONS ARE MANDATORY ON THESE 3 AIRCRAFT.

****From CP68-7,8&9 (CH4,CH19,CH26,CH29,CH33,CH39)****
A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not positive of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. Do not fly a Long-EZ or VariEze without vortilons. In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on your particular aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power. Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. **Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the forward face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around.** **SKETCH OMITTED**

This change is mandatory and should be completed before next flight. Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats. Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall crash that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

THE FOLLOWING IS AN ANALYSIS OF THE UTAH ACCIDENT
The Utah accident involved a deep stall, flat descent (angle of attack of about 80 degrees). The fact that the pilot survived and that a slower-than-expected sink rate occurred (confirmed by video tape evidence of the last 2.3 seconds of descent) presents somewhat of a dilemma. We are baffled as to why this can occur. A similar phenomena has been experienced during several deep stall accidents with the Velocity aircraft. All were survivable and one went into water with the pilot experiencing no injury at all! (See article in July '91 *Sport Aviation*.)

The Utah Long-EZ had a wing-loading of about 12.2 lbs./sq. ft. and, considering all its area, including the wings, strakes, cowl and fuselage, a "flat-plat loading" of about 9.2 lbs./sq. ft. (1150 lbs. divided by 125 sq. ft.). A basic calculation of the predicted rate-of-sink in a flat descent would use a flat-plate drag coefficient of about 1.2 and would predict a sink of about 4820 ft. per minute or 80 ft./sec. This would definitely not be survivable.

Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

1) Analysis of the video tape shows a sink rate of about 48 ft./sec. (2900 ft./min.). This required measuring the size of the airplane image and may be off as much as 30 percent. The post-crash video data show the rate of drift of dust from impact. Comparing this rate of drift of dust (wind was about 20 knots) to the rate of sink of the airplane (on video) confirms the approximate 48 ft./sec. estimate.

2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

Chapter 4, Fuselage Bulkheads

Long-EZ Plans Changes

From CP25-6 (CH4)
LPC #17, MEO, Page 4-2.
Bottom right: Clarification: "both sides" means "left and right, on the forward face only"! The foam doubler goes on aft face, with no additional plies at this time. See Section A-A, B-B and C-C on page A3.

From CP25-6 (CH4,CH28)
LPC #22, MEO, Page A-3 correction.
Hole for gear retract drive tube should be 1" to the right of CL.

From CP25-6 (CH4,CH13)
LPC #23, MEO, Page 13-6.
NG 31 is called out of R45 dark blue foam, should be R100 1/4" red foam, see page 2-3. **Also note on page 2-3 that F28 can easily be cut in one piece from the instrument panel foam sheet.**

From CP25-6 (CH2,CH4,CH15,CH30)
LPC #25, DES, Page 4-3 and Page 2-2.
Aluminum can be substituted for the steel firewall, don't install fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and aluminum. Install fiberfrax with silicone rubber, not epoxy.

From CP27-7 (CH4)
LPC #42 OPT Page 4-2
Add "alternate the BID and UND plies that reinforce the sides of the forward face of F-22". Note: Modification is not required if you have already installed these without alternating.

From CP27-7 (CH4,CH7)
LPC #46 OPT
Revise F28 bulkhead by moving the longeron notch down 0.25". This raises F28, for better fit to canopy.

From CP27-7 (CH4,CH15,CH16)
LPC #47 DES
Due to a probable rubbing of the rudder cable on the aileron pushrod, the left hand rudder pulley bracket should be moved up 0.6". If you have already mounted the 3 bolts in the firewall such that you cannot make this change, you can provide cable clearance by carefully bending the rudder pulley bracket to move the pulley aft approximately 0.2". Bend as shown below. **SKETCH OMITTED**

From CP27-7 (CH4,CH18,CH30)
LPC #48 DES, Firewall, page A4
Increase size of firewall at top as shown to assure adequate height to fit cowling. **SKETCH OMITTED**

From CP29-7 (CH3,CH4)
LPC #68,MEO
Section I Page 4-1, note at the foot of the page. Remove "NOT" so that it reads, "micro slurry is used on this type R45 foam. We do recommend slurry to be used on all of the various foams in a Long-EZ.

Prefabricated Parts

From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)
PRE-FABRICATED COMPOSITE PARTS
Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan

Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.
1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Wings and winglets to follow soon at $779.00.
2. **Long-EZ bulkhead kits at $655.00.**
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415
(707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

****From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)****

FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom)	448.00
weight saved, approx. 6 lbs.	
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert. 500 x 5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	**655.00**
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.

Contact: Michael or Larry at: FeatherLite, Inc.
P.O. Box 781
Boonville, CA 95415
(707)895-2718

Firewall

****Also see LPC #25 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #47 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #48 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP25-4 (CH4,CH15,CH30)****

FIREWALL - LONG-EZ AND VARIEZE

We now approve the use of fiberfrax (a space age ceramic material) as a replacement for asbestos. Since fiberfrax is as good a fire barrier as stainless steel, we approve substituting .016 2024 T-3 aluminum for the stainless. This saves almost 2 lb at the firewall. Both Wicks and Aircraft Spruce are now shipping kits with fiberfrax and aluminum.

Installation of fiberfrax is as follows: Complete airframe construction through cowling installation, then remove everything from the firewall bulkhead, and install fiberfrax with a bead of silicone around the edge of the bulkhead. Do not wet out fiberfrax with epoxy. Now install the .016 2024 T-3 aluminum which is required to protect the fragile fiberfrax, from local damage, abrasion etc. See plans changes section of this newsletter.

****From CP27-6 (CH4,CH18,CH30)****

Long-EZ Cowl and Canopy fitting.

As will be shown in the new Long-EZ Lycoming engine installation section (IIL), the Lycoming cowl has been moved aft 0.7" from where it was in a VariEze. This was done to provide better clearances. With the new dynafocal engine mount, the engine is moved aft also, to provide good magneto clearances and an acceptable structural arrangement for the mount tubes. The new Section IIL will show you how to fill the cowl-firewall gap when mounting the cowl using the method used on N79RA and on Mike and Sally's Long. Cowling manufactured for Long-EZs after December 20, 1980 have the lip extended to allow easier installation. These cowlings can be identified by checking the dimension shown below.

SKETCH OMITTED

(OLD COWL=32.0)
(NEW COWL=32.7)

This cowling move has resulted in a miss-match of cowl-to-firewall at the top of about 0.2". Mike faired the miss-match in with dry micro, since he had already fabricated the canopy aft cover piece (Chapter 18). To avoid this micro fill, we suggest that you: Trial fit your cowling to the firewall before carving your canopy aft cover piece. **If you have not cut out your firewall, make it taller at the top and trim to fit your cowl during Chapter 18.** (see LCP #48).

Miscellaneous

****Also see LPC #68 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)****

BUILDER HINTS

You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. This works great for hotwire templates too.

****From CP29-8 (CH4)****

CLARIFICATION

Section I, Page 4-2. Several builders have had difficulty understanding the sketch of the aft seat bulkhead. This sketch shows a 0.95 taper in the left side. Since this is a symmetrical part, it follows that there is also a 0.95 taper in the right side. This fact is verified by the dimensions shown. **SKETCH OMITTED**

Table of Contents for Chapter 5, Fuselage Sides

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Chapter 5, Fuselage Sides

Long-EZ Plans Changes

From CP25-6 (CH5)
LPC #5, MEO, Page 5-1
Spacing between dimension on fuselage sides is 10", aft dimension is 3".

From CP25-6 (CH5,CH28)
LPC #20, MEO, Page A5.
Clarification: The 15 ply BID pad for the aft gear attach angle should stop at W.L. 12.35 (Don't glass above 12.35)(Chap 5).

From CP27-7 (CH5,CH9)
LPC #45 OPT Page 9-3
Move the 3/8" holes in all four extrusions up 0.4". Also modify outlines to maintain original edge distances around the 3/8" hole. This moves the entire main gear up 0.4", resulting in an improved gear-fuselage juncture reducing aerodynamic drag.

From CP28-9 (CH5,CH28)
LPC #58, MEO. Page A5.
On the main gear mounting pads bottom of page, two places shows only 1 ply. Should be 15 plies of BID.

From CP29-7 (CH5)
LPC #67, MEO
Section I Page 5-3, nuts on the AN6-80A bolt should be AN363-624, not MS21042-6.

From CP30-9 (CH5)
LPC #82 Section I, page 5-2, step 2.
One ply of BID extend entire 103" length, this ply of BID should be at 45 degree and can be in several pieces.

From CP35-9 (CH5)
Clarification Plans Change LPC #82, CP 30, page 9. This has been causing some confusion. This change was simply to clarify the orientation of the one ply BID called out in Section I, page 5-2. This ply is not an addition. It goes full span along the longerons and laps onto the inside skins 1/2", and should be at 45 degrees to the longeron, not at 90 degrees as some builders have tried to install it.

Main Gear Attach

Also see LPC #20 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #45 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #58 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #67 in the "Long-EZ Plans Changes" section of this chapter.

From CP25-13 (CH5,CH6)(Photo caption)
Mike and Dick at work on their Longs. Note tools for fuselage bottom carving and main gear attach hardware. The AN4-16A **bolts require two washers for mounting these brackets. A shorter bolt should not be used, as it results in threads in the bracket.**

From CP26-7 (CH5)
MAIN GEAR ATTACH - A builder has suggested using left over scraps of R45 (dark blue) foam in the landing gear attachment area where we call out using urethane foam. This is fine, although not as easy to carve down to the wood longerons as the urethane.

From CP27-8 (CH5,CH9)
Ken Brock is now manufacturing the heavy 1/4" aluminum main gear mounting extrusions. They incorporate the 0.4" move (plans change #45) and also have 1/2" diameter flanged steel inserts for improved durability. Part numbers are - Aft: LMGB-RA and LMGB-LA, Fwd: LMGB-RF and LMGB-LF. The forward parts are supplied without the large lightening holes, so VariEze builders can saw off the top 1" to install a Long-EZ gear on a VariEze.

From CP46-7 (CH5,CH9)
LONG-EZ MAIN GEAR ATTACH
The AN6-80A bolt should be torqued to a value of 275 inch/lbs. Care should be used to assure that the nut does not bottom on the threads. If this occurs, it is possible for the loads to gradually cause this 3/8" bolt to elongate the holes in the aluminum extrusions. If you bought your extrusions from Brock, you will note that they have flanged, steel bushings pressed into the aluminum angles, these steel bushings are available separately from Brock and are an excellent idea. If your AN6-80A bolt appears to be too long, simply add an extra washer or two under the head and under the nut to make certain that the nut is clamping down on the extrusion and LMGA tube. Of course, the general rule here is that you need two threads protruding beyond the nut.

Miscellaneous

From CP27-6 (CH5,CH28)
Aft fuselage side shape. A number of builders have noted that the A-5 drawing has a different shape the that obtained when fabricating the fuselage sides per the page 5-1 dimensions. This approximately 0.2" error will not present a problem if you follow these instructions: Carefully follow all the dimensions on page 5-1. This will assure that the firewall will fit. Do use the 5.8 and 6.9 dimensions on A-5 and be sure the extrusions are perpendicular to the top longeron. Ignore the small difference between the bottom shape and that on A-5.

From CP28-8 (CH5)
Clarification, Page 5-2 Long-EZ
A couple of builders have been confused at where to install the 3-ply UND stiffeners on the top insides of the fuselage sides. (page 5-2 step 2). The adjacent sketch will clarify this. **SKETCH OMITTED**

From CP29-5 (CH5)
PREFAB FUSELAGE SHELLS FOR LONG-EZ
When the second VariEze prototype (N4EZ) was built, we considered prefab fuselage skins. These would be 2-piece shells fabricated by vacuum-bagging a glass-foam-glass sandwich into a female mold. An analysis of cost and construction savings showed that the time saved was minor, particularly considering the extra work involved fitting the bulkheads and systems to the rounded interior.

Fuselage shells bagged into molds should have a potential of a weight savings and a savings in exterior finishing work. However, based on our components and the results of the prototypes which have been built both moldless and molded, the weights of completed ones. The molded-shell method is a good one for the bulky fuselages of side-by-side airplanes, where extensive compound curves are required. However, they are not cost/time effective for the Long-EZ Their production cost is high due to mainly tooling amortization, reject rate and packing requirements.

To say that pre-molded fuselage shell would significantly reduce building time is not true. Effect on total building time is less than 3%.

Long-EZ Fuselage Shells
Time Savings - Man Hours

Chapter 4	- 5 mh	Round bulkheads
Chapter 5	+15 mh	Fab and glass sides
Chapter 6	- 8 mh	Exterior jig required
Chapter 6	+10 mh	Carve and glass bottom
Chapter 7	+13 mh	Carve and glass outside.
Total	25 mh saved - 2.5 percent	

Fuselage shell cost, including packing and shipping $500 - more than materials for moldless construction. Results = $20/man hour.

Chapter 6, Fuselage Assembly

Long-EZ Plans Changes

From CP34-7 (CH6)
LPC #105 MEO
Section I, page 6-3. The 1" x .7" x 3" wood doubler should be glassed over with 1 ply BID at 45 degrees, lapping .4" onto F28, top longeron and fuselage side.

Miscellaneous

From CP25-4 (CH6,CH7,CH14)
REFERENCE LONG-EZ CHAPTER 14, STEP 13
At least a couple of you Long-EZ builders may have noticed by now that, due to the kink in the centersection spar it interferes with the aft seat bulkhead when you try to slide it into the fuselage. Do not remove the firewall to clear this. Using a coping saw, remove a triangular piece of the back seat bulkhead about 1" deep at the center and tapering to zero at the sides. After the spar's in place this piece is installed with wet micro and is structurally tied in by the tapes that lap onto the spar. **For new construction do not permanently install the plywood firewall bulkhead in Chapter 6 or 7.** Put the spar in from the back in Chapter 14, then install the plywood firewall bulkhead, lapping 1 ply BID around all edges.

From CP25-5 (CH6)
Carving the inside of the fuselage bottom R45 PV foam can most easily be accomplished by using a very stiff wire brush, cup or cone shaped, in a drill and cut the foam away about 1/4" to 3/8" at a pass. Then smooth it down with a high speed hand held disc sander (Metabo, Bosch, etc). Finish it with #40 grit sand paper in your fingers. Be careful not to gouge the foam in the corners with the edges of the sandpaper.

From CP25-13 (CH5,CH6)(Photo caption)
Mike and Dick at work on their Longs. **Note tools for fuselage bottom carving and main gear attach hardware.** The AN4-16A bolts require two washers for mounting these brackets. A shorter bolt should not be used, as it results in threads in the bracket.

From CP27-12 (CH6)(Photo Caption)
Clarence Willwerth flying his fuselage around the garage.

From CP29-8 (CH3,CH6)
BID TAPES
There is still some confusion as to what BID tape is and where and how it is used. BID tape in not a purchased item. You can not buy a roll of BID tape. You cut it from your 38" wide roll of BID glass. BID tape should be cut in 2" or 2 1/2" wide strips at 45 degrees to the selvage edge. **In most places where you will use BID tapes (eg. fuselage sides to bulkheads) you need to lap 1" onto the bulkhead and 1" onto the fuselage side.** Therefore you need a 2" wide tape. In actual practice it is wiser to cut the tape 2 1/2" wide, because it will stretch and get narrower between the cutting table and the airplane.

If you need a longer BID tape than you can cut off a 38" wide roll, it is ok to join the tape by lapping 1/2".

Since you cannot squeegee the BID tapes very easily you should wet them out with a brush, then peel ply the edges to give a neat smooth finish and also to help dry out the layup. Add a minimum of epoxy to wet out the peel ply, rather use the peel ply to soak excess epoxy out of the BID tape layup. Always peel-ply all edges of tapes.

From CP30-6 (CH6)
Long-EZ Ref: Section I, Chapter 6
When you assemble your fuselage sides to the bulkheads, be sure to install the firewall first, then the aft seat bulkhead, the forward seat bulkhead, the instrument panel, F22 bulkhead and then F28. If it is done in this order you will have little trouble bending the sides. There may be a tendency for the foam to crack in the area of the aft seat bulkhead. To avoid this possibility, particularly when working in a cool or cold shop, apply local heat with a hair dryer, to the foam. This will greatly reduce any possibility of cracking foam.

From CP30-16 (CH6)(Photo Caption)
Charlie Gray's Long fuselage in the assembly stage. Note the blocks on the flat table to hold the sides in symmetric alignment. Also note the mid-section bungee cord to hold things down and in for cure.

From CP31-4 (CH3,CH6)
A 3M part #7770 Clean'n'Strip brush, mounted on your drill really does a super job of carving the R45 dark blue foam. As an example the bottom can be carved and ready to glass in only 45 minutes. Thanks to Don Jehlik for this one.

From CP38-4 (CH6)
Front Seat Bulkhead Location
For shorter pilots, Mike Melvill moved his front seat bulkhead forward 2". He did not change the angle nor anything else. The landing brake is installed 2" forward of plans. In other words, it is still related to the front seat bulkhead per the plans. The landing brake handle position and right side stick controller were not changed. This resulted in an excellent fit for Mike (5'9" tall) and also for Sally (5'4" tall) and gave them a larger rear cockpit and helped the aft cg problem, since they used a starter and alternator. The landing brake, positioned 2" further forward, works great with zero pitch trim change.

Chapter 7, Fuselage Exterior

Long-EZ Plans Changes

****From CP24-6 (CH7,CH21)****
LCP #4, DES, Chap 7 & 21
See Safe-T-Poxy recommendation below for fuel areas.
GIVEN BELOW
New construction only. The interior fuel tank layup and fuselage side layup should be done using <u>only</u> Safe-T-Poxy. Laboratory tests have shown Safe-T-Poxy to be more resistant to fuel than either Lambert or RAE epoxy systems. Our survey of possible fuel contamination (see CP #22 pg 7) did not reveal anything of major concern, although several of the 64 responding, reported a gummy substance on the float valve seat. Be sure to follow the CP #22 pg 8 Owners Manual carburetor inspection requirement.

****From CP27-7 (CH7)****
LPC #50 MEO Page 7-1
Section A-A. This sketch is not accurate. See page A2 for the correct full size drawing. Also note LPC #46 in this CP.

****From CP27-7 (CH4,CH7)****
LPC #46 OPT
Revise F28 bulkhead by moving the longeron notch down 0.25". This raises F28, for better fit to canopy.

****From CP29-7 (CH7)****
LPC #70, MEO
CP #28, Page 8, under builder hints, UND layups on the fuselage sides should be ± 30 not ± 45. This is shown correctly in the plans.

Miscellaneous

****From CP24-5 (CH7,CH21)****
<u>FUEL GAUGE VISIBILITY</u>
Micro or traces of air entrapped in the fiberglass layup at the visual fuel gauge area will result in poor gauge readability. <u>This is a very common problem, existing in a least half the airplanes we have seen lately</u>. The gauge will read with excellent contrast <u>only</u> if the layups are perfectly clear. If you have not yet installed the fuel tank top, inspect your gauge area carefully. Without touching the surface you should be able to see your fingers clearly enough to count them when looking through the gauge. If it is not perfectly clear and translucent, cut out the gauge area, about 0.7" wide. Sand adjacent skin inside fuselage and out. Then layup two plies BID at 45 degrees onto two pieces of "Saran Wrap" (or glad-wrap) thin plastic kitchen plastic. Apply to inside and outside using your fingers on inside and outside to expel <u>all</u> air. The plastic wrap keeps the layup from drawing in air. After cure, remove the plastic. The result will be a gauge clear enough to see your hand through and will give a <u>good contrast</u> with fuel.

****From CP25-4 (CH6,CH7,CH14)****
<u>REFERENCE LONG-EZ CHAPTER 14, STEP 13</u>
At least a couple of you Long-EZ builders may have noticed by now that, due to the kink in the centersection spar it interferes with the aft seat bulkhead when you try to slide it into the fuselage. Do not remove the firewall to clear this. Using a coping saw, remove a triangular piece of the back seat bulkhead about 1" deep at the center and tapering to zero at the sides. After the spar's in place this piece is installed with wet micro and is structurally tied in by the tapes that lap onto the spar. For new construction <u>do not permanently</u> install the plywood firewall bulkhead in Chapter 6 or 7. Put the spar in from the back in Chapter 14, then install the plywood firewall bulkhead, lapping 1 ply BID around all edges.

****From CP25-5 (CH7)****
Carving the outside shape of the Long-EZ fuselage will be a lot easier if you rough the corners off with a large carpenters saw (careful not to cut too deep). Then use a body sander with a course sanding disk (or any highspeed power disc sander). Sand right into the bottom longeron till a max. of 0.4" of wood is visible. This gives you a rough shape. Now get a real coarse wood rasp (hardware store). This tool will remove foam with very little effort, and will enable you to arrive at a really pleasing shape. Finish with a 36 or 40 grit hard sanding block. This entire carving job can be done in 2 to 3 hours.

From CP25-5 (CH7)
After carving the outside of the fuselage, just before laying up the outside skin, lay out the outline for the speed brake with a magic marker. Now stick strips of grey tape (furnace duck tape) in this area covering the entire speed brake area. Then proceed with the UND skin layup. When you cut out for the speed brake it will be much easier to separate the glass skin from the R45 PV foam. Unlike the urethane foam used for the VariEze fuselage, the R45 PV has tremendous peel strength retaining the glass skin.

From CP25-12 (CH7,CH37)(Photo caption)
It seems the fastest Long-EZ builders are those that have built VariEzes. The adjacent fuselage is the first 1 1/2 weeks work by Herb Sanders. Other EZ-types of note are Ed Hamlin and Don Shupe. Ed and Don have a total of just under 1000 hours on their EZ's. Ed, Joanne, Don and Bernadette plan a round-the-world trip for a summer vacation when they get their Longs finished.

From CP28-8 (CH7)
Long-EZ. Method to lap outside skin plies at bottom CL fuselage to avoid a bump. **DRAWING OMITTED**

From CP28-10 (CH7,CH30)
Q. I want to install the NACA inlet. Can I do it before glassing the bottom of the fuselage?
A. No. The normal glass on the bottom of the fuselage is required structure. The NACA inlet per Tim Gehres and Steve Wood's plans is purely an inlet-shape add on, and provides no structural tie between the bottom longerons.

From CP29-3 (CH7,CH30)
NACA FLUSH INLET
We are getting a lot of inquiries about this and frankly we really cannot make your decision as to whether or not you should install it on your VariEze or Long-EZ. Here are the facts. This is all we can tell you. Please do not ask us to help make your decision.

1) You have to build the bottom of your fuselage per plans whether you use the NACA inlet or not, since this is required structure to tie the two bottom longerons together. The NACA inlet is an aerodynamic cosmetic add-on, and provides no structural tie between the fuselage sides. The NACA inlet is homebuilder-carved (no prefab parts are available) and spliced in to the standard cowl. You will not need the "CI" cowl inlet part.

2) The NACA inlet works well for cooling and is lower drag than the ram scoop, adding about 3 knots more airspeed. Since the fuselage sides are lower in the area of the main gear you get a better aerodynamic juncture between the main gear and the fuselage.

3) The sex change operation (going from the "male" ram scoop to the "female" NACA inlet) will add about 4 to 6 lb weight.

4) You may elect to install the flush inlet for aesthetic reasons only. We like the side profile view of the female EZ very much, and almost everyone who has seen it agrees.

5) RAF did not develop this installation, and therefore we cannot support you in building it. Tim Gehres and Steve Wood did all the work on it, they sell the plans, and they will support you if you have any builder questions. Contact Tim or Steve at:

Wood and Gehres Inc.
105 Appleblossom Ct.,
Orlando, FL 32807

Plans cost $20 and are very easy to follow.

From CP34-11 (CH7)(Photo Caption)
Mike Rhodes and family, "trying it on for size".

From CP43-7 (CH7)(Photo Caption)
Phillip Wessel, Scottsdale, Arizona carving his Long-EZ fuselage.

From CP43-8 (CH7)(Photo Caption)
Michael Marks and builder assistants trying it on for size. I guess we all fly 'em around the yard before we get done, we certainly do at RAF!

From CP48-8 (CH7)(Photo Caption)
Robert Hughes of Pembroke Pines, Florida getting a little stick time!

From CP48-9 (CH7)(Photo Caption)
RAF received the following pictures from "Captain Val". Captain Val is building his own composite design. The story goes that he was wondering how to trim and shape the fuselage when his wife asked him when he was going to trim the hedges. He went to the garage and found the hedge trimmer and says "the light came on". As you can see he made short work of trimming the fuselage!!! Captain Val got so carried away trimming foam, he had trouble finding his epoxy pump!!

From CP50-10 (CH7)(Photo Caption)
Cesar Contrenas, Serial No. 1685 Long-EZ of Tuxpan, Ver. Mexico trying it on for size - Looks very good, Cesar!

From CP50-10 (CH7)(Photo Caption)
"First flight in the living room" - Charlie Maddox, looking quite pleased with his efforts so far - all of us have been here, haven't we?

From CP53-13 (CH7)(Photo Caption)
Nelson Millar, Fostoria, MI making the obligatory first flight around his yard.

From CP54-6 (CH7)
Shaping the Fuselage - Dana Terrill sent this one in. Using a small Hitachi electric hand plane, he was able to carve the fuselage to match the template in just a few minutes, see photo. Skill, Stanley, Black & Decker, etc., all make handheld electric planers which will cut through the PVC foam, the fiberglass and wood longeron (even the firewall and F-22 bulkhead) like butter. Experiment a little with depth of cut, 1/16" works quite well. This can be a big time saver and will allow you to make a nice clean job.

From CP54-10 (CH7)(Photo Caption)
Dana Terrill's Long-EZ fuselage, after a few minutes work with the small Hitachi electric planer - bottom of photo.

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Chapter 8, Roll Over/Seat Belts

Long-EZ Plans Changes

****From CP26-6 (CH8)****
LPC #37, MEO, page 8-1.
Sides of roll over structure should be 13" not 12.7".

****From CP27-7 (CH8)****
LPC #52 MEO Page 8-1
Roll over structure assembly 4.5" should be 4.0", moving shoulder harness insert outboard 1/2".

Miscellaneous

****FROM CP24-4 (CH8)****
EON E-8000 SEAT BELT UPDATE
In CP #22 we reported the EON E-8000 seat belt was unairworthy and that Dr. Cross, President of EON Corp would. replace the belts with one that was acceptable. Unfortunately Dr. Cross reneged on his commitment. Long delays were reported and the ones he did replace were still the same type (dash 4) and in our opinion still unsatisfactory. We recommended the EON E-8000 be removed from your aircraft and replaced with another approved style. We have been very active with the FAA to the the cap-over buckle recalled. Now, over 5 months since we recalled the buckle and pointed it out to the FAA and EON, Airworthiness Directive dated 4 March 1980 80-05-04 amendment 39-3706 has also recalled them.

****From CP26-10 (CH8,CH39)****
1) An Illinois VariEze crashed on landing approach, fatally injuring the pilot/builder. The pilot had turned sharply from a low slow downwind and failed to upright the aircraft. Impact was 150 feet short of the end of runway. Weather conditions were low ceilings and strong gusty direct crosswinds of about 25 mph. The pilot was thrown forward through the instrument panel and clear of the fuselage. **The seat belt (EON 8000 type 4) was found open. (see CP 24 page 4).** This airplane had previously been damaged when landed short of a 5000 ft runway.

****From CP44-2&3 (CH8,CH39)****
VARIEZE/LONG-EZ ROLLOVER/HEADREST
We have received a letter from Andrew Detroi of the FAA concerning the forced landing/crash of a Long-EZ that he investigated. This crash involved a Long-EZ that lost power after takeoff. The pilot made a successful 180 degree turn, landed long and left the runway. The nose gear collapsed, the nose dug in and the aircraft flipped inverted with enough forward velocity to break the canard in half and rip one wing off at the end of the centersection spar. The rollover/headrest was broken off. The pilot and passenger received minor head cuts, scratches and bruises.

This letter has been distributed to the various FAA offices and in some cases redistributed with some inaccuracies. This has caused some consternation among the local FAA and among groups and individual Long-EZ builders.

We have spoken to the FAA in Chicago and they have agreed with us that obviously the pilot's head rest is not, nor was it ever intended to be strong enough to resist the forces imposed in an inverted crash with any appreciable forward speed. It is a roll over structure, and has proven that it will remain intact in the event that one of these aircraft should roll over with little or no forward speed. This was in fact the case, when Ken Swain flipped his EZ in a corn field near Oshkosh after an engine failure. His aircraft ended up resting on the rollover structure (canopy broken), the firewall and two broken winglets. He was not injured, but had to wait for others to lift the aircraft to get out. The rollover has provided this protection in at least two other cases, one example is in CP #14. However, the rollover structure is obviously not designed to handle an inverted landing! This structure is also a head rest and doubles as a map case/storage area. It will not protect you should you strike the ground inverted or roll over with any significant speed or impact energy.

We of course object to Mr. Detroi's inference that the rollover should have (or could have) provided protection in an earlier Minnesota Long-EZ accident that was not survivable, regardless of the head rest. (See CP #31).

Design loads for an "adequate" roll over protection are difficult to define. Obviously, a second landing gear on the top could protect for 10 ft/sec drop at full landing speed and just as obvious a very heavy structure would be snapped off by a hole or curb at only 10 mph. RAF does not have a specific recommendation in this area and we will not be reinforcing our headrests. The decision to do this rests with each individual homebuilt manufacturer. RAF will continue to strive to openly pass along all information to help you in your building decisions. You may for example want to change references of "rollover structure" to "headrest" if you feel this is more appropriate.

****From CP65-7 (CH8)****

HEADREST/ROLL OVER

The FAA has requested that RAF make it clear to all VariEze and Long-EZ builders that the triangular shaped foam and fiberglass headrest on top of the front seat bulkhead is just that, a headrest. It is not a roll over structure. It will not support the loads that would be imposed on it in the event of an accident in which the aircraft might flip upside down. The construction of the headrest triangle is such that it is a lightweight, stiff "box" that makes an excellent storage area for maps, logbooks, etc. and, with a cushion attached to the forward face, it makes for a comfortable place to rest the back of your head when flying. The light weight foam and glass structure can not possibly support any turnover crash loads. As the builder/pilot of a VariEze or Long-EZ, you should be aware of this important information.

Update Number 81
to
Chapter 8,
Roll Over/Seat Belts

Information derived from CP81 published by RAF July 1995

****From CP81-8&9 (CH8,CH21,CH30,CH39)****
A Southern California Long-EZ crashed shortly after departing from the Santa Monica airport. The pilot survived but was badly injured.

A careful post-crash investigation revealed that this airplane's fuel system had been extensively modified by removing the engine driven mechanical fuel pump as well as the electric boost pump. The fuel tanks had been plumbed together to form a gravity fuel system similar to a Cessna 150.

This pilot had also modified the front seat shoulder harness attach point and had installed a "Y" type shoulder harness, installed using a single bolt in the center of the seat bulkhead. There was no provision to carry the crash loads, no hardpoint and no beef-up of the bulkhead skins. The result was predictable. This single bolt pulled through the seat bulkhead and the should harness provided zero restraint. The seatbelts were installed per the plans and survived undamaged.

This is an absolute No-No! *RAF* Thoroughly explored the possibility of a gravity fuel system for the Long-EZ back in 1979 using the prototype, N79RA. Flight test results forced us to conclude that the margin of safety using a gravity fuel system was too slim and we opted to use a fuel system similar to a Grumman Tiger or Cherokee that includes two separately selectable fuel tanks, an electrically powered in-line fuel boost pump and an engine driven mechanical fuel pump. All of the above are mandatory in order to provide reliable fuel delivery to the carburetor on a typical Lycoming-powered Long-EZ,. This information was published in several *Canard Pushers* as well as in the plans and engine installation instructions. The following is taken from page 3 of the Section IIL of the Long-EZ plans:
"The most important item to consider is the mechanical fuel pump. The Long-Ez's fuel system is designed to <u>require</u> the use of an engine driven mechanical fuel pump, backed up by an in-line electric pump. This is a mandatory requirement and there is no acceptable way around it."

This important safety requirement was not just dreamed up, it was derived from a carefully conducted flight test program - do not try to second-guess the designer's motives behind critical systems such as the fuel system. The plans built fuel system on the Long-EZ is an excellent, trouble free system that is known to work on hundreds and hundreds of airplanes.

If you know of someone who may be contemplating a change to his or her airplane like this, get involved, help him or her out, don't let another unnecessary accident happen.

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Table of Contents for Chapter 9, Main Gear/Landing Brake

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Table of Contents for Chapter 9, Main Gear/Landing Brake

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Update Number 67 to Chapter 9, Main Gear/Landing Brake

****From CP67-8&9 (CH9,CH22,CH30)****
WICKS AIRCRAFT SUPPLY CO.
We have been asked us to let you know that they now carry in stock Real Gaskets, the 100% silicon rocker cover gaskets for Continentals and Lycomings. As we have said before, there is no better gasket and no better way to eliminate oil leaks at the rocker cover.

Also, Bud Meyers says they now carry the 5" axles (1-1/4" dia.) in a slightly longer version (6" instead of 5-3/4") to better fit the heavy duty Cleveland brake installation. They also have the wider spacer for the inboard side of the wheels to facilitate the use of the heavy duty brakes. These new axles have two cotter pin holes (at 90 degrees to each other) drilled in the threaded end. (An excellent idea. ED)

Bud has researched the Snap Action fuses and circuit breakers as mentioned in CP66 and has decided to stock the Snap Action MB-1. It is smaller and weighs less than other circuit breakers and is less expensive. Contact Wicks for more information.

****From CP67-11 (CH9,CH10,CH31)****
AN INTERESTING OBSERVATION
"After flying my VariEze for over 400 hours with the small tires and no wheel pants, I changed to the Lamb tires, still with no wheel pants. Guess what? With small tires, it pitched slightly nose up in rain but with the larger Lamb tires, it now has a slight nose down pitch trim change in rain!
Gordon Hindle"

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Update Number 68 to Chapter 9, Main Gear/Landing Brake

****From CP68-7 (CH9,CH33)****

ACCIDENTS AND INCIDENTS

FAILED MAIN LANDING GEAR DUE TO HOT BRAKES.

This is a subject that has been addressed before but we continue to hear from builders who are having problems in this area. We are revisiting this problem because recently we have received two reports from builder/flyers who have had this problem on airplanes with 300 to 500 flying hours on them.. These were not new airplanes. Originally the problems were associated with new airplanes doing taxi tests with wheel pants on. All the braking used while learning to drive a different airplane like an EZ, simply overheats the brake discs. This heat radiates into the strut and literally boils the epoxy out of the strut locally opposite the brake disc. Well, we are now finding out that this scenario also holds true on older airplanes. At one time, we had figured that the strut, over a period of time, gets postcured by repeated heat cycles due to braking and, thus, the heat distortion temperature goes up and makes the strut less prone to this type of problem. We still believe this to be true but only to a point. If you, for example, go to check out a new EZ pilot and have him or her conduct high speed taxi runs and stops on a runway, be certain that you <u>will</u> have this failure occur if you do not remove the wheel pants. There simply is not enough cooling available with wheel pants on to allow for this kind of operation. Normal take-off, go somewhere, then land operations do not put the thermal load into the discs that high speed taxi and runway flight tests do.

For additional protection from this radiating heat damage, install a 1/8" thick aluminum plate between the axle flange and the gear strut such that is extends up an inch or two above the brake disc and is somewhat wider than the strut. This will act as a heat reflector to reflect radiating heat from a red hot brake disc. You will still need to wrap the strut with fiberfrax and aluminum foil tape to insulate the glass strut.

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Update Number 69 to Chapter 9, Main Gear/Landing Brake

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	**$ 349.00**
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	**150.00**
Wheel pants (500x5)	**180.00**
Above item in Kevlar	**215.00**
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

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Update Number 70 to Chapter 9, Main Gear/Landing Brake

****From CP70-5&6 (CH9)****

LONG-EZ MAIN GEAR MELT DOWNS

We continue to hear from at least one builder/flyer each quarter who has had this problem. We have reported on this problem several times in past *Canard Pushers* yet it continues to happen. The bad part is that each flyer who we hear from acts as though they had never heard of this problem and why weren't we warning people about it?! It is quite frustrating for us at RAF because this is a problem that, frankly, does not need to happen - should never happen, in fact.

If you have a Long-EZ (or know of someone operating a Long-EZ) who is using the heavy duty brakes, this is what must be done to fix this potential problem. You must install heat shields between the axle mounting flange and the glass/epoxy main gear strut. This shield is purely a radiant heat shield and, as such, must be large enough to prevent the hot brake disc from "seeing" the gear strut. A fan-shaped, 1/8" thick aluminum heat shield that extends up above the brake disc by at least 1/2" works fine. You don't need any more than that. We have seen more gear legs damaged in this way than we care to think about and <u>all</u> of them had exactly the same damage: namely, the epoxy had been boiled or vaporized out of the glass strut directly opposite the brake disc. The damage was confined to an area the same shape and size as the disc. The damage can, and does, occur even through fiberfrax insulation. I repeat, this damage is caused by radiating heat from the red hot brake disc and is locally confined to a small section of gear leg directly opposite to and the same shape and size as the disc.

To our knowledge, this damage has only ever occurred when tight fitting wheel pants were installed. Apparently with no wheel pants, the disc gets enough cooling air flowing over it to keep it from getting hot enough to do this kind of damage. So - if you have tight fitting wheel pants, expect your brake discs to get very hot and protect the gear with an aluminum shield. In addition to the radiating heat damage, it is possible to generate enough heat inside an unvented wheel pant that this trapped oven-like heat can soften the epoxy and cause the gear strut to bend, usually at the highest point in the wheel pant. To protect against this kind of damage, you must wrap the strut from axle to the top of the inside of the wheel pant with Fiberfrax insulation, held in place with silicone (RTV). We have found wrapping over the Fiberfrax with aluminum tape makes a neat job and helps hold the Fiberfrax firmly in place. This will help the "oven heating" problem (as opposed to red hot radiation), but you must provide a place for this hot air to "chimney" out of the wheel pant. A vent of some kind is needed. This vent should be placed at the highest point in the wheel pant when parked, whether you park 3-point or nose down. This position may change a little depending on the wheel pant design. The important thing here is that the vent must be high to allow the trapped hot air to flow out and pull cool air in around the tire. These two fixes together will help prevent a softening of the epoxy-type failure.

The NACA scoop-type inlets and outlets we have all seen on wheel pants may have some value but you really need the cooling after you come to a stop. Cooling the brakes during braking probably has some value but these NACA-type cooling scoops are generally too low to allow good chimney venting when parked.

The single most important thing is not to conduct extensive braking/taxi testing with wheel pants installed. Do all initial taxi tests with no wheel pants. Once the airplane has been test-flown and signed off, generally you will not find a need to do extensive taxiing/braking. If you do have to check-out a new pilot, for example prior to his or her first flight in their own EZ, <u>remove</u> your wheel pants before you allow someone to practice for their first flight in your airplane.

If you have to taxi a long way with a strong crosswind, for example, the full length of a 10000 foot taxiway on a day with a 90 degree, 30 knot crosswind, you will have to ride one brake all the way. Under these circumstances, you might consider removing the affected wheel pant as soon as you park. This small inconvenience is tiny compared to getting stuck in some remote area, miles from home, due to a failed gear leg.

And if you are unfortunate enough to fail a main gear leg due to heat, contact Mike Melvill at Scaled Composites to borrow his steel splint that was made specifically to ferry a Long-EZ home with this problem. So far, it has been used on two Long-EZs and one Cozy and it will fit left or right Long-EZ main gear legs!

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Update Number 73 to Chapter 9, Main Gear/Landing Brake

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

****From CP73-6&7 (CH9,CH38,CH39)****
"Dear Mike:
Several weeks ago, I had a right brake failure on landing. Please re-alert others as to the serious nature of a brake failure, and suggest they frequently inspect their brakes. Finally, I suggest there may be a problem with Silicone brake fluid (DOT 5 motor vehicle standard #116).

In the last 2 months, I have flown around 200 hours, and the brakes had been working fine. (Yes, the brakes were inspected twice during this period). The takeoff at MEI, prior to the problem landing, the right brake was nearly gone. Previous flight, only 1 hour before, indicated no problem. I aborted the takeoff to bleed the brake. This seemed to fix the problem and I left with excellent brakes. However, two hours later I landed at RKW with NO right brake.

Assuming I might still have a problem, I landed with the wind on the right side. This worked great down to about 30 knots when it was obvious the nose had to be lowered to stop (I should have cut the engine on landing!). The damage was minor (retract gear and a few scratches) but could have been very serious. For example, had I landed the other direction, I would have left the runway at a much higher speed and went into the trees. The pilot has little control of a Long-EZ without brakes. It's a very sobering, dangerous situation -- best avoided!

I inspected the brakes after the accident, and found three confusing things. The calipers and pads had retracted about 1/4" from the disk. Why? The pads, disk and wheel pant were covered with silicone brake fluid. A leak (but small??) was found in the tube where it connected to the caliper. I believe the leak was initiated by 7 years of age and a "hot" landing several weeks before at a high altitude airport. Finally, there was a "gummy" gray deposit on the O-rings within the tubing and elsewhere. This indicates stability/compatibility/moisture problem with Silicone Fluid. I have changed back to standard good old red aviation fluid. Its thicker, lubricates better, works and leaks are apparent! I had changed to silicon fluid about three years ago after reading about it in a CP.

Mike, I have over 1300 hours in Long-EZ's and I have never had as serious a problem as this. I spend more time inspecting/working on my airplane than flying it! For example, in the last 7 years, I have replaced both master cylinders, upgraded to 50-106 disks and completely dissembled, cleaned and inspected the brake system 3 times. Yet, it got me! I will be even more attentive to the brake system!
Tim Crawford"

Editor's note: We have used silicon brake fluid (Dot 5) in all RAF airplanes for many years, the main reason was aircraft red brake fluid is highly flammable, Dot 5 is not. This is the first problem we have had reported. Mike did replace the o-rings in his master cylinders about 6 months ago and found a "grey" deposit in each cylinder. This was cleaned out and the brakes have functioned perfectly ever since. Has anyone else seen any problems using Dot 5 silicone brake fluid?

Keep those letters coming! Remember, anything that was a problem, or of interest to you, will also be appreciated by other EZ people.

****From CP73-10 (CH9,CH38)****
The "Bead Buster" TM - $75.00.

If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe.
Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

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Update Number 76 to Chapter 9, Main Gear/Landing Brake

****From CP76-10 (CH9,CH38)****
THE "BEAD BUSTER"TM
If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. (Mike purchased one of these tools and wonders how he ever got along without it!) Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe - $75.00.

Contact: Tom Caughlin
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Update Number 77 to Chapter 9, Main Gear/Landing Brake

Information derived from CP77 published by RAF Jan 1994

From CP77-1,2,3&4 (CH9,CH30)

ANOTHER CLOSED COURSE WORLD RECORD

"Ontario Approach, this is VariEze N99VE, 25 miles east of Homeland VOR at 10,500 ft. Request transition to Homeland for a 180 turn."

"VariEze N99VE, Ontario Approach. We've been waiting for you. Approved as requested. Will call your turn."

Two hours down and 14 more to go, I thought. All of that planning over the past 3 months is paying off. Fuel consumption and time are better than planned, the air is smooth, no significant wind, and the moon is full. Couldn't ask for better conditions. Looks like a go for the record....

It was almost ten years ago on the weekend of July 14 and 15th, 1984 that Jeana Yeager set the same closed course world's record for aircraft weighing between 661 and 1102 pounds in the same aircraft, N99VE. Jeana circled a course from Bakersfield, CA to Merced and back for a total of 8 laps and 2428 miles. Several hours later I followed up with a distance over a straight line departing Mojave, CA and flying non-stop to Martinsburg, WV just west of Washington, D.C. for a total of 2214 miles - two records in one weekend. Turning 50 this month, and needing a mid-life crisis thing to do, nothing seemed more appropriate than to test all the improvements I have made to the plane and getting both distance records in my name. In each of the old records, the plane had averaged about 150 mph and 50 miles per gallon. Since the fully loaded take off weight was right up against the maximum of 1102 pounds allowed for the class, my weight over Jeana's meant that I would be carrying about 10 gallons less. Aircraft improvements since that time had to make up for the difference.

Since 1983, I have been very active in the CAFE 400 events, taking my share of trophies like those shown in the October '93 *Sport Aviation* article. To be competitive with people like Klaus Savier in his very efficient and fast VariEze and Gene Sheehan with his highly refined Q200 prototype, took some dedicated effort to constantly modify and test, looking for every last knot of speed and efficiency. Major changes since the original records are the addition of custom designed high compression pistons for the Continental A65, lower drag wheel pants replacing the original "football" shaped pants, an Ellison throttle body injection carburetor, a modified oil tank and induction system to accommodate a low drag cowl, and an electronic ignition supplied by Light Speed Engineering with manifold pressure regulated spark advance.

Getting Ready

After I finish a typical modification, I try to gauge how much effort was expended for the speed gained; some mods are more successful than others. **The wheel pants are perhaps the highest payoff of any mod to date adding about 5 knots to my top speed. The pants are carved from a single block of foam with a top planform using a 65-025 symmetrical airfoil. The side view is driven by the requirement for a constant pressure distribution at each station down the pant. To achieve this, the angle that the top and the bottom of the pant make with the waterline is the same as the angle that the left and right side make with the line of flight. All of the flow lines appear laminar, traveling straight aft without curling back. A plug and female mold were made on which two layers of glass were laid up to give a weight of about 1 1/2 lbs. per pant.**

The original A65 was designed with 6.5:1 compression in the days when fuel for general aviation over 80 octane wasn't readily available. It is well known that the thermodynamic efficiency of a piston engine increases as a function of compression ratio. After several iterations (some not so successful), I designed and had constructed by a custom automotive piston manufacturer, a set of forged pistons with a 9.0:1 compression ratio. Also, I installed a set of modern technology automotive rings with a 3-

piece oil control ring and Total Seal gapless 2nd compression ring. As a result, I average about 25 hours per quart of oil and have a very low idle manifold vacuum reading of about 7 inches. Crankcase blow-by is almost nonexistent.

The Ellison throttle body injection unit has become a familiar piece of equipment in the homebuilding community. The ability to lean much beyond a conventional carburetor and still run smoothly gives nearly a 10% savings in fuel consumption. The Ellison is mounted horizontally in front of the oil tank to allow the installation of a low profile cowl. The induction tube passes through the tank and exits at the distribution spider. The induction air heating lowers volumetric efficiency somewhat (reduces maximum power) but provides a longer mixing length to give better fuel distribution prior to reaching the spider. Since efficiency is the primary goal, the trade off was worth it. Also an added benefit of oil cooling eliminates the need for an oil cooler.

Over the years, I have had three different engine cooling systems on the airplane. When originally built, being convinced that Burt's way was the only way, I installed a conventional EZ pitot cooling scoop. Since that time I have had the flush NACA scoop, and now the "arm pit" scoops. The arm pit scoops show a slight advantage over the flush scoops, but this is one of those modifications where the speed increase per hours spent is very poor. The place where this modification is a real winner is in the way it looks and how it cools the engine. Head temperatures in cruise are in the 260-280F range. Many other aerodynamic cleanup changes can be classified as attention to detail; such as fairings and leak sealing, contribute to the overall efficiency.

The standard magneto is designed with fixed timing to give detonation-free operation during worst case operation (maximum power, hot day, sea level condition). At high altitude, where conditions are cool and power is reduced, the optimum ignition advance is considerably higher to account for a much slower flame travel within the combustion chamber. The light weight electronic ignition supplied by Light Speed Engineering replaces one of the magnetos with an electronic processor and a set of ignition coils. The system senses manifold vacuum and adjusts spark advance up to a maximum of 17 degrees above the nominal setting. The effect of this advance is dramatically illustrated at altitude by noting a 50 RPM drop switching from the full advanced setting of 43 degrees back to the nominal setting of 26 degrees.

All of these efforts to increase efficiency have also paid off in speed. When first constructed, the plane would not quite reach 180 mph. Recently, at an EZ racing event held at Wendover, NV over the Bonneville salt flats, the airplane turned 204 mph on a 125 mile triangular course. Not too bad for a two-place plane with 170 cubic inch displacement engine at 7000 ft. density altitude.

Flying The Record

I had not given much thought to going after a second record and was even unsure that the aircraft had the capability of breaking the existing record until I received encouragement from Dick Rutan at this past year's Oshkosh event. On the trip home, I started doing some serious data taking. Calculations confirmed that indeed the aircraft had the range necessary to beat the old record if the empty weight had not crept up over the years. To my surprise, my attention to weight additions had paid off. The empty weight with auxiliary fuel tank installed was about 10 lbs. more than at the time of the previous record attempt, more than accounting for all those "essentials" such a LORAN and autopilot. I contacted Art Greenfield of the National Aeronautical Association (NAA) and received a package of all the forms necessary to sanction and certify a World's Record. Turnpoint verification can be accomplished by either a NAA certified observer or the FAA. I chose the FAA route and contacted the Approach Control people at both Phoenix and Ontario, CA. Both groups were delightful to work with and anxious to help in any way they could. I sent the forms for turn point verification that they were to fill out at each passage. The NAA, the United States certifying authority of the Federation Aeronautique Internationale (FAI), requires that an NAA observer must witness the aircraft weighing, barograph installation, gas tank sealing, takeoff, and landing. Klaus Savier, who is an NAA member and the present record holder for the 1000 and 2000 kilometer speed records in his VariEze, filled the requirements for a qualified observer.

Planning for the right time takes a little bit of common sense and a lot of luck. Since part of the flight occurs at night, I wanted the moon to be as full as possible in case an off-airport landing would be necessary. On the weekend of October 30/31, the moon was at its full brightness. The closed course turn points of Chandler, AZ and Homeland VOR on the eastern edge of the LA basin were chosen for the flat, low altitude terrain and the safety of paralleling Interstate 10 the entire route. As the time approached, the Santa Ana conditions that fanned the fires in the LA area were developing. The airplane gods were smiling, and what was supposed to be peak wind conditions all weekend actually turned out to be light and variable to 10 knots from the south at altitude.

Klaus flew to Phoenix in mid-afternoon on Saturday the 30th to help with final preparations of the airplane. We fueled up, less an anticipated 4 gallons and parked the plane. I went home to try to get some sleep. After a largely unsuccessful attempt to rest, I got dressed with borrowed ski pants, down booties and a warm coat. Leroy Castle, a local EAA member and keeper of the Arizona EAA Council platform scales, showed up at the airport at about 9 pm.

After rolling N99VE onto the scales, I climbed in with all the equipment that I would eventually take off with. After adding the necessary fuel to bring the total weight up to the 1102 pound class limit, Klaus sealed the tanks. Total fuel on board was calculated to be 49.3 gallons. My conservative "how-goes-it" chart said that I would need 48 of those gallons to make it four times around the predetermined course for the record. At 10:50 pm, I departed into the night for Homeland VOR. The rest is history. The plan went off without a hitch. Fuel flows, engine temperatures and all the electronics worked flawlessly. At each turn point, I exceeded my anticipated times, speeds and fuel flows. Taking data with a calibrated fuel flow meter at each point, I generated the following summary: **CHART OMITTED**

After all the concern for adequate margin, I landed with almost 7 gallons of fuel on board or almost 400 additional miles possible. At this writing, all the paperwork has been submitted for final approval by the NAA and FAI.

Gary Hertzler"
ED. Congratulations, Gary, attention to detail is everything! 58-1/2mpg at 157mph - WOW!

From CP77-5 (CH9,CH38)
TIRE WEAR
Over the years, we have seen EZ's, Defiants and even Viggens with horrendous wear patterns on the tires. Regardless of the original main wheel alignment method used during construction, in the final analysis, the wear pattern on the tires tells it all.

Ideally, the main tires should wear evenly across each tire. They should not wear on the outside or inside shoulders. If your tires are wearing unevenly, fix the problem, don't just accept it as inevitable. If the rubber tread is wearing heavily on the outside shoulder, you have too much toe in. If the inside shoulders are wearing badly, you have too much toe out. To correct both problems, install aluminum taper shims as required between the axle flanges and the main gear strut. These taper shims are available from several sources including Aircraft Spruce and usually come in 1/2, 1 and 2 degree increments. These may be combined to give greater tapers if required. (They can be installed so as to remove excess camber as well, if required.)

We have found that it can take several iterations to finally achieve the even tread wear that is most desirable, but it can be done. Give it a try.

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Update Number 78 to Chapter 9, Main Gear/Landing Brake

Information derived from CP78 published by RAF for April & July 1994

****From CP78-4&5 (CH9,CH38)****

BRAKES AND MASTER CYLINDERS

EZ's require serious diligence when it comes to brake maintenance because the brakes are not only used to slow or stop the airplane, but they are the only means of steering while taxiing.

Recently, there have been two incidents involving brake failures resulting in loss of control, running off runways, through ditches, causing no injuries but seriously damaging both airplanes. The damage included ripped out landing gears, broken wings/winglets and even a broken canard.

Maintaining the brakes is absolutely essential to the safe operation of an EZ and is easy to forget or ignore because most EZ's have wheel pants fitted that hide the brakes. Make it a habit to routinely and regularly remove these wheel pants and carefully check the brake linings for wear. Look for any sign of hydraulic leaks. These will appear as a dark stain at the threads of a "B" nut or fitting. Do not use shop air to blow the dust out of the wheel, this dust consists of asbestos or asbestos-like particles which could be very harmful to your lungs over the long term. Rather, use a high pressure water jet (a garden hose) to flush most of the dust, then use a commercial brake cleaner in a spray can (available at auto parts store) to completely clean the entire brake caliper, brake disc and wheel. Replace worn brake linings and fix any hydraulic leaks. Allow the brake assembly to dry out completely before going flying.

If you have Nylaflow brake lines, you should change them out every year when you do your annual inspection. Nylaflow is easily damaged by ultra violet (sunshine) and is prone to damage from the radiating heat of the sometimes red hot brake disc. To be safe, change them out as often as necessary. I, long ago, went to Stratoflex Teflon/stainless braided brake lines and have never regretted this upgrade.

Brake master cylinders are all too often ignored. Every couple of years, or more often if you have a brake problem, you should remove and dismantle these critical parts. Replace any suspect "O" rings and thoroughly clean all the parts. (Denatured alcohol works well). Use a bright light and examine the bore of each master cylinder. If there is any scoring or other contamination such as rust, consider honing the bores prior to reassembly.

Aircraft hydraulic brakes are always filled from the bottom of the brake caliper. The hydraulic lines should run continuously uphill to the master cylinder to assure that the fluid drives all of the air out of the system as it is forced into the small brake bleeder on the lowest part of the brake caliper. Have an assistant watch for the fluid as it gets to the brake master cylinder or reservoir. They should do this using a flash light and looking through the small threaded hole usually plugged with a plastic plug.

If you have to do this job alone, you need to make up a clear plastic tube with a fitting on one end that will screw into the 1/8" pipe threaded hole in the reservoir. The plastic line should be long enough to reach out of the reservoir and down to a can on the floor. You must be able to see this plastic line as you pump brake fluid into the brake caliper. (I use a large trigger-operated oil can and it never gets used for anything else!). Continue to pump until you can see brake fluid flowing through the overflow line you have installed. Usually there are a few bubbles in this line. Continue to pump until there are no air bubbles. Now, as you are pumping, tighten the 1/4" nut that is the bleeder. Do not over tighten this nut, it only needs to be firmly snug. Remove the overflow fitting and plastic line and siphon a little fluid out, lowering the fluid level about 1/2" in the reservoir. I use a 3 foot length of Nylaflow to suck the fluid out. Be careful not to get any in your mouth, it tastes awful! Replace the plastic plug, be sure that it has a small breather hole (1/16" dia. is fine) drilled through it.

Careful maintenance is the key to safe flying - and don't forget, the airplane will usually let you know before it bites you. If you notice a change in your brakes, don't fly - fix it first!

Update Number 79 to Chapter 9, Main Gear/Landing Brake

Information derived from CP79 published by RAF Oct 1994

****From CP79-6 (CH9,CH38)****

DOT 5 SILICONE BRAKE FLUID

We recently received our second letter regarding a problem with the silicone brake fluid, this time in a Defiant. John Rippengal, who built and flies his Defiant in Cyprus, found that after 4 years of use, he had a leak at the caliper on one brake. He dismantled the calipers and found that the 'O' rings were sticky and showed signs of roughness.

Some time ago, we received a letter from a Long-EZ builder with similar complaints. At that time, we recommended a complete tear down of the brake system, including master cylinders, and a complete and careful cleaning of all parts before installing new 'O' rings and new DOT 5 brake fluid.

DOT 5 brake fluid is 100% silicone. Silicone is an inert material and should not react with any other material, however, maybe, when mixed with red aircraft brake fluid, it does slowly attack the 'O' rings.

In spite of these problems, we still believe that DOT 5 silicone is safer because it is not flammable. Normal aircraft brake fluid is highly flammable. There have been several brake fluid fires reported in Ezs and one in a Defiant. So far, we don't know of anyone having lost his or her airplane, but it has been close a couple of times. Since silicone can not burn, we feel that even if it requires a complete cleaning and 'O' ring replacement every 3 or 4 years, it is worth it. Mike Melvill has been using DOT 5 silicone brake fluid for almost 10 years. About four years ago, he did a complete tear down and replaced all 'O' rings, including master cylinders. At that time, he did notice what appeared to be rust in the master cylinders. It was very thin and cleaned up easily using 3M Scotch Bright. He has had no brake problems before or since. We know of several antique-ers who fly J-3 Cubs, etc. who have used only DOT 5 silicone for more than 15 years with no problems.

If anyone experiences a problem with silicone brake fluid, please let us know so that we can share it with others. Also, if anyone out there knows of a different 'O' ring material that perhaps should be used, please drop us a line.

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Chapter 9, Main Gear/Landing Brake

Note: Refer to Supplemental Chapter 29 for Landing Brake related information

Long-EZ Plans Changes

****From CP26-6 (CH9,CH29)****
LPC #35, MEO, page 9-1.
Landing brake paragraph - after the word "installation" add the words "and other important landing brake details".

****From CP26-6 (CH9,CH33)****
LPC #41, MAN GRD, page 33, Owners Manual.
After "70 to 80 psi" add "75 to 85 psi for 6-ply tires".

****From CP27-7 (CH5,CH9)****
LPC #45 OPT Page 9-3
Move the 3/8" holes in all four extrusions up 0.4". Also modify outlines to maintain original edge distances around the 3/8" hole. This moves the entire main gear up 0.4", resulting in an improved gear-fuselage juncture reducing aerodynamic drag.

****From CP29-7 (CH2,CH9)****
LPC #71,MEO
Section I, Page 2-1, add to Ken Brock parts list - 4 spacers A4-84 and 2 nuts J1.25 (axle spacers and nuts).

****From CP30-8 (CH9)****
LPC #75 Section I, page 9-1
The axle bolt location in the sketch on the lower left is not accurate. See sketch below. Warning - Note that the 1/16" clearance between the main gear strut and the brake caliper is a mandatory requirement. The caliper must not be able to touch the strut or the wheel pant or you could have an intermittent brake or even a brake failure. **SKETCH OMITTED**

****From CP30-9 (CH9,CH28)****
LPC #80 'A' drawings, page A-5.
2" x 2" x 1/4" aluminum ext. shown full size page 18-3, should be page 9-3.

****From CP30-9 (CH2,CH9)****
LPC #83 Section I, page 9-4.
The AN960-1018 washers called out should be AN960-1016 and are not called out in the bill of materials on page 2-4. Add 4 more AN960-1016 to the 2 washers called out.

****From CP30-9 (CH9,CH28)****
LPC #85 'A' drawings, page A5, to right.
"shown full size, page 18.3" should be "page 9-3".

****From CP31-5 (CH9)****
LPC #89 MEO, Section I, page 9-3.
Sketch on lower left of page shows brake line run between the gear strut and brake disc. This is incorrect. The brake line must run around the inboard face of the strut. This puts the strut between the brake disc and the brake line.

****From CP36-6 (CH9)****
LPC #112, MEO, Section I, page 9-1, top right
"Refer to Chapter 8" should read "refer to Chapter 14".

****From CP48-5 (CH9,CH38)****
LPC #127
A mandatory inspection of your nylon brake lines is required before next flight. If these brake lines have been directly exposed to radiating heat from the brake discs, or to sunlight (UV) they must be replaced.

From CP48-5 (CH9,CH38)
LPC #128
Main gear attach. Inspect with a mirror and a flashlight to determine if the gear attach tabs have slid aft on the LMGA steel tube. We have received two reports of this from Long-EZ flyers. This is not a structural problem, but may cause the nylon brake lines to be pinched between the trailing edge of the main gear strut and the fuselage side where the gear comes out of the fuselage.

If you find any evidence of movement in this area, please let us know. Pry the gear forward to its proper position on the LMGA tube then fill the gap between the aft attach tab and the aft aluminum extrusion on each side with flox. Allow to cure for 24 hours before flying. **SKETCH OMITTED**

Refractable Gear

From CP55-3 (CH9,CH30,CH37)
Excerpt from Ivan's letter to Mike Melvill

"Dear Mike,
Please find enclosed a photograph of my latest project, the Shaw "TwinEze", thought you may be interested.

G-Ivan started life as a VariEze that I built in 1980-81. After 350 happy hours flying, I decided to convert it to a Long-EZ then, inspired by Starship, got carried away with twin engines and retractable gear.

The engines are British fully certified units - three cylinder, inline, water cooled, two strokes giving 77 bhp at the prop. They were designed and built my Mike Hewland for the ARV Super Two aircraft. Both engines have completely separate systems, batteries, etc. and left fuel tank feeds left engine, right feeds right.

To date, I have completed approximately 10 hours flying with the only problems being getting the cooling air to go where I wanted it to go and some fuel vapour (sic) locking that has only been completely cured by running on 100LL instead of MOgas. The good news is that it flys superbly, just like the Long-EZ, the noise level and vibration is less. Control on a single engine could not be easier, 350 fpm climb and a VMCA wings level of 56 knots on the critical engine. I have not opened up the envelope speed-wise yet but one thing I am sure of and that is it's going to be fast. The main gear is a retractable unit of my own design that tucks the wheels aft through 115 degrees to where the engine used to be, it is powered by hand hydraulic.

The technical challenge has been everything and more that I expected. The bureaucratic hassle has been something you have to live through to believe. After static load testing the aircraft to 5 g's, gear drop tests to beyond FAR part 23 requirements, engine mount static load test, 25 hours of ground running, taxi, runway hops, my approved inspector clearing it as airworthy, after all this, it took a further six months to get permission to commence a test flight program. I was actually told that I could not do this because, "it has not been done before". What a sorry state of affairs for a country that once led the world in innovation.

My flight testing continues. I will keep you updated on my progress.

Thanks, Burt, for the inspiration,
Ivan Shaw"

From CP55-11 (CH9,CH30,CH37)(Photo Caption)
Ivan Shaw's Twin-Eze, a modified VariEze/Long-EZ retractable twin.

Prefabricated Parts

From CP27-8 (CH5,CH9)
Ken Brock is now manufacturing the heavy 1/4" aluminum main gear mounting extrusions. They incorporate the 0.4" move (plans change #45) and also have 1/2" diameter flanged steel inserts for improved durability. Part numbers are - Aft: LMGB-RA and LMGB-LA, Fwd: LMGB-RF and LMGB-LF. The forward parts are supplied without the large lightening holes, so VariEze builders can saw off the top 1" to install a Long-EZ gear on a VariEze.

From CP29-6 (CH9)
Mismatch on the Main Gear
Due to a mold shift, a few Long-EZ main gear struts have been shipped with a slight mismatch. We inspect every strut and have determined that a mismatch of up to 0.1" is of absolutely no concern structurally. You can sand the surrounding glass down to match, or you can build up the low spot with strips of UND and Safe-T-Poxy. Either method is acceptable. A disc grinder with a 16-grit heavy duty disc is best to remove the flash. Be sure to wear a dust respirator and protect your skin with Ply-9 to prevent itching. **SKETCH OMITTED**

From CP45-6 (CH2,CH9,CH13,CH30)
PREFAB GLASS PARTS
Larry Lombard, owner/builder of VariEze N15LL, one of the highest time EZs we know of with over 1200 hours, is now on line and is making Long-EZ main and nose gears and is set up to make Defiant gear.

Larry is working on tooling for Defiant cowlings and fuel strakes and would appreciate hearing from Defiant builders who would be interested in these parts.

He has available tooling for Long-EZ cowlings and **wheel pants**, VariEze cowlings and wheel pants and can take orders for these parts. We would request however, that if you are ready and need a cowling or a pair of wheel pants, that you contact either Aircraft Spruce and Wicks Aircraft first, since they may still have a few of these parts in stock and we would like to deplete their stock before Larry starts.

Mike Melvill and Michael Dilley flew up to northern California and spent the day with Larry, checking out his equipment and also helped him run the first Long-EZ gear. Larry has built a really nice hanger/shop right on the Boonville airport which is north of San Francisco and west of Ukaiah. He has just completed a first class oven in which to cure the gear. All of the equipment worked well and he is now ready to accept orders.

Larry will be handling all of these parts directly and you should contact him at:

P.O. Box 781
13451 Airport Road,
Boonville, CA 95415
707-895-2718

Larry has a very extensive background in working with composites. He had built several homebuilt aircraft including his own VariEze, and worked here at RAF for two years during which time he helped build the Grizzly and Solitaire. Larry will be working in close conjunction with RAF and we are confident that he will produce high quality parts at reasonable prices.

From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)
PRE-FABRICATED COMPOSITE PARTS
Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. **Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants.** In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.
1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415 (707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

****From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)****
FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	**324.00**
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom)	448.00
weight saved, approx. 6 lbs.	
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert.500 x 5 tires)	**155.25**
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	499.00

strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.
Contact: Michael or Larry at: FeatherLite, Inc., P.O. Box 781, Boonville, CA 95415, (707) 895-2718

Gear Antenna

From CP35-5&6 (CH9,CH22)

From the desk of Jim Weir - Radio Systems Technology:
"NO ANTENNA FOIL ON THE GEAR LEGS. NONE, NO HOW, NO WAY. Get the idea? There have been a series of reports that the gear-leg antennas work very well when first installed, then gradually deteriorate over time. Actually, the "deterioration" seems most pronounced after a hard landing. The copper foil is not as resilient as the glass, and rather than flexing like the fiberglass, copper tape breaks. Net result - lousy antenna operation.

Instead of copper tape, use a copper braid similar to Radio Shack 64-2090 (use 2 strips side-by-side) or Belden 8664. Every bit as good, but slightly harder to make, is to strip the black jacket from RG58 coaxial cable, remove the polyethylene/copper center conductors, and flatten out the resulting braid. Install this on the gear leading edge or trailing edge, not at the maximum thickness, to avoid flex failures.

For those of you who have a broken antenna, I recommend removing as much foil as possible - - both elements of the dipole - - and glassing braid on the OPPOSITE leg. It would be a major job to strip the glass from the broken glass and remove it, so I suggest you just leave it alone.

Actually, if I was a-buildin' the airplane, and I didn't have the wing and winglet glassed yet, I'd go ahead with a winglet antenna like the Long-EZ has for the COM antenna.

Jim Weir"

On new construction VariEzes the "Long-EZ" comm antenna can be installed on the winglet and outboard wing as shown. Follow the instructions in CP 26, page 7 for the Long-EZ comm antenna.

Incidentally Jim recently checked the performance of a Long-EZ winglet COMM antenna and it's radiation pattern proved to be quite exceptional, much more uniform than the factory builts.**SKETCH OMITTED**

Gear Attach

Also see LPC #45 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #83 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #128 in the "Long-EZ Plans Changes" section of this chapter.

From CP28-8 (CH9)

Long-EZ Main Gear
When drilling the 5/8" diameter holes through the main gear attach tabs, the 5/8" counter-bore tool drills a slightly undersized hole in the fiberglass laminate. An easy way to get this hole to fit the LMGA tube is to use a dremel sanding drum. Do not use it in a dremel tool, rather chuck it up in your 1/4" power drill (much slower rpm) and it will make the hole a perfect fit on the tube.

From CP35-12 (CH9)(Photo Caption)

Mark Borom. Got the main gear on!!

From CP42-10 (CH9)(Photo Caption)
From time to time we receive suggestions and photos of "easier and better" ways to install Long-EZ main gear struts. This one is from Bob Davenport, (305-567-1844) and is probably the ultimate extreme that a builder could go to! Anyone interested in Bob's method is welcome to call him. Our feeling here at RAF is that the plans method is still the simplest and quickest. But that is what being an "experimentor" is all about!

From CP46-7 (CH5,CH9)
LONG-EZ MAIN GEAR ATTACH
The AN6-80A bolt should be torqued to a value of 275 inch/lbs. Care should be used to assure that the nut does not bottom on the threads. If this occurs, it is possible for the loads to gradually cause this 3/8" bolt to elongate the holes in the aluminum extrusions. If you bought your extrusions from Brock, you will note that they have flanged, steel bushings pressed into the aluminum angles, these steel bushings are available separately from Brock and are an excellent idea. If your AN6-80A bolt appears to be too long, simply add an extra washer or two under the head and under the nut to make certain that the nut is clamping down on the extrusion and LMGA tube. Of course, the general rule here is that you need two threads protruding beyond the nut.

From CP46-13 (CH9)
Shirley Brandt sent in this shot of her Long-EZ main gear attach. This is how it should look. Very nice work Shirley.

From CP47-9 (CH9,CH38)
MAIN GEAR ATTACH ON EZS
Every 100 hours or once per year, you should check your main gear attachment points for any movement. The best way to do this is to lift the wheels, one at a time, clear of the ground, supporting the wing on a piece of foam to spread the load. Get into the rear cockpit and put your hand on the attach point. Have a friend push and pull the wheel in a fore and aft motion. You should not feel any movement at the attach point. If you feel movement, you may have a problem developing. If there is significant movement, you will have to go in and see what it is. It probably will be the bolt holes in the aluminum extrusions, elongating and allowing the bolt to move. This is much more likely to occur in a VariEze than a Long-EZ. Best repair is to ream the holes out to a larger size, press in a steel bushing and bolt the gear back in place.

Axle Installation/Toe-In

Also see LPC #71 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #75 in the "Long-EZ Plans Changes" section of this chapter.

From CP30-6 (CH9)
Ref: Section I Page 9-2 and 9-3
Attaching axles to the main gear strut: CAUTION! You must set the toe-in parallel to the WL, not 90 degrees to the strut as several builders have tried to do. The main gear strut should be mounted on the fuselage. A good idea at this point, is to stretch a tight wire down the fuselage centerline, at the level of the axle centers. This assumes your fuselage is upside down, with the main gear strut sticking up. Using a rasp or a course file, trim the faces of the strut where the axles will be mounted, to roughly give you the correct toe in. Try the brake plates on, to be sure that they seat flat onto the axle flanges. You may have to file a small radius into the brake plate to get it to seat properly. Now, position the axles on the gear, the flat machined areas on the axle flanges should be oriented close to vertical, and the bottom of the flanges should be approximately 1/2 inch up from the bottom of the gear strut. The brake caliper must be oriented forward and the top (with the airplane upright) of the caliper will be level with the top longerons or W.L. With these parameters, there is only one way that you can install the axle/brake plate/caliper assembly. When you cut the main gear strut to clear the caliper, be absolutely certain that there is a minimum of 1/16" between the caliper and the strut. The caliper must not be able to touch the strut at all, or you can have an intermittent or failed brake. Now, layup 3 plies of BID both sides of each strut and mount the axles using clamps to position the axles such that you can place a 24 inch steel carpenters square on the axles as shown on page 9-3 (section I). With the square held in position on the axle, measure from the forward tip of the square to the tight wire, (1/2 of dim. A) and from the heel of the square to the tight wire (1/2 of dim. B). The difference between these dimensions, (1/2 dim. B) minus (1/2 dim. A) should be a minimum of 0.1" to a maximum of 0.2". The smaller dimension is better, this is approximately 1/4 degree of toe-in, and will give excellent tire wear. N26MS was done this way and now has over 500 landings on the original set of tires.

From CP31-10 (CH9)(Photo Caption)
This photo clearly shows the 7 to 8 degree camber of the Long's gear with a light load.

From CP32-5 (CH9,CH38)
CAUTION - ROTATION SPEED
Several things influence rotation speed, and thus take-off distance. The fuselage station of the axle centerline is very important. **You should hold this within 1/2". (See Chapter 9 and the back cover of Section I). Toe-in of your mains also has a powerful influence on rotation speed (not to mention tire wear!). Accept nothing less than a total of 1/4 of a degree to 1/2 a degree.** (N26MS has 1/4 degree toe-in, and still has the original tires, with over 700 landings, 320 hours in one year). If your tires are showing excessive wear, do not accept it, remove the axles and shim them until the toe-in is correct. This can be done quite easily by laying up one or two plies of BID on the strut and bolting the axles back on, gently tightening the bolts until the correct toe-in is achieved (by crushing the BID layup into a taper). Allow the

layup to cure, then torque the axle bolts to their proper value of 75 inch/lbs. ft./lbs.). You could also use a commercially available taper shim. Aircraft Spruce sells them in various taper values.

Tire pressure can also influence take-off roll distance/rotation speed (as well as tire wear). Check your tire pressures regularly.

Ground attitude of the airplane can also cause long take-off rolls. Your Long-EZ or VariEze should sit level to slightly nose up on level ground, when loaded to gross weight. If your airplane has a pronounced nose down ground attitude under the above conditions, it should be corrected. Note that a nose-down attitude during construction is normal, before the weight of the engine and wings are added.

****From CP34-8 (CH9)****

Brake torque plates - Check to see that the torque plates fit flush on to the axle flange. Occasionally the hole in the torque plate will interfere with the radius between the axle and flange. Careful filing or grinding of the corner in the torque plate will allow a perfect flush fit. See sketch. **SKETCH OMITTED**

****From CP34-11 (CH9)(Photo Caption)****

Main gear on N26MS, showing location of axle bolts, brake caliper, brake line & relief tube (insulated with fiberfrax). The wheel pant bracket has been removed for this photo.

****From CP55-10 (CH9,CH38)****

WHEEL ALIGNMENT

When you built your EZ or your Defiant, you should have set the axles on the main gear such that your main wheels were toed in about 1/4 degree on each side. If you have noticed excessive tire wear, inside edges or outside edges, it is time for you to check and possibly adjust the main gear alignment. With an already completed airplane, probably the easiest method of checking this is as follows: Load the airplane to the same load that you normally fly. Now, pull the airplane at least 100 feet forward on a smooth concrete or blacktop surface. This will allow the gear to spread to its normal position, the wheels will be in their natural position for this weight, and this is the condition you want to check the wheel alignment. Using a plumb bob or level, drop the aircraft centerline to the ground (center of the nose, center of the spinner tip), snap a chalk line between these two points. Use a 36" straight edge (hardware store, aluminum yardstick) and hold it so that the center of the 18" mark is at the axle centerline. Hold the straight edge against the wheel rim (or tire if fat tires are used!) and measure from each end of the 36" straight edge to the chalk line aircraft centerline. Record these dimensions and repeat on the opposite wheel. Ideal or perfect results would have A=A2, B=B2 and A+A2 = B+B2 or slightly less. **SKETCH OMITTED**

When A+A2 = B+B2, then the main gear toe-in is zero which is probably the perfect situation for tire wear, but 1/4 degree of toe-in, that is A, would be approximately .080 smaller than B and A2 would be approximately .080 smaller than B2, would be best for ground handling and straight tracking. Measuring to the airplane's centerline lets you know if you have the gear on straight but, realistically, it is not critical of your A and B dimensions are not identical to your A2 and B2 dimension. Wow, hopefully you are not all too confused by the above!

Remove your axles and use metal taper shims (available from Aircraft Spruce or Wicks) or build up the gear leg with glass and grind to set your axles to meet the above dimensions (you also must use 36" straight edges or the dimensions will be different for the same angle!). Once you have the correct toe-in set, you will notice an improvement in tracking, shorter take-off and less tire wear! Go for it!

****From CP57-3,4&5 (CH9,CH30)****

SOME REFLECTIONS ON 3 MONTHS OF THE EZ LIFE

On the sixth of July of this year, my Long-EZ N316DB flew. Thus ended some 7 years of anticipation, occasionally very intensely focused work, and an inordinate outlay of cash. And thus began a probable lifetime of very enjoyable flying, occasionally very intensely focused work, and monumental expenditures.

The pressure was on. I had to complete my 40 hours of test flying (all within a 25-nm circle with an airplane of range of about 50 times that) within 15 days in order to make my departure deadline for The Big Trip.

The Big Trip was what had kept me motivated for the previous seven months or so. Back in December of 1987, Sid Stiber (Shelter Island, NY) and Mike and Sally Melvill and I had discussed a tour of the east coast after Oshkosh '88. I had never been to New England, or many of the areas we planned to tour, and so it was the perfect motivation. Plans were set.

And so the Runabout (as I call my Long) and I departed Mojave on 22 July bound for Kansas City. I left early for Oshkosh in order to attend my 10th high school reunion. I climbed directly to 17500 ft and averaged about 165 ktas into (of course) about 15 kt of headwind. As I crossed Colorado, it became apparent that I was going to have to slow down in order to make the trip nonstop. By the time Great Bend, Kansas arrived, I ran the left tank dry, and has about 6 in the right. Playing the fuel flow against the time-to-go (thank you, Alcor and Northstar), I was able to arrive at Johnson County Industrial airport with about 20 min fuel left (2 gal). Total flight time was 7 hours, 50 minutes. The distance was 1180 nm, and I used 50 gallons of fuel. I was, to say the least, extremely pleased. This was the first time that the Runabout had been away from its test area, and it had gone more than halfway across the country nonstop! I was amazed to find that I was not particularly fatigued, and I felt that after a pit stop I could have gone for several more hours.

After several more days of flying around the Kansas City area, I continued to Oshkosh. There the final details of our trip east were cemented. Mike & Sally decided that they would not be able to go after all, so Bruce and Bonnie Tifft, Sid, Dick Kreidel, and I left Wittman Field on Tuesday, 2 August for Montreal (aka the Great White North). Four-and-a-half hours later, the flight of four made a tower-requested low approach at the international airport in Montreal, and landed at St. Hubert's. Kay Kreidel joined us that evening (via airlines) in Montreal. I must say, the people that we met in Montreal went out of their way to make our visit enjoyable. It was, however, still over 450 degrees Fahrenheit outside. Sadly, this was our last experience with air conditioning for two more weeks.

After a quick trip to Burlington, VT to clear customs, we proceeded to Rockland (Owl's Head), Maine. Dick Kreidel hadn't eaten (whole) lobster before, and videotapes of the spectacle are available from Squadron 1. On to Wiscasset (Bath), ME, then to Boston (or is it Bastun?), then the Runabout and I made a ceremonial pilgrimage to Martha's Vineyard and Nantucket islands. The group rejoined at East Hampton airport, where Sid bases his Long. The next day we were joined by Peter Magnuson and his USAF Thunderbird Fighting Falcon Long-EZ. Peter and Dick and I enjoyed flying formation and 1v1v1 combat maneuvers over the coast of Long Island. Then a trip to Mattituck, to visit where Dick's engine was assembled. The next day, it was on to Linden, NJ (New York City) via Central Park, the Hudson River, and the Statue of Liberty (at 500' agl, no less!). Several days were then spent being poached in and around Central park.

Well, so far so good. The return to Kansas City went well (nonstop from Linden to Columbia, MO). It looked like a trivial trip back to Mojave. And then...

Dick and I were descending together into Farmington, NM (our planned fuel stop) when, as if by magic, the Runabout was no longer hitting on all four. We informed the tower of my problem and were cleared to land. We were about six miles out, I guess, and about 4000 ft agl. The engine was still making power (some), but the CHT on the #4 cylinder was way lower than the rest. Nothing in the usual litany of procedures produced any good results, so I pressed on to a high overhead approach to the west. Still high, a lot of slipping, but the airspeed was high on final (about 90 kt). Better to be high than low, but this is silly. The engine won't idle below 1500 rpm or so (on the idle stop). Touch down, no problem, some crosswind but don't notice it, roll out, plenty of brake. Made it. Taxi back, park, shutdown.

Wow, bad day. I got out and went back to look at the engine area. No oil, but the prop is really beat up. Wow, Now what? Must have broken a valve, and the pieces went out the exhaust pipe and through the propeller.

But the worst came next. I looked down at the right main gear and imagine my surprise to find the wheel and wheel pant sitting about 90 degrees from where they should be. Much worse news than the engine problem!

So the trip ended with the airplane in a hangar at Farmington, and me riding home in the back of Dick's Long-EZ.

THE FIX

I was all set to get a trailer and take the Runabout apart and haul it home. I envisioned having to take the engine off, flip it over, and put a new strut in. Also, who knew what kind of engine work lay ahead?

Fortunately, I know more rational people. Dick Rutan, who had once trailered his Long home, said that no matter how much work he had to do away from home, he would never trailer his again. Burt said the same thing. Mike was convinced it could be fixed there. So it was.

Mike and I flew to Farmington in his Long-EZ the next weekend with three critical parts. First, a replacement propeller. Second, a new cylinder and all its attendant parts. And the really important one, The Splint.

Mike had made The Splint from some 1/4 inch 4130 steel strap, sort of roughly formed over his right main gear strut. The plan was to remove the axle, bend the strut back straight-ish, and install The Splint to sandwich both sides of the gear strut. The axle then would be mounted outboard of the steel piece with longer bolts.

It worked. We had thought ahead and brought two industrial strength heat guns, and these were mandatory in order to reheat the gear strut to bend it straight, for although the fibers were failed locally, the resin had rehardened to a startling degree.

I should digress and describe the failure more thoroughly. Apparently, I had used more braking than I thought during the landing (due to both landing fast and the high idle speed). Also, the other tire was low, which required more right brake. And I had the shimmy damper adjusted too tight, requiring even more brake. Finally, since the Runabout is a bit on the hefty side, I have the big brakes. More heat. The failure was in an arc, the same size and shape as the brake disk, and the mode of failure was resin burnout from direct heading of the brake disc.

The Splint worked admirably. The cylinder change went without difficulty (the piston hadn't broken, and there was no metal in the screens). In fact, the entire time on-site was less than 24 hours. The next afternoon, the Runabout completed her trip east, a cross-country of well over 6000 nm. She had 89.5 hours on the Hobbs (in less than 60 days).

After returning to Mojave, we repaired the gear strut. A particle board fixture was made for the inboard side of the gear strut, and bondoed in place. A body grinder was used to grind away about 2/3 of the S-glass strut at the bottom, tapering to nothing about 12 inches up the strut. Some dry S-glass roving (see your neighborhood Defiant builder) was wet out on a piece of visqueen and then put in place and mummy-wrapped in peel ply to hold it. The next day, the axle holes and brake cutout were transferred from the inside of the strut to the outside. Then, the inside of the strut was ground away, and more S-glass was put in place, essentially replacing the lower part of the gear strut with new material. The next day, the per-plans torsional wraps were put on, the brake line and relief tube bonded back into place, some bodywork, and Presto! a 3-day gear repair.

The next magical trick was to install a 1/8 thick aluminum plate between the axle and gear strut. This fan-shaped plate extends upward to just above the brake disc, and is intended to protect the strut from the direct radiant heat of the brake disc. The usual Fiberfrax and aluminum tape were reinstalled. The aluminum plate may seem like overkill, but I don't ever want that to happen again.

The prop was sent back to Great American for repair...$120 later, it was fixed.

Anything else? Oh yes, I replaced the other three exhaust valves with new Superior model 17540 units. I had so many people tell me how dumb I was not to put NEW exhaust valves in my engine instead of the unknown-history USED valves I ended up using, that you might think I'd have listened. But no. Instead of spending the several hundred dollars up front, I spent them later, plus about 700 more for a new cylinder, a couple of hundred for hangar rent away from home, a hundred more for the prop, and a lot of anxiety dollars for the landing duress and gear malady. But the lessons you learn, huh?
Doug Shane.

****From CP57-10&11 (CH9)****
MAIN GEAR LEG OVERHEATING
Suddenly, we are receiving a number of reports of softening main gear problems. This subject has been covered before, but there is now a new factor so it bears mentioning again.

The new factor is, or course, the very popular "big" brakes, particularly for the Long-EZ. We believe that big brakes are aggravating this problem and we feel that it may be appropriate to install an aluminum heat shield between the brake disc and the main gear strut. We have done this quite easily by cutting a piece of 1/8" thick 2024-T3 aluminum that fits between the axle flange and the strut, and is clamped in place when the four AN-4 bolts holding the axles on are tightened. The 1/8" thick plate will probably require the use of one size longer AN-4 bolts. This heat shield should be tall enough to protect the strut to about one inch above the brake disk, and should be wide enough to prevent the heat radiating out of the disk to "see" any of the main gear strut. (see Doug Shane's article: EZ LIFE.)

Several Long-EZ's are flying now with these heat shields with no further problems reported. Don't let it happen to you. Never do taxi tests, low speed or high speed, with wheel pants installed. Be aware that your brake discs can, and will, get red hot. This heat can radiate directly into the "S" glass and epoxy strut. Once the epoxy in the strut reaches its heat distortion point, the strut will fold up, an extremely frustrating experience at best, requiring extensive repair or replacement of the strut. If this happens away from home, it can be even more frustrating. Take care of your main gear strut and it will take care of you with years of trouble-free service.
1) Wrap the strut with fiberfrax covered with Reynolds wrap or aluminum tape. Use RTV silicone to glue the fiberfrax to the strut.
2) Install the 1/8" aluminum plate heat shields.
3) Cut vent holes in the <u>TOP</u> of your wheel pants to vent the hot air inside, after a panic stop.
4) Plan your taxiing and landings so as to use minimum braking - better to roll to the end using little or no braking, than to brake violently in order to make the first turn off.

****From CP57-15 (CH9)(Photo caption)****
Sad but true! - the result of heavy braking & riding a brake.

****From CP57-15 (CH9)(Photo caption)****
It took two heat guns to warm the epoxy enough to straighten the strut.

****From CP57-15 (CH9)(Photo caption)****
Fitting The Splint!

****From CP57-15 (CH9)(Photo caption)****
A perfect fit!, incredibly the toe-in was even correct!

****Also see LPC #41 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP34-11 in the "Axle Installation/Toe-in" section of this chapter.****
****Also see CP40-7 in the "Brake Malfunctions" section of this chapter.****
****Also see CP42-4&5 in the "Brake Malfunctions" section of this chapter.****
****Also see CP57-3,4&5 in the "Axle Installation/Toe-in" section of this chapter.****
****Also see CP57-10&11 in the "Axle Installation/Toe-in" section of this chapter.****

****From CP24-7 (CH9)****
TIRES: Both Aircraft Spruce and Wicks now stock Goodyear 6 ply ribbed tires. This has been the most satisfactory tire we have tested so far. We recommend them for both VariEze and Long-EZ. These tires should be inflated to 80 psi. Long-EZ now has over 240 HR on a set of these - they may go 300+ HR. Toe-in is 1/4 degree.

****From CP26-5 (CH9,CH38)****
FROM BYRON McKEAN - "I have the Goodyear 6-ply 3.40x5 tires and have ruined 3 inner tubes at the joining of the valve stem to the tube. I enlarged the hole and rounded the edges but it still went flat after 15 landings. Tire repair stations say the rim is too wide for this tire". Ben Duarte machined his wheels (and modified axles) to narrow them to reduce sidewall flexing, as he has had sidewall breakdown with his 6-plies. We at RAF believe the primary cause of both stem failure and sidewall failure is under-inflation. Under-inflation is almost always the cause of stem problems. When we introduced the 6-ply tires in CP #24 (page 7) we recommended a pressure of 80 psi. These tires are rated for pressure up to 95 psi. We ran them at 110 psi for the world record flight (gross weight was 1920 Ibs.). We got over 180 landings on the first set and second set of 6-ply tires. We have run them too low (60 psi)for much of their service. We experienced sidewall breakdown in the form of blisters, near the end of tread wear, but never a flat. Because of the reported incidence of sidewall breakdown be sure to carefully inspect tires on your preflight inspections. (last pages of owners manual). If you have had or do have a breakdown or a flat, report it to us, indicating the service life and pressure history. We will access this data to determine if a wheel modification or change in tire specification is to be recommended.

****From CP29-6 (CH9)****
NEW TIRE TESTED
We recently tested a neat 6 ply tire for both VariEze and Long-EZ which is a little larger than the 3.40 x 5 Goodyear tire, but looks just exactly like a miniature 500 x 5 aircraft tire. It has a smooth rib pattern and is rated to 70 lb./in. We have a pair on N79RA, together with a pair of the current small wheel pants, and we like the tire, and recommend it for all VariEzes and for those builders of Long-EZs who do not want to use the larger 500 x 5 tires.

This new tire should be available through Aircraft Spruce and Wicks Aircraft. It is an 11" x 400 x 5 6 ply ribbed tire. Be certain to use only the 6 ply rated tire.

****From CP30-3 (CH9)****
Mike and Sally's Long-EZ N26MS
Sally flew our Long to Oshkosh and back, put 37 hours on it and used only 1 quart of oil. We have 260 hours total time now, with virtually zero maintenance. We could not be more pleased with the airplane. It does everything as advertised and more. Most of our flying is to and from work, which includes a lot of take-offs and landings. When commuting we only fly 0.3 hours between landings. **I estimate we have well over 500 landings at this time, and the tires look as though they are good for that many again. I am very pleased with the 500 x 5 tires, we get excellent tire wear and a super comfortable taxi ride. With a decent wheel pant the performance is still excellent.**

Sally and I recently made a cross country trip to Fort Collins-Loveland for the Rocky Mountain Regional Fly In. This trip was 720 nm (828 sm). We flew from Tehachapi to Loveland direct, non stop. This took us over Las Vegas, Grand Junction and Long Peak (14,300 ft.). Time was 4.9 hours, we burned 27 gallons of 100 oct. We indicated 120 knots at 13,500 ft. (temp. 1 degree C) for a true airspeed of 150.3 knots (173 mph). Our ground speed, block to block was 147 knots (169 mph).

Our figures for the return trip were virtually identical, I flew out there and Sally flew back. Weather was perfect with virtually no wind. The route took us over some spectacular country, with the highlight being perhaps flying over the top of Long Peak, which is on the Continental Divide west of Loveland. The Long-EZ performed flawlessly, and handled this kind of flying with absolutely no problems. It was comfortable, both in the front seat and the back seat. Our relief tubes worked well, and I am very "relieved" we put them in! Noise level, with headsets, was very acceptable and I must say it was nice to listen to taped music to pass the time. Here is a break down of the trip.

Climb segment:	4,000 ft. (Tehachapi) to 13,500 ft.
Fuel Used:	2.4 Gallons
Time:	0.3 Hours
Distance:	40 nm (46 sm)

Cruise segment:

Distance	= 720 - 40 = 680 nm (782 sm)
Time	= 4.9 - 0.3 = 4.6 hours
Ground Speed	= 680 = 148 knots (170 mph)
	4.6
Fuel used 24.6 gal	Fuel flow 5.35 gph
Economy 27.64 nm/gal	(31.8 sm/gal)

The Long-EZ Owners Manual shows 4.8 gal/hr at 120 kt indicated at 14,000 ft. (148 kt. true) at a gross weight of 1100 lbs. Correcting this to 1350 lbs. results in 5.4 gal/hr and 27.4 nm/gal.

Thus, on this trip our Long-EZ did slightly better that the Owners Manual, and certainly more than satisfied Sally and I. We won best composite at the airshow, and really had a great time.

****From CP31-4 (CH9)****

When you install your wheels, spin them and check the disc for runout/wobble. It should run true, within .010". If not true it can force the brake caliper piston back inside the caliper, and then you may have to pump the brakes once or twice before you get a solid brake.

****From CP31-4 (CH9,CH38)****

If you are experiencing gear "walk" or shudder as you roll out to take off or land, particularly as you brake to slow down, you should balance your wheels and tires. An out of balance condition that may not be noticeable on a factory built, may be objectionable on a VariEze or Long-EZ due to the relatively flexible gear strut.

****From CP31-10 (CH9)(Photo Caption)****

Size comparison 3.40 x 5 - 4 ply and the new 11 x 4.00 x 5 - 6 ply. The new 11 x 4.00 x 5 - 6 ply has shown excellent durability in service. We strongly recommend it or the 500-5 for the heavier Long-EZ. Also, it is the best VariEze tire size.

****From CP37-3 (CH9,CH21,CH22,CH30)****

Long-EZ builder, T. Dinneen has the following suggestion for obtaining an engine for your Long-EZ. He paid $7,500 for a 1978 Tomahawk in good flying condition. Not only did he get an airplane to fly and stay current in, but he also got:

1) A Lycoming 0-235 L2C engine complete, including a mechanical fuel pump with 920 hours total time
2) A full gyro panel and instruments
3) **500 x 5 wheels, tires, brakes, axles and master cylinders**
4) 720 channel com, Nav and VOR head
5) Transponder
6) Nav lights/strobe anticollision light system
7) ELT and seat belts
8) Circuit breakers, engine instruments and battery
9) Fuel plumbing, fuel valve, electric fuel pump etc.

In addition, he figures he can sell the airframe for about $1,000.00 after he has 'gutted' it. This means he has laid out $6,500.00 for the lot. On top of that you can bank finance the whole deal. Check Trade-a-Plane for "deals" on Tomahawks!

****From CP41-5 (CH9,CH41)****

Brake pads - As reported in a previous newsletter, Dick Kriedel and Mike Melvill have been trying a new Cleveland brake pad. This is a semi-metallic material and works quite well. Brake effectiveness is increased and brake pad life is extended. It is important however to use the correct break-in procedure for this type of pad or you will not realize its full potential.

Remove your wheel pants and taxi at 40 to 50 knots. Execute three consecutive hard brakings to a stop. Do not allow brakes to cool between brakings. This procedure will glaze the brake pad surface and prevent uneven pad wear and brake disc scoring. This is Cleveland's recommended procedure for the semi-metallic brake pads, Part #66-56. These pads are available from Aircraft Spruce.

If you are using the regular organic Cleveland brake pads (Part#66-2), and entirely different break-in procedure is called for. Remove the wheel pants and taxi at 25 to 40 knots. Brake to a stop using light pedal effort. Allow the brakes to cool. Repeat this procedure a minimum of six (6) times. This will generate sufficient heat to cure the resins in the pads, but will not get so hot as to cause carbonization. A single hard brake application on organic linings can carbonize and prevent attainment of the correct coefficient of friction for the entire life of the linings (which won't be long).

The above information was sent in by Long-EZ builder, Dick Kriedel, who tells us that you can get an informative catalog containing lots of wheel and brake information for $2.00 from:

Cleveland Aircraft Wheel and Brake Division
Parker Hannifin Corp.
P.O. Box 158
Avon, Oh 44011

From CP49-7 (CH9)

LONG-EZ BRAKES

Those of us who have heavy Long-EZs have known for a long time that the standard Cleveland 500 x 5 brakes were somewhat marginal. At best, they eat up brake pads at the rate of a set every 25 hours! Over a year ago, Mike Melvill obtained a heavy duty set of brakes from "Flying Magazine" journalist Peter Garrison. Peter designed and built the Melmoth, an ultra long range airplane which he flew across the Atlantic as well as the Pacific. Melmoth weighed over 3,000 lbs. at gross weight, yet it used 500 x 5 wheels.

Peter obtained a special set of brakes from Cleveland which was working with the Italian company, Caproni, to develop a heavy duty brake for Caproni's jet trainer. These brakes consisted of a stock 500 x 5 disc, except it was almost 3/8" thick. The caliper was from a 600 x 6 brake.

Peter Garrison put over 2,000 hours on his Melmoth before it was destroyed in a freak accident. He gave the brakes to Mike and Sally and they have flown them now for over 300 hours.

Mike reports that these brakes are over 60 percent more effective than the standard brake and do not use up brake linings. He finally replaced the linings after 250 hours and they really weren't all that worn!! Of course, RAF has been attempting to find out if Cleveland could provide these brakes for Long-EZ builders, but with no luck. Dick Kriedel of Squadron 1 in Los Angeles tried even harder and finally got them to special-build him a set of the thick discs. Apparently the right hand does not talk to the left hand at Cleveland because Tom McNeilly, an experienced builder from the Phoenix, Arizona area, who has built two beautiful Long-EZs, has managed to discover that Cleveland does, indeed, manufacture these brakes and that they are, in fact, still available. We sure appreciate Tom's efforts, for these brakes really do fix the one weak point on the Long-EZ (particularly a heavy one!) and we certainly recommend them. Tom has installed them on two Long-EZs so far and reports a dramatic improvement in braking effectiveness. He feels the safety benefits are well worth the money.

Tom obtained his brakes through: Varga Enterprises
2350 S. Airport Blvd.
Chandler, AZ 85249
(602)963-6936

Talk to George Varga. The part numbers are:

Caliper Assembly	30-133.
Heavy Duty Disc	164-85.

Total cost is around $400.00 The installation is simple. The caliper assembly slips right on to your existing 500 x 5 brake plate and the disc is a direct bolt-on replacement. The thicker discs can absorb much more energy and the 30-133 caliper assembly has a piston in it that has almost twice the area (2" diameter versus 1.5" diameter) of the standard 500 x 5.

Keep in mind that this more powerful brake will generate more heat! Fiberfrax protection for the gear strut is even more important. If your disc is too close to the strut, consider installing a 1/4" thick aluminum spacer between the axle flange and the gear leg. Ventilate the top of the wheel pants by cutting a hole at the highest point in the wheel pant when the airplane is parked nose down. This will allow a chimney effect to cool hot brakes after you stop when there would not normally be any flow through the wheel pants. For new installation, it is even more important to remove your wheel pants before conducting any taxi testing!!

Now that he has good brakes, Mike has noticed that the additional heat generated is even harder on the nylon brake lines and even though he has carefully insulated them, the heat transfer from the brass elbow seems to cause the nylon close to the brass elbow to become brittle and to cause a small hydraulic oil leak at the fitting. Since his experience of a brake fire in the Defiant, he is very suspicious of small leaks and has been inspecting these fittings frequently. **His conclusion has been that he is going to change the brake lines from nylon to stainless braided teflon high pressure brake lines.** This is a big step but he feels it is worth it. While he is at it, he is going to drain the aircraft grade brake fluid which is flammable and carefully flush the system with 100 percent denatured alcohol. **Then he will use automotive DOT 5 100 percent silicone brake fluid. The main advantages are that the silicone fluid is not flammable and is completely inert and therefore does not effect O-rings or rubber seals.** There are a number of EZ flyers already using this brake fluid with perfect results. The Antique Aircraft builders have used it for years because it does not effect their dope and fabric airplanes!

We can talk more about this at Oshkosh.

From CP51-8 (CH9)

Aircraft Spruce and Wicks Aircraft both have in stock Cleveland wheels and brakes as follows: For VariEze and possibly very light Long-EZ - upgrade kit 199-93, includes a thick brake disc, but uses original 1-1/2" diameter piston in the brake caliper.

OR

199-156, includes wheels, thick brake discs and 1-1/2" diameter pistons and calipers.

FOR NORMAL OR HEAVY LONG-EZ

199-152, wheels, thick brake discs and large calipers with 2" diameter pistons. These give excellent braking capacity, even to a fully loaded Long-EZ and this is what Mike and Sally have had on N26MS for over 2 years with excellent results.

From CP51-8 (CH9)

Varga Enterprises
2350 South Airport Blvd.
Chandler, AZ 85249
(602)963-6936

Talk to George Varga. George was the original source for the heavy duty Long-EZ brakes and he reports that he now has complete sets which include heavy duty 500 x 5 wheels and bearing, heavy duty (3/8" thick) discs, and heavy duty (2" diameter piston) calipers. Kit part #199-152, complete for only $371.35. At this price you get the wheels for nothing! Good deal, George!

From CP52-4 (CH9)

Heavy Duty Brakes

If you elect to install the larger brakes as strongly recommended in CP51, there is a possible problem to watch out for. If you have not installed the wheel pants, the easiest way to take care of the problem is to order two special steel spacers from Brock. The part number is A484-187. These new spacers will be installed on the axles first, then the main wheels will be installed normally. This will space the wheels 3/16" outboard.

If you already have wheel pants installed, watch for an interference between the wheel/tire and wheelpant. The amount of interference will depend on how tightly fitted your wheelpant is. The only alternative to this fix, which will not affect the wheel-to wheelpant fit, is to make new, longer locator pins and install them in the brake calipers. This requires some machining capability as well at lathe and thread cutting capability. We did go this route and we simply removed the locator pins by removing the nuts and pressing the pins out. We carefully measured these pins and machined up four new ones, but made them 1/4" longer. This will cure the potential problem without causing any wheel-to-wheelpant interference, but is much more difficult to accomplish than the first option of using the two Brock spacer rings.

The reason for the above change is the possibility of the brake caliper locator pins pulling out of the fixed brake plate, thus allowing the brake caliper to rotate. This has already occurred in one case and it caused considerable damage to the wheelpant and the gear strut. Look carefully at the brake caliper and disc and you will see that as the brake linings wear down, the brake caliper will move inboard, away from the wheel and disc. If the brake linings are allowed to wear all the way down to the rivets, the locator pins may pull out of the steel bushings in the fixed brake plate. This is a real GOTCHA, so don't ignore it if you have the heavy duty brakes.

NOTE: This will not occur if you are still using the standard 500x5 Cleveland brakes. However, we feel very strongly that any Long-EZ should use the heavy duty brakes (part #199-152, see CP51) and even some of the heavier VariEzes probably should be using them.

From CP61-6 (CH9,CH13,CH38)

IMPORTANCE OF WHEEL BALANCING

Many builders ignore this rather important step. Our plastic airplanes with their plastic gear are probably more prone to being effected by an out of balance wheel than a standard spam can, but all airplanes will benefit from keeping the wheels balanced.

Do you experience a vibration right after lift-off? Can you see the canard tips vibrating up and down at this point? If so, you need to balance your main wheels, and perhaps even the nose wheel. At RAF we religiously balance all of the wheels on all the aircraft, and we do it fairly routinely, usually at least once a year at the annual.

You will need to build a pair of knife edges. Planer blades from a thickness planer, or jointer will work very well. They should be bondo'd to a "U" shaped wood frame so that the steel blades are level to each other and exactly parallel. Now you will need an arbor. It probably is not practical for each individual to make his or her own arbor, rather a group or chapter could make one (or get it made) and lend it to the members. Dick Kreidel very kindly sent us a drawing of one he machined out of a length of 2" diameter cold rolled steel (CRS). The wheel is slipped onto this "axle" type arbor, an axle nut is used to secure the wheel, then the arbor is set down on the knife edges. Use sticky backed tape lead weights (available from any wheel balancing garage which handles mag wheels) to balance the wheel. The idea is to get it to the point where the wheel will not roll either way. The weights should be stuck inside the wheel or inside the brake disc. Just be certain that there is no interference with the brake caliper. You may be shocked to find out just how much lead weight it takes to balance your wheel, even with a new tire installed. However, you will be delighted when you see the difference just after lift-off. Balanced wheels can also help the vibration some EZ flyers see in the gear on rollout. **SKETCH OMITTED**

From CP62-2&3 (CH9,CH13,CH38)

RE: WHEEL BALANCING ARTICLE IN CP 61

George Lyle sends in the following hints to enhance safety when installing sticky-backed weights in your wheels:

1) Make sure that the mounting location is absolutely clean - use MEK and a paper towel, wipe several times until paper towel is clean. Brake residue makes it difficult for the adhesive to grip, and a lead weight in the brake caliper would not be too neat!
2) Bend the lead weight to match the curvature of the wheel - allows 100% contact for the adhesive.
3) Use lead weights with the thinnest adhesive foam tape for best results.

Thanks, George.

From CP63-11 (CH9,CH38)

CAUTION - WHEEL BRAKE DISCS RUNOUT.

This can cause vibration in your main gear as you apply the brakes. Use a micrometer to measure disc thickness. Check it in six or eight places around the disc. Thickness should not vary more than .002". Use a dial indicator to check for side-to-side out-of-true. We have seen Cleveland brake discs run out more than .020"! This is completely unacceptable. Sometimes is it in the disc weldment itself, but even more upsetting, it can be in the machining of the wheel halves themselves! If you suspect this, you should return them to Cleveland for replacement.

A better bet may be the new Rosenhaan brakes. While we have not actually tried them, we recently saw a set and they are really neat. They have a very heavy (thick) disc and have dual calipers with four brake linings. Should have serious stopping power. The neat part is they are VariEze to true up if ever they should start to chatter. Simply have them ground flat on a Blanchard grinder. The disc itself is a flat piece of steel. If you are interested in this type of brake, contact: Phil Mattingly

PO Box 8604
Salt Lake City, UT 84108
801-583-2118

Brake Lines

Also see LPC #89 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #127 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP34-11 in the "Axle Installation/Toe-in" section of this chapter.
Also see CP49-7 in the "Main Wheels, Tires & Brakes" section of this chapter.

From CP27-5 (CH9)

Page 9-3, Long-EZ plans, a small 1/8" o.d. brass tube 1/2" long is called out to be used in the end of the Nylaflow brake line. In some cases the little brass tube will slip up into the Nylaflow tube, and be difficult to extract. This problem can easily be overcome by using a Weatherhead tube, part #2030X4. This little tube has a flange on it and it works great. If you cannot obtain it locally, Aircraft Spruce has them.

From CP45-7 (CH9,CH38)

BRAKE LINES

The Nylaflow nylon brake lines which are used on all of the EZs have been generally extremely reliable and on all five of the airplanes here at RAF have performed flawlessly, some of them for more than 10 years. On one occasion we did replace the brake line on the left gear leg of Long-EZ N79RA due to a small blister or bubble that appeared in the nylon line directly opposite the brake disc. At the time we had no insulation on the nylon lines and the heat from the disc heated and softened the nylon line, so that as the brakes were used the pressure blew a small balloon in the line! We replaced the line and insulated them with fiberfrax and silicone and have not experienced any problems. Recently however, we have received two reports of problems with the nylon brake line even though they were insulated. In one case the nylon line blew a balloon and burst causing a loss of brake and a major leak of brake fluid and in the other case, the nylon apparently hardened right at the brass fitting, as though heat was conducted through the fitting into the nylon causing brittleness which due to vibration, broke within 1/4 to 3/8 of the brass elbow.

These are our observations. First of all, the nylon tubing is an excellent, flexible hose, easily capable of handling the pressures required when new and fresh. Sun light is very hard on nylon, the ultraviolet will make it hard and brittle and it then may crack. So keep it out of the sun. When you receive it from the distributor, store it in a black plastic garbage bag until you install it. After it is installed, protect it from sunlight with black electrical tape or something similar. Once you have wheel pants on then the problem goes away.

Protect it from heat. Radiated heat as well as conducted heat can soften the nylon, and also over a long period of time, can cause it to become brittle. Insulate the nylon tube. We wrap it with fiberfrax and glue the fiberfrax on with silicone. Covering the fiberfrax with a reflective aluminum foil such as Reynolds wrap is an excellent idea.

Route the nylon brake line so that it can not "see" the hot disc. Bring it down the trailing edge of the gear leg then around the inboard face of the gear leg into the brass elbow. Do not run the nylon brake line between the gear leg and the disc, this will definitely cause problems. Also it makes it very difficult to change the brake linings!

Last of all, perhaps it is a good idea to install the nylon brake line onto the trailing edge of the gear inside a piece of plastic line, such as hardware store type vinyl tubing or even soda straws stacked together. This allows for easy replacement of the brake line. This is an option not a mandatory change. We have never done this here at RAF, and when we did have to replace a brake line, we found it to be a simple job, but it did mess up the paint job on the gear leg.

From CP46-6&7 (CH9)

Long-EZ builder Bill Friend sends in the following suggestions for insulating the brake lines at the wheel. Bill wrapped the exposed nylaflow (or nyloseal) brake line (from the trailing edge of the strut to the caliper) with fiberfrax (RTV silicone will help stick it down). The fiberfrax was then wrapped with aluminum foil. A length of heat shrink tubing was then slipped over the whole thing and shrunk into place (the heat shrink must be slipped on before the nut and ferrule are installed). We tried this system recently and it works great.

****From CP47-11&12 (CH9)****

CAUTION - BRAKE FAILURE

We have used NYLON NYLAFLOW brake lines in all of the RAF designs so far with very low required maintenance. There are a few points that require care and if you do sloppy work here, you may set yourself up for a potential brake failure. If this occurs after a period of hard braking, it is even possible to have a brake fire. This could have serious consequences, so do not take this lightly.

First of all, NYLON lines must never be stored where they get exposed to direct sunlight. An excellent idea would be to store your roll of brake line in a black plastic bag until you are ready to install it. After it is installed, paint it with black or silver paint. Do not roll it out into the sunlight without wheel pants or paint to protect it. Heat can soften the Nylaflow and allow it to expand under pressure, and possibly even burst if the heat is excessive. For this reason, it is very important to route the brake lines as far as possible from the brake disc. Keep in mind that under heavy breaking the disc can get very, very hot. This heat radiates toward the gear leg, (which must be insulated with several layers of fiberfrax siliconed to the strut) and if the brake line passes between the strut and the disc, you have set yourself up for a potential disaster. The brake line must pass inboard of the strut, which keeps the strut between the disc and the brake line. In addition we strongly recommend insulating the brake line with fiberfrax. We cut a long narrow strip, perhaps 5/8" wide, applied silicone to the fiberfrax and wound it around and around the brake line until it was covered from where it appeared out of the trailing edge of the strut to the nut on the fitting on the caliper. A little tape will hold it in place, slip a piece of heat shrink tubing over the whole thing and shrink it down onto the fiberfrax. We also wrap this in aluminum foil, which of course helps by reflecting any radiated heat.

If you have not taken any of the above measures and have been operating your airplane for any length of time, the chances are that you may already have caused heat damage to the nylon line. Repeated heat applications to a sample piece of Nylaflow have shown that it causes imbrittlement. It becomes stiff and when you try to bend it, it may break. If you have this problem you should replace the brake lines. This is not as hard as it may sound. We have done it a few times ourselves. Use a dremel with a small saw, 3/8" - 1/2" diameter, cut through the glass into the brake line at the trailing edge, full length from fuselage to wheel. Grab one end of the brake line and pull it out through the saw cut. Install a new piece by opening the saw cut and carefully working it in full length of each gear leg. Layup a thin ply of hobby store glass or one ply of BID to retain it in the trailing edge of the gear and you have it. The whole operation can be done in an hour! **SKETCH OMITTED**

We have recently installed "Nyloseal" nylon tubing in two of our aircraft for brake lines and, so far, it looks very good. We only have a few hundred hours of test time at this point, but we are pleased with its performance. All of the above precautions were, of course observed. One of the best ideas to avoid heat problems associated with heavy breaking, is to cut vent holes in the highest point in the wheel pants (aircraft parked nose down). This allows trapped hot air to rise out of the wheel pant, drawing in cold air to cool the hot disc.

For new construction, a good suggestion would be to install a hardware store type plastic tube into the trailing edge, such that the brake lines may be slipped through for easy removal if it should ever become necessary. You would need to find a plastic tube with about a 3/16" to 1/4" I.D. The stiff type of hardware store plastic tube would be best.

****From CP51-5 (CH9,CH38)****

BRAKE LINES

As mentioned in CP49, page 7, Mike and Sally installed Teflon hose assemblies (Stratoflex part #124001-3CR) in place of the Nylaflow nylon brake lines. These Teflon hoses are constructed with a seamless, smooth-bore, Teflon inner tube wrapped with braided stainless steel cover. These hoses come made to length with the ends swaged (not reusable ends) so must be ordered the correct length to suit your particular airplane. They are not cheap but should last the life of the airframe. Mike and Sally ordered theirs from Aircraft Spruce and the cost was approximately $42.00 per 40" length. These hoses come with a certification tag on them certifying that they are good to 1,500 psi. Mike installed them from the brake calipers to the master cylinders in one piece, mainly to avoid any more joints than necessary and to help eliminate any place for a leak to develop. The smallest hose available in Stratoflex is a -3, so you will have to use -3 elbows and nipples. For example, at the caliper, Mike used AN822-3D elbows and AN816-3D nipples on the master cylinders. The stainless wrapped Teflon hoses were inserted into a hardware store plastic tube (split the plastic tube lengthwise) then Hot Stuffed to the main gear strut trailing edge. One ply of BID was layed up over the plastic tube to permanently hold the new brake lines in place.

With over 200 hours on their Long-EZ since installing these brake lines, Mike reports that he is one hundred percent satisfied with their performance, and it was well worth the higher cost. While he was at it, he disassembled his master cylinders and installed all new "O" rings, cleaning the parts in denatured alcohol. The calipers were cleaned up and new "O" rings installed. Dot 5 brake fluid, a 100 percent silicone brake fluid (a General Electric product purchased at a local hot rod auto parts store), was used and Mike does recommend it since it is completely inert and therefore non-flammable. It does not affect seals, "O" rings, paint, or hoses so there has been zero maintenance on their brake system and we are in the process of installing the same system on Burt's Defiant, N78RA.

Be sure to measure your own airplane to get the Stratoflex the correct length for your aircraft. If you have brake master cylinders up front, as many builders do, you can either run the Stratoflex lines all the way (probably best, but expensive) or you can run the Stratoflex up each gear leg and then go with Nylaflow or Nyloseal from there. It will take an AN910-1D coupling (1/8" pipe thread) together with an AN816-3D nipple and a 268P male connector on each side.

Bleeding Brakes/Brake Fluid

****Also see CP49-7 in the "Main Wheels, Tires & Brakes" section of this chapter.****
****Also see CP42-4&5 in the "Malfunctions" section of this chapter.****

****From CP52-4 (CH9)****
Installing and Bleeding Brakes
We had assumed that everyone would know how to install and plumb the brakes on an EZ, and that everyone would know how to bleed the brakes. This has not been an area of great problems but has been an ongoing support requirement. Recently we saw a brake installation on a new Long-EZ that was done so as to make it extremely difficult, if not impossible, to successfully bleed the brakes.

First of all, when you receive a new set of Cleveland brakes, the brake bleeder fittings will almost certainly be installed into both brake calipers the same way. In other words, you may assume you have two left hand or two right hand brakes. No so! The bleeder fitting must be installed so it is on the bottom, or lowest point, on each brake caliper. You should never have a brake bleeder valve on the top of a brake caliper. So remove the one that will end up on top of the caliper and install it on the bottom, using teflon thread paste or tape. The 90 degree elbows should be similarly installed on the top of each caliper.

The brake plate, or brake caliper locator, a steel plate with a large hole in the center and 8 smaller holes punched around the large hole and with two steel bushings in it, should be slipped over the axle and should seat snugly against the axle flange. If it does not, which is quite common, use a file or a Dremel tool and radius the large hole in the steel plate until it will fit tightly against the axle flange. Choose the appropriate 4-hole bolt pattern (you have two choices) and bolt the axles onto your main gear strut. See CP34, page 11 for a clear photo of the left main wheel and brake on a Long-EZ installed correctly. Also see the sketch below. **SKETCH OMITTED**

Now, when you are ready to bleed the brakes, a really handy gadget is a Cleveland brake line bleeder tool (part #87-5) currently $21.30 in the Aircraft Spruce catalog. Install an 18" long flexible rubber or tygothane hose on this tool and connect the other end of the rubber hose to the nozzle of a large oil can with a trigger-type pump. Fill the oil can with Dot 5 automotive 100 percent silicone brake fluid, usually purple in color and made by most brake fluid manufacturers including GE which is the one we used. Now, remove the rubber bleeder cap and install the 87-5 tool onto the brake bleeder valve. Using a 1/4" wrench, loosen the bleeder valve 1 to 2 turns. Pump the silicon brake fluid until the master cylinder reservoir is 3/4 full and tighten the bleeder valve (be gentle, this is a tiny little valve!). Remove the 87-5 tool and your brake is ready to fly. Since the whole system goes continuously uphill, there will not be any air in the system. Due to the small size and throw of an aircraft-type master cylinder, it is almost impossible to fill the brake master cylinder and line from the top as you would in an automobile. Using an 87-5 tool and filling from the bottom mounted brake bleeder valve, bleeding your EZ brakes is quite literally a 5 minute or less job. It helps to have an assistant watching the level in the master cylinder reservoir so you can quit before you pump fluid all over the place.

We highly recommend the 100 percent silicone brake fluid (must be Dot 5). Since it is completely inert, it is compatible with any type "O" rings and seals. It is not flammable and it does not destroy your paint as normal aircraft brake fluid does. We bought it at a Hot Rod-type auto parts store locally.

****From CP53-4 (CH9)****
Source of Dot-5 silicone brake fluid in England. Ian Wilde found it and it is the correct material and costs $15.50 (Sterling) including postage from: Automec, Ltd.
Stanbridge Road
Leighton Buzzard
Bedfordshire, LU7 8QP
England
Telephone: 0525-376608
or: 0525-375775

Relief Tubes

****Also see CP34-11 in the "Axle Installation/Toe-in" section of this chapter.****

****From CP31-4 (CH9)****
Many builders have enquired about the relief tubes that are installed in N26MS and in the prototype N79RA. Here is a brief description of how we did it. We used 5/16" ID x 3/8" OD plastic line from the local hardware store. We left it about 2 ft. long in each seat and ran it down the length of the fuselage through the aft seat bulkhead to the trailing edge of the gear. Then is was run down the trailing edge of the gear and left long enough at the bottom of the gear to protrude out of the wheel pants. The brake line was run down aft of the relief tubes on the trailing edge of the gear, to help fair in the gear strut. **SKETCH OMITTED**

After you install your wheel pants, drill a 3/8" hole in the aft bottom of the wheel pant and run the relief tubes out about 1 1/2 " through this hole. **SKETCH OMITTED**

We coil up the excess 24" or so and stow the coil in the front seat on the left side behind the static port line, and in the back seat, under the right console. To use the relief tubes, uncoil them and plug a rectangular plastic funnel into the end of the tube. The funnel is kept in a zip lock bag in the center section spar. To keep it and the relief tube clean and fresh, rinse out with a mixture of vinegar and water. **SKETCH OMITTED**

Wheel Pants

****Also see CP45-6 in the "Prefabricated Parts" section of this chapter.****
****Also see CP46-8&9 in the "Prefabricated Parts" section of this chapter.****
****Also see CP51-8 in the "Prefabricated Parts" section of this chapter.****
****Also see CP49-7 in the "Main Wheels, Tires & Brakes" section of this chapter.****
****Also see 47-11&12 in the "Brake Lines" section of this chapter.****

****From CP24-4 (CH9)****
Brake Cooling-
The "Real" George Scott reports brake overheating with his tight-fitting wheel pants. He has solved this by installing cooling ducts in his wheel pants to cool the brakes. He has detected no change in cruise airspeed, and has not experienced any brake fade since installing per sketch below. **SKETCH OMITTED**

****From CP26-10 (CH9,CH33,CH39)****
5) A Nebraska VariEze equipped with the original 2-ply tires, was making a gross weight takeoff. The pilot began rotation at 85 or 90 mph, (above the normal lift off speed of 75 mph), when the right tire blew. He aborted the takeoff, using left brake all the way to stop to maintain directional control. He reported it was not hard to control even though the right brake bleed failed and the right wheel pant and brake rotor was destroyed. His gear strut was the original configuration, not reinforced. He placed the right wheel up on a dolly tilting the aircraft with most of the weight on the left wheel, then pushed it half mile to a hangar. On arriving, the left gear strut buckled a few inches above the axle, inside the tightly-sealed, non-vented wheel pant. The cause of the strut failure was heat. The long, continuous high speed braking resulted in a very hot brake. This heat, sealed in by the wheel pant, slowly permeated the fiberglass strut allowing it to soften and buckle under load. **Lessons learned: Do not use the two-ply tires. Ventilate the top of your wheel pants. If unusually heavy braking is done, 'set' the gear to relieve load or jack the airplane to relieve stress while the strut cools. Glue a piece of your fiberfrax fire wall insulation material to the strut (use silicone rubber adhesive) adjacent to the brake disc.** Your VariEze and Long-EZ should lift off and land at under 65 kts and 60 kts respectively, unless you have an airspeed instrument error or airspeed position error. Leaving the airplane on the ground above this speed increases tire stresses and reduces tire life.

****From CP27-8 (CH9)****
Both Aircraft Spruce and Wicks will have the 3.40 x 5 wheel pants in stock in February. These are suitable for both VariEze and Long-EZ. They will also be stocking wheel pants for 500 x 5 tires (Long-EZ). Contact them for expected date.

****From CP28-10 (CH9)****
Aircraft Spruce or Wicks Aircraft supplied Wheel Pants
These wheel pants for VariEze/Long-EZ 3.40 x 5 tires should be available by the time you read this. Those for 500 x 5 tires will be available in a month.

The correct method of installing these wheel pants is as follows: Install 11 K100-3 nut plates in the flanges, evenly spaced. Drill and countersink #10 holes for AN509-10R8 screws. Jig the pant halves loosely in place and carefully mark the top for the gear leg cutout. Cut this out and reposition the pant, making sure it clears the brake caliper and that the incidence is correct. It is best to have the pant about 3 to 4 degrees nose down. Be certain to leave a 1/10" clearance around the brake line to avoid a brake leak due to the pant chaffing on the line.

Now, fabricate an aluminum bracket from .032" 2024T3 approximately 2.5" x 8", see sketch. This bracket mounts on the four axle mounting bolts in a horizontal position. Install two nut plates (K1000-3) in each bracket, and bend the bracket as shown to extend inboard one inch. Drill two #10 holes in the pant to match the bracket. Drill and tap the axle 1/4 x 28 (use a #3 drill). Now cut out 3 pieces of your 1/4" plywood (firewall bulkhead) and glue them together to make one piece 3/4" thick x 2" x 2". This piece should be pyramid shaped and should have an AN970-4 washer on top of the pyramid. Layup 2 plies of BID over this washer and plywood block lapping at least 1/2" all around onto the inside of the wheel pants. After this cures, drill a 1/4" hole through the center of the washer, and you should be able to mount the pant nice and firmly to the gear leg/axle. Use low profile AN525 screws for low drag. **SKETCH OMITTED**

****From CP30-7 (CH9)****
Prefab 500 x 5 wheel pants, are now available from Aircraft Spruce and Wicks Aircraft. Hardware kits to install these wheel pants are also in stock. Instructions for installation of the 500 x 5 wheel pants are essentially the same as for the 3.40 x 5 wheel pants, except that 16 K1000-3 nut plates should be installed evenly spaced on the flange, instead of 11. .062 thick 2024-T3 aluminum is substituted for .032 for the mounting bracket. See CP 28, page 10 for these instructions.

From CP31-4 (CH9,CH33)

Caution - Damage From Brake Heat

Do not conduct your taxi tests, high speed taxi and first flights with wheel pants installed. You will be using far more brake during this period than is normal. See Long-EZ Owners Manual, page 41, under low speed taxi.

If you do have wheel pants installed, it is possible to generate enough heat buildup to soften the main gear strut and cause it to sag/fail.

Long-EZ and VariEze - Glue a piece of fiberfrax on to the outboard face of the main gear strut to protect the strut from local heat radiation from the brake disc.

From CP34-6&7 (CH9)

Installation Instructions for Prefab Wheel Pant from Aircraft Spruce or Wicks Aircraft. (500 X 5)

NOTE: All twelve prefab fiberglass parts are labeled (six left and six right).

The approximate tire clearance cut out is scribed and the axle centerlines are marked.

1. Make an aluminum bracket as shown using .063 2024T3. Mount this bracket vertically on the inboard side of the main gear strut using the four nuts that attach the axle. **SKETCH OMITTED**
2. Cut out tire clearance hole in the bottom of the outboard pieces.
3. Use gray tape (duct tape) to tape the two halves together.
4. Fit the four prefab corner pieces into their correct positions by reaching in through the tire clearance hole. The proper position of these parts are marked on them (ie. right bottom aft). Using a #30 drill bit, drill four evenly spaced holes through the three long corner pieces and the inboard wheel pant half. Drill three evenly spaced holes through the short piece marked, bottom forward and the inboard wheel pant half. Drill three holes through each corner piece and the outboard wheel pant half. Install clecos in these holes as you drill them.
5. Drill four #18 holes, evenly spaced, through the outboard wheel pant half into each of the three long corner pieces and drill three evenly spaced holes through the outboard wheel pant into the short corner piece.
6. Remove the clecos and separate the two halves. Pop rivet K1000-08 nut plates inside the 4 corner pieces.
7. Use a gray tape or saran wrap release on all edges not to be bonded and sand the inside of the halves and the matching corner pieces dull.
8. Reassemble two halves to check for a good fit to each using AN 525-832R7 and clecos.
9. Leave screws in place and remove clecos to disassemble.
10 Apply a generous coat of wet flox to all surfaces to be bonded - reassemble using flush head pop rivets in place of the clecos. Allow to cure.
11. Drill a #30 hole at the marked axle centerline and position the inside half of the wheel pant on the strut using the #30 hole as a guide for correct height and tire clearance hole as a fore-aft guide. Position the wheel pant approximately 3 degrees nose down for least drag at cruise. Drill two #30 holes through the inboard pant half and .064 aluminum bracket and cleco inboard pant to aluminum bracket. **SKETCH OMITTED**
12. Drill a #30 hole approximately 5/16" inch below or to one side of the marked axle centerline (see sketch) and fit outboard pant into position. Push a small wire through the #30 hole to measure the distance from the outboard pant to the end of the axle. This will be about 1 1/2". Remove the outboard pant and make a wood pyramid shaped block, the correct height and flox it into place on the inside of the outboard wheel pant. Layup 2 plies of BID lapping .7 onto the pant.
13. After this cures, drill through the #30 locating hole with a 1/4 inch drill. Refit the outboard pant half and drill through the 1/4 inch hole into the end of the axle, approximately 1/4 inch deep. Use a #3 drill and drill the hole 3/4 inch deep and tap this hole with a 1/4-28 tap. (CAUTION - This 1/4-28 tapped hole is not drilled in the center of the axle due the cotter pin location, rather it is drilled offset per sketch). **SKETCH OMITTED**
14. Use an AN4 bolt and wide area washer to attach outboard pant to axle, such that the bolt grip extends through the wood and glass pyramid block into the axle, this assures that no shear loads are transmitted through the bolt threads. See sketch.
15. Drill #10 holes through inboard wheel pant half and .064 aluminum bracket. Remove pant halves and rivet K1000-3 nut plates to.064 aluminum bracket.
16. Sand and finish wheel pants and reinstall. **SKETCH OMITTED**

Parts needed.

2 - AN4-20A	Bolt
- AN970-3	Washer
30 - AN525-832R7	Screws
4 - AN3-5A	Bolts
4 - AN960-10L	Washers
4 - K1000-3	Nutplates
30 - K1000-08	Nutplates

30 - Pop rivets - 1/8 Avex # 1604 04 -12
68 - 3/32 Cherry pop rivets MSC-32

From CP34-8 (CH9,CH13)

Ray Cullen reports good success with small "mud flaps" on the wheel pants. After three months of hard operation, prop nicks are minimal. The small "mud flaps" are made from plastic coffee can lids pop-riveted to a 3" x 1" bracket made from .018 stainless (firewall material). These flaps should have at least 1/4" of clearance from the tire.

Gary Hertzler has had a "fender" on his nosewheel for some time and it too is a big help as far as prop damage. Gary made his fender from 3 plies BID and it has a small "mud flap" of engine baffle material (neoprene/asbestos) or the plastic coffee can lid would probably work fine. These mud flaps should be quite close to the runway, if they are too long, they won't be after one take off!

From CP44-7 (CH9)
LONG-EZ - Wheel Pants. We received this idea from a builder. When installing wheel pants on the Long-EZ do not assume that the scribe mark for the axle hole is correct. Cut out the strut hole and tire cutout. Mount the inside wheel pant half onto the aluminum bracket bending as required to position the wheel pant to fit the tire. Fit the outside wheel pant half to the inside sanding edges as necessary.

Drill and tap the axle for a 1/4 x 28 bolt (AN-4) off center to avoid the cotterpin. Cut the head off an AN-4 bolt and thread it into the axle. Build the wood spacer as shown in the wheel pant instructions. Drill a 1/4" hole in the center of it and slip it onto the headless bolt which is sticking out the end of the axle. **SKETCH OMITTED**

Fit the outside wheel pant in place checking to be certain the thickness of the spacer block is correct. Apply flox to the end of the spacer block, sand the contact area of the outside wheel pant and tape the wheel pant halves together. Allow this to cure. After cure back drill the 1/4" hole using the wood block as a guide and countersink for the AN509 machine screw. Remove and discard the headless bolt.

We have had a couple of complaints on fitting the large wheel pants on the Long-EZ. It seems after careful inspection that the left wheel pant is not exactly the same as the right wheel pant. To understand how this could have happened it is necessary to understand how the wheel pants were made.

As most of you are aware the 500 x 5 aircraft tires were not originally approved for the Long-EZ, only the low profile Lamb tires were and they fit the VariEze wheel pants. Then Mike and Sally's Long-EZ N26MS had aircraft tires installed, tested and approved for use on the Long-EZ by RAF. There were no wheel pants designed to fit these tires, so Mike made his own by carving blocks of foam and using the moldless composite method.

These were hand carved using only the eyeball to judge the shape. After they were finished and flying, the results could be judged by the speed increase in the aircraft by 10 knots. Everyone who saw these wheel pants wanted a set and after much convincing, Mike pulled the wheel pants off N26MS and molds were pulled directly from these. In this case the builders got exactly what they asked for. Most builders just fit the wheel pants on and look for the speed increase, all of them that we have talked to, got it. Do not however, get your micrometer out and measure side to side on your wheel pants, you will be disappointed. Instead install them and you will be pleased.

From CP54-8 (CH9)
Access doors for wheelpants. These 1" diameter, spring loaded doors can be riveted into your wheelpants. They open inward, so that using an appropriate tool, you can check pressure or inflate your tires quite easily without removing the wheelpants. These little access doors are made of stainless steel (which can be polished) by the Cam Loc Company. Bud Myers of Wicks Aircraft has obtained a supply of these high quality parts.

Contact: Wicks Aircraft
410 Pine Street
Highland,IL 62249
1-618-654-2191

Ask for: Part number KM713-16-080 access doors.

(See photos and further details elsewhere in this CP)

From CP54-12 (CH9)(Photo Caption)
Access door seen from inside wheel pant.

From CP54-12 (CH9)(Photo Caption)
Wheel pant prepared for installation of Camloc access door.

From CP54-12 (CH9)(Photo Caption)
Camloc access door, cleco'd in place, ready to rivet.

From CP54-12 (CH9)(Photo Caption)
Access door riveted in place, ready to paint.

From CP54-12 (CH9)(Photo Caption)
Spring loaded, Camloc access door, available from Wicks Aircraft Supply.

From CP54-12 (CH9)(Photo Caption)
Air tool to inflate tire, simply line up valve and push in the Camloc access door.

****Also see CP57-3,4&5 in the "Axle Installation/Toe-in" section of this chapter.****
****Also see CP57-10&11 in the "Axle Installation/Toe-in" section of this chapter.****

****From CP40-7 (CH9,CH33,CH38)****
VariEze and Long-EZ - If you ever experience what appears to be a brake failure, that is to say you hit the brake and it goes all the way down, don't just sit there!! Hit it again and if necessary several times and it will almost certainly be as good as ever. This had been a fairly common problem, and can be caused by several things. The first place to check is the clearance between the brake caliper and the wheel pant and/or the main gear strut. If the strut or wheel pant touches the caliper, this will cause the piston in the caliper to back away from the brake disk, and this will then necessitate several quick pumps on the brake to bring the piston back. Similarly, a disc that does run true can do the same thing. Do not just assume that your master cylinder is shot, do check it for signs of hydraulic fluid leaks, also check the elbow and fitting in the caliper for leaks. Don't forget to check fluid level in the master reservoir. Do not fly if you suspect a bad brake.

Another potential place to keep an eye on is the hole in the firewall where the rudder/brake cable goes through and connects to the CS15 bellcrank. Check and be sure that it is not possible for the nicopress sleeve on this cable to go into the hole and jam. If necessary enlarge these holes a little, or adjust the brake cable length to limit the travel so the nicopress sleeve does not get into the firewall.

Dick Kreidel has been using a new brake lining, a Cleveland part #66-56, which is a semi metallic material with good success. He reports equal brake effectiveness, but about three times the brake lining life. RAF is currently testing these linings and so far have not managed to wear them out, so cannot comment on the brake life.

****From CP42-4&5 (CH9,CH13,CH25,CH30,CH33,CH38)****
LONG TERM MAINTENANCE ITEMS ON EZs
Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth. Of course this strips off about half the teeth on the wormgear.
Solution - Rotate wormgear 180 degrees and you back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

****From CP53-7 (CH9,CH33,CH38)****
CAUTION: BINDING BRAKES
Dave O'Neill, Long-EZ builder from Johannesburg, South Africa, writes of his first flight. Empty weight was 849 lbs. with starter and alternator and 500 x 5 wheels. The only problem Dave had was one that could effect all of us and this is binding brakes. Even a fairly light binding of the brakes can increase rotation speed significantly. Dave had to accelerate to more than 15 kts. above normal rotation speed in order to get the nose wheel off. This is potentially quite hazardous since you are taxiing at above flying speed and things could get out of hand quite rapidly in the event of some small problem. Check your brakes before you go out to do your high speed taxi runs and be sure that the brake discs turn freely between the brake pads when the brakes are not applied. Thank you for this important point, Dave, and congratulations on your first flight.

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****From CP66-11 (CH10,CH31)****
VORTEX GENERATORS ON CANARDS.
Since Magna Liset of Oakey, Australia reported on his epoch trip across Australia, we have had numerous requests for information on his modification (vortex generators).

Magna has been good enough to send us a sketch of what he did. Essentially, he glued tiny vortex generators (aluminum angles) to the top skin, forward of the elevators, approximately 40 of them on each side, at specific angles and positions This reportedly completely eliminated the annoying pitch trim changes he used to experience every time he flew into, or out of, rain or visible moisture. This was also done on the Voyager prior to world flight for the same reason.

The Roncz 1145MS canard will also achieve the same result but for anyone who might be interested in Magna's information, we can send a copy if you send a SASE with your request to RAF.

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Update Number 67 to Chapter 10, Canard

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. <u>Don't trust anyone else with your safety</u>. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

****From CP67-11 (CH9,CH10,CH31)****
AN INTERESTING OBSERVATION
"After flying my VariEze for over 400 hours with the small tires and no wheel pants, I changed to the Lamb tires, still with no wheel pants. Guess what? With small tires, it pitched slightly nose up in rain but with the larger Lamb tires, it now has a slight nose down pitch trim change in rain!
Gordon Hindle"

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Update Number 69 to Chapter 10, Canard

****From CP69-2 (CH10,CH31)****
CAUTION
We were shocked to see an example of a prefabricated canard for a Cozy/Long-EZ at Oshkosh. The workmanship on this canard was the worst we have ever seen. This canard was not built in accordance with the plans, it was grossly overweight and,as poorly as it was built, had it been flown on an airplane, it might have caused a life-threatening accident. If you have purchased a prefabricated canard from Fitzgerald Composites, Inc. of Bristol, WI, we would strongly recommend that you not fly it. At the very least, weigh it. If it weighs more than 19 lbs. (canard only), cut 3" off one end, outboard of the outboard elevator hinge, and carefully examine the structure. If it is not built precisely per the plans, discard it and build one yourself. If a canard fails in flight, there is no possibility of survival.

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	**160.00**
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

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Update Number 71 to Chapter 10, Canard

****From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)****

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

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Update Number 80
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Information derived from CP80 published by RAF Jan 1995

****From CP80-7 (CH10,CH19,CH31)****
MOLDED VORTEX GENERATORS
CCI is pleased to announce the availability of pre-molded generators. Specially engineered for aircraft application, the 1" long by 0.40 high device is injection molded from U/V resistant polycarbonate material.

The design has been engineered so the "sail" is stiff enough to impart the desired energy into the boundary layer but flexible enough to resist breakage from "hangar rash" and the curious. Because they are molded from light weight polycarbonates rather than cut from extruded aluminum, these pieces are less likely to cause injury, chip paint or cause propeller ingestion damage on pusher aircraft. Available in white, they can also be custom molded in quantity to match specific paint colors for aircraft manufacturers and OEM suppliers. Coloring does not compromise their ability to withstand harmful ultra-violet radiation.

The gluing surface of each generator is flexible and slightly concave to facilitate adhesion to either cambered or flat surfaces. The perimeter of each base is feathered to blend seamlessly onto the surface to which it is attached. After installation, the sail appears to be molded an integral part, rather than and "add-on". The final result not only looks better, it performs better than typical hand-made aluminum fences. Molded vortex generators adhere better, do not corrode, require no painting and are easy to install: one Long-EZ canard can be equipped with a full span of generators in less than 90 minutes.

Effective may 15, 1994, a kit containing fifty generators is available for a price of $25.00 plus $2.00 shipping and handling per kit. **Two kits are sufficient to equip the full span of a typical canard (i.e. Long-EZ, Dragon-Fly, et al) or both ailerons on either canard or conventional planforms.** Documentation is included. Please send check or money order to:

CCI
PO Box 607
Plainfield, NJ 07061-2318

Please allow 2-3 weeks for delivery, Sorry, no COD's. For more information 6:00-10:00pm EST, Mon.-Fri.

908-757-9573
908-755-9639 FAX

Note: These vortex generators are not TSO'd for use on type-certificated aircraft.

****From CP80-8 (CH10,CH16,CH19,CH31)****
TITANIUM ACCESSORIES AVAILABLE!
Custom anodized in 15 different colors,
Rudder and aileron gust locks - $20.00-30.00.
GU canard full span vortex generators with layout template - $170,00. These are hot looking !
Contact: Mike Rhodes
PO Box 1052
Grover Beach, CA 93483-1052
805-489-8155

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Update Number 82 to Chapter 10, Canard

Information derived from CP82 published by RAF Oct 1995

****From CP82-13 (CH10,CH16,CH19,CH20)****

TITANIUM ACCESSORIES AVAILABLE!

Custom anodized to any of 15 different colors, shades of copper, purples, blues, greens, yellow/gold, even rainbow effect. Rudder and aileron gustlocks - $20.00-$30.00.

GU canard full span vortex generators with layout template - $170.00.. These are very exciting! Rudder horn CS-301L&R replacements, $25/pair. Shipping inc.

Ti Specialties
P O Box 1052
Grover Beach CA 93483-1052
(805) 489-8155

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Chapter 10, Canard

Long-EZ Plans Changes

****From CP25-6 (CH10)****
LPC #16, MEO, Page 10-2.
Clarification: Remove the word "centerline" two places, W.L. 19.4 is correct, but is not centered on the shear web.

****From CP26-6 (CH10)****
LPC #30,MEO, page 10-3.
Upper right drawing #3 holes should be 1/4".

****From CP26-6 (CH10)****
LPC #38, MEO, page 10-3.
Two places, cut 12 pcs. UND should be, cut 6 pcs. UND.

****From CP27-7 (CH10)****
LPC #44 MEO Page 10-1 Step 1 paragraph two
Refers to two 7 x 14 x 41 blocks (two places), change this to one block.

****From CP27-7 (CH10)****
LPC #51 MEO Page 10-1, Step 1
Refers to Chapter 13 for winglets, should be Chapter 20.

****From CP27-7 (CH2,CH10,CH13,CH31)****
LPC #53 MEO Page 2-1
Add CLI and NG5 to Brock list.

Prefabricated Parts

****Also see LPC #53 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
PRE-FABRICATED COMPOSITE PARTS
Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and

not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.

1. **Pre cut foam cores, Long-EZ (new canard or GU) at $99.50.** Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415, (707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

****From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)****
FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom) weight saved, approx. 6 lbs.	448.00
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert. 500 x 5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	**99.50**
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.

Contact: Michael or Larry at:
FeatherLite, Inc.
P.O. Box 781
Boonville, CA 95415
(707)895-2718

HotWiring

****Also see LPC #44 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #51 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP24-4 (CH3,CH10,CH11,CH19,CH20,CH31)****
Hotwire Templates-
An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood, available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

****From CP25-5 (CH3,CH10,CH11,CH19,CH20,CH31)**
HOT WIRING
Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

****From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)****
BUILDER HINTS
You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. **This works great for hotwire templates too.**

****From CP27-5 (CH3,CH10,CH19)****
Hot wire troughs - Use the following method to separately cut the troughs. This gives more accurate, sharper cuts. Nail a temporary template (a popsicle stick works fine) to guide the wire straight across over the trough. Then, remove the stick, and in a separate pass, cut the trough. Be careful to not let your core move between the cuts. **SKETCH OMITTED**

****From CP30-7 (CH3,CH10,CH11,CH31)****
Hotwire Templates
When making identical templates, (canard, elevators, etc.) clamp them together, and use your Disston abrader to sand them to exactly the same shape. This is also valid for canard jigs.

From CP30-7 (CH10)

Hotwire Cutting The Canard

Ref: Section I page 10-1, step 1.

An excellent suggestion for hotwire cutting the four foam cores for the canard is to use the outboard templates (no spar trough) only, to cut all four cores. Then use the inboard templates to cut the spar troughs on the two inboard cores. Caution: If you use this method you must leave the cores in the blocks weighted onto your table during the trough cuts. Otherwise, if the cores warp, the trough depth will vary incorrectly along the span.

This method makes certain that all four cores are identical, and also lets you cut well defined spar troughs, with no lag in the corners.

From CP34-8 (CH10,CH31)

Brent Parsons suggests taking a coat hanger wire, bend it to form a 1" wide 'u' shape about 5" long and install it into a 250 w soldering gun. This can be used to rapidly and cleanly remove the blue foam in the canard for installation of the high density foam blocks. **SKETCH OMITTED**

From CP35-6 (CH10)

Canard Construction - VariEze and Long-EZ

Builder support on canards has been quite heavy, particularly in regards to getting the leading edge foam core bonded to the shear web, on the two inboard cores, in the correct position, vertically. If this is bonded on too low (relative to the airplane) the result will be a hollow lower spar cap and a bump in the top spar cap. This bump in the top cap is a problem, since it cannot be corrected. If yours is this way, our experience has shown that a small error here can usually be accepted provided a good job of filling with dry micro and fairing is done. The worst of this problem will be buried within the fuselage under the canard fairing block and usually will not extend much more than 10" to 15" outboard of the fuselage sides. A bump of up to 1/16" at the fuselage side, tapering to nothing at B.L. 25 each side, has not been detrimental to flying qualities.

A method we have used to eliminate this problem is as follows: Hot wire cut 4 canard cores. Before cutting the leading edge off the two inboard cores, obtain 6 pieces of wood dowel 1/4" diameter, 6 1/2" long, sharpen one end to a point just as you would sharpen a pencil. **SKETCH OMITTED**

Insert these dowels equally spaced into the trailing edge of the two inboard cores as shown. Push them into the foam, twisting them with your fingers. They should protrude beyond the shear web cut line about 1 1/2". Now pull the dowels out and hot wire cut the leading edge foam cores at the shear web. **SKETCH OMITTED**

Jig the inboard cores, and layup the shear web per plans. After this layup cures, drill 1/4" holes through the shear web in 6 places where the dowels will go through (use a flashlight to locate the holes). Now bond the leading edge foam cores to the shear web per plans, using micro. Paint micro onto the dowels and push all 6 of them in, until they are flush with the aft face of the canard. Complete the canard per plans. The dowels will guarantee that the leading edge foam cores are perfectly aligned and your spar troughs will be correct top and bottom. We recently built a canard using this method and ended up with a really nice contour, top and bottom, with no bump or hollow place in the spar cap area. Try it, you'll like it!

From CP36-6 (CH3,CH10,CH11,CH19,CH20,CH31)

V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)

HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)

VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)

VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

Shear Web

Also see LPC #16 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #30 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #38 in the "Long-EZ Plans Changes" section of this chapter.

From CP27-6 (CH10,CH31)
The canard inserts (page 10-2) should be drilled to match the hole pattern of CLT (page 10-3). These inserts (CLI) are available from Brock. Brock is also stocking the NG5 plate (page 13-3).
Note: The raw materials list does not include the 1/8" aluminum for these parts.

Spar Caps

From CP26-7 (CH10,CH19,CH31)
Wing Spar Caps - We have found a good way to clamp the spar caps during cure to get minimal waviness and to force them down level with the wing cores. See the accompanying sketch. Select some hot wire cuts of styrofoam (left over from wing core cutting) about 1" to 1 1/2" thick and cut them 4" wide. These should be covered on one side with grey duct tape for a release, and you should cut and fit them end to end to go the length of the spar cap. Get these prepared before doing the cap layup. Now layup the cap normally, squeegee it out properly, then carefully place the foam pieces (with duct tape down) on top of the wet cap. Weight the foam down evenly with lead shot bags, milk jugs full of sand, salt bags or whatever. This will pack the cap layup down evenly and result in less sanding before the skin layup.

From CP34-8 (CH10,CH14,CH19,CH31)
Spar caps - wings, canard and centersection - Be sure to peel ply these spar caps, or you will wear yourself out sanding prior to installing the skins.

Trailing Edge Close Outs

From CP32-6 (CH10,CH11,CH19,CH20,CH31)
CAUTION - TRAILING EDGE CLOSE OUTS
It is very important for structural integrity, that you ensure that your trailing edges of the canard, elevators, wings, ailerons, winglets and rudders meet the prescribed minimums in the plans. Do not accept delaminations in the trailing edge glass to glass area. Even the smallest delam can get moisture in it which will freeze and expand when you climb through the freezing level, and thus delaminate further and further with each occurrence until it could weaken the overall integrity. About the quality of your trailing edge glass to glass close outs - accept nothing less that perfection in this area. Always sand smooth every lap after cure - do not leave them joggled as shown. **SKETCHES OMITTED**

LAP DIMENSION Ignoring the proper procedure here could result in serious consequences, even structural failures! Here is a list of these areas. The minimum dimension should be considered an absolute minimum. If you don't meet this criterion it requires repair before you fly.

	Glass Lap Dimension Shown	Minimum Acceptable Lap
Canard	**0.45"**	**0.3"**
Elevators	0.25"	0.2"
Wings	0.6"	0.5"
Aileron cut outs	1.0" (top)	0.75" (top)
	0.75" (bottom)	0.52" (bottom)
Ailerons	0.5"	0.3"
Wing Root Rib	0.6"	0.4"
Winglets	0.6"	0.4"

SKETCHES OMITTED

****From CP34-5 (CH10)****

Rain Effect On Lift

We recently received a letter from Owen Billman, reporting on his Quickie accident in which moisture on the airfoil decreased his ability to climb. The result was a destroyed aircraft after striking tree tops. Our answer to him contains some information of interest to EZ flyers. While our research on rain effects is not complete, the information is published here in order to clear up some misinformation floating around.

"Dear Owen,

Thank you for sending along your account of your Quickie experience.

The subject of rain-induced boundary layer transition and its effect on trim and performance is one that we have been investigating for several years now. Tests have included fixed and free transition measurements of six different airfoil shapes on the VariEze, Long-EZ, Amsoil racer and Defiant. Full scale moisture tests have been conducted in the NASA Langley 30 x 60 wind tunnel. I have not published an account of these tests because they still contain some contradictory results. For example, theoretical predictions call for the largest trim change to exist on the well-contoured aircraft that normally have the most extensive laminar flow. Just the opposite is true - the best contoured ones have the least trim change in rain!

The trim change of the Long-EZ and VariEze in rain is generally mild. Most trim down in rain, about 25 percent of the VariEzes trim nose up. There have been several reports of a strong nose down trim change, outside of the pitch trim capability. In general, these have been fixed with a correction of canard incidence or elevator shape. I know of no rain-induced accidents with the VariEze or Long-EZ, however several have reported extensive increases in takeoff rotation speed and take off distances.

Again, there are variances from one airplane to another. We have done low-level aerobatic maneuvers in driving rain with our Long-EZs without noticing any major difference in maneuverability. We have no operational limitations for flying in rain except to throttle back to save the propeller leading edges from erosion.

Fix transition test conducted by applying grit on the leading edges (at 4 percent chord top and bottom) has shown that maximum lift is reduced significantly, increasing the minimum speed by about 8 knots. The NASA wind tunnel tests (see the adjacent plot of CL with fixed, free and wet surfaces) seem to predict that the EZ has about half the degradation in rain as for fixed transition. This approximately four to five knot increase in minimum speed while wet generally is not a problem since we all seem to fly a bit more conservatively in the weather.

Our tests with new airfoil designed to reduce the rain-induced trim have not led to changes on the Long-EZ since they have all shown degraded low speed performance (less lift). The low Reynolds-number if 0.5 million is a particularly difficult section design area. The Defiant's canard operates at twice the RN. It has a very mild nose up change in rain and no measurable effect on take off speeds. The Defiant doesn't have a trim change with airframe ice. Long-EZ N26MS has a moderate nose down trim change with rime ice.

Concerning your Quickie and others that have near equal-area tandem wings: we have not conducted fixed transition or moisture test on these, but based on your and others experience, it appears that the transition effect on maximum lift is more severe. This is apparently due to the double effect of loss of CL and the inability to trim to an adequate angle-of-attack. I have referred your letter to Quickie Aircraft Corporation. They no doubt will be conducting tests and/or making recommendations or improvements to prevent recurrence of your accident.

Best Regards,
Burt Rutan"
GRAPHS OF EFFECT OF WATER SPRAY ON CANARD AERODYNAMICS OMITTED

****From CP35-2,3,4&5 (CH10)****

Effects Of Rain Or Surface Contamination On Pitch Stability And Control

Last Canard Pusher we discussed again the effects of rain or surface contamination on the pitch flying qualities of the Long-EZ. This subject has been addressed and discussed in the Owner's Manual since it was discovered in 1975 that our VariEze prototype experienced a nose up trim change when encountering IFR conditions or flight in rain. This phenomena had not been encountered during our earlier experience with the VariViggen aircraft. At that time it was recognized that assessing the trim change due to boundary layer trim transition, (i.e.: due to leading edge insect accumulation or flight into rain conditions) would need to be accomplished in order to verify that the effect on the pitch flying qualities would not be adverse. Studies subsequently done using data from many different VariEzes did not reveal consistent results in that some of the airplanes would tend to trim nose up when entering rain conditions and others would tend to trim nose down when entering flight into moisture. Occasionally a VariEze was found to exhibit a relatively strong nose down trim change which would require several pounds of stick force to maintain the same flight condition and require a retrimming when entering or leaving rain conditions. The confusing result about the investigation was that there was an apparent disagreement between theory and flight test data. Theory would predict that if an airplane were relatively rough to begin with, the trim change should be less than that experienced than on a very clean well built surface in which a larger extent of laminar flow is lost when entering rain.

Experience with conventional airplanes and investigation of test data for wing sections in general revealed that when an aircraft enters rain, it's flying surfaces produce less lift at a given angle of attack and also the maximum lift is reduced resulting in a higher stall speed. At the time NASA was testing a full scale VariEze in the 30' x 60' wind tunnel at Langley and we asked Joe Chambers, director of those tests, to spray water on the aircraft and attempt to measure the change in lift and to compare that change with that found when the laminar boundary layer is transitioned by applying grit or tape near the leading edge. The results of those tests were published in the last CP and show a definite loss of maximum lift. The NASA wind tunnel tests indicated that a larger elevator deflection is required to fly in rain conditions. This was an expected result for some of the aircraft which had reported a definite aft stick requirement when entering rain.

We instrumented the VariEze prototype, N4EZ with an accurate elevator position indicator and gathered the elevator position versus speed data shown in the adjacent plot. Upon landing we applied grit and tape to the aircraft flying surfaces, wing and canard to provide a positive transition of the boundary layer at 5% of chord. This consisted of adding a "step" to the otherwise smooth surface of the airfoil that was sufficient to destroy all the laminar flow, a condition caused by either an accumulation of insects on the leading edge, or flight in rain. We then added the fuel used during the first flight to bring the airplane back to the same exact gross weight and cg and flew again gathering the same elevator position data. As shown in the adjacent plot the elevator position required to achieve a given indicated speed was greater than with the smooth surfaces. It should be emphasized though, that the trim change that the pilot feels is not the same as the shifted elevator position since the transitioned boundary layer alters the pressure distribution around the elevator. Even though the elevator is more trailing edge down it does not necessarily result in an aft stick force. In the case of the VariEze N4EZ, the trim change due to the trim change transition (the force required to fly the airplane without adjusting the trim lever) is extremely small and is for most of the flight regime not noticeable as a nose down trim change.

The NASA concern for a greatly increased stall speed, was not achieved as you can see from the data, the minimum speed achieved with the transitioned aircraft was higher, but only by approximately 1 to 2 knots.

While we are discussing the VariEze elevator data it is interesting to note the shape of these curves and discuss why the VariEze was designed in a way to provide natural stall limiting. Notice that as the pilot slows up, the normal stability requires a greater elevator position. The shape of this elevator position versus speed curve is similar to a conventional airplane at all speeds above approximately 55 knots. As the airplane slows to less than 55 knots however, the pilot notes that all of a sudden he requires a large change in elevator position to achieve a small reduction in speed. For example from the elevator position of 4 degrees at 53 knots, the pilot can apply an additional 8 degrees elevator and only slow down to 48 knots. As he pulls the stick back further the elevator itself and the canard begin to stall and the airplane "bobs" noticeably up and down. If the pilot pulls the stick back an additional 6 degrees or more, (greater than 18 degrees elevator position) the airplane begins a very apparent pitch bucking i.e.: The nose bucks up and down a couple of degrees approximately once every two seconds. This is a generally stable flight condition and the full use of yaw and roll control is retained. Compare this to a conventional airplane: when the elevator is brought back, a stall of the main wing and the airplane either drops or "departs" (rolls to one side or yaws into a spin).

Note that transitioning the boundary layer did not change the highly desirable shape of these curves, it only resulted in a minor increase in the minimum speed. Looking at the high speed end of the same plot shows that tripping the boundary layer did have a significant effect on the airplanes maximum speed. Reducing the surface deterioration reduced the maximum speed by nearly 9 knots. This is a significant increase in drag of approximately 20%.

Referring now to the data of Long-EZ N26MS, a definite shift in elevator position is apparent at all normal speeds. After collecting the clean data the aircraft was trimmed to 100 knots 'hands off'. Then, without changing pitch trim, it was landed, the tape applied, and the fuel burned was replaced to keep cg and gross weight identical. It was then flown back to 100 knots. Data shows a 2 1/2 degree shift in elevator position and the pilot reported a 1 1/2 lb. pull force. Then, without changing trim, the aircraft was flown to 110 knots where it was again 'hands off' i.e.: no stick force. Note that the force was the same (zero) even though the position was 2.2 degrees different.

The minimum speed at 53 knots was unaffected by transition. This does not agree with earlier data from Long-EZ N79RA in which a 9 knot difference was measured. This points up the importance of recognizing that relatively small changes in contour (particularly with the GU canard airfoil) can adversely effect the transition characteristics.

Turning now to the Solitaire data, the pilot of the Solitaire could not feel any stick force trim change when operating between clean conditions and flying through rain showers. The transition elevator data, however, do show a minor trailing edge down trim change at speeds below 63 knots and trailing-edge-up trim change when faster than 63 knots. Remember, however that this is elevator position rather than stick force data and the changes seen here were not significant enough to be noticed by the pilot. As in the VariEze the minimum speed achieved when the surfaces were deteriorated with grit and tape were approximately 2 knots faster. The gliding performance was degraded considerably when the boundary layer was transitioned. The data shown are for powered flight with the self launch engine running at a constant power. A similar change is experienced during gliding flight except that the transition trim change "cross over" speed is reduced from 63 knots to 60 knots. With power off, the minimum speed achieved on the clean Solitaire is within 1 knot of that achieved with fixed transition. Note that the Solitaire has a relatively high amount of longitudinal stability in that the elevator position changes rapidly with speed changes. This condition results in a large elevator deflection (approximately 6 to 8 percent) required for normal thermalling flight. This results in a trim drag that reduces thermalling performance. Some fine tuning of the aerodynamics and cg range is being considered in order to see if improved thermalling performance can be achieved by reducing the large elevator deflection.

Referring to the Defiant data, tests show that with identical trim settings there was no stick force change due to fixed transition. Interestingly, the minimum speed with tape applied was less, probably due to the fact that the wing was more effected by the transition than the canard. This would result in a higher trim angle-of-attack.

We recently read an unpublished article written by a retired NASA engineer, which claims that all canard-type aircraft have a strong nose down trim change when encountering rain and that this characteristic may generally be dangerous. The article also interpreted the strong stable break in the pitching moment characteristics of the tandem wing airplanes as a "undesirable deficiency in elevator effectiveness at low speeds; rather than the desired characteristic of natural stall limiting that results in the safe flying qualities achieved by most of these airplanes. Due to the large number of errors in this unpublished article, the editors did not publish it. However, the author has succeeded in spreading rumors about these characteristics that some have attributed to our homebuilts. The author of the article has not flown any of the aircraft and had made some speculation based on reported results of other types that apparently do have strong or possible unsafe trim changes in rain conditions. In his article he even goes on to caution a pilot from pulling back on the stick in rain for fear that the nose will drop sharply. These characteristics, of course, are not seen in our homebuilts. As you see from the adjacent plots, the nose up positive elevator required to reduce speed is achieved at all conditions up through the flight conditions at which the aircraft's nose 'bobs' or 'bucks'.

Rain or no rain, the VariEze, Long-EZ or Solitaire can be maneuvered at normal speeds from base to final turns without fear of insufficient control power.

An analysis of the flying qualities resulting with fixed position should always be done during the flight test program of any new design, be it a canard, tandem wing or a conventional tail aft configuration. This is a relatively simple test to do. It is done by simply applying a strip of masking tape approximately 1/4" to 1/2" wide down all the leading edges, (top and bottom) at approximately 5% of chord. The effect on stability and maneuverability of the Long-EZ or VariEze due to this transition will be noticeable but not serious. For example, Mike and Dick both do low altitude aerobatic maneuvers with their Longs in driving rain conditions and notice only that a higher force is required to complete a given high-g maneuver. The take-off performance in rain is degraded in rain conditions, particularly at forward cg. much as it is on a conventional aircraft.

The following information is also interesting to note: The airplanes which exhibit a stronger nose down trim change in rain are generally found to be those that require too much trailing-edge-down elevator to trim in the clean (no rain) condition. One Long-EZ who reported a strong nose down trim change in rain, corrected his canard incidence by increasing it by 1 degree (which brought the elevator position back into the proper trim range) and thereafter found that the rain induced trim change was greatly reduced. You would think that if a very small contamination of the surface caused by a few bugs or rain would cause a noticeable trim change, a large change would be experienced when the aircraft accumulated large build ups of airframe ice and icing conditions. The opposite is true, ice has been accumulated on the Defiant and Dick's Long-EZ airframes without producing trim changes. Stall speeds increase, of course, similar to conventional aircraft.

The GU type airfoils used on the VariEze and Long-EZ are more susceptible to a change of lift due to rain than are more conventional, lower lift sections. The GU-type airfoils are not low drag sections, however, and several attempts have been made to increase the performance of the VariEze or Long-EZ by the use of different airfoil sections. The original VariEze prototype N7EZ first flew with a NASA GAW-1 (now designated the LS013) section which resulted in unacceptable stall characteristics and a high stall speed. More recently some modern sections have been flown both with slotted elevators and with plain elevators on three different Long-EZs. None of those tests have indicated that a overall improvement could be achieved in the Long-EZ or VariEze due to an airfoil modification. Note that this does not apply to all tandem-wing types, it is quite probable that an airfoil improvement may be necessary or desirable on other aircraft which do not have sufficient control power at low speeds due to the transition of the boundary layer.

GRAPH OF VARIEZE N4EZ LONGITUDINAL CHARACTERISTICS OMITTED

GRAPH OF LONG-EZ, VARIVIGGEN, AND SOLITAIRE LONGITUDINAL CHARACTERISTICS OMITTED

GRAPH OF DEFIANT LONGITUDINAL CHARACTERISTICS OMITTED

From CP38-4 (CH10)

Pitch Trim - VariEze and Long-EZ

While most VariEzes and Long-EZ have a rather mild pitch trim change in rain, some are less mild then others. Try this: scuff sand your canard using 500 wet or dry (wet). Sand only in a chord wise direction, until you have a uniform dull look. Ken Clunis did this to his with surprisingly good results.

From CP50-1 (CH10,CH31)

OSHKOSH '86

Burt flew his Defiant, N78RA, and Mike and Sally flew their Long-EZ, N26MS, into Oshkosh again this year and this year saw more Rutan Designs on the flight line than ever before.

Irene "Mom" Rutan did her usual sterling job of checking everyone in and chasing down all elusive ones parked in camping areas, etc.. Once again, not everyone registered, so her count does not jive with the number published in the Sport Aviation. It really is hard to understand why you guys and gals don't register, a few minutes of your time, and that is all - maybe next year? According to Irene, there were 54 VariEze's, 67 Long-EZ's, 3 Defiants and 3 VariViggens that were parked on the ground at Oshkosh in 1986. That is a grand total of 127! A list of all "N" numbers recorded by Irene and seen by her on the field is published in this CP.

The RAF booth was shared this year by Feather Lite Products (Larry Lombard and Michael Dilley) and the IVHC. This made for a much more interesting booth with all kinds of hospitality club members helping out, the booth was always crowded, friendly and happy. Larry and Michael had several of their products there for builders to inspect and it was really neat having them there to help answer questions.

We are very proud of "our" EZ builder/flyers who keep showing the way with some truly outstanding workmanship, and who continue to blow away the rest of the field with the kinds of incredible trips routinely flown all over these United States as well as many, many parts of the world. A recent example is two Long-EZ's which flew from Spokane, Washington to Australia, crossing the Atlantic via the Azores, (not to be confused with the more normal island hopping route via Greenland, Iceland and Scotland which can easily be accomplished even in a Cessna 172).

Pretty incredible, really. As we said, we are proud to be associated with these kinds of people.

Some highlights for us at this year's Oshkosh were the obvious effort that EAA had made on the flight line, the Homebuilders Corner, a neat little building on the flightline used one morning by the EZ group, good coffee, good company and lots of "hanger flying". The Italians were sensational! The Goodyear blimp was ponderous, but interesting. The Pitcairn Autogiro was quaint! The little Stratos from Australia was cute. Best of all, the Hospitality Club dinner, as always was really the highlight of the week. Thanks to Bernadette and Doc Shupe.

A poll was taken at the Bull Sessions of rain trim changes in VariEze's, Long-EZ's and Defiants. The VariEze's had 9 examples that trimmed nose up and 12 that trimmed nose down in rain. The Long-EZ contingent had 16 that trimmed nose down and 1 with no trim change, all standard canards. Three examples of the Roncz canard were there and all 3 had no trim change. All three Defiants reported no trim change. The trim change in the EZ's range from very slight to slight (90 percent), or moderate (5 percent), heavy (5 percent). It was very difficult to see or feel any difference between these canards.

If you did not make it this year, too bad, how about next year? Don't forget to register!

****From CP63-13,14&15 (CH10,CH31,CH37)****

ACROSS AUSTRALIA, NONSTOP - TWICE!

The trip from Brisbane to Perth nonstop and return three days later, is a crossing of 1948 nm Great Circle Route across Australia. This was a planned, nonstop trip to see our buddy homebuilders in Western Australia for the weekend function. The trip didn't take long but the drama of preparing paper work to satisfy the bureaucrats was something else. To get a permit for a homebuilt 39% overweight, for a 16 hour flight sounded easy. The reply was, "We have never done this before." Nothing is impossible; the Civil Aviation Authority chaps are great guys but are bound by structured rules that are out of date. With a so-called modern aircraft, Long-EZ or, for that matter, anything different - with no engineering justifications; the EZ Flight Manual so conservatively written - things looked bad for any approval.

The only way to get anything through is to sit back and wait until you US EZ guys do your thing and get approval on History of Performance, but this is where it starts for us down under.

I must thank Rutan Builder Support for all their time and nonprofit effort to justify overweight Long-EZs that have flown in record breaking attempts with success. After this effort, all this evidence had to be set up properly by an aeronautical engineer and his Statement of Approval was necessary. The tank and fuel system had to be designed; the tank, 9G forward load with 7-1/2 psi pressure test, weighed only 9 lbs. Fibreglass/foam panel is amazingly strong. The tank, 49 US gallons, was built in a big hurry. Some glass/foam panel was left over for an oil tank made with 5 minute flox joints.

Nothing was built until approval for safety and airworthiness came through the system. The Engineer had to have all the Special Flight Manual Inserts with CAA signatures all over them, and a one square meter drawing of tank and fuel system. It all looked good in the end for a late getaway. As usual. Jean, my son, Glen, and friend crawling all over the Long-EZ for the final inspection/completion.

In the rush, a last minute decision to try the Vortex Generators - this time without approval, fitted on the canard. On the way to the Brisbane Airport, 75nm, I found a cloud to try them in. Believe me, it really worked. No down pitch. I knew then that I might stand a chance for a successful trip.

Next morning, raining, of course. After the rush of preparing for this flight, the three hours sleep were welcome. There was no point in expecting a VFR departure 2 hours before light so I waited till first light and saw a couple of holes in the sky - really only good for F18-type aircraft. The rain had eased with low clouds, 1/8-1800 ft. Out came the TV cameras. Two national channels had been waiting in rain 2 hours but they weren't disappointed. The aircraft, at 1850 lbs. approved maximum take-off weight, flew normally and climbed 500 ft./min. under this cloud cover. Testing the canard and climbing into this spitting heavy cloud for 15 minutes. was fine, "the bloody thing worked, no trim change."

Departed on radial, clocked on departure by the Tower, and I disappeared into a white, precipitating cloud and never saw the ground for 30 mins.. while climbing a coastal range. The stick pressure did get heavier as it rained, but climbing with this weight, normally my canard would have given up long ago.

Now settled in at 10,000 feet in between stratiform layered clouds, I knew this was about as bad as it would get for this trip. Bearing west for 945 nm, intercepting a couple of NDB stations, went smoothly. The fuel burn was established on the Alcor Fuel Meter and full throttle was acceptable with maximum fuel flow of 22.5 liters/hour (5.9 gal.). The 0-235-L2C maintained 2700 rpm with all engine gauges showing normal and the TAS averaging 150 kts., over and back.

Very soon the tree line disappeared, leaving red sand and only an occasional salt lake for direction. At the 945 nm mark, the NDB was working. The average ground speed was now 145 kts. for the 945 nm. The next 757 nm was strictly dead reckoning, 5 hrs. on the new RMI compass, resulting in a track error of 3^{0} or 40 nm off track, acceptable for a homebuilt, plastic aircraft.

The next, and last, 300 nm flight was over a civilized part of the country with a few trees visible and signs of cattle tracks leading to water holes and, soon after, the fields were ploughed.

The sun was still high in the sky giving a beautiful reflection in the Indian Ocean. This was one of the highlights of the trip - to experience seeing the Pacific Ocean on departure and then, the Indian Ocean on arrival. This puts it together in a nutshell: it's a long way across this 2000 nm wide, barren continent in a light aircraft, nonstop.

The reception was overwhelming with meeting old friends again. The TV didn't miss the landing either. So now the Long-EZ, "Winglettes" stands taller in the misnamed category "Ultralite".

The trip from Perth to Brisbane was much easier to handle and it helps if you go to sleep sometimes. The return flight from Perth started 2 hours before first light and I must say, in Australian terms, "as black as a sheep's gut". When dawn broke, I was 10,000 ft., in stratiform layer clouds with the outline of the coast to the south; a beautiful sunrise mixed with Swan Lake stereo music tickling my excitement made it one of my life's most precious starts for the day.

I flew over the South Australian coastline with 700 miles of the whitest and purest beaches fading from green to the deepest blue ocean you'd find anywhere. I have flown this area with Jean at water level; it's beautiful, pure, clean and undisturbed. This trip was a mixed bag of air with little, if any, tail wind. Density altitude for most of the trip over and back was around 12,500 ft. I used only .5 liters. of oxygen and I'm sure this kept me on the ball.

Long range flying is another dimension of flying, if you can lie back as you do in the Long-EZ, you don't get muscle fatigue from sitting, I was amazed. The fourteen hours soon went in excitement.

Eventually, the coast came up - Brisbane at 10,000 ft. for a Tower clock timing a final decent to Oakey, 75nm west again, landing in the night.

What a private welcome! Jean had the hangar doors open and we had lots to talk about.

FILED RECORD

BN - PTH - 1948 nm (Great Circle) clocked 13 hrs., 41 mins.., (heading west) 145.57 kts. av., 24.12 L/hr (6.35 US gal.) - 380 litres fuel useable - 330 litres used - 50 liters remaining.

FILED RECORD

PTH - BN - 1948 nm (Great Circle clocked 13 hrs.., 55 mins.., (heading east) 140.88 kts. av., 24.43 L/hr. (6.45 US gal.) - 380 liters fuel useable - 340 litres used - 40 liters remaining.

FILED RECORD

Longest distance-2037 nm nonstop for C1B Class, Australia."
Magna Liset

Static Loading

From CP29-9 (CH10,CH31)(Photo Caption)
VariEze canard in a specially designed load testing device at the University of Texas, in Arlington. Prof. Jack Fairchild conducted the test to destruction on two canards.

From CP33-9 (CH10,CH31)(Photo Caption)
An informal static load test of a reject canard loaded at the Miami seminar. Sixteen men wrestle for room while Mike measures the buttline of everyone's feet! A non-catastrophic failure occurred near a hinge fitting at about 11.5-g.

****From CP40-3 (CH3,CH10,CH19,CH31)****

TO STATIC LOAD OR NOT TO STATIC LOAD

RAF has been receiving more and more requests from builders who would like to static load their newly constructed VariEze or Long-EZ. We are concerned that many of these builders may not fully understand what a static load entails and what the consequences of an incorrectly done static load can be.

Anyone who absolutely insists on doing a static load, can obtain a copy of the load schedule from RAF. We strongly recommend that you have a qualified structural engineer present during the load tests. Perfectly good parts can easily be failed by poorly or incorrectly done static load tests. This has occurred to some of the builders from overseas. Unfortunately, for some of the countries, their equivalent to our FAA has a requirement for a static load to be done. We know of two builders who have had their wings (on completed aircraft) destroyed. Do not allow some government official to decide on a load schedule for your airplane. Write to RAF and get a copy of the correct load schedule.

Before you rush off and static load your brand new EZ, consider this. When you purchased your plans from RAF, you paid for the benefit of all the aerodynamic and structural design capability that Burt and RAF has. RAF does an extremely thorough job of structural analysis, as well as conducting any static load test deemed necessary by Burt. Once the airplane is flying and the flying qualities are to Burt's liking, the airplane is put through an extremely thorough flight test program. Prior to the prototype being built, the amount of testing of various materials to be used in the aircraft is unsurpassed.

We believe that if you build your aircraft structurally and aerodynamically in accordance with the plans, and you layup the correct number of plies of the appropriate glass, (no less, and certainly no more), in the correct orientation, and you do a reasonable job of wetting out the glass with the appropriate epoxy, you will have an airplane that is more than adequately strong enough.

****From CP41-8 (CH10)(Photo Caption)****

Three smiling Long-EZ builders just after successfully passing their mandatory static load tests in Switzerland. Holding their canards left to right: Peter Froidevaux, Hans J. Schmid and Fritz Heer.

****From CP45-3 (CH48,CH10,CH31)****

RAF FLYIN - JUNE 8 1985 - MOJAVE

What a day! The morning dawned bright and clear with little wind (we had all been praying to the Mojave wind gods and they were kind!!) About 7:30 a.m. a bunch of volunteers from the Long-EZ Squadrons I and II showed up and started getting ready for the spot landing contest which they had kindly offered to organize. They barely had their white line painted on the runway, when the first airplane, Bruce and Bonnie Tifft overflew the airfield and announced they were on downwind for the landing. Bruce touched down less than 20 feet beyond the white line and we all began to think that this was too easy! HA!! Not at all, in fact Bruce was the leader for most of the day until finally Bill Oertel of Norco, California landed a scant 8 feet short of the line. The flyin did not really start until 9:00 a.m. but by that time there were 25 EZs tied down on the ramp! After it was all over it turned out that 39 VariEzes and 37 Long-EZs flew in. In addition to this of course there were present on the ramp the 85 percent scale Starship, the Voyager, the Grizzly, the Solitaire and the Defiant. The Gemini, Dave and Kathy Ganzer's unique push pull twin two place was also on the line. The total count of airplanes was 83! This is the largest number of RAF designs ever assembled on one airport at one time, including Oshkosh!!!

A busy schedule, starting with the spot landing contest, then going into a hands on demonstration of composite construction methods, and the finishing of the composites, followed by lunch and the highlight of the day for most people, when we static loaded three different VariEze/Long-EZ canards. A raffle was held for a brand new multilaminate Great American prop, a number of door prizes were given away and the party started breaking up around 4 p.m.

We did not get an absolute head count but we believe we had over 400 people. The hands on seminar was a standing room only situation. Even more people were jammed into the hangar for the static load testing. The first canard was one that was built by a homebuilder and was rejected due to an extremely dry layup. This canard was mounted in a frame (upside down) in exactly the same manner as it would have been in the aircraft.

Thus the static load test was a valid test of the aluminum attach points as well as the composite structure. With Burt directing proceedings, 25 lb lead shot bags were carefully loaded onto the bottom surface of the canard in the proper order and spacing to simulate airloads. Burt called out the load factor at each 2 g increment. At 10 g there was a loud crack as the top skin, forward of the spar cap failed in compression. The spar cap was still in good shape, so we continued to load shot bags until we were one bag short of a 14 g load on each side, when with a mighty crack, the canard failed catastrophically. All failures were in compression, there was not one tension failure. The attach points (lift tabs) did not fail. At the time of failure, there were 69 bags, each weighing 25 lb loaded on each side of this canard! The tips were deflected an average of about 11 inches. This was 1725 lbs. on each side, for a total load of 3450 lbs hanging on those little lift tabs!!

A dramatic demonstration that surely made every builder feel good about his or her airplane.

We attempted to fail two more canards, but due to the fact that these had been painted white and were shiny and slick (each was airworthy and had over 800 hours of flying time each), we had difficulty keeping the lead shot bags from slipping off. Both went to 12 g with no sign of failure before the load of lead slipped. Interestingly, one side of one of these canards had been deliberately damaged by Burt using a special damage tolerance testing device. The damage was quite severe, enough to have punched deep dents all over an aluminum wing, but in spite of this, there was no difference in deflection from the damaged side to the good side, even at 12 g!!

We at RAF had a really great day and we hope everyone who attended our flyin enjoyed it as much as we did. There were many beautiful examples of EZs on the ramp, presenting a golden opportunity to EZ builders and potential builders to look at and talk to the owners.

We would like to thank all the people who made this flyin such an enormous success, in particular Squadron I and II members. Dick Kreidel, David Orr, Lynn Burks, Joe Orrico and especially Joan Richey. There were many others who also helped. Thank you all, shall we do it every year!?!

From CP45-8 (CH10,CH31)(Photo Caption)
About 3.7 g so far. Burt is standing by to make sure we place the bags correctly.

From CP45-8 (CH10,CH31)(Photo Caption)
Right at 12 g. At this point there is 3000 lbs of lead shot on the canard - all suspended from the "little aluminum" lift tabs! Deflection at the tip is around 10" on each side - scary!

From CP45-10 (CH10,CH31)(Photo Caption)
Careful now! Going for about 13 'g'. This rejected homebuilt canard failed at 13.8 'g'.

Table of Contents for Chapter 11, Elevators

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Update Number 66
to
Chapter 11,
Elevators

****From CP66-3 (CH3,CH11,CH31,CH38)****

ALERT! POSSIBLE CORROSION IN ELEVATOR TORQUE TUBES IN EZS.

We have one report from a VariEze builder/flyer who lives and hangars his EZ in Ohio. He noticed small bumps rising up on the top of each elevator along the aluminum torque tube. He could depress these bumps a little with his finger. He has removed each elevator and cut the glass and foam away along the top of each elevator, exposing the aluminum torque tubes. He reports that he has found "severe corrosion pits where each bump was located." We have not seen this corrosion yet - he is sending us a sample of the affected tube. We will report further in the next CP. He says that this corrosion occurs only under the foam and glass. These is no corrosion at all on the exposed ends of the elevator torque tubes.

Pitch control is absolutely critical to safe flight. For this reason, any report such as this must be taken seriously. All EZ, Defiant and Solitaire flyers should inspect the leading edges, the tops and the bottoms of both elevators for bumps such as we have described here, before next flight. If any evidence of bumps or corrosion is found, ground the airplane and remove foam and glass locally. Inspect the aluminium tubing under a bright light. Please report any problems found to RAF as soon as possible.

Any builders who have not yet built the elevators should treat the aluminum tubing with Alodine before starting on the foam and glass elevators. Do not omit this step! Remember, the corrosion, if it exists, is not visible on the exposed part of the tubing. It is under the foam and glass and cannot be seen without removing the foam and glass. Do not remove foam and glass without evidence of bumps or swellings that may or may not be soft. Do let RAF know of any evidence of corrosion.

The above report came out of Ohio where it is hot and humid in summer and cold and damp in winter. Anyone who lives where there is much humidity and/or near the coast should be especially concerned and should check the area called out before each flight.

We have checked all of the EZs at Mojave with no sign of any problems but that probably was to be expected, this being a desert with only a few inches of rainfall in a good year.

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Update Number 67 to Chapter 11, Elevators

****From CP67-5&6 (CH11,CH16,CH19,CH20,CH31,CH32)****

CONTROLS - RIGGING

Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should not be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons {aileron stall}).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees more in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you must be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and no more. (More travel gives less lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept any friction in the pitch control system. If you have friction, do not fly until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on every pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

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Chapter 11, Elevators

Long-EZ Plans Changes

From CP26-6 (CH11)
LPC #33, MEO, page 11-2.
Lower left side, 3 lines up - should be 2 strips, not 3 strips.

From CP30-9 (CH11)
LPC #76 Section I, page 11-5
"See detail page 5.4" should read "see detail page 11-4".

From CP33-4 (CH11,CH16,CH31,CH33)
VariEze and Long-EZ MEO
Owners Manual appendix three add "CAUTION friction in the pitch system can seriously degrade flying qualities". Also add ditching procedure shown on next page.

From CP57-8 (CH11,CH31,CH38)
MAN GRD: Conduct an inspection or provide a certification that the elevator quality regarding correctness of laminate schedule, orientation of plies, numbers of plies and workmanship relative to the weight of the layup and straightness of the primary surface is correct. This should include inspection or verification that additional filler materials have not been added to increase the elevators weight and thus change is natural frequency of oscillation. If you have purchased structure from someone else and cannot otherwise verify the structural quality and conformance, conduct a dissection of the elevator skins to assure the proper structure, or better yet, discard the elevator and build new ones that you know are in conformance with the tested and approved configuration. Any variance in weight, stiffness, or shape should be suspected of being dangerous and not allowing you to rely on the testing that was conducted to verify freedom of flutter. The weight limits shown are absolute maximums. A properly fabricated, accurate core with a properly squeeged minimum-resin laminate will result in weights well below the limits shown in CP 21 pg 5. In order to provide more margin for variables in this extremely important area, we are now recommending that any elevators that require additional mass balancing beyond those weights shown for the basic configuration be discarded and new elevators fabricated. If you are unable to build elevators that can be balanced by the basic balance weights, both inboard and outboard, you are possibly unable to produce adequately safe flying components. Do not compromise by using up to your margin of safety by merely increasing balance weight. This increases the weight of the elevator and lowers the frequency of its oscillation. Above all, be certain that your elevators meet the balance hanging angle of 12 to 20 degrees after painting. If there's any doubt that they are absolutely perfect, discard them and start over. It is possible, with proper tube orientation, to retain the aluminum tubing when building new elevators.

From CP57-9&10 (CH11,CH12,CH31,CH38,CH39)
A CENTRAL CALIFORNIA VARIEZE experienced in-flight severe flutter of the elevator and canard which caused a structural failure of the canard, and the pilot was killed when his VariEze crashed on a wooded hillside. He had about eight hours in his VariEze before the crash.

He had not built the airplane but had purchased it with all of the structure done. He then completed the finishing and systems installation. The elevators were carefully checked for correct balance and some weight was added inboard on each elevator to bring the elevators into the proper balance tolerance.

Prior to the fatal flight, the pilot had removed the canard to check something in the nose. Previously, a friend had helped him to install the canard and noted that he had had great difficulty in getting the canard attach bolts to line up and thread into the nutplates.

A very careful post crash investigation by the FAA, as well as by RAF, determined that the probable cause of the catastrophic flutter was that one of the canard attach bolts was not correctly installed. Either it was not torqued up at all, or it was cross threaded. In any case, it did not clamp the aluminum lift tab to the F-22 bulkhead. This resulted in the natural frequency of the canard being lowered considerably since it was only firmly attached on one side. A gust, or something, excited the elevators driving the canard into a divergent destructive flutter mode.

Although the elevators were balanced, they were very heavy, having been modified from the original short chord design to the long chord by the addition of a large heavy piece of balsa wood and several plies of BID. This caused the elevators to have a lower natural frequency of oscillation. Thus, these overweight elevators may have contributed to this accident, however, the primary cause was the failure of the pilot to properly install the canard.

This tragic accident brings it home to all of us, just how careful we must be as we work on our aircraft. When you are doing a critical job such as installing a wing or a canard or a control surface, you, and only you, are responsible to ensure that all fasteners are correctly installed and properly torqued. Too often we get sidetracked while working on a critical installation when we get interrupted by a friend or passerby. Should this happen to you, do not stop until you have the critical part installed and safetied - even if you have to be rude to your visitor.

Accidents such as this have been caused by an interruption or disruption of your thoughts while working on an important aspect of the aircraft. A simple example is changing the oil. The oil is drained, the drain plug replaced, then a visitor shows up with a bunch of questions - you forget to fill the sump with fresh oil and - presto - a destroyed engine when you start it. It happens so easily, it seems so unlikely, but it happens. Be conscientious, use checklists, be very particular and careful if you have removed a canard or wing or canopy, etc. Be absolutely certain you have adequately completed any task you do on your airplane. Last of all, be very conscientious about doing a thorough preflight on your creation before you commit you, and perhaps a member of your family's or a friend's, life to your workmanship.

As you know from past Canard Pusher newsletters, the subject of flutter has been a major concern for years. CP numbers 17, 18, 19 and 21 have reported discussions and/or warnings relative to the importance of conformality in the fabrication of the canard and elevator system. *It is extremely important to be aware that elevators improperly fabricated, too heavy or with the incorrect bending or torsional stiffness characteristics which result from improper materials, or fiber orientation, cannot be balanced with any method.*

A mass balance called out for the elevator and the specification for balancing them, applies only to an elevator fabricated with the same weight and stiffness as that which has successfully passed all the flutter testing. It is extremely important, and life-critical, that the manufacturer or owner of each VariEze, Long-EZ or any plane for that matter, assure, without a doubt, that the control surfaces are conformal to those which have passed flight tests and been shown to be flutter free.

The advisory shown in the plans change section must be followed to assure that there are no non-conformal elevators that could contribute to, or result in, an accident. Do not take this situation lightly. As we have indicated before in the CP, - IT COULD KILL YOU.!

Elevator Shape

From CP30-7 (CH11,CH31)

Long-EZ Elevator Templates

Ref: Section I Page 11-1, step I.

A few builders have reported that they have cut the templates accurately, and still ended up with oversize foam cores after hotwiring the elevators. It appears that perhaps we allowed a little too much allowance for the hot wire burn-down. So when you make your elevator templates, go ahead and clamp them together, and sand down not just to the line, but you should sand virtually all of the line off. Check your templates carefully against the full size drawing on page 11-5. Remember that 2 plies of UND (the skin) will add only .018" to the size of the foam core. Be absolutely certain your foam cores are perfect before you glass the skins.

From CP47-8 (CH11,CH31)

ELEVATOR SHAPE

We have had this in many CPs in the past, but surprisingly, we still find builders out there with the bottoms of their elevators convex or curved. No matter which canard you have, you must have perfectly flat bottoms on your elevators. Lay a machinists 6" scale or other known straight edge chordwise across the elevator bottom. There should be contact from the tangent point of the elevator torque tube to the trailing edge as shown in the correct example below. **SKETCH OMITTED**

If your elevators are not flat or look like the INCORRECT example, you elevator will try to float trailing edge down in flight. As a result you will find yourself pushing forward on the stick at cruise speed, and probably will not have enough trim authority to trim off this force. This is normal at very high speeds, but should not be true at cruise speeds.

From CP59-5&6 (CH11,CH12,CH17,CH19,CH31,CH33)

THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.

This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is normal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

HotWiring

****From CP24-4 (CH3,CH10,CH11,CH19,CH20,CH31)****

Hotwire Templates-

An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood, available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

****From CP25-5 (CH3,CH10,CH11,CH19,CH20,CH31)**

HOT WIRING

Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

****From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)****

BUILDER HINTS

You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. **This works great for hotwire templates too.**

****From CP30-7 (CH3,CH10,CH11,CH31)****

Hotwire Templates

When making identical templates, (canard, elevators, etc.) clamp them together, and use your Disston abrader to sand them to exactly the same shape. This is also valid for canard jigs.

****From CP36-6 (CH3,CH10,CH11,CH19,CH20,CH31)****

V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

Trailing Edge Close Outs

From CP32-6 (CH10,CH11,CH19,CH20,CH31)
CAUTION - TRAILING EDGE CLOSE OUTS
It is very important for structural integrity, that you ensure that your trailing edges of the canard, elevators, wings, ailerons, winglets and rudders meet the prescribed minimums in the plans. Do not accept delaminations in the trailing edge glass to glass area. Even the smallest delam can get moisture in it which will freeze and expand when you climb through the freezing level, and thus delaminate further and further with each occurrence until it could weaken the overall integrity. About the quality of your trailing edge glass to glass close outs - accept nothing less that perfection in this area. Always sand smooth every lap after cure - do not leave them joggled as shown. **SKETCHES OMITTED**

LAP DIMENSION Ignoring the proper procedure here could result in serious consequences, even structural failures! Here is a list of these areas. The minimum dimension should be considered an absolute minimum. If you don't meet this criterion it requires repair before you fly.

	Glass Lap Dimension Shown	Minimum Acceptable Lap
Canard	0.45"	0.3"
Elevators	**0.25"**	**0.2"**
Wings	0.6"	0.5"
Aileron cut outs	1.0" (top)	0.75" (top)
	0.75" (bottom)	0.52" (bottom)
Ailerons	0.5"	0.3"
Wing Root Rib	0.6"	0.4"
Winglets	0.6"	0.4"

SKETCHES OMITTED

Fasteners

****From CP32-6 (CH3,CH11,CH19,CH20)****
BUILDER HINTS
Clarification on use of various pop rivets. Anywhere on the airframe where you are installing nutplates, on hinges, access panel, use 3/32" diameter flush pop rivets, or solid aluminum rivets. When installing aileron hinges onto the ailerons, use 1/8" round head pop rivets (Avex 1601-0410, or cherry MSP 43) rudder hinges are installed into the rudder using flush pop rivets (Avex 1604-0412 or cherry MSC 43). **CS2 elevator hinges are installed on the elevator using flush pop rivets (Avex 1604-04 or cherry MSC 43).**

Control Surface Balancing

****From CP51-4 (CH11,CH19,CH20,CH31,CH32)****
CONTROL SURFACE BALANCING
We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so that the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50 percent of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and ,more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons and elevators without any additional lead. At least, this has been our experience.

Elevator Positioning & Travel

****From CP24-4 (CH11,CH31)****
Elevator Positioning
VariEze Section I, page 5-5 (or Long-EZ page 11-5) shows a smooth transition from the trailing edge of the canard onto the top of the elevator. This is not easy to attain, and still get full and easy elevator travel. It is acceptable to have up to 0.1" of "step-down" as shown below. However, be sure the slot shape and elevator shape are precise. **SKETCH OMITTED**

****From CP48-4 (CH11,CH33)****
CAUTION
ELEVATOR CONTROL STOP POSITION. This applies to VariEzes as well as Long-EZs using the original GU canard (Roncz 1145MS not affected). The design philosophy of the EZ canard type airplane calls for the canard airfoil to develop maximum lift coefficient (CLmax) at full aft stick. Thus the elevator trailing edge down (nose up command) stop must be set correctly. On an accurately built GU canard/elevator, this will usually be at approximately 22 degrees (trailing edge down).

Recently, we have heard from a few builders, both VariEze and Long-EZ, who have noticed stall characteristics that were not "per the handbook". In all cases, the cause was the elevator nose up stop set to allow too much elevator travel. If you have noticed any of the following symptoms, check that you have no more than 22 degrees to 22-1/2 degrees trailing edge down travel on your elevator.

1) Perform a 1-'g', wings level, straight ahead stall with sufficient power to maintain level flight. Slowly pull the control stick back to full aft stick. This should result in a nose high attitude with a "pitch bucking" that can vary from hardly noticeable to quite vigorous, perhaps "one buck" per second, with a deck angle change of several degrees per "buck". This is normal and will vary depending on the cg. If, however, you notice a strong stall break (canard stalls) and the nose comes down through the horizon until you are in a stable shallow dive, even though you are still holding full aft stick, the speed may build up to over 100 KIAS before the EZ begins to climb again. This very long period pitch "bucking" can be as long as 30 seconds per cycle and is indicative of too much elevator trailing edge down travel. You can verify this by releasing back pressure on the stick during the nose down phase of the cycle and gently raising the elevator trailing edge perhaps 1/8" at a time.

This should allow the canard to develop more lift and pitch the nose up. Try to determine by experimenting with elevator position, where CLmax is, then set your elevator stop at that position.

2) Another classic symptom may be noticed during a take off. At full aft stick, it may take a longer take-off roll to lift off that it does at, say, slightly forward with the stick. If you have ever noticed this, it should be corrected. Under certain circumstances, this could become a serious problem. A Long-EZ builder/flyer in Alaska, attempting to take off on a rather short runway, discovered that he was rapidly approaching the end of the runway and, even though he was holding the stick all the way back, was not rotating. Realizing he was not going to make it, he backed off from the full aft stick stop and, to his surprise, the airplane literally jumped into the air! Again, his trailing edge down elevator stop was set for too much travel. This same scenario has also been reported to us by a San Diego VariEze pilot.

What causes this? If the elevator stop is set so that at full aft stick your canard can develop its maximum possible lift, this will result in the lowest possible rotation speed for take-off and a good, clean canard stall (limiting the main wing angle of attack) or classic "per the book" stall at full aft stick in flight. If, however, you have set your elevator stop for too much travel (perhaps you thought you could lower your rotation speed?!!) what happens is that you are now on the "back side" of the lift curve, lift is less than maximum, <u>and</u> the elevator is creating lots of drag. The result may be running off the end of the runway. Keep in mind that this condition could be aggravated even further if it were raining.

****From CP60-6&7 (CH11,CH39)****

<u>A TEXAS LONG-EZ</u> experienced an unintentional landing on the dirt foundation of a future runway, causing some minor damage to the airplane but no injuries. During a fly-in, while flying in a high speed/low speed competition, this pilot was slowing to his minimum flying speed and was indicating 65 knots, very nose high, when he noticed he was sinking. At what he judged to be about 20 feet, the nose pitched down. He immediately applied power which he said had no effect, so he pulled the power to idle and held the stick full back. The nose continued dropping and he hit the soft dirt in a 3 point attitude. The Long-EZ slid to a stop in about 300 feet. Damage was minor and he had it flying again the next day.

The weather conditions were good, no rain, light winds and the airplane was being flown very light. What caused this problem? We experienced a situation very similar to this once ourselves, but at the time we were flying with an experimental canard airfoil and it was raining. This test airfoil was retired and not put into production!!

It is <u>not</u> <u>normal</u> for an EZ to behave in this way. There have been rumors over the years that EZ's were prone to this behavior, but that is simply not true. At least of a plans built, correctly rigged EZ. **A Long-EZ using the original GU canard, with the elevator rigged so that the full aft stick (FAS) mechanical stop is at a point <u>beyond</u> maximum lift coefficient, approx. 22 degrees trailing edge down, <u>would</u> possibly exhibit the same characteristics described by this Texas Long-EZ pilot.**

It is critically important that the maximum attainable lift on the canard occur <u>at full aft stick</u>. A perfectly built canard/elevator will reach maximum lift at 22 degrees of elevator deflection, however beyond 22 degrees, the lift available will <u>decrease</u>. When you do your initial flight testing check that you are, indeed, getting maximum lift at full aft stick.

We believe it is possible that the above incident may have been caused, at least in part, by the elevator having been deflected beyond the point at which it allows the canard to generate maximum lift. Another contributing factor may have been an incorrect airspeed indication. At 65 KIAS, a light weight Long-EZ certainly should not be at such a nose high condition that the pilot cannot see forward, nor should it stall at 65 KIAS. This pilot may have been much slower than he thought, and had actually reach the stall condition - normally a pitch bucking as the canard stalls and unstalls. If this were the case, this condition might have been aggravated by the main wing getting into ground effect which would cause a small nose down pitching moment due to the long moment arm of the swept main wing and the "cushion" between the wing tips and the ground.

It must be pointed out, however, that it would be a problem to land an EZ if this were a normal characteristic of all EZ's! After all, we have all probably landed at 65 KIAS or slower many times without having the nose pitch down prior to touch down or even after touchdown. When the prototype Long-EZ was in flight test back in 1979, we landed it many times at full aft stick. This is not a good method of landing but it can be done with some practice. It does not produce the shortest landing distance, however, and is not recommended. It is only brought up here to make the point that a Long-EZ should not do what this Texas Long-EZ did.

****Also see CP33-4 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP33-5 (CH11,CH16,CH31,CH38)****
CAUTION! CONTROL SYSTEM FRICTION
The presence of friction in the pitch controls of an EZ will result in serious degradation in flying qualities. Mike recently installed a different shape canard tip and when reinstalling the elevators one of the pivot bolts was adjusted to bind an elevator. Sally and Mike both flew the aircraft with friction and reported PIO tendencies and over-control difficulty. Adjusting out the bind immediately returned the excellent pitch control and smooth flying qualities.

****From CP47-12 (CH11,CH16,CH19,CH31,CH38)****
CAUTION: CONTROL SYSTEM STIFFNESS
We have previously warned builders to ensure absolute freedom from stiffness in the pitch control system. This is very important and must be corrected if it exists in your EZ. We never have particularly addressed lateral (roll) control system stiffness. While not quite as important as pitch, tight bearings in the aileron control system really spoils the nice flying qualities inherent in an EZ. Conscientious attention to detail here will pay dividends. Long-EZs and VariEzes have similar lateral control systems, the main difference being that the CS-132L belhorn in a Long-EZ is mounted inside of the wing root, and the same part (CS-132) in a VariEze hangs out in the breeze, inboard of the wing root, close to the bottom cowling.

Both of these areas can be troublesome. In the Long-EZ, you must assure that the end of CS-132L cannot contact the bottom of the wing. Even if you have to dish the skin locally, you cannot accept any rubbing here. In fact, it would be best to have at least 1/4" of clearance. The VariEze though, needs even more clearance between the lower end of CS-132 belhorn and the bottom cowling, because the cowling will tend to flex up in flight and could cause a rubbing interference, or even worse. For example, if your CS-132 belhorn just barely clears the bottom cowl while at rest on the ground, it is possible that in flight the cowl could move up enough to seriously interfere with lateral control of the aircraft! The answer is a streamlined blister on the bottom cowl which will give the required clearance and will stiffen the bottom cowl.

Lubricate all bushings and bearings in the control system and do not fly until you have the control system working nice and free with no tight spots or stiffness anywhere within the full range of control stick movement.

****From CP55-6 (CH11,CH16,CH31,CH38)****
CAUTION
Friction in the pitch control system of an EZ can make it very difficult to fly. In fact, it can flat-out make it so uncomfortable to fly that you won't enjoy it at all!

Friction in an EZ's pitch control system is easy to avoid and must be avoided. There are so few parts involved that it is simple to check. Disconnect the pitch trim springs, push the stick forward and aft, or grab the trailing edge of the elevator and move it full travel up and down. There should be no perceptible friction. It should not hang up anywhere, it should easily flop all the way up and all the way down. If it feels stiff or tight anywhere in the full arc of travel, find out where it is binding and fix it before you attempt to fly. Check the rod ends at the stick and at the inboard ends of the elevators. Check the stick's pivot points. Check every one of the elevator hinges. On the original GU canard, it is easy to get one or more hinge points too tight. The washers at the hinge points should easily spin. The bronze bushing should be lubricated and should be a nice easy slip fit on the AN525 screws which are the hinges. Check that the mass balance weights are not rubbing or chafing inside the slot in the canard on each elevator.

Lastly, put a saw horse or chair under each canard tip (well padded, of course) and have someone push down on the nose or center of the canard. Apply enough weight to bend the canard at least 3 or 4 inches up at the tips, then check all of the above for friction or binding or chafing under load. There should be no perceptible drag in the pitch control system (with no pitch trim springs installed) in any of the RAF designs, VariEzes, Long-EZs. Defiants or Solitaires.

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Chapter 12, Canard Installation

****From CP55-5 (CH12,CH19,CH20,CH31,CH33,CH37)****
HIGH ANGLE OF ATTACK DEPARTURE TESTING
Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. **Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable.** Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

****From CP57-9&10 (CH11,CH12,CH31,CH38,CH39)****
A CENTRAL CALIFORNIA VARIEZE experienced in-flight severe flutter of the elevator and canard which caused a structural failure of the canard, and the pilot was killed when his VariEze crashed on a wooded hillside. He had about eight hours in his VariEze before the crash.

He had not built the airplane but had purchased it with all of the structure done. He then completed the finishing and systems installation. The elevators were carefully checked for correct balance and some weight was added inboard on each elevator to bring the elevators into the proper balance tolerance.

Prior to the fatal flight, the pilot had removed the canard to check something in the nose. Previously, a friend had helped him to install the canard and noted that he had had great difficulty in getting the canard attach bolts to line up and thread into the nutplates.

A very careful post crash investigation by the FAA, as well as by RAF, determined that the probable cause of the catastrophic flutter was that one of the canard attach bolts was not correctly installed. Either it was not torqued up at all, or it was cross threaded. In any case, it did not clamp the aluminum lift tab to the F-22 bulkhead. This resulted in the natural frequency of the canard being lowered considerably since it was only firmly attached on one side. A gust, or something, excited the elevators driving the canard into a divergent destructive flutter mode.

Although the elevators were balanced, they were very heavy, having been modified from the original short chord design to the long chord by the addition of a large heavy piece of balsa wood and several plies of BID. This caused the elevators to have a lower natural frequency of oscillation. Thus, these overweight elevators may have contributed to this accident, however, the primary cause was the failure of the pilot to properly install the canard.

This tragic accident brings it home to all of us, just how careful we must be as we work on our aircraft. When you are doing a critical job such as installing a wing or a canard or a control surface, you, and only you, are responsible to ensure that all fasteners are correctly installed and properly torqued. Too often we get sidetracked while working on a critical installation when we get interrupted by a friend or passerby. Should this happen to you, do not stop until you have the critical part installed and safetied - even if you have to be rude to your visitor.

Accidents such as this have been caused by an interruption or disruption of your thoughts while working on an important aspect of the aircraft. A simple example is changing the oil. The oil is drained, the drain plug replaced, then a visitor shows up with a bunch of questions - you forget to fill the sump with fresh oil and - presto - a destroyed engine when you start it. It happens so easily, it seems so unlikely, but it happens. Be conscientious, use checklists, be very particular and careful if you have removed a canard or wing or canopy, etc. Be absolutely certain you have adequately completed any task you do on your airplane. Last of all, be very conscientious about doing a thorough preflight on your creation before you commit you, and perhaps a member of your family's or a friend's, life to your workmanship.

As you know from past Canard Pusher newsletters, the subject of flutter has been a major concern for years. CP numbers 17, 18, 19 and 21 have reported discussions and/or warnings relative to the importance of conformality in the fabrication of the canard and elevator system. *It is extremely important to be aware that elevators improperly fabricated, too heavy or with the incorrect bending or torsional stiffness characteristics which result from improper materials, or fiber orientation, cannot be balanced with any method.*

A mass balance called out for the elevator and the specification for balancing them, applies only to an elevator fabricated with the same weight and stiffness as that which has successfully passed all the flutter testing. It is extremely important, and life-critical, that the manufacturer or owner of each VariEze, Long-EZ or any plane for that matter, assure, without a doubt, that the control surfaces are conformal to those which have passed flight tests and been shown to be flutter free.

The advisory shown in the plans change section must be followed to assure that there are no non-conformal elevators that could contribute to, or result in, an accident. Do not take this situation lightly. As we have indicated before in the CP, - IT COULD KILL YOU.!

****From CP59-5&6 (CH11,CH12,CH17,CH19,CH31,CH33)****

THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.

This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. **First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.**

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is normal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

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Table of Contents for Chapter 13, Nose and Nose Gear

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Update Number 66
to
Chapter 13,
Nose and Nose Gear

From CP66-7 (CH13)
Nose gear crank ratchet.
We cannot say enough about this truly clever device. Once you fly it, you will wonder how you ever did without it. It locks the gear in the up and locked position while in flight, and at the flip of a tiny lever, allows you to crank the gear down where the ratchet locks the gear into the down and locked, over-center position - no more chance of the nose gear vibrating out of the over-center position and stripping the worm gear. This gadget is simple, incredibly effective and easy to install

Contact: Curt Smith
5114 Canaan Center Rd.
Wooster, OH 44691
216-345-7721
Send a check for $34.95 to cover cost and shipping.

From CP66-7 (CH13)
Heavy Duty Nose Gear Strut Spring
If your shock strut does not stay all the way up with you in the pilot seat, you may want to consider one of these springs designed and tested by Nat Puffer, designer of the Cozy. We are told by the people at Danley Die Set that the springs are still available and they do sell to individuals but need cash or credit card when an order is placed. Ask for Catalog #9-2416-36

Contact: Danley Die Set
3019 South Tanager
Los Angeles, CA 90040
800-243-2659

From CP66-9 (CH13)
A NEAT IDEA FROM KEN CLUNIS
This is my fix to keep the nose wheel from vibrating down inadvertently in flight. It also serves as a tire pressure gauge! The tire must roll over the 1/2 round, and the amount of force is proportional to the tire pressure. It works and is easy to make and install. **SKETCH OMITTED**

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Update Number 67
to
Chapter 13,
Nose and Nose Gear

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. **I removed the small aluminum plate off my nose wheel** years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. Don't trust anyone else with your safety. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

****From CP67-6 (CH13,CH38)****
NOSE GEAR EXTENSION PROBLEM
"On my first flight, I left the nose gear down for the entire flight. When I attempted to retract the nose gear to park nose down, it retracted until the nose tire contacted the aft edge of the nose wheelwell then stopped moving! Turning the crank handle either way had no effect. On examination, I found that the AN-4 70AD4-10 rivets attaching NG60 to NG65 (worm gear to shaft) had sheared off! I am so happy I did not retract my nose gear on that first flight".
Jack Bennett
DeKalb, IL

Jack sent this note in because he was worried that the suggestion from Ken Clunis in CP66, Page 9, may cause more failures like he experienced. We print this information, like we do all of our hints and problems, in case they may help others. Let this serve as a warning to carefully check your rivets before next flight.

On the bright side, this is the first failure of this kind we have had reported. I checked on just our local fleet of EZs on the Mojave airport (at least 7 EZs as of April 1991!) with a collective total flight hours of 7668 hours! None of these have had this problem. Maybe Jack had some sharp edged holes or something - hopefully it won't become a common problem. Jack solved his problem by simply installing an AN-3 bolt in place of the rivets. An excellent fix if you find yours is loose.

Please report any failures like this to RAF so we can disseminate the information to the several thousand builders and flyers around the world.

From CP67-7 (CH13)
SHIMMY DAMPER
As noted in a previous CP, Bob will not be continuing to sell his shimmy dampers. He says he has 19 left of the final production run!

These are the best shimmy dampers available - price is $71.48 per kit, delivered.

Contact: Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
407-567-1844

From CP67-8 (CH13)
NOSE GEAR CRANK RATCHET
NOTE NEW ADDRESS AND PHONE NUMBER
We cannot say enough about this truly clever device. Once you fly it, you will wonder how you ever did without it. It locks the gear in the up and locked position while in flight, and at the flip of a tiny lever, allows you to crank the gear down where the ratchet locks the gear into the down and locked, over-center position - no more chance of the nose gear vibrating out of the over-center position and stripping the worm gear. This gadget is simple, incredibly effective and easy to install

Contact: Curt Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

Send a check for $34.95 to cover cost and shipping.

Update Number 69 to Chapter 13, Nose and Nose Gear

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	**58.00**
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	**21.00**
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	**19.50**
Nose wheel cover NB	**19.50**
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	**70.00**

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

****From CP69-3 (CH13,CH18)****
NACA FRESH AIR INLET VENT DOORS.
Gene Zabler's neat little vent door is still available for $7.50 pp. Gene tells us that after 8 years in service some of these little doors are wearing out. If yours is, send an SASE and $2.00 to Gene and he will ship you a new rubber insert. **Gene also manufactures and sells a light weight nose wheel fender (protects your prop from gravel damage) for $45.00 pp.**
Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
414-886-5315

****From CP69-4 (CH13)****
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 pp. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it.
Contact: Curtis Smith
1846 Sextant Dr.
Worden, IL 62097
618-656-5120

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Update Number 75 to Chapter 13, Nose and Nose Gear

****From CP75-7 (CH13,CH38)****

DAVENPORT SHIMMY DAMPER UPDATE

I'd like to report on a letter which was received from Mark Buxbaum of Richland WA. It seems, after making a series of "not so good landings" last summer, he experienced catastrophic shimmy on landing at Dubois, WY. This occurred with the Super Shimmy Damper installed!! After replacing the nose gear assembly with another complete assembly, including a Super Shimmy Damper, Mark continued on his way to Oshkosh with no further problems.

On returning home and checking over the failed nose gear assembly, Mark discovered he had bent the wheel disc on one of those "not so good landings". Run-out was found to be .020" which be believes drove the nose wheel to oscillate beyond the capacity of the shimmy damper.

If that is correct, then we should all check our nose wheels for run-out regardless of the type of shimmy damper installed.

Mark did not indicated which type of wheel was installed, but my guess is his unit was of the single center disc type with the overhung wheel bearings. This wheel is very prone to bending and failing under a side load and could possibly provide a little excitement in your life similar to Marks' experience.

A far better choice would be a Gerdes nosewheel (part # NWA 1230 from Wicks). This wheel is made just like the main wheels and has proven to be very reliable in Mike's Long-EZ for more than 1000 hours.

I occasionally get requests for the Super Shimmy Damper from people who are near first flight. I feel I need to clarify the supply situation. I do not have a machine shop and, therefore, subcontract all parts to a high quality shop. I keep no inventory of parts or complete assemblies. I hold all orders until a total of 25 accumulate. That quantity is required to keep the delivered sale price to $71.48. All checks are kept until two weeks prior to shipping. Save yourself a disappointment by ordering the unit when you can afford a waiting period that won't disrupt your schedule.

Bob Davenport

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Update Number 78
to
Chapter 13,
Nose and Nose Gear

Information derived from CP78 published by RAF for April & July 1994

From CP78-8 (CH13)
NOSE GEAR RATCHET
Dr. Curtis Smith's nose gear crank ratchet is still available at $38.00 which includes postage and packaging. No need to call, just send check or money order. This little device should be considered a "must" by all Long-EZ and VariEze builder/flyers. Once you have flown with it you will wonder how you ever did without it. Contact: Curtis Smith

1846 Sextant Dr.
Worden, IL 62097
618-656-5120

From CP78-9 (CH13)
NOSE WHEEL SHIMMY DAMPER
Bob Davenport tells us that he can still supply this excellent damper. Unfortunately he gets very few orders nowadays but can sell them even if he gets only one order. Including the set up charge, the cost is $236.00 delivered in the USA.
Contact: Bob Davenport

PO Box 650581
Vero Beach FL 32965-0581
407-567-1844

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Update Number 81 to Chapter 13, Nose and Nose Gear

Information derived from CP81 published by RAF July 1995

****From CP81-7&8 (CH13,CH30,CH38,CH39)****
A Texas VariEze which was not built by this pilot but was purchased as a completed airplane, crash landed short of the runway due to a throttle control system anomaly that this pilot was unfamiliar with. This VariEze was equipped with an electrically operated nose gear system. Letter follows:

"On April 8th, my VariEze was force landed after the throttle stuck in the closed position while approaching Addison Field for a landing.

The pilot had been practicing formation flying with a Long-EZ flown by a friend. The pilot had been cleared for an approach, as a flight of two, into Addison. Approximately one mile from the runway, the tower requested that the flight reduce speed to the minimum possible to enable a twin on right base to land ahead of the flight. In complying with this request, power was reduced to a minimum. Shortly before this power reduction, the pilot noticed that the knob of the throttle control lever had dropped off. One part of the knob was retrieved and placed under the pilot's thigh for safety.

When the time came to open the throttle to maintain altitude and continue the landing procedure, it was found the throttle would not open more than a half inch. A determined effort to force the throttle open was unsuccessful. The limited opening provided insufficient power to maintain altitude and it was not possible to stretch the glide to reach the runway. It was difficult to try and resolve the problem and fly the aircraft safely at the same time, so the decision was made to concentrate on landing safely. A field that seemed to have fewer wires and other nasties, became the option. The landing was made safely and the aircraft rolled three hundred and fifty feet before being launched back into the air by a sharp rise in the ground. The aircraft then flew over a road and landed on a bank on the other side of the road. The impact came with the plane level but descending almost vertically - what might be termed a genuine pancake. The distance between impact and final stopping place was about ten feet. Damage was extensive; nose gear, which did a great job in absorbing kinetic energy; main gear, folded back; and extensive damage to the fuselage in the attachment area. The landing gear fork, broken by the impact and then folded back under, came through the fuselage floor, through the thigh support and the seat and cut into the pilots right thigh. **Far more destructive was the remains of the electric landing gear which tore loose and destroyed the instrument panel bulkhead, both the radio and transponder, the turn and bank as well as severely bruising the pilot.**

The cause of the throttle problem: The aircraft had had a plans built cable throttle originally. This was later changed to a push/pull, Morse cable which was different from the original in requiring a straight motion from the bottom attach point of the lever. This was achieved by making a second lever, longer from the fulcrum to the lower attach point than the original but using the same fulcrum and control knob pattern. Instead of removing the original lever, the second lever was placed alongside the original, such that both moved together, although the original was now no longer functioning or attached to a cable. When the knob which went through both levers came off, there was no longer any restraint to prevent the levers from moving independently. One fowled against the other and jammed.

With more altitude and thus more time to fiddle around, the problem might have been overcome, or if the pilot had been aware of the way the system had been installed, he might have come up with a way to overcome the jamming. On the other hand, given the circumstance, making the decision without delay and maintaining control probably was a contributing factor in the limited damage the pilot and aircraft sustained.

I am concerned that builders who have installed electric nose landing gear activation may be in for a rude shock if they ever have an off field landing. The operating mechanism is heavy, and potentially a lethal weapon if it comes loose in an accident. I would strongly recommend to those contemplating the use of this gear to have another think. The only thing that saved me from injury from the gear was the almost zero forward speed on impact. I do not want to think about what that bloody great torpedo shaped missile would do to one in a frontal impact situation. When this aircraft is rebuilt, it will definitely have a plans built nose gear."

Update Number 76 to Chapter 13, Nose and Nose Gear

****From CP76-2&3 (CH13,CH21,CH33,CH36,CH39)****

TRUCK-EZ TESTS - THE LATEST ON DEEP STALL

For several years, we have been trying to obtain information and data on the characteristics of various canard-types at deep stall conditions. Data for the VariEze has been available since the late 70's when NASA conducted rotary-balance wind tunnel tests and concluded that the VariEze has no stable spin modes, i.e., that if forced to any angle of attack and spin rate, it will recover by itself. Also, the small model tests showed normal flat-plate drag at high angles of attack. These data and extensive stall-departure flight tests with N4EZ formed the basis for our confidence in the deep-stall safety of these general aircraft types.

Then, about 5 years ago, several accidents occurred with the Velocity aircraft. We think the problem could have been determined if extensive aft-CG departure testing had been done during development, like we did with the Long-EZ and Defiant. Two very noteworthy results from these Velocity accidents were 1). The descent was a stable, non-rotating condition about 50 to 80 degrees AOA, not recoverable with forward stick or by rocking the wings. 2). The descent was slow enough to allow impact in water without pilot injury.

Rumors were abound about this slow, 1000 ft./min. "parachute-like" descent probably induced by a violent, trapped vortex above the wing. Researching this, we found the rumors were just speculation, that there was no hard data on the descent rate. Even the test pilot who stayed with a Velocity to the ocean instead of using his parachute admitted he had not timed the altimeter nor remembered the rate-of-climb indicator's data. He merely climbed partially out, but feeling the "light breeze" of the descent, elected to ride it down. We have been extremely skeptical that an airplane can descend at this low rate, even with the best possible vortex. To put things in perspective, consider what would be required. The EZs and the Velocity have a "loading" of about 10 lb. per square foot of total planform area (including wings, canard, fuselage strakes and cowl). If all this area acts like a "flat plate" in the descent, the airplane would sink at 50 knots or 5000 ft./min. (flat plate Cd=1.24). The very highest Cd we have seen in aerodynamic research papers on trapped vortex is about 10. Using a Cd of 10 for the entire airplane (very unlikely, of course), the sink rate would be 17 knots or 1800 ft./min. If the airplane could descend flat at 1000 ft./min. (only 9.9 knots), it would have a Cd over 30!!

Our interest in this phenomena certainly was increased after the deep stall accident of a Long-EZ at Kanab (CP 68). Now we had some data, but very poor data. Only a tiny image of the airplane during the last 2.8 seconds on a video tape. This airplane hit the dirt without killing the pilot so we believed it could not have been descending at 5000 ft./min. An attempt to analyze the video resulted in a very rough approximation of 2900 ft./min. which results in a Cd of 3.7. Our surprise, of course, was that forward stick did not recover from the deep stall. The surprise subsided when we later learned that the airplane was being flown with the CG well aft of the FS 103 aft limit.

While the 2900 ft./min. sink estimate seemed to make sense, it was not considered accurate due to the problem of measuring a fuzzy blip on the video. We then made a decision to try to gather full scale data on the Long-EZ. The previous full scale tests done in Florida on the Velocity did not measure drag and lift, only the more important data of recoverability with various airplane modifications.

Then, another Velocity deep stall accident occurred. This one descended inverted, hit land, not water, and killed the pilot. In this accident data was available - good, accurate radar and transponder data. Obtaining this data from the FAA is a story in itself.. Finally, after threatening a media expose about government cover-up, we received the data. This Velocity entered a deep stall at about 7000 ft. and descended at a nearly constant 4400 ft./min. (44 knots) for the entire 90 seconds to impact. Of course, this inverted descent data may not apply to an upright Velocity but, at least, for the first time it represented good data during a deep stall accident.

We proceeded to develop the rig to allow us to measure the Long-EZ. This turned out to be a much more difficult and expensive job than originally thought. It was made possible by the loan from Donald Douglas of Sherman Oaks, CA of his Long-EZ that is accurately built to the plans, without modifications. A 3-axis electronic balance was built to measure lift, drag and pitching moment and an accurate speed indicator was installed in front of an Isuzu truck. These "Truck-EZ" tests can only be done in dead calm winds, so after many delays, we were able to obtain data at 40, 50, 60, 71 & 80 degrees angle of attack.

The data are presented in this newsletter. Note that these are full-scale tests at near the same Reynolds number as flight, so they are much more accurate than the small scale model tests done by NASA in the 70's.

First, let's discuss the lift and drag data. The data show substantial scatter due to the truck riding over bumps in the runway. A line faired through the average of scatter is considered reliable. If we combine the lift and drag resolved to a total reaction that would support the airplane during a stable deep stall descent, we can calculate the sink rate. This data, sink rate vs. angle of attack, is shown. Note that this prediction is very close to the radar data of the Velocity (4400 fpm).

Now, how slow does a Velocity descend upright in the deep stall attitude? We don't know, but we now tend to suspect that it is relatively high, 3500 to 4500 ft./min. We reason that the low damage and pilot survival is related to the fact that the water impact is nose down and the bottom fuselage is curved, this allows a few feet of deceleration at impact which can explain the lack of pilot injury.

How slow does a Long-EZ descend in a deep stall attitude? First of all, our pitching moment data show that it cannot descend at the extremely flat attitude of 70 to 90 degrees angle of attack. The pitch data indicated that if the CG is aft of limit, say F.S. 106, the aircraft may hang up at about 40 to 50 degrees angle of attack. It would then descent at about 5000 feet per minute. Why did the Kanab pilot survive? Possibly the nose-low attitude allowed a couple of feet of "crush and rotate" deceleration that provided adequate protection.

Our concern now is that there are many Long-EZs with extensive modifications that can affect deep stall recovery (long noses, bigger strakes, baggage pods, etc.). While we do not approve these modifications and can't be expected to analyze or test each one, we do feel obliged to encourage everyone to conduct adequate testing to determine the safety of their own modified airplane. Conduct stall tests at the CGs you fly, with adequate altitude for a parachute jump (egress above 8000 ft. AGL). Do not ride it down, even over water.

Another concern is that many of you do not accurately know your CG position. Calculating weight and balance is a pilot's responsibility (FAR 21) for each flight. Be sure you fly within limits (your <u>own</u> test-verified limits for modified airplanes) and check CG when any changes are made.

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF LIFT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF SINK RATE, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF DRAG COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-13 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF MOMENT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

See pages 2 and 3 in this CP for article "Truck-EZ Test.

****From CP76-14 (CH13,CH21,CH33,CH36,CH39)****
Donald Douglas lent us his beautiful plans-built Long-EZ so that we could generate the full scale, angle-of-attack data using this "Truck-EZ" rig. Many thanks, Don. **PHOTOGRAPH OMITTED**

Chapter 13, Nose and Nose Gear

Long-EZ Plans Changes

From CP25-6 (CH4,CH13)
LPC #23, MEO, Page 13-6.
NG 31 is called out of R45 dark blue foam, should be R100 1/4" red foam, see page 2-3. Also note on page 2-3 that F28 can easily be cut in one piece from the instrument panel foam sheet.

From CP25-6 (CH13)
LPC #27, DES.
For rough or grass fields and to relieve stress on nosegear components, install the spring assembly (page 8) in place of the NG 9/10A rod. **DRAWINGS OMITTED**

From CP27-7 (CH2,CH10,CH13,CH31)
LPC #53 MEO Page 2-1
Add CLI and NG5 to Brock list.

From CP30-9 (CH13,CH38)
LPC #86 MAN/10HRS Rudder pedal weldments.
Before 10 hours of flight the top tab welded to the rudder pedal (see section I, page 13-3) must be reinforced per Figure 2, page 5 this newsletter. Also change the full size drawings on page 13-3 to show the top tab per Figure 1, page 5 this CP.

From CP30-9 (CH13)
LPC #87 Chapter 13, page 4.
Change wall thickness on NG17 to .188. Change wire diameter of spring to .083.

Prefabricated Parts

From CP40-4 (CH2,CH13,CH21)
CAUTION - Unauthorized Prefab Parts For The Long-EZ
It has recently come to our attention that there are some prefabricated nose cones for Long-EZs, as well as other parts, such as fuel/baggage strakes, that are being misrepresented as being approved by RAF. The only RAF approved prefab Long-EZ parts, are manufactured by Task Research of Santa Paula, California. These parts are sold through Wicks, Aircraft Spruce and Task Research.

The prefab nose cone in particular is manufactured from non approved glass and polyester resin. It is not a sandwich construction, is heavy and would be difficult to incorporate safely into a Long-EZ. The nose section of a Long has to be able to support the loads taken by the nose gear. In order to do this safely, we believe the plans should be followed as closely as possible. The Long-EZ nose is not simply a fairing, it is a structural sandwich, composite design that should not be compromised.

From CP45-6 (CH2,CH9,CH13,CH30)
PREFAB GLASS PARTS
Larry Lombard, owner/builder of VariEze N15LL, one of the highest time EZs we know of with over 1200 hours, is now on line and is making **Long-EZ main and nose gears** and is set up to make Defiant gear.

Larry is working on tooling for Defiant cowlings and fuel strakes and would appreciate hearing from Defiant builders who would be interested in these parts.

He has available tooling for Long-EZ cowlings and wheel pants, VariEze cowlings and wheel pants and can take orders for these parts. We would request however, that if you are ready and need a cowling or a pair of wheel pants, that you contact either Aircraft Spruce and Wicks Aircraft first, since they may still have a few of these parts in stock and we would like to deplete their stock before Larry starts.

Mike Melvill and Michael Dilley flew up to northern California and spent the day with Larry, checking out his equipment and also helped him run the first Long-EZ gear. Larry has built a really nice hanger/shop right on the Boonville airport which is north of San Francisco and west of Ukaiah. He has just completed a first class oven in which to cure the gear. All of the equipment worked well and he is now ready to accept orders.

Larry will be handling all of these parts directly and you should contact him at:

P.O. Box 781
13451 Airport Road,
Boonville, CA 95415
707-895-2718

Larry has a very extensive background in working with composites. He had built several homebuilt aircraft including his own VariEze, and worked here at RAF for two years during which time he helped build the Grizzly and Solitaire. Larry will be working in close conjunction with RAF and we are confident that he will produce high quality parts at reasonable prices.

From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)

PRE-FABRICATED COMPOSITE PARTS

Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS

Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. **Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended.** We have been able to trim some weight from the 500 x 5 wheel pants. **In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.**

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING

From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE

For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS

We are pleased to announce three new products to our line.

1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. **NG-30 cover at $19.95.**

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415 (707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

****From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)****
FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	**55.00**
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom) weight saved, approx. 6 lbs.	448.00
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert. 500 x 5 tires)	155.25
NG30 cover (optional)	**19.95**
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	**17.85**
nose wheel cover - NG	**17.85**
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.

Contact: Michael or Larry at: FeatherLite, Inc.
P.O. Box 781
Boonville, CA 95415
(707)895-2718

Miscellaneous

From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)

BUILDER HINTS

You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. This works great for hotwire templates too.

From CP35-10 (CH13,CH22,CH24)

Cabin Heat

These are excellent heaters, small, lightweight and reliable. Mike gave his a good test a few weeks ago when he climbed to 23,000 feet to do some fuel flow testing. The temperature was -25 degrees C and yet he says his feet were quite comfortable.

The most important thing is to seal every little gap where air might blow in, as best you can. **Make a cover to go over the top of the nose gear crank mechanism, between the NG30 bulkheads (2 plies BID).** Seal around the canard to fuselage juncture, using RTV silicone. Seal the gaps fore and aft of the elevator torque tubes with soft sponge rubber, glue it to the canard and fuselage with RTV silicone. Be certain that there is no interference or friction with full elevator travel. Most important, you battery must be the manifolded type and it is mandatory that it is vented overboard. For 12 volt systems the 20 amp model will probably be best for most, while for 24 volt systems, the 16 amp model is fine. Mike uses a 24 volt, 16 amp model, since his Long-EZ is 24 volt. When using this cabin heater you must have at least 20 amp (10 for 24 volt system) alternator output above other drains.

From CP39-7 (CH13,CH22)

VariEze and Long-EZ - Transponder antenna. Bob Beard installed his antenna forward of his right rudder pedal on the floor. An aluminum ground plane at least 5" in diameter (larger is better) is siliconed to the floor. The antenna is bolted to the ground plane so it sticks out through the bottom about 1". This antenna really works great.

From CP39-9 (CH13)(Photo Caption)

A typical Long-EZ "nose gear area" installation. Note the furniture clamp holding the NG-30 assembly to the F22 bulkhead.

From CP61-14 (CH13)(Photo caption)

Sam Kreidel's nifty battery access door. It is held shut by two small camlock screws. This is Sam's second Long-EZ and this one is something pretty special!

Retract Assembly

From CP30-7 (CH13,CH38)

Worm/Wormgear Retract Mechanism

Some builders have experienced "chatter" when extending the nose gear while static on the ground. While this has never been a problem in the air, due to air loads, it is possible to minimize this by checking alignment of worm and wormgear, and also backlash between worm and wormgear. If you have fore-aft movement of the worm, use a washer to shim it snug. This will eliminate the chatter.

From CP31-4 (CH13)

Caution - Nose gear crank systems on both VariEze and Long-EZ, must have the two NG14 heavy wall aluminum tubes installed. These parts may not have been included in your nose gear actuator assembly from Brock.

From CP34-8 (CH13)

Gerald Collins reports that he had a problem with his nose gear retract system. When he taxied over rough ground, occasionally he noticed the handle would turn perhaps a half turn. He paid no attention, until taxiing at no more than 10 mph over rough asphalt, he was suddenly looking down at the taxiway. The retract mechanism had bounced out of the over center position. This put all the loads on the cast iron worm gear, which stripped and let the plane down hard on its nose block. Nose damage was minimal. To minimize the possibility of this occurring, be certain that your nose gear box is mounted at the correct angle so that when it is down and locked, it is well over center as shown in the plans. The installed system generally had adequate friction to prevent backoff. However, if your mechanism becomes loose and allows your gear to extend a little in flight, you can install a spring loaded friction lock. (See sketch). **SKETCH OMITTED**

From CP38-5 (CH13)

Worm Gear in Nose Gear Mechanism - VariEze, Long-EZ and VariViggen

If you buy the worm gear from Boston Gear, it will not be a solid gear, but will have holes in the hub area. This can still be used, but must have the holes filled first. We simply used flox. See sketch. **SKETCH OMITTED**

If you would prefer a solid gear as shown in the plans, the only source we are aware of is from Ken Brock Mfg. Brock also sells this gear for VariViggen builders, for the main gear retract mechanism.

From CP43-5 (CH13,CH38)

VariEze and Long-EZ - Nose gear chattering.

George Dyer is a gear expert and we sure appreciate this excellent hint.

"The following procedure will reduce and in most cases eliminate the chattering of the nose gear during lowering and some reported cases of inadvertent lowering in flight during turbulent weather conditions. This condition is caused by the weight of the nose gear wheel assembly pulling the gear housing arm (NG50) and causing it to over run the speed of the rotating worm gear (NG58) during lowering. An axial thrust load on the low speed shaft (NG52) will resist the weight and over running condition. The nose gear housing sides (NG51) and (NG30) are considered a flexible gear housing and require a greater axial thrust load present on the low speed shaft (NG52) than a rigid gear housing to eliminate the low speed gear (NG53) over running the worm hear (NG58) during lowering which results in a chattering sound. This can eventually result in gear fatigue.

To accomplish the axial thrust load, washers (AN960-1016), regular or light thickness, need to be added on the low speed shaft between the NG55 spacer and the NG53 bearing as required to achieve an even clearance of .030" to .060" at points A and B shown on figure #1. Clearance should be set before the gear housing is installed in the plane since you will be unable to determine the thrust load clearance when installed.

Both bearings (NG54) should be lubricated with a grease type lubricant before installation.

If there are any questions or problems, please feel free to give me a call or write: George Dyer, 6221 Chapman Ave, Garden Grove, CA 92645, 714-894-6448". **SKETCH OMITTED**

From CP46-3&4 (CH13,CH22,CH25,CH30,CH38)

N26MS, MIKE AND SALLY'S LONG-EZ - the first 1000 hours.

As many of you (who attended the RAF flyin in June and also Oshkosh this year), will know we have given our "old" Long-EZ a face lift. It is hard to believe, but she will be 5 years old this December.

It all started when Mike decided (and the check book said ok) that we needed a Loran C!! After much looking around, we opted for the MicroLogic ML6500. Our reasoning included, easy to operate, fully automatic chain selection and a size and shape that would fit our panel. It turned out that the panel had to be cut out and a completely new one be designed, built and installed! While we were at it, we tore out all the wiring (it was done in a hurry and Mike was never very happy with it). Our panel night lighting was never very good, so we installed post lights over all the instruments, as well as a dimmer switch. Panel lighting at night is now superb.

In order to do all this work, we removed the wings and canard, cut out the side consoles, cut out the instrument panel, reshaped the nose to allow installation of brake master cylinders up front and optimum placement of the two 12 volt motorcycle batteries, that make up our 24 volt electrical system. We also reshaped the cowling extending it aft a full 3" to reduce the closure angle and hopefully reduce drag a bit.

The structure was given a very thorough inspection, wing attach hardpoints looked like the first day they were put together. We are extremely pleased with the composite structure. A few small cracks were found in the paint, all were examined, by removing all finish down to the glass. In no case did any crack extend into the glass, we are ashamed to admit that each crack was over a rather generous build up of Bondo! The moral here is use dry micro not Bondo. We did a little recontouring, filling with West System, sanding and priming with Mortons Eliminator. We installed the new Roncz 1145MS canard, carefully fairing it into the nose. **We designed and built two battery access doors (they work nicely, but are not worth the amount of work it took).** We installed the Loran C antenna in the left winglet. Then we wet sanded the original Imron finish down until the whole airplane was dull.

Mike sprayed the entire airplane with Imron using a slightly whiter white than we used last time, and we trimmed it in metallic gray instead of the green we used the first time. We had the seat cushions recovered in gray to match the trim. All the consoles were glued and glassed back into place, the interior was once again painted in charcoal gray Zolatone. We installed the Ian Ayton's canopy/gear warning systems, (it flashes the warning light and buzzes the horn intermittently). We cannot say enough about this system. It is really neat. It is small, easy to install and you absolutely cannot ignore it. If you override the horn, the light continues to flash, and in about 50 seconds, the horn starts to buzz again, a very worthwhile addition and one we both heartily recommend.

When we finally reassembled her, she looked like new! We did a careful weight and balance on 3 certified aircraft scales (naturally she had put on a little weight), then we rolled her outside, fired her up and went flying.

The whole face lift was supposed to take a few weeks and in fact ended up taking over three months. (It only took 5 1/2 months to build her from scratch!!)

The Loran C works well. We get SNRs (signal to noise ratio) of 99 on the master as well as both slave stations, with everything turned on, engine running and in flight. This is true in the Mojave, Bakersfield, Fresno area at least where the testing was done. Obviously there are many places where we cannot get these kind of optimum results. The antenna we use is a 3/16" O.D. hobby store brass tube. We sharpened the end, put it in an electric drill, and "drilled" it into the bottom of the lower winglet, pushing it all the way to the top of the winglet. It goes up the leading edge of the upper winglet. We soldered the preamp to the bottom of this brass tube, removed a wingtip light assembly, dug out a little foam and installed the preamp behind the wingtip light. We are very pleased with this simple, cheap antenna.

We recently installed miniature fuel and oil pressure gauges (1 1/4" dia) that read actual pressure (not electrons!). They are plumbed directly from the engine to the instrument. We used nyloseal tubing fittings. These are really great little instruments, a bit expensive, but worth it. (See page 206 in the Aircraft Spruce catalog). In addition we have an Electronics International digital CHT-EGT with a four way switch, so we can look at all four cylinders. We bought an oil temperature probe and connected the cylinder #1 EGT to the oil temp. Thus we have 4 CHT, 3 EGT and oil temperature in one gauge. Also in this small side panel, is a digital voltmeter by Davtron. Again, expensive but worth it. We know exactly how the electrical system, alternator charge, etc is doing, plus or minus 0.1 volt.

The only item that really required maintenance was the nose gear strut and associated pivots. Mike removed the top bolt and took the whole strut out. The bushings in the NG-6 assembly (NG-23 as shown on Page 13-1) were quite worn allowing considerable side to side play in the top pivot. Mike machined up two steel bushings, pressed them into the NG-6 casting then reamed them to be a very close fit on the NG-7 spacer. A grease fitting (Zerk) was installed in the NG-6 casting allowing future lubrication of this pivot without dismantling it. The two HM-6 rodend bearings in the shock strut were also somewhat worn, allowing some fore-aft movement of the nose gear strut. We replaced these rodend bearings with very expensive aircraft quality rodend bearings (approximately $25.00 each) which essentially eliminate any play.

The vertical pivot at the nose wheel fork had already been overhauled per CP 44, page 7. Thus the entire nose gear strut and wheel has received a complete major overhaul. It is now working flawlessly and we are very pleased with the above modification and repairs.

The brake master cylinders up forward modification was done for three reasons: To help move the CG forward, to allow better access for inspection and hydraulic fluid replacement, and to also allow better access to the magnetos.

Mike designed this particular installation, it works quite well, but if we were to do it again, we would use Debbie Iwatate's method. (See "for sale" this CP).

We did find one drawback to the forward mounted brake cylinders, that we had not foreseen. It is now quite difficult to adjust the rudder position for various size pilots. The original design used only adjustment to lengthen or shorten the cable aft of the pedal. Now we have to <u>also</u> adjust the pedal to brake master cylinder relationship, which with our design is awkward. As a result no one else gets to fly our Long - advantage or disadvantage?!?!?!

We have also done a lot of work on optimizing engine and oil cooling. At this point in time though it is too early for us to comment on the success. We are flying the airplane quite a lot, in fact since Oshkosh we have put over 100 hours on her. N26MS continues to meet or exceed our expectations. We have enjoyed nearly 5 years of fun flying, visiting faraway places and meeting interesting people. We are looking forward to the next 1000 hours.

****From CP46-7 (CH13,CH38)****
<u>NOSE GEARS ON ALL EZs</u>
Several builder/flyers have reported having the nose gear vibrate or jump out of the over center, down and locked position when landing hard, or on a rough runway. Should this happen, it will normally result in the gear retracting, allowing the airplane to come to rest on its nose. This will almost always result in the cast iron worm gear being stripped of its teeth. Keep in mind that this gear is <u>never</u> supposed to see any load greater than the retract or extend load. It <u>will not</u> support the airplane if the load gets into this gear. The design calls for the mechanism to crank the nose wheel down at which point the NG10A strut or shock strut takes <u>all</u> the load in compression and dumps this load through the NG50 weldment into the NG-14 spacer and AN4-41A bolt. See page 13-2 (Long-EZ, Section I). The worm and worm gear see zero load at this point.

If your airplane has shown signs of the nose gear handle trying to wind down on a rough runway, you need to check that your mechanism does indeed go <u>over center</u> and perhaps rig up some sort of a friction device at the instrument panel, behind the gear handle. If you are unfortunate enough to strip a gear, you can save the day, by turning the gear 180 degrees and using the other half. This trick only works once though.

****From CP48-3 (CH13,CH33)****
<u>NOSE GEAR MISTREATMENT</u>
We have noticed a growing tendency among EZ owners to set the nose gear at one-half to two-thirds down and then leave the airplane sitting on its 3 wheels. This is asking for a stripped worm gear in the retract mechanism. Take a look at the drawings. It should be obvious that the worm/worm gear never sees the load. With the gear down and locked, the pushrod is in an overcenter position and takes all the load in compression. The worm/worm gear mechanism only takes the weight of the gear driving the retract/extend cycle and that is all it is ever designed to do. It cannot carry the weight of the airplane and will strip instantly if you ever allow it to "see" the weight of the nose plus a pilot. Park it nose down, or tie it down with the nose gear extended.

From CP62-5 (CH13)
Nose Gear Crank Getting Loose?

Curt Smith may have just the thing for you. He uses the ratchet out of a Craftsman socket drive to hold the gear in the up, as well as in the down, position. Since the little gear inside the Craftsman socket drive must be annealed, machined than reheat treated, he is offering to do this and will sell you one, ready to install for $29.95. This has been an area of concern for several years and many ideas have been tried by many different people. The ratchet holds the gear handle firmly all the way gear up, then, flip the ratchet lever and the same ratchet holds the gear handle firmly in the gear down position - sounds great, wish we had thought of this years ago!

Send $29.95 to: Curt Smith
5114 Canaan Center Rd
Wooster, OH 44691
216-345-6571

From CP65-9&10 (CH13)
NOSE GEAR "RATCHET" CRANK
Dr. Curtis Smith of Wooster, OH has developed a neat little method of assuring that the nose gear on a VariEze or a Long-EZ remains securely locked in both the gear-up and the gear-down position. This editor has already recommended this nose gear crank ratchet in CP ? last year. That recommendation was based on a description and photo of the mechanism.

Recently we had the opportunity to help install one of Curtis Smith's little gadgets and to see just exactly what it was, how it worked and how difficult it was to install. The installation went quite quickly and was not difficult. The only problems we experienced were that the existing Brock-supplied crank handle shaft was not a perfect fit in the inside diameter of the case-hardened gear and it was a tough job drilling through the hardened gear in order to install the required, and supplied, "split" pin. It took about an hour to complete the installation. The idea is to use a 1/4" ratchet wrench drive to lock the crank handle in the gear-up and the gear-down position. To crank it in the opposite direction, the pilot must position the little ratchet lever as required. It looks good and it works so well you wonder why you did not think of it! It is a marvelously simple idea and is a must for all EZ drivers. It virtually eliminates the concern of having the nose gear retract while taxiing or landing on a rough surface. It also ensures that the nose gear does not vibrate down in flight. This editor recommends Curtis Smith's clever idea without reservation.

Contact: Dr. Curtis Smith
5114 Canaan Center Rd.
Wooster, OH 44691

Enclose a check or S34.95 which includes shipping. Due to the machining and heat treatment required, allow 6 to 8 weeks for delivery.

Shock Strut

Also see CP51-5 in the "Nose Wheel/Fork Assembly" section of this chapter.

From CP25-3 (CH13)
MODIFIED LONG-EZ NOW APPROVED FOR GRASS FIELDS
Rutan Aircraft has recently tested a spring loaded "shock strut" which was installed in place of the NG-9/NG-10A rod on Long-EZ. This, combined with 500 x 5 main tires, was tested by progressively taxiing over 1" x 2", 2" x 4" 's and finally over two 2" x 4" 's, one on top of the other. The results showed a very significant increase in the rough-field absorption qualities of the landing gear. Taxiing over stacked 2" x 4" 's resulted in very acceptable loads, with a satisfactory ride.

We then flew N79RA to a average grass strip and conducted takeoffs and landing at a range of weights and cg positions. Also, taxi test in tall grass and undulating surfaces was satisfactory. A Long-EZ with the spring strut and 500 x 5 main tires is now approved to operate from average grass fields. This does not mean it is acceptable for gravel or unprepared/rough surface. The prop damage that can result from operating on gravel is unacceptable.

The spring strut is installed by simply removing the 2 bolts on the NG 10A pushrod and replacing it with the spring assembly. Additional clearance is required by trimming away a portion of the strut cover.

The spring is intended primarily for the Long-EZ, to give it the grass capability, however VariEze owners may want to install it to improve the rough field handling of the nose gear. The spring allows the gear to deflect aft and up when a bump or hole is encountered, and greatly reduces the loads on all parts (strut, NG10A, castings fork and wheel). The Long-EZ fiberglass strut is stiffer than the VariEze, thus the new spring is strongly recommended unless you plan to always operate from smooth surfaces. Without it, nose gear damage may occur from rough surfaces.

Note: This is not intended to provide grass field capability for the VariEze. Its faster takeoff/landing speed and inability to use 500 x 5 tires makes it unacceptable for grass.

The strut, ready to install, is being made available by Ken Brock. Ken will also stock the LST-6 spring for those wanting to build their own. Refer to the drawing in this newsletter. Several different spring configurations were tested until arriving at the 1.5 x 4" heavy duty rectangular coil spring. If building your own, shim as required to obtain the specified 250 lb preload. The strut should not deflect when static with pilot in cockpit and full fuel. **DRAWINGS OMITTED**

****From CP26-4 (CH13)****

FROM LAURENT MORELLE, FRANCE - "First flight 10 July 1980 for F-PYHT and no problem. It is a wonderful machine, I won Grand Champion cup at Brienne Le Chateau show and VariEze G-LASS (Don Foreman, England) won best foreign aircraft. Four other EZ's are flying in France. Mr. Lesschaeve reports the 5 EZ's were at the Brienne Le Chateau including Rudi Kurth (Switerland) and Mr. Ghimbal and Briguet of France. **Our development of the nose gear shock strut (CP #25) was preceded by Mr. Bruno Ghimbal who uses a polyurethane damper on his VariEze nosegear.** He reports it rides "like a Citroen CX!".

****From CP26-4 (CH13)****

FROM DR. JOHN STEICHEN - "I would recommend the shock strut for all VariEzes. I recently removed the bolt from NG10 and found it bent with no memory of any pot holes".

****From CP54-5 (CH13,CH38)****

NOSE GEAR SHOCK STRUT SPRING REPLACEMENT

Several builders have reported a 3 to 5 knot reduction in nose wheel lift off speed after replacing the "sagging" old LST spring as called out in CP51. The easiest way to remove the LST spring is to leave NG-3 and NG-5 attached. Remove the retainer bolt nut and, with the gear in the extended position, have someone push down on the nose. You can now easily lift out the retainer bolt and the shock strut will come apart for easy replacement of the LST spring. Look for wear on the retainer bolt, replace the bolt if there is any sign of grooves worn into it. Look for sharp edges on the LST-2 slotted holes, dress these down with a smooth file if necessary. Apply a generous quantity of grease to the shock strut before re-assembly. If your nose gear shock strut comes off the extended stop when you get into your EZ, you need a new LST spring which is available from Ken Brock Mfg.

****From CP54-5&6 (CH13)****

Nose Gear Shock Strut

Reference Long-EZ plans, 13-2, and CP25, page 8

The rod ends used on the shock strut can be either RE4M6, REP4M6, or HM-6. RE4M6 and REP4M6 are functionally and dimensionally equivalent, the difference being the RE4M6 are "new surplus" with solid metal seals, and the REP4M6 are of new manufacture with Plyo-Seal or Teflon seals.

The major difference between the "RE" rod ends and the HM-6 rod end is the diameter of the hole machined into the ball of the rod end. The "RE" rod ends have a 1/4" diameter hole in the ball, while the HM-6 rod end comes with a .3750 (3/8") diameter hole.

The "RE" rod ends can be used "out of the box" because you will be using AN4 (1/4" dia.) bolts through the rod end ball. The HM-6 rod ends, however, need a bushing to reduce the bore size from 3/8" to 1/4". These bushings can be ordered from Aircraft Spruce along with your HM-6 rod end for an additional $1.00 each. The Wicks catalog does not list the required bushing, however, they may be available upon request.

If you desire to make the bushings yourself (as I did), it's a very easy task. First, get ahold of a piece of 3/8" OD x 1/4" ID 1015/1020 steel bushing stock. Both wicks and Aircraft Spruce carry this item for under $2.50 per foot. The bushing stock I ordered was a perfect slip fit into the HM-6 ball, however, the 1/4" ID was a little undersize. A 1/4" reamer took care of this problem in short order. The length of you bushings should be slightly less (approx. 1/16" less) than the width of the ball. After cutting the bushing stock to the approximate length with a hack saw, chuck the bushing into your drill and face the ends of the busing with a metal file, until the bushing is the proper length. The whole process took me less than an hour.

It is much simpler to use the "RE" rod ends instead of the HM-6's with bushing, however, there is another factor you should consider before you make you decision. PRICE! A quick comparison of the price difference between the HM-6's and the "RE's" will show a savings of over $16.00 each in using the HM-6's, or a savings of over $32.00 for the two required for the shock strut."

The above sent in by Stet Elliott who has been working hard on a complete computer printout of all CP's from #24 to the present, listing all hints and changes in chapter form. We are looking forward to this and will announce it in the CP when it is available.

EDITOR'S NOTE: If you have a 'heavy' Long-EZ or you are on the heavy side, you would be wise to increase the AN4-15A bolt to an AN5-15A. This would require drilling and reaming the 1/4" hole in NG-3 and NG-4 to 5/16" and you would need to drill and ream the HM-6 "bushings" to fit a 5/16" bolt.

From CP61-5 (CH13)

STRONGER, STIFFER NOSE GEAR SHOCK SPRING.

Nat Puffer, designer of the Cozy, has found and has tested a shock strut spring that is much stronger than the original. Several Long-EZ builders have tried this spring and all have reported good results. If your shock strut does not stay all the way up with you in the pilot seat, you may want to consider one of these springs. The are available from:

Danley Die Set
3019 South Tanager
Los Angeles, CA 90040
213-685-8151

Nose Wheel/Fork Assembly

Also see LPC #87 in the "Long-EZ Plans Changes" section of this chapter.

From CP30-4 (CH13,CH38)

CAUTION: Nose gear shimmy can fail the nose gear fork.

Many of us operating EZs are lax on checking the friction of the shimmy damper during preflight. This is EZ to do since we do not see the nose gear when parked nose down. Always check for the 2 to 4 lb. damper friction on preflight. If the damper is free, the gear can shimmy at high speed and fail the fork within 1/4 second. Further, the failed wheel can strike and destroy your prop.

Nose wheel rigged at the proper angle and having at least 2-lbs. friction damping cannot shimmy. Some airplanes have had a bent NG17 tube that binds under load. Then, the owner backs off and the friction adjustment to allow good taxi qualities. Then with little or no load (rebound) at high speed it can and will shimmy. If your gear pivot binds, making taxi turns difficult, check you NG17 for evidence of bending, or ovalizing. Some time ago we increased the wall thickness on the Long-EZ NG17 part sold by Brock to handle the heavier loads. If your NG17 is not perfectly straight, replace it with a steel tube of at least .125" wall.

One of the reasons that the shimmy damper can easily get out of adjustment is that to get the proper force, the spring is coil-bound or nearly coil-bound. Thus, if a little wear or a slight bolt back-off occurs, the damping action is lost. To solve this, Brock is now having made a supply of springs with a heavier (.083 diameter) wire. The orders filled after October will have the heavy spring. Also, as soon as they are received (mid November) Brock will be sending the heavy spring to all who have bought the nose gear assembly. We have tested the heavy spring on N26MS and have confirmed that the adjustment bolt can be backed off a full half turn before losing adequate damping friction. With the old spring a 1/8 turn would result in inadequate friction.

The shimmy failures have resulted in the rumor that the nose gear fork is not strong enough. This is not true. The failures were due to high speed shimmy, not overload. Our nosegears have been extensively tested to in excess of design ultimate loads (CP #18, page 4) and during punishing development tests of the rough field capability (CP #25, page 3). Also, the exact assembly is currently operating at higher weights (2,100 lbs.) and speeds (90 kts) in two jet aircraft, the NASA AD-1 and Model 73 NGT, without problems of any kind. Of course, the friction is checked during each preflight.

We strongly recommend that each Long-EZ and VariEze use the CP #25 spring shock in the nose system. This greatly relieves the shock loads experienced when encountering ruts, chuck holes etc.

From CP32-6 (CH13,CH38)

CAUTION: Nose Gear Pivot

Correctly installed, the pivot axis should be between vertical and 5 degrees from vertical with the top aft. See sketch on page 13-1, Section I. We recently saw a Long-EZ that had the pivot oriented top forward. Under these conditions, the nose wheel is susceptible to violent shimmy which will fail the fork. Never taxi or fly an EZ if the shimmy damper is not set within limits.

From CP33-6 (CH13,CH38)

NOSE WHEEL SHIMMY/FAILURE

We have heard of three more nose wheel fork failures. This is a part of our airplanes we seldom see; it is retracted when parked and we are usually in the seat when the gear is extended. Do not neglect to check you nose wheel during your preflight. Pay particular attention to the friction damper. You should grab the tire as far aft as possible and swing the fork left and right. It should take 2 to 4 lbs. of force to do this. If you are not certain how much 2 to 4 lbs. is, use a spring scale to calibrate yourself. If you have less than 2 lbs., it is possible for the nose wheel to shimmy. This shimmy or flutter instantly goes divergent and in only a fraction of a second the fork will fail, due to side loads. The nose wheel/fork, can bounce back and go through the prop. The nose wheel fork is designed with more than enough integrity to take the maximum expected landing loads and has been tested to over 80% above the FAR Part #23 requirement without failure (see CP #18). This type of failure caused by shimmy generally occurs with very little load on the nose wheel, usually at the very moment of a nose wheel touch down, or even at the moment of nose wheel lift off during a take off. The new shimmy damper spring called out in CP 30, page 4 MUST be installed and correctly adjusted. Also check to see you have no ovalizing or bending of the NG17 steel tube and that the thick-wall (0.125+ wall) NG17 is installed.

****From CP34-9 (CH13,CH38)****
Nose Wheel Shimmy
We have cautioned EZ pilots about nose gear shimmy damper adjustment in the last two Canard Pushers, yet we still have EZs losing their nosewheels. It is a fact that your nosewheel fork will fail if you experience shimmy on landing or take off. It is also a fact, that if the friction damper is correctly adjusted, you will not have shimmy at all. The nosewheel fork will not fail due to a normal landing. It is very strong, the original fork has been grossly overloaded to the point of failing the NG15A casting and/or the 1/8" aluminum plate on the forward face of the NG15A casting. Yet the fork was not damaged. This has occurred several times. We are satisfied that the fork will fail only if it shimmies. Therefore if you keep the friction damper adjusted and check it regularly, you will not have this problem. Every time you extend the nose gear, just before you get into your EZ, hold the nose wheel clear of the ground and use your foot on the trailing edge of the nosewheel tire to check the friction. You will soon get "calibrated". You should have to push or pull 3 to 5 lbs to pivot the fork.

When taking off, try to rotate positively, hold it down until you have the proper speed, then rotate smoothly. Try to keep the nose wheel from touching back down or skipping, this is when shimmy is most likely, at the instant of a light touchdown. The same applies to landing. Hold the nose wheel off until you are traveling as slowly as possible. Then let the nose down and hold it down with forward stick. Do not let it skip. Avoid nosewheel touchdown at very high speed.

If you follow these simple steps you will minimize any chance of shimmy and therefore the chances of losing a nosewheel. The prototype Long-EZ still has the original thin wall fork and with over 680 hours, has never experienced any shimmy. N26MS has almost 500 hours with probably more take off and landings than the prototype and it too has not had nose gear problems. Dick and Jeana have the high time Long-EZ with over 700 hours and also have not had shimmy or nose wheel failures. There is a lesson here - get into the habit of preflighting your nose gear. Keep your friction damper correctly adjusted.

****From CP38-4 (CH13,CH38)****
Shimmy Damper - VariEze and Long-EZ
If your nose wheel shimmy damper is not holding consistently, check to see if the phenolic "piston" is tight in its vertical hole. If so, ream the hole about .005" oversize to allow a nice free fit on the phenolic "piston". Reassemble, being certain to use the heavy duty spring called out in CP 30, page 4 and this problem should be solved.

****From CP41-5 (CH13,CH38)****
NOSE WHEELS
As we stated once before in CP 34, the nose wheel is prone to being forgotten. After all it is retracted when you are parked and while doing your preflight and when it is extended, you are normally in the front seat and unable to look at it. Get into the habit of extending it and prior to climbing into the seat, use your foot to check the friction damping. It won't take long to "calibrate" your foot and soon you will be aware of how it should feel. If it is loose and swings around with little or no drag, DO NOT FLY. Adjust the friction damper to give 3 to 5 pounds of force required to move it when pushing or pulling at the trailing edge of the tire.

If your airplane has a tendency to turn left or right while taxiing straight ahead on a level taxiway with no wind, you probably have your nose wheel mounted so the the nose wheel itself is not perpendicular to the level ground. We have recently corrected this problem on two Long-EZs by removing the four bolts and the 1/8" aluminum plate from the NG15A casting. Then using a home made "puller", consisting of 4 bolts, lots of washers and a spacer, we were able to pop the NG15A casting loose from the nose gear strut. Local heat such as an industrial heat gun can sometimes help.

We ground away some material at the tip of the nose gear strut, such that we were able to reinstall the nose wheel fork and pivot casting(NG15A) with the wheel itself absolutely perpendicular to the ground, with the aircraft level, sitting on level ground. In both cases this made an immediate and dramatic effect, allowing less use of brakes while taxiing, a shorter take off roll, since little or no braking was required and longer brake pad life.

****From CP42-4&5 (CH9,CH13,CH25,CH30,CH33,CH38)****
LONG TERM MAINTENANCE ITEMS ON EZs
Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - **Nose wheel friction damper seems to loosen after one or two flights.**
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - **A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing.** Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - **Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth.** Of course this strips off about half the teeth on the wormgear.
Solution - Rotate wormgear 180 degrees and you back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

****From CP44-7 (CH13,CH38)****
VARIEZE AND LONG-EZ - Nose wheel pivot. Remove the aluminum collar that retains the nose wheel fork. Drop the complete wheel/fork assembly out of the NG15A casting. Check for wear in the bronze bushings. We found quite a lot of wear on a Long-EZ with 900+ hours, and a couple of builders have reported wear in these bushings that warranted replacement. You can obtain replacement bushings from any bearing supply house. We installed longer bushings this time, for more bearing area and hopefully longer life. These were Oilite bronze flanged bushings, part #FF-838-3, obtained locally in Mojave at the King Bearing store. These bushings were 1" long. We cut them down to 3/4" long to leave space between them as a grease pocket. We also bought (from the same source) two Torrington thrust races parts #TRA-1220. These are essentially large, flat, thin steel washers. They are 1/32" thick and have an I.D. of .752 and an O.D. of 1.240.

We installed one of these between the aluminum fork casting and the bottom flange bushing and one between the top flanged bushing and the aluminum retaining collar. Obviously this takes up more space than is available, so we miked the two Torrington washers, and faced that amount of material off the bottom of the aluminum retaining collar. We applied a generous coat of grease on all moving parts and reassembled the fork to the NG15A casting. We then carefully adjusted our friction "shimmy" damper until we had approximately 5 lbs. of side force required to turn the wheel. When we tested this set up, we found that the nosewheel pivoted very smoothly, and nose wheel steering now required much less braking effort. At least 5 local EZ flyers have done this modification to date, and all have reported a big improvement. We are pleased with the results of this mod, and have found that we can increase the friction damping force, without making it harder to steer, thus dramatically decreasing the likelihood of shimmy or flutter on the nose wheel.

****From CP50-7 (CH13,CH38)****
"Dear Mike,
Thought I should pass on some information about nose wheel tube failures I've experienced and what was done to hopefully prevent future occurrences.

It all started with about 100 hours on the airframe. The nose tire went flat just after landing touchdown. The shimmy got quite violent and it wasn't until after we got it stopped that we knew is was a flat. I thought for sure we had broken something.

It appeared that the tube had been creased when it was originally installed in the tire by the supplier (back in 1976). The tube through use evidently moved around and the creased smoothed out. The failure occurred where the tube was creased, apparently due to it's age. A replacement was obtained from a fellow builder who happened to have a spare from a kit he had picked up.

Sixty hours later the nose tire went flat again. This time, luckily I had just started to taxi when things went all wobbly. The unlucky part was that I was 400 miles from home on a Sunday morning and I had a golfing date 250 miles away. To make a long story short, I was able to talk a very generous local builder into taking the tube from his project so that I could get under way. The failure this time was due to a pinch on the valve stem. This was either poor assembly or that the tire had rotated slightly to cause the interference with the rim.*

Eight hours later and fortunately, during taxi at the home port, another failure occurred. I was beginning to develop a phobia at this point. The failure this time had occurred in a manufactured seam of the tube. There is a good possibility that this tube also was quite old.

This time we replaced both the tire and tube with new (or at least recently purchased) units. We also drilled the rim and installed three equally spaced screws on each side of the wheel to prevent the tire from rotating. This is the same method used by automobile drag racers for years. The screws are self tapping and extend into the bead of the tire about on eighth inch. So far, we've got thirty hours on this setup with no problems.

I would recommend to anyone who has an old inner tube, especially from the 70's vintage kit, to replace it, or them, if the mains are that old also. I was lucky, these failures could have easily resulted in damage to the airplane.

Best regards,
Herman J. Kuebler"

*EDITOR'S NOTE: We have found that the best method of preventing the tire from rotating on the wheel is simply to keep it inflated to at least 40 psi. Because the nosegear is retracted while the EZ is parked, the nose tire gets very little attention and, if the pressure gets down to 15 or 20 lbs., the tire will rotate and the valve will pull out of the tube.

****From CP51-4 (CH13)****

NOSE GEAR/NG-15 CASTING ATTACH

The NG-15 casting is attached to the bottom of the glass strut by potting it in flox and bolting it on with AN525-10R24 screws through a 1/8" thick 2024T3 aluminum plate - (see page 13-9). While these screws can easily handle normal landing loads, a very hard landing may pull the heads off these screws. Several builders have reported to us that this happened to them. The solution is to substitute AN3-14A bolts which can handle a much higher tension load.

****From CP51-5 (CH13,CH38)****

NOSE GEAR CARE

We recently replaced a nose gear shock spring on our Long-EZ (Brock part #LST-6) and were amazed at the difference. We had noticed that while taxiing, the strut would flex off the stop. The spring very slowly loses its capability to support the nose and, over a couple of years, insidiously, this condition gets worse and worse until you are taxiing nose down a few inches. It happens so gradually that you may not notice it. In fact, since we replaced ours, we have been noticing quite a number of Long-EZs that fly into Mojave are taxiing "nose low". If you have noticed that your nose gear rides on the spring as you taxi on a smooth taxiway, chances are you need a new spring.

Shimmy dampers! This has been by far the most frequent maintenance item on the EZs. The problem is that unless you keep your shimmy damper in perfect adjustment, the results can be a broken nose wheel fork. We recently installed an innovative shimmy damper designed by Bob Davenport onto two Long-EZs here in Mojave and so far, the results have been excellent. Bob has gone out and found an excellent machine ship to produce the few parts required to make this shimmy damper a bolt-on kit. Bob's kit is complete and includes stainless steel Belville washers (which provide the spring pressure), the threaded shaft, and all necessary washers, the nut and cotter pin. We have noticed a marked improvement in several areas. There has been no need to adjust it in over 3 months - about 50 hours of flying time. When the nose wheel touches down, it does not move at all when viewed through the little plexiglass window, whereas the original damper always allowed the nose wheel to shake side to side just a little at touchdown. Also, it seems, subjectively, to be easier and smoother to taxi and make turns using the brakes.

We strongly recommend Bob's shimmy damper for all Long-EZs and it will also work well on a VariEze (Paul Mason has been using one on his VariEze for almost two years with no problems whatever). Bob will sell you a complete kit including the drawings and instructions for $39.05 plus shipping.

Contact: Bob Davenport,
PO Box 650581
Vero Beach, FL 32965
303-567-1844

****From CP52-6 (CH13,CH33,CH39)****

The following two incident reports were sent in by Long-EZ builder/flyer, Jimmie Hays.

"I had a totally unnecessary off-airport landing the other day. I pulled the airplane into an exceptionally nose high attitude while bleeding off speed from cruise to do some stall tests. As I pushed over to recover, the carburetor became unported and the engine quit. This wasn't altogether a surprise, but when the engine would not start right away after speed and "G" forces were returned, it was a definite surprise!

I went through all the emergency procedures (several times!), switched tanks, boost pump on, pumped the throttle, tried carb heat, talked to ATC, all to no avail! I was over distinctly unhealthy terrain but, fortunately, there were a couple of fields in gliding distance. I made the decision to lower the nose gear on short final, to absorb some of the landing shock and minimize nose-over possibilities. At about 25 feet, I noticed, for the first time, the tach was resting on zero! Too late to hit the starter, I went ahead with the landing. A very short landing roll in very sandy, loose soil. I am sure happy I decided to put down the nose gear. The only damage was some paint damage and the loss of one vortilon while loading it onto the wrecking truck which got stuck 4 times getting out of the field!

Obviously, checking the tach has now become VERY MUCH a part of my personal engine-out procedures. The prop had stopped in the horizontal position and may not have been noticed, even if I had looked back."

Canopy/Nose Gear Experience

"Less than 6 hours into my test flight period, I failed to lock the canopy before take-off. Everything went perfectly normally through rotation and until the mains came off the runway. Suddenly, the canopy slammed open against the safety catch. The noise level immediately went up from wind and engine noises. I, also immediately, thought of all the stories I'd read about control problems with the canopy open. I reached to grab the canopy with my left hand and my right hand subconsciously followed, driving the nose gear smartly back into the runway. I reacted almost as quickly, raising the nose again, but, alas, the nose wheel was no longer there. What a strange looking thing that nose gear strut is in the bare state when you look at it through the little plexiglass window.

Naturally, the nose wheel assembly had found the prop, so now I also had a lopsided prop to add to my problems. The nose wheel and fork assembly came through the whole affair quite nicely (and is still doing well with 200-plus hours). **The only damage was the four bolts having failed as described in CP51.** I retracted the nose gear strut and landed with minimal skin damage in the nose area. LESSONS LEARNED: 1) Fly the airplane! 2) the airplane would have flown quite nicely with the canopy open against the safety catch. 3) the airplane is distractingly noisy with the canopy partly open. 4) the canopy won't lift against the safety catch until just at take-off speed and attitude. 5) wooden props will keep going with quite a lot of damage. 6) FLY THE AIRPLANE, STUPID!"

****From CP52-6&7 (CH13,CH38)****

BOB DAVENPORT'S NOSE GEAR SHIMMY DAMPER

Unfortunately, Bob have us the wrong area code for his phone number - the correct phone number is 305-567-1844. Bob's address is PO Box 650581, Vero Beach, FL 32965. We continue to run two of Bob's shimmy dampers and grow more and more convinced that this is the only way to go. Bob has complete kits and instructions available for $39.05. We strongly recommend this excellent shimmy damper to all VariEze and Long-EZ flyers.

****From CP54-6 (CH13,CH38)****

NOSE WHEEL/FORK ASSEMBLY ATTACH

The plans call out for (4) AN525-10R24 screws to attach the NG-15A nose gear casting to the 'S' glass strut. As we have reported previously, a really hard landing can pop the heads off these AN525 screws allowing the 1/8" aluminum plate to separate from the NG-15A casting which allows the whole nose wheel/fork/pivot assemble to depart from the strut! We strongly recommend that these AN525 screws be replaced by AN3-14A bolts. These are much stronger and the heads will not pull off as they can do with the AN525.

We have called out this recommended change before but we still get occasional builder/flyers who did not get the word and have ended up with this failure. It is an easy fix - can be done in a few minutes and it can save you much grief and frustration.

****From CP55-6 (CH13,CH38)****

NOSE WHEEL CASTINGS CRACKING AND DISINTEGRATING

We have had several reports of this problem from Long-EZ and VariEze builders and, as we stated in a past CP, you should remove your nose wheel periodically and take it apart, clean it and carefully inspect it for cracks in the cast aluminum center bearing holder. This is especially true if you have ever experienced shimmy in your nose wheel. We have disassembled and examined all of the Brock nose wheels we have here at RAF and have found no sign of any cracking. However, we have seen several examples that were cracked and several more examples that broke and, in fact, disintegrated.

Wicks Aircraft Supply in Highland, Illinois sells a nose wheel that is a direct replacement for the Brock nose wheel that is built just like a miniature of your main wheels. This wheel looks like an excellent alternative although it is a little heavier. If you have had one crack and are looking for something stronger, give Wicks a call. Ask for NW-A1230 nose wheel, they cost around $50.00, fit the same tire and tube and will mount into the EZ for with a minimum of fuss.

From CP56-4 (CH13)

Bob Davenport's nose gear shimmy damper for VariEze and Long-EZ...

This is a very important addition to your EZ. The original plans-built shimmy damper required constant care and adjusting, and in many cases, still allowed the nose wheel to shimmy and break the nose wheel fork. This has happened to a lot of EZ flyers. Don't let it happen to you. Contact:

Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
305-567-1844

From CP57-6 (CH13)

SHIMMY DAMPER

Any VariEze or Long-EZ still flying with the original shimmy damper is running a serious risk of nosewheel shimmy and possible loss of the nosewheel and fork. Contrary to popular belief, it is not a hard landing that will break the nosewheel fork. It is shimmy! Control the shimmy and the problem is eliminated. Bob Davenport has designed, and offers for sale, the best solution to this problem we have seen.

Contact: Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
305-567-1844

From CP59-10 (CH13)

NOSE WHEEL SHIMMY DAMPERS

If you still have the original plans nosewheel shimmy damping set up, you are risking nose wheel shimmy and possible nose fork failure. Bob Davenport, a Long-EZ builder in Vero Beach, FL, has designed and sells the best shimmy damper available. We have never heard of a nose wheel fork failure from anyone using Bob's shimmy damper. Contact:

Bob Davenport
PO Box 650581
Vero Beach, FL 32965-0581
407-567-1844

From CP61-6 (CH9,CH13,CH38)

IMPORTANCE OF WHEEL BALANCING

Many builders ignore this rather important step. Our plastic airplanes with their plastic gear are probably more prone to being effected by an out of balance wheel than a standard spam can, but all airplanes will benefit from keeping the wheels balanced.

Do you experience a vibration right after lift-off? Can you see the canard tips vibrating up and down at this point? If so, you need to balance your main wheels, and perhaps even the nose wheel. At RAF we religiously balance all of the wheels on all the aircraft, and we do it fairly routinely, usually at least once a year at the annual.

You will need to build a pair of knife edges. Planer blades from a thickness planer, or jointer will work very well. They should be bondo'd to a "U" shaped wood frame so that the steel blades are level to each other and exactly parallel. Now you will need an arbor. It probably is not practical for each individual to make his or her own arbor, rather a group or chapter could make one (or get it made) and lend it to the members. Dick Kreidel very kindly sent us a drawing of one he machined out of a length of 2" diameter cold rolled steel (CRS). The wheel is slipped onto this "axle" type arbor, an axle nut is used to secure the wheel, then the arbor is set down on the knife edges. Use sticky backed tape lead weights (available from any wheel balancing garage which handles mag wheels) to balance the wheel. The idea is to get it to the point where the wheel will not roll either way. The weights should be stuck inside the wheel or inside the brake disc. Just be certain that there is no interference with the brake caliper. You may be shocked to find out just how much lead weight it takes to balance your wheel, even with a new tire installed. However, you will be delighted when you see the difference just after lift-off. Balanced wheels can also help the vibration some EZ flyers see in the gear on rollout. **SKETCH OMITTED**

From CP62-2&3 (CH9,CH13,CH38)

RE: WHEEL BALANCING ARTICLE IN CP 61

George Lyle sends in the following hints to enhance safety when installing sticky-backed weights in your wheels:

1) Make sure that the mounting location is absolutely clean - use MEK and a paper towel, wipe several times until paper towel is clean. Brake residue makes it difficult for the adhesive to grip, and a lead weight in the brake caliper would not be too neat!

2) Bend the lead weight to match the curvature of the wheel - allows 100% contact for the adhesive.

3) Use lead weights with the thinnest adhesive foam tape for best results.

Thanks, George.

From CP62-11 (CH13)
MISCELLANY
Bob Davenport has let us know that he will be getting out of the business of supplying his excellent nose wheel shimmy damper soon.

If you don't already have a Davenport shimmy damper, get your order in now before it's too late. As we have said before - Bob's shimmy damper is very effective and remains effective with minimal adjustment or maintenance.

From CP63-9 (CH13)
Bob Davenport nose wheel shimmy damper. Don't forget that Bob has informed us of his intention to quit producing this item. It is absolutely the best shimmy damper available at any price. Don't be left out in the cold, contact: Bob Davenport
PO Box 650581
Vero Beach, FL
32965
407-567-1844

From CP64-3 (CH13)
FIRST FLIGHT
Andre Deberdt reports his first flight in his Long-EZ, registration number PP-ZAD. Andre is from Sao Paulo, Brazil. He worked on his airplane for 5 years before finally taking to the air. Unfortunately, his first landing was not as successful as his first flight. **He landed hard, hitting the nosewheel hard enough to fail the 4 AN-525 washer-head screws that secure the NG-15A casting to the strut. All four screws pulled their heads off allowing the nose wheel/fork assembly to depart the nose strut.** Andre maintained control and held the nose off as long as he could. Once he touched the strut (NG-1) down on the runway, it ground off about 2". He slid for between 900 and 1000 feet on the end of the NG-1 strut.

Note: These four screws were changed to AN-3 bolts several years ago in the CP.

The mains hit hard enough to spread the gear to the point of grinding off one brake bleeder fitting, so he was without brakes. To his credit though, this was the only damage and he was out flying again the very next day, thanks to the generosity of a fellow builder,not as far along, who lent him a complete nose gear strut.

Andre tells us that his is the fourth example of a RAF design to fly in Brazil. There are now one VariEze, and 3 Long-EZ's flying there. He says he hopes to make it to Oshkosh some day and tells us that he is more satisfied with his EZ every time he flies it. Congratulations, Andre!

Rudder Pedals

Also see LPC #86 in the "Long-EZ Plans Changes" section of this chapter.

From CP30-5 (CH13,CH38)
Rudder Pedal Failure
There have been at least two cases of failure of the top tab which is welded to the rudder pedal, and to which the rudder/brake cable is connected. One case was a gas welded, homebuilt part, and this was attributed to a poor weld. Another case was a prefab Brock part, but according to the owner, the tab had been bent and then straightened cold. If this tab should fail, it will invariably fail while taxiing under braking load, when you need it most, and directional control will be lost.

As of this date (Oct 81) Brock-supplied rudder pedals have been modified per Figure 1, to strengthen the tab. If you purchased your rudder pedals prior to this date, you can obtain from Brock a pair of tab reinforcement brackets. Brock part #LE2026R-1 and LE2026R-2, and these must be riveted into place over the existing tabs per Figure 2. This will stiffen and back up the weld which failed. Of course, you can also homebuild these brackets from Figure 2. This is a mandatory change, see LPC #86.
SKETCHES OMITTED

From CP34-4 (CH13,CH26)
Long-EZ First Flight Report
"Dear RAF,
First flight of Long-EZ N158TG was on September 3, 1982. It now has 21 hours on it with only minor problems and adjustments. With equipment shown including strobes, nav lights, landing light and big alternator but no starter, empty weight is 800 pounds. Performance appears to be right with the handbook with 0-235 L2C engine and B and T 62 x 66 prop.

I am 6 ft. 9 inches tall and pilot seating is very comfortable. My seat cushion is 1" thick in the seat increasing to 2" in the thigh support and back seat. **Also, the rudder pedals are 4 1/2" forward of standard and the pedals themselves are 3" taller.** I have been to 12,000 ft. and to 140 knots indicated which would be 185 mph true.

I am very pleased with the aircraft and wish to thank RAF again for the clarity of the plans and the quality of support.
Best wishes.
Tom Garrison"

****Also see CP46-3&4 in the "Retract Assembly" section of this chapter.****

****From CP44-2 (CH13,CH22,CH30)****

Mike and Sally's Long - N26MS - is in the shop for a few changes and a face lift. This airplane has 925 hours and is over 4 years old. We are installing new upholstery, and will be repainting the whole airplane. While it is down, we are doing a few things to it that we have always wanted to do, but have never got around to. We are installing a Loran-C, we chose a Micro Logic 6500. We are also installing a F-TEC ST-1A engine monitor meter. This promises to be a really neat multiple engine functions gauge as well as a great panel space saver.

In addition, we have modified the trailing edge of the cowling, by extending it aft about 3" towards the prop. The goal here is (hopefully) a lower drag cowl with improved cooling. **We have also moved our brake master cylinders up into the nose. This modification has been done by many builders, using several different methods.** The advantages are better access to firewall area, mags etc, and for cg, weight on the aft end moved into the nose is better.

All of the above are now in the works. This is quite a major undertaking, requiring a new instrument panel. Oh yes, we are completely rewiring the entire airplane! Please don't call on any of these mods. We will thoroughly flight test all mods and report on the results in the next newsletter. We anticipate flying in about 6 weeks time.

****From CP46-8 (CH13)****

Plans for forward mounted brake cylinders. This is the method pioneered over 8 years ago by the late Ed Hamlin and proven by many VariEze and Long-EZ builder/flyers. Debbie Iwatate (Long-EZ N455EZ) has written an excellent set of instructions on how to accomplish this. All she asks for a copy of this set of plans is a few dollars to pay for postage. We think it would be nice if people would send her $10.00 to cover printing, postage and handling plus a few bucks for the effort she has put out.

Contact: Debbie Iwatate,
400 South 41st Ave.
West Richland, WA 99352

****From CP47-13 (CH13,CH41)****

Debbie Iwatate (Long-EZ builder/flyer) has updated and improved her forward mounted brake plans to include several cosmetic and functional changes that she incorporated into her beautiful Long-EZ. She has put this collection of neat ideas into one very attractive booklet which she has available for $20.00. Debbie has done a super job on this little book.

Contact: Debbie Iwatate
400 South 41st Ave.
West Richland, WA 99352

****From CP57-5&6 (CH13,CH17)****

NOSE MOUNTED BRAKE CYLINDERS

A few years ago, Long-EZ builder/flyer, Debbie Iwatate put together a neat little booklet containing plans for some of the neatest ideas she had incorporated into her own Long-EZ such as forward mounted brake master cylinders, a real slick roll trim modification, etc. Well, Debbie still has this booklet available at the same price, $20,00, but she has moved. Please contact Debbie at:

804 Cottonwood Loop
Richland, WA 99352
509-943-9579

****From CP62-4 (CH13,CH17,CH41)****

SHOPPING

Debbie Iwatate's EZ ideas book is still for sale - still costs only $20.00 and you can get one from Debbie at her new address:

1699 April Loop
Richland, WA 99352
509-943-9579

This little book contains plans, done EZ-style, for forward mounted brake master cylinders, a nifty roll trim system, and other neat little ideas that Debbie and Ken came up with while building their excellent example of a Long-EZ.

****Also see CP46-3&4 in the "Retract Assembly" section of this chapter.****

****From CP30-7 (CH13)****
Long-EZ Pitot Tube
Ref: Section I page 13-10, step 6.
Install the pitot tube so that it runs uphill continuously from the tip of the nose to the airspeed indicator. The easiest way is to run it aft through NG31, then over against the left side, and all the way uphill to the airspeed indicator. The tube can be attached to the fuselage side with a few narrow strips of BID.

****From CP35-7 (CH13,CH15,CH17,CH30)****
FROM THE BUILDERS AND FLYERS
First flight from Debbie Iwatate.
"Long-EZ N455EZ flew for one hour on it's first flight October 31, 1982. It went so smoothly that we found ourselves thinking, "is that all there is to it!", after the landing. A big reason for having an uneventful first flight was our friendship with Bryan Giesler (VariEze 90331). By the time we were ready for flight testing the Long, I had accumulated almost 15 hours of back seat time and 3 hours of solo time in his aircraft ..... that does wonders for a persons confidence! The only changes we have made to the plane are to change to REM37BY plugs, modify the upper brake arm (BA) to make it an inch longer to increase the braking effectiveness, and change the pitch trim spring lengths to gain more nose down trim authority. I have flutter tested up to 198 mph IAS, stalls are at 60 mph engine idle (straight forward and smooth) and 55 mph power on. We are burning about 4 - 4 1/2 gallons per hour average.

It took us about 2,000 hours to build the plane (325 for the finishing) and that was spread over 21 months. We didn't cut too many corners on cost and our final cash outlay was around $18,000 (well worth every penny). Many thanks to you Mike, for your assistance every time I called for help.

Incidently, the nose (side) airvents work very well! Leading the air into the cockpit through eye-ball vents, we are getting fantastic ventilation. In addition we added "extra air" vents on the sides above the CC spar "deck".

We have 33 hours on the plane now and have been signed off by the FAA. Now we can settle into the maintenance routine and get our fly-in schedule made up for the summer of '83. Many thanks to Burt for making such a project possible to folks like us. Take Care, Debbie Iwatate".

Debbie is the first female builder/flyer to complete and fly a Long-EZ. Congratulations!!!

****From CP46-2&3 (CH13,CH19,CH30,CH33,CH36)****
HOMEBUILDER MODIFICATIONS
Recently we have noticed a trend towards homebuilder modified Long-EZs, particularly the long nose and heavier engines. These are not RAF approved modifications and we are concerned that most pilots may not be aware of what they could possibly be getting into. First of all, the longer nose IS destabilizing in pitch as well as directionally (yaw). How much of it may influence your particular airplane is not known. We believe you as the pilot should know just how stable your own airplane is. We strongly recommend to anyone who has modified their own aircraft in this way, that first of all you should install vortilons on the main wings. The vortilons allow a little more stall margin. Secondly, you should put on a parachute, and climb to at least 10,000 feet above the ground and at that altitude, you should fully explore the stall/full aft stick characteristics of your airplane. Do it first at a mid cg position, then ballast to the aft limit, (103") and do it again. In this way at least you will be aware of any possible unpleasant stall behavior or unstable tendency, and you would be a lot less likely to later discover any nasty trait at low altitude with no margin for a safe recovery.

We are really concerned when we hear that a particular builder has done a major modification to his airplane. For example, a larger, heavier engine and a longer nose. Then he goes out and flies it for a few hours and then tells all the builders in his area what a neat thing he has done. Now some of these builders decide, based on his results to do the same thing. Meanwhile, the original experimentor never did test his airplane at aft limit cg, at full aft stick, with aggravated control inputs, or at the red line or at limit g so he never knew for a fact that his airplane was safe. Another builder, influenced by the first experimentor makes similar changes, goes out and while demonstrating the much touted stall characteristics to a passenger, enters a deep stall condition at low altitude, does not have enough room to recover, and so he and his airplane become another statistic and make not only the Long-EZ look bad, but also puts a blot on the accident record of all homebuilts.

To sum up: If you must make changes to your aircraft, keep in mind that you now have a different airplane than the original plans built Long-EZ prototype. Your new design may have perfectly safe aft cg, high angle of attack flying characteristics, but it may also have unsafe, nasty characteristics, just waiting to bite you at an inopportune time. To protect yourself, and any future passenger you may take for a ride, 1) you should install the vortilons, 2) you should thoroughly test your airplane at aft cg, high angle of attack (full aft stick) with aggravated control inputs. If your airplane does not handle well, limit your aft cg. You do not have to go back to the published limit. If you are not comfortable at 103, try 102 or 102.5. If it is good there, limit it there, note it in your log book, placard the airplane, and don't ever exceed this (or any other) limitation. Remember, each Long-EZ, or any other homebuilt design, is different. Don't assume because Joe Blow did it and was safe, that you will be. You may not be and that really can take the fun out of the whole project. Don't ever lose sight of the fact that, that is what this whole thing is about - having fun!! FLY SAFE AND ENJOY.

****From CP50-9 (CH13)(Photo Caption)****
Seen at Mojave - this is what happens when you get carried away with the nose shape - you can't park it on it's nose!

Nose Bumper

****From CP28-3 (CH13,CH33)****
A note from EZ Ed - owner of one of the highest time VariEzes.
Burt asked me to jot a note for the newsletter since at this writing (4/22/81) I have 680 hours on 777EJ. It first flew in March of '78 and since that time we have really flown it quite regularly. In '78 we went to Oshkosh plus explored all of California twice. In '79 we made a trip through Canada, we were going to Alaska but "someone" got carb ice and Joanne had a tooth go bad in Calagary. In 1980 we went to Montana (home again) and toured some in that area. We also made the Bahamas trip in '80-81 to cap off '80 and start '81. At Easter we went to Loreto Baja Sur, Mexico. Had a really great time.

The reason that the hours build up on 777EJ so fast is that I also use the airplane in my work. I work for Placers Savings and we have 22 branches. I visit each branch at least once a month and often more frequently. I average flying to a branch once or twice a week, (the boss buys the gas) so we really get to keep the cobwebs off Echo Juliet.

As far as maintenance goes I really haven't had any major problems. The engine has run great but I did a top at 400 hours and had one wierdo, a warped intake valve seat. Those two problems though didn't stop the flying for long.

I have used a lot of brake pads as the airplane is an all brake situation after it's on the ground. I can touch down say at 75 mph on a 5200 ft runway, (I did it at Mendocino, with a passenger) and probably would go off the other end. That's with speed brake down and rudders extended. If I ever suspected I didn't have brakes I would land nose gear up. **A 2" x 3" x 1/4" steel pad is good for at least 3 nose gear up landings!**

When we get 1000 hours we will write another article.

Ed Hamlin.

****From CP39-4 (CH13)****
"Dear Mike,
Just a quick note to tell you that Gene Scott and I have finally finished Long-EZ, serial #180 and to enclose a couple of pictures. It took three years of weekends and about 500 gallons of Gene's character building coffee and many times it seemed like we were making no progress, but last week it was time to see if we had an airplane or just a conversation piece.

We were concerned because we were heavier than you folks would like (starter, generator, full IFR and less than perfect attention to weight in our layups) but we could put it off no longer. Last Sunday I had the privilege to take the initial flight. We had been doing high speed taxi tests for a couple of weeks and were both proficient in holding the nose off the runway, and I felt reasonably comfortable in attempting to lift it a couple of feet off the runway and then plunk it right back down (we had an 8000 feet runway). What I was unprepared for was the feeling of the Long when it left the ground ..... it turned into a solid, stable, easily controlled, great flying machine. The next trip down the runway, it was impossible not to point the nose up and get it into its real element. From that point on (as you are well aware) it was a great experience that can't be properly described.

I do have to report one note of embarrassment, however. We decided to fly with a few "minor" details left undone. One of these was the nose gear warning system. As a result, on one flight I did not get the gear completely down into the "over-center" position and it collapsed during landing, stripping the gear mechanism and folding the gear completely into the wheel well, allowing me to skid into an inglorious halt in front of the tower. **Fortunately, (and I highly recommend this to other builders) we had installed a 1/4" stainless steel plate under the nose "bumper", and this saved us from any real structural damage.** The runway merely sanded the paint and fiberglass directly in front of the gear. Had the plate been just a little thicker, even the paint would not have been scuffed. Moral: Every little detail IS important!

By the way, thanks to the Ken Brock organization for getting new gears to us within two days.

Like so many letters that we have read in the CP, this one is to thank you for a really great flying experience. We now have about twenty hours on N6NG and are looking forward to getting the initial time flown off so we can take it back to our home base at Gillespie field. I guarantee you it won't spend much time on the ground.
Jerry Hansen,
Las Mesa, CA"

****From CP51-6&7 (CH13,CH33,CH39)****
Long-EZ N218EZ: Incident Report
Scenario: I was the pilot in command of Long-EZ N218EZ at Scottsdale Municipal Airport when it crashed into a Cessna 152 after hand propping the engine. The situation occurred as follows: I had just fueled up for a local flight and was preparing the aircraft for engine start. I placed the wheel chock under the port tire and set the magnetos for ignition. I set the throttle position

incorrectly although I did not realize this until it was too late. I then hand propped the engine and she started on the first pull but the RPMs were too high and the Long-EZ jumped the chock. I ran around the port wing but then my last failsafe malfunctioned. **The rubber stopper under the nose, which was made out of a hockey puck, sheared off and the Long-EZ raced away toward the active runway. A previous gear up landing prompted the installment of a stainless steel plate under the nose in the event that a gear up landing occur again.** The steel plate offered little friction to the asphalt and she accelerated away from me (I am slow of mind not of foot). I was only able to get alongside the wing at full sprint and the plane was still accelerating toward the active runway. I decided to try to alter the plane's course and at my last chance grabbed the port winglet and pulled myself up off the ground. Off balance, the Long-EZ did veer away from the runway but my troubles were just beginning. Now a less than willing passenger on the wing of a pilotless plane going approximately 25 mph, I helplessly watched as the Long settled on a course directly at a parked Cessna 152. I had no choice but to release and watch the planes collide.

Damage: The Cessna suffered a collapsed wing and sustained propeller, nose gear, and engine cowl damage. The Long lost the canard and punctured the port wing strake on the Cessna's propeller.

Recommendations: This situation arose primarily because the throttle was set at too high a power setting thus initiating the runaway condition. **Second, the rubber stopper was made out of the wrong material (hockey pucks are designed to slide) and it was not secured to the fuselage properly.** For those who hand prop their planes, I would recommend installing a parking brake and/or some remote cutoff switch for the engine. A simple procedural solution would be to set the fuel valve to off so that if the plane runs away, it won't get too far. Always be certain of your throttle setting. By Michael Best

Nose Tie-Down

****From CP26-8 (CH13)****

NOSE TIE-DOWN FOR THE NOSE-DOWN PARKING

In order to tie your Long-EZ or VariEze down when parked nose-down (best way for high winds), we recommend installing this simple tie down, which is located at F.S. 1.5" and W.L. 8.9". The tie down consists of an aluminum tube floxed into a hole in the side of the nose, oriented horizontally. A removable steel tube slides into this aluminum tube and locks with 90 degrees of rotation. The steel tube protrudes approximately 2 1/2" out of the left side of the nose, and has a steel ring welded to it, so that when the steel tube is pushed in, turned 90 degrees to lock, the steel ring points at the ground. **SKETCH OMITTED**

Materials required:
Part #NTDA 1 pc. 7/8" O.D. x .058" wall x 7 1/4" long, 6061-T6 aluminum tube
Part #NTDB 1 pc. 3/4" O.D. x.049" wall x 10" long, 4130N steel tube
1 hardware store type 2" diameter steel ring (3/16" or 1/4" wire size)
1 AN3-11A bolt
1 MS21042-3 nut

On a new Long-EZ, the best time to install the nose tie down is in Chapter 13, page 11. With the top of the nose cut off to fabricate the nose door (step 9), drill or cut with a dremel a 7/8" diameter hole through the left side at F.S. 1.5" and W.L 8.9". This hole must be drilled through both NG30's as well. Before installing NDA tube, drill a #12 hole through it, 3/4" from the inboard end. When you slip the NTDA tube into the holes it should lie right against the NG31 bulkhead. NTDA should be sanded dull with 220 grit, and should be floxed in with wet flox. One ply of BID should be layed up over the tube onto the NG31 bulkhead on both sides. Orient the #12 hole vertically and install the AN3-11A bolt and nut. Allow this to cure.

NTD-B is a 10" long piece of 4130N steel tube with a 2" diameter hardware store steel ring welded close to one end per sketch. The other end is slotted and notched so that the ring is held horizontally facing forward, while NTD-B is slipped into NTDA. The slotted end locates over the AN3 bolt, then the NTD-B tube is rotated 90 degrees to orient the ring vertically down, pointing at the tie down.

To park the airplane, park it with the tie down ring directly over the normal "tail" tie down rope, and snub it down firmly. The large ring allows you to use ropes or chains normally found at airports. **SKETCHES OMITTED**

****From CP49-7 (CH13)****

NOSE TIE DOWN

It can be difficult, even impossible, to remove the nose gear strut due to the AN5 pivot bolt having to go through the side of the nose. This problem can easily be solved and you get a good nose tie down into the bargain! **SKETCH OMITTED**

By removing the AN3 cross bolt from the aluminum tube, you can reach the head of the AN5 nose gear pivot bolt using a socket on an extension, and the bolt can be withdrawn through the aluminum tube allowing periodic inspection of the nose gear pivot.

Steerable Nosewheel

****From CP34-1 (CH13)****

RAF ACTIVITY

RAF has undergone several changes since Canard Pusher #33. Burt's new company Scaled Composites Inc. is officially off and running. Scaled's new building is going up rapidly next door to RAF. Roger Houghton and Doug Shane have both joined Scaled and Larry Lombard has moved to Task Research in Santa Paula.

This has left RAF with Burt, Mike and Sally, Trish Palmer and Michael Dilley, Michael Dilley was heavily involved in the construction of the Amsoil Racer. He is also an expert prop carver and is proving to be a very valuable asset. Both Michaels are presently hard at work drawing Solitaire plans. RAF is shooting for a target date of January 1983, when we hope to have the Solitaire plans available. Prefab parts will be developed and should be ready about the same time. In between, development continues in the Solitaire's engine department. We have just installed our third engine, this one is a KFM 107E and it looks promising.

RAF has agreed to join with Voyager aircraft (Dick and Jeana) to build the Voyager. Work is currently underway. This will be an interesting project due to the very latest state-of-the-art technology being used. Voyager will be built at RAF and should be flying in the summer of 1983.

We are also developing a new, steerable nosewheel (fork and lower casting) which will be retrofittable to both VariEzes and Long-EZs. This project is in the early stages of development, so please don't call us for information. When it is successfully developed and flight tested it will be available from Ken Brock, perhaps around Chrisunas time.

****From CP35-1 (CH13)****

"STEERABLE NOSEWHEEL FOR THE LONG-EZ?"

We have worked very hard to develop a nosewheel steering system for the Long-EZ. This endeavor has been a dismal failure so far. It really is a much more complicated problem than it seemed at first. We have had several different iterations installed including two totally new nosewheel forks. None of our efforts have shown enough promise to pursue. What it boils down to would be a major redesign of the rudder/brake system, as well as the nose gear. At this point in time we are going to put this project very much on the back burner. The Long-EZ is such a simple, easy to maintain machine as it is, a change such as that suggested above, would necessarily make it more complicated and difficult, not to mention expensive to maintain. Of course this still leaves us with the need to be very conscious of the necessity to carefully check the friction damper before every flight. We have four aircraft here at RAF with the standard nose gear. These four aircraft have an accumulated total of over 2,500 hours, and heaven knows how many landings. None of these airplanes has ever experienced nose wheel shimmy of any kind, and no nose wheel fork failures, even when N79RA was deliberately run over pieces of 4" x 4" lumber at speeds from 20 mph to 50 mph. Check your friction often and you will be rewarded with lots of fun flying - neglect it, and you will pay the price of a shimmy-induced fork failure.

Fenders/Mud Flaps

****From CP34-8 (CH9,CH13)****

Ray Cullen reports good success with small "mud flaps" on the wheel pants. After three months of hard operation, prop nicks are minimal. The small "mud flaps" are made from plastic coffee can lids pop-riveted to a 3" x 1" bracket made from .018 stainless (firewall material). These flaps should have at least 1/4" of clearance from the tire.

Gary Hertzler has had a "fender" on his nosewheel for some time and it too is a big help as far as prop damage. Gary made his fender from 3 plies BID and it has a small "mud flap" of engine baffle material (neoprene/asbestos) or the plastic coffee can lid would probably work fine. These mud flaps should be quite close to the runway, if they are too long, they won't be after one take off!

****From CP54-8 (CH13,CH18)****

NACA, canopy vent doors and light weight front wheel fenders. By now most of us are familiar with Gene Zabler's neat, quality vent doors and fenders. Gene tell us that he has not had a price increase since he introduced these parts more than four yours ago. Increased costs of materials and shipping costs have forced him to raise his prices. The vent door will now cost $7.50 p.p. and the front wheel fender will not cost $40.00 p.p. If you have not tried one of Gene's simple, easy to install, vent doors, you owe it to yourself to try one, particularly at this time of the year. **The nose wheel fender can really extend the life of your prop by helping to keep small stones and gravel out of the prop during taxi, take-off and landing.**

Write to: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
1-414-886-5315

From CP61-12 (CH13,CH18)

Cockpit vent doors for Long-EZ and VariEze. $8.00 each. EZ to install - work great. **Nose wheel fenders (help keep rocks off your prop) made from glass and aluminum. Ready to paint and install - $40.00 each.** Gene has had these products for sale now for over 7 years and is not sure how long he will continue to supply them. Do yourself a favor and get them now. Contact:

Gene Zabler
48 Robin Hill Dr.
Racine, WI 53406

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Table of Contents for Chapter 14, CenterSection Spar

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Chapter 14, CenterSection Spar

Long-EZ Plans Changes

From CP25-6 (CH14,CH28)
LPC #19, MEO, Page A4.
Engine mount extrusions "Chapter 6" should be "Chapter 14", 2 places.

From CP25-6 (CH14)
LPC #26, OPT.
To save work and weight substitute UND for BID on centersection spar as shown on page 4 of this newsletter.

From CP25-4 (CH14)
OPTIONAL LONG-EZ LAYUP CHANGE SAVES WEIGHT
The following approved layup change on the Long-EZ centersection takes advantage of the better structural efficiently of oriented UND as compared to woven BID. These changes are easier to layup and save 3.5 lb weight!

Page	Layup#	Old	New
14-2	5	3 Ply BID @ 45degrees	1 Ply UND @ 45 degrees 1 Ply UND @ -45 degrees
14-3	6	3 Ply BID @ 45degrees	1 Ply UND @ 45 degrees 1 Ply UND @ -45 degrees 1 Ply UND @ 45 degrees 1 Ply UND @ -45 degrees
14-4	8	3 Ply BID @ 45degrees	1 Ply UND @ 45 degrees 1 Ply UND @ -45 degrees

Note: UND cloth is butted, not overlapped at selvage edges. Be sure alternate plies of UND cross at 90 degrees fiber orientation to each other.

From CP25-6 (CH14)
LPC #28, MEO, Page 14-2, Step 4.
Outboard LWA 1 (sketch on left center of page) 1.0" dimension should be to outside of CS 5 and 8, not inside. Change inside dimension to 0.75". Be sure to transition edges of all metal parts with flox.

From CP28-9 (CH14,CH19)
LPC #56, MAN GRD
Clarification CP #25 Page 6 Lower right corner. Long-EZ spar cap thickness. This box must be complied with. Several builders have ignored this. Do not omit this, you must have the prescribed amount of glass in the spar caps, in both the centersection spar and the wings.

From CP32-7 (CH14)
LPC #99 DES, Section I, pages 14-10 & 14-11, Sections E-E, F-F, G-G & H-H. The UND layup #3 & #4 are incorrectly shown to lap onto the CS7 & CS8 bulkheads. The words describing this layup on page 14-2 are correct. Layup #3 & #4 are layed up onto CS2 & CS3 in Sections E-E & F-F and only onto CS1 in Sections G-G & H-H.

From CP43-4 (CH14,CH19)
LPC #119, Section I, page 14-7, parts #LWA4 and LWA5.
Increase the size on 8 LWA4 from 1 1/2" x 2" to 1 3/4" x 2" and on two LWA5 from 2" x 2" to 2 1/4" x 2". The increase is in the vertical dimension and is to allow more leeway when drilling the 5/8" wing mounting holes. Several builders have come very close to the edge of these parts, a couple have actually broken out. Breaking out is cause for rejection.

****From CP30-7 (CH14,CH22)****
Wiring From The Wing To The Centersection
Cut a 2" diameter hole in the outboard bulkheads in the centersection spar, opposite the point where the wiring comes inboard through the hotwired holes in the wing cores. Mike bought some pin male and female plugs and sockets from Radio Shack and wired nav. lights and strobe lights through these plugs and sockets, breaking the wiring bundle a few inches inside the centersection spar. This enables you to reach in through the hole in the bottom of the centersection spar, and pull the wiring bundle down and out so that it may be disconnected in order to remove a wing. The comm. antenna (s) should of course also have a BNC connector at the same location. Mike ran his Nav/Strobe light wiring bundle out through the wing, together with the comm. antenna coax and has no perceptible interference. All this wiring is now brought inboard through a hole cut in the CS6 and CS7 bulkheads (a 1" diameter hole is fine) and then inboard to just inside the fuselage sides at which point you can drill up to a 1/2" diameter hole in the forward bottom of the spar box, and run the wiring down through these holes into the area aft of the back seat bulkhead.
CAUTION! Do not drill through the lower spar cap.

****From CP32-7 (CH14)****
Centersection Spar Clarification. A few builders have been having problems understanding the sketch in Section I, page 14-2, top right. This sketch is correct, and it shows the line you should follow on the aft face of the spar box, when you cut through the CSI foam aft face. The dimension .55" at the outboard ends is correct. The spar cap at this point is only .150" thick (top cap) and .113" thick (bottom cap). This is because the spar box top tapers to match the wing root airfoil. If you look at page 14-9, Section C-C you can see the original outside shape of the spar box shown as a dashed line. If you measure down the aft face (CSI) top aft corner to the foam under the shearweb, layup #5, you will see that it is .55". Note how the spar cap templates (page AII) set this taper. The template outside edges are level waterlines. **SKETCH OMITTED**

****From CP35-6&7 (CH14,CH21)****
Detecting Fuel Tank Leaks
Most leaks can usually be detected by the tried and tested soapy water method. Occasionally however, a persistent small leak may exist that simply will not show up with soapy water. These leaks are probably located in the forward face of the centersection spar, or on the fuselage side. A sure fire method to locate these leaks is to use a "Freon Gas Sniffer". These expensive gadgets can usually be borrowed from your local friendly auto airconditioning repair man. Simply spray a little Freon into the offending tank, pressurize it by raising the altimeter no more that 1,500 feet. The Freon Sniffer will quickly locate the leak. If the leak is inside the centersection spar, you may have to cut through a CS5, CS6, CS7, or CS8 bulkhead. Cut a plug no bigger than you have to, to get your hand through. Cut the plug out at an angle so the plug can easily be floxed back in place. **SKETCH OMITTED**

Repair with two plies BID lapping at least 1" onto the remaining pane. Now that you have the exact location of the leak, you can suck a 1,500 ft. lower than ambient pressure, causing a slight vacuum. Paint warm epoxy over the leak area, working it in with a brush or rag. Do this for a couple of minutes. Then open the tank to ambient pressure. This is most important, since the epoxy that was drawn into the leak, would continue to be drawn in until the leak was once again there. You want the epoxy to cure in the leak area. **Incidentally if you intend to install position lights/strobes and/or antennas in the wingtips, you will need holes in the CS5, CS6, CS7 and CS8 bulkheads to run the wiring and coax through from the wings to the fuselage. A maximum of a 2" diameter hole may be cut through the center of each bulkhead.**

****From CP39-7 (CH14,CH21)****
Long-EZ - Richard Marr suggests this method to roll your Long-EZ over after you have your fuel strakes and centersection installed. Bolt a 1" x 10" pine board to your 3 wing attach points on one side. Make the board long enough to protrude about 15" beyond the outboard tip of the centersection spar as shown. Now if you set the nose on a piece of carpet or similar pad, it is possible (though not without some strain) for one person to roll it over. The pine board keeps the centersection strake off the ground. Two people can do the job very easily. **SKETCH OMITTED**

****From CP42-4 (CH14)****
Spruce blocks in the Long-EZ centersection spar. These four wood block are microed into the foam core such that they touch the forward edge of the spar caps and extend forward 3". They are there to absorb the crush forces when the two bolts that attach the engine mount extrusions to the centersection are tightened. It is important that these bolts go through the spruce blocks. See sketch. **SKETCH OMITTED**

****From CP49-4 (CH3,CH14)****
CAUTION
We heard from a builder the other day who was preparing to build his centersection spar and was planning to substitute blue styrofoam (wing foam) for the urethane! This is an absolute NO-NO. The centersection spar box is the aft wall of the fuel tanks and one tiny pinhole leak in the glass facing would allow fuel to permeate into the styrofoam which would then dissolve. Once the foam, which supports the glass spar caps was gone, the spar would fail. Don't even think about substituting styrofoam anywhere where it may come in contact with fuel.

If it ever crosses your mind to do so, do yourself a favor and pour a little gasoline onto a styrofoam scrap and watch what happens!! PVC foam and urethane foams are not affected by fuel.

Spar Cap

****Also see LPC #56 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP25-6 (CH14,CH19)****
LONG-EZ SPAR-CAP THICKNESS - CENTERSECTION SPAR AND WING
The number of plies of the UND tapes for the spar caps shown in the plans (Chapter 14 and 19) is based on each ply being .035 to .038 thick. We have found that some of the UND tape is of less bulk than expected, and is laying up only about .025 per ply. If this happens, the spar is weak and the depressions are not filled flush. Check your spar cap material by making a 5-ply layup. Cure then measure thickness. It should be 0.18 thick. If it is only 0.125 thick you must add the following plies to all your spar cap layups. All the additions can go on top of the plans shown caps.

Chapter 14, Step 7, Bottom Cap.
Add 1 Ply full span, plus 1 ply to B.L. +-45, plus 1 ply to B.L. +-30, plus 1 ply to B.L. +- 15.

Chapter 14, Step 7, Top Cap.
Add 1 ply full span, plus 1 ply to B.L. +-47, plus 1 ply to B.L. +-37, plus 1 ply to B.L. +-27, plus 1 ply to B.L. +-17, plus 1 ply to B.L. +-12.

Chapter 19, Step 5, Bottom Cap.
Add 1 ply B.L. 25 to B.L. 130, plus 1 ply B.L. 40 to B.L. 90.

Chapter 19, Step 7, Top Cap.
Add 1 ply B.L. 23 to B.L. 140, plus 1 ply B.L. 33 to B.L. 92, plus 1 ply B.L. 40 to B.L. 78.

CAUTION! - Use care in carving spar cap troughs, (Chapter 14, Step 5). Do not carve too deep!

****From CP27-6 (CH3,CH14,CH19,CH31)****
Long-EZ builder hints.
Heavy Unidirectional Fiberglass Tape - The 3" wide roll of unidirectional glass is used only for the spar caps of the wing and centersection spar. "BID tapes" called out are cut from BID cloth (generally 45 degree orientation). Other UND pieces or strips are cut from UND cloth. Be sure fiber orientation is correct.

****From CP29-8 (CH14,CH19)****
On the centersection spar caps and wing spar caps, most people will require the extra plies as called out in CP #25 and CP #28. If you are going to need the extra plies, it is best to apply them in order. That is, the longest ply should go on first, and the shortest ply should go on last.

****From CP34-8 (CH10,CH14,CH19,CH31)****
Spar caps - wings, canard and centersection - Be sure to peel ply these spar caps, or you will wear yourself out sanding prior to installing the skins.

****From CP51-6 (CH14)****
CAUTION! DO NOT CUT THROUGH ANY SPAR CAPS!! WE HAVE HAD SEVERAL BUILDERS WHO HAVE CALLED US FOR HELP AFTER CUTTING THROUGH A CENTERSECTION SPAR CAP! UNFORTUNATELY, THERE ARE SOME THINGS THAT ARE SO DIFFICULT TO FIX THAT IT IS EASIER AND QUICKER TO BUILD THE PART OVER. THE MAIN PROBLEM IS IN THE AREA OF THE ACCESS HOLES FOR WING ATTACH BOLTS ON THE OUTBOARD END OF THE CENTERSECTION SPAR BOX. BE CAREFUL, GO SLOWLY AND BE CERTAIN YOU ARE CUTTING THROUGH FORWARD OF THE SPAR CAP! IT MAY SEEM BETTER TO HAVE THE ACCESS HOLE CLOSER TO THE WING, BUT IN THIS CASE IT IS NOT! LOOK AT THE PLANS IN CHAPTER 14, PAGE 9, SECTION C-C AND YOU WILL READILY SEE THAT THE ACCESS HOLE IS FORWARD OF THE SPAR CAP, THROUGH A RELATIVELY EASY-TO-CUT GLASS-FOAM-GLASS AREA. IF YOU CUT INTO THE SOLID GLASS SPAR, IT WILL BE VERY TOUGH TO CUT. IF YOU FEEL IT IS TOUGH TO CUT - QUIT! CHECK AND DOUBLE CHECK BEFORE PROCEEDING.

From CP25-4 (CH6,CH7,CH14)
REFERENCE LONG-EZ CHAPTER 14, STEP 13
At least a couple of you Long-EZ builders may have noticed by now that, due to the kink in the centersection spar it interferes with the aft seat bulkhead when you try to slide it into the fuselage. Do not remove the firewall to clear this. Using a coping saw, remove a triangular piece of the back seat bulkhead about 1" deep at the center and tapering to zero at the sides. After the spar's in place this piece is installed with wet micro and is structurally tied in by the tapes that lap onto the spar. For new construction do not permanently install the plywood firewall bulkhead in Chapter 6 or 7. Put the spar in from the back in Chapter 14, then install the plywood firewall bulkhead, lapping 1 ply BID around all edges.

From CP27-5 (CH14)
Engine mount and mount extrusions - The older conical-type engine mount had tubes that were flexible enough to accommodate minor variances in the positioning of the aluminum angle extrusions in the fuselage. The new mount designed for the Lycoming dynafocal configuration has extra supports and is very rigid. Extreme care was taken to make the Brock welded mount accurate, to fit the extrusions, however normal tolerances may preclude a good fit on all airplanes. Thus, we are recommending the following method to assure an acceptable fit: Before allowing the extrusions to cure in place in the fuselage, clamp the welded mount to them. Shim with additional plies of BID if needed on the fuselage and centersection spar. Let the extrusions cure with the welded mount clamped in place.

From CP32-5 (CH14,CH30)
CAUTION
When installing your engine mount, we tell you to set the mount on the extrusions leaving approximately .030 gap between the mount and the firewall, see Section IIL ,page 7. This is true if the mount is perfectly straight, however you should check to see that it is, by measuring from the firewall to the aft of the engine mount and verifying that the mount is at the correct fuselage station as shown in Section IIL, page 14 for conical mounts and page 15 for dynafocal mounts. Bear in mind that even though the mount is accurately welded up on a fixture, when it is normalized by heat treating, it is possible for the weldment to warp, creep or otherwise move enough that if you rely on the .030 measurement, you may have an engine that is not correctly located. Correctly installed, your engine crankshaft should be aligned with the zero buttline, plan view. Side view, the crankshaft should have 2 degrees of down thrust, (± 1 degree) that is to say the spinner end is higher than the accessory case end.

From CP38-7 (CH14,CH15,CH16,CH23,CH30)
CAUTION - Long-EZ
Note that the engine section of the plans, Section IIL updates Section I of the plans. Do not do any work in the area of engine mount installation, brake master cylinder installation or anything aft of the firewall until you have Section IIL in hand. Also - **do not install the aluminum engine mount extrusions until you have the engine mount at hand and can clamp it to the extrusions while they cure in place. This assures a perfect match of engine mount to extrusions.**

From CP53-6 (CH14,CH19)
How to install Long-EZ wings
If you are building a Long-EZ in a basement or a garage too small to mount the wings to the centersection with the centersection mounted into the fuselage, or if by mounting the centersection into your fuselage you can no longer get it out of your basement, or if you would just prefer not not mount the centersection in the fuselage but would like to complete the installation of the wings to the centersection, here is how it worked for Doug Shane (former RAF employee, now an engineer/test pilot for Scaled Composites).

Mike Melvill offered to help Doug after Oshkosh this year to try to get his Long-EZ completed by the end of the year. Doug had completed the fuselage, which was on the gear, and the canard and centersection. With occasional help from Mike's wife, Sally, and Doug's friend, Bob Williams, the two of them worked evenings from 5:30pm to 10:30pm and Saturdays - no Sundays! Sally and Bob helped with wing layups on a couple of Saturdays. To give you an idea of what a couple of determined fellows can do (should we say "lunatics"?) in exactly 6 weeks, working the above schedule, both wings, both winglets (upper and lower) were completed, then the ailerons were cut out, completed and hinged. The wing roots were completed, the wings were drilled and mounted onto the centersection spar, the winglets were mounted on the wings and the rudders cut out, completed and hinged. The centersection was mounted into the fuselage and the engine mount extrusions were installed. The canard was mounted and the entire flight control system was installed and hooked up. The brake master cylinders were mounted up front per Debbie Iwatate's instructions and connected to the rudder pedals. Not bad for six weeks of part time work!

During this exercise, the idea of mounting the wings to the centersection prior to installing it into the fuselage came up. Of course, this is the normal way it is done on a VariEze so they were not unfamiliar with the procedure.

Doug's garage is small, but surprisingly, with the centersection firmly bondo-ed to his work bench, carefully leveled laterally, as well as vertically (aft face plumb), the work bench plus centersection was placed diagonally and both wings could be mounted to the centersection. Some care was necessary in placing the workbench, but it just barely fit in his garage. The wings were strapped to the centersection using two nylon ratchet-type straps (see photos) on each wing. Using a level on the bondo boards on each wing, and some small wood wedges, the wings were jigged exactly into the correct position relative to the centersection and to each other. Generous blobs of bondo were used to fix the wings to the centersection spar. Doug then spent the next four hours drilling the 6 wing attach holes! That same evening, the bondo was cut and the aluminum flanged bushings were floxed in place and both wings were bolted to the centersection, properly shimmed so that the bondo boards were level, and left to cure the flox to bushings bond with everything lined up.

The next day, the centersection was cut loose from the workbench and this complete unit, wing/centersection/wing, was taken outside for photos. Then it was installed onto the fuselage (out on the driveway) as a complete unit. Of course, the firewall had not been installed yet so the centersection was floxed into the fuselage and held exactly in the proper position, checking each levelling bondo board on the wings and measuring from each wing tip to the nose, by bondo-ing several pieces of lumber, strategically placed, from the fuselage to the centersection. All glass tapes were then installed to tie the centersection to the fuselage and also to support the engine mount extrusions.

This method worked extremely well, better in some ways than the plans call-out. The centersection was very securely mounted to a heavy workbench with bondo and pieces of 2 x 4 lumber, making it easier to mount the wings since it was not sitting on rubber tires and rocking around. It was at a much handier working height for setting the wing incidence and for drilling the mounting holes. Being able to measure from each wingtip to the nose guaranteed that the wing sweep was perfectly symmetrical, something very difficult to do per the plans installation.

Somehow, this method seemed to go quicker, too. In any event, we would recommend using this method to anyone who has remembered to leave the firewall bulkhead loose! Several photos of this installation will be printed at the end of this newsletter.

From CP53-11 (CH14,CH19)(Photo Caption)
Doug Shane's fuselage on the gear - note that the firewall is not installed yet.

From CP53-11 (CH14,CH19)(Photo Caption)
Centersection and right wing. Level-board is bondo'd and must remain in place until wings are drilled and cured to centersection.

From CP53-11 (CH14,CH19)(Photo Caption)
Centersection bondo'd to work bench with both wings strapped in place, ready to drill wing attach holes.

From CP53-11 (CH14,CH19)(Photo Caption)
Centersection is level laterally and aft face is plumb. Wings are strapped to centersection with ratchet/nylon straps.

From CP53-11 (CH14,CH19)(Photo Caption)
Wing/centersection/wing assembly bolted together and ready to install in fuselage.

From CP53-11 (CH14,CH19)(Photo Caption)
Wing/centersection/wing assembly is floxed into fuselage. Note that this assembly is "sighted" to align perfectly with canard. Firewall being "buttered" with flox prior to installation.

From CP53-11 (CH14,CH19)(Photo Caption)
Lumber bondo'd from fuselage to centersection spar to firmly locate it while it is taped in place.

From CP53-11 (CH14,CH19)(Photo Caption)
Generous bondo "blobs" will hold centersection firmly, but only if you sand the glass where the bondo goes.

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Table of Contents for Chapter 15, Firewall and Accessories

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Chapter 15, Firewall and Accessories

Long-EZ Plans Changes

****From CP25-6 (CH2,CH4,CH15,CH30)****
LPC #25, DES, Page 4-3 and Page 2-2.
Aluminum can be substituted for the steel firewall, don't install fiberfrax now. Wait until after cowling installation. This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and aluminum. Install fiberfrax with silicone rubber, not epoxy.

****From CP27-7 (CH4,CH15,CH16)****
LPC #47 DES
Due to a probable rubbing of the rudder cable on the aileron pushrod, the left hand rudder pulley bracket should be moved up 0.6". If you have already mounted the 3 bolts in the firewall such that you cannot make this change, you can provide cable clearance by carefully bending the rudder pulley bracket to move the pulley aft approximately 0.2". Bend as shown below. **SKETCH OMITTED**

****From CP49-6 (CH15,CH16,CH30)****
LPC #131 MAN-GRD Modify the roll and yaw control systems between the firewall and the aluminum protective ribs at the wing roots by substituting 4130 steel or any stainless steel for all aluminum components with thicknesses less than 0.1 inches. This includes tubes, pushrods (with inserts), pulley brackets and bellcrank brackets. Apply Ocean No.1644 Flexibilized - Intumescent Fireproof Coating Compound to the engine-side surface of the aluminum wing root shield ribs. Apply Ocean 1644 Intumescent to the aft surface of the centersection spar including interior flange surfaces between the existing firewall and the wing root rib. If your Fiberfrax shield is aluminum rather than the stainless steel option, coat its aft surface with Ocean 1644 Intumescent. Inspect all fuel system plumbing and fuel system components for approved fireproof components. Substitute approved fireproof components (steel or stainless) for any aluminum components and be sure that fireproof sleeves are used on all hose components. Any exposed aluminum tubing or fittings should be corrected with approved stainless steel or steel aircraft fitting. If your gascolator bowl is aluminum, wrap it with approved fire sleeve material similar to the hose sleeves.

Miscellaneous

****From CP35-7 (CH13,CH15,CH17,CH30)****
FROM THE BUILDERS AND FLYERS
First flight from Debbie Iwatate.
"Long-EZ N455EZ flew for one hour on it's first flight October 31, 1982. It went so smoothly that we found ourselves thinking, "is that all there is to it!", after the landing. A big reason for having an uneventful first flight was our friendship with Bryan Giesler (VariEze 90331). By the time we were ready for flight testing the Long, I had accumulated almost 15 hours of back seat time and 3 hours of solo time in his aircraft ..... that does wonders for a persons confidence! The only changes we have made to the plane are to change to REM37BY plugs, **modify the upper brake arm (BA) to make it an inch longer to increase the braking effectiveness,** and change the pitch trim spring lengths to gain more nose down trim authority. I have flutter tested up to 198 mph IAS, stalls are at 60 mph engine idle (straight forward and smooth) and 55 mph power on. We are burning about 4 - 4 1/2 gallons per hour average.

It took us about 2,000 hours to build the plane (325 for the finishing) and that was spread over 21 months. We didn't cut too many corners on cost and our final cash outlay was around $18,000 (well worth every penny). Many thanks to you Mike, for your assistance every time I called for help.

Incidently, the nose (side) airvents work very well! Leading the air into the cockpit through eye-ball vents, we are getting fantastic ventilation. In addition we added "extra air" vents on the sides above the CC spar "deck".

We have 33 hours on the plane now and have been signed off by the FAA. Now we can settle into the maintenance routine and get our fly-in schedule made up for the summer of '83. Many thanks to Burt for making such a project possible to folks like us. Take Care, Debbie Iwatate".

Debbie is the first female builder/flyer to complete and fly a Long-EZ. Congratulations!!!

From CP37-4 (CH15,CH16,CH23,CH30)
Section IIL - NOTE: The engine installation plans update and supercede information in Section I. Do not do any work aft of the firewall without having Section IIL in your hands. Section IIL also has lots of information on engines, which may help you to make your selection.

From CP38-7 (CH14,CH15,CH16,CH23,CH30)
CAUTION - Long-EZ
Note that the engine section of the plans, Section IIL updates Section I of the plans. Do not do any work in the area of engine mount installation, brake master cylinder installation or anything aft of the firewall until you have Section IIL in hand. Also - do not install the aluminum engine mount extrusions until you have the engine mount at hand and can clamp it to the extrusions while they cure in place. This assures a perfect match of engine mount to extrusions.

FireProofing

Also see LPC #131 in the "Long-EZ Plans Changes" section of this chapter.

From CP25-4 (CH4,CH15,CH30)
FIREWALL - LONG-EZ AND VARIEZE
We now approve the use of fiberfrax (a space age ceramic material) as a replacement for asbestos. Since fiberfrax is as good a fire barrier as stainless steel, we approve substituting .016 2024 T-3 aluminum for the stainless. This saves almost 2 lb at the firewall. Both Wicks and Aircraft Spruce are now shipping kits with fiberfrax and aluminum.

Installation of fiberfrax is as follows: Complete airframe construction through cowling installation, then remove everything from the firewall bulkhead, and install fiberfrax with a bead of silicone around the edge of the bulkhead. Do not wet out fiberfrax with epoxy. Now install the .016 2024 T-3 aluminum which is required to protect the fragile fiberfrax, from local damage, abrasion etc. See plans changes section of this newsletter.

From CP38-7 (CH15,CH30)
CAUTION
There is a product being sold that supposedly can be used in a liquid form and painted on in place of the recommended firewall. RAF does not approve the use of this material on a VariEze or Long-EZ. While this material is fire proof, it has virtually no insulating qualities. This means the cockpit side of your firewall bulkhead can be almost as hot as the engine side during a fire. The spontaneous flash point of the epoxy system is only about 850 degrees F, so it is possible to have a fire inside the cockpit area, even thought the fire did not burn through. The insulating qualities of the fiberfrax is required to keep the temperature on the cockpit side of the firewall bulkhead below the flash point of the epoxy.

From CP49-3 (CH15,CH30)
Ocean No. 1644 Flexibilized - Intumescent Fireproof Coating Compound, a remarkable heat protection paint for use on firewalls, wing roots and engine cowling areas, is available from:

Wicks Aircraft
410 Pine St.
Highland, IL 62249
618-654-7447

From CP49-5 (CH15,CH16,CH30)
FIREWALLS AND FIRE PROTECTION OF FLIGHT CONTROLS
The study of VariEze accident history has always shown considerably reduced incidents of fire as a result of an accident than the conventional metal aircraft with the engine on the front. The reasons for this are relatively obvious in that the sources of ignition of the fire are more remote to the major impact. Another feature that has been considered safer than the tractor aircraft is the airflow pattern through the engine area which pulls the fire away from the aircraft rather than impinging it toward the firewall. There have been no accidents or incidents in the VariEze or Long-EZ that have been caused by fire destroying aircraft structure or flight controls. There may be, however, a possibility of this occurring and this possibility is something that we feel obligated to address and, thus, are recommending specific modifications to the VariEze, Defiant and Long-EZ to reduce, as much as possible, the exposure to this risk.

Several years ago, we tested a product called Liquid Firewall and found it did not provide satisfactory fireproofing/insulation and, thus, did not recommend its use and, in fact, specifically cautioned those who would attempt substituting it for the recommended firewall. A couple of weeks ago, Wicks Aircraft sent us a new product (Ocean 1644 Intumescent) to evaluate. This material is intumescent which means it swells up to a very thick layer of high temperature insulation and provides surprising results in that it will protect an aluminum surface from fire damage for a considerable time period. We do not have the equipment to specifically qualify this material to FAR 23 regulations, however the torch tests we have conducted have convinced us that it can provide a considerable barrier to deterioration by fire to aluminum or composite structure. The other good news is that this material costs considerably less than the previous liquid protection product.

Because of our concern that it may be possible to suffer unacceptable structural damage or loss of flight controls, we are recommending mandatory changes in this newsletter to all our designs except the Solitaire. This is particularly important in the VariEze and Long-EZ where both yaw and roll systems pass through the engine compartment. Loss of roll control on a Defiant may allow recovery using rudder.

****From CP50-5 (CH15,CH16,CH30)****

Clarification of changes to VariEze and Long-EZ control systems aft of the firewall called out in CP 49.

As any plans owner knows, the aileron control system aft of the firewall consists of aluminum pushrods and several thin aluminum brackets. The intent of the plans change is to assure that an EZ pilot will retain, at least, roll and pitch control in the event of a serious engine compartment fire. Obviously, pitch control would not be effected by an engine fire, but it may be possible that an aluminum pushrod or aluminum bracket might be melted thus robbing an EZ pilot of lateral (roll) control in the event of a serious but otherwise survivable engine compartment fire. For this reason, we have carefully evaluated the control system for fire survivability. We have decided to only preserve the lateral (roll) control system, and to let the directional (rudders & brakes) system go. Our reasoning is that in such a serious situation as a bad engine compartment fire, the most important thing is for the pilot to retain sufficient control to be able to safely execute an immediate emergency landing. Pitch and roll control are all that are absolutely necessary for this. Stopping, once on the ground, can be accomplished by collapsing the nosewheel.

Toward this end, we are recommending in the strongest possible terms, the direct replacement of all aluminum pushrods aft of the firewall, with 1/2" O.D. x .028" wall 4130N steel tubing. The CS-1 aluminum threaded inserts in the ends of the aluminum pushrods should be replaced by steel inserts (part #CS-50). These inserts should slip inside the 1/2" O.D. x .028" wall steel tubes and should be fastened with four (4) stainless steel pop rivets, such as Cherry #CCP-42. Your existing dash 3 rod-ends can be screwed into these CS-50 inserts. In addition the four CS-127 aluminum brackets on the aft face of the VariEze centersection spar and in the wing root of the Long-EZ must be replaced by steel parts fabricated from .032 4130N steel. Ken Brock will have both of these parts available by mid November. They will be cadmium plated steel per RAF's specification.

Since this was published in CP 49, we have received all kinds of mail, mostly wanting clarification. Hopefully, the above has done that. We also received a few derogatory letters suggesting we were simply trying to "cover our -ss". Obviously, anyone is entitled to his opinion, but you should know that a decision to make such a change as this one is not taken lightly. First of all, RAF's agreement with Brock means that RAF has to buy all remaining inventory such as CS-127 aluminum brackets and CS-1 aluminum threaded inserts.. Secondly, a change like this is always confusing to many builders and our workload on builder support goes up dramatically. Thirdly, and most importantly, we have tried and will continue to try to make any change necessary to make flying RAF designs safer, no matter what it costs or what anyone thinks. We have an awful lot of friends out there and are very sincere in our efforts to provide any information to make flying these airplanes safer. Last but not least, we cannot force anyone to make any changes, we can only print the suggestions in the CP. It is up to you whether you comply or not. Naturally, we hope every one will because these changes are not made on a whim. However, we do not have the authority to force you to ground your airplane and make the change, only the FAA can do that and then usually only when it concerns certificated airplanes.

****From CP50-6 (CH15,CH30)****

"Fire-Proofing" your firewall: by Arnie Ash (Reprinted from Central States Newsletter).

"The arrival of the latest Canard Pusher just two days before leaving for Oshkosh and also just prior to mounting my engine for the final time was indeed timely. The following is an account of a few thoughts regarding the purchase, application and protection of Ocean 1644 "fireproof coating".

To coat to the proper thickness your firewall and side "heat shields" you will need more then one quart of 1644 but less than two. Wicks prices this material at $25.00/quart or $60.00/gallon. It would seem that perhaps three EZ's could be treated with one gallon so you may want to consider splitting the cost of a gallon with a couple of your buddies. You will also need the special thinner which sells for $15.00/half gallon. (You'll use less then a cup of this material though).

Application: Grab the oldest spray gun you can find - you don't need to break out the high priced equipment. Thoroughly mix the 1644 and draw off approximately 3/4 of a quart. Cut this by about 5 percent with the special thinner. Set your spray gun up in the suction mode with about 50 lbs. pressure at the gun. The material seems to flow on best at a range of only 5-7 inches from the part being sprayed. To get the required material thickness you'll have to spray 7 to 9 coats (depending on the thickness of each coat). Allow a few minutes between each coat for the material to "tack" and you'll avoid any runs. (If all goes well you'll have the firewall coated to the required thickness in less than 45 minutes. Wear a good mask and be sure to protect the rest of your airplane from any overspray). This material needs a couple of days to really give you the feeling it's dry.

Once dry you'll have a nice white firewall - - until the first time you touch it with dirty hands or spill a little oil on it. This material appears to be pretty porous and thus absorbent. I called the manufacturer, Ocean Chemical, Savanna, Georgia, inquiring as to the availability of a top coat to help keep the firewall looking nice.

Although they apparently have a product, their lab suggested an excellent top coat would be Imron 500-S Clear polyurethane enamel, sprayed to a thickness of about 3 mills. The problem: If you go to your local paint dealer and buy the smallest container if Imron 500-S and the 192-S activator required you will have as much invested as the Ocean 1644 and you'll only be using about six ounces!!

ONE SOLUTION: Ask the paint dealer who his biggest customer for Imron is and go tell this "end user" your tale of woe. In my case it was the local "Big Truck" body shop and enough Imron 500-S and 192-S cost me a case of Pepsi!

Mix the Imron at a ratio of 3 parts of 500-S to 1 part 192-S. The firewall will take about 4-5 ounces. Application is handy using one of those $3.00 aerosol "touch-up" bottles you can pick up from the guy who told you who his biggest "end user" was. (At least he sold you something!) Spray this material just as you would any "lacquer type" material. This stuff will run easily so best to spray a light coat and let it tack for 10-15 minutes then follow up with successive coats until you achieve the desired thickness.

One last thing: Even though you will only be spraying a few ounces do not under any circumstances attempt to spray this material without a very good mask. I used a good mask and pumped fresh air from a bottle into the mask to create a positive internal air pressure, and I still got a mild headache. This is nasty, nasty stuff. Be careful. . . . Arnie

P.S. At normal room temps. the Imron will take at least two days to cure to the point where you can work on the firewall. Total cure, they tell me, takes about two weeks."

Table of Contents for Chapter 16, Control System

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Update Number 67 to Chapter 16, Control System

****From CP67-5&6 (CH11,CH16,CH19,CH20,CH31,CH32)****

CONTROLS - RIGGING

Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should not be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons (aileron stall)).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees more in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you must be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and no more. (More travel gives less lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept any friction in the pitch control system. If you have friction, do not fly until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on every pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

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Update Number 73 to Chapter 16, Control System

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. **Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots.** I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago. have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

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Update Number 79 to Chapter 16, Control System

Information derived from CP79 published by RAF Oct 1994

****From CP79-10(CH16)****

LONG-EZ PLANS CHANGE

1/2"X.028" WALL STEEL TUBING NO LONGER AVAILABLE.

Ken Brock Mfg. has informed us that the 1/2"x.028" steel tubing called out for use in place of the original aluminum aileron control push rods is no longer available. They will supply 1/2"x.035" wall 4130 steel tubing from now on.

This means that the CS-50 steel inserts originally called out won't fit. Brock has changed the sizes of the CS-50 to ensure that these inserts do fit the 1/2"x.035" steel push rods. These inserts have a 10-32 thread machined into them to accept the dash 3 rod ends.

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Update Number 80 to Chapter 16, Control System

Information derived from CP80 published by RAF Jan 1995

****From CP80-8 (CH10,CH16,CH19,CH31)****
TITANIUM ACCESSORIES AVAILABLE!
Custom anodized in 15 different colors,
Rudder and aileron gust locks - $20.00-30.00.
GU canard full span vortex generators with layout template - $170,00. These are hot looking !
Contact: Mike Rhodes
POBox 1052
Grover Beach, CA 93483-1052
805-489-8155

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Update Number 82 to Chapter 16, Control System

Information derived from CP82 published by RAF Oct 1995

****From CP82-13 (CH10,CH16,CH19,CH20)****
TITANIUM ACCESSORIES AVAILABLE!
Custom anodized to any of 15 different colors, shades of copper, purples, blues, greens, yellow/gold, even rainbow effect. **Rudder and aileron gustlocks - $20.00-$30.00.**

GU canard full span vortex generators with layout template - $170.00.. These are very exciting! Rudder horn CS-301L&R replacements, $25/pair. Shipping inc.

Ti Specialties
P O Box 1052
Grover Beach CA 93483-1052
(805) 489-8155

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Chapter 16, Control System

Long-EZ Plans Changes

From CP26-6 (CH16)
LPC #29, MEO, page 16-3.
CS119 should be 4.1" not 3.1"

From CP26-6 (CH16)
LPC #40, MEO, page 16-3.
The AN 315-3 jamb nut shown is not supplied in the bill of materials. It is satisfactory to substitute a MS21042-3 nut. Run a 10-32 tap through the MS nut before installation.

From CP27-7 (CH4,CH15,CH16)
LPC #47 DES
Due to a probable rubbing of the rudder cable on the aileron pushrod, the left hand rudder pulley bracket should be moved up 0.6". If you have already mounted the 3 bolts in the firewall such that you cannot make this change, you can provide cable clearance by carefully bending the rudder pulley bracket to move the pulley aft approximately 0.2". Bend as shown below. **SKETCH OMITTED**

From CP32-7 (CH16)
LPC #95 DES, Section I, page 16-2, step 3, paragraph 1, last sentence. Pivot hole drilled to 23/64" (0.359). This results in an extremely tight interference fit,(0.016) and it would work better using a letter "U" drill (0.368) & better yet if you then ran a 3/8" press fit reamer (approximately 0.373) through the hole.

From CP33-4 (CH11,CH16,CH31,CH33)
VariEze and Long-EZ MEO
Owners Manual appendix three add "CAUTION friction in the pitch system can seriously degrade flying qualities". Also add ditching procedure shown on next page.

From CP36-6 (CH16)
LPC #111, MEO, Section I, Page 16-4
Universal joint CS120, should be MS20271-B10, not AN271-B10

From CP49-6 (CH15,CH16,CH30)
LPC #131 MAN-GRD Modify the roll and yaw control systems between the firewall and the aluminum protective ribs at the wing roots by substituting 4130 steel or any stainless steel for all aluminum components with thicknesses less than 0.1 inches. This includes tubes, pushrods (with inserts), pulley brackets and bellcrank brackets. Apply Ocean No.1644 Flexibilized - Intumescent Fireproof Coating Compound to the engine-side surface of the aluminum wing root shield ribs. Apply Ocean 1644 Intumescent to the aft surface of the centersection spar including interior flange surfaces between the existing firewall and the wing root rib. If your Fiberfrax shield is aluminum rather than the stainless steel option, coat its aft surface with Ocean 1644 Intumescent. Inspect all fuel system plumbing and fuel system components for approved fireproof components. Substitute approved fireproof components (steel or stainless) for any aluminum components and be sure that fireproof sleeves are used on all hose components. Any exposed aluminum tubing or fittings should be corrected with approved stainless steel or steel aircraft fitting. If your gascolator bowl is aluminum, wrap it with approved fire sleeve material similar to the hose sleeves.

From CP58-10 (CH16,CH19,CH38)
MAN-GRD: Long-EZ and VariEze - see section on belhorn failure. Replace aileron belhorns within the next 25 hours of flight. If ailerons are vibrating, you must re-balance.

From CP58-7&8 (CH16,CH19,CH38)
LONG-EZ AILERON BELHORN FAILURE
RAF has recently received two separate reports of failures of one of the CS132L weldments, the belhorn, which drives the aileron out in the wing roots. One of these belhorns has had lightening holes bored through the .050 steel belhorn and it cracked through one of these holes. However, the second one was as received from Brock and it cracked across at the edge of the weld around the tube. Prior to the failure of the belhorn this builder pilot had had to replace the rod end that bolts to this belhorn, at least twice over the past 350 flight hours, due to the rod end being "pounded out" until it was dangerously loose.

The belhorn failure occurred in flight and caused a few moments of concern, but in both cases the Long-EZ was easily controlled. A disconnected aileron will float trailing edge up. To keep the wings level, the pilot has to raise the trailing edge of the operable aileron which, of course, will give a nose up pitching moment requiring forward stick to fly level. The one operable aileron will provide reasonable roll control and, of course, the rudders will roll the airplane by themselves. The greatest hazard would be if the disconnected aileron pushrod, being loose in the cowling/root of the wing area, ever managed to get itself jammed. Depending how much lateral input there was at the time, you may or may not be able to correct the roll with rudder.

A primary control system failure is cause for strong concern so we at RAF have designed, built and flight tested a new aileron belhorn. Drawings for this new part have been sent to Ken Brock Mfg. and Ken will have these parts available as soon as possible. We will provide a drawing of the new belhorn in this CP for those people who would like to make these parts themselves. (see sketch, page 15) **SKETCH OMITTED**

Why would this belhorn fail on two relatively low time Long-EZs when we have literally dozens of Long-EZs with 1000-plus hours and some with 1500-plus hours with no failures and zero wear on the rod ends? Bill Freeman, Long-EZ builder/flyer and a man whose specialty is working with vibration problems and who has a Master's degree in Mechanical Engineering, has a theory with which we concur. The original control system with aluminum push rod tubes apparently was OK. The natural frequency of this collection of parts was not the same as the normal cruise excitation frequency of the engine/prop. Changing the aluminum tubes to steel as called out in the CP may have moved the control system into the excitation frequency of the engine/prop combination. Bill says that this strongly suggests to him a spanwise vibration of the CS132L belhorn and CS129L pushrod at, or near, its natural frequency, inducing a high-cycle fatigue failure in the CS132L belhorn. The fact that the rod end bearings were beaten out is strongly suggestive of a resonant vibration of the CS132L and CS129L pushrod. This vibration would have the bottom end of CS132L and the aft end of CS129L moving spanwise, bending CS132L in the weak direction with high enough stress levels to initiate a fatigue failure in CS132L.

The new part, part number CS132L-R, has two arms instead of one which will more than quadruple the stiffness of the system and will also provide redundant links in the aileron system as well as providing positive retention of the rod end in the event of a ball slipping out.

If you absolutely insist on flying before the new belhorn is replaced, a careful examination of your CS132L belhorns are mandatory. Use a bright light and a magnifying glass. Examine the area shown in the sketch while gently flexing the CS132L left and right. Any sign of a crack starting requires immediate grounding of the aircraft until the new CS132L-R is installed. Examine the rod ends bolted to the CS132L. Look for a loose ball, or play in the rod end in the fore/aft plane. A worn rod end must be replaced before flight and you should realize from the above discussion that a worn rod end almost certainly indicates that a belhorn failure is imminent. If you have steel tube push rods (CS132L), your belhorns are definitely more suspect. If you have worn rod ends, do not fly until you replace the belhorns and rod ends. Even if everything looks OK, replace belhorns within the next 25 hours of flight. The CAD plated CS132L belhorns should not be painted since the paint may hide a crack.

This is a serious matter and should not be ignored. A primary control system failure could result in a serious accident.

Please report any cracked or broken belhorns to RAF along with the number of hours on the airplane, whether you have aluminum or steel push rod tubes and if you have experienced rod end wear or failure.

From CP58-8&9 (CH16,CH19,CH38)

AILERON VIBRATION

Below is an excerpt of a letter received at RAF recently.

"Thanks for all the good newsletters. Just to clarify, I have had aileron flutter (see Ed. note). At 10 hours, I noted a lot of aluminum dust behind the aileron hinges. In flight, I visually could see the tip of both ailerons as a 1/4" blur. I added leading edge weight and installed the Teflon hinge pin setup. At this point, I had no visible vibration at 2000 ft at 120 mph, but still had vibration at 8000 ft., 160 mph. It remained this way for many hours of "hauling rides" but less than 5 cross country hours. Note: I never was able to detect any vibration on the stick.

I recently put more weight on the right aileron which was still vibrating slightly at altitude. This extra weight was along the outboard end where I had previously not had any. This finally cured the problem. Now the ailerons hang with the top surface level. Note: The problem occurred when the ailerons balanced bottom surface level as per plans. Note: Both ailerons had this problem. The left aileron is very accurate dimensionally, the right's trailing edge rises 1/4" in the outboard 8" from a straight line. Also, I have a good surface finish, laminar flow, as evidenced by wing drop before the vortilons.

It is very hard to see the trailing edge of the aileron and difficult to decide if it is indeed vibrating 1/4" or if your eye is just not that sharp, but having fixed it, I can verify that it was not an optical illusion.

I feel that many Long-EZ's probably have this problem and their pilots are not aware of it. Again, there is no indication of stick vibration.

Larry Bush"

EDITOR'S COMMENT

We have published Larry's letter as he wrote it because we believe he experienced the same phenomena described above: Engine/prop excited "forced vibration" driving his aileron at the same frequency as the engine/prop. "Flutter" is an aerodynamic condition and is normally divergent, i.e., expands to destruction. "Forced vibration" can continue as long as the source (engine/prop) is maintained near the same frequency as the natural frequency of the aileron. By over-balancing his ailerons to the top limit as called out in the plans, he has (1) changed the mass of his ailerons thereby lowering the natural frequency of the ailerons and, (2) repositioned the CG of the aileron relative to the hinge, thus reducing the "forced vibration" input.

If your ailerons are vibrating at the trailing edge as Larry's were, you must add more leading edge weight. Note: We checked several Long-EZs here at Mojave and none of them exhibited any visible vibration at the trailing edge, however, all of them show some signs of aileron hinge wear (black aluminum dust on the aileron, particularly after flying through moisture).

Keep in mind that it may be difficult to spot. Have a passenger in the rear seat look at the aileron trailing edges very, very carefully. Spend at least 30 seconds staring at the ailerons in level flight, in a climb, in a descent, and in left and right turns. If any vibration is seen, re-balance the ailerons.

The easiest way is to get some lead ribbon from a golf pro shop and stick it to the top of the aileron leading edges, full span, until it balances top skin level. Lay up one ply of BID to permanently secure the lead to the aileron leading edge. (see sketch, page 15). **SKETCH OMITTED**

We would like to thank Larry Bush for the excellent feedback on this situation. This is the kind of information we all need to know about in order to keep the large fleet of EZs flying safely and consistently.

From CP59-9 (CH16,CH19,CH38)
AILERON "VIBRATION"
The reports in CP58 have really put the cat among the pigeons! A controversial topic, to say the least. In spite of all of this, only three flyers have reported finding their ailerons vibrating visibly in flight (one was not sure), one reported finding his vibrating at various RPM's while running on the ground -probably true of all EZ's while they are sitting on their wheels (the tires are like springs, as is the gear), so we believe you must look for this problem while in flight and it will be difficult to see and will require a rear seat passenger to watch the ailerons. If you have a visibly vibrating aileron or ailerons, you should increase the mass balance as required to a maximum of what it takes to balance the ailerons with the top skin level. If it only takes 25% or 50% of the maximum to stop the vibration, then that is enough. Unless you know you have this problem, do not change the mass balance.

Brock has the new aileron belhorns available now and many have been delivered and installed. If you have evidence of worn or beaten out rod end bearings in your aileron control system, you should ground your airplane until you have replace the original belhorns with the new part which is about 8 times stiffer and this is out of the vibration frequency that has been causing the problems. A number of Long-EZ owners have reported worn out rod ends, but far more have reported no sign of wear or vibration. Apparently, it depends greatly on the vibration characteristics of each engine/prop/mount combination and it does not necessarily occur in all Longs - watch for it, though, this is a potential accident waiting to happen - always listen to your airplane - it will invariably try to warn you before it bites!

From CP60-8&9 (CH16,CH19,CH38)
LONG-EZ AILERON BELCRANK VIBRATION UPDATE
We have had only three reported incidents of aileron vibration in flight in the Long-EZ. Since our original CP article on this subject, only a few builders have found their rod ends badly worn. All of these had steel push rods installed (heavier than the original aluminum pushrods). One builder had no problem with rod ends but the rivets holding the inserts into the steel pushrods were loose!

Be sure and check these rivets next time you remove the cowling. Obviously, the heavier weight of the steel pushrods has moved the natural frequency of these parts into a frequency range that can be driven by the engine at certain RPM's. If you have steel push rods installed, check the rivets and the rod ends often, and be sure to replace the original aileron belhorns (CS-132L) with the new double arm belhorns (CS-132L-R) available from Ken Brock.

Miscellaneous

From CP26-1 (CH16,CH30)
NEW BROCK ITEMS
Ken Brock Manufacturing now stocks a new stick grip that fits VariEzes and Long-EZs. It is styled after the ski pole grip that nests the lower side of your palm, resulting in a comfortable, low-fatigue grip. Part no. LESG1. Ken also has in stock, the new square style 12 volt fuel pump. This pump can be substituted for the Bendix electric pump with a small weight savings and at less than half the cost. Part no. is EFB. We have recently finalized the engine mount design for the Lycoming dynafocal configuration. By the time you read this, Brock will have this item available.

From CP26-10 (CH16,CH39)
2) A VariEze crashed as it entered the downwind leg of the busy approach pattern at the Oshkosh EAA convention. The aircraft was observed to maneuver erratically then turn and dive at very high speed, with high power maintained to impact. Both occupants died immediately. The aircraft struck a concrete street in a near vertical (60-70 degree) dive, at a low angle of attack. A pilot witness 200 feet away observed that it did not appear that the pilot was attempting to pull out of the dive. This points to a possibility of either a pitch control system disconnect or pilot incapacitation. All but two parts of the control system were found

- they did not indicate control system disconnect. **The aircraft did not have a rear seat control stick.** Thus, pilot incapacitation is the suspected cause.

Destruction of the aircraft was unbelievable, only small parts remained. The engine struck the concrete road at the same point that the nose did. The bow shape of the main gear strut was clearly imprinted on the concrete at the impact point.

Initial investigation at the scene of this accident suspected fuel starvation because there was no evidence of fuel and there was no fire. It was determined that the tremendous force of the estimated 200 mph impact resulted in a fuel and oil explosion, however there was no resulting fire. There have been no fires associated with any VariEze accident.

****From CP27-5 (CH16)****
Drill a sight hole through all control push rods in order to verify that you have the rod ends screwed in with sufficient threads into the push rods. This hole should be 1/16" diameter, located at 0.4" from the end of the push rod. **SKETCH OMITTED**

****From CP28-10 (CH16)****
Q. Can I make a soft leather "boot" to cover the control sticks, in place of the fiberglass cosmetic covers shown?
A. Yes, we have seen several examples of this, and they looked excellent. The leather can be attached with contact cement or velcro. There must be no restriction to control stick travel.

****From CP31-4 (CH16)****
If your control sticks have any lateral slop, try substituting AN174-20 close tolerance bolts for AN4-20 pivot bolts in the control handles.

****From CP37-4 (CH15,CH16,CH23,CH30)****
Section IIL - NOTE: The engine installation plans update and supercede information in Section I. Do not do any work aft of the firewall without having Section IIL in your hands. Section IIL also has lots of information on engines, which may help you to make your selection.

****From CP38-5 (CH16,CH38)****
Front Control Stick - Long-EZ
Be certain that the lower bolt in the control stick can not catch on the rudder conduit at full left aileron deflection. Check this carefully before next flight. One builder had this occur in flight. He got quite a scare before he forced the stick right and tore the conduit off the fuselage side.

****From CP38-7 (CH14,CH15,CH16,CH23,CH30)****
CAUTION - Long-EZ
Note that the engine section of the plans, Section IIL updates Section I of the plans. Do not do any work in the area of engine mount installation, brake master cylinder installation or anything aft of the firewall until you have Section IIL in hand. Also - do not install the aluminum engine mount extrusions until you have the engine mount at hand and can clamp it to the extrusions while they cure in place. This assures a perfect match of engine mount to extrusions.

****From CP49-7 (CH16)****
CONTROL GUST LOCKS
Control locks on the ailerons and rudders can prevent damage to the control system and to the winglets when the rudders are blown forward allowing the rudder belhorn to gouge the paint. A nice, simple gust lock can be made up using a few pieces of .032 aluminum and some short lengths of aluminum angle. See sketch. **SKETCH OMITTED**

A little weatherstrip rubber can be stuck to the face of the angles to help the gust lock remain tightly in place and to prevent damage to the painted surfaces.

Other gust locks we have seen include simple duct tape (red is best since it is easy to see) and large spring clips with rubber glued to the jaws. A long, red ribbon would help prevent accidentally leaving them on. Which brings up the question of safety. Down through the years, there are many, many instances of accidents caused by leaving gust locks in place. A thorough preflight should eliminate this possibility. The elevators really don't need gust locks, just set the bungee trim to hold the elevator in the faired position and always try to park the EZ nose down facing into the prevailing wind.

Control System Friction

****Also see CP33-4 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP33-5 (CH11,CH16,CH31,CH38)****
CAUTION! CONTROL SYSTEM FRICTION
The presence of friction in the pitch controls of an EZ will result in serious degradation in flying qualities. Mike recently installed a different shape canard tip and when reinstalling the elevators one of the pivot bolts was adjusted to bind an elevator. Sally and Mike both flew the aircraft with friction and reported PIO tendencies and over-control difficulty. Adjusting out the bind immediately returned the excellent pitch control and smooth flying qualities.

From CP47-12 (CH11,CH16,CH19,CH31,CH38)

CAUTION: CONTROL SYSTEM STIFFNESS

We have previously warned builders to ensure absolute freedom from stiffness in the pitch control system. This is very important and must be corrected if it exists in your EZ. We never have particularly addressed lateral (roll) control system stiffness. While not quite as important as pitch, tight bearings in the aileron control system really spoils the nice flying qualities inherent in an EZ. Conscientious attention to detail here will pay dividends. Long-EZs and VariEzes have similar lateral control systems, the main difference being that the CS-132L belhorn in a Long-EZ is mounted inside of the wing root, and the same part (CS-132) in a VariEze hangs out in the breeze, inboard of the wing root, close to the bottom cowling.

Both of these areas can be troublesome. In the Long-EZ, you must assure that the end of CS-132L cannot contact the bottom of the wing. Even if you have to dish the skin locally, you cannot accept any rubbing here. In fact, it would be best to have at least 1/4" of clearance. The VariEze though, needs even more clearance between the lower end of CS-132 belhorn and the bottom cowling, because the cowling will tend to flex up in flight and could cause a rubbing interference, or even worse. For example, if your CS-132 belhorn just barely clears the bottom cowl while at rest on the ground, it is possible that in flight the cowl could move up enough to seriously interfere with lateral control of the aircraft! The answer is a streamlined blister on the bottom cowl which will give the required clearance and will stiffen the bottom cowl.

Lubricate all bushings and bearings in the control system and do not fly until you have the control system working nice and free with no tight spots or stiffness anywhere within the full range of control stick movement.

From CP55-6 (CH11,CH16,CH31,CH38)

CAUTION

Friction in the pitch control system of an EZ can make it very difficult to fly. In fact, it can flat-out make it so uncomfortable to fly that you won't enjoy it at all!

Friction in an EZ's pitch control system is easy to avoid and must be avoided. There are so few parts involved that it is simple to check. Disconnect the pitch trim springs, push the stick forward and aft, or grab the trailing edge of the elevator and move it full travel up and down. There should be no perceptible friction. It should not hang up anywhere, it should easily flop all the way up and all the way down. If it feels stiff or tight anywhere in the full arc of travel, find out where it is binding and fix it before you attempt to fly. Check the rod ends at the stick and at the inboard ends of the elevators. Check the stick's pivot points. Check every one of the elevator hinges. On the original GU canard, it is easy to get one or more hinge points too tight. The washers at the hinge points should easily spin. The bronze bushing should be lubricated and should be a nice easy slip fit on the AN525 screws which are the hinges. Check that the mass balance weights are not rubbing or chafing inside the slot in the canard on each elevator.

Lastly, put a saw horse or chair under each canard tip (well padded, of course) and have someone push down on the nose or center of the canard. Apply enough weight to bend the canard at least 3 or 4 inches up at the tips, then check all of the above for friction or binding or chafing under load. There should be no perceptible drag in the pitch control system (with no pitch trim springs installed) in any of the RAF designs, VariEzes, Long-EZs. Defiants or Solitaires.

FireProofing

Also see LPC #131 in the "Long-EZ Plans Changes" section of this chapter.

From CP49-5 (CH15,CH16,CH30)

FIREWALLS AND FIRE PROTECTION OF FLIGHT CONTROLS

The study of VariEze accident history has always shown considerably reduced incidents of fire as a result of an accident than the conventional metal aircraft with the engine on the front. The reasons for this are relatively obvious in that the sources of ignition of the fire are more remote to the major impact. Another feature that has been considered safer than the tractor aircraft is the airflow pattern through the engine area which pulls the fire away from the aircraft rather than impinging it toward the firewall. There have been no accidents or incidents in the VariEze or Long-EZ that have been caused by fire destroying aircraft structure or flight controls. There may be, however, a possibility of this occurring and this possibility is something that we feel obligated to address and, thus, are recommending specific modifications to the VariEze, Defiant and Long-EZ to reduce, as much as possible, the exposure to this risk.

Several years ago, we tested a product called Liquid Firewall and found it did not provide satisfactory fireproofing/insulation and, thus, did not recommend its use and, in fact, specifically cautioned those who would attempt substituting it for the recommended firewall. A couple of weeks ago, Wicks Aircraft sent us a new product (Ocean 1644 Intumescent) to evaluate. This material is intumescent which means it swells up to a very thick layer of high temperature insulation and provides surprising results in that it will protect an aluminum surface from fire damage for a considerable time period. We do not have the equipment to specifically qualify this material to FAR 23 regulations, however the torch tests we have conducted have convinced us that it can provide a considerable barrier to deterioration by fire to aluminum or composite structure. The other good news is that this material costs considerably less than the previous liquid protection product.

Because of our concern that it may be possible to suffer unacceptable structural damage or loss of flight controls, we are recommending mandatory changes in this newsletter to all our designs except the Solitaire. This is particularly important in the VariEze and Long-EZ where both yaw and roll systems pass through the engine compartment. Loss of roll control on a Defiant may allow recovery using rudder.

****From CP50-5 (CH15,CH16,CH30)****

Clarification of changes to VariEze and Long-EZ control systems aft of the firewall called out in CP 49.

As any plans owner knows, the aileron control system aft of the firewall consists of aluminum pushrods and several thin aluminum brackets. The intent of the plans change is to assure that an EZ pilot will retain, at least, roll and pitch control in the event of a serious engine compartment fire. Obviously, pitch control would not be effected by an engine fire, but it may be possible that an aluminum pushrod or aluminum bracket might be melted thus robbing an EZ pilot of lateral (roll) control in the event of a serious but otherwise survivable engine compartment fire. For this reason, we have carefully evaluated the control system for fire survivability. We have decided to only preserve the lateral (roll) control system, and to let the directional (rudders & brakes) system go. Our reasoning is that in such a serious situation as a bad engine compartment fire, the most important thing is for the pilot to retain sufficient control to be able to safely execute an immediate emergency landing. Pitch and roll control are all that are absolutely necessary for this. Stopping, once on the ground, can be accomplished by collapsing the nosewheel.

Toward this end, we are recommending in the strongest possible terms, the direct replacement of all aluminum pushrods aft of the firewall, with 1/2" O.D. x .028" wall 4130N steel tubing. The CS-1 aluminum threaded inserts in the ends of the aluminum pushrods should be replaced by steel inserts (part #CS-50). These inserts should slip inside the 1/2" O.D. x .028" wall steel tubes and should be fastened with four (4) stainless steel pop rivets, such as Cherry #CCP-42. Your existing dash 3 rod-ends can be screwed into these CS-50 inserts. In addition the four CS-127 aluminum brackets on the aft face of the VariEze centersection spar and in the wing root of the Long-EZ must be replaced by steel parts fabricated from .032 4130N steel. Ken Brock will have both of these parts available by mid November. They will be cadmium plated steel per RAF's specification.

Since this was published in CP 49, we have received all kinds of mail, mostly wanting clarification. Hopefully, the above has done that. We also received a few derogatory letters suggesting we were simply trying to "cover our -ss". Obviously, anyone is entitled to his opinion, but you should know that a decision to make such a change as this one is not taken lightly. First of all, RAF's agreement with Brock means that RAF has to buy all remaining inventory such as CS-127 aluminum brackets and CS-1 aluminum threaded inserts.. Secondly, a change like this is always confusing to many builders and our workload on builder support goes up dramatically. Thirdly, and most importantly, we have tried and will continue to try to make any change necessary to make flying RAF designs safer, no matter what it costs or what anyone thinks. We have an awful lot of friends out there and are very sincere in our efforts to provide any information to make flying these airplanes safer. Last but not least, we cannot force anyone to make any changes, we can only print the suggestions in the CP. It is up to you whether you comply or not. Naturally, we hope every one will because these changes are not made on a whim. However, we do not have the authority to force you to ground your airplane and make the change, only the FAA can do that and then usually only when it concerns certificated airplanes.

Loss of Pitch Control

****From CP27-13 (CH3,CH16,CH38,CH39)****

The following letter was received just at press time for this newsletter. With Victor's permission we are printing it:

Dear Burt and Company,

Thank you for your Christmas card. It found me recovering from a crash landing of my VariEze and with even more respect for the design. On November 11, 1980 I was working to take off the 40 hours a bit at a time. We had about 30 minutes before dark after work (my second mistake) to get a few trips around the patch. Mary-Kate and I had decided to install the new Long-EZ elevator trim but I over-ruled and decided to put it off until certification (my first mistake). I wanted to complete the 8 hours remaining to my certification as soon as I could.

After one touch and go I was climbing out about 600-700 AGL when I eased the stick forward to level off at 800 and nothing happened. **The bolt between BC4W10 and CS136 had come off.** I immediately called "mayday" and requested emergency equipment. I thought I was dead. However, I realized 62MV was still climbing so I began to analyze my possibilities. I could not reach past my right leg to reach CS136 so I experimented with power changes. I found that at about 80 MPH indicated the nose would begin to drop and about 120 MPH it would pick up. The initial oscillations must have been 200-300 feet up and down. I found by careful throttle changes and by moving my body forward and backward I could greatly reduce the up/down changes, but I still was faced with only gross control. I flew 3 patterns, about 15 minutes, and on the last down wind discovered I could touch the elevator balance weight with my right toe. Holding about 100-110 MPH and using the toe technique to give progressive downward dips I made my final approach to runway 10 (4000' long) into a 5 degree right wind of 5 to 10 knots. At about 30 to 50 feet AGL, darkness made judgement poor, I was almost to the runway when the nose began its upward cycle at about 80 MPH. Knowing I would not stand another cycle, especially the 120 mile per hour dive I cut power and dropped it in. At the same time I cut power I deployed my landing brake, I probably should not have used the landing brake since it does tend to increase the sink rate.

The landing was just about 20 feet short of runway 10 in a slight left turn so that I skidded across the corner of the runway and onto the grass beside the runway. I came to a stop in the newly planted wheat field about 20 feet from the runway. I had lowered the nose gear to take up shock as well as the possibility I could make a controlled landing. The nose gear push rod bolt sheared, the main gear attach taps on the gear sheared or split , and the lower cowl was crushed. The intake spider broke and the carb separated as did the gascolator and intake hose. The oil pan was crushed and the bottom 3" of the firewall cracked and bent aft about 15 degrees. We hit so hard that the pilot's seat area broke and combined with skidding across the runway made a hole clear through the pilot compartment floor about 3" from the left console and about 9" wide by 20" long. I was able to turn everything off, release my harness and climb out. I noticed severe pain in my back so decided to lie down because the ambulance was pulling up. I next woke up in the ambulance on the way to the hospital. I suffered shock and two cracked vertebra #L2 and L3. After 11 days in the hospital and a month at home I am feeling pretty well. I will wear a back brace for at least another month but should not have any future problems.

Why did the nut (MS210042-4) come off? I don't know. I may not have had it on all of the way but I am sure I did because I had developed the habit of checking for 2-3 threads through the nut. The canard and of course this nut had been off about 10 times for work on the electrical and instrument systems. Do such nuts wear out? The nut and bolt are included for your inspection. I find I can get it on to almost one thread with just my fingers. The FAA inspector was Glenn Martin of Wichita GADO. He was just as surprised as I to find out the a VariEze will fly without elevator control.

N62MV normally trimmed out level with a slight nose down force required. I was able to correct it with the original spring trim system. At the time of this flight I had 2 gal in the fuselage tank and about 7 gal total in the wing tanks. The engine is an A80-8 and the original long canard is installed.

I expect to wait about a year before repairing the plane. What do you think of having the main gear strut and wing attach areas x-rayed? There doesn't appear to be any damage to the wing or canard attach fittings or surrounding areas. Both lower winglets were ripped off, right rudder was destroyed and of course the gear and gear attachment area. The enclosed photos were taken by Glenn Martin. I would like to have them back because they are all I have. Enclosed find SASE.

Thanks again for an outstanding design. If you would want to question me please feel free to call.

Sincerely,
Victor Sullivan

It should be emphasized that an elevator disconnect downstream of the trim system will not necessarily result in the amount of control Victor was able to achieve. Any small inconsistency in elevator shape could result in a very low or very high trim speed. Victor had rejected his original elevators and build new ones to a more accurate shape - he probably could not have survived a control disconnect with the original ones. The new trim system, of course, could have allowed a satisfactory amount of control and safe landing.

We have inspected the bolt and nut and found it is of the proper length and that the locking friction, though reduced from new condition, seems adequate for proper safetying. It appears improbable that it could have been tightened properly. Victor agrees that it may be possible that he was distracted during canard installation and might not have tightened the nut beyond finger tight. Even the most critical items can be overlooked by the most competent mechanic. For example, one VariEze attempted a takeoff without the 2 bolts that hold the canard on - the canard flew off when the pilot pulled the stick back for rotation. **Builders should follow the accepted practice of replacing critical locknuts after several repeated installations (discard any fiber-lock nuts after one use). Also, discard any bolt or nut that has any sign of reduced locking friction.**

****From CP35-8 (CH16,CH38,CH39)****

FROM THE BUILDER/FLYERS

Paul Williams and Max Cortner write that they have over 150 hours on their Long-EZ, also known as "White Lightening". Max is planning on a honeymoon trip to the Bahamas this month and Paul will be flying it to Phoenix in February. Paul recently had a scary incident - pitch control disconnect in flight! Happily he landed uneventfully using the pitch trim system for pitch control. They had had the canard off to seal around it and when it was replaced, the clevis pin was pushed through from the outside, horizontally toward the center, so that the safety pin was easier to install. What they think happened was that the safety pin caught on the pilot's pant leg and was pulled open. The pin eventually worked it's way out due to being oriented horizontally and the pitch control system was disconnected.

This is a very serious thing, we should all be aware of. **First of all the clevis pin should be oriented vertically and should be installed from the top so gravity holds it in place. Secondly a piece of gray tape wrapped around the safety pin will stop it vibrating and protect it from inadvertently being opened.** One school of thought would be to install an AN3 bolt and locknut in place of the clevis pin. After all, how often do you remove the canard? In any event this connection should be on everyone's preflight checklist.

****From CP35-8 (CH16,CH38,CH39)****

A Southern California VariEze flyer/builder crashed into the bay on short final at Palo Alto, during a night approach. **A critical nut and bolt which had not been installed correctly came loose, causing the airplane to suffer a pitch control disconnect.** The VariEze was completely destroyed by the impact with the water at approach speed. The pilot suffered a serious back injury but was able to swim to shore.

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Chapter 17, Roll/Pitch Trim System

****From CP34-5 (CH17,CH38)****

Caution

Wes Gardner had a scary experience in his VariEze when the nose up trim spring on his pitch trim system (Long-EZ style) suddenly broke. It made a loud noise with the aircraft pitching nose down. Wes thought he had had a midair. He had trouble pulling out because the nose down spring was pulling the elevator into the nose down position. He got back to his home base ok, but was quite shaken. As if this was not enough, it has since happened to him twice. Should it ever happen to you - remember, FLY the airplane. Even with a broken trim system, it will still fly normally.

****From CP35-7 (CH13,CH15,CH17,CH30)****

FROM THE BUILDERS AND FLYERS

First flight from Debbie Iwatate.

"Long-EZ N455EZ flew for one hour on it's first flight October 31, 1982. It went so smoothly that we found ourselves thinking, "is that all there is to it!", after the landing. A big reason for having an uneventful first flight was our friendship with Bryan Giesler (VariEze 90331). By the time we were ready for flight testing the Long, I had accumulated almost 15 hours of back seat time and 3 hours of solo time in his aircraft ..... that does wonders for a persons confidence! The only changes we have made to the plane are to change to REM37BY plugs, modify the upper brake arm (BA) to make it an inch longer to increase the braking effectiveness, and **change the pitch trim spring lengths** to gain more nose down trim authority. I have flutter tested up to 198 mph IAS, stalls are at 60 mph engine idle (straight forward and smooth) and 55 mph power on. We are burning about 4 - 4 1/2 gallons per hour average.

It took us about 2,000 hours to build the plane (325 for the finishing) and that was spread over 21 months. We didn't cut too many corners on cost and our final cash outlay was around $18,000 (well worth every penny). Many thanks to you Mike, for your assistance every time I called for help.

Incidently, the nose (side) airvents work very well! Leading the air into the cockpit through eye-ball vents, we are getting fantastic ventilation. In addition we added "extra air" vents on the sides above the CC spar "deck".

We have 33 hours on the plane now and have been signed off by the FAA. Now we can settle into the maintenance routine and get our fly-in schedule made up for the summer of '83. Many thanks to Burt for making such a project possible to folks like us. Take Care, Debbie Iwatate".

Debbie is the first female builder/flyer to complete and fly a Long-EZ. Congratulations!!!

****From CP57-5&6 (CH13,CH17)****

NOSE MOUNTED BRAKE CYLINDERS

A few years ago, Long-EZ builder/flyer, Debbie Iwatate put together a neat little booklet containing plans for some of the neatest ideas she had incorporated into her own Long-EZ such as forward mounted brake master cylinders, **a real slick roll trim modification**, etc. Well, Debbie still has this booklet available at the same price, $20,00, but she has moved. Please contact Debbie at:

804 Cottonwood Loop
Richland, WA 99352
509-943-9579

****From CP59-5&6 (CH11,CH12,CH17,CH19,CH31,CH33)****

THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.

This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is normal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

****From CP62-4 (CH13,CH17,CH41)****

SHOPPING

Debbie Iwatate's EZ ideas book is still for sale - still costs only $20.00 and you can get one from Debbie at her new address:

1699 April Loop
Richland, WA 99352
509-943-9579

This little book contains plans, done EZ-style, for forward mounted brake master cylinders, a nifty roll trim system, and other neat little ideas that Debbie and Ken came up with while building their excellent example of a Long-EZ.

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Update Number 67 to Chapter 18, Canopy

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
<u>*LETTER FROM VARIEZE FLYER*</u>
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. **I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be.** This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. <u>Don't trust anyone else with your safety</u>. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

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Update Number 69 to Chapter 18, Canopy

****From CP69-3 (CH13,CH18)****
NACA FRESH AIR INLET VENT DOORS.
Gene Zabler's neat little vent door is still available for $7.50 pp. Gene tells us that after 8 years in service some of these little doors are wearing out. If yours is, send an SASE and $2.00 to Gene and he will ship you a new rubber insert. Gene also manufactures and sells a light weight nose wheel fender (protects your prop from gravel damage) for $45.00 pp.
Contact: Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
414-886-5315

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Update Number 73 to Chapter 18, Canopy

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

****From CP73-10 (CH18,CH24)****
Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

Blank

Update Number 82
to
Chapter 18,
Canopy

Information derived from CP82 published by RAF Oct 1995

****From CP82-9 (CH18)****
Canopys
Airplane Plastics
8300K Dayton Rd
Fairborn OH 45324
(513) 864-5607

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Chapter 18, Canopy

Long-EZ Plans Changes

From CP27-7 (CH18)
LPC #43 MEO Page 18-7
Lower right "to firewall bulkhead" should be "to aft end of canopy frame FS 117" (two places). See page 18-5.

From CP27-7 (CH4,CH18,CH30)
LPC #48 DES, Firewall, page A4
Increase size of firewall at top as shown to assure adequate height to fit cowling. **SKETCH OMITTED**

Miscellaneous

From CP24-4 (CH18)
Yaw String
We have always flown our VariEze with a yaw string glued to the front edge of the canopy. This is used in sailplanes and is an excellent heads up yaw reference. Glue or tape a 3" long piece of yarn or string to your canopy leading edge, and be sure it is on the aircraft centerline. Mark the canopy where the string should lie in coordinated flight. **SKETCH OMITTED**

From CP25-3 (CH18)
A FUNNY THING HAPPENED ON THE WAY TO EZ COMPLETION
By Jud Bock Serial #738.
While doing some finishing work in the back seat, I decided to close the canopy to check the rear head rest. It felt great, so I went to open the canopy and lo and behold the safety catch in the front cockpit was working perfectly! There I was, all 210 lb of me, locked in the back seat with no tools or anything to reach the 4" more, required to release the catch. My wife had just gone shopping and was not expected back for three quarters of an hour. Did I panic? Hell yes, because I was getting warm (hot actually!), and I decided to use my head and tried to use mind power to move the catch. After that failure, I started thinking some more and it finally dawned on my dulled brain that I had shoes on, which I promptly removed one of and was out in less than 5 minutes.

In another instance the builder has no shoes on. He removed his pants, rolled them into a stick and used it to reach the catch!

With consideration of this problem we designed the safety catch to be mounted at F.S.57 on the Long-EZ. VariEze new construction should follow suit.

From CP26-7 (CH18)
Canopy - page 18-2. Do not compromise the "A" dimension, this 13 1/2" is required for good forward visibility. If it is desirable to lower the aft end of the canopy to better fair it into the cowling, or to meet the "B" dimension, it is structurally OK to remove the flange from the plexiglass aft of the roll over structure. **SKETCH OMITTED**

When you get your canopy, do check a couple of dimensions: measure from the point of the plexiglass nose, aft 27". Now squeeze the sides in at the 27" point, till it measures 18.5", hold a straight edge across at this point, an measure up to the inside top of the canopy. For it to fit a Long-EZ satisfactorily this dimension should be from 11.25" to 12.75". If it is less than 11.25" it would reduce forward visibility by forcing the pilots head too low.

From CP27-6 (CH4,CH18,CH30)
Long-EZ Cowl and Canopy fitting.
As will be shown in the new Long-EZ Lycoming engine installation section (IIL), the Lycoming cowl has been moved aft 0.7" from where it was in a VariEze. This was done to provide better clearances. With the new dynafocal engine mount, the engine is moved aft also, to provide good magneto clearances and an acceptable structural arrangement for the mount tubes. The new Section IIL will show you how to fill the cowl-firewall gap when mounting the cowl using the method used on N79RA and on Mike and Sally's Long. Cowling manufactured for Long-EZs after December 20, 1980 have the lip extended to allow easier installation. These cowlings can be identified by checking the dimension shown below.

SKETCH OMITTED

(OLD COWL=32.0)
(NEW COWL=32.7)

This cowling move has resulted in a miss-match of cowl-to-firewall at the top of about 0.2". **Mike faired the miss-match in with dry micro, since he had already fabricated the canopy aft cover piece (Chapter 18). To avoid this micro fill, we suggest that you: Trial fit your cowling to the firewall before carving your canopy aft cover piece.** If you have not cut out your firewall, make it taller at the top and trim to fit your cowl during Chapter 18. (see LCP #48).

****From CP29-4 (CH18,CH38)****

PLEXIGLASS HINTS FOR PERFECT CANOPIES.

1. Cutting: An abrasive disc powered by a high speed drill, a Dremel tool, or a hand held circular saw is recommended. We have found that abrasive cut-off wheels of aluminum oxide or silicone carbide provide excellent cutting results. A six inch disk is available at most hardware stores for around $3.50 A small grinding disc or Dremel saw disc will also give good results. Reciprocating saws like saber saws are not recommended and will probably break your canopy. A tool that progresses slow and hot on the canopy to grind through the canopy is best. Tape a poly plastic cover on the canopy and mark your outline with masking tape. Never cut a cold canopy. Allow the canopy to warm to 70 or more for at least an hour. Don't allow the canopy to vibrate or chatter during the cutting or it may chip and crack. Support your canopy on a flat surface so it will not twist or spread during the trimming. Duct tape is handy to hold things in place. Remember: cut slowly, don't push the cutter. Let the tool do the work. Be sure to use eye protection. Plexiglass chips can be a problem in your eyes since they are clear and difficult to see.

2. Drilling: The drill should be ground off to a zero rake angle to prevent digging in, chipping and cracking the Plexiglass. A standard drill bit, ground with no cutting edge pitch, is a safe method of making holes. Be sure to make the holes oversize to allow for motion caused by thermal expansion and contraction. The drill bit should not be allowed to chatter or will chip and break the Plexiglass. Don't push the drill. Let it cut at its own rate.

3. Cleaning: A damp soft cloth or an air blast will clean the saw dust away. The damp cloth will also dissipate static electricity. To clean dirty plexiglass use plenty of water and a non abrasive soap or detergent. Dry with a clean chamois or soft cotton. Never use acetone, benzene, carbon tetrachloride, lighter fluid, lacquer thinners, leaded gasoline, window sprays or scouring compounds. Grease or oil may be removed with kerosene, white gasoline, naphtha or isopropyl alcohol. Small scratches can be buffed out with "Mirror Glaze" HGH-17 and a lot of rubbing. Hard automobile paste wax should be applied as a protective coating and buffed with a soft cotton flannel cloth. Do not use cheesecloth, muslin or shop cloths, they scratch. For deep scratch removal, procure a hand polishing kit from a Plexiglass dealer or your canopy supplier.

****From CP30-7 (CH18,CH22)****

Wicks Aircraft

Now have brushable "Spray-Latt" canopy protective material in stock. They also carry the full line of VDO instruments and still have the Whelen strobe/nav light system (single flash) for Long-EZs.

****From CP31-4 (CH18)****

When applying Spraylat to your canopy for protection, be sure to get a good thick coat, preferably 2 or even 3 coats. This will make it much easier to remove. Also, if you spill epoxy on the Spraylat, wipe it up with a paper towel before it cures. If it cures, it will not damage the plexiglass, but it does make it very difficult to remove the Spraylat locally.

****From CP31-6 (CH18,CH39)****

Long-EZ - Runway And Visibility

A Long-EZ crashed on takeoff from a small Minnesota airport. Conditions were clear, it was dark (about 1 hour before sunrise),the runway was hard surfaced, but covered with ice and snow, some large lumps of ice up to 4" thick. The runway was 2,000 ft. long and ended near the edge of a lake. The aircraft was in excellent condition with approximately 60 hours total time, with 5 hours flown the previous day. **It had been hangared and had no frost on the wings, however an eye witness reported that the canopy was frosted over on the inside such that he was unable to see the pilot just before take off.** The pilot commented that it was no problem because his experience was that the canopy would clear as soon as he had some speed. It appeared from wheel tracks in the snow that he had a very extended takeoff roll, in fact rolled virtually the full length of the runway. He struck several hard lumps of packed snow/ice with nose and main wheels, which probably slowed him down. When he lifted off he did not climb enough and flew into the tops of some small trees of the end of the runway. The left canard and left elevator were torn off at this point, which caused the airplane to roll left. The left wing then struck the ground and was broken off at BL57. The airplane rolled inverted and crashed into a frozen swamp on the edge of the lake. It then slid over a small embankment and broke through the ice coming to rest in four feet of water. The fuselage remained essentially intact, however the pilot was killed instantly.

The cause of this accident appears to be a combination of several things. 1) Takeoff attempt on an uncleared runway with snow and lumps of ice. 2) **Frosted canopy probably restricting visibility.** 3) Total darkness with lake at end of runway resulting in "black hole" visibility effect at lift off, causing disorientation. As is often the case in accidents, one problem could probably be handled by an experienced pilot, but a combination of the right conditions can be enough to result in disaster.

****From CP35-6 (CH18)****

Canopy frame construction - VariEze and Long-EZ.

The following optional method includes several revisions to the plans procedure that make the canopy frame easier to build:

Cut out and locate the plexiglass canopy onto the fuselage per the plans. Using gray "duct tape" as a release, protect the fuselage longeron full length from the F28 to the firewall. The F28 bulkhead and firewall bulkhead should also be protected with gray tape.

Now working with 2 inch thick urethane foam scraps about 12 inches long, fit them all around the canopy per plans. They should be a reasonable fit to the canopy and to each other. Do not use micro to "glue" these blocks to each other and to the plexiglass, rather use Liquid X 40, foam-in-place (or an equivalent 2 lb/cubic ft "pour-in-place"-foam). Mix up small quantities and paint the liquid into the gaps and joints until the "frame" is securely bonded to itself and to the plexiglass canopy. Within an hour you can carve the frame to the required shape per the plans. The "pour foam" joints will carve and sand almost as easily as the urethane and a whole lot easier than micro joints. Glass the "frame" per Long-EZ plans:

1st ply - BID at 45 degrees overall (F28 to firewall)
2nd ply - BID at 45 degrees overall
3rd ply - UND lengthwise, sides only
4th ply - BID at 45 degrees front and rear only
5th ply - UND lengthwise, sides only;
UND side strips should lap 3 inches onto the front and rear BID.

Allow this layup to cure for 48 hours, then Bondo lumber stiffeners to the canopy frame per plans and remove the entire thing from F28 to the firewall. Turn it upside down and support it well on two saw horses. (Use Bondo to hold it firmly). Carve the inside (including all hard points per plans) and layup the same glass schedule as used on the outside, full length from F28 to the firewall. Allow this to cure for 48 hours, then you can cut the front and rear covers off per plans. These edges can be treated in a variety of ways, flox corners and ply of BID is fine. Several builders have made lapped or joggled edges using dry micro for a more weather proof joint.

From CP38-8 (CH3,CH18,CH22)
Aircraft Spruce now has in stock the electric cockpit heaters as tested by Mike Melvill in N26MS. Also a substitute for the now extinct Disston Abrader, a handy little tool for sanding and filing glass and foam. **Also a new type of spray-lat for protecting plexiglass canopies. We tried it and it works great.**

From CP41-6 (CH18,CH39)
A northern California VariEze crashed soon after take off. Several eye witnesses observed the canopy open immediately after lift off. The pilot was observed to reach up to the canopy with both hands. The aircraft veered to the left and struck the ground 200 feet left of the runway centerline. The pilot did not survive. The NTSB investigator confirmed that there was no damage to the canopy latches and that they were in the unlocked position. **They noted that there was no canopy safety catch.**

See Cp #40, Page 4 for more information on canopy opening in flight. The biggest point is FLY THE AIRPLANE. You can not possibly get back safely if you don't gather your thoughts and concentrate on flying the airplane.

From CP58-4&5 (CH18,CH33,CH39)
BIRDSTRIKE! BIRDSTRIKE!
"On the Sunday after Thanksgiving, my wife and I departed Inyokern airport (Mojave desert) for a casual Sunday morning flight in our Long-EZ. I climbed out to 5500 feet MSL (approx. 2500 feet AGL), leveled off and throttled back to approximately 150 mph TAS. I looked up just in time to see a bird about 50 feet above my flight path and several hundred feet ahead. I didn't have time to determine its direction of flight or which way I could turn to avoid it. I had probably less than 2 seconds between first sight and impact. Just before impact, the bird winged over and dove down, striking the canopy head on .....instant explosion/implosion? The canopy was shattered and completely missing from my head forward. From my head back, the canopy stayed intact.

The bird and/or plexiglass struck me, knocking my headset off and giving me a fat lip. The bird ended up in the back seat. My glasses were undisturbed.

I immediately throttled back and nosed up slightly to reduce airspeed to keep the debris from flying around and anything else from ripping out. I was in control of the airplane at all times and slowly turned for the airport 8 miles away. I reached for my headset microphone, cupped my hand around it and declared an emergency. I was later able to put my headset on while my wife took the stick.

We proceeded to motor back to the airport at about 100 mph. The direct wind in the face was no worse than riding a motorcycle at 80 mph. My glasses stayed put with no problem. The plane flew fine and a normal landing was made.

The prop was totaled. There was a chunk missing from each blade (approximately 1" x 1/2" x 1/2") and one blade had a split from the tip toward the center about 10" long. I experienced no noticeable vibration on the flight back or in taxiing. The bird's head was missing and probably went through the prop. The leading edges of the prop were severely chewed up by the canopy fragments. The webfooted bird (Duck??) weighed in at 1-1/2 pounds. My wife was bloodstained but unhurt with a duck in her lap.

My canopy was formed from 1/8" thick plexiglass. The manufacturer increased the thickness for Long-EZ canopies to 3/16" a few years ago.

Prop and canopy: On order!

Gary Spencer"

EDITOR'S COMMENT
Char and Gary Spencer's experience with a birdstrike that broke the canopy is the first reported EZ incident of its kind. Gary remained cool and FLEW THE AIRPLANE and with no further problems, made a safe landing at his home airport. Congratulations, Gary!

We have had several reports of birdstrikes on the canopy, as well as other parts of the airframe, but none resulting in a broken canopy. Now we hear from a Texas Long-EZ builder/flyer who inadvertently took off without latching his canopy. His safety catch had been bent so it did not catch as it should have and the canopy opened rapidly, and with enough force to fail the "throw over" canopy stay bracket on the canopy frame. This allowed the canopy to open beyond its normal position and smash into the right fuel strake, breaking the plexiglass canopy into small pieces. This occurred right after lift off and, to make matters worse, it was raining! Well, our intrepid pilot remembered to FLY THE AIRPLANE. He ignored the canopy problem, slowed down to cut down some of the stinging effect of the rain and flew a normal pattern back to a safe landing on the same runway he had so recently departed from. Apart from the stinging raindrops, he suffered more form hurt pride than anything else. His canopy frame was in perfect shape, all the plexiglass was gone, but incredibly, there was no damage to his prop! Presumably, the pieces departed toward the right winglet with enough velocity to completely miss the prop. He reports that the Long-EZ flew OK, he had no trouble maintaining control or in making a normal landing. Now he is faced with the unenviable job of replacing the plexiglass canopy.

All of this goes to show that as long as you continue to think and continue to FLY THE AIRPLANE, you can fly away from even this kind of a serious emergency problem. Replacing the plexiglass is tedious, hard work but it can be done, and it's a lot easier than trying to repair a badly damaged airplane - or worse.

1) NEVER fly with your canopy warning system inoperative - NEVER EVER.
2) CHECK YOUR SAFETY CATCH FOR CORRECT FUNCTION BEFORE EVERY FLIGHT, it could save your canopy or even your life. - NEVER FORGET that there have been several fatal accidents because the canopy opened on take-off or in flight.
3) IF you are unfortunate enough to have an emergency situation such as an open canopy in flight, if you do nothing else, FLY THE AIRPLANE, then, and only when you have the airplane under reasonable control, you might consider what else you could do.
4) When pilots are faced with an emergency, frequently their first problem is realizing (or admitting) that it is an EMERGENCY. That is the first switch that must be thrown. After the pilot accepts that he or she has an emergency, and is FLYING THE AIRPLANE, and has reasonable control, obviously the flight may have become non-standard to some degree or other, depending on conditions, careful evaluation of the situation must then determine the extent of deviation from normal procedures. You must get back on the ground as quickly and as safely as possible, but NEVER exceed your own capabilities. If necessary, declare an emergency, but get an immediate clearance for any runway (if at an airport). You may have to land downwind, or crosswind, whatever. Keep your cool, watch your speed and make as normal a landing as possible, depending on the circumstances.

****From CP58-13 (CH2,CH18)****
RAF RECOMMENDED SUPPLIERS

Aircraft Spruce PO Box 424 Fullerton, CA 92632 714-870-7551	Wicks Aircraft 410 Pine Street Highland, IL 62249 618-654-7447
FeatherLite PO Box 781 Boonville, CA 95415 707-895-2718	Brock Mfg. 11852 Western Ave. Stanton, CA 90680 714-898-4366

The Airplane Factory
8300 Dayton Road
Fairborn, Ohio 45324
513-864-5607

The above suppliers are still the only authorized RAF dealers for all your various aircraft materials and components.

****From CP30-7 (CH18)****

Long-EZ and VariEze "Throw Over" Stay

Many builders noticed these neat canopy stays on Burt's, Mike's and Dick's Long-EZs at Oshkosh, and requested information on how to build one. The original idea for this came from Bob Woodall who has one on his VariEze. He had his on at Oshkosh 1980. The stay is constructed from aluminum tubing (2024-T3) .035 wall x 3/8" O.D. and a few small pieces of .025 thick 2024-T3 aluminum flat stock.. The small bushings shown were obtained from a surplus supply house in Los Angeles several years ago and we are not aware of a good source for these. The pivoting stay is mounted to the top of the roll over structure, we simply drilled a 3/4" diameter hole in the back of the roll over structure, and pushed a 3/4" wood dowel into the roll over, floxed it into place and layed up a ply of BID over it, inside the roll over to retain it. The other end is mounted to an additional hard point in the canopy frame, which is exactly the same as the rest of the hard points called out for, for hinges and canopy latches. This is not difficult to do even if your airplane is complete. Drawing next page.**DRAWINGS OMITTED**

****From CP36-7 (CH18)****

Wicks Aircraft Supply has a slightly different version of the throw over canopy stay. Made by a Long-EZ builder, Jim Duprey, these are complete and ready to bolt on.

****From CP36-7 (CH18)****

Ken Brock Mfg. has just completed a run of throw over canopy stays per the drawings in CP30 and has them in stock.

****From CP40-4 (CH18,CH33,CH39)****

Canopy Opening In Flight In An EZ

Ralph Gaither, an experienced naval pilot with over 26 years of experience in airplanes and a VariEze pilot/owner called the other day to let us know of a canopy opening that he had. First of all his canopy warning system was out of order, a micro switch had failed. (Don't laugh, this can happen to you!) Secondly it was a hot day in Arizona. The canopy was kept open while taxiing out to the runway. The canopy was locked, then the wind shifted necessitating a long taxi to another runway. The canopy was opened for better ventilation (you can see it coming, right?) To make a long story short, he had to quickly fit in between traffic for take off, his safety catch had somehow gotten bent and did not catch, so the canopy opened fully at between 200/300 feet AGL during the climb out. Ralph, kept his cool, he flew the airplane, maintaining the climb, left the throttle full up, reached with his left hand and grabbed the canopy rail. He pulled the canopy down and closed it on his wrist (not fully closed). He climbed out in this configuration until at 1000 feet AGL. He trimmed the airplane as best he could, and throttled back to fly level at a reasonably slow speed (100 to 110 knots would be best). Then he took his right hand off he stick and calmly locked the canopy and continued on his way. Ralph's canopy does not have the throw over stay that was shown in CP 30, page 8. Rather he has a simple retaining cable. **He expressed the concern to us that he felt that the over-center type throw stay may have made it much more difficult to close the canopy in flight.** We have given this some thought and we agree. It would be more difficult to close the canopy, but certainly not impossible. Anyone who flies an EZ with this type of stay, will know that it takes both hands for about a second to flick it over center and close it.

It is food for thought and we wanted to give the builder and flyers the benefit of Ralph's experience. We believe the throw over stays advantages out weigh its disadvantages. It is very light, it will hold your canopy open in a wind without allowing it to crash closed or open against the fuel tank. It does not impose the tremendous torsional loads through the canopy frame that the gas spring type canopy restrainers do.

Consider also that there has to be literally a triple failure before this would become a factor in flight.

1. The canopy warning system must have failed.
2. The safety catch has to fail.
3. The pilot must have a brain failure, or fails to comply with his or her checklist.

All three of the above have to occur before the throw over stay becomes a factor. We at RAF have elected to keep our throw over stays but we feel that each individual builder should make his or her own decision.

Incidentally, Ralph reported that the airplane was not at all difficult to fly, he easily maintained heading and continued his climb. The biggest thing to remember is to FLY THE AIRPLANE.

Canopy Seal

From CP25-9 (CH18,CH26)
Ray and Nova Cullen have moved.
New address is now: Rt 1, Box 213 #26
Baker, OR 97814
(503)523-5096

They are now offering plans for their survival kit plus the custom VariEze/Long-EZ seats for $8.00. They will also supply some of the more difficult to locate items of the survival kit. They are still interested in supplying any builder support that is requested even though they are now in a very rural area.

The canopy seal they are using on the side rails of the canopy is a 3M Adhesive Weather strip part #021200-01235 Cat #1235, Stock #93011. It is sold in a few stores there in Oregon but is still hard to find. Nova and Ray have tried almost everything on 22809 to gain rain protection and this stuff is the best! Note: Ray and Nova keep their airplane out a lot in a very wet climate.

From CP35-6 (CH18)
Mike recently installed a "drip tray" around the front cover to canopy joint, which really does a job on keeping moisture out of the avionics, even in driving rain. **SKETCH OMITTED**

This is tough to install as a retrofit but can be done easily at the time of the original construction.

From CP42-8 (CH18)
Aircraft Spruce is now carrying an excellent new canopy seal, as seen on Mike's Long-EZ, N26MS. V-canopy seal sells for $0.40 per foot. 20 feet required per canopy.
Contact: Aircraft Spruce,
714-870-7551

From CP46-8 (CH18)
Long-EZ builder Jim Schultzman has come across a pure silicone rubber canopy seal, that is without a doubt the finest we have seen. It comes with its own adhesive, simply pull the protective tape and stick it down. It is a 'V' shaped extrusion that is normally part of a larger shape. Jim has set up a system to cut off the relevant 'V' shaped piece, so it can be used on an EZ canopy.
Contact: Jim Schultzman,
2638 Westwood Drive
Las Vegas, NV 89109

From CP50-3 (CH18)
Jim Shultzman's pure silicone canopy seal, a very fine, "V" shaped seal. The best we have seen is still available but not for long. Jim (who now works for Composite Prototypes) is getting out of the business. He has a limited number of canopy seal kits.
Contact: Jim Shultzman
Building 13 - Airport
Mojave, CA 93501

NACA Scoop

From CP40-7 (CH18)
VariEze and Long-EZ - Cooling vent door, installed easily in the little NACA scoop in the canopy frame. It is so simple and works so well, it is amazing. Designed by Gene Zabler, himself a VariEze builder/flyer, this little door can be installed in 10 minutes. You control it with one finger from completely shut to full open or anywhere in between. It eliminates the need for a foam plug and you can keep your hankie in your pocket when it rains. Gene will sell you one for $6.00 plus .50 for packaging and postage.
Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53406

From CP43-3 (CH18)
NACA air vent door for VariEze and Long-EZ. Simple, light weight, only minutes to install. $6.00 each plus $0.50 postage and handling.
Contact: Gene Zabler,
48 Robin Hill Drive,
Racine, WI 53506

From CP45-6 (CH18,CH22)
Designed and built by Ian Ayton a Long-EZ builder/flyer, is a real neat plastic NACA cooling vent prefabed and ready to install in your canopy frame or in the side of the fuselage or under the baggage strake. This little gem has an adjustable ramp door that opens and closes to give perfect ventilation. It is made of ABS plastic and can be glassed or riveted into place.

Also designed by Ian, is a little black box that can be wired into your gear/canopy warning system. It will sound your horn in an intermittent manner rather than a continuous blast. At the same time the warning light will blink on and off. You can override the horn but not the blinking light. However, if after about one minute, you have not moved the throttle to recycle the warning system, the horn will again sound. This is a great idea and could save an embarrassing gear up landing. Mike has installed one on his Long-EZ and is very pleased with it.

Contact: Ian Ayton,
4061 Via Pavion,
Palos Verdes Estates, CA 90274
213-375-9269

From CP53-5 (CH18)
NACA Air Inlet Vent Doors - simply the lightest, simplest and most functional way to control the ventilation flow through your canopy vent. Developed by VariEze builder/flyer, Gene Zabler, who also sells a neat, lightweight nose wheel fender which will reduce prop damage from small stones and gravel thrown into the prop by the nose wheel. Contact:

Gene Zabler
48 Robin Hill Dr.
Racine, WI 53406
(414)886-5315

From CP54-6 (CH18)
A quick fix for the pilot's vent or NACA scoop. This idea sent in by new Long-EZ builder/flyer, an Englishman working and living in France, N.W. Ruston.
"I used two 1/8" diameter pop rivets to attach a rectangle of the flexible black neoprene/asbestos to the bottom lip of the NACA inlet. The width of the rectangle should be such that it is a tight fit in the NACA inlet." **SKETCH OMITTED**

By pushing part, or all, of the rectangle into the inlet, you can adjust the air flow easily and simply from zero to 100% air flow - neat idea.

From CP54-8 (CH13,CH18)
NACA, canopy vent doors and light weight front wheel fenders. By now most of us are familiar with Gene Zabler's neat, quality vent doors and fenders. Gene tell us that he has not had a price increase since he introduced these parts more than four yours ago. Increased costs of materials and shipping costs have forced him to raise his prices. The vent door will now cost $7.50 p.p. and the front wheel fender will not cost $40.00 p.p. If you have not tried one of Gene's simple, easy to install, vent doors, you owe it to yourself to try one, particularly at this time of the year. The nose wheel fender can really extend the life of your prop by helping to keep small stones and gravel out of the prop during taxi, take-off and landing. Write to:

Gene Zabler
48 Robin Hill Drive
Racine, WI 53406
1-414-886-5315

From CP61-12 (CH13,CH18)
Cockpit vent doors for Long-EZ and VariEze. $8.00 each. EZ to install - work great. Nose wheel fenders (help keep rocks off your prop) made from glass and aluminum. Ready to paint and install - $40.00 each. Gene has had these products for sale now for over 7 years and is not sure how long he will continue to supply them. Do yourself a favor and get them now. Contact:

Gene Zabler
48 Robin Hill Dr.
Racine, WI 53406

Canopy Replacement

From CP36-4 (CH18,CH21,CH22,CH30,CH37)
N26MS - Mike and Sally's Long
With 521 hours on the Hobbs, 26MS is running like a dream and continues to prove what a reliable high speed transportation machine a Long-EZ is. I recently got tired of my combination 12V/24V system which never did work correctly. I cut the front cover over the instrument panel off and rewired the airplane to be a 100 percent 24 volt electrical system. It was intimidating thinking about how I was going to do this, but once started it was actually quite simple to do. I have also installed Wes Gardner's fuel sight gauges (see CP 35 page 10) and must say I am pleased with the result. Also installed Wes's oil separator breather and it has worked great! No more cleaning cowling after landing.

A few weeks ago a photographer from "Technology Illustrated" took a bunch of slides of my Long-EZ for the cover of the May edition. He wanted to light up the inside of the cockpit. He handed me a remote controlled flash unit with quite a heavy power pack. Like a dummy, I laid it on my lap, not tied down. **In the middle of the photo session, I hit a strong bump, the flash unit sailed off my lap and crashed into the canopy cracking it badly just in front of my head.** It cracked almost clear across with a hole a couple of inches square. It scared me but once I slowed down and pulled the cracked pieces back into place, I found it to be no immediate problem and was able to complete the mission.

Sally temporarily repaired it by laying up a huge fiberglass patch both inside and out. At least we could fly until the new canopy came in. Actually went to the IVHC Agua Caliente flyin this way! I talked to Dan Patch and Phil Cornelius, both of whom had been through repairing a broken canopy.

First we cut the plexiglass canopy about 1 inch above the rail all the way around (son Keith did the work, I supervised!). This removed the broken canopy. We turned the frame over and cut through the fiberglass just inside the edge of the plexiglass lip. This allowed us to peel out the fiberglass piece that fitted the original plexiglass bubble exactly. This thin glass "frame" was carefully layed into the new "bubble" and was used to layout where it should be trimmed in order to fit. While I cut the new bubble, Keith broke out the remaining plexiglass with a vice grip, a hammer and wood chisel and a dremel grinder. The plexiglass does not come out easily. After the frame was cleaned up, the new bubble fitted almost perfectly. We floxed it into the frame and let it cure over night. Next morning, I trimmed and sanded. I microed in all the voids and the layed up two plies of BID over the plexiglass up onto the inside of the frame. I let this gel up for a few hours, then reinstalled the whole canopy/frame onto the airplane. I locked it down and let it cure for two days. This assured that it would fit the fuselage. Later I removed it, cleaned it up and sprayed the charcoal Zolatone inside the canopy frame. I did not have to repair the outside frame. The new canopy gives me a little more head room (not all canopies are alike!) and the visibility without the fiberglass patch is superb!!

Table of Contents for Chapter 19, Wings, Ailerons/Wing Attach

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Update Number 66 to Chapter 19, Wings, Ailerons/Wing Attach

****From CP66-8 (CH19,CH20,CH32)****
CHECK YOUR BELHORN PLANS
Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error. (Joan did it).

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Update Number 67 to Chapter 19, Wings, Ailerons/Wing Attach

From CP67-5&6 (CH11,CH16,CH19,CH20,CH31,CH32)

CONTROLS - RIGGING

Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should not be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons (aileron stall)).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees more in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you must be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and no more. (More travel gives less lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept any friction in the pitch control system. If you have friction, do not fly until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on every pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

From CP67-7 (CH19,CH20,CH32)

SPRINGS FOR FLUSH BELHORNS

NOTE NEW ADDRESS AND PHONE

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
921 College Rd.
Lebanon, IL 62254
618-537-2142

From CP67-9 (CH19,CH20)

AILERON/RUDDER HINGE RETROFIT KIT

The purpose of this kit is to effectively prevent additional wear on the aircraft hinges and thereby circumnavigating a time consuming hinge repair down the road. The hinge kit will fit any MS20001-P3, '-P4, '-P5, or '-P6 extruded aluminum piano hinge that is specified for use on the Long-EZ, VariEze, Defiant, Cozy, Glasair ailerons and/or rudders. You will be supplied with enough Teflon spaghetti tubing and a special high grade stainless spring steel wire for all the hinges used in the ailerons and rudders.

This hinge kit will work in an already worn hinge, but just how worn out (larger I.D. of hinge hole) remains a question we cannot answer. We believe the DuPont/Teflon tubing supplied in the kit will wear proportionally to the amount of space between the tube and the hinge. After more than four years there has not been any additional wear on any of the installed retrofit kits that we know of.

INSTALLATION: Mike Melvill and I found this retrofit to be a piece of cake, taking approximately 10 minutes for each wing. I enclose detailed instructions with each kit explaining several different installation methods used by various builders.

I really don't believe you will have any questions, but just in case, you can call me anytime 0800 through 1700 hours E.S.T., Monday through Friday at 305-974-6610. Please identify yourself as an experimental aircraft builder.

Please note: These kits cost $21.00 US within the USA and Canada. Overseas, the cost is $25.00 US. All orders shipped in the 48 continental United States will be UPS, the rest are shipped by mail. Please add $2.00 US on Rutan Defiant Kits.

When ordering any of the kits, please supply the following information for purpose of giving you the proper kit supplies and providing emergency updates should that necessity arise. Shipping costs are included in the above prices.

1. Name and address. Kits cannot be delivered by UPS to a PO box. Address must be a physical structure. Please type or print clearly.
2. The serial number the kit designer has given you and your government supplied tail number,if you have them.
3. Phone numbers for both work and home, if that is at all possible or practical.
4. Type of aircraft, e.g., Glasair, Defiant, Long-EZ, etc.

Contact: Gary A. Hall
851 SW 63 Ave.
North Lauderdale, FL 33068
305-971-9731 (home recorder)
305-974-6610 (Parkson Corp)

From CP67-10 (CH19,CH20,CH32)

CHECK YOUR BELHORN PLANS

Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error.

Update Number 68 to Chapter 19, Wings, Ailerons/Wing Attach

****From CP68-5 (CH19,CH20,CH32)****
NOTE: NEW ADDRESS FOR ORDERING FLUSH RUDDER BELHORN SPRINGS.
John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

****From CP68-7,8&9 (CH4,CH19,CH26,CH29,CH33,CH39)****
A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not positive of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. **Do not fly a Long-EZ or VariEze without vortilons.** In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on your particular aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power. Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the forward face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around. **SKETCH OMITTED**

This change is mandatory and should be completed before next flight. Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats. Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall crash that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

THE FOLLOWING IS AN ANALYSIS OF THE UTAH ACCIDENT
The Utah accident involved a deep stall, flat descent (angle of attack of about 80 degrees). The fact that the pilot survived and that a slower-than-expected sink rate occurred (confirmed by video tape evidence of the last 2.3 seconds of descent) presents somewhat of a dilemma. We are baffled as to why this can occur. A similar phenomena has been experienced during several deep stall accidents with the Velocity aircraft. All were survivable and one went into water with the pilot experiencing no injury at all! (See article in July '91 *Sport Aviation.*)

The Utah Long-EZ had a wing-loading of about 12.2 lbs./sq. ft. and, considering all its area, including the wings, strakes, cowl and fuselage, a "flat-plat loading" of about 9.2 lbs./sq. ft. (1150 lbs. divided by 125 sq. ft.). A basic calculation of the predicted rate-of-sink in a flat descent would use a flat-plate drag coefficient of about 1.2 and would predict a sink of about 4820 ft. per minute or 80 ft./sec. This would definitely not be survivable.

Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

1) Analysis of the video tape shows a sink rate of about 48 ft./sec. (2900 ft./min.). This required measuring the size of the airplane image and may be off as much as 30 percent. The post-crash video data show the rate of drift of dust from impact. Comparing this rate of drift of dust (wind was about 20 knots) to the rate of sink of the airplane (on video) confirms the approximate 48 ft./sec. estimate.

2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

Update Number 69 to Chapter 19, Wings, Ailerons/Wing Attach

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	**1199.00**
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

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Update Number 70 to Chapter 19, Wings, Ailerons/Wing Attach

****From CP70-7 (CH19,CH20,CH32)****
FLUSH RUDDER BELHORN SPRINGS.
Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049
NOTE: NEW ADDRESS FOR ORDERING

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Update Number 71 to Chapter 19, Wings, Ailerons/Wing Attach

****From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)****

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

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Update Number 73 to Chapter 19, Wings, Ailerons/Wing Attach

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. **Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots.** I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.

Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

Blank

Update Number 74
to
Chapter 19,
Wings, Ailerons/Wing Attach

From CP74-6 (CH19)

WING FITTING VENTILATION - LONG-EZ

The outboard main wing attach fitting recesses in the wings should be ventilated to avoid an accumulation of condensation. Drill a #30 hole in the bottom cover. Remove the top cover and drill a hole in the lowest point of the recess such that it will break into the recess underneath the wing. This hole should allow a soda straw to slip through. Work a little micro into this hole and slip a soda straw through. Allow to cure. Now, carefully cut the soda straw flush with the bottom of the recess. Silicone the top cover back on. This will allow the two covered areas to "breathe" and eliminate condensation which could corrode the wing bolts.

SEE SKETCH TOP OF NEXT COLUMN

SKETCH OMITTED

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Update Number 78
to
Chapter 19,
Wings, Ailerons/Wing Attach

Information derived from CP78 published by RAF for April & July 1994

****From CP78-5 (CH19)****

NAVAID WING LEVELER TRACKING

Andre Deberdt reports that the fix recommended in the CP for this problem, namely, to reduce friction in the roll control system, worked very well for him. He replaced the phenolic bushings in the wing roots with ball bearings and now his NAVAID tracks to the degree - and besides, his control stick has much lower friction and the Long-EZ is more fun to fly.

****From CP78-9 (CH19,CH20)****

AILERON/RUDDER HINGE RETROFIT KIT

The purpose of this kit is to effectively prevent additional wear on the aircraft hinges and thereby circumnavigating a time consuming hinge repair down the road. The hinge kit will fit any MS20001-P3, '-P4, '-P5, or '-P6 extruded aluminum piano hinge that is specified for use on the Long-EZ, VariEze, Defiant, Cozy, Glasair ailerons and/or rudders. You will be supplied with enough Teflon spaghetti tubing and a special high grade stainless spring steel wire for all the hinges used in the ailerons and rudders.

This hinge kit will work in an already worn hinge, but just how worn out (larger I.D. of hinge hole) remains a question we cannot answer. We believe the DuPont/Teflon tubing supplied in the kit will wear proportionally to the amount of space between the tube and the hinge. After more than four years there has not been any additional wear on any of the installed retrofit kits that we know of.

INSTALLATION: I enclose detailed instructions with each kit explaining several different installation methods used by various builders.

Pleas note: These kits cost $27.00 US within the USA and Canada. Overseas, the cost is $31.00 US. All orders shipped in the 48 continental United States will be UPS, the rest are shipped by mail. Please add $2.00 US on Rutan Defiant Kits and $10.00 on Solitaire kits. Please try to send the correct amount as kits will be sent COD (balance owed) unless other arrangements are approved by us.

When ordering any of the kits, please supply the following information for purpose of giving you the proper kit supplies and providing emergency updates should that necessity arise. Shipping costs are included in the above prices.

1. Name and address. Kits cannot be delivered by UPS to a PO box. Address must be a physical structure. Please type or print clearly.
2. The serial number the kit designer has given you and your government supplied tail number, if you have them.
3. Phone numbers for both work and home, if that is as all possible or practical.
4. Type of aircraft, e.g., Glasair, Defiant, Long-EZ, etc.

Contact:
Gary A. Hall
851 SW 63rd. Ave.
North Lauderdale, FL 33068
305-971-9731 (home recorder)
305-477-0809 (SoftSol Corp.)

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Update Number 80
to
Chapter 19,
Wings, Ailerons/Wing Attach

Information derived from CP80 published by RAF Jan 1995

****From CP80-7 (CH10,CH19,CH31)****
MOLDED VORTEX GENERATORS
CCI is pleased to announce the availability of pre-molded generators. Specially engineered for aircraft application, the 1" long by 0.40 high device is injection molded from U/V resistant polycarbonate material.

The design has been engineered so the "sail" is stiff enough to impart the desired energy into the boundary layer but flexible enough to resist breakage from "hangar rash" and the curious. Because they are molded from light weight polycarbonates rather than cut from extruded aluminum, these pieces are less likely to cause injury, chip paint or cause propeller ingestion damage on pusher aircraft. Available in white, they can also be custom molded in quantity to match specific paint colors for aircraft manufacturers and OEM suppliers. Coloring does not compromise their ability to withstand harmful ultra-violet radiation.

The gluing surface of each generator is flexible and slightly concave to facilitate adhesion to either cambered or flat surfaces. The perimeter of each base is feathered to blend seamlessly onto the surface to which it is attached. After installation, the sail appears to be molded an integral part, rather than and "add-on". The final result not only looks better, it performs better than typical hand-made aluminum fences. Molded vortex generators adhere better, do not corrode, require no painting and are easy to install: one Long-EZ canard can be equipped with a full span of generators in less than 90 minutes.

Effective may 15, 1994, a kit containing fifty generators is available for a price of $25.00 plus $2.00 shipping and handling per kit. **Two kits are sufficient to equip the full span of a typical canard (i.e. Long-EZ, Dragon-Fly, et al) or both ailerons on either canard or conventional planforms.** Documentation is included. Please send check or money order to:

CCI
PO Box 607
Plainfield, NJ 07061-2318

Please allow 2-3 weeks for delivery, Sorry, no COD's. For more information 6:00-10:00pm EST, Mon.-Fri.

908-757-9573
908-755-9639 FAX

Note: These vortex generators are not TSO'd for use on type-certificated aircraft.

****From CP80-8 (CH10,CH16,CH19,CH31)****
TITANIUM ACCESSORIES AVAILABLE!
Custom anodized in 15 different colors,
Rudder and aileron gust locks - $20.00-30.00.
GU canard full span vortex generators with layout template - $170,00. These are hot looking !
Contact: Mike Rhodes
PO Box 1052
Grover Beach, CA 93483-1052
805-489-8155

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Update Number 82 to Chapter 19, Wings, Ailerons/Wing Attach

Information derived from CP82 published by RAF Oct 1995

****From CP82-11 (CH19,CH30,CH38,CH39)****

Broken exhaust threatens wing!

This happened to be a Cozy MKIV, but the wing attach system, exhaust system, and engine cowling area are essentially the same as the Long-EZ and Defiant. RAF is publishing the story here in the hope that this knowledge may prevent a similar incident in one of our airplanes.

While flying at 10,000 feet over the Gulf of Mexico near Pensacola at night, the exhaust pipe on cylinder number 4 broke off. Fortunately it remained, in the cowling and did not go through the prop. **However, hot exhaust gases traveled between the wing and the center-section spar, heating the epoxy in the wing near the wing-attach hard points. The epoxy softened enough for both wings to move upward at the wingtips, 1/8 inch on the left wing, and 3/8 inch on the right wing.**

The spar caps were not damaged, but the shear web on the right wing actually fractured near the out board wing-attach point, allowing the wing to move to a new dihedral angle.

Unfortunately, the pilot was unable to land when he first heard the exhaust let go, but had to fly for nearly an hour to the nearest suitable airport. It is possible that an immediate landing would have prevented the damage and resulting enormous repair job.

The pilot reported that the engine sound made an abrupt change. Performance was not affected, but the noise level was obviously higher, and led him to suspect a broken exhaust system. He throttled back to 1,800 RPM and continued on. He noticed that cylinder head temperatures on 2 and 3 settled down to around 300 degrees F, but cylinder 4 remained up around 400 degrees F.

He landed safely, and had the exhaust stack repaired. He did not notice the wing problem until the next day. There was considerable foam shrinkage (due to heat) all around the hard points. He found a small hole in the inboard glass rib, near the aileron torque tube bearing, and the heat had gotten into the wing through this hole. The only visible damage anywhere in the cowling was a small blister on the cowl itself. Fortunately all of his fuel lines were fire-sleeved, and his wing ribs were protected with 1/8 inch fiberfrax glued on with high-temp silicone. None of the glass on the firewall or in the wing roots were damaged.

What can be learned from this incident? First of all, exhaust systems are subject to vibration and high temperatures and are vulnerable to cracking, even in an type-certificated aircraft.

Inspect your exhaust stacks often and carefully, using a strong flashlight. All visible glass in the cowling area, firewall, center section spar aft face , wing roots, etc, should be protected using fiberfrax. The 1/8 inch-thick material is best, and it should be cut to fit perfectly, and then glued onto the glass using red (high-temp) silicon, available at any auto parts store.

Seal all possible paths for hot air, such as the gap between the center section spar and the wing, and any holes you may have made in the wing root ribs. All of the air, hot or cold, should have to exit the cowl around the spinner in front of the prop, except the air that flows through your oil cooler.

If you ever hear an abrupt, unusual increase in the noise level from your engine compartment, make a precautionary landing at the nearest suitable airport and remove the cowling for a thorough inspection.

Do not fly until you comply with the plans change section on page 15 of this newsletter.

****From CP82-13 (CH10,CH16,CH19,CH20)****
TITANIUM ACCESSORIES AVAILABLE!
Custom anodized to any of 15 different colors, shades of copper, purples, blues, greens, yellow/gold, even rainbow effect.
Rudder and aileron gustlocks - $20.00-$30.00.

GU canard full span vortex generators with layout template - $170.00.. These are very exciting! Rudder horn CS-301L&R replacements, $25/pair. Shipping inc.

Ti Specialties
P O Box 1052
Grover Beach CA 93483-1052
(805) 489-8155

Chapter 19, Wings, Ailerons/Wing Attach

Long-EZ Plans Changes

****From CP24-6 (CH19)****
LCP #2, MEO, pg 19-10
Oops! We forgot to include the tie downs in the Long-EZ plans. Drill a 3/8" hole through the wings, 13" inboard along the leading edge, and 9.5" aft of the leading edge. This will assure that you do not drill through the shear web, but will be just aft of the shear web. Now flox a piece of aluminum tube into each wing, so that the tube is flush with the skins top and bottom 3/8 O.D. x .049w 2024T3. Obtain two AN4 bolts and make up a couple of removable tie downs as shown These can be stored in the centersection spar when not in use. **SKETCH OMITTED**

****From CP25-6 (CH19)****
LPC #8, MEO, Page 19-8 Step 9.
Second line should read "form the 0.7" rib by removing foam with a rotary file".

****From CP25-6 (CH19)****
LPC #9, MEO, Page 19-6, Step 6.
Third line down LWA7 should be LWA2.

****From CP25-6 (CH19)****
LPC #10, MEO, Page 19-6.
Lower right paragraph, LWA7 should be LWA2.

****From CP25-6 (CH19)****
LPC #11, MEO, Page 19-7.
Bottom right, 3 lines up, LWA7 should be LWA2.

****From CP25-6 (CH19)****
LPC #12, MEO, Page 19-8.
Bottom left, 2 lines up, LWA8 should be LWA7.

****From CP26-6 (CH19)****
LPC #31, MEO, page 19-5.
Lower left paragraph, 3 plies should be 2 plies.

****From CP26-6 (CH19)****
LPC #32, MEO, page 19-3.
Last paragraph, third sentence between "at" and "12" add "the correct place at the wing top. Hot wire "0" to".

****From CP26-6 (CH19)****
LPC #36, MEO, page 19-15, page 19-16.
Clarification: CS127 can be made from the drawings on these two pages. Use .032" 2024T3 aluminum.

****From CP28-9 (CH14,CH19)****
LPC #56, MAN GRD
Clarification CP #25 Page 6 Lower right corner. Long-EZ spar cap thickness. This box <u>must</u> be complied with. Several builders have ignored this. Do not omit this, you <u>must</u> have the prescribed amount of glass in the spar caps, in both the centersection spar and the wings.

****From CP28-9 (CH19)****
LPC #64, DES. Page 19-17
Snub the aileron hinge pins per instructions in this newsletter.

****From CP30-9 (CH19)****
LPC #77 Section I, page 19-18. Step 11.
"Refer to chapter 6 and 7" should be "refer to pages 14-8 and 14-9".

From CP30-9 (CH3,CH19)
LPC #81 Section I, page 19-14. Section E-E.
Detail A shows the rodend bolt on the CS 132L belhorn reversed. Anytime a rodend is cantilevered off one side of a belhorn, the bolt head must be on the belhorn side, see sketches below:
SKETCHES OMITTED

From CP31-5 (CH19)
LPC #88 MEO, Section I, page 19-16.
Part #CS127 is made from .032 2024T3 aluminum.

From CP31-5 (CH19)
LPC #91 MEO, Section I, Chapter 19.
Covers for the access holes, three each side, for wing attachment can be fabricated out of .016 aluminum sheet, painted to match you airplane. To install, stick over the hole using a small bead of RTV (silicone, clear silicone rubber sealant by Dow Corning is best). The covers should be taped or weighted into position and left to cure for at least 24 hours. They are water-tight and keep the rain out of the attach area. If you need to remove them later, a razor blade will easily cut them loose. **SKETCH OMITTED**

From CP34-7 (CH19)
LPC #107, MEO
Section I, page 19-8, step 10 clarification. The root of the aileron should be cut at 90 degrees to the trailing edge along the line on the top skin to the hinge line defined by the 5.9 dimension. This cut is a vertical plane and will not pass through the point on the bottom skin that is defined by the 7.6" dimension.

From CP43-4 (CH14,CH19)
LPC #119, Section I, page 14-7, parts #LWA4 and LWA5.
Increase the size on 8 LWA4 from 1 1/2" x 2" to 1 3/4" x 2" and on two LWA5 from 2" x 2" to 2 1/4" x 2". The increase is in the vertical dimension and is to allow more leeway when drilling the 5/8" wing mounting holes. Several builders have come very close to the edge of these parts, a couple have actually broken out. Breaking out is cause for rejection.

From CP45-4 (CH19,CH32)
LPC #121, Long-EZ High Performance Rudder Plans.
For new construction only - install the rudder cable conduit in the wing so that the conduit is 1.5" aft of where it is shown on the full sized pattern on Page A-12 of the large 'A' drawings supplied with Section I of the plans.

From CP47-7 (CH19)
LPC #126, MAN
Vortilons on the leading edges of each main wing are mandatory - see this CP, Page 15.

From CP58-10 (CH16,CH19,CH38)
MAN-GRD: Long-EZ and VariEze - see section on belhorn failure. Replace aileron belhorns within the next 25 hours of flight. If ailerons are vibrating, you must re-balance.

From CP58-7&8 (CH16,CH19,CH38)
LONG-EZ AILERON BELHORN FAILURE
RAF has recently received two separate reports of failures of one of the CS132L weldments, the belhorn, which drives the aileron out in the wing roots. One of these belhorns has had lightening holes bored through the .050 steel belhorn and it cracked through one of these holes. However, the second one was as received from Brock and it cracked across at the edge of the weld around the tube. Prior to the failure of the belhorn this builder pilot had had to replace the rod end that bolts to this belhorn, at least twice over the past 350 flight hours, due to the rod end being "pounded out" until it was dangerously loose.

The belhorn failure occurred in flight and caused a few moments of concern, but in both cases the Long-EZ was easily controlled. A disconnected aileron will float trailing edge up. To keep the wings level, the pilot has to raise the trailing edge of the operable aileron which, of course, will give a nose up pitching moment requiring forward stick to fly level. The one operable aileron will provide reasonable roll control and, of course, the rudders will roll the airplane by themselves. The greatest hazard would be if the disconnected aileron pushrod, being loose in the cowling/root of the wing area, ever managed to get itself jammed. Depending how much lateral input there was at the time, you may or may not be able to correct the roll with rudder.

A primary control system failure is cause for strong concern so we at RAF have designed, built and flight tested a new aileron belhorn. Drawings for this new part have been sent to Ken Brock Mfg. and Ken will have these parts available as soon as possible. We will provide a drawing of the new belhorn in this CP for those people who would like to make these parts themselves. (see sketch, page 15) **SKETCH OMITTED**

Why would this belhorn fail on two relatively low time Long-EZs when we have literally dozens of Long-EZs with 1000-plus hours and some with 1500-plus hours with no failures and zero wear on the rod ends? Bill Freeman, Long-EZ builder/flyer and a man whose specialty is working with vibration problems and who has a Master's degree in Mechanical Engineering, has a theory with which we concur. The original control system with aluminum push rod tubes apparently was OK. The natural frequency of this collection of parts was not the same as the normal cruise excitation frequency of the engine/prop. Changing the aluminum tubes to steel as called out in the CP may have moved the control system into the excitation frequency of the engine/prop combination. Bill says that this strongly suggests to him a spanwise vibration of the CS132L belhorn and CS129L pushrod at, or near, its natural frequency, inducing a high-cycle fatigue failure in the CS132L belhorn. The fact that the rod end bearings were beaten out is strongly suggestive of a resonant vibration of the CS132L and CS129L pushrod. This vibration would have the bottom end of CS132L and the aft end of CS129L moving spanwise, bending CS132L in the weak direction with high enough stress levels to initiate a fatigue failure in CS132L.

The new part, part number CS132L-R, has two arms instead of one which will more than quadruple the stiffness of the system and will also provide redundant links in the aileron system as well as providing positive retention of the rod end in the event of a ball slipping out.

If you absolutely insist on flying before the new belhorn is replaced, a careful examination of your CS132L belhorns are mandatory. Use a bright light and a magnifying glass. Examine the area shown in the sketch while gently flexing the CS132L left and right. Any sign of a crack starting requires immediate grounding of the aircraft until the new CS132L-R is installed. Examine the rod ends bolted to the CS132L. Look for a loose ball, or play in the rod end in the fore/aft plane. A worn rod end must be replaced before flight and you should realize from the above discussion that a worn rod end almost certainly indicates that a belhorn failure is imminent. If you have steel tube push rods (CS132L), your belhorns are definitely more suspect. If you have worn rod ends, do not fly until you replace the belhorns and rod ends. Even if everything looks OK, replace belhorns within the next 25 hours of flight. The CAD plated CS132L belhorns should not be painted since the paint may hide a crack.

This is a serious matter and should not be ignored. A primary control system failure could result in a serious accident.

Please report any cracked or broken belhorns to RAF along with the number of hours on the airplane, whether you have aluminum or steel push rod tubes and if you have experienced rod end wear or failure.

From CP58-8&9 (CH16,CH19,CH38)

AILERON VIBRATION

Below is an excerpt of a letter received at RAF recently.

"Thanks for all the good newsletters. Just to clarify, I have had aileron flutter (see Ed. note). At 10 hours, I noted a lot of aluminum dust behind the aileron hinges. In flight, I visually could see the tip of both ailerons as a 1/4" blur. I added leading edge weight and installed the Teflon hinge pin setup. At this point, I had no visible vibration at 2000 ft at 120 mph, but still had vibration at 8000 ft., 160 mph. It remained this way for many hours of "hauling rides" but less than 5 cross country hours. Note: I never was able to detect any vibration on the stick.

I recently put more weight on the right aileron which was still vibrating slightly at altitude. This extra weight was along the outboard end where I had previously not had any. This finally cured the problem. Now the ailerons hang with the top surface level. Note: The problem occurred when the ailerons balanced bottom surface level as per plans. Note: Both ailerons had this problem. The left aileron is very accurate dimensionally, the right's trailing edge rises 1/4" in the outboard 8" from a straight line. Also, I have a good surface finish, laminar flow, as evidenced by wing drop before the vortilons.

It is very hard to see the trailing edge of the aileron and difficult to decide if it is indeed vibrating 1/4" or if your eye is just not that sharp, but having fixed it, I can verify that it was not an optical illusion.

I feel that many Long-EZ's probably have this problem and their pilots are not aware of it. Again, there is no indication of stick vibration.

Larry Bush"

EDITOR'S COMMENT

We have published Larry's letter as he wrote it because we believe he experienced the same phenomena described above: Engine/prop excited "forced vibration" driving his aileron at the same frequency as the engine/prop. "Flutter" is an aerodynamic condition and is normally divergent, i.e., expands to destruction. "Forced vibration" can continue as long as the source (engine/prop) is maintained near the same frequency as the natural frequency of the aileron. By over-balancing his ailerons to the top limit as called out in the plans, he has (1) changed the mass of his ailerons thereby lowering the natural frequency of the ailerons and, (2) repositioned the CG of the aileron relative to the hinge, thus reducing the "forced vibration" input.

If your ailerons are vibrating at the trailing edge as Larry's were, you must add more leading edge weight. Note: We checked several Long-EZs here at Mojave and none of them exhibited any visible vibration at the trailing edge, however, all of them show some signs of aileron hinge wear (black aluminum dust on the aileron, particularly after flying through moisture).

Keep in mind that it may be difficult to spot. Have a passenger in the rear seat look at the aileron trailing edges very, very carefully. Spend at least 30 seconds staring at the ailerons in level flight, in a climb, in a descent, and in left and right turns. If any vibration is seen, re-balance the ailerons.

The easiest way is to get some lead ribbon from a golf pro shop and stick it to the top of the aileron leading edges, full span, until it balances top skin level. Lay up one ply of BID to permanently secure the lead to the aileron leading edge. (see sketch, page 15). **SKETCH OMITTED**

We would like to thank Larry Bush for the excellent feedback on this situation. This is the kind of information we all need to know about in order to keep the large fleet of EZs flying safely and consistently.

****From CP59-9 (CH16,CH19,CH38)****
AILERON "VIBRATION"
The reports in CP58 have really put the cat among the pigeons! A controversial topic, to say the least. In spite of all of this, only three flyers have reported finding their ailerons vibrating visibly in flight (one was not sure), one reported finding his vibrating at various RPM's while running on the ground -probably true of all EZ's while they are sitting on their wheels (the tires are like springs, as is the gear), so we believe you must look for this problem while in flight and it will be difficult to see and will require a rear seat passenger to watch the ailerons. If you have a visibly vibrating aileron or ailerons, you should increase the mass balance as required to a maximum of what it takes to balance the ailerons with the top skin level. If it only takes 25% or 50% of the maximum to stop the vibration, then that is enough. Unless you know you have this problem, do not change the mass balance.

Brock has the new aileron belhorns available now and many have been delivered and installed. If you have evidence of worn or beaten out rod end bearings in your aileron control system, you should ground your airplane until you have replace the original belhorns with the new part which is about 8 times stiffer and this is out of the vibration frequency that has been causing the problems. A number of Long-EZ owners have reported worn out rod ends, but far more have reported no sign of wear or vibration. Apparently, it depends greatly on the vibration characteristics of each engine/prop/mount combination and it does not necessarily occur in all Longs - watch for it, though, this is a potential accident waiting to happen - always listen to your airplane - it will invariably try to warn you before it bites!

****From CP60-8&9 (CH16,CH19,CH38)****
LONG-EZ AILERON BELCRANK VIBRATION UPDATE
We have had only three reported incidents of aileron vibration in flight in the Long-EZ. Since our original CP article on this subject, only a few builders have found their rod ends badly worn. All of these had steel push rods installed (heavier than the original aluminum pushrods). One builder had no problem with rod ends but the rivets holding the inserts into the steel pushrods were loose!

Be sure and check these rivets next time you remove the cowling. Obviously, the heavier weight of the steel pushrods has moved the natural frequency of these parts into a frequency range that can be driven by the engine at certain RPM's. If you have steel push rods installed, check the rivets and the rod ends often, and be sure to replace the original aileron belhorns (CS-132L) with the new double arm belhorns (CS-132L-R) available from Ken Brock.

****From CP61-11 (CH19,CH38)****
VARIEZE MAN/GND Ground your VariEze until you have completed a full and careful inspection of your wing attach fittings, taper plugs, and AN 4 bolts as described on page 10 of this CP. The engine control cable check as called out for the VariViggen applies equally to the VariEze.

LONG-EZ The Long-EZ wing attach method is completely different from the VariEze and there is no mandatory inspection or concern for Long-EZs in this area at this time.

Prefabricated Parts

****Also see CP58-10 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
PRE-FABRICATED COMPOSITE PARTS
Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.
1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. **Wings and winglets to follow soon at $779.00.**
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415, (707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

From CP24-3 (CH19)(Photo caption)
Johnny Murphy - Long-EZ #2, will fly to Oshkosh, 1980. **Johnny's right wing.**

From CP29-2 (CH3,CH19)
FULL-CORE COMPOSITE SANDWICH WINGS
RAF pioneered the structural method of using the hot-wire styro block to form full-depth foam core wings in 1974. We have built over 60 flight-hardware flying surfaces using this method in the development of the S.P. VariViggen, VariEze, Quickie, Defiant, Long-EZ, AD-1 and other aircraft.

The method has since been used on other types, including an STC'ed vertical fin for the older Mooneys. It is estimated that approximately 500 full-core aircraft are now flying, logging over 100,000 flying hours.

The major advantages of full-core are the ease of moldless construction, the accurate contour maintenance under airloads, and elimination of moisture traps. Critics have claimed that full-core is heavier than the hollow wing with standard skins. Our analysis has shown the weights to be very close. However, we have built and tested wings designed to the same criterias (hollow vs. full core) and have found the hollow wings to be heavier. In addition, the hollow structural configuration is more susceptible to workmanship errors that can result in structural failure. This is due to the presence of peel loads and blind rib closeouts. In addition, the hollow structure flexes, has more points of concentrated stress and is more prone to catastrophic failure should a joint open up (leading or trailing edge).

A builder who had built a VariEze, Quickie, Long-EZ and Adventure is now building a homebuilt with molded wing skins. He reports that despite the large molded parts, the man hours in the wing are at least 50% more than for both full-core Long-EZ wings. This is due to the many ribs, jigs, control system parts etc.

From CP31-4 (CH19)
Long-EZ Clarification
Section I, page 19-8.
Lay up #5 is one ply of UND per leg of the "V" layup. (2 plies over the shearweb face).

From CP33-6 (CH19,CH22)
Nat Puffer suggests a good place for a DME or transponder antenna is in the leading edge of the wing root. Simply hollow the wing leading edge out a little deeper, see Page 19-13, Section F-F. Do this similar to Section E-E on Page 19-14, and mount the antenna in the void.

From CP35-12 (CH19)(Photo Caption)
Dick Pretice cut a hole through his garage wall to solve the problem of installing both wings at the same time in a single car garage.

From CP38-4 (CH19,CH21,CH38)
Fuel Leaks into Outboard Wings - VariEze and Long-EZ
We have now had reports from three different flyers, that they have had small pin hole leaks in the outboard ribs of their fuel tanks, and that fuel had somehow seeped into the outboard wings. Small pin holes in the root rib of the outboard wings have allowed fuel to attack the styrofoam in the wings. This is a serious situation, since the wing structure requires the foam core for buckling support of the wing skins.

The solution of course, is to be positive that your fuel tanks do not leak and any fuel stains observed near the wing would require removal of that wing and careful checking for any loss of foam structure. Fuel will instantly melt styrofoam and will find its way through the smallest pin holes if its allowed to. If this happens, a repair requires removing all of the melted foam, and cutting back into good foam. Then a block of foam must be cut and fitted, then micro'ed into this void. A possible alternative would be to use "pour-in-place" Liquid X foam or equivalent. Sand the foam to the original shape and do a standard fiberglass repair.

From CP40-3 (CH19,CH22)
LORAN C UPDATE
Contrary to our thoughts that Jim Wiers super Sport Aviation article on Loran-C installations in composite aircraft would eliminate questions on the subject, it has only created more questions!! Please be aware that RAF is not an avionics shop, our expertise lies in aerodynamics and composite structures. Until recently we had never even flown behind a Loran-C. When we worked on the Army Long-EZ, we installed a T.I. 9100 Loran-C per the manufacturers instructions. This particular Loran is one of the best and most expensive available. It is also specifically designed for use in aircraft.

It worked perfectly parked on the ground, even in the hangar as long as the engine was not running. As soon as we started the engine, it dropped off the line. Apparently the electronic noise that runs around the electrical system in an aircraft that would normally be "damped" out or lost in the metal structure and skin (which is the ground), does not get lost in a composite airplane. The ground in the composite airplane in most cases, is only one piece of wire that runs the length of the aircraft from the negative battery terminal to the firewall.

What can be done about this? Get the ground plane (all the large metal parts) tied together electrically to form as large a ground plane as possible. This means, to attach pieces such as elevator torque tubes to each other and to the negative terminal of the battery. All of the wiring should run up and down each side of the fuselage inside either aluminum or copper tubes which will act as a shield for the wiring. The tubes should run from the battery negative terminal (or as close as practical, and then electrically bonded with a short piece of wiring) down the length of the fuselage and out through the firewall. On the aft side of the firewall, the tubes should be electrically bonded to the aluminum or stainless steel firewall. A length of automotive braided copper ground strap should go from the bolt that connects these tubes to the firewall, to a convenient bolt on the engine accessory case or oil pan. **This will give you the largest practical ground plane you can get, short of installing Jim Wier's wires under the wing skin, which can only be done if the wing has not been skinned.**

A recent innovation in Loran-C antennas is to buy an automotive windshield type antenna. This consists of a very thin wire centered on a piece of clear tape. This can be installed inside the top of the canopy, starting as far aft as possible and running down B. L. O, all the way to the forward edge of the plexiglass canopy. The Loran-C preamp must be mounted on the aft canopy frame, and the antenna wire should be connected directly to the preamp. The preamp will be connected to the Loran with a normal coax cable, RG-58 AU. This antenna is reported to work great and is the brain child of Phil Stotts of Western Avionics of Fresno, CA (209-255-4872). Phil is a clever guy when it comes to Loran-C installations and has quite a lot of experience with VariEzes and Long-EZs. If you are planning a Loran installation, give Phil a call.

VariEze builder/flyer, Wes Gardner is flying with the above antenna installed and reports that his MLX works like a charm. One strange fact is that if this auto windshield antenna is removed from the canopy and lowered into the fuselage, the signal will immediately become intermittent. Could it be that the glass is not as transparent to VLF as it is to VHF?

Of course it goes without saying that a noisy regulator or alternator will give you problems even if you follow the above suggestions to the letter. A good linear regulator such as Bill Bainbridge of B & C Specialty, Newton, KS. sells, will effectively eliminate this problem. Contact Bill at B & C Specialty, 518 Sunnyside Court, Newton, KS 67114.

RAF will continue to disseminate information on successful Loran-C installations. Obviously there are probably many ways to make a Loran-C work in an EZ. Those we have suggested are just a few.

On the Loran-C article in CP 39, page 2 we forgot to include Bill Butters address. Our Apologizes.

Bill Butters
1478 Urbandale
Florissant, MO 63031

****From CP55-5 (CH12,CH19,CH20,CH31,CH33,CH37)****

HIGH ANGLE OF ATTACK DEPARTURE TESTING

Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. **Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable.** Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

****From CP59-5&6 (CH11,CH12,CH17,CH19,CH31,CH33)****

THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.

This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. **First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.**

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is nonnal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

****From CP59-6&7 (CH19,CH20,CH32)****

****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****

FLUSH RUDDER BELHORNS FOR A LONG-EZ.

A few enterprising builders have designed their own method of hiding the external rudder belhorn and when Mike and Sally converted their Long-EZ, N26MS, about a year ago, we started getting enquiries from Long-EZ builders who wanted to do the same. Now that we have a years experience on the system used by Mike and Sally, we feel we can share it with Long-EZ builders who may wish to remove the external belhorns. RAF will be making a simple set of instructions, drawings, sketches and photos available within the next 6 to 8 weeks. These will sell for around $10.00.

The first "flush belhorns" Long-EZ we ever saw was Ben Ellison's Long-EZ (of Ellison Throttle Body fame). A beautiful Long, the simple elegance of the smooth outboard faces of the winglets made it even cleaner. Then we saw Joe LaCour's Long-EZ at Oshkosh and he had done something similar to Ben's and made some sketches as to how he had done it. Mike and Sally decided to use Joe's basic method and it has worked flawlessly for just over a year now. Ben Ellison, Joe LaCour and Mike and Sally's

Long-EZs have one thing in common, all have forwarded mounted brake master cylinders. The hidden rudder belhorns method used by all three of these Long-EZs has the rudder striking a hard mechanical "stop" at full throw. This means that it is mandatory to have a strong spring in the rudder cable to allow normal use of the brakes.

While we have not tried this method on a Long-EZ with the brake master cylinder mounted on the firewall, per plans, we believe that with the springs installed correctly, this method should work well. This is only for Long-EZs with the tall, high performance rudders and would not work well at all on the small, original rudders.

First of all, why do it? Mike did it because it looked better and he tells people he gained 10 kts! (which, of course, is nonsense). Obviously, it is lower drag but probably so little as to be impossible to measure. Not having the steel belhorns protruding out of each winglet saves you from catching your clothes on them, it also saves you from bending them on the side of the hangar and cracking the paint but, best of all, from a safety standpoint, it eliminates the possibility of someone flipping the rudder cable end thimble over the back of the belhorn. This can make for quite an exciting take-off if you don't catch it in your preflight!
The external steel belhorns are removed and discarded, new belhorns are fabricated (from full size patterns) and installed into the rudders. **A new rudder cable conduit must be installed in a different location in the wing. (Much easier to do in original construction but certainly possible as a retrofit).** A strong compression spring, rigged like tail wheel springs, must be installed into each rudder cable to allow you to use the brakes after the rudders strike their stops at the end of their travel.

With forward mounted brake master cylinders, the CS-15 belcranks can be removed and discarded and pulleys can be installed in their place between the CS-71 belcrank brackets. The rudder cables can then be routed through the firewall through a short length of nylon conduit, thus eliminating the large slot required when using firewall mounted brake master cylinders. Also, when using forward mounted brake master cylinders, the rudder cables can be small, 1/16" diameter, all the way from the rudder pedals to the rudders.

The simple plans will consist of full size patterns for all parts required, and will cover building from scratch, new construction, as well as how to retrofit to an existing Long-EZ, however, it will be a simple set of instructions and will not cover every tiny detail, rather, it will assume that since you built the airplane, you can surely figure out this simple thing! Mike did take a series of photos of his retrofit, so these will be included plus a brief outline of procedures.

If you would like a set of these "plans", send a check for $10.00 to Rutan Aircraft, Bldg 13 - Airport, Mojave, CA 93501 and Joan will mail them to you.

****From CP60-11,12&13 (CH19,CH20,CH25,CH33)****
<u>*HOW TO CHECK IF YOUR AIRPLANE IS STRAIGHT.*</u>
So you have a few hours on your new EZ/Long/Defiant/etc., and you are buzzing around within your limited 25 mile radius of home base - why not spend the required hours you have left to take a close look at your airplane. Specifically, checking the rigging, the "straightness", if you will, of your brand new creation.

Assume you have built a "perfect" airplane, both wings are mounted to the fuselage at the correct incidence with <u>zero</u> relative difference, the canard is straight and at the correct incidence, and the two winglets are correct and exactly symmetrical relative to each other. This airplane should fly at cruise power, level flight, with the ball centered and both ailerons even and faired with the wing trailing edges. Depending on the CG and the speed, the elevator may also be perfectly faired with the canard tips. Since elevator position is a function of speed and, to a lesser degree, to CG position, I will limit this discussion primarily to rudder and ailerons.

How many of you have reached this goal? Not many I would bet. I know my own Long-EZ certainly is short of this state of perfection. How important is it to have a perfectly straight airplane? Difficult to say. Obviously, the straighter it is, the less control surface deflection there will be in high speed flight and the lower the drag and the greater the efficiency will be.

How do you check for a straight airplane? First of all, you will have to have a slip indicator, accurately installed. This can be a short length of yarn stuck to the canopy on the aircraft centerline with a small piece of masking tape (this will only work on gliders and pushers!). Place it about 12" up from the leading edge of the plexiglass canopy. If you have a needle and ball, a turn coordinator and ball, or just a ball, it must be mounted in the panel, ball centered with the wings exactly level. Be sure this is correct before attempting to evaluate the airplane.

Now, <u>before</u> you conduct the following flight test, check to see that the two elevators are rigged perfectly, <u>relative</u> to each other. You will have to remove the canard to check this out. Simply eyeball along the elevator trailing edges. They should be in a straight line. If they are not, you <u>must</u> correct this before doing the flight testing. Elevators rigged incorrectly will roll the airplane.

Also, stand behind your airplane looking at the center of the spinner. Raise or lower your head until your eyes can see <u>along</u> the top skin forward of the trailing edges of the wings. You don't want to be looking down on top of the wings or up at the bottom skins. You must be able to see the trailing edges and the top skins as a line. Now, without tilting your head, look from the right wing to the left. Any differences? Shouldn't be. If you can see more of the top of one wing, you have a <u>relative</u> incidence problem. Make a note as to which way it should roll and verify this in flight.

Take off and establish a high cruise in level flight, feet <u>off</u> the rudder pedals and ailerons perfectly centered (if you can't see your ailerons, take a passenger along to help you get them centered. Remember, your limitations allow you to carry a passenger if they are essential to the mission)! Now, look at the ball. Is it centered? Are the wings level? Probably not! Bummer, oh well, take comfort in knowing that almost everyone else is in the same boat! Keep the ailerons centered (visually verify this), and "step on the ball", that is, step on the rudder to center the ball. Step on the rudder opposite the direction of the yarn slip indicator. Lock your feet, ball centered (yarn centered), keep ailerons centered, and carefully observe the horizon and your DG (if you have one) to see if the airplane is flying a straight course over the ground or if it is slowly turning. If you have no turning rate and your wings are level with the horizon, you have one or both winglets attached to the wings slightly crooked. Even though you have a small error in your airplane, at least you know what is wrong and it can be corrected.

What if you are turning? Carefully null out the turn. Use just enough aileron in the proper direction to zero the turn. Verify this by watching for zero heading change on your DG or by observing a distant peak or other prominent object on the ground at the horizon. This takes a little time and patience but you can get it perfect if you try. With zero turn rate and the ball centered, check how much aileron and rudder deflection you have and in which direction. An assistant can be a great help here. Have them write down, for example, "right aileron up 3/16", left aileron down 3/16" and left rudder outboard 1/4", right rudder at zero." These dimensions can be quite accurately "eyeballed" with a little practice. If you doubt your passenger's ability to judge this, before you fly, have him or her sit in the passenger seat and you move the ailerons and rudders, using a scale and have them call out what they see. Now you know you have a relative wing incidence problem, as well as a <u>relative</u> winglet incidence problem.

Block the rudder out to whatever the eyeball estimate was by taping a small wood block to the inboard trailing edge of the winglet. When the rudder is released, it should close on this block and remain deflected outboard the estimated amount. Repeat the flight test and verify that the ball is centered with zero turn rate.

Now, in the case of a Long-EZ or Defiant, you will have to install shim washers on one of the outboard wing attach bolts such that the wing incidence is altered in the proper direction, i.e., in the example above of the right aileron trailing edge up, this wing would need to be shimmed by perhaps one thin washer (AN960-816L) on the <u>bottom</u> outboard bolt. The left wing probably should be left alone until you look at the results of this change in flight.

Fly it and see if this was enough and if it was in the correct direction. Remember, do this kind of adjusting only in <u>small</u> increments. Use thin washers or thin shim stock, one piece at a time, starting with the wing that appeared to be off when you eyeballed the airplane from behind, whichever wing needs to be shimmed to <u>raise</u> the trailing edge. If one washer on one wing does not do it, add one on the other bolt on the opposite wing. Keep both wings even by eyeballing from behind - do <u>not</u> get one wing much different than the other. Continue using small increments until the airplane flys wings level, ball centered with zero turn rate.

You now have a straight but ugly airplane! Unfortunately, if you have already painted it, you will have some work to do. If it is still in primer, fair the fuel strakes to match the wing roots with dry micro (West System). To fair the rudder with the upper and lower winglet (on a Long-EZ), use a hacksaw blade to cut through the outboard skin along the rudder hinge line to the top and bottom of the winglet. If necessary, widen this saw cut as required and cut through the foam core to the inside of the inboard skins above the rudder and below the rudder. Check that you can now flex the trailing edges of the top and bottom of the winglet til it lines up with the rudder (still in its blocked outboard position). Now, <u>reduce</u> the amount the rudder is blocked out by approximately 10 percent, fill the saw cuts with micro and force the top and bottom outboard to exactly match to the rudder. Clamp them in this position and allow to cure. Layup a 2-ply BID repair over the saw cuts and fill, sand and finish. Install a permanent block, full span along the inboard trailing edge of the winglet to block the rudder in its proper faired position. You can use wood or a piece of pre-cured glass here.

Your airplane should now fly straight and the winglet repair will not be detectable.

This works great on a Long-EZ, but what about a VariEze? Since it is not possible to adjust the incidence of the wings of a completed VariEze, you will have to do surgery to the <u>TOP</u> of whichever wing it takes to correct the tendency to roll. If it rolls left (ailerons centered), you will have to slit the top skin of the right wing, outboard of the aileron along the aileron hinge line and bend this trailing edge up as described for Long-EZ winglets/rudders. If you have to do this to your VariEze, call me at RAF and let's discuss it before you do it.

Well, I hope this is helpful and not too confusing. I'd be happy to discuss this with any builders or flyers who may find themselves having to make this kind of correction.

Mike Melvill

****From CP62-5 (CH19,CH20,CH32)****
****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****
Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 93501
805-824-2645 (Tues. & Fri. only)

From CP63-9 (CH19,CH20,CH32)
Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!
FOR SALE
Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set
Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

From CP64-5&6 (CH19,CH20,CH32)
Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!
Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set
Contact: Joan Richey
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805-824-2645 (Tues. only)

HotWiring

Also see LPC #32 in the "Long-EZ Plans Changes" section of this chapter.

From CP24-4 (CH3,CH10,CH11,CH19,CH20,CH31)
Hotwire Templates-
An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood. available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)
BUILDER HINTS
You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. **This works great for hotwire templates too.**

**From CP25-5 (CH3,CH10,CH11,CH19,CH20,CH31)
HOT WIRING
Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

From CP27-5 (CH3,CH10,CH19)
Hot wire troughs - Use the following method to separately cut the troughs. This gives more accurate, sharper cuts. Nail a temporary template (a popsicle stick works fine) to guide the wire straight across over the trough. Then, remove the stick, and in a separate pass, cut the trough. Be careful to not let your core move between the cuts. **SKETCH OMITTED**

From CP36-6 (CH3,CH10,CH11,CH19,CH20,CH31)
V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

****From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)****
VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

Wing Jigs

****From CP26-7 (CH19)****
Wing jig Templates - Clarification - after gluing the 'A' drawing together, connect the W.L.'s with a straight edge. This will make it a lot easier to get things straight, and will be a check that the drawings don't warp when glued down. When Dick and Mike built their Long-EZ wings, the jigs fit the foam cores well except at the leading edges, where a gap of 0.1" and 0.4" was apparent between jigs and foam cores. A few builders have found this as well, and a few have reported that their's fitted tight. The jigs are sized to be a bit loose to avoid interference with the foam core and possibly there is some paper stretch or shrinkage during gluing. If you have a gap, it is not a problem. Go ahead and align the foam cores using the trailing edge as a reference, (butt core T.E. to jigs) and center the leading edges of the foam cores in the jigs, accepting the gap as shown. **SKETCH OMITTED**

****From CP29-8 (CH19)****
When you Bondo your wing jigs to the floor, be sure to Bondo them so that you can remove the bolts and spit the jigs vertically or you will not be able to get the foam cores into the jigs.

****From CP41-8 (CH19)(Photo Caption)****
Ralph Van Cleve's Long-EZ wing jig prior to inserting foam cores.

****From CP41-8 (CH19)(Photo Caption)****
Ralph's left main wing in the jig with the shear web layup complete.

****From CP42-11 (CH19)(Photo Caption)****
R. Van Cleve's Long-EZ wing in the jig, shearweb is layed up and once cured, the whole thing will be jigged horizontal for spar caps and wing skins.

Spar Caps

****Also see LPC #56 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP25-6 (CH14,CH19)****
LONG-EZ SPAR-CAP THICKNESS - CENTERSECTION SPAR AND WING
The number of plies of the UND tapes for the spar caps shown in the plans (Chapter 14 and 19) is based on each ply being .035 to .038 thick. We have found that some of the UND tape is of less bulk than expected, and is laying up only about .025 per ply. If this happens, the spar is weak and the depressions are not filled flush. Check your spar cap material by making a 5-ply layup. Cure then measure thickness. It should be 0.18 thick. If it is only 0.125 thick you must add the following plies to all your spar cap layups. All the additions can go on top of the plans shown caps.

Chapter 14, Step 7, Bottom Cap.
Add 1 Ply full span, plus 1 ply to B.L. +-45, plus 1 ply to B.L. +-30, plus 1 ply to B.L. +- 15.

Chapter 14, Step 7, Top Cap.
Add 1 ply full span, plus 1 ply to B.L. +-47, plus 1 ply to B.L. +-37, plus 1 ply to B.L. +-27, plus 1 ply to B.L. +-17, plus 1 ply to B.L. +-12.

Chapter 19, Step 5, Bottom Cap.
Add 1 ply B.L. 25 to B.L. 130, plus 1 ply B.L. 40 to B.L. 90.

Chapter 19, Step 7, Top Cap.
Add 1 ply B.L. 23 to B.L. 140, plus 1 ply B.L. 33 to B.L. 92, plus 1 ply B.L. 40 to B.L. 78.

CAUTION! - Use care in carving spar cap troughs, (Chapter 14, Step 5). Do not carve too deep!

From CP26-7 (CH10,CH19,CH31)
Wing Spar Caps - We have found a good way to clamp the spar caps during cure to get minimal waviness and to force them down level with the wing cores. See the accompanying sketch. Select some hot wire cuts of styrofoam (left over from wing core cutting) about 1" to 1 1/2" thick and cut them 4" wide. These should be covered on one side with grey duct tape for a release, and you should cut and fit them end to end to go the length of the spar cap. Get these prepared before doing the cap layup. Now layup the cap normally, squeegee it out properly, then carefully place the foam pieces (with duct tape down) on top of the wet cap. Weight the foam down evenly with lead shot bags, milk jugs full of sand, salt bags or whatever. This will pack the cap layup down evenly and result in less sanding before the skin layup.

From CP27-6 (CH3,CH14,CH19,CH31)
Long-EZ builder hints.
Heavy Unidirectional Fiberglass Tape - The 3" wide roll of unidirectional glass is used only for the spar caps of the wing and centersection spar. "BID tapes" called out are cut from BID cloth (generally 45 degree orientation). Other UND pieces or strips are cut from UND cloth. Be sure fiber orientation is correct.

From CP29-8 (CH14,CH19)
On the centersection spar caps and wing spar caps, most people will require the extra plies as called out in CP #25 and CP #28. If you are going to need the extra plies, it is best to apply them in order. That is, the longest ply should go on first, and the shortest ply should go on last.

From CP34-8 (CH10,CH14,CH19,CH31)
Spar caps - wings, canard and centersection - Be sure to peel ply these spar caps, or you will wear yourself out sanding prior to installing the skins.

Trailing Edge Close Outs

From CP32-6 (CH10,CH11,CH19,CH20,CH31)
CAUTION - TRAILING EDGE CLOSE OUTS
It is very important for structural integrity, that you ensure that your trailing edges of the canard, elevators, wings, ailerons, winglets and rudders meet the prescribed minimums in the plans. Do not accept delaminations in the trailing edge glass to glass area. Even the smallest delam can get moisture in it which will freeze and expand when you climb through the freezing level, and thus delaminate further and further with each occurrence until it could weaken the overall integrity. About the quality of your trailing edge glass to glass close outs - accept nothing less that perfection in this area. Always sand smooth every lap after cure - do not leave them joggled as shown. **SKETCHES OMITTED**

LAP DIMENSION Ignoring the proper procedure here could result in serious consequences, even structural failures! Here is a list of these areas. The minimum dimension should be considered an absolute minimum. If you don't meet this criterion it requires repair before you fly.

	Glass Lap Dimension Shown	Minimum Acceptable Lap
Canard	0.45"	0.3"
Elevators	0.25"	0.2"
Wings	0.6"	0.5"
Aileron cut outs	1.0" (top)	0.75" (top)
	0.75" (bottom)	0.52" (bottom)
Ailerons	0.5"	0.3"
Wing Root Rib	0.6"	0.4"
Winglets	0.6"	0.4"

SKETCHES OMITTED

****Also see LPC #107 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP26-7 (CH19)****
AILERONS - Use care on the leading edges of ailerons to get the full radius around the mass balance without a sharp edge. A sharp edge will cause early airflow separation on the up-deflected aileron and will reduce roll power. **SKETCH OMITTED**

****From CP27-6 (CH19)****
After you have installed your ailerons, check to be sure you have a minimum of 0.1" gap between the aileron leading edge and the bottom skin of the wing. This is necessary for protection from ice freezing the aileron to the wing. This can happen even in VMC conditions, if the wing is wet and you climb above freezing level so do be certain to comply with this.

****From CP32-6 (CH3,CH11,CH19,CH20)****
BUILDER HINTS
Clarification on use of various pop rivets. Anywhere on the airframe where you are installing nutplates, on hinges, access panel, use 3/32" diameter flush pop rivets, or solid aluminum rivets. **When installing aileron hinges onto the ailerons, use 1/8" round head pop rivets (Avex 1601-0410, or cherry MSP 43)** rudder hinges are installed into the rudder using flush pop rivets (Avex 1604-0412 or cherry MSC 43). CS2 elevator hinges are installed on the elevator using flush pop rivets (Avex 1604-04 or cherry MSC 43).

****From CP37-3 (CH19)****
CAUTION
We have had this one in the CP before but is it important enough to warrant a rerun. The leading edges of the lower surface of your ailerons must be rounded per plans per page 19-14. If you have a sharp corner here your aileron could develop a heavy vibration at full control deflection from 90 to 120 knots. Sand this corner round to follow the shape of the steel mass balance weight. **SKETCH OMITTED**

****From CP37-3 (CH19)****
BUILDER HINTS
Mike Rhodes reports having difficulty bonding the aileron hinges to the aileron and keeping everything aligned at the same time. He came up with a neat idea to use a piece of scrap foam rubber between the wing and the hinge which due to its springiness will hold the hinge tight against the aileron at A2 and A5 until the Bondo sets. (see sketch). **SKETCH OMITTED**

****From CP39-7 (CH19)****
Long-EZ - Bill Smullin, Long-EZ builder has available an excellent spherical bearing that can easily be installed in the wing root instead of the phenolic block that inevitably rattles and allows play in the aileron torque tube and thus play in your roll control system. These spherical bearings are easy to install, just drill the phenolic block out to fit (a hole saw works well) and flox the bearing into the phenolic block. A couple of plies of BID over the bearing, just lapping onto the edge of the bearing guarantees it will not come out. The ID of the bearing is an excellent fit on the steel tube (CS152) in the aileron torque tube CS151. Bill can supply these spherical bearings to builders for $12.00 a pair.

Contact: Bill Smullins,
1000 North San Gabriel,
Azuza, CA 91702
(213)969-3979 or
(213)963-4706

****From CP43-6 (CH19,CH38)****
CAUTION - Aileron to Wing Clearance on Long-EZ and Defiant. With the ailerons in the neutral position, the gap between the lower leading edge of the aileron and the trailing edge of the wing should be a minimum of 1/8". Pay particular attention to this at the outboard end of the aileron. You may have nice free moving ailerons, static on the ground, but when the wing start to carry the load and bend, this clearance actually closes up a little. This is a point to inspect if you have an airplane flying. Look for worn spots in the paint. **SKETCH OMITTED**

****From CP47-12 (CH11,CH16,CH19,CH31,CH38)****
CAUTION: CONTROL SYSTEM STIFFNESS
We have previously warned builders to ensure absolute freedom from stiffness in the pitch control system. This is very important and must be corrected if it exists in your EZ. We never have particularly addressed lateral (roll) control system stiffness. While not quite as important as pitch, tight bearings in the aileron control system really spoils the nice flying qualities inherent in an EZ. Conscientious attention to detail here will pay dividends. Long-EZs and VariEzes have similar lateral control systems, the main difference being that the CS-132L belhorn in a Long-EZ is mounted inside of the wing root, and the same part (CS-132) in a VariEze hangs out in the breeze, inboard of the wing root, close to the bottom cowling.

Both of these areas can be troublesome. **In the Long-EZ, you must assure that the end of CS-132L cannot contact the bottom of the wing.** Even if you have to dish the skin locally, you cannot accept any rubbing here. In fact, it would be best to have at least 1/4" of clearance. The VariEze though, needs even more clearance between the lower end of CS-132 belhorn and the bottom cowling, because the cowling will tend to flex up in flight and could cause a rubbing interference, or even worse. For example, if your CS-132 belhorn just barely clears the bottom cowl while at rest on the ground, it is possible that in flight the cowl could move up enough to seriously interfere with lateral control of the aircraft! The answer is a streamlined blister on the bottom cowl which will give the required clearance and will stiffen the bottom cowl.

Lubricate all bushings and bearings in the control system and do not fly until you have the control system working nice and free with no tight spots or stiffness anywhere within the full range of control stick movement.

From CP55-5&6 (CH19,CH33)

CAUTION - AILERONS FREEZING

Jerry Nibler, an Alaskan Long-EZ builder/pilot tells us of an experience he had near an area known as "the trench". He encountered heavy rain and low visibility while trying to fly north so he did a 180 degree turn to where there were breaks in the cloud cover and climbed up on top. Climbing through the freezing level at 8,000 feet, he noticed the ailerons getting stiffer and stiffer until he could hardly bank the plane at all.

This scared him rather, so say the least, so he did another 180 degrees and descended below the freezing level where the ailerons returned to normal, much to his relief. Jerry thinks the rain water got into the hinges, did not have time to dry out completely before he climbed to the freezing level where, of course, the moisture froze. He advises to stay below the freezing level after flying in rain or taking off covered in dew until the airplane has a chance to completely dry out.

This is a good point, one we have mentioned in the CP before but one that should be repeated because it can really scare you if it happens to you. We have had it happen to us in a Long-EZ as well as Burt's Defiant. We found we could control the bank angle well enough to continue by using the rudders and, eventually, the ice sublimated away and we were able to break the ailerons free. We suspect that water runs across the bottom of the wing, bridges the gap between the bottom wing skin and the leading edge of the ailerons, then freezes there. You can help this a little if you keep the ailerons moving left and right as you climb through the freezing level.

Thanks for this report, Jerry. This is the kind of thing that can really help out a fellow EZ pilot. By the way, Jerry ended his letter by saying that his Long-EZ is the most valued of all his material possessions and has provided him with more shear pleasure that anything else he can think of (yes, even more than that! he says).

Hinge Pins

Also see LPC #64 in the "Long-EZ Plans Changes" section of this chapter.

From CP28-8 (CH19)

Aileron Hinge Pins.

Long-EZ and VariEze aileron hinge pins. The piano-hinge pins have in some cases been wearing out much more rapidly than they should. This is characterized by evidence of aluminum stain aft of the hinge on the aileron surface and excessive hinge free-play. The wear is caused by vibration of the hinge and can be eliminated if the pin is snubbed to prevent rattle. For new construction, before final installation of the hinge pins, bend them into a gentle "S" shape. This will ensure that they don't rattle in the hinge. A rattling loose hinge pin will cause excess wear to both pins and hinges.
DRAWING OMITTED

From CP39-7 (CH19)

VariEze and Long-EZ - Aileron hinge pin wear. This problem still has not gone away, even with the "bent" hinge pins. Rodie Rodewald originally suggested a modification, and Dick Kreidel has had it installed for 125 hours with "zero slop". It consists of a piece of thin-walled teflon tubing inserted through the hinge, with a piece of stainless steel welding rod 1/16" dia. for a hinge pin. The teflon tube makes an excellent tight fitting 'liner' for the hinge pin that does not allow any rattling or looseness, yet allows smooth pivoting action.

The only drawback is that it is tricky to install. You will need a piece of teflon tube a little more than twice the length of each hinge, for each hinge. Use and Xacto knife to slit the tube for half its length. **SKETCH OMITTED**

Now fold it up to reduce its diameter, and push it through the hinge. When you have it all the way through, (the unslit half is not into the hinge yet) now insert your welding rod hinge pin into the unslit half of the teflon tube, then pull the whole works through the hinge until your new hinge pin and teflon liner are properly aligned in the hinge. The teflon tube can be obtained from McMaster Carr, part #5335K17, McMaster-Carr Co., P.O. Box 54960, Los Angeles, CA 90054, (213)945-2811

From CP50-4 (CH19,CH20)

Gary Hall has an excellent aileron/rudder hinge pin kit. Consists of enough Teflon tubing and stainless steel pin stock to convert your aileron and rudder hinges on a Long-EZ or VariEze. This is retrofitable and well worth the effort. A comprehensive instruction sheet is included.

Contact: Gary A. Hall
4748 NW 43rd. St.
Lauderdale Lakes, FL 33319
(303)484-4949

From CP51-6 (CH19,CH20)

INSTALLING TEFLON "SPAGHETTI" TUBING IN AILERON AND RUDDER HINGES

John Bingham, VariEze builder, suggests the following idea: Split the Teflon tubing as shown in CP39, page 7, then, using a needle and about 12" of strong thread, stitch the thread into the end of a piece of Teflon tubing per sketch. **SKETCH OMITTED**

Now, pull the needle through the aluminum hinge using a small magnet. Then, pull the thread at the same time as you push the Teflon tube through the hinge. While it is difficult to push the Teflon tube through the hinge, it is easy to pull it through! Thanks, John.

From CP51-8 (CH19,CH20)

CORRECTION - RETROFIT AILERON HINGE KIT

We received the following from Gary Hall after CP50 came out.

"My correct area code is (305) not (303) and the house number is 4784 not 4748. I've notified my neighbor and called Colorado. I explained to those nice people that they are going to get a few calls from a crazy group of people called experimental aircraft builders asking for Gary Hall. The RETROFIT AILERON HINGE KIT IS $21.00 and will be shipped UPS unless you instruct me to do otherwise. (Outside US - $25.00) The kit consists of Teflon spaghetti tubing and a special high grade stainless spring steel to fit inside the tube. If your hinges are "CLEAN" it will take you about 10 minutes per Long-EZ aileron to retrofit. The importance of this kit is to prevent any wear on the AL2 hinge. Teflon should last several years. This is how long Mike has had his in place and there has not been any wear. This kit will work on any Long-EZ, VariEze, Defiant or other aircraft using he MS20001-P3, P4, P5, or P6 hinge.

Gary Hall
4784 NW 43rd Street
Lauderdale Lakes, FL 33319
(305)484-4949 (home)

From CP53-5 (CH19,CH20)

Teflon Hinge Pin Kit for ailerons and rudders on VariEzes, Long-EZs, Defiants, and Solitaires. Includes Teflon tubing and stainless steel hinge pin. Fits MS20001 series piano hinges.

Contact: Gary Hall
4784 NW 43rd St.
Lauderdale Lakes, Florida 33319
Home: (305)484-4949
Work: (305)974-6610

Please identify yourself as an EZ builder.

These Teflon hinge pin liners really do cut down on hinge wear, especially the ailerons which, due to their proximity to the engine, suffer much wear and tear from vibration. Send $21.00 and Gary will ship UPS. ($25.00 outside USA).

From CP57-6 (CH19,CH20)

HINGE PIN KITS

Gary Hall's teflon hinge pin kits are suitable for all RAF designs. The kit consists of stainless steel hinge pin material together with a pure teflon tubing sized correctly to fit over the hinge pin and inside of the aluminum hinge knuckle. This virtually eliminates hinge wear, particularly on the aileron hinges which take quite a beating from engine/prop associated vibration.

Contact:
Gary Hall
4784 NW 43rd St.
Lauderdale Lakes, FL 33319
305-484-4949

From CP62-4&5 (CH19,CH20)

Hinge Pin Kit - Teflon tubing and high grade stainless steel hinge pin material - enough for ailerons and rudders on any VariEze, Long-EZ or Defiant.
Kits for VariEze or Long-EZ - $21.00 ($25.00 overseas).
Defiant - $23.00 ($27.00 overseas).

Contact: Gary Hall
851 SW 63rd Ave.
North Lauderdale, FL 33068
305-971-9731 (H)
305-974-6610 (W)

Please identify yourself as an Experimental Aircraft builder if calling at work.

Control Surface Balancing

****From CP31-4 (CH19)****
Balancing Long-EZ ailerons. Several builders have reported having a problem in this area. If you are having difficulty with this, double check your hinge pivot is exactly correct, in most cases this has been the problem. When building your wings, keep the aileron as light (almost dry) as possible. Install the balance weight in the correct relationship to the hinge. Some builders are getting the weight too close to the hinge. See Section I, page 19-14 for full size sections.

****From CP51-4 (CH11,CH19,CH20,CH31,CH32)****
CONTROL SURFACE BALANCING
We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so that the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50 percent of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and ,more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons and elevators without any additional lead. At least, this has been our experience.

Wing Attach

****Also see LPC #91 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP25-5 (CH19)****
When boring the 5/8" dia. holes in the centersection and wings, using the spotface tool, go slow!! Clear the spotface frequently and be sure not to get the layup too hot. Resharpen the tool if required.

****From CP26-7 (CH19)****
WING ATTACHMENT - Follow the instructions on page 19-18, step 1 except drill the 1/4" holes through the forward face and the aft face of the centersection spar. Now follow through step 2 and use two sawhorses/boxes per wing, with blocks of foam left over from the wing to bring the wings up close to the height of the centersection spar. Now cut 4 foam wedges 7" wide, 2" thick tapering to nothing. These are used to fine tune the height of the wing at the centersection spar and the tip. Now get a suitcase strap, rope or several belts and strap the inboard wing to the centersection spar. This stabilizes the wing against the centersection spar, and stops it from moving fore and aft and in sweep while you adjust the tip and root for correct relationship to the spar. Cinch the straps tight, double check that the wings fit well to the centersection and especially important the the incidence is correct (of course, the fuselage must be level). Four large 'blobs' of bondo (about 3/4" diameter) are placed roughly above and below the hard point. Allow this bondo to cure completely, before you attempt to drill the 6 mounting holes. Now, run your long 1/4" drill through the centersection spar and drill through the "hard points" in the wings. You are now ready to enlarge all six holes to 5/8" diameter, using your spotface tool. As you drill into each "hard point" the 5/8" spotface will break through each lamination of glass and aluminum. You will find that the spotface will break loose a thin "washer" of glass or aluminum located on its cutting edges each time it breaks through a layer. At this point it can no longer cut, and you must withdraw the tool and remove the small "washer" or "disc". Do not try to drill all the way through one hole in one operation. Clear the spotface often, and every time it breaks through a layer of glass or aluminum. It is a good idea to move from one hole to another to allow each hole to cool off. You must not get the wing fitting area hot, so go slowly and carefully, clearing often, and if necessary, stop and allow things to cool. We have found that this entire set up, jigging and drilling both wings to the centersection, takes about 5 hours, 2 hours just for drilling. If you are building your Long-EZ in a 2 car garage, you will have to

take it outside to do this set up. Be sure to protect the fuselage and wings from direct sunlight with white bed sheets or newspaper.

We found that our spotface tool tended to bore a hole as much as .007" over its intended .625" size. This results in a loose fit on the LWA9 bushings. It is satisfactory to fill this void with wet flox when installing the bushings. It is recommended that this flox be cured while the wing is bolted to the centersection spar. This assures perfect alignment of the bolt holes.

From CP26-13 (CH19)(Photo caption)
Mike & Sally's Long-EZ, mating the wings

From CP34-11 (CH19)(Photo Caption)
Charlie Gray's technique for holding the wings to the centersection spar, prior to drilling in the attach bolt holes. Hardware store turnbuckles and cable - neat!

From CP38-5 (CH19)
Wing Fitting Ventilation - Long-EZ
The outboard main wing attach fitting recesses in the wings should be ventilated to avoid an accumulation of condensation. Drill a #30 hole in the bottom cover. Remove the top cover and drill a hole in the lowest point of the recess such that it will break into the recess underneath the wing. This hole should allow a soda straw to slip through. Work a little micro into this hole and slip a soda straw through. Allow to cure. Now carefully cut the soda straw flush with the bottom of the recess. Silicone the top cover back on. This will allow the two covered areas to "breath" and eliminate condensation, which could corrode the wing bolts. **SKETCH OMITTED**

From CP39-7 (CH19)
Long-EZ - Long-EZ builder Fox Smith, sent this one in and although we have not tried it, it sounds great. He used a Morse #TAIO-5/8" high speed hole saw bit, called "The Real McCoy". Reportedly, it simply 'walked' through the aluminum/glass wing attach pads, when mounting the wings to the centersection spar.

From CP44-11 (CH19)(Photo Caption)
Jo and Chuck Moore of San Diego, California are moving right along. This shot shows the right wing jigged in position prior to drilling the wing attach fittings to mount the wing.

From CP48-6 (CH3,CH19)
CAUTION
Very recently while reading copies of the various EZ support newsletters that are currently being produced all over the US, we came across a couple of bad suggestions. One of these is of great concern, a suggestion to use WD-40 Silicone lubricant to lube and cool the counterbore tool while drilling the wing attach holes in the wings and centersection of a Long-EZ. NO WAY, NO HOW, NOT FOR ANY REASON must you use WD-40 or ANY similar silicone type lubricant to help you drill these holes. Plain water is as much as you can do. Getting silicone lubricant onto any glass surface will absolutely guarantee that you will never be able to get anything to stick to that area again. Epoxy will not stick, nor will primer or paint. In short, you have a major problem on your hands. The wing attach bushings must be glued into these holes securely with flox. WD-40 will not allow you to get a bond in this area. This is a very foolish and dangerous suggestion - do not even think about doing it.

The other suggestion which was printed in the EAA Designee newsletter, was to use a salt shaker to sprinkle micro balloons onto an uncured layup for future contouring. We do not like this idea for two reasons: It makes it impossible to inspect the layup after it cures, which is unacceptable and in order for the dry micro balloons to wet out they must be leaching epoxy out of your layup.

If you have already done a good job on the layup, which you obviously should have done, if you are following the instructions in the plans, you are then causing what might have been an excellent layup with the correct epoxy to glass ratio to become a starved, dry layup, which you would never be able to check.

Be very careful about getting away from the basic plans and instructions. These methods have been developed and tested over a number of years and hundreds of airplanes. Fooling around with the structural integrity of your EZ could result in a serious accident.

From CP50-11 (CH19)(Photo Caption)
Don's neat idea for assuring that the wing attach hardpoints are level and true. This guarantees that the wings will fit perfectly to the C/S spar with zero shims and correct incidence. **DEFIANT WINGS**

From CP50-11 (CH19)(Photo Caption)
Don's method of drilling straight, square pilot holes through the C/S spar and wing-attach hardpoints - simple, but clever. Of course, these ideas will also work on a Long-EZ.

From CP52-5 (CH19,CH38)
CAUTION - WING ATTACH BOLTS
We recently heard from a Cozy builder who had been chasing a minor but annoying vibration in his aircraft for some time. He finally traced it to the fact that his wing attach bolts were slightly loose allowing his wings to move a little in flight. After he tightened the three 1/2" bolts in each wing (the Cozy uses the Long-EZ wing and wing attach system) the vibration went away.

He checked several Long-EZs in his area and found a couple of them with the same problem. We had not had anything like this reported to us before and we checked the two Long-EZs we have here at RAF, both were solid.

The way to check for this problem is to have someone put their hands on the joint between the centersection spar and the wing to feel for excess movement while you lift at the wing tip. A small amount of movement, less than 1/16" at the wing root leading edge, is normal. If excessive movement is detected, you must remove the wing bolt covers and torque the bolts. It is difficult to use a torque wrench in this area. We simply used two ratchet wrenches, each 6" long, and pulled about as hard as we could. It takes two people to do it right.

Since a person can pull with about 75lbs of force with one hand, we can calculate the torque - 75x5=375in/lbs or 31ft/lbs. Using this method, we have never had one of these bolts work loose. A 1/2-20 aircraft bolt can handle 600in/lbs (50ft/lbs) of torque. However, with the glass plies in between the aluminum hard points, we would recommend no more than 400in/lbs (33ft/lbs) of torque on these bolts.

From CP53-6 (CH14,CH19)

How to install Long-EZ wings

If you are building a Long-EZ in a basement or a garage too small to mount the wings to the centersection with the centersection mounted into the fuselage, or if by mounting the centersection into your fuselage you can no longer get it out of your basement, or if you would just prefer not not mount the centersection in the fuselage but would like to complete the installation of the wings to the centersection, here is how it worked for Doug Shane (former RAF employee, now an engineer/test pilot for Scaled Composites).

Mike Melvill offered to help Doug after Oshkosh this year to try to get his Long-EZ completed by the end of the year. Doug had completed the fuselage, which was on the gear, and the canard and centersection. With occasional help from Mike's wife, Sally, and Doug's friend, Bob Williams, the two of them worked evenings from 5:30pm to 10:30pm and Saturdays - no Sundays! Sally and Bob helped with wing layups on a couple of Saturdays. To give you an idea of what a couple of determined fellows can do (should we say "lunatics"?) in exactly 6 weeks, working the above schedule, both wings, both winglets (upper and lower) were completed, then the ailerons were cut out, completed and hinged. The wing roots were completed, the wings were drilled and mounted onto the centersection spar, the winglets were mounted on the wings and the rudders cut out, completed and hinged. The centersection was mounted into the fuselage and the engine mount extrusions were installed. The canard was mounted and the entire flight control system was installed and hooked up. The brake master cylinders were mounted up front per Debbie Iwatate's instructions and connected to the rudder pedals. Not bad for six weeks of part time work!

During this exercise, the idea of mounting the wings to the centersection prior to installing it into the fuselage came up. Of course, this is the normal way it is done on a VariEze so they were not unfamiliar with the procedure.

Doug's garage is small, but surprisingly, with the centersection firmly bondo-ed to his work bench, carefully leveled laterally, as well as vertically (aft face plumb), the work bench plus centersection was placed diagonally and both wings could be mounted to the centersection. Some care was necessary in placing the workbench, but it just barely fit in his garage. The wings were strapped to the centersection using two nylon ratchet-type straps (see photos) on each wing. Using a level on the bondo boards on each wing, and some small wood wedges, the wings were jigged exactly into the correct position relative to the centersection and to each other. Generous blobs of bondo were used to fix the wings to the centersection spar. Doug then spent the next four hours drilling the 6 wing attach holes! That same evening, the bondo was cut and the aluminum flanged bushings were floxed in place and both wings were bolted to the centersection, properly shimmed so that the bondo boards were level, and left to cure the flox to bushings bond with everything lined up.

The next day, the centersection was cut loose from the workbench and this complete unit, wing/centersection/wing, was taken outside for photos. Then it was installed onto the fuselage (out on the driveway) as a complete unit. Of course, the firewall had not been installed yet so the centersection was floxed into the fuselage and held exactly in the proper position, checking each levelling bondo board on the wings and measuring from each wing tip to the nose, by bondo-ing several pieces of lumber, strategically placed, from the fuselage to the centersection. All glass tapes were then installed to tie the centersection to the fuselage and also to support the engine mount extrusions.

This method worked extremely well, better in some ways than the plans call-out. The centersection was very securely mounted to a heavy workbench with bondo and pieces of 2 x 4 lumber, making it easier to mount the wings since it was not sitting on rubber tires and rocking around. It was at a much handier working height for setting the wing incidence and for drilling the mounting holes. Being able to measure from each wingtip to the nose guaranteed that the wing sweep was perfectly symmetrical, something very difficult to do per the plans installation.

Somehow, this method seemed to go quicker, too. In any event, we would recommend using this method to anyone who has remembered to leave the firewall bulkhead loose! Several photos of this installation will be printed at the end of this newsletter.

From CP53-11 (CH14,CH19)(Photo Caption)

Doug Shane's fuselage on the gear - note that the firewall is not installed yet.

From CP53-11 (CH14,CH19)(Photo Caption)

Centersection and right wing. Level-board is bondo'd and must remain in place until wings are drilled and cured to centersection.

From CP53-11 (CH14,CH19)(Photo Caption)
Centersection bondo'd to work bench with both wings strapped in place, ready to drill wing attach holes.

From CP53-11 (CH14,CH19)(Photo Caption)
Centersection is level laterally and aft face is plumb. Wings are strapped to centersection with ratchet/nylon straps.

From CP53-11 (CH14,CH19)(Photo Caption)
Wing/centersection/wing assembly bolted together and ready to install in fuselage.

From CP53-11 (CH14,CH19)(Photo Caption)
Wing/centersection/wing assembly is floxed into fuselage. Note that this assembly is "sighted" to align perfectly with canard. Firewall being "buttered" with flox prior to installation.

From CP53-11 (CH14,CH19)(Photo Caption)
Lumber bondo'd from fuselage to centersection spar to firmly locate it while it is taped in place.

From CP53-11 (CH14,CH19)(Photo Caption)
Generous bondo "blobs" will hold centersection firmly, but only if you sand the glass where the bondo goes.

From CP54-6 (CH19)
Easier Long-EZ Wing Removal
During the construction period, after wings have been installed and before the strakes are closed out.
You may be surprised how many times you will install and remove your wings during this time. To make it easier on yourself, using a 1-1/4" diameter hole saw, open the 1/4" diameter pilot holes in the forward face of the centersection spar to 1-1/4" diameter to allow yourself to get your 3/4" socket wrench through the forward face of the centersection spar. Of course, these 1-1/4" diameter holes must be filled with PVC foam plugs and glassed with 2 wet plies of BID before you close out the fuel tanks/strakes - don't forget, or you will have an unbelievable fuel leak!!

From CP54-6 (CH19)
Make the job of installing your main wings easier - sent in by Mike and Nancy Mayo. The problem is that it is difficult to align everything, then push in the bolts and keep the spacer washers on the bolts. A small piece of styrofoam, such as a piece of the round core you cut out of the foam blocks for the wiring conduit holes, is ideal. Cut to the right length and jam into the wing attach bolt access holes such that the outboard two bolts are held firmly in place, including any washers required. Wing rigging then becomes an easy task even for only two people, one at the wing tips and one at the root. The root person holds the inboard wing attach bolt in place while the wing is slid into place. A neat, simple way to do what can be a rather frustrating job.

From CP55-5 (CH3,CH19,CH38)
VARIEZE MAIN WING ATTACH - CORROSION
Since we first reported the corrosion problem in VariEze main wing attach plates in CP53, page 7, we have heard from only two or three builder/flyers who had found signs of corrosion. Just this week, we received a letter from a VariEze owner/pilot who found corrosion in the WA-2-2 plate. He has spent a considerable amount of time and energy removing this plate, in fact, he said he almost resorted to using dynamite! He sent us the WA-2-2 plate, the lower plate of the top two plates mounted to the centersection spar. By far the toughest plate to remove and replace. This plate (see photo) has one of the worst cases of intergranular corrosion we have seen. It is absolutely not safe to fly and must be replaced. Unfortunately, this is probably going to be very difficult, and we honestly do not have any simple fix for this. Just removing the WA-2- plate could do serious damage to the centersection spar. The UND wrap around the end of the centersection spar may have to be cut and removed. The foam under the WA-2-2 plate must be dug out, the 8 AN525 (or AN509) screws must be removed (drilling them out may be the easiest method). A replacement plate must be fabricated, duplicating exactly all of the holes in the plate. This is a difficult job and will require an expert machinist and a lot of patience. Brock will not be able to help you with this. Each case will have to be dealt with on an individual basis. The new piece should be alodined and then floxed and screwed back into place. If the UND wrap was damaged, it must be replaced, which requires cutting into the fuel tank (we did say it would be tough!).

This is major work, not anything that could not be done by a person who has built a VariEze, but very tedious, difficult work. And it must be done right. There is no short cut, no easy way. If you find more than simple white powder surface corrosion, stuff you can easily polish off with 320 grit sandpaper, you must ground your VariEze and replace the corroded parts.

A mandatory inspection is required before next flight for all VariEzes. So not take this problem lightly, it could kill you and anyone who may be with you. Remove both wings. Clean all visible aluminum parts at the wing root and centersection spar. Look at the edges of all the WA plates on the centersection spar. Look for a thinner edge or a swollen appearance under the glass. Look in between these plates (where the WA-3 tongue slides in). A white powder appearance that can be completely removed and polished out with 320 grit is OK, but the plates should be very thoroughly cleaned and sprayed with zinc chromate. LPS or a good quality grease as used in marine applications should be generously applied everywhere before re-installing the wings. Check the WA-4 pins and the AN4 bolts and grease both thoroughly. Replace the AN4 bolts if they show any sign of corrosion.

New construction VariEzes, or anyone replacing wing attach fittings with new ones, should clean all aluminum parts with Alumiprep 33 or Metal Prep #79 then alodine them with Alodine 1201 which puts a tough, corrosion-resistant, visible, golden finish on. We are reluctant to try alodining parts in place due to the acid etch (Alumiprep 33) possibly getting under the glass onto the aluminum.

When you inspect your VariEze, be very conscientious. Check very carefully, it is difficult to find, you may have to probe under the glass over the WA-2-2 plates. Look hard and long at it before you decide it is safe to fly.

The only good news about this is that where the epoxy was bonded to this WA-2-2 plate which we have, there is no corrosion. The surface of the metal is as new. Intergrandular corrosion is very common in airplanes that live near the ocean.

Sea planes are especially prone and require constant inspection and maintenance aimed at preventing just this problem. The salt in the air plus water from rain or condensation, plus heat and aluminum and, presto!, you have a battery! Galvanic reaction and you have corrosion. Keep the aluminum parts clean, grease them often, and you will have no problems. People who live far from the ocean may not see this problem but they must check for it just the same.

This problem is confined to the VariEze. The Long-EZ wing attachment is completely different and this same problem should not occur. Of course, all metal parts must be protected from corrosion - aluminum with alodine or zinc chromate, steel with zinc chromate (after cleaning in metal Prep). **Wing attach bolts and parts should be generously covered with a good grease in VariEze and Long-EZs.** Replace any rusty bolts and nuts.

****From CP55-11 (CH3,CH19,CH38)(Photo Caption)****
VariEze wing attach fitting WA-2-2 removed from a Harlingen, TX based VariEze. Note extensive flaking typical of severe intergranular corrosion.

Static Loading

****From CP40-3 (CH3,CH10,CH19,CH31)****
TO STATIC LOAD OR NOT TO STATIC LOAD
RAF has been receiving more and more requests from builders who would like to static load their newly constructed VariEze or Long-EZ. We are concerned that many of these builders may not fully understand what a static load entails and what the consequences of an incorrectly done static load can be.

Anyone who absolutely insists on doing a static load, can obtain a copy of the load schedule from RAF. We strongly recommend that you have a qualified structural engineer present during the load tests. Perfectly good parts can easily be failed by poorly or incorrectly done static load tests. This has occurred to some of the builders from overseas. Unfortunately, for some of the countries, their equivalent to our FAA has a requirement for a static load to be done. We know of two builders who have had their wings (on completed aircraft) destroyed. Do not allow some government official to decide on a load schedule for your airplane. Write to RAF and get a copy of the correct load schedule.

Before you rush off and static load your brand new EZ, consider this. When you purchased your plans from RAF, you paid for the benefit of all the aerodynamic and structural design capability that Burt and RAF has. RAF does an extremely thorough job of structural analysis, as well as conducting any static load test deemed necessary by Burt. Once the airplane is flying and the flying qualities are to Burt's liking, the airplane is put through an extremely thorough flight test program. Prior to the prototype being built, the amount of testing of various materials to be used in the aircraft is unsurpassed.

We believe that if you build your aircraft structurally and aerodynamically in accordance with the plans, and you layup the correct number of plies of the appropriate glass, (no less, and certainly no more), in the correct orientation, and you do a reasonable job of wetting out the glass with the appropriate epoxy, you will have an airplane that is more than adequately strong enough.

Vortilons

****Also see LPC #126 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP42-5 (CH19)****
VORTILONS FOR VARIEZES
These little wing leading edge fences, or more properly, vortilons, have been seen by many builders on Mike and Sally's Long-EZ N26MS. Since Oshkosh '84, we have been testing them on several airplanes including the prototype Long-EZ, N79RA. We also received expert assistance from Chuck Richey who installed and tested them on his VariEze, and from Gary Hertzler who did essentially the same thing on his VariEze and from Bruce Evans who installed them on his VariEze and test flew it to Oshkosh.

We are pleased to be able to report that the vortilons, as shown here (full sized patterns) are approved for installation on VariEzes as called out. They replace the leading edge cuff, which should be removed if using the vortilons. There is little or no speed penalty caused by the vortilons, but there is a very noticeable improvement in takeoff and climb performance. Visibility over the nose during rotation for lift off as well as in the flare for landing is greatly improved. Stall characteristics are also improved at all weights to gross and at all c of g conditions from 97" to 102.2". **FULL SIZE PATTERNS OMITTED**

The installation information given is for VariEzes. **The vortilons on the Long-EZ are not as effective as on the VariEze due to the higher sweep angle of the VariEze wing and the different airfoils used on the two airplanes.** Vortilons only work on swept wings and will do nothing on straight wings. After considerable testing on 3 different Long-EZs we do not feel there is enough to be gained, to warrant the trouble to install them on the Long-EZ.

****From CP44-3&4 (CH19,CH31)****

VORTILONS

We noticed that almost all of the VariEzes at Sun 'n' Fun had vortilons installed on their wing leading edges, some even installed them over the cuffs! During some of the bull sessions, we talked to the builder/pilots and all agreed that the vortilons are well worth having. Slow speed stability, visibility over the nose for take off and landing were greatly improved. If you have not already installed them on your VariEze, do it, you will like 'em. We believe it is better to remove any existing wing cuffs before you install the vortilons, and the vortilons are definitely superior to the cuffs and are lower drag. **We are even starting to notice a few Long-EZs with vortilons.** Yes, they will improve visibility over the nose and lateral stability a little (with the standard canard) but we did not feel they were warranted until we flew the new R1145MS canard. As we mentioned, if you install the new canard on a Long-EZ, the vortilons are mandatory. They are not an option. The new canard with no vortilons can drive the main wing to such a high angle of attack that the main wing can stall before the canard does.

Vortilons are impressive little devices, but keep in mind that they only work on a swept wing. It would not help to put them on your canard for example. Any straight wing with no sweep will not benefit from vortilons.

****From CP46-2&3 (CH13,CH19,CH30,CH33,CH36)****

HOMEBUILDER MODIFICATIONS

Recently we have noticed a trend towards homebuilder modified Long-EZs, particularly the long nose and heavier engines. These are not RAF approved modifications and we are concerned that most pilots may not be aware of what they could possibly be getting into. First of all, the longer nose IS destabilizing in pitch as well as directionally (yaw). How much of it may influence your particular airplane is not known. We believe you as the pilot should know just how stable your own airplane is. **We strongly recommend to anyone who has modified their own aircraft in this way, that first of all you should install vortilons on the main wings. The vortilons allow a little more stall margin.** Secondly, you should put on a parachute, and climb to at least 10,000 feet above the ground and at that altitude, you should fully explore the stall/full aft stick characteristics of your airplane. Do it first at a mid cg position, then ballast to the aft limit, (103") and do it again. In this way at least you will be aware of any possible unpleasant stall behavior or unstable tendency, and you would be a lot less likely to later discover any nasty trait at low altitude with no margin for a safe recovery.

We are really concerned when we hear that a particular builder has done a major modification to his airplane. For example, a larger, heavier engine and a longer nose. Then he goes out and flies it for a few hours and then tells all the builders in his area what a neat thing he has done. Now some of these builders decide, based on his results to do the same thing. Meanwhile, the original experimentor never did test his airplane at aft limit cg, at full aft stick, with aggravated control inputs, or at the red line or at limit g so he never knew for a fact that his airplane was safe. Another builder, influenced by the first experimentor makes similar changes, goes out and while demonstrating the much touted stall characteristics to a passenger, enters a deep stall condition at low altitude, does not have enough room to recover, and so he and his airplane become another statistic and make not only the Long-EZ look bad, but also puts a blot on the accident record of all homebuilts.

To sum up: If you must make changes to your aircraft, keep in mind that you now have a different airplane than the original plans built Long-EZ prototype. Your new design may have perfectly safe aft cg, high angle of attack flying characteristics, but it may also have unsafe, nasty characteristics, just waiting to bite you at an inopportune time. To protect yourself, and any future passenger you may take for a ride, 1) you should install the vortilons, 2) you should thoroughly test your airplane at aft cg, high angle of attack (full aft stick) with aggravated control inputs. If your airplane does not handle well, limit your aft cg. You do not have to go back to the published limit. If you are not comfortable at 103, try 102 or 102.5. If it is good there, limit it there, note it in your log book, placard the airplane, and don't ever exceed this (or any other) limitation. Remember, each Long-EZ, or any other homebuilt design, is different. Don't assume because Joe Blow did it and was safe, that you will be. You may not be and that really can take the fun out of the whole project. Don't ever lose sight of the fact that, that is what this whole thing is about - having fun!! FLY SAFE AND ENJOY.

****From CP46-3 (CH19,CH31)****

NEW RONCZ 1145MS CANARD UPDATE

Quite a number of these plans have been sold now and we have been receiving lots of feed back. There are several small errors in the plans, (see this issue, Long-EZ plans changes) but generally most builders have been doing real well building the canard.

There are at least three flying now, the first homebuilder to notify us that he was flying his new canard was Harold Martindale of Anchorage, Alaska. Harold called after his first flight during which he had flown in and out of several rain showers and was delighted with the lack of trim change.

One of the errors in the plans has caused a few people to build a shorter canard by 2". This is not good. The elevators are shown the correct length, the elevator torque tubes as provided by Ken Brock are the correct length. Do not cut your elevators down. If you have built your canard too short (Page CI, 64" dimension should be 65", 10" dimension should be 11"), you will need to glue a 1" piece of foam to each end of the canard, carefully sand it to match the airfoil shape.

Mount the elevators, then proceed according to the plans, with the shaped wingtips. Now, when you glass these wingtips, simply run the two ply layup on the tip over the 1" foam addition onto the canard. Do this top, bottom and trailing edge and your canard will be the proper length.

Do not cut down the length of this canard. There is apparently a rumor being put out by someone in the Florida area, that you can vary the length of the canard depending on your weight. This is absolutely not true. We have tested this airfoil section at various lengths and the length called out in the plans is the optimum length and should not be changed.

Do not neglect to install the vortilons on your main wings - vortilons on the main wings are MANDATORY when using the R1145MS canard. They are optional when using the original GU section and we have had reports varying from no change to "really makes a big difference" with the original canard. Try them and see.

****From CP47-9 (CH19)****

VORTILONS FOR LONG-EZs

Due to the wide variety of workmanship, flying characteristics can vary considerably from one airplane to another, even though they may have been built from the same plans. We have been confident up until now that Long-EZs were pretty much immune from a main wing stall, if they were operated within the normal limitation of gross weight and CG. Recently we were surprised to learn of a stock Long-EZ that experienced a main wing stall. Admittedly this aircraft had been loaded to well over normal gross weight, but the fact that it occurred at all has led us to make the following change a mandatory one for all Long-EZs, regardless of which canard is installed.

All Long-EZs must have three vortilons installed as shown on the leading edge of each main wing. We have conducted rather extensive testing of vortilons and they definitely do add to the stall margin of a swept wing.

They have always been required when using the new R1145MS canard, they are now required even if you have the original GU canard installed.

Probably the best way to install vortilons is to make them with a small flange on each side. Finish them through final paint (using your trim color is a neat idea) then glue them to the finished wing in the appropriate position using a small amount of clear RTV silicone.

We have included full scale patterns for each vortilon, as well as a plan view and front view showing the positions at which each vortilon should be installed. The main design requirements are that the vortilons are mounted so that they are vertical, relative to the aircraft in level flight, and that they are mounted parallel to B.L.O. or centerline. They do not cant outboard or inboard. The vortilon itself should be made from a six ply BID solid glass layup. The flanges can be two plies of BID on each side of each vortilon. **FULL SCALE PATTERNS OMITTED**

****From CP48-2 (CH19)****

VORTILONS ON EZ'S

We continue to receive glowing reports from EZ flyers who are very pleased with the results of installing the vortilons on both VariEzes and Long-EZs. Don't miss out on these definite improvements. Vortilons are now mandatory on VariEzes and Long-EZs (regardless of which canard you have). Do NOT slit the wing leading edge to install the vortilons. This will weaken the wing, particularly in a VariEze which has a monocoque wing structure. Vortilons should be installed per the CP recommended procedure. Make the vortilons with small flanges as shown in CP 42, page 7 (VariEze) and CP47, page 15 (Long-EZ), finish them in your trim color, and attach them to the leading edges using RTV silicone.

Laminar Flow

****From CP30-2 (CH19)****

NASA Tests Long-EZ

Researcher Bruce Holmes and Research test pilot Phil Brown of NASA's Langley Center recently visited RAF to study the Long-EZ. Of particular interest was the measurement of the extent of natural laminar flow on the flying surfaces. Also, the stall characteristics and departure susceptibility. They had previously measured extensive laminar flow on their full scale VariEze in the Langley 30 x 60 wind tunnel. This was verified by flight tests at Langley of Bob Woodalls VariEze. They found essentially textbook predicted boundary layer transition locations are being achieved with the airfoils on the EZ despite the presence of wing sweep and canard impingement. This is due to the stable contour that is achieved with our full core composite construction.

The Long-EZ main wing airfoil was designed by Richard Eppler. It has a steep initial pressure gradient intended to provide a reasonable probability of laminar flow despite minor leading edge contamination. The Eppler computer code predicts 32% chord laminar flow on the upper surface for a perfectly smooth surface. As the photos elsewhere in this newsletter show, the sublimating chemical tests on Long-EZs N26MS and N79RA verify that the wings are achieving the full 32% chord laminar flow. Small insect remains on the leading edge forward of about 4% chord will not trip the boundary layer. Bugs aft of 5% chord will destroy laminar flow, as will the small bump of a paint stripe. We now have documentation of the boundary layer characteristics on all surfaces and intersections of the Long-EZ.

Also of interest to NASA was the departure immune stall characteristic we have noted during our tests. NASA wanted to test the spin susceptibility to supplement the extensive data they have gathered on all types of general aviation aircraft. Phil put the

Long-EZ through all types of extreme stall entry conditions: accelerated entries, vertical entries, etc. with all combinations of control inputs. He also alternated left and right rudder inputs at the dutch roll natural frequency, combining opposite aileron to add adverse yaw effects, at the maximum attainable angle of attack. Despite all combinations of gross misuse of flight controls, and attaining over 45 degrees sideslip, he was unable to obtain a departure from controlled flight. Phil left with the comment that he could find no way of inducing loss of control in the Long-EZ.

This is a stark contrast to the general aviation aircraft configurations he has testing at Langley, all of them being relatively susceptible to loss of control or spin entry from any aggravated stall entry. Many of them have unrecoverable spin modes that require wingtip rockets or anti-spin parachutes to effect recovery.

From CP30-18 (CH19)(Photo Caption)
Sublimating chemicals applied to the Long-EZ wing and vertical fins show the extent of laminar flow. Note that turbulent flow is induced when the paint trim strip is located aft of 5 percent chord on vertical fin.

Table of Contents for Chapter 20, Winglets/Rudders

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Update Number 66 to Chapter 20, Winglets/Rudders

****From CP66-8 (CH19,CH20,CH32)****

CHECK YOUR BELHORN PLANS

Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error. (Joan did it).

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Update Number 67 to Chapter 20, Winglets/Rudders

****From CP67-5&6 (CH11,CH16,CH19,CH20,CH31,CH32)****

CONTROLS - RIGGING

Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should not be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons (aileron stall)).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees more in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you must be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and no more. (More travel gives less lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept any friction in the pitch control system. If you have friction, do not fly until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on every pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

From CP67-7 (CH19,CH20,CH32)
SPRINGS FOR FLUSH BELHORNS
NOTE NEW ADDRESS AND PHONE
Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!
Contact: John York
921 College Rd.
Lebanon, IL 62254
618-537-2142

From CP67-9 (CH19,CH20)
AILERON/RUDDER HINGE RETROFIT KIT
The purpose of this kit is to effectively prevent additional wear on the aircraft hinges and thereby circumnavigating a time consuming hinge repair down the road. The hinge kit will fit any MS20001-P3, '-P4, '-P5, or '-P6 extruded aluminum piano hinge that is specified for use on the Long-EZ, VariEze, Defiant, Cozy, Glasair ailerons and/or rudders. You will be supplied with enough Teflon spaghetti tubing and a special high grade stainless spring steel wire for all the hinges used in the ailerons and rudders.

This hinge kit will work in an already worn hinge, but just how worn out (larger I.D. of hinge hole) remains a question we cannot answer. We believe the DuPont/Teflon tubing supplied in the kit will wear proportionally to the amount of space between the tube and the hinge. After more than four years there has not been any additional wear on any of the installed retrofit kits that we know of.

INSTALLATION: Mike Melvill and I found this retrofit to be a piece of cake, taking approximately 10 minutes for each wing. I enclose detailed instructions with each kit explaining several different installation methods used by various builders.

I really don't believe you will have any questions, but just in case, you can call me anytime 0800 through 1700 hours E.S.T., Monday through Friday at 305-974-6610. Please identify yourself as an experimental aircraft builder.

Please note: These kits cost $21.00 US within the USA and Canada. Overseas, the cost is $25.00 US. All orders shipped in the 48 continental United States will be UPS, the rest are shipped by mail. Please add $2.00 US on Rutan Defiant Kits.

When ordering any of the kits, please supply the following information for purpose of giving you the proper kit supplies and providing emergency updates should that necessity arise. Shipping costs are included in the above prices.

1. Name and address. Kits cannot be delivered by UPS to a PO box. Address must be a physical structure. Please type or print clearly.
2. The serial number the kit designer has given you and your government supplied tail number,if you have them.
3. Phone numbers for both work and home, if that is at all possible or practical.
4. Type of aircraft, e.g., Glasair, Defiant, Long-EZ, etc.

Contact: Gary A. Hall
851 SW 63 Ave.
North Lauderdale, FL 33068
305-971-9731 (home recorder)
305-974-6610 (Parkson Corp)

From CP67-10 (CH19,CH20,CH32)
CHECK YOUR BELHORN PLANS
Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error.

Update Number 68 to Chapter 20, Winglets/Rudders

****From CP68-5 (CH19,CH20,CH32)****
NOTE: NEW ADDRESS FOR ORDERING FLUSH RUDDER BELHORN SPRINGS.
John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

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Update Number 69 to Chapter 20, Winglets/Rudders

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	**1199.00**
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

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Update Number 70 to Chapter 20, Winglets/Rudders

****From CP70-7 (CH19,CH20,CH32)****
FLUSH RUDDER BELHORN SPRINGS.
Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049
NOTE: NEW ADDRESS FOR ORDERING

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Update Number 71 to Chapter 20, Winglets/Rudders

****From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)****

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

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Update Number 73 to Chapter 20, Winglets/Rudders

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

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Update Number 74 to Chapter 20, Winglets/Rudders

****From CP74-8 (CH20)****

HELP!! -- We've lost John York! Last we heard, he was in Virginia and we don't know if his belhorn springs are available any longer. Please let us know if you have any information of interest to other builders. ED.

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Update Number 78 to Chapter 20, Winglets/Rudders

Information derived from CP78 published by RAF for April & July 1994

****From CP78-9 (CH19,CH20)****

AILERON/RUDDER HINGE RETROFIT KIT

The purpose of this kit is to effectively prevent additional wear on the aircraft hinges and thereby circumnavigating a time consuming hinge repair down the road. The hinge kit will fit any MS20001-P3, '-P4, '-P5, or '-P6 extruded aluminum piano hinge that is specified for use on the Long-EZ, VariEze, Defiant, Cozy, Glasair ailerons and/or rudders. You will be supplied with enough Teflon spaghetti tubing and a special high grade stainless spring steel wire for all the hinges used in the ailerons and rudders.

This hinge kit will work in an already worn hinge, but just how worn out (larger I.D. of hinge hole) remains a question we cannot answer. We believe the DuPont/Teflon tubing supplied in the kit will wear proportionally to the amount of space between the tube and the hinge. After more than four years there has not been any additional wear on any of the installed retrofit kits that we know of.

INSTALLATION: I enclose detailed instructions with each kit explaining several different installation methods used by various builders.

Pleas note: These kits cost $27.00 US within the USA and Canada. Overseas, the cost is $31.00 US. All orders shipped in the 48 continental United States will be UPS, the rest are shipped by mail. Please add $2.00 US on Rutan Defiant Kits and $10.00 on Solitaire kits. Please try to send the correct amount as kits will be sent COD (balance owed) unless other arrangements are approved by us.

When ordering any of the kits, please supply the following information for purpose of giving you the proper kit supplies and providing emergency updates should that necessity arise. Shipping costs are included in the above prices.

1. Name and address. Kits cannot be delivered by UPS to a PO box. Address must be a physical structure. Please type or print clearly.
2. The serial number the kit designer has given you and your government supplied tail number, if you have them.
3. Phone numbers for both work and home, if that is as all possible or practical.
4. Type of aircraft, e.g., Glasair, Defiant, Long-EZ, etc.

Contact:
Gary A. Hall
851 SW 63rd. Ave.
North Lauderdale, FL 33068
305-971-9731 (home recorder)
305-477-0809 (SoftSol Corp.)

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Update Number 82 to Chapter 20, Winglets/Rudders

Information derived from CP82 published by RAF Oct 1995

****From CP82-13 (CH10,CH16,CH19,CH20)****

TITANIUM ACCESSORIES AVAILABLE!

Custom anodized to any of 15 different colors, shades of copper, purples, blues, greens, yellow/gold, even rainbow effect. **Rudder and aileron gustlocks - $20.00-$30.00.**

GU canard full span vortex generators with layout template - $170.00.. These are very exciting! **Rudder horn CS-301L&R replacements, $25/pair. Shipping inc.**

Ti Specialties
P O Box 1052
Grover Beach CA 93483-1052
(805) 489-8155

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****

Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00
Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00

Sensible stuff

VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	**18.50**
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	**10.00**
Moldless Composites manual	14.50

Postage & handling included in price.

Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

Chapter 20, Winglets/Rudders

Long-EZ Plans Changes

****From CP25-6 (CH20)****
LPC #6, MEO, Page 20-2
Add A,B,C, dimensions: A = 102.15"
B = 108.35"
C = 118.35"

****From CP25-6 (CH20)****
LPC #13, MEO, Page 20-1, Step 1.
Third line down, Add page A3 and A14.

****From CP31-5 (CH20)****
LPC #90 MEO, Section I, page 20-4.
Step 6, says see Section III, this should read, see page 22-3.

****From CP32-7 (CH20,CH28)****
LPC #97 MEO, Page A-14, lower winglet, tip template.
The arrow pointing inboard is correct, the words, "this side for lt.....", etc. are reversed. The side shown is for the right winglet, transfer numbers to the other side for left.

****From CP34-7 (CH20)****
LPC #104 MEO
Section I, page 20-2, second paragraph, "3rd ply is on the upper surface only" change "surface" to "winglet" to clarify.

Prefabricated Parts

****From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
PRE-FABRICATED COMPOSITE PARTS
Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.
1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. **Wings and winglets to follow soon at $779.00.**
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415, (707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

Miscellaneous

****From CP55-5 (CH12,CH19,CH20,CH31,CH33,CH37)****
HIGH ANGLE OF ATTACK DEPARTURE TESTING
Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. **Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable.** Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

****From CP60-11,12&13 (CH19,CH20,CH25,CH33)****

HOW TO CHECK IF YOUR AIRPLANE IS STRAIGHT.

So you have a few hours on your new EZ/Long/Defiant/etc., and you are buzzing around within your limited 25 mile radius of home base - why not spend the required hours you have left to take a close look at your airplane. Specifically, checking the rigging, the "straightness", if you will, of your brand new creation.

Assume you have built a "perfect" airplane, both wings are mounted to the fuselage at the correct incidence with zero relative difference, the canard is straight and at the correct incidence, and the two winglets are correct and exactly symmetrical relative to each other. This airplane should fly at cruise power, level flight, with the ball centered and both ailerons even and faired with the wing trailing edges. Depending on the CG and the speed, the elevator may also be perfectly faired with the canard tips. Since elevator position is a function of speed and, to a lesser degree, to CG position, I will limit this discussion primarily to rudder and ailerons.

How many of you have reached this goal? Not many I would bet. I know my own Long-EZ certainly is short of this state of perfection. How important is it to have a perfectly straight airplane? Difficult to say. Obviously, the straighter it is, the less control surface deflection there will be in high speed flight and the lower the drag and the greater the efficiency will be.

How do you check for a straight airplane? First of all, you will have to have a slip indicator, accurately installed. This can be a short length of yarn stuck to the canopy on the aircraft centerline with a small piece of masking tape (this will only work on gliders and pushers!). Place it about 12" up from the leading edge of the plexiglass canopy. If you have a needle and ball, a turn coordinator and ball, or just a ball, it must be mounted in the panel, ball centered with the wings exactly level. Be sure this is correct before attempting to evaluate the airplane.

Now, before you conduct the following flight test, check to see that the two elevators are rigged perfectly, relative to each other. You will have to remove the canard to check this out. Simply eyeball along the elevator trailing edges. They should be in a straight line. If they are not, you must correct this before doing the flight testing. Elevators rigged incorrectly will roll the airplane.

Also, stand behind your airplane looking at the center of the spinner. Raise or lower your head until your eyes can see along the top skin forward of the trailing edges of the wings. You don't want to be looking down on top of the wings or up at the bottom skins. You must be able to see the trailing edges and the top skins as a line. Now, without tilting your head, look from the right wing to the left. Any differences? Shouldn't be. If you can see more of the top of one wing, you have a relative incidence problem. Make a note as to which way it should roll and verify this in flight.

Take off and establish a high cruise in level flight, feet off the rudder pedals and ailerons perfectly centered (if you can't see your ailerons, take a passenger along to help you get them centered. Remember, your limitations allow you to carry a passenger if they are essential to the mission)! Now, look at the ball. Is it centered? Are the wings level? Probably not! Bummer, oh well, take comfort in knowing that almost everyone else is in the same boat! Keep the ailerons centered (visually verify this), and "step on the ball", that is, step on the rudder to center the ball. Step on the rudder opposite the direction of the yarn slip indicator. Lock your feet, ball centered (yarn centered), keep ailerons centered, and carefully observe the horizon and your DG (if you have one) to see if the airplane is flying a straight course over the ground or if it is slowly turning. If you have no turning rate and your wings are level with the horizon, you have one or both winglets attached to the wings slightly crooked. Even though you have a small error in your airplane, at least you know what is wrong and it can be corrected.

What if you are turning? Carefully null out the turn. Use just enough aileron in the proper direction to zero the turn. Verify this by watching for zero heading change on your DG or by observing a distant peak or other prominent object on the ground at the horizon. This takes a little time and patience but you can get it perfect if you try. With zero turn rate and the ball centered, check how much aileron and rudder deflection you have and in which direction. An assistant can be a great help here. Have them write down, for example, "right aileron up 3/16", left aileron down 3/16" and left rudder outboard 1/4", right rudder at zero." These dimensions can be quite accurately "eyeballed" with a little practice. If you doubt your passenger's ability to judge this, before you fly, have him or her sit in the passenger seat and you move the ailerons and rudders, using a scale and have them call out what they see. Now you know you have a relative wing incidence problem, as well as a relative winglet incidence problem.

Block the rudder out to whatever the eyeball estimate was by taping a small wood block to the inboard trailing edge of the winglet. When the rudder is released, it should close on this block and remain deflected outboard the estimated amount. Repeat the flight test and verify that the ball is centered with zero turn rate.

Now, in the case of a Long-EZ or Defiant, you will have to install shim washers on one of the outboard wing attach bolts such that the wing incidence is altered in the proper direction, i.e., in the example above of the right aileron trailing edge up, this wing would need to be shimmed by perhaps one thin washer (AN960-816L) on the bottom outboard bolt. The left wing probably should be left alone until you look at the results of this change in flight.

Fly it and see if this was enough and if it was in the correct direction. Remember, do this kind of adjusting only in small increments. Use thin washers or thin shim stock, one piece at a time, starting with the wing that appeared to be off when you eyeballed the airplane from behind, whichever wing needs to be shimmed to raise the trailing edge. If one washer on one wing does not do it, add one on the other bolt on the opposite wing. Keep both wings even by eyeballing from behind - do not get one wing much different than the other. Continue using small increments until the airplane flys wings level, ball centered with zero turn rate.

You now have a straight but ugly airplane! Unfortunately, if you have already painted it, you will have some work to do. If it is still in primer, fair the fuel strakes to match the wing roots with dry micro (West System). To fair the rudder with the upper and lower winglet (on a Long-EZ), use a hacksaw blade to cut through the outboard skin along the rudder hinge line to the top and bottom of the winglet. If necessary, widen this saw cut as required and cut through the foam core to the inside of the inboard skins above the rudder and below the rudder. Check that you can now flex the trailing edges of the top and bottom of the winglet til it lines up with the rudder (still in its blocked outboard position). Now, reduce the amount the rudder is blocked out by approximately 10 percent, fill the saw cuts with micro and force the top and bottom outboard to exactly match to the rudder. Clamp them in this position and allow to cure. Layup a 2-ply BID repair over the saw cuts and fill, sand and finish. Install a permanent block, full span along the inboard trailing edge of the winglet to block the rudder in its proper faired position. You can use wood or a piece of pre-cured glass here.

Your airplane should now fly straight and the winglet repair will not be detectable.

This works great on a Long-EZ, but what about a VariEze? Since it is not possible to adjust the incidence of the wings of a completed VariEze, you will have to do surgery to the TOP of whichever wing it takes to correct the tendency to roll. If it rolls left (ailerons centered), you will have to slit the top skin of the right wing, outboard of the aileron along the aileron hinge line and bend this trailing edge up as described for Long-EZ winglets/rudders. If you have to do this to your VariEze, call me at RAF and let's discuss it before you do it.

Well, I hope this is helpful and not too confusing. I'd be happy to discuss this with any builders or flyers who may find themselves having to make this kind of correction.

Mike Melvill

HotWiring

****Also see LPC #97 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP24-4 (CH3,CH10,CH11,CH19,CH20,CH31)****

Hotwire Templates-

An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood, available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)
BUILDER HINTS
You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. **This works great for hotwire templates too.**

**From CP25-5 (CH3,CH10,CH11,CH19,CH20,CH31)
HOT WIRING
Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

From CP36-6 (CH3,CH10,CH11,CH19,CH20,CH31)
V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

Winglet Antenna

From CP26-7 (CH20,CH22)
LONG-EZ COM ANTENNA - At last, a high performance com antenna. Jim Weir from Radio Systems Technology developed a com antenna for the Long-EZ that fits in the winglet. (see photo) We have tested it in the Long-EZ N79RA and found it to have excellent range. We were able to use it at distances of over 80 nm. The antenna uses copper foil and RG58U lead in. It does not require a ground plane. It can be installed on the foam core before glassing and is completely enclosed within the winglet. Ours was placed on the outside skin after drilling some carefully-aimed holes. Install the antenna system before glassing the inboard side of the winglet. Cut 2 strips of copper foil 20.3" long, remove the protective backing and stick the foil to the foam one inch from and parallel to the trailing edge. Measure the rudder cut out area and bend the lower (2") end of the foil forward to miss the rudder. From where the two foil strips come together cut a slot just deep enough to hold the RG-58U/A lead in cable flush with the foam surface. Hold the lead in with toothpicks similar to the method used on page 19-7 rudder conduit. Be sure the three Ferrite Balums are installed just above the connection as shown. Solder the center wire of the RG-58U/A to the top foil strip and the outside "ground" braid to the lower foil strip.

Be sure the upper and lower foil strips don't touch or short out. Use about 1/8" separation. Check that none of the wire, ferrite balums etc. stick up above the foam surface, trowel in dry micro around the solder joints and other voids and glass the inboard winglet as per the plans.

Coil up the excess cable and thread it through the wing during winglet installation.

The antenna kit is available from:
Radio Systems Technology
10985 Grass Valley Avenue
Grass Valley, CA 95945

Antenna kit price -
Assembled - $25.50
(with BNC connectors)
Unassembled - $15.00

SKETCH OMITTED

****From CP26-12 (CH20,CH22)(Photo caption)****
Mike, installing the RST antenna on N78RA Long-EZ. Note: this antenna will not fit the VariEze.

****From CP40-2 (CH20,CH22,CH32)****
NEW RUDDERS FOR THE LONG-EZ
The plans for the new rudders for the Long-EZs have been very popular although there has been some confusion. We will try to clear up a few points.

First of all, these plans are strictly for Long-EZ. They absolutely do not apply to the VariEze or any other type aircraft. VariEze builder/flyers should be able to recall a mandatory change in CP 22, Page 8, that reduced the allowable rudder travel from the original plans call out of 3.5" to 2". This was because the rudder authority of a VariEze was powerful enough in some cases to depart the airplane. The VariEze is the last airplane that needs stronger rudders!

If you have not installed your comm antenna(s) in your winglet(s) on your Long-EZ and you would like to have the high performance rudders, do not install any antenna in the winglets until you have the plans for the new rudders in hand. If you are wanting to retrofit the new rudders to a Long-EZ that is already flying, or one that has the antenna already installed per CP 26, you will have to cut through the original antenna and install a new one forward of the new rudder hinge line. This is covered in the new rudder plans. We have made this modification now to 3 Long-EZs and in all 3 cases the old antenna is still under the glass skin, (cut through and disconnected) and the new antenna works very well. We have not been able to perceive any degradation in radio performance. In fact on two of the three, we seem to have improved range both transmitting and receiving!

The new rudders on the Long-EZ give at least twice the yaw authority of the original rudders and allow you to steer while taxiing at speeds as low as 25 to 30 knots without using the brakes. The main advantage of course is in a crosswind take off from a narrow runway. With the new rudders minimal braking is required for steering, so you can accelerate to rotation speed more rapidly. You can rotate at your normal rotation speed of 50 to 60 knots (depending on cg) in any amount of crosswind up to 20 knots at 90 degrees and lift off in essentially the same distance as you would with no crosswind. Quite a few homebuilt Long-EZs have flown into RAF with the new rudders and every one so far has been pleased with them.

Trailing Edge Close Outs

****From CP32-6 (CH10,CH11,CH19,CH20,CH31)****
CAUTION - TRAILING EDGE CLOSE OUTS
It is very important for structural integrity, that you ensure that your trailing edges of the canard, elevators, wings, ailerons, winglets and rudders meet the prescribed minimums in the plans. Do not accept delaminations in the trailing edge glass to glass area. Even the smallest delam can get moisture in it which will freeze and expand when you climb through the freezing level, and thus delaminate further and further with each occurrence until it could weaken the overall integrity. About the quality of your trailing edge glass to glass close outs - accept nothing less that perfection in this area. Always sand smooth every lap after cure - do not leave them joggled as shown. **SKETCHES OMITTED**

LAP DIMENSION Ignoring the proper procedure here could result in serious consequences, even structural failures! Here is a list of these areas. The minimum dimension should be considered an absolute minimum. If you don't meet this criterion it requires repair before you fly. **SKETCHES OMITTED**

	Glass Lap Dimension Shown	Minimum Acceptable Lap
Canard	0.45"	0.3"
Elevators	0.25"	0.2"
Wings	0.6"	0.5"
Aileron cut outs	1.0" (top)	0.75" (top)
	0.75" (bottom)	0.52" (bottom)
Ailerons	0.5"	0.3"
Wing Root Rib	0.6"	0.4"
Winglets	0.6"	0.4"

****Also see LPC #6 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP33-5 (CH20,CH39)****
ACCIDENT - Inflight Airframe Failure
The thought of an airplane coming apart in the air brings chill to most aviators and certainly to aircraft designers. Despite many horror stories related to severe weather, drastic overspeed in dives, and even airframe flutter (unbalanced elevators), we had yet to hear of an inflight failure of a Rutan design - until June 21st when the caller described a **winglet ripping off a VariEze** at 200+ mph during an airport buzz job. Within two hours Mike Melvill and Dick Rutan were airborne in the Defiant for a non-stop flight to Dallas, Texas to investigate. What they found, though, did not lead to grounding or flight restriction of other VariEzes. The cause was tantamount to leaving the wing attach bolts off your Cessna and expecting the fairing strip to hold the wing on. Their report follows:

An aerobatic pilot witness standing nearby described what happened when the winglet came off. The aircraft yawed, rolled, and pitched up 90 degrees. The calculated 13-g loads did not fail the wings but twisted the fuselage enough to shed most of the plexiglass from the canopy frame. The aircraft impacted inverted on the prop and top cowling, then it slammed down, shearing the pilot's rollover structure, the top of the instrument panel and impacted the canard/fuselage fairing. It then bounced back into the air, rolled left to upright, and struck the ground upright,failing the main gear (pulled brackets and major glass structure from the fuselage). The aircraft came to rest 90 feet from the initial impact point at a heading of 110 degrees right of flight path. The nose gear was retracted. The right winglet was located about 1,900 feet short of the wreckage. Parts of the plexiglass canopy were found 1,000 feet short. With the exception of the right winglet and rudder assembly, and parts of the plexiglass canopy, the wreckage was essentially complete and in one spot. Although it had sustained major damage, the airplane was located in a small area, not over 20' x 30'.

The right winglet failed inward during the high speed low pass. Sample sections were cut out of the winglet-root/wingtip. Skin coupons were burned out and the number of plies were counted. The type of glass and fiber orientation were determined.

Figure 1 shows the VariEze design structure and the structure found on the wreckage of N11CH. The major tension layup (#8) that was omitted was, without question, the primary weakness which allowed the winglet to fold inward and fail at high speed. The winglets lift inward and, at high speed (with zero sideslip) have an inward bending moment that is equal to that attained in a 15 degree sideslip at the maneuvering speed. Note that with layup #8 omitted, and with layup #9 not extending to the lower skin, the only structure opposing the bending was the foam core acting through rib #6 to the bottom skin. It is conservatively estimated that the structural strength of the winglet-to-wing joint of N11CH was less that 1/20 of what it should have been. It is very surprising that it did not fail sooner. The incredible thing that was not answered was how the builder could have omitted the primary structure and why it had not been noticed. Even after the final paint job, it was obvious that the #6 rib could be seen on the surface.

This aircraft throughout showed evidence of poor workmanship. Poor workmanship in itself had not precipitated structural failure with these construction materials. Prior to this accident the VariEze type had amassed approximately 150,000 hours flying without inflight airframe failure, even though many of the aircraft have relatively poor workmanship. The omission of important primary structure was clearly the cause of the structural failure. **SKETCHES OMITTED**

****From CP42-4 (CH3,CH20)****
Bondo for jigging - When you position your winglet onto the tip of your wing, be careful to sand the wing and the winglet locally where you apply the bondo that will jig it into position for the structural layup. If you do not sand the glass, the bondo may not hold, and it is possible that the bondo will fail in the middle of the cure cycle of the structural glass layup. This can cause the winglet to be misaligned incidence wise. This has happened before and it can happen to you. Sand the glass wherever you intend to apply bondo for accurate jigging purposes.

****From CP43-5 (CH3,CH20)****
VariEze and Long-EZ - Hot Stuff model airplane "instant" glue. A cyanoacrolate glue, Hot Stuff can be extremely handy to "tack" pieces in place, to essentially give you a third hand, by almost instantly glueing small parts and firmly holding them in position. Hot Shot, a spray accelerator that speeds up the curing time of Hot Stuff glue can also be used to great advantage. We like the thick glue as opposed to thin, and when used with Hot Shot accelerator, can produce an unbelievably strong bond between glass pieces, plywood or even PVC foam pieces (do not use on Styrofoam). We have tacked winglets to wings with Hot Stuff, instead of Bondo. The advantage is, it cures instantly and you can layup glass right over the tiny drops of Hot Stuff. We also have found it a great time saver when jigging parts. Experiment and you will find all kinds of places you can use this material.

****From CP53-12 (CH20)(Photo Caption)****
Douglas' wing/winglet juncture - this is how it is supposed to look - very sanitary work, Don.

****From CP32-6 (CH3,CH11,CH19,CH20)****
BUILDER HINTS
Clarification on use of various pop rivets. Anywhere on the airframe where you are installing nutplates, on hinges, access panel, use 3/32" diameter flush pop rivets, or solid aluminum rivets. When installing aileron hinges onto the ailerons, use 1/8" round head pop rivets (Avex 1601-0410, or cherry MSP 43) rudder hinges are installed into the rudder using flush pop rivets (Avex 1604-0412 or cherry MSC 43). CS2 elevator hinges are installed on the elevator using flush pop rivets (Avex 1604-04 or cherry MSC 43).

****From CP49-4 (CH20,CH38)****
CAUTION
If someone plays with your rudder, or even if the wind blows your rudder forward, in some cases it may be possible to get the rudder cable snagged inside the cowling. This is especially the case on the left side where most of us have our oil cooler. We know of at least two instances where this did, indeed, occur, and it really does make for an interesting landing technique. Remove the top cowl and have someone move the rudder back and forth and carefully evaluate the chances of this happening. If it can, it will! Install a guard or shield to prevent this possibility and be absolutely certain that your guard does not make the situation worse! Thoroughly test your installation before installing the top cowling.

****From CP50-4 (CH19,CH20)****
Gary Hall has an excellent aileron/rudder hinge pin kit. Consists of enough Teflon tubing and stainless steel pin stock to convert your aileron and rudder hinges on a Long-EZ or VariEze. This is retrofitable and well worth the effort. A comprehensive instruction sheet is included.

Contact: Gary A. Hall
4748 NW 43rd. St.
Lauderdale Lakes, FL 33319
(303)484-4949

****From CP51-6 (CH19,CH20)****
INSTALLING TEFLON "SPAGHETTI" TUBING IN AILERON AND RUDDER HINGES
John Bingham, VariEze builder, suggests the following idea: Split the Teflon tubing as shown in CP39, page 7, then, using a needle and about 12" of strong thread, stitch the thread into the end of a piece of Teflon tubing per sketch. **SKETCH OMITTED**

Now, pull the needle through the aluminum hinge using a small magnet. Then, pull the thread at the same time as you push the Teflon tube through the hinge. While it is difficult to push the Teflon tube through the hinge, it is easy to pull it through! Thanks, John.

****From CP51-8 (CH19,CH20)****
CORRECTION - RETROFIT AILERON HINGE KIT
We received the following from Gary Hall after CP50 came out.

"My correct area code is (305) not (303) and the house number is 4784 not 4748. I've notified my neighbor and called Colorado. I explained to those nice people that they are going to get a few calls from a crazy group of people called experimental aircraft builders asking for Gary Hall. The RETROFIT AILERON HINGE KIT IS $21.00 and will be shipped UPS unless you instruct me to do otherwise. (Outside US - $25.00) The kit consists of Teflon spaghetti tubing and a special high grade stainless spring steel to fit inside the tube. If your hinges are "CLEAN" it will take you about 10 minutes per Long-EZ aileron to retrofit. The importance of this kit is to prevent any wear on the AL2 hinge. Teflon should last several years. This is how long Mike has had his in place and there has not been any wear. This kit will work on any Long-EZ, VariEze, Defiant or other aircraft using he MS20001-P3, P4, P5, or P6 hinge.

Gary Hall
4784 NW 43rd Street
Lauderdale Lakes, FL 33319
(305)484-4949 (home)

****From CP53-5 (CH19,CH20)****
Teflon Hinge Pin Kit for ailerons and rudders on VariEzes, Long-EZs, Defiants, and Solitaires. Includes Teflon tubing and stainless steel hinge pin. Fits MS20001 series piano hinges.

Contact: Gary Hall
4784 NW 43rd St.
Lauderdale Lakes, Florida 33319
Home: (305)484-4949
Work: (305)974-6610

Please identify yourself as an EZ builder.

These Teflon hinge pin liners really do cut down on hinge wear, especially the ailerons which, due to their proximity to the engine, suffer much wear and tear from vibration. Send $21.00 and Gary will ship UPS. ($25.00 outside USA).

****From CP57-6 (CH19,CH20)****

HINGE PIN KITS

Gary Hall's teflon hinge pin kits are suitable for all RAF designs. The kit consists of stainless steel hinge pin material together with a pure teflon tubing sized correctly to fit over the hinge pin and inside of the aluminum hinge knuckle. This virtually eliminates hinge wear, particularly on the aileron hinges which take quite a beating from engine/prop associated vibration. Contact:

Gary Hall
4784 NW 43rd St.
Lauderdale Lakes, FL 33319
305-484-4949

****From CP59-6&7 (CH19,CH20,CH32)****
****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****

FLUSH RUDDER BELHORNS FOR A LONG-EZ.

A few enterprising builders have designed their own method of hiding the external rudder belhorn and when Mike and Sally converted their Long-EZ, N26MS, about a year ago, we started getting enquiries from Long-EZ builders who wanted to do the same. Now that we have a years experience on the system used by Mike and Sally, we feel we can share it with Long-EZ builders who may wish to remove the external belhorns. RAF will be making a simple set of instructions, drawings, sketches and photos available within the next 6 to 8 weeks. These will sell for around $10.00.

The first "flush belhorns" Long-EZ we ever saw was Ben Ellison's Long-EZ (of Ellison Throttle Body fame). A beautiful Long, the simple elegance of the smooth outboard faces of the winglets made it even cleaner. Then we saw Joe LaCour's Long-EZ at Oshkosh and he had done something similar to Ben's and made some sketches as to how he had done it. Mike and Sally decided to use Joe's basic method and it has worked flawlessly for just over a year now. Ben Ellison, Joe LaCour and Mike and Sally's Long-EZs have one thing in common, all have forwarded mounted brake master cylinders. The hidden rudder belhorns method used by all three of these Long-EZs has the rudder striking a hard mechanical "stop" at full throw. This means that it is mandatory to have a strong spring in the rudder cable to allow normal use of the brakes.

While we have not tried this method on a Long-EZ with the brake master cylinder mounted on the firewall, per plans, we believe that with the springs installed correctly, this method should work well. This is only for Long-EZs with the tall, high performance rudders and would not work well at all on the small, original rudders.

First of all, why do it? Mike did it because it looked better and he tells people he gained 10 kts! (which, of course, is nonsense). Obviously, it is lower drag but probably so little as to be impossible to measure. Not having the steel belhorns protruding out of each winglet saves you from catching your clothes on them, it also saves you from bending them on the side of the hangar and cracking the paint but, best of all, from a safety standpoint, it eliminates the possibility of someone flipping the rudder cable end thimble over the back of the belhorn. This can make for quite an exciting take-off if you don't catch it in your preflight!
The external steel belhorns are removed and discarded, new belhorns are fabricated (from full size patterns) and installed into the rudders. A new rudder cable conduit must be installed in a different location in the wing. (Much easier to do in original construction but certainly possible as a retrofit). A strong compression spring, rigged like tail wheel springs, must be installed into each rudder cable to allow you to use the brakes after the rudders strike their stops at the end of their travel.

With forward mounted brake master cylinders, the CS-15 belcranks can be removed and discarded and pulleys can be installed in their place between the CS-71 belcrank brackets. The rudder cables can then be routed through the firewall through a short length of nylon conduit, thus eliminating the large slot required when using firewall mounted brake master cylinders. Also, when using forward mounted brake master cylinders, the rudder cables can be small, 1/16" diameter, all the way from the rudder pedals to the rudders.

The simple plans will consist of full size patterns for all parts required, and will cover building from scratch, new construction, as well as how to retrofit to an existing Long-EZ, however, it will be a simple set of instructions and will not cover every tiny detail, rather, it will assume that since you built the airplane, you can surely figure out this simple thing! Mike did take a series of photos of his retrofit, so these will be included plus a brief outline of procedures.

If you would like a set of these "plans", send a check for $10.00 to Rutan Aircraft, Bldg 13 - Airport, Mojave, CA 93501 and Joan will mail them to you.

****From CP62-4&5 (CH19,CH20)****

Hinge Pin Kit - Teflon tubing and high grade stainless steel hinge pin material - enough for ailerons and rudders on any VariEze, Long-EZ or Defiant.
Kits for VariEze or Long-EZ - $21.00 ($25.00 overseas).
Defiant - $23.00 ($27.00 overseas).

Contact: Gary Hall
851 SW 63rd Ave.
North Lauderdale, FL 33068
305-971-9731 (H)
305-974-6610 (W)

Please identify yourself as an Experimental Aircraft builder if calling at work.

****From CP62-5 (CH19,CH20,CH32)****

****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 93501
805-824-2645 (Tues. & Fri. only)

****From CP63-9 (CH19,CH20,CH32)****

****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****

FOR SALE

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

****From CP64-5&6 (CH19,CH20,CH32)****

****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

****From CP65-10 (CH20,CH32)****

FOR SALE

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
230 Coachman Way
O'Fallon, MO 63366
314-281-5851

Thanks for your generosity, John. We realize this is essentially a non-profit operation but it is a much needed service.

****From CP51-4 (CH11,CH19,CH20,CH31,CH32)****

CONTROL SURFACE BALANCING

We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so that the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50 percent of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and ,more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons and elevators without any additional lead. At least, this has been our experience.

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Table of Contents for Chapter 21, Strakes - Fuel/Baggage

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Update Number 66 to Chapter 21, Strakes - Fuel/Baggage

****From CP66-3&4 (CH2,CH21,CH30,CH38)****

CAUTION

Check that what you order is what you get! Plastic fuel lines must be checked - often.

"Just re-read an article in the *Canard Pusher* about fuel lines in VariEzes. These "original call-out" urethane, flexible fuel lines have been reported to deteriorate over time and should be carefully inspected and replaced periodically. Unless the material for these fuel lines is the correct material, deterioration can be very rapid. Visually examining plastic tubing when it arrives from the supplier may not tell the builder/flyer that it is, in fact, the correct material. Even when the correct material is used, deterioration can occur and be invisible to all but an extremely thorough examination. Here is my experience:

Recently, I brought my VariEze home on a trailer and had it in the carport, nose down. It had been sitting there for quite some time awaiting my attention. When I finally got around to it and opened the canopy, I smelled fuel but could find no sign of liquid fuel. Later, I was checking fuel lines under the rear seat by squeezing them with my fingers to determine hardness or brittleness when the header tank fuel line fell off in my hand! This was the source of the fuel smell. With the nose down, fuel had slowly leaked behind the rear seat bulkhead and into the rear cockpit. All of the other fuel lines were discolored to a dark brown but still felt pliable. In removing them from the fitting, to my horror, they easily split and crumbled.

I had always assumed that deterioration would occur in low spots in the fuel lines where water may collect. These failures, however, were up high at the aluminum fittings. They had been installed in July of 1983 and flown for a total of 750 hours, so they were seven year old. I have used auto fuel, regular, when at home and 100LL Avgas when traveling. Lately, regular auto fuel is no longer available locally so I have been using auto unleaded (no alcohol). I have, on occasions, used Marvel Mystery oil as a fuel additive and, many years ago, I used TCP.

I believe that VariEze fuel lines should be changed at least every three years and great care should be taken to order the correct material. Also, make sure you receive the correct material. As a further safeguard, cut a few small pieces of the new fuel line and submerge some in a bottle of gasoline and some in a bottle of acetone. I check these samples from time to time for any obvious signs of deterioration.

Byron McKean"

Editors comment: Thanks for your report, Byron. We agree wholeheartedly with the suggestion to change plastic fuel lines at least every three years. Also, we have found that buying polyurethane-type tubing from a supplier like McMaster Carr (locations in Chicago, Los Angeles and New Brunswick, NJ) will get you a receipt that spells out part numbers. For example, according to McMaster Carr's catalog, Tygon tubing comes in at least two material types, one called out for fuel and lubricants, another for food and beverage! Each material has its own part number. Tygothane, the material originally called out in the VariEze plans, is recommended for fuels and lubricants. Using McMaster Carr, at least you have the verification of the part number on the receipt. We highly recommend this company as a source of an unbelievable variety of materials, tools, etc. Their catalog is an awesome tome!

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Update Number 67
to
Chapter 21,
Strakes - Fuel/Baggage

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. Don't trust anyone else with your safety. **Fortunately, I have always bad all caps safety wired witb stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one througb the prop.**

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

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Update Number 68 to Chapter 22, Electrical System

****From CP68-3 (CH22)****

LETTERS

"Dear RAF,

Just like to bring you up to date on my experience with my SNR problems with Loran C. I installed the IIMorrow model 604TCA. I immediately noticed SNR problems with alternator and strobes. In flight, at 2500 rpm station, M would read 25. I installed the RF170 and in flight at 2500 rpm, alternator only, M = 125, but when I added the strobes, M = 30. (255 = 100 percent and at 64 percent the warning light comes on.) I then talked to Technical Support at IIMorrow and they recommended installing a 3100uf 75vdc capacitor directly across the alternator. I then proceeded upon their advice and was successful with readings of 243 at 2500 rpm. I then also added a 4700uf 25vdc at the input power leads of the strobe power supply. At 2500 rpm, alternator and strobes, all stations have SNRs of 240 or better. These caps are electrolytic with screw top terminals and cost anywhere from $4 to $8 each.

Happy Flying,

Ray Gonzales"

Editor's Note: While we have not tried this fix, it is such a low cost way to get such excellent results we felt we should share this information with those of you who may not have the best Loran installation.

****From CP68-6&7 (CH22)****

OVERVOLTAGE PROTECTION

SOME THOUGHTS FROM THE AEROELECTRIC CONNECTION.

"Some kit plans and newsletters are recommending the installation of automotive alternators with built-in regulators and NO OVERVOLTAGE protection. In speaking with authors of these publications the rational offered is that they've never seen or heard of anyone having a catastrophic overvoltage event. Folks, I kid you not. The Feds will not allow me to design a certified system which lacks such protection. I too have never experienced nor talked with anyone who has experienced such a failure. However, my engineering job assignments over the years have included many failure mode effects analysis (FMEA) and mean time between failure (MTEA) studies. I can tell you that while the event is indeed rare the probability of occurrence is not zero. I can also tell you that the effects can range from trivial to life threatening.

So please, irrespective of what type of alternator/regulator combination you install in your airplane, include an automatic overvoltage protection device. In some instances of small alternators charging fairly hefty batteries, an overvoltage warning light is sufficient. See the chapter on OV protection. Any questions? Write or call."

Editor's comment: Contact Bob Nuckolls at:
The AeroElectric Connection
Medicine River Press
6936 Bainbridge
Wichita, Kansas 67226
316-685-8617

if you have any problems. Bob designs electronic controls for a living and is an expert in the field.

This editor has seen what happens when a voltage regulator stops controlling the alternator's charge to the battery. Bob's comment about "life threatening" is not an exaggeration. The results are spectacular. Thank heavens my example occurred on the ground! The best way to take care of this problem in my opinion is to install one of Bill Bainbridge's high tech voltage regulators.(designed by Bob Nuckolls). These have built-in instantaneous overvoltage protection. Contact Bill at: B & C Specialties

316-283-8662

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Update Number 69 to Chapter 21, Strakes - Fuel/Baggage

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	**524.00**
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	**19.50**
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

****From CP69-3&4 (CH21)****
<u>*FOR SALE*</u>
New, Improved Fuel Sight Gauges. Use with auto fuel or avgas. Clear bubble with white background. Easy retrofit for VariEzes and Long-Ezs. $30.00 per set.

Contact: Vance Atkinson
3604 Willomet Ct.
Bedford, TX 76021-2431
817-354-8064

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Update Number 76 to Chapter 21, Strakes - Fuel/Baggage

****From CP76-2&3 (CH13,CH21,CH33,CH36,CH39)****

TRUCK-EZ TESTS - THE LATEST ON DEEP STALL

For several years, we have been trying to obtain information and data on the characteristics of various canard-types at deep stall conditions. Data for the VariEze has been available since the late 70's when NASA conducted rotary-balance wind tunnel tests and concluded that the VariEze has no stable spin modes, i.e., that if forced to any angle of attack and spin rate, it will recover by itself. Also, the small model tests showed normal flat-plate drag at high angles of attack. These data and extensive stall-departure flight tests with N4EZ formed the basis for our confidence in the deep-stall safety of these general aircraft types.

Then, about 5 years ago, several accidents occurred with the Velocity aircraft. We think the problem could have been determined if extensive aft-CG departure testing had been done during development, like we did with the Long-EZ and Defiant. Two very noteworthy results from these Velocity accidents were 1). The descent was a stable, non-rotating condition about 50 to 80 degrees AOA, not recoverable with forward stick or by rocking the wings. 2). The descent was slow enough to allow impact in water without pilot injury.

Rumors were abound about this slow, 1000 ft./min. "parachute-like" descent probably induced by a violent, trapped vortex above the wing. Researching this, we found the rumors were just speculation, that there was no hard data on the descent rate. Even the test pilot who stayed with a Velocity to the ocean instead of using his parachute admitted he had not timed the altimeter nor remembered the rate-of-climb indicator's data. He merely climbed partially out, but feeling the "light breeze" of the descent, elected to ride it down. We have been extremely skeptical that an airplane can descend at this low rate, even with the best possible vortex. To put things in perspective, consider what would be required. The EZs and the Velocity have a "loading" of about 10 lb. per square foot of total planform area (including wings, canard, fuselage strakes and cowl). If all this area acts like a "flat plate" in the descent, the airplane would sink at 50 knots or 5000 ft./min. (flat plate Cd=1.24). The very highest Cd we have seen in aerodynamic research papers on trapped vortex is about 10. Using a Cd of 10 for the entire airplane (very unlikely, of course), the sink rate would be 17 knots or 1800 ft./min. If the airplane could descend flat at 1000 ft./min. (only 9.9 knots), it would have a Cd over 30!!

Our interest in this phenomena certainly was increased after the deep stall accident of a Long-EZ at Kanab (CP 68). Now we had some data, but very poor data. Only a tiny image of the airplane during the last 2.8 seconds on a video tape. This airplane hit the dirt without killing the pilot so we believed it could not have been descending at 5000 ft./min. An attempt to analyze the video resulted in a very rough approximation of 2900 ft./min. which results in a Cd of 3.7. Our surprise, of course, was that forward stick did not recover from the deep stall. The surprise subsided when we later learned that the airplane was being flown with the CG well aft of the FS 103 aft limit.

While the 2900 ft./min. sink estimate seemed to make sense, it was not considered accurate due to the problem of measuring a fuzzy blip on the video. We then made a decision to try to gather full scale data on the Long-EZ. The previous full scale tests done in Florida on the Velocity did not measure drag and lift, only the more important data of recoverability with various airplane modifications.

Then, another Velocity deep stall accident occurred. This one descended inverted, hit land, not water, and killed the pilot. In this accident data was available - good, accurate radar and transponder data. Obtaining this data from the FAA is a story in itself.. Finally, after threatening a media expose about government cover-up, we received the data. This Velocity entered a deep stall at about 7000 ft. and descended at a nearly constant 4400 ft./min. (44 knots) for the entire 90 seconds to impact. Of course, this inverted descent data may not apply to an upright Velocity but, at least, for the first time it represented good data during a deep stall accident.

We proceeded to develop the rig to allow us to measure the Long-EZ. This turned out to be a much more difficult and expensive job than originally thought. It was made possible by the loan from Donald Douglas of Sherman Oaks, CA of his Long-EZ that is accurately built to the plans, without modifications. A 3-axis electronic balance was built to measure lift, drag and pitching moment and an accurate speed indicator was installed in front of an Isuzu truck. These "Truck-EZ" tests can only be done in dead calm winds, so after many delays, we were able to obtain data at 40, 50, 60, 71 & 80 degrees angle of attack.

The data are presented in this newsletter. Note that these are full-scale tests at near the same Reynolds number as flight, so they are much more accurate than the small scale model tests done by NASA in the 70's.

First, let's discuss the lift and drag data. The data show substantial scatter due to the truck riding over bumps in the runway. A line faired through the average of scatter is considered reliable. If we combine the lift and drag resolved to a total reaction that would support the airplane during a stable deep stall descent, we can calculate the sink rate. This data, sink rate vs. angle of attack, is shown. Note that this prediction is very close to the radar data of the Velocity (4400 fpm).

Now, how slow does a Velocity descend upright in the deep stall attitude? We don't know, but we now tend to suspect that it is relatively high, 3500 to 4500 ft./min. We reason that the low damage and pilot survival is related to the fact that the water impact is nose down and the bottom fuselage is curved, this allows a few feet of deceleration at impact which can explain the lack of pilot injury.

How slow does a Long-EZ descend in a deep stall attitude? First of all, our pitching moment data show that it cannot descend at the extremely flat attitude of 70 to 90 degrees angle of attack. The pitch data indicated that if the CG is aft of limit, say F.S. 106, the aircraft may hang up at about 40 to 50 degrees angle of attack. It would then descent at about 5000 feet per minute. Why did the Kanab pilot survive? Possibly the nose-low attitude allowed a couple of feet of "crush and rotate" deceleration that provided adequate protection.

Our concern now is that there are many Long-EZs with extensive modifications that can affect deep stall recovery (long noses, bigger strakes, baggage pods, etc.). While we do not approve these modifications and can't be expected to analyze or test each one, we do feel obliged to encourage everyone to conduct adequate testing to determine the safety of their own modified airplane. Conduct stall tests at the CGs you fly, with adequate altitude for a parachute jump (egress above 8000 ft. AGL). Do not ride it down, even over water.

Another concern is that many of you do not accurately know your CG position. Calculating weight and balance is a pilot's responsibility (FAR 21) for each flight. Be sure you fly within limits (your <u>own</u> test-verified limits for modified airplanes) and check CG when any changes are made.

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF LIFT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF SINK RATE, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF DRAG COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-13 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF MOMENT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

See pages 2 and 3 in this CP for article "Truck-EZ Test.

****From CP76-14 (CH13,CH21,CH33,CH36,CH39)****
Donald Douglas lent us his beautiful plans-built Long-EZ so that we could generate the full scale, angle-of-attack data using this "Truck-EZ" rig. Many thanks, Don. **PHOTOGRAPH OMITTED**

****From CP76-5&6 (CH21,CH33,CH38,CH39)****
A VariEze crashed on departure from the Kansas City GIG on June 13, 1993. Since there were a lot of EZ builders and flyers on the field at the time, a rather extensive investigation was conducted on the spot, not only by FAA/NTSB personnel, but also by several EAA members, all of whom are very familiar with EZs. Tragically, two people died in this accident.

By all accounts, the airplane was refueled some time prior to take-off. **The fuel caps on this particular VariEze were not the plans-recommended Brock-type fuel caps. They were the "Thermos" expanding 'O' ring-type. This type of fuel cap requires regular lubrication of the 'O' rings at 25 hour intervals. If this is not done, the 'O' rings will crush and crack and, even though you may have the locking tab down and "locked", the cap in fact will not be locked!**

Shortly after take-off, the engine was heard to surge and loose power. The airplane began a 45 degree bank turn to the left. After completing 90 degree of the left turn, the nose began to drop and the aircraft impacted in a ploughed field, 30 degree nose low in a 45 degree left bank.

The investigators located all airframe parts except for the tip of one blade of the prop and the right fuel cap. The next day, parts of the fuel cap and pieces of the wood prop blade were found near the center line of the runway on the airport. This verified the theory postulated by the investigators that a fuel cap had come off and gone into the prop disc, breaking the prop. The resulting heavy vibration probably caused the pilot to pull the power back. For some reason, he elected to try to turn back to the runway. With little or no thrust, a heavy airplane in a steep bank (which causes high inducted drag) simply got too slow to fly and descended to the ground at a high sink rate.

It is too late for the couple in this VariEze but it is not too late for all of us who fly to learn from this tragedy. **If you are flying a RAF design and have not complied with the CP advisories recommending you chain your fuel caps to the filler neck - do not fly again until you have corrected this omission.** If the fuel cap on this VariEze had a chain to retain it, this accident would not have occurred. Please check your back issues of the CP for more information about chaining the fuel caps to the filler neck. See CP28, pg. 7&9; CP 31, pg. 5; and CP50, pg. 5&7.

Another lesson we should all learn from this accident is the problem of trying to make a 180 degree turn back to the runway while low and slow. A landing straight ahead into the wind (which was 15-20 knots that day) even if near the end of the runway, is much more likely to be survivable than a landing with a 15-20 knot tailwind. Think about it. Assume 100 knots airspeed. With 20 knots of headwind, your ground speed would be 80 knots. Downwind, it would be 120 knots! The kinetic energy in a downwind landing, in this case, is 2.25 times as high as it would be in a upwind landing. This could turn a survivable 15 "G" impact into an unlikely-to-survive 34 "G" impact! This assumes that you have not caused a higher sink rate due to the extra drag in the steep turn!

Please read this accident report and never forget the lessons learned. It is much, much better to land long, into the wind, and roll off the end of a runway at slow speed, even if you have to negotiate obstacles, than to land off field, downwind, at high speed.

****From CP76-6 (CH21,CH33,CH39)****
An Indiana VariEze departed after refueling. The control tower operator noticed a fire on the wing trailing edge and notified the pilot, suggesting an immediate return for landing. The pilot put the airplane into a high speed dive while returning to the airport to land - and succeeded in putting out the fire. The left aileron, wing trailing edge and engine cowling were slightly damaged by the fire. **The fire was caused by the fuel cap being left off during refueling and fuel syphoning out of the fuel tank onto the hot exhaust system.**

****From CP76-10 (CH21)****
NEW PRICE
SIGHT GAUGES
New, improved fuel sight gauges. Use with auto fuel or Avgas. Clear bubble with white background. Retrofit for Long-EZ and VariEze. $35.00 per set.
Contact: Vance Atkinson
3604 Willomet Court
Bedford, TX 76021-2431
817-354-8064

****From CP76-10 (CH21)****
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

ALL RAF DESIGNS - Secure fuel caps to fuel filler necks before next flight..

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Update Number 78 to Chapter 21, Strakes - Fuel/Baggage

Information derived from CP78 published by RAF for April & July 1994

From CP78-2&3 (CH21,CH30,CH33,CH38,CH39)

WATER IN FUEL

A recent off-field landing in a Long-EZ, fortunately with no injuries, forcibly brought to mind the ritual of checking for water at all the drains. A standard Long-EZ has a gascolator drain on the firewall which should be easily accessible through the cowling inlet. This should be drained before each flight, once the airplane is in the level position (on all three wheels). There is a water drain at the forward end of each main fuel tank and these must be drained before each flight but before the airplane is moved. That is to say, while it is parked in the normal nose down position. Do not lift the plane up to the 3-point position until after you have checked these two water drains. **If you are in the habit of normally parking your EZ in the level, 3-point position (tying the nose down), you should consider installing low point water drains in each sump blister and then check them religiously before every flight.**

Where does the water come from? Sometimes, but rarely, from the gas pump (or gas truck), very rarely, if ever in a composite EZ-type, from condensation in a less than full fuel tank. This is common in metal airplanes. That is why it is normal to top off the tanks in any Spam Can after a flight. Because the fuel tanks in any RAF design are insulated sandwich construction, they are similar to a thermos bottle and condensation does not normally form on the inside of our fuel tanks. **The most likely way for water to get into your fuel tanks is a leaking fuel cap on an airplane left out in the rain. The "O" rings on any of the commonly used fuel caps do not last forever. Far from it, in fact. Ozone, ultra violet light and many airborne pollutants attack these rubber "O" rings. Check them frequently and replace them as soon as you see small cracks in the outer edges of these "O" rings.**

Be especially diligent about checking your water drains if you have left your airplane out in the rain. Also, if you fly into an airport on one fuel tank with no problems, consider taking off and climbing to a safe altitude on that same, known to be free of water, fuel tank. Switch to the other (unknown) tank only after you have plenty of altitude to allow a safe return to the airport in the event water may be in this fuel tank. This philosophy is an old one but a good one. For the same reason, if anything untoward happens when you switch tanks, always switch back to the first tank before you try anything else.

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Update Number 79 to Chapter 21, Strakes - Fuel/Baggage

Information derived from CP79 published by RAF Oct 1994

From CP79-6&7(CH21)

LONG-EZ FUEL TANK VENTS AND CAPS

A little history is needed here. The plans show only one vent in each fuel tank. Mike and Sally built N26MS according to the plans and soon discovered that one vent in such a large, flat tank is not enough! When parked out in the sun, nose down, the air above the fuel is heated by the sun and expands, forcing the fuel up and out of the vents. This fuel then spills into the cockpits! I am sure more than a few of you have experienced this problem!

The answer was published in CP27, page 9 and consists of a second vent line that is located in the inboard, aft corner at the top of each fuel tank. There should be four 1/4" aluminum fuel tank vents protruding out of the top of your fuselage just forward of the cowling. Do not run all or some of these separate vents together. For redundancy, they must be separate. This will fix the leaking-vent-in-the-hot-sun syndrome.

At the time, Mike was ready to do his first flight so he solved the problem by drilling a small hole in the fuel caps. While this fixed the leaking vent, it ruined a pair of very expensive fuel caps and, also, made it impossible to park nose down with full fuel tanks. It also made it possible for rain to leak into the fuel tanks resulting in small quantities of water in the fuel tanks after the airplane had been parked outside in the rain.

Recently, this problem was solved by installing the second vents in each tank and by removing the drilled fuel caps and installing Newton Aero fuel caps. These are sold by Aircraft Spruce and are made in England by Robin Voice. These are truly works of art! They have been in production for more than 10 years and can be found on a wide range of Ducati motorcycles as well as such supercars as the Ferrari F40 and the Jaguar XJ220. It is also common on many European racing cars and motorcycles.

It is a solid aluminum cap in an aluminum ring that is bolted into the tank with a ring of stainless allen bolts. The cap and receptacle are anodized and buffed to a bright finish and they look really fine mounted flush with the skin. The recessed tab is pulled up and rotated 90 degrees. The cap is then lifted out. Mike added a safety chain which is mandatory and he is absolutely delighted with these completely fuel-tight fuel caps. Take a look at them next time you see Mike and Sally at a fly-in.

These caps sell for about $85.00 each and can be found in the Aircraft Spruce catalog under "fuel caps" They are the Newton Fuel Caps. They are also available with key locks installed to prevent losing fuel to thieves. (See photo). **PHOTOGRAPH OMITTED**

From CP79-13(CH21)(PHOTO CAPTION

The Newton fuel cap. Solid aluminum anodized and polished - available with or without the locking feature - absolutely seals against fuel leaks with 'O' ring seals.

From CP79-8&9(CH21,CH33,CH38)

STATIC FUEL FLOW CHARACTERISTICS

We often receive inquiries as to what the acceptable static fuel flow is on an EZ or Defiant. While draining all of the fuel prior to installing new fuel caps into his Long-EZ recently, Mike took the opportunity to carefully measure the fuel flow. Here are the results: The fuel line was removed at the carburetor and run into a container. The fuel was allowed to flow for 6 minutes, exactly, then the container was weighed and the fuel flow was calculated. This was done with the in-line boost pump off, and with the boost pump on.

With 12 gallons in one of the tanks, the free flow with the in-line boost pump turned off, was 7.1gph. With the pump turned on, this increased to 21.1gph. With only 2 gallons of fuel in a fuel tank, the free flow, boost pump off, was 5.3gph, with the boost pump on, it increased to 19.8gph.

This airplane has a Lycoming 0-360 engine and the fuel supply to this engine has been very adequate over the past 1400 hours without the boost pump running, and at altitudes from sea level to 27000 feet. If your fuel flows are at least this good, you have nothing to worry about.

This test should be carried out by anyone who is preparing to fly a new airplane. Check the flow with 10 to 12 gallons in either fuel tank, boost pump on and off. Then repeat the test with a minimum fuel, such as 2 to 3 gallons. If you do not have flows similar to the above, you probably have a blockage in the fuel lines somewhere and this should be corrected before you attempt your first flight.

Mike ballasted the airplane so it was level on all 3 gear (not parked nose down). His fuel valve is between the pilot's legs, exactly per the plans. His boost pump is in line (all the fuel must go through the Facet fuel pump) per the plans. The only addition is the presence of a flow-scan fuel flow transducer between the engine-driven, mechanical fuel pump and the carburetor. This transducer was left in place for this test.

Update Number 80
to
Chapter 21,
Strakes - Fuel/Baggage

Information derived from CP80 published by RAF Jan 1995

****From CP80-5 (CH21,CH30,CH33,CH38)****

STATIC FUEL FLOW TESTING

In CP79, we reported the results of a thorough static fuel flow test conducted on Mike and Sally's Long-EZ, N26MS. This test was conducted at two fuel levels, tanks with half fuel and tanks almost empty. This was checked with the boost pump running as well as with the boost pump turned off.

The results have been questioned by several builders who generally agreed on the flow with the electric boost pump running but who could not achieve any flow at all with the pump turned off, even with a full tank of fuel!

Well, it turns out that there may be a plausible explanation. We have published static fuel flow results over the years from the prototype Long-EZ, N79RA; from Burt's Defiant, N78RA and from Mike's, N26MS. All of these aircraft had used engines in them which also had used, and probably quite old, mechanical fuel pumps installed on them. All of these pumps were manufactured before 1988. In 1988, Lycoming began manufacturing the AC mechanical fuel pump themselves. All of these pumps have 4 ounce springs installed at both the inlet and outlet of each pump. It takes about 1 psi to open one of these spring-loaded valves. In order to accomplish this, the fuel head would have to be at least two feet above the mechanical fuel pump. Actually, even with full tanks, we only have a little more than one foot of head on a Long-EZ.

AC mechanical fuel pumps manufactured prior to 1988 had only 1 ounce springs installed at the inlet and outlet valves. One ounce springs at the valves will allow about 5 gallons per hour of static flow. We believe this solves the mystery of why some builders have easily achieved the fuel flows called out in the CP and others could not achieve any flow (pump off).

Mike is close to a major overhaul on his engine and will conduct these tests, once again, with 4 ounce springs in the mechanical fuel pump and we will report the results here in the CP. With your boost pump turned on, you should have at least 20 gallons per hour of flow, even if you have the new mechanical fuel pump.

The electric boost pump (Facet Square pump) allows fuel to flow through it even when it is not running, the problem is in the newer AC mechanical fuel pumps. It may be possible to design a fuel system that by-passes the mechanical fuel pump, but keep in mind, that a system like this requires a check valve in the system and check valves, themselves, have spring-loaded valves that require some pressure to open so you may not gain any redundancy. You can take some solace from the fact that every low wing aircraft (Cherokee, Grumman Tigers, Cheetah, Mooney, etc.) suffer from the same situation and we are not aware of any of these aircraft having engine failures due to a double failure (both fuel pumps fail at the same time). We welcome any feedback on this subject. As long as one, or both, fuel pumps are functioning, the engine will run to its maximum power capacity.

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Update Number 81
to
Chapter 21,
Strakes - Fuel/Baggage

Information derived from CP81 published by RAF July 1995

****From CP81-8&9 (CH8,CH21,CH30,CH39)****
A Southern California Long-EZ crashed shortly after departing from the Santa Monica airport. The pilot survived but was badly injured.

A careful post-crash investigation revealed that this airplane's fuel system had been extensively modified by removing the engine driven mechanical fuel pump as well as the electric boost pump. The fuel tanks had been plumbed together to form a gravity fuel system similar to a Cessna 150.

This pilot had also modified the front seat shoulder harness attach point and had installed a "Y" type shoulder harness, installed using a single bolt in the center of the seat bulkhead. There was no provision to carry the crash loads, no hardpoint and no beef-up of the bulkhead skins. The result was predictable. This single bolt pulled through the seat bulkhead and the should harness provided zero restraint. The seatbelts were installed per the plans and survived undamaged.

This is an absolute No-No! *RAF* Thoroughly explored the possibility of a gravity fuel system for the Long-EZ back in 1979 using the prototype, N79RA. Flight test results forced us to conclude that the margin of safety using a gravity fuel system was too slim and we opted to use a fuel system similar to a Grumman Tiger or Cherokee that includes two separately selectable fuel tanks, an electrically powered in-line fuel boost pump and an engine driven mechanical fuel pump. All of the above are mandatory in order to provide reliable fuel delivery to the carburetor on a typical Lycoming-powered Long-EZ,. This information was published in several *Canard Pushers* as well as in the plans and engine installation instructions. The following is taken from page 3 of the Section IIL of the Long-EZ plans:
"The most important item to consider is the mechanical fuel pump. The Long-Ez's fuel system is designed to <u>require</u> the use of an engine driven mechanical fuel pump, backed up by an in-line electric pump. This is a mandatory requirement and there is no acceptable way around it."

This important safety requirement was not just dreamed up, it was derived from a carefully conducted flight test program - do not try to second-guess the designer's motives behind critical systems such as the fuel system. The plans built fuel system on the Long-EZ is an excellent, trouble free system that is known to work on hundreds and hundreds of airplanes.

If you know of someone who may be contemplating a change to his or her airplane like this, get involved, help him or her out, don't let another unnecessary accident happen.

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Chapter 21, Strakes - Fuel/Baggage

Long-EZ Plans Changes

From CP24-6 (CH7,CH21)
LCP #4, DES, Chap 7 & 21
See Safe-T-Poxy recommendation below for fuel areas.
GIVEN BELOW
New construction only. The interior fuel tank layup and fuselage side layup should be done using only Safe-T-Poxy. Laboratory tests have shown Safe-T-Poxy to be more resistant to fuel than either Lambert or RAE epoxy systems. Our survey of possible fuel contamination (see CP #22 pg 7) did not reveal anything of major concern, although several of the 64 responding, reported a gummy substance on the float valve seat. Be sure to follow the CP #22 pg 8 Owners Manual carburetor inspection requirement.

From CP28-9 (CH21)
LPC #59, MEO. Page 21-6, section F-F.
The outside strips of UND glass, the third ply in layup #7 and #9 (shown on Page 21-4) has been omitted. This should be shown on Section F-F (on the outside of the tanks, directly above layup #4 directly below #3).

From CP28-9 (CH21)
LPC #60, MEO. Page 21-3 Fifth paragraph.
1/4 - 27 NTP should be 1/8 - 27 NTP

From CP30-9 (CH21)
LPC #84 Section I, page 21-5, step 10.
We omitted to tell you to micro a urethane foam block (2 lbs.ft3 green) to the 'flat' leading edges of the strakes, see page 21-7, cure, then carve to match proper leading edge contour (ribs R23, R45 and the wing). Slurry the foam and lay up two plies of UND crossing each other at 45 degrees to the leading edge of the strakes. Lap this layup 1/2" onto the strakes top and bottom.

From CP32-7 (CH21)
LPC #96 MEO, Section I, page 21-5, drawing at lower left.
Material for fuel valve mounting bracket should be 0.062 2024-T3 aluminum. The fuel valve handle should be trimmed down to clear the instrument panel.

From CP33-4 (CH21)
LPC #102 MEO, Section I, page 21-4, step 6.
Strike the 5th, 6th and 7th sentences. Substitute the following: "Glass the inside with one ply of BID. Flox in place holding with nails. (Section F-F)".
Page 21-4, step 7. After "halfway down O.D.", insert "lapping 1" onto the forward face of the centersection spar".

From CP54-9 (CH21,CH33,CH38)
LPC #133 DES Check the static flow, as well as the flow with the boost pump running per the method shown in this CP.

From CP55-8 (CH21,CH33)
DES Static ground for potential fire problems. See this CP for details.

From CP65-7 (CH21,CH30,CH38)
PLANS CHANGES/INSPECTIONS
LONG-EZ MAN/GND
Polyurethane fuel and vent lines. Mandatory Inspection before next flight - See article on this page.
Throttle/mixture springs. Mandatory inspection next 10 hours - See article on page 13.

From CP65-7&8 (CH21,CH30,CH38)
VARIEZE POLYURETHANE FUEL LINES
A VariEze builder/flyer recently reported to RAF that while conducting an inspection of his VariEze, he found all of the polyurethane fuel lines in his VariEze were cracked and when he squeezed these lines in his fingers, they crumbled to pieces. This VariEze is 10 years old and has been flown fairly regularly.

He has removed and replaced every piece of the urethane fuel line. This is a serious matter and for that reason RAF is making it a mandatory requirement to carefully examine every inch of urethane fuel line in all VariEze's. Use a strong light to check for cracks or crazing and squeeze the line at the same time. If the normal resilience is not felt, if the fuel line feels stiff or has any sign of checking, cracking or crazing, it should be removed and discarded. Any fuel lines forward of the firewall could either be soft aluminum tubing, using AN fittings, or as an option, could be new fuel compatible clear polyurethane tubing, or transparent yellow Tygon tubing. McMaster-Carr Supply Co. sells both of these products.

Any fuel or vent lines aft of the firewall should be stainless steel tubing or firesleeved aircraft-grade fuel line, such as Stratoflex stainless braiding over teflon tubing with stainless end fittings. Under no circumstances should there be any urethane or rubber hose in the engine compartment and all fuel hoses in his area should be protected by installing fire sleeve.

Prefabricated Parts

From CP26-1 (CH21)

The Prototype Long-EZ prefabricated Fuel/Baggage Strakes

These will be installed on Mike's Long-EZ, to check the fit and develop installation drawings. These items should be available this winter. Bear in mind that these are large pieces and therefore are likely to be quite expensive. We will report on difficulty of installation and on building time saved in a report in the next newsletter.

From CP28-10 (CH21)

Pre-Fab Fuel/Baggage Strakes for Long-EZ

Fuel/baggage strakes will be available by June. These will consist of 4 large pieces (2 tops and 2 bottoms) vacuum bagged into excellent molds. The pieces join at a leading edge joggle joint, eliminating the TLE/BLE pieces, and they extend to match the wing. Installation drawings for these tanks will be provided.

These components will be sold direct by the manufacturer.

Contact: Task Research
848 East Santa Maria Street
Santa Paula Airport
Santa Paula, CA 93060
(805)525-4445

Contact them for price and availability.

From CP31-7 (CH21)

Task Research - Fuel/baggage strakes are in stock for immediate shipment. Special on the next 25 orders only. Ribs and baffles will be included with strakes for $884.

From CP32-6 (CH21)

When installing the Task Research fuel/baggage strakes, be certain to remove all peel ply, from inside and out. There should be two plies of peel ply, about 5" wide oriented diagonally, (see Section I, page 21.-4) which will leave a slight depression once they are removed. This depression will be filled with the one ply UND strip that laps from the top of the centersection spar, diagonally forward and around the leading edge of the fuel strake. This holds true top and bottom. Do not forget to remove the two plies of peel ply. Important this one ply of UND strip must lap from the strake onto the centersection spar smoothly, without a joggle. Sand any joggle into a smooth taper before the UND strip layup. See sketch. Next page. **SKETCH OMITTED**

From CP34-9 (CH21)

Task Research fuel strakes with ribs and baffles - on sale November 10, 1982 for $884.00. 50 sets only. No orders will be taken before November 10. Mail orders only with a 50 percent deposit. NO phone orders will be taken. NO exceptions. Write:

Task Research
848 East Santa Maria
Santa Paula, CA 93060

From CP40-4 (CH2,CH13,CH21)

CAUTION - Unauthorized Prefab Parts For The Long-EZ

It has recently come to our attention that there are some prefabricated nose cones for Long-EZs, as well as other parts, **such as fuel/baggage strakes**, that are being misrepresented as being approved by RAF. The only RAF approved prefab Long-EZ parts, are manufactured by Task Research of Santa Paula, California. These parts are sold through Wicks, Aircraft Spruce and Task Research.

The prefab nose cone in particular is manufactured from non approved glass and polyester resin. It is not a sandwich construction, is heavy and would be difficult to incorporate safely into a Long-EZ. The nose section of a Long has to be able to support the loads taken by the nose gear. In order to do this safely, we believe the plans should be followed as closely as possible. The Long-EZ nose is not simply a fairing, it is a structural sandwich, composite design that should not be compromised.

From CP40-7&8 (CH21)

Long-EZ - Fuel/baggage strakes. If you are installing the Task Research prefabricated strakes, it is a good idea to delay cutting out the baggage holes in the fuselage sides, until you have the strakes in hand and fitted. Mark around them, measure inside this mark the thickness of the sandwich strake and cut along this new line. Do not attempt to install the fuel/baggage strakes unless the appropriate wing is bolted in place. It is nearly impossible to position the strake so it fairs nicely with the wing if you don't. You can do this one wing at a time if you are pressed for space.

Fitting the ribs/bulkheads to the inside of the top of the strake on prefab as well as homebuilt strakes. Install the ribs and bulkheads per the plans. Trial fit the top and sand the ribs and bulkhead down until the top of the strake fits well to the fuselage, centersection, wing root and leading edge of the bottom strake. There is no need to strive for a perfect fit on top of the ribs and bulkheads (this is difficult to do). Now stick a strip of grey tape inside the top of the strake to correspond with every rib and bulkhead in the tank/baggage area. Pile flox on top of each rib and bulkhead generously, then set the top in place, cleco or clamp or grey tape it in its proper position and allow the flox to cure. Pop the top off, remove the grey tape release and sand the appropriate areas for bonding. Trim the flow overspill on each side of each rib and bulkhead, sand the top of the flox (which is now a perfect match to your strake top). Smear a thin, wet flox coat on the top of each bulkhead and rib, don't forget the leading edge and along the fuselage, then put the top on for the final time. Clamp, cleco and or grey tape it in position for a full cure.

This method gives you a perfect fit between the ribs/bulkheads and fuel tank top. This gives better support for when people sit on your strake while climbing in and out of the airplane and of course it is much stronger.

Do yourself a favour and paint a generous, wet, full coat of Safe-T-Poxy everywhere inside the fuel tank, paying particular attention to the fuselage sides and the forward face of the centersection spar before you close the tank. This will eliminate the frustration of fuel tank leaks.

From CP42-9 (CH21)

Task Research strake sale!!

First come, first served. 50 sets at $884.00.

Contact: Task Research,
805-525-4545

From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)

PRE-FABRICATED COMPOSITE PARTS

Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS

Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.

1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. **Long-EZ leading edge fuel strakes and bulkheads at $499.00.**
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415
(707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

****From CP50-3 (CH2,CH3,CH21)****
BOONVILLE, CA. UPDATE
Larry and Michael (Featherlite Products, Inc.) have been busy since Oshkosh where they shared the RAF booth and had on display a number of their products. They really enjoyed talking to so many of their customers and to be able to get out of their shop and talk airplanes for a whole week.

The Long-EZ leading edge fuel strake kit is now out and quite a few have already been installed. The leading edge "D" section is slightly oversize to enable you, the builder, to custom trim to perfectly fit the fuselage and wing. To identify the proper position, B.L. 23 rib must be located at the jink or bend, then you can trim to fit the fuselage, then the wing. Don't forget to remove the peel ply from the top and bottom lips before installing the flat panels.

After much scrutiny, Defiant cowlings are now on line. Cheeks have been enlarged to accommodate the O-320, as well at the O-360 Lycomings. The rear cowls will fit most prop/spinner combinations with little or no trimming required. The front cowlings may require some homebuilder "blending" for the various combinations of props, spinners and prop extensions.

Defiant wheel pants are under development and will soon be available. These are based on Fred Keller's beautiful Defiant's wheel pants.

Several builders have asked about removing mold release. After waxing, PVA (poly vinyl alcohol), a thin, green film, is applied to the molds. This film is water soluble, so use a wet sponge and lots of water to wash it off your parts. Allow parts to dry thoroughly before scuff sanding for finish.

For more information, contact Larry or Michael at:
Featherlite Products, Inc.
P.O. Box 781
13451 Airport Rd.
Boonville, CA 95415
(707)895-2718

From CP50-9 (CH21)(Photo Caption)
Larry Lombard, FEATHERLITE PRODUCTS, INC., with their Long-EZ fuel strake kit. All ribs and baffles come with a prefab leading edge.

From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)
FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom)	448.00
weight saved, approx. 6 lbs.	
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert.500 x 5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	**499.00**
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.
Contact: Michael or Larry at: FeatherLite, Inc., P.O. Box 781, Boonville, CA 95415, (707) 895-2718

From CP54-7&8 (CH21)
FeatherLite Fuel/Baggage Strakes
Doug Shane has just completed the installation of a set of these strakes from Larry and Michael in Boonville, CA. Doug was skeptical of his ability to do a nice job on the strakes and was almost reluctant to start on the project. Ultimately though, there was nothing else left to do, so he went for it!

It was easy! He was amazed, the pre-formed leading edge sections were easy to fit to the fuselage and wing root. Hot Stuff was used to temporarily located them in position while the prefab ribs were trimmed to fit. Most of the trimming and fitting was done at the centersection spar forward face, then Hot Stuff was again used to jig all the ribs, baffles, and baggage compartment walls into place.

Doug cut each of the top and bottom skins out of a single piece of 3/8" H-45 Divinycel PVC foam and glassed the inside face. Then the whole assembly was broken down and permanently glued together with flox, after sanding judiciously in all the appropriate spots. This framework was allowed to cure. The bottom was then floxed into place using straight pieces of 2x4 lumber at the leading and trailing edges with 1x2 lumber "legs" to the floor of his garage to hold the bottom skin firmly into place and this was allowed to cure. All plumbing, vents, drains, etc., were installed per plans and the top was floxed on after a heavy coat of epoxy was painted everywhere in each tank. (Don't neglect to do this or your tank will leak.) The top was held in place with weights until cured. A little careful sanding and each strake was ready to be glassed on the outside. A rather simple way to do a difficult job, and they really do look nice. The leading edges are a very nice shape and will probably hold a little more fuel than a Task strake or a homebuilt strake. Doug would happily recommend the FeatherLite strake kit and hes says if he can do it, anyone can!

Doug's Long-EZ is now into the messy finishing and wiring stage. Engine has been installed and he and Mike Melvill have built a custom cowling, in place, on the airplane. See photos of Doug's strakes in this CP.

From CP54-12 (CH21)(Photo Caption)
FeatherLite leading edge fuel/baggage strake, ribs and baffles installed in Doug Shane's Long-EZ.

From CP54-12 (CH21)(Photo Caption)
Prefab rib kit is cut essentially to size, requiring only a little trimming to fit.

From CP54-12 (CH21)(Photo Caption)
Baggage compartment walls, baffles and ribs come prefabbed.

From CP54-12 (CH21)(Photo Caption)
Leading edge fuel/baggage strakes come glassed on the inside.

Miscellaneous

From CP25-5 (CH21)
Long-EZ Fuel Tanks
CAUTION!! Be sure to align bulkhead's RB45 and RB23 parallel to the B.L. (fuselage CL), or your tank will not fit the wing.

From CP30-7 (CH21)
Homebuilt Fuel/Baggage Strakes
Ref: Section I page 21-7.
Builders have reported that they built the fuel strakes without installing the wings, and when they came to installing the foam block between the wing root and the diagonal rib (O.D.) the top of the strake was too high to fair in nicely with the wing. When you are ready to install the top cover on the fuel strakes, install the wing, and check with a straight edge that you will have a nice fit to the wing. If necessary, trim the O.D. rib down before installing the tank top.

From CP31-4 (CH21)
Caution - When floxing the top of your VariEze fuel strakes into place, be careful that excess squeeze out of flox does not drip down onto the screen, drip through and fall onto the open end of fuel pick up tube.

From CP31-9 (CH21)(Photo Caption)
Our thanks to Gerry Grueber for sending in these nice photos showing the fuel/baggage strake construction.

From CP31-9 (CH21)(Photo Caption)
Jig "tables" in place ready to build bottoms of fuel/baggage strakes on a Long-EZ.

From CP31-9 (CH21)(Photo Caption)
Fuel/baggage strakes with bottoms layed up and ribs micro'ed into place. Be sure to do almost "wet" layups inside your tanks to eliminate the chance of leaks later on.

From CP31-9 (CH21)(Photo Caption)
Ribs, layed up, will be knife trimmed later. The notched out openings should be painted with pure epoxy. No need to do a glass layup on the edges of any of these holes.

From CP31-9 (CH21)(Photo Caption)
View of the inside of the top of the fuel/baggage strake. Note that this foam part is supported by a lumber frame bondo'd to the outside.

From CP31-9 (CH21)(Photo Caption)
Fuel/baggage strakes floxed into place for cure.

From CP34-4 (CH21,CH33)
AUTO FUEL IN COMPOSITE FUEL TANKS
RAF has recently received many requests to use auto fuel in VariEzes and Long-EZs. RAF cannot approve or disapprove the use of auto fuel. We can advise though, and we do not recommend using any auto fuel in a composite fuel tank. This is because of possible toluene content and its effect on the epoxy matrix. There is no way to be positive that the auto fuel you buy does not contain toluene (or possibly other potentially damaging aromatics). This is especially true of the unleaded or low lead auto fuels, which can leach the uncured epoxy residues out of the inside laminates of your fuel tanks, including the aft wall of the tank,

which is your center section spar. The damage may be very insidious and may take years to become obvious. Safe-T-Poxy is much more resistant to aromatics than the previous RAE epoxy, but may still be effected in the long term.

****From CP34-8 (CH21)****
A good method to form the foam for the top and bottom fuel/baggage strakes is as follows: support the foam appropriately; place two layers of dry bath towels at the area to be curved, soak the towels with 4 to 6 quarts of boiling water. The foam will easily form to the desired shape. Allow to cool, remove the towels and be certain not to glass over the foam until it is completely dry. **SKETCH OMITTED**

****From CP37-3 (CH9,CH21,CH22,CH30)****
ong-EZ builder, T. Dinneen has the following suggestion for obtaining an engine for your ong-EZ. He paid $7,500 for a 1978 Tomahawk in good flying condition. Not only did he get an airplane to fly and stay current in, but he also got:

1) A Lycoming 0-235 L2C engine complete, including a mechanical fuel pump with 920 hours total time
2) A full gyro panel and instruments
3) 500 x 5 wheels, tires, brakes, axles and master cylinders
4) 720 channel com, Nav and VOR head
5) Transponder
6) Nav lights/strobe anticollision light system
7) ELT and seat belts
8) Circuit breakers, engine instruments and battery
9) **Fuel plumbing, fuel valve,** electric fuel pump etc.

In addition, he figures he can sell the airframe for about $1,000.00 after he has 'gutted' it. This means he has laid out $6,500.00 for the lot. On top of that you can bank finance the whole deal. Check Trade-a-Plane for "deals" on Tomahawks!

****From CP39-7 (CH14,CH21)****
Long-EZ - Richard Marr suggests this method to roll your ong-EZ over after you have your fuel strakes and centersection installed. Bolt a 1" x 10" pine board to your 3 wing attach points on one side. Make the board long enough to protrude about 15" beyond the outboard tip of the centersection spar as shown. Now if you set the nose on a piece of carpet or similar pad, it is possible (though not without some strain) for one person to roll it over. The pine board keeps the centersection strake off the ground. Two people can do the job very easily. **SKETCH OMITTED**

****From CP65-5,6&7 (CH21,CH22,CH33)****
LANDING LIGHTS AND COCKPIT NIGHT LIGHTING.

Why does the Long-EZ have its landing light where it is? Initially, the prototype Long-EZ had no landing light. It also had no navigation or strobe lights. When Dick Rutan wanted to try for the Closed Course Distance Record in the C1B class, it was obvious that night lighting would be required. Dick and Mike hurriedly designed, built and installed a "fold out" type landing light under the right thigh support which was somewhat similar to the present plans call-out for a Long-EZ.

The light worked quite well, but due to its design, it was difficult to extend and it took up storage space under the thigh support. This led directly to the present landing light design. While there are probably a lot of EZ drivers who have landed their EZ's at night, there are probably a lot more who have not.

There are several requirements for an effective landing light on an EZ. One of the most important is that it have the capability to be correctly pointed for landing and then re-positioned for taxiing. An EZ approaches to land, nose high. The Cessnas and Pipers that many of us learned to fly in, do not. Due to their flaps, they normally approach nose down. This means that a landing light on an EZ must point down to a much greater degree than the light in a Cessna. Once this angle is determined (by trial and error), it will be immediately obvious that this light is now essentially unusable for taxiing since it points at the ground directly in front of the nose of the aircraft and the pilot can only see forward for about 6 to 8 feet. If this light is adjusted to make taxiing possible, it becomes useless for a landing light. That is why it is adjustable and must be adjustable at least to these two positions.

This pretty well eliminated using the nose mounted landing light that Burt had called out for the VariViggen back in the early '70's. Some VariEze builders did use this type of light but not many used it to actually land at night. Those who use it regularly found they needed to have a two position adjustment, usually a cable driven, difficult-to-design and-build device.

A number of EZ's have the landing/taxi light mounted in the leading edge of the outboard fuel strakes. We rejected this idea very early on because we were concerned about these lights reflecting on the canard, lighting up the canard and blinding, or at least hurting, the pilots night vision. This editor would welcome constructive comments based on actual experience using this type of landing/taxi lights. One definite advantage would be to make it easier to flash a landing light while flying at cruise speed.

Using the Long-EZ plans landing light requires some practice and a couple of little tricks only learned by experience. If you have never used your landing light at night, you are in for a surprise! The first time you turn it on and extend it, it will probably light up the interior of the front cockpit! It will tend to blind you by glaring off the nose gear strut into the little plexiglas window between your legs. Here are a few ideas to help you with these problems.

First of all, you should paint the inside of the nose wheel well flat black. Also, the inside of the trough where the nose gear strut fits while the gear is retracted should be painted flat black. The aft face and both sides of the nose gear strut itself, including any nose gear doors or covers should be flat black. Make a small cover (a piece of engine baffle rubber works quite well) that can quickly and easily be installed over the plexiglas window through the lower instrument panel. Velcro works really well here. Do not permanently cover this window. For daytime and night flying, this window can save your butt by allowing the pilot to verify that the gear is indeed down. Extend the nose gear, extend the landing light, verify that the gear is down, then install the window cover to completely block any light. With the landing light on, you should get no reflected light through the plexiglas window or through the fiberglass wheel well. If you do, take whatever steps it requires to correct this.

The above evaluation should be conducted on the ground, at night. Before you go flying at night, you should address all of the above suggestions and satisfy yourself that you are comfortable with the landing light's effectiveness. Focus the light to an optimum taxi position and practice taxiing at night. Keep in mind that you will have to depress the light considerably from the optimum taxi position to the optimum approach-to-land position.

This editor has logged over 300 hours of night flight, many of those hours in a Long-EZ. The way I use the landing light is as follows: I slow to about 100kts on base and extend the landing light to what I feel is about the correct position. Once established on final, I fine-tune the landing light until I can plainly see the runway numbers illuminated by the landing light. (Mine is a 250 watt light and, as such, easily lights up the approach end of the runway). I continue to slow to reach touchdown speed just above the runway. I use a small amount of power right to touch down and I drive it on, rather than, flare for a "greaser" type landing. This avoids the problem of dropping it in and it also helps keep the landing light focused on the runway and not up in the sky (as it might be with a very nose high, fully flared touchdown). Once the nose wheel is rolling on the ground, I readjust the landing light to clearly illuminate the runway/taxiway in the 3 point position. So much for the landing light - if you have only a 100 watt light and you do actually fly at night, you should replace the 100 watt with a 250 watt. 14v 250w #4313, 28v 250w #4587.

Now to address the instrument panel lighting. An airplane with a canopy rather than a windshield presents a rather more difficult cockpit lighting problem due to the "fish bowl" affect. This is the result of all the panel light being reflected in the bowl shaped canopy and making it difficult to see outside. In this editor's opinion, the very best form of instrument lighting (to help cut down the fish bowl affect) is internal lighting in each instrument. Unfortunately, this is not available on most aircraft instruments but you should use it where possible such as VOR heads, engine instruments, etc.

The next best lights, I feel, are post lights. The least desirable form of lighting would be a flood light. A good dimmer switch is important, particularly when you are taking off or landing and need to maximize your ability to see outside. Dim the instrument panel lights down as much as possible while still being able to read the critical instruments. With post lights, there should be two to each critical flight instrument - airspeed, attitude, altimeter and rate of climb. These post lights can be turned to focus their small red glow to best illuminate each instrument.

Now, sit in your airplane at night with the canopy closed. You may be surprised to see just how much reflection you have in the canopy. You should obtain a piece of cardboard or fairly stiff paper, painted flat black, and cut it to closely fit into the forward end of the plexiglas canopy at the bottom edge of the plexiglas (where the plexiglas is retained in the canopy frame by fiberglass). You should ideally be able to secure this stiff paper in place with velcro or something similar. While seated in the normal position in the seat with the canopy closed, your eye should see only the aft edge of this cardboard or paper. It must not restrict your view of the instrument panel or your view outside through the canopy. You should now have zero glare or "fish bowl" affect on the canopy. Cut the aft edge of the flat black cardboard away as much as you can to give you more physical room but not so much that you get the glare on the canopy. This must be done at night with the cockpit lights on. You should experiment, by trial and error, until you get it right.

All this may seem like a lot of trouble to go to but, believe me, if you plan on flying your creation at night, you will be very glad you took the time. Just be sure that this paper glareshield does not restrict your visibility of the instruments or of the outside. It should be soft enough to collapse out of the way in the unfortunate event of an abrupt stop or accident.

One other point. Flying at night can be a beautiful experience. It can also become a terrifying and dangerous experience if anything at all goes wrong. Flying a single engine at night is considered by many to be an unacceptable risk. Away from an airport, an engine or prop failure at night will almost certainly result in an accident and the chances of surviving an off-field landing at night are so small as to be essentially non-existent. This is a decision you, the pilot, must make. The information in this article is to assist you should you decide to fly at night. It is absolutely not intended to encourage you to do so.

****From CP28-10 (CH21)****
Q. Can I move my B.L. 45 rib outboard in my Long-EZ fuel tank in order to carry more fuel?
A. Absolutely not. This will give you an aft c.g. condition, even with a small quantity of fuel on board. Long-EZ's should have enough fuel/range to satisfy anyone.

****From CP29-3 (CH21,CH30)****
LONG-EZ FUEL SYSTEM
Do not change the fuel system. This system was carefully and thoroughly flight tested at all attitudes, and works very well as per plans. Several builders have asked if they could convert the fuel system to a "both on" situation. Absolutely not! Both fuel tanks feeding the carb together will only work on a gravity system. The Long-EZ does not have enough fuel "head" to use a gravity system. Therefore we use a pumped system. That is, the primary pump is a mechanical, engine driven pump, backed up by an electrical boost pump. This is similar to most low wing airplanes, Grumman Tigers, Cherokees etc.

If you try to pump fuel out of two tanks at the same time, it can draw from one tank only, until it is dry then you will get air, and in spite of having one tank almost full of gas, you will flame out and have to land because of fuel starvation.

Be very careful of fuel systems, they must be absolutely fool proof in order to work reliably and consistently.

****From CP39-5 (CH21,CH33,CH39)****
A modified Long-EZ crashed on the Southern California coast. (This accident was mentioned briefly in CP37). We have actively been trying to determine a possible cause on this one but so far have been frustrated. Although there were a few eye-witnesses, their information is sketchy and contradictory. Several witnesses reported seeing the aircraft flying low along the beach and pulling up into steeply banked turns. No one we have talked to saw the actual impact. We have carefully examined the wreckage and it appears that the airplane struck the beach with very little forward speed in a flat attitude. There was no evidence of rotation. **This aircraft has a non standard fuel system.** A header tank containing 5 gallons was built into the space over the centersection spar, aft of the passenger's head. This tank was kept full with a fuel pump at all times, and the engine was gravity fed from this header tank.

The aft cg, and the vertical cg of this fuel possibly contributed to an unacceptably aft cg condition for the airplane, particularly at higher deck angles, when the vertical cg would cause a worse aft cg condition. We know this aircraft made its first flight with 30 lbs of ballast in the nose. There was no evidence of any ballast in the wreckage.

NOTE: We would like to reiterate what we said in CP 37. Due to individual builder tolerance build-ups, and contour variances, you cannot assume that your airplane will behave exactly like the original prototype, N79RA. Because of possible variances, we are now making the aft cg limit of F.S. 103 (recommended in CP 37), a mandatory permanent change.

****From CP50-4&5 (CH21,CH30,CH33,CH38,CH39,CH41)****
A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally fuel associated. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or **a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating from the plans is probably the most common reason.** Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. Tony Bengelis' book Firewall Forward is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

****From CP53-2&3 (CH21,CH33)****

STOLEN LONG-EZ

During the last week of June 1987, N83RT, a really beautiful Long-EZ IFR equipped with King avionics, was stolen from its tiedown on the ramp at Montgomery Field in San Diego, California.

The owner knew there was only 200 miles of fuel in the tanks, so he flew to every airport in a 200 mile radius and left a reward poster with two color photos of the plane and instrument panel giving all details such as equipment, serial numbers and identifying features. In addition, these posters were mailed to every tower-controlled airport and all flight service stations in California.

By great luck, and due entirely to the keen memory of a fellow San Diego VariEze driver, the above aircraft has been returned to its owner. The thief had previously tried to steal a different Long-EZ from a hangar on the field. He failed for some reason, but did take the owner's manual which was later recovered from his home. When he flew away in 83RT, the tower operator, who knew the owner/pilot, exchanged pleasantries with the thief but did not realize it was not the owner. He flew only 30 miles to Ramona where is was hangared for two weeks while it was dismantled. Then it was removed to the thief's home where he seriously damaged the airplane, cutting out the wiring, instrument panel and sanding all identifying colors and numbers off the airframe.

By pure good luck, a VariEze owner/flyer landed at Ramona right behind the thief. He did not recognize the stolen Long-EZ as a local airplane and maybe that is why when, several weeks later, he returned to the airport and saw the reward notice, he called the owner. The San Diego police followed up and got the name and address of the thief and literally caught him about to repaint the aircraft.

What can we all learn from this incident? First of all, notify the local police and work closely with them. Give them all possible information (do you have all serial numbers, engine, avionics, etc. recorded?). Second, fly to all landing strips within a reasonable radius and talk to as many pilots as possible. Near the Mexican border, you might notify the Drug Enforcement Agency (DEA), also the FBI since stealing an airplane is a federal offense.

Most importantly, we should all give serious thought to coming up with some method to prevent the plane from being flown. A plastic coated, heat treated chain wrapped around the prop and secured with a quality lock is good. **Perhaps a fuel shut-off valve located, where only you know, in addition to the normal fuel valve. This could be shut off after you park it.** Be very careful that this, or anything else you do to disable your aircraft, does not bite you in some way!! If you park it outside on an airport ramp for any length of time, notify the focal FBO, tower, mechanics, etc. that it will be there and ask them to keep an eye on it.

The owners of N83RT were extremely lucky. Imagine if you will, that this thief had managed to get the new panel installed and get the airplane repainted. He could have showed up at Montgomery Field with his "new" Long-EZ on a trailer, announced the rollout of his "new" Long-EZ, even had a little celebration to celebrate its "first flight" - may even been able to join the local San Diego EZ group, and probably no one would have been the wiser! Keep your EZ locked up if at all possible. The heartbreak of having it stolen must be experienced to be appreciated.

Fuel Guage

****From CP24-5 (CH7,CH21)****

FUEL GAUGE VISIBILITY

Micro or traces of air entrapped in the fiberglass layup at the visual fuel gauge area will result in poor gauge readability. This is a very common problem, existing in a least half the airplanes we have seen lately. The gauge will read with excellent contrast only if the layups are perfectly clear. If you have not yet installed the fuel tank top, inspect your gauge area carefully. Without touching the surface you should be able to see your fingers clearly enough to count them when looking through the gauge. If it is not perfectly clear and translucent, cut out the gauge area, about 0.7" wide. Sand adjacent skin inside fuselage and out. Then layup two plies BID at 45 degrees onto two pieces of "Saran Wrap" (or glad-wrap) thin plastic kitchen plastic. Apply to inside and outside using your fingers on inside and outside to expel all air. The plastic wrap keeps the layup from drawing in air. After cure, remove the plastic. The result will be a gauge clear enough to see your hand through and will give a good contrast with fuel.

****From CP35-10 (CH21,CH30)****

Wes Gardner is still selling his excellent, reusable foam air filters. Wes has some other neat "EZ" items. **A retrofitable fuel sight gauge, for those with poor translucency in their gages** and an oil separator system that takes the place of the starter cover on an O-200 Continental and this is guaranteed to remove all traces of breather oil mess on your cowling. Wes is still working on a similar one for the Lycoming engines. Mike will be installing it shortly on his Long, N26MS. Contact Wes for more information:

Wesley Gardner
1310 Garden St.
Redland, CA 92373
714-792-1565

****From CP36-4 (CH18,CH21,CH22,CH30,CH37)****

N26MS - Mike and Sally's Long

With 521 hours on the Hobbs, 26MS is running like a dream and continues to prove what a reliable high speed transportation machine a Long-EZ is. I recently got tired of my combination 12V/24V system which never did work correctly. I cut the front cover over the instrument panel off and rewired the airplane to be a 100 percent 24 volt electrical system. It was intimidating thinking about how I was going to do this, but once started it was actually quite simple to do. **I have also installed Wes Gardner's fuel sight gauges (see CP 35 page 10) and must say I am pleased with the result.** Also installed Wes's oil separator breather and it has worked great! No more cleaning cowling after landing.

A few weeks ago a photographer from "Technology Illustrated" took a bunch of slides of my Long-EZ for the cover of the May edition. He wanted to light up the inside of the cockpit. He handed me a remote controlled flash unit with quite a heavy power pack. Like a dummy, I laid it on my lap, not tied down. In the middle of the photo session, I hit a strong bump, the flash unit sailed off my lap and crashed into the canopy cracking it badly just in front of my head. It cracked almost clear across with a hole a couple of inches square. It scared me but once I slowed down and pulled the cracked pieces back into place, I found it to be no immediate problem and was able to complete the mission.

Sally temporarily repaired it by laying up a huge fiberglass patch both inside and out. At least we could fly until the new canopy came in. Actually went to the IVHC Agua Caliente flyin this way! I talked to Dan Patch and Phil Cornelius, both of whom had been through repairing a broken canopy.

First we cut the plexiglass canopy about 1 inch above the rail all the way around (son Keith did the work, I supervised!). This removed the broken canopy. We turned the frame over and cut through the fiberglass just inside the edge of the plexiglass lip. This allowed us to peel out the fiberglass piece that fitted the original plexiglass bubble exactly. This thin glass "frame" was carefully layed into the new "bubble" and was used to layout where it should be trimmed in order to fit. While I cut the new bubble, Keith broke out the remaining plexiglass with a vice grip, a hammer and wood chisel and a dremel grinder. The plexiglass does not come out easily. After the frame was cleaned up, the new bubble fitted almost perfectly. We floxed it into the frame and let it cure over night. Next morning, I trimmed and sanded. I microed in all the voids and the layed up two plies of BID over the plexiglass up onto the inside of the frame. I let this gel up for a few hours, then reinstalled the whole canopy/frame onto the airplane. I locked it down and let it cure for two days. This assured that it would fit the fuselage. Later I removed it, cleaned it up and sprayed the charcoal Zolatone inside the canopy frame. I did not have to repair the outside frame. The new canopy gives me a little more head room (not all canopies are alike!) and the visibility without the fiberglass patch is superb!!

****From CP36-7 (CH21)****

Retrofittable fuel sight gauges, PVC and 3/16" thick glass. Not only gives you a crystal clear view of your fuel, but also damps out the sloshing, making it easy and accurate to read fuel levels.
Engine breather oil separator for both Continental and Lycoming.
Contact: Wes Gardner
1310 Garden Street,
Redlands, CA 92373
(714)792-1565

****From CP39-2 (CH21)****

NEW EZ FUEL GAUGE

Paul Prout has been working for almost a year on a fuel gauge for VariEze/Long-EZ. He brought a demonstration model up to show us last week. It is retrofittable, and consists of a white plastic background, with a clear plastic sight gauge bonded to the background. The clear part is triangular in shape. A small hole at the top and bottom allows fuel to flow into the sight gauge. Almost all of the sloshing associated with turbulence is thus eliminated. The fuel is clearly visible through the clear plastic, (crystal clear in fact!). Then Paul added the icing to the cake. He installed a small red light bulb at the bottom of the guage, which illuminates the white background and clearly illuminates the fuel, particularly the surface or maniscus of the fuel. This will allow good night visibility of fuel level. On top of all this, Paul has installed a photo electric cell (or some such gadget!), at the level that approximates 30 minutes of fuel at 75 percent power. When the fuel level drops below this level, a red light is illuminated on the instrument panel. The electronics is self testing and the whole works weighs almost nothing. The secret to the success of this remarkable fuel management system is the type of plastic used and the method of bonding the parts together. Paul demonstrated his sight gauge by striking it a terrible blow with a hammer! The result, absolutely no damage. The type of plastic and the bonding method Paul is keeping proprietary to himself.

Paul sells a kit consisting of two gauges, electronics, two red lights and an excellent set of instructions on how to install them. RAF is pleased to recommend Paul's fuel gauges. They have all the desirable features: very light weight, simple, fuel is clearly visible day or night (what you see is what you got, absolutely the best system) and they warn you when you get to 30 minutes of fuel each side, a total of 1 hour.

Contact: Paul Prout,
4039 Olive Point Place,
Claremont, CA 91711
(714)621-0060

****From CP40-9 (CH21)****

PAUL PROUT'S NEW EZ FUEL GAUGE

Mike and Sally recently installed a pair of these gauges in their Long-EZ, N26MS. The installation was straight forward and the instructions supplied were easy to follow. The installation took two days mainly due to cure times on the epoxy. They look neat and best of all, work great. The fuel is clearly visible. Thanks to a soft red light in the base of the gauge, the fuel is visible at night. Mike says that the most desirable thing about these fuel gauges is the fact that when you get down to approximately 30 minutes of fuel on either side, you get a low level warning light on the panel. No more inadvertently running out of fuel on one side. Now the light comes on and you have the choice of switching tanks or going to an airport. Best of all, you can still clearly see how much fuel you have, even with the low level light on. This feature makes these gauges highly desirable and greatly enhances the safety of you EZ. For more information contact:

Paul Prout,
4039 Olive Point Place,
Claremont, CA 91711
(714)621-0060

****From CP43-6 (CH21,CH33)****

CAUTION

Paul Prout's fuel sight gauge as advertised in previous CPs should not be used with auto gas. Av gas is no problem at all and the pair installed in N26MS over a year ago have worked perfectly using only av gas. Paul is working on a auto gas option, but until then no auto fuel in Paul's sight guages.

****From CP48-4 (CH21,CH30)****

Wes Gardner is still selling his excellent, reusable foam air filters. Wes has some other neat "EZ" items. **A retrofittable fuel sight gauge, for those with poor translucency in their gauges.** An oil separator system for the Continental O-200 and the Lycoming O-235 that is guaranteed to remove all traces of breather oil mess on your cowling. Contact Wes for more information:

Wes Gardner
1310 Garden Street
Redland, CA 92373
(714) 792-1565

****From CP50-3 (CH21)****

Retrofitable Fuel sight gauges - machined from PVC, not only gives you a crystal clear view of your fuel, but also damps out the fuel sloshing making it easy and accurate to read fuel levels. Easy to install on new or existing EZ's.

Contact: Wes Gardner
1310 Garden St.
Redland, CA 92373
(714)792-1562

****From CP52-7 (CH21)****

RETROFITTABLE FUEL SIGHT GAUGES

Aircraft Component Technology (ACT) has developed a new fuel gauge for Rutan composite airplanes. A look over your shoulder rewards you with the truth about your fuel supply. It is a clear, shatter-resistant gauge which is backed by an opaque, white plastic base. Repeated blows with a hammer have resulted in deformation, never breakage. This is important because a broken gauge would mean uncontrollable fuel leakage into the cockpit. Like the Rutan composites, the gauges are intended for use with avgas. They are retrofittable from the cockpit side using flox and BID tape. A hand drill is the only tool needed.

Unlike the early model ACT EZ gauges, the new gauges are not illuminated nor are they equipped with a low-fuel warning system. Kits are $30.00 ($33.00 outside the U.S.) including shipping and piece-of-mind. Each kit contains two complete gauges and detailed installation instructions. Each gauge is 2" wide, 6 5/8" high and about 5/8" deep.

Inquiries may be directed to:

Aircraft Component Tech.
Attn: John Van Osterom
1501 Albright
Upland, CA 91786
Tel: 1-714-985-5887

****From CP55-8&9 (CH21)****

Defiant - Optional low level float switches for the fuel tanks, as used in Burt's Defiant are supposed to float in AVgas. They used to! We have used them many times on various airplanes over the years with excellent results. Recently, we installed brand new float switches in the Catbird fuel tanks and, much to our chagrin, they sank and were useless.

We removed them, checked them in water, they floated, but they would not float in fuel!! We called the company that makes them and were told, "yes, that is correct, they are made not to float in gasoline"! Something to do with liability insurance. Anyway, - what to do? We simply carved a foam ball out of H-45 PVC foam (Divinycell), drilled a hole in the ball, and floxed it on to the end of the float. The ball is a little smaller than a golf ball. We painted the ball of foam with a light coat of epoxy to seal it and protect it. It floats great in fuel, and PVC foam is impervious to fuel so it should last indefinitely. While these are not specifically called out in the Defiant plans, we strongly recommend them to be installed one in each sump tank.

From CP64-7 (CH21)
The nifty sight gauges sold by John Van Ostrom are no longer available from him. I will be taking over from him and they will be the same unbreakable quality as before. Price remains the same at $30.00 per pair. ($36.00 overseas) I have had a pair in my Cozy for 2-1/2 years and visibility is super. I have been unable to break or fracture the clear plastic with a hammer (test unit!). Builders can contact me:
Vance Atkinson
3604 Willomet Ct.
Bedford, TX 76021

Fuel Vents

Also see CP65-7 in the "Long-EZ Plans Changes" section of this chapter.

From CP27-9 (CH21)
Fuel venting - Long-EZ
The Long-EZ fuel vent lines in the wing are positioned so their inlets are above the fuel level in level flight or climb. Thus air expansion with altitude increase is expelled out the vents with no fuel loss. However, when parked nose down with a large fuel load, the vent inlets are submerged. If the fuel caps were perfectly sealed, expansion on the ground due to rising air temperature could force some fuel out the vents. The fuel caps used in the Long-EZ do not provide an air-tight seal around the dzuz-head. Thus, this parked fuel loss will not occur. If you install a tightly sealed cap, like those on Mike and Sally's Long, consideration must be given to expansion. A tiny hole in the fuel cap will do, or you can install a second vent line with it's inlet at the far aft inboard top of the tank. This vent must be routed to the same outside location and orientation (into the airflow) as the other vent. We have tested an alternate configuration consisting of a small hole in the existing vent line where it enters the tank, however this configuration results in fuel loss in climb.

From CP36-6 (CH21)
V/E & L/E: Fuel tank vents icing over - none of us should fly into icing conditions. However, if it should happen to you inadvertently, it is possible to have your fuel tank vents clogged by impact or rime ice. This could cause your engine to quit! The remedy is to drill a #50 hole on the aft side of the vent tube per sketch. **SKETCH OMITTED**

From CP47-6 (CH21,CH39)
An Alabama VariEze took off after a thorough preflight with full tanks. At 400-500 feet AGL, the engine quit with no warning. All attempts to restart failed. The choices for a landing site were bleak, trees or a small road. This pilot chose the road and lowered his nose gear. Just as he was really committed, a truck came over the rise. Trees and utility poles would not allow him to move over far enough, so his left wing hit the truck and broke off. The VariEze was pretty much totally destroyed, although the cockpit remained enough intact that the pilot got out with only a broken leg.

The accident investigators found a mud dauber (wasp-like insect) had built a nest 6" up the fuel tank vent line where it was very difficult to find, even with a thorough preflight. The FAA investigator recommended a screen over the fuel tank vent.

We believe a screen over the vent would reduce the necessary ram pressure to near static pressure. Our recommendation would be redundant vents. Put another 'T' in the vent such as downstream of the top 'T' and run a second vent. Be sure and check both vents for obstructions every 100 hours.

From CP48-3 (CH21)
CAUTION
We have noticed a few builders who have connected all four fuel tank vent lines on a Long-EZ to a common manifold then ran a single vent line up through the skin presumably because it "looks nice"?! This is a no-no! This completely defeats the main reason for the multiple fuel tank vents - REDUNDANCY. With a single vent line, one mud wasp can cause you to loose your engine even though you have two tanks full of fuel. Each fuel tank requires at least one independent vent. If you have totally sealed fuel tank caps, you need two separate vent lines per tank. Don't compromise here, this is a flight safety item and could seriously ruin your day, maybe even the rest of your life.

From CP51-6 (CH21)
VARIEZE FUEL TANK VENT
Recently had a report from a VariEze builder who was having terrible "overrich" problems with his new EZ. Every flight the engine ran so rich it required severe leaning to run smoothly. Fuel stains were all over the cowling and carburetor, pointing to a leaking needle and seat or a stuck float. Several calls later, after much head scratching, several mechanics had looked at it and given various opinions. The carburetor was completely overhauled and still, the fuel leaked all over the inside of the cowl!

Finally, on the phone, we decided that it was the fuel tank vent. It was installed so that it protruded out of the bottom of the fuselage into the airstream but, inside the engine cowling inlet! We were rather astonished by this but we are printing it here just in case anyone else may misinterpret the plans and install the tank vent incorrectly. If it happened once, it could happen again! Apparently, the suction of the cooling air entering the cowling sucked fuel out of the tanks through the vent and into the cowling, spraying fuel all over the carburetor and cowling leading this builder to suspect a sunk float or bad needle and seat. This was not only very frustrating for him, it could have been a disaster with all that fuel blowing around in the cowling near the hot exhausts.

We thank this builder for allowing us to print this story. Hopefully we can all learn a lesson here. On a VariEze, the main fuel tanks vent (which must be a common vent) protrudes out through the side of the fuselage under the right fuel tank/strake and faces forward at least 0.6" from the fuselage side and fuel tank bottom surface in high pressure air.

After he rerouted his vent into the correct position, this problem was completely eliminated and he is now enjoying flying his VariEze.

Fuel Caps

Also see CP27-9 in the "Fuel Vents" section of this chapter.
Also see CP55-3&4 in the "Refueling Fire" section of this chapter.

From CP24-7 (CH21,CH33,CH38,CH39)
ACCIDENTS
Since CP #23 there have been two off-field forced landings in VariEzes due to engine failure. No injuries, but both aircraft received major damage. The one in Southern California landed in the desert after the engine failed (reason yet unknown) taking the gears off and buckling the forward fuselage. The other in central California - engine failed just after take off when the pilot selected a tank with water in the fuel. (non-standard fuel system). The field was undulating soft grass. When the aircraft touched down it took the main gear off and damaged the under fuselage and wings. The nose gear was not extended. **Rain water got into the tank due to a very badly deteriorated "O" ring in the fuel cap. The aircraft had no gascolator or tank drains.**

What is learned from the above? First, we don't recommend the nose be retracted for any landing no matter what the terrain is, even water. The nose gear provides extra cushion and keeps the nose from slapping down and digging in after the mains hit. The one possible exception could be brake failure after landing to retract the nose to keep from running off into unfavorable terrain or obstacles.

Water in the fuel system - - be sure the cap "O" rings are in good shape. **Be sure all three drains are installed and used.** If you suspect water, drain at least two quarts. Drain first while the nose is down from the wing tanks then from the gascolator with nose up. Some times it takes a lot of doing to get to the water. Run your engine at high power for awhile before take-off (nose up) to purge the water. Better to have it quit on the ground than just after take-off.

Don't be in a big rush to switch tanks. Have a safe landing area in sight before switching tanks if you can. Especially the first time you take fuel from the tank. In the case of water, even if you switch back to the "good" tank, you may not get it going in time. It takes a long time to purge water out of the carb. Also don't take short cuts on your systems, it takes a lot less time to do it right the first time than rebuild it.

Fuel Flow

Also see LPC #133 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP50-4&5 in the "Fuel System Modifications" section of this chapter.

From CP54-3 (CH21,CH33,CH38)
"The airplane will always try to tell you before it lets you down."
This is a well remembered statement Dick Rutan always preached at RAF when he worked here. Many, many times we have found it to be so very true. The problem is to recognize and act on the information.

A classic case in point occurred a few months ago with Burt's Defiant. N78RA had always had lower fuel pressure on the front engine than on the back, at least as long ago as any of us could remember, even after we installed the 180 hp engines and constant speed props. Lately though, it seemed the pressure was even lower. On the way to Oshkosh 1987, Burt said he had only 2 psi on the front and 6 psi on the rear. Must be the gauge, right? Wrong! On the approach into Oshkosh, the pressure dropped to 1 psi. Mike and Sally moved into very close formation, looking for any sign of a fuel leak - nothing.

On the trip back from Oshkosh, the fuel pressure hung between 1 & 2 psi. The engine seemed okay though, so Burt pressed on. A few weeks after the return from Oshkosh, Burt and Tonya decided to take two friends to Big Bear for lunch. The take off and climb to 300 feet were normal. Then, suddenly, the front engine began to die. Burt was frozen for a second trying to determine if he should turn back and land - should he shut it down and feather it? What?

He happened to glance at the two fuel pressure gauges - the rear was at 6 psi, the front was showing ZERO! He reached down and cross fed the front engine to the rear engine fuel tank - instantly, the front engine recovered and returned to full power! This airplane had been trying to tell us for a couple of years that something was wrong, but no one was listening.

We knew now that it was in the left (front) fuel system. We checked all the screens and filters - nothing. Finally we pulled out the fuel lines themselves and there we found a blockage of foam chips, small pieces of fiberglass and tiny fragments of micro and epoxy. This blockage was fully 4 inches long in the fuel line from the left tank to the fuel valve, right at the fuel valve. We replaced all the fuel line in the airplane and now we have 6 psi, front and rear, at all times.

The moral of the story is this: If you notice anything unusual, pay attention, the airplane may be trying to tell you something. A new noise, a "different" vibration, any change in fuel or oil pressure, don't ignore these things - remember Dick's teachings, "The airplane will always try to tell you, before it zaps you!"

P.S. The accumulation of debris was caused when we had to replace two low-level light switches in the aft sump tank in Burt's Defiant. Apparently, we were not careful enough when cleaning out the tank before closing it. Burt's sump tanks do not have screens in them, the assumption being that the screen in the main tank should do the job.

****From CP54-3 (CH21,CH33,CH38)****

Similar Problems in a Long-EZ

Marc Borom, N966EZ, writes that he had had many engine hesitations, slight rough running periods, some requiring the use of the boost pump to make it run smooth. All of this was during Marc's first 25 hours in his test area. Needless to say, Marc was rapidly loosing confidence in his new Long-EZ. How would he ever be able to fly cross country in this thing?

He called us here at RAF several times and we had long discussions about his problem. Finally, one day he decided to make a short cross country to visit a fellow Long-EZ builder.

During this flight, the engine literally quit each time he shut off the boost pump. He asked himself, "Am I having fun yet?" The answer was an obvious - NO!

Safely back on the ground, he once more broke down the fuel lines aft of the firewall. Same results, no problems downstream of the gascolator. Then he remembered that when he had done his fuel flow checks, the fuel flow was sluggish at the gascolator (the airplane was trying to tell him!). He mentioned this fact to other pilots who persuaded him that it was due to low fuel "head" pressure with the nose down. He put that important data point aside as probably not being pertinent.

With no other clues, it was time to check the fuel lines forward of the firewall and back to the sumps. He disassembled the gascolator and found he could blow through both lines from the valve to each sump with very little effort. While he had the system apart, he decided to check the line from the fuel valve to the gascolator. To his amazement and horror, he could not blow through this section of fuel line. He had, at last, found the source of his problems.

He called RAF to discuss this problem and we suggested he use shop air to blow the line clear. The blockage cleared itself with a loud "POP". What he found was a 1" long plug of foam and fiberglass chips that had backed up behind a needle of epoxy coated fiberglass that had lodged in the first sharp bend in the aluminum tube.

This problem was very similar to Burt's problem in the Defiant, and it re-enforces the necessity to "listen" to your airplane. When she tries to tell you something, don't ignore her, check it out and you will become more confident in this machine you have built. In time, you will come to trust her and, therefore, enjoy her and to get more utility out of her. Remember, she will always try to tell you.....

****From CP54-3 (CH21,CH33,CH38)****

Suggested Method of Checking Static Fuel Flow

VariEze, Long-EZ and Defiant - Before first flight, and if you are now flying but have never done this check, we strongly recommend a fuel flow check. Disconnect the fuel line at the carburetor and hold the airplane in the normal level flight attitude of approximately 1-1/2 degrees nose up (a 24" level with a 5/8" block under the rear end of the level on the top longeron will give you this attitude). Now, using a stop watch and a bucket, turn the fuel valve on for two minutes. Weigh the bucket of fuel, then weigh the bucket empty. The result is the weight of fuel that flowed in two minutes. Since a minimum of 10 gph for a VariEze is required, you should have at least 1/3 gallons (2 lbs.) of fuel in the bucket after a 2 minute run.

For a Long-EZ, you need a minimum of 12 gph, so you should have .4 of a gallon or 2.4 lbs. (without the electric boost pump running). This should increase to a minimum of 16 gph with the boost pump running, or 1/2 of a gallon (3.2 lbs.) in the bucket after 2 minutes. Remember to check both tanks in a Long-EZ, left and right.

For a Defiant you need a minimum of 14 gph (NO boost pump), 0.46 gallons or 2.8 lbs. in 2 minutes. With the boost pump running, you should see a minimum flow of 18 gph, or 0.6 gallons or 3.6 lbs. in two minutes. Don't forget to test both tanks as well as cross feed on both tanks.

These flows are fairly arbitrary, but are flows we have tested for and measured on each of the above aircraft. You should get at least, and probably better than, these numbers when you test your own airplane. If you are way down on these numbers, you should disassemble the fuel lines and blow through them to check for a blockage. Use caution blowing through lines that go into fuel tanks. High pressure shop air might rupture a fuel tank even with the fuel cap removed.

This fuel flow test should be conducted on any new airplane and it would not hurt at all to retest at each annual. Keep in mind that foam chips tend to float on the surface of the fuel and may not get into the fuel lines for a long time or, at least, until you run that tank very low or all the way empty.

From CP58-7 (CH21,CH33,CH38)
FUEL FLOW CHECKS
As called out in CP 53 have caused a number of builders some confusion. We even re-checked our numbers to be sure we had not made a mistake! Mike and Sally's Long-EZ and Burt's Defiant are both relatively old (8 years and 11 years) and the electric fuel boost pumps were also this old at the time of the tests, as were the mechanical fuel pumps.

Since we have installed new Facet electric boost pumps on both of the above aircraft, we also cannot get the fuel flows called out in CP 53. We believe that the foot valve springs in the new pumps must be creating enough restriction to fuel flowing by gravity, that it is impossible to obtain the flow rates called out in CP 53. Of course, the "fuel pump on" tests are still relevant and nothing has changed in this test. We believe, now, that the gravity flow check must be conducted by removing the gascolator bowl or breaking the fuel line at the gascolator. You should be able to achieve the flows shown in CP 53 using this method for the gravity flow check. You should re-connect the fuel line at the gascolator for the "fuel pump on" test and break the fuel line at the carburetor. Again, you should be able to achieve the flows shown in CP 53. If you cannot get at least the correct flows shown, you may have a restriction in the fuel lines or fuel valve. This restriction must be cleared before flight.

From CP62-2 (CH21,CH33,CH38)
FUEL LINE BLOCKAGE
This has been a CP subject before, but we continue to receive reports of fuel line contamination. Listen up, People! A fuel line blockage may, at the least, cause a forced landing and at the worst, kill you. Foam chips, fiberglass shards, pieces of micro falling into your fuel tanks when you install the fuel caps, can work their way into the fuel lines and we have even heard of them getting all the way to the fuel valve and jamming the valve! How about that for a problem! Check your fuel lines for obstructions before first flight. Check them again after 50 hours and thereafter at each annual inspection. A fuel line or valve blockage is a very serious problem.

Fuel Valve

Also see LPC #96 in the "Long-EZ Plans Changes" section of this chapter.

From CP24-5 (CH21,CH38)
SOLUTION TO STIFF FUEL VALVES
One homebuilder reported his stiff fuel valve problems were solved by using a fuel valve lubricant called "parker fuel lube" available in most aircraft supply stores. Cost $10 or $12 for a small can. The lubricant is not soluble in fuel. This small can could lube dozens of EZs.

From CP29-6 (CH21,CH38)
STICKING FUEL VALVE
Some VariEze fliers continue to have problems with their fuel valves sticking. In CP 17 we reported that tight valves must be overhauled before flight. The brass valves can be fixed by dismantling, cleaning and installing a lighter spring (or cutting some off the existing spring). If this is not completely successful the valve must be replaced. In CP 18 we switched to a Weatherhead #6749 valve with a Delrin spool. This appeared to solve the problem. However, a few people still had valves that were hard to turn. Recently a VariEze had a forced landing due to fuel starvation. The airplane was damaged, but fortunately the pilot was not hurt. Examination of the valve revealed that the Delrin spool had broken internally and the valve handle would not turn the spool. This valve had become so tight, on one occasion it required pliers to turn. This VariEze should have been grounded for valve overhaul.

CAUTION If your VariEze fuel valve (brass or Delrin) takes more that 5 lbs. of force to turn it, (10 lbs. is ok for long-EZs) ground your airplane until this is fixed.

The best fix is to shorten the spring by cutting some off and lubricate the valve spool and body with Parker fuel lube. (as reported in CP 25, page 5). Do not treat this situation lightly, you could destroy your aircraft for lack of fuel and yet have plenty of fuel on board.

From CP38-5 (CH21,CH38)
Sticking Fuel Valve - VariEze and Long-EZ
Hank Ashmore has found an excellent replacement for a VariEze/Long-EZ fuel valve. It is a Gerdes products fuel selector valve, and is found on Beech Musketeers, Sundowners, Sierras etc. It is a perfect match for the EZ valve and does not stick. Hank found his at an aircraft salvage yard and paid $20.00 for it. Unfortunately they cost around $125.00 new!! We are not advocating that everyone should run out and get one, but for those flyers with a particularly nasty sticking valve problem, it may be an alternative worth considering.

From CP46-4 (CH21,CH38)
FUEL VALVE STICKING PROBLEMS
During the past 1000 hours of operation in N26MS, we like many EZ pilots have had problems with the fuel valve becoming stiff with time. We have used Parker Fuel Lube for about 3 years, but this has been a temporary situation at best. In fact lately the Parker Fuel Lube only lasts a few weeks, then the valve is just as stiff as before. This is a bad situation, and could even become a dangerous situation.

Recently Dick Kreidel, past president of Squadron I in the Los Angeles Basin area, introduced us to a new grease. This material is very expensive, try almost $800.00 for a one pound can!! Dick gave us a minute amount, enough to cover your thumb nail, and frankly we thought, what a scrooge! Wrong! This is in fact probably a life time supply. Seriously, we ran the Long-EZ down to two or three gallons of gas on each side. We raised the nose as high as we could to get the fuel valve above the fuel level. We tied the nose down to avoid having it fall on its tail and then used a small ladder to reach inside and disassemble the fuel valve.

We removed the whole thing and noticed signs of 'galling' on the tapered brass valve. We cleaned it thoroughly and "lapped" the valve using jewelers rouge. Brasso metal polish or something similar would also work. Then we cleaned the valve and parts and applied the new "Kreidel" magic grease sparingly all over the tapered brass valve. We reassembled the valve and greased the "detent" mechanism. We had also in the past removed a small amount off the length of the spring. This was done by carefully grinding about half the wire thickness in the spring on each end of the spring on a grinding wheel. Don't get the spring too hot or you will ruin the temper.

We reinstalled the valve and have now got over 80 hours operation over a period of a couple of months since the "lube" job. The valve literally turns like it was on ball bearings. We are very satisfied with this system and heartily recommend it.

Obviously, at $800.00/lb this grease is not reasonable for each individual to purchase, so we (Mike and Sally) have bought a small can of it and we would be happy to send a "small" (literally less than 1/2 teaspoon) quantity to any builder or EZ flyer who will send $10.00 to us at RAF. The $10.00 will cover the cost of a small plastic container, a jiffy bag, postage and cost of the grease. It is on back order at the time of this writing, and should be in our hands November 15, 1985.

Dick Kreidel has been using it for almost two years (over 500 hours) in his beautiful Long-EZ and he says that although it does eventually wear down to where the valve starts to get a little stiff, he says it seems to last longer with each application. He has only greased his twice in 500 hours.

From CP50-4 (CH21,CH38)
FUEL VALVE LUBE
Mike and Sally offered a very expensive and very special grease for this purpose for some time but have run out. They will not be ordering more. Anyone who would like to may contact:

Burmah - Castrol
16815 Von Karmen Avenue. Suite 202
Irvine, CA 92714
(714)660-9414

The grease was formerly known as Brayco 3L-38RP, now Braycote 601 and can be bought as follows:

2 oz. for $190.00
4 oz. for $300.00
1 lb. for $800.00

Very expensive, but the only grease we have tested that really works.

From CP51-8 (CH21,CH22,CH38)
Aircraft Spruce is now carrying the Braycote 601 **fuel valve grease** that Mike and Sally had. 2 oz. syringe cost $209.95 (enough to grease at least 20 EZs). They also have a new, economical flight warning system for gear or canopy warning. Please note that all EZ fiberglass prefab parts offered in the Spruce catalog are made by Larry Lombard and Michael Dilley of Featherlite, Inc., Boonville, CA.

From CP55-7 (CH21,CH38,CH39)
A Pennsylvania Long-EZ builder/flyer was fatally injured when his newly completed airplane crashed short of the runway on his second flight.

Apparently, the first flight was picture perfect, a flight that lasted about forty minutes. The second flight lasted about the same length of time. His engine was heard to be cutting in and out, on his second approach to land. He started a climbing left turn in an apparent effort to return and land. The airplane spiraled down from about 100 feet and crashed.

The right fuel tank was intact and contained approximately 8 gallons. The left tank was crushed, but the 1:20 minutes of flight would probably have used about 8 gallons of fuel. The airplane had 8 gallons on each side when it first took off. The pilot's shoulder harness was tight for take-off yet was found to be loose after the accident, so he may have been trying to reach the fuel valve which was reportedly difficult to turn.

An accident like this is very sad. We have repeatedly given the advice "FLY THE AIRPLANE", and this accident brings it home very forcefully. No matter what happens, if you run out of fuel on one tank or you have to shut it down for one reason or another, "FLY THE AIRPLANE". This must be your first priority. It cannot fly itself, you must maintain control, you must maintain airspeed. Then, and only then, switch tanks or do whatever else you may have to do, all the while maintaining control of the airplane.

Check your fuel valves for ease of operation. If yours is stiff, dismantle it, lap it in with jewellers rouge or a metal polish such as Brasso, using an electric drill. Clean it thoroughly and lubricate it with a suitable grease such as fuel lube, etc. Even if you have to do this once every 6 months or a year, do it, do not let your fuel valve get so tight that it becomes difficult to switch tanks.

While we are on the subject of fuel valves, be certain that you know where your valve handle should point when it is on the left and when it is on the right tank. Check carefully that the valve is in the detent and that this is, indeed, the tank you had selected. Clearly mark the position the handle is in when it is switched to the RIGHT, to the LEFT, as well as to the OFF position. It may be possible to select a mid-position between both tanks. This would not be good since, if one tank was empty, the fuel pump would pump air from the empty tank causing the engine to quit. Know your fuel system. Maintain your fuel valve regularly. Calibrate your fuel sight gauges so that you know exactly how much fuel you have on board. If, in spite of all of your care and diligence, something goes wrong, FLY THE AIRPLANE, try to correct the problem, pick a landing site, and execute a normal landing. Don't try anything fancy. A normal landing, maintaining flying speed and control to touchdown is always your best bet.

****From CP57-13 (CH21)****
STICKING FUEL VALVES (AGAIN)
On at least three occasions, we have brought up this subject in past CP's. We continue to hear from EZ builders and flyers that they are still experiencing occasional problems. Thanks to Long-EZ builder/flyer, Jim Evans of Yorktown, VA, we have what we believe to be an excellent alternative to the present brass valve with the tapered brass cone that sometimes sticks!

Jim tells us he has over 80 hours on his new Long-EZ and has used a "Whitey" valve which has a stainless steel body, stainless steel ball and stem and uses pure teflon seals. Stainless and teflon are not affected by fuel and these valves are easily available - and they turn smoothly! We obtained one of these valves and Mike has installed it on his Long-EZ and is extremely pleased with it.

The valve body is machined from solid 316 stainless steel bar stock, as is the one piece ball/stem. The ball, itself, (not a cone) is encapsulated between teflon seals which can be adjusted without removing or disconnecting the valve.

There are several sizes and fitting styles available. The Swagelok fittings look good but are not what we are used to in "aircraft style" fittings. The valve we are recommending for all VariEzes, Long-EZ's and Defiants, is Whitey's catalog number SS-44xF4. This valve has an orifice through the stainless ball .281" in diameter, has female 1/4 NTP pipe threads in the inlet and left and right outlets. These will accept the AN 822-6D 90 degree elbows. The one piece stainless ball/stem eliminates any backlash and the black plastic handle has positive stops for left and right positions. The "off" position is in the center and does not have a positive stop. The handle points left for the left tank and right for the right tank. We checked the flow rate through this valve, using gravity and a 6" fuel head (simulating the worst case, low fuel in a gravity feed VariEze). We measured almost 30 gallons per hour, more than adequate for any VariEze and, of course, for the pumped systems on Long-EZ's and Defiants - probably an "over kill" - however, keep in mind that there have been two incidents that we know of where the pilot had a forced landing due to a stuck valve.

These valves can be obtained from your local Whitey distributor. We obtained ours from Bakersfield Valve and Fitting Co. in Bakersfield, CA. Contact Whitey Co., 318 Bishop Rd., Highland Heights, OH, 44143, for the name of your nearest distributor. Phone-

****From CP58-6 (CH21,CH38)****
FUEL SELECTOR VALVE UPDATE
In CP 57, we discussed the sticking fuel valve problem which is not a problem to be taken lightly. At least one VariEze has crashed due to a stuck valve and the FAA has contacted us asking us to do something about this problem. The Whitey stainless (or brass) valve is a good valve, uses Teflon seals against a ball, and it turns nice and smoothly. The major disadvantage is the configuration. It is not a bolt in direct replacement. It requires a new mounting bracket and the intake is located on the bottom of the valve, making it more difficult to install.

Yesterday, we saw the best fuel valve we have ever seen. It is a direct, bolt-in replacement for your existing weatherhead valve. It uses the same elbows and nipple in the same orientation but, best of all, it turns smoothly and freely with a very positive spring-loaded ball detent system which lets you feel that you are in the left, the right, or the off position. The handle cannot be installed incorrectly and it is not a tapered plug design which can be prone to sticking. It has a parallel shaped valve body that uses replaceable "o" rings. The whole valve comes apart with two snap rings for easy maintenance. It is made of hard, anodized aluminum and is very light. OK, so what's the catch? The perfect valve, right? Yes, but - Wicks Aircraft will need at least 50 firm orders before they will be able to stock them. They will sell to the homebuilder for $118.65! A lot of money, but then again, what is your life worth? And maybe the life of a loved one or friend? A stuck valve can ruin your day. For $118.65, this problem which has been ongoing for several years now, will be gone forever. If you would like to have one, write or call Wicks and place an order. When Bud Myers has 50 orders, he will get them in stock and this fine fuel valve will, hopefully, eliminate this "sticky" problem once and for all.

From CP58-10 (CH21,CH38)
"The best fuel valve we have ever seen", will be in stock at Wicks soon. Part #6S122. It is a direct, bolt in replacement for your VariEze, Long-EZ or Defiant, and it is all "O" ring seals (replaceable) with a very positive spring and ball detent system. Place your order with:

Wicks Aircraft Supply
410 Pine Street
Highland, IL 62249
818-654-2191

From CP59-9&10 (CH21,CH38)
THE BEST FUEL VALVE we have ever seen - anodized aluminum, replaceable body, easily removable barrel (not tapered!), with 'O' ring seals and an excellent, positive, position spring detent system. Best of all, it is a simple bolt-in replacement for your existing brass weatherhead or Imperial valve. It is now in stock at both Aircraft Spruce and Wicks Aircraft. It is expensive, at around $120.00, but well worth it in the long run, no more sticking fuel valve, no more disassembling and greasing the valve, just easy, smooth rotary action.

From CP59-10 (CH21,CH38)
WHITEY BALL VALVES (Fuel Valve)
The SS-44xF4 stainless steel valve which we recommended for a good fuel valve does have one drawback, it does not have a very wide recommended operating temperature range. No one has ever reported this as being a problem, but a better choice of Whitey valve would be their SS-83xF4, a valve specifically designed for temperature extremes. Quite frankly though, the very best choice of fuel valve is the one recommended in CP58 and now stocked at Wicks and Spruce.

From CP60-8 (CH21,CH38)
THE NEW FUEL VALVE
Unbelievably, after all the effort to finally find the perfect fuel valve, we still apparently have problems. We have received reports from both Wicks and Aircraft Spruce that some builders have returned the new fuel valve as unusable, won't fit, not as represented in the CP, etc.!! Even the Cozy newsletter condemned the valve without even looking at it!

WOW!! What can we say? The new fuel valve is all we said it was. It is a direct replacement for the original brass valve. Several EZ owners at Mojave, including Mike and Sally, have installed the new valve and have reported that it is great. It turns so easily, and the strong spring/ball detents are very positive. In fact, the valve can be turned to either tank by feel, without ever looking at it!

There may be some confusion about the left-right orientation of the new valve. Keep in mind that the original valve is identical. If you installed your original valve exactly per plans (i.e., left tank goes to right side of valve and right tank goes to left side of valve, see plans page 21-5), your new valve will fit and work exactly as your old one does. You may have to file an additional flat on the valve shank (there are only 3, whereas the original had 4 flats) depending on how you oriented your fuel valve handle. Other than that, the new valve bolts on to the same bracket, same bolt location, uses the same elbows and fittings and, also, uses your original handle. Remember, this valve was manufactured specifically to replace the brass valve in Piper Cherokees. Since this was the same brass valve, it must fit your Long-EZ! If you have any problems, call Mike here at RAF.

The new valve is available at both Aircraft Spruce and Wicks. It uses "O" ring seals, all of which are replaceable. It turns so freely it has to be used to be appreciated. It has the most positive position detents we have ever seen. Don't let yourself be caught with a stuck fuel valve - get one on order today - even though they are expensive, they will prove to be worth it in the long run.

RAF has received many complimentary letters and phone calls on this valve. We appreciate the feedback on this and anything else you feel might be useful

From CP61-12 (CH21)
Wicks Aircraft and Aircraft Spruce both stock the recommended Cherokee-type fuel valve, part #6S122. This is the best fuel valve we have seen. It incorporates a cylindrical valve turning in a hard anodized aluminum body. (It does not use a tapered valve which sometimes stick.) The seal is accomplished with "O" rings which can easily be replaced by removing a snap ring. There are two large "O" rings, Part #MS29513-114 and two small "O" rings, Part #M83248/1-011. A synthetic silicone base lube should be used such as Dow Chemical's DC-4 grease.

We have received many enthusiastic reports from builders and flyers who have installed this new aircraft quality valve and RAF heartily recommends it. We only wish this valve had been available when the Long-EZ was first developed! It would have saved a lot of confusion.

Fuel Leaks

From CP35-6&7 (CH14,CH21)

Detecting Fuel Tank Leaks

Most leaks can usually be detected by the tried and tested soapy water method. Occasionally however, a persistent small leak may exist that simply will not show up with soapy water. These leaks are probably located in the forward face of the centersection spar, or on the fuselage side. A sure fire method to locate these leaks is to use a "Freon Gas Sniffer". These expensive gadgets can usually be borrowed from your local friendly auto airconditioning repair man. Simply spray a little Freon into the offending tank, pressurize it by raising the altimeter no more that 1,500 feet. The Freon Sniffer will quickly locate the leak. If the leak is inside the centersection spar, you may have to cut through a CS5, CS6, CS7, or CS8 bulkhead. Cut a plug no bigger than you have to, to get your hand through. Cut the plug out at an angle so the plug can easily be floxed back in place. **SKETCH OMITTED**

Repair with two plies BID lapping at least 1" onto the remaining pane. Now that you have the exact location of the leak, you can suck a 1,500 ft. lower than ambient pressure, causing a slight vacuum. Paint warm epoxy over the leak area, working it in with a brush or rag. Do this for a couple of minutes. Then open the tank to ambient pressure. This is most important, since the epoxy that was drawn into the leak, would continue to be drawn in until the leak was once again there. You want the epoxy to cure in the leak area. Incidentally if you intend to install position lights/strobes and/or antennas in the wingtips, you will need holes in the CS5, CS6, CS7 and CS8 bulkheads to run the wiring and coax through from the wings to the fuselage. A maximum of a 2" diameter hole may be cut through the center of each bulkhead.

From CP36-6 (CH21)

V/E & L/E: Phil Cornelius turned in this neat method of tracing a fuel tank leak. This assumes you have the fuel cap holes cut and have a small enough leak not to be detectable using soapy water. Push an ammonia soaked rag into the tank and seal the caps. (Phil bondo'd an aluminum cover over the hole). Then soak a rag in Phenolphthalein ($C_2O\ H_{14}\ O_4$) and hold it against the outside of the tank moving it around until you see a purple spot. This purple spot is your pinhole leak! Pop off the aluminum cap covers, remove the ammonia rag and vacuum the vapors out of the tank. Wipe down the outside of the strake with soap and water.

You should be able to scrounge a small baby food jar's worth of $C_2O\ H_{14}\ O_4$ from your local high school or college chemistry teacher. It it's in powder form, use alcohol to dissolve it into solution. CAUTION - Phenolphthalein is hazardous if it comes in contact with your bare skin. Use only with rubber gloves.

From CP37-3 (CH21)

FUEL TANK AND SUMP BLISTER LEAKS

There is nothing more discouraging that getting your airplane ready all the way through to paint and then to find fuel tank leaks. Lately a few builders have reported leaks found in the sump blisters. You must paint a generous coat of Safe-T-Poxy on the inside of your fuel strakes, on the side of the fuselage, on the forward face of the centersection spar and the inside face of the baggage wall and outboard rib. Do not neglect to do this. Its a good idea to squeegee the epoxy onto these surfaces to ensure that you force the epoxy into any tiny pin holes that may exist. Allow the epoxy on the inside of the top of the strake to tack up or even cure before installing. Paint a real generous coat of Safe-T-Poxy inside the sump blister prior to installation. Most important, leak check your tanks before you do any finishing work. Leaks should be repaired per the instructions in previous CPs.

From CP38-4 (CH19,CH21,CH38)

Fuel Leaks into Outboard Wings - VariEze and Long-EZ

We have now had reports from three different flyers, that they have had small pin hole leaks in the outboard ribs of their fuel tanks, and that fuel had somehow seeped into the outboard wings. Small pin holes in the root rib of the outboard wings have allowed fuel to attack the styrofoam in the wings. This is a serious situation, since the wing structure requires the foam core for buckling support of the wing skins.

The solution of course, is to be positive that your fuel tanks do not leak and any fuel stains observed near the wing would require removal of that wing and careful checking for any loss of foam structure. Fuel will instantly melt styrofoam and will find its way through the smallest pin holes if its allowed to. If this happens, a repair requires removing all of the melted foam, and cutting back into good foam. Then a block of foam must be cut and fitted, then micro'ed into this void. A possible alternative would be to use "pour-in-place" Liquid X foam or equivalent. Sand the foam to the original shape and do a standard fiberglass repair.

From CP38-7 (CH21)

CAUTION

Several builders have been leak checking their fuel tanks by pressurizing them, or pulling a vacuum on the tanks so strongly that they cracked their tanks. Be careful! The only safe way to leak check your fuel tanks, is to plumb an altimeter into the vent line and suck or blow an altitude change of a maximum of 1500 feet. Use your mouth to do this. Do not use a vacuum pump. There is an awful lot of square inches of surface area inside your tank, and even a relatively small change in atmospheric pressure per square inch, can put hundreds of pounds of force on your tank.

From CP62-2 (CH21)

CAUTION

Seal your fuel tanks with a generous coat of Safe-T-Poxy before you close them out. (Two coats is even better). Do not neglect to paint at least two coats of epoxy inside the sump blisters before you install them. They will certainly leak if you don't.

Refueling Fire

Also see CP55-8 in the "Long-EZ Plans Changes" section of this chapter.

From CP52-6 (CH21,CH33,CH39)

REFUELING FIRE

We received this information third hand. We have not had any contact with the Long-EZ pilot. Apparently, after a flight in his Long-EZ, a Norwegian builder/pilot landed at an airport in Norway and requested fuel. As the attendant started to fill one of his tanks, a static spark jumped and ignited the fumes around the fuel cap area. Fortunately, a fire extinguisher was available and the fire was extinguished.

The above is all the information we have. We are endeavoring to find out more about this incident and we would appreciate any information anyone may have about this or any other similar incident.

This is the first time we have had a report of a fire while fueling an EZ. We have, of course, fueled many composite airplanes here at Mojave, literally hundreds of times, and we have never even seen a static spark. That is not to say it could not happen but of all the places it should happen, Mojave, with its extremely dry climate, would seem to be a likely candidate.

What can be done to prevent such an incident? If you built a ground strap into the tank connecting the fuel cap ring to the aircraft ground, and you grounded the aircraft during a refueling operation, this should not be able to occur. However, if your airplane was ever struck by lighting, the ground strap would conduct the charge. It would become red hot and melt which may cause an explosion/fire! Not a good alternative.

The most practical thing to do would be to always touch the fuel truck's ground cable to each fuel cap BEFORE you open these caps. This would discharge any static build-up on the aircraft skin/strake area. Another suggestion was made in EAA's Sport Aviation magazine and that is to make up a length of brass bathroom chain with a small clip on one end. Clip it to the fuel nozzle and drop the chain into your fuel BEFORE pumping fuel into the tank. The idea is to discharge any static that may build up due to the friction of the fuel running out of the nozzle into the tank. This would be in addition to the first suggestion.

We are not experts in this field at all. During fueling we, ourselves, have never taken any special precautions other than the normal grounding of the exhaust pipe (which may or may not do anything at all!) We have been fueling composite airplanes here at Mojave and, indeed, all over the United States for more than ten years without any evidence of a problem. We simply present the report of this incident as food for thought. If anyone has any suggestion as to what could be done to prevent such a thing, we would be pleased to hear from you.

From CP53-3 (CH21,CH33,CH39)

REFUELING FIRE IN A LONG-EZ

"To Ground Or Not To Ground?" By Alfred K. Tiefenthal

"I had intended to carry out an exact calibration of the fuel sight gauges of my Long-EZ. While in my hangar, and using a metal funnel and "Jerry" cans, I began pouring Avgas 100LL into the right tank. The metal funnel had three legs, but due to the cross wire in the Brock fuel tank opening, they were too short. I supported the funnel with pieces of wood and foam. With that arranged, the funnel did not touch the metal tank opening or cross wire but was a few millimeters away from it. I suppose it was at this gap that a spark jumped over and ignited the fuel.

This happened when I was pouring in the third can. The tank was about half full. Fortunately, there was no explosion, the fuel just started to burn. I must have bumped the funnel when the ignition happened because there was splashed, burning fuel all around the tank opening and dripping down the leading edge. The can I was pouring from was on fire and I, myself, got burned on my right hand, fortunately, not seriously.

I will never forget the nasty sight of my beautiful and beloved Long-EZ, after four years of hard work, burning all over the wing strake with the flames reaching almost to the roof! A few seconds later, I managed to extinguish the fire with a single blow from a powder-type fire extinguisher I found in the hangar, and it was all over.

There was very little damage, some discolored spots on the strakes and a few paint blisters along the leading edge. These were quickly repaired and, surprisingly, I actually flew the plane the next day!

There is no doubt in my mind that the source of the fire was a spark caused by static electricity. It was my fault, of course, that I did not ground the aircraft. Nor had I any grounding connection between can, funnel, and aircraft. I will never pour any amount of fuel into any aircraft without ground, and if I have to fill from "Jerry" cans, I will also make a ground connection between the can, funnel, and grounded aircraft.

It is illegal to refuel an aircraft in a hangar and without grounding and I was fined 500$ (Norway money!), but what is that?! I could have lost my airplane, or even my life, if the ignition had occurred earlier while there was a combustible mixture in the fuel tank- or it could have exploded.

My hope is that this story will prevent other builder/flyers from having a refueling fire."

The above letter was received from Alfred Tiefenthal who lives in Norway and it is the same incident as was described in CP 52. We made a couple of suggestions then and have received several comments concerning this incident.

A fueling fire is a very, very serious situation and anything that can be done to prevent it should be done. Also, be sure to have a suitable fire extinguisher at hand whenever you are doing anything with fuel.

Haley Haynes wrote to us concerning our suggestion of a brass chain and he is concerned that the chain should not be grounded to the fuel nozzle until after it has been dropped into the fuel. The connection to the fuel nozzle should be made as far away as possible and upwind from the fuel tank opening.

He says that at the present level of understanding, a static charge can and does build up on the surface of the fuel, probably due to molecular friction between two dissimilar materials, like cat hair and plastic.

The obvious solution would seem to be to install some form of uninsulated metal ground into the tanks during construction, and securely connect these to the aircraft ground and engine. Thus, the gas truck operator grounding your exhaust system would be grounding the fuel. Unfortunately, the problem is not that simple. This solution, in event of an airborne lightning strike, could result in the inside-the-tank ground strap becoming red hot and causing an explosion! Also, the fuel acts as a dielectric between the metal fuel lines and the static charge on the surface of the fuel. Therefore, a very large area ground is needed in the fuel tank. The aluminum mesh called "Explosafe" and advertised in Sport Aviation, if properly grounded to the engine during construction, may be a good way to go.

We would welcome suggestions and comments on this problem. The other side of the coin is, of course, the fact that many hundreds of EZ's have been fueled many thousands of times all over the world without any reported problem until we heard from Alfred Tiefenthal. Is the problem really as big as it seems? We wish we knew, but unfortunately, we are not experts in this field and we would truly welcome the view of any experts.

Our biggest concern, now, is that someone may actually cause a fire trying to avoid the problem by grounding his fuel incorrectly or in the wrong sequence. We are certainly going to have a nice big Halon fire extinguisher at hand for all fueling operations here at Mojave, but what to do on a cross-country?

****From CP55-3&4 (CH21,CH33,CH39)****

REFUELING FIRE

"I knew it was possible, but surely it wouldn't happen to me. How many thousands of times have EZ's been refueled without any incidents of fire? One reported in Norway (see CP 52 and 53) and now me. Why does it happen? It is carelessness, or is it preventable?

After a 40 minute flight in my LEZ N8HA, I called for the fuel truck and parked on the ramp with the nose headed into an 8 knot breeze. The fuel truck drove up and was parked about 8 feet behind the plane - downwind. Gary, the driver, unreeled the ground cable and clipped it to the exhaust stack, just the same as we had done about 30 times before. Gary then brought the fueling hose around the left wing and I removed the left tank fuel cap. Eleven gallons of (100 LL) fuel was pumped into the tank and it was about an inch and one-half from being full. He then shut the nozzle down to slow the flow and with both of us looking directly at the fuel tank opening, the fumes from the tank started burning. No explosion. The flame above the tank was a couple of feet high and was being blown across the wing aftward about 4 to 6 feet. I remember seeing the end of the fuel nozzle positioned even with the fuel tank opening and in the center of the 3 inch flush filler ring when the fire started. We don't know if the nozzle had touched the ring or not. The nozzle was also on fire.

By very fast reaction and a dry powder extinguisher from the rear of the fuel truck, we had the flame out in about 12 seconds from the time it started. Gary had one hand singed and I was spitting dry powder. I had just turned around from getting a small Halon unit in my cockpit when he shot across the wing with the powder. Damage to my LEZ was mostly cosmetic, but with a couple of heat wrinkles in the skin just aft of the filler ring, and some places in the centersection and wing spar area where the finish paint was blistered up from the primer coat. A large area was smoke blackened from the filler ring to the trailing edge. If we had been standing on the downwind side of this operation it may have been a tragedy for both of us.

The main thing I will do for sure is to install a grounding lug onto the metal fuel filler ring and use it instead of the engine exhaust. Also, a jumper groundwire will be clipped to that lug and to the fuel nozzle BEFORE removing the jumper wire or ground cable. The fuel truck should be parked crosswind from the plane and not downwind of it, and should be grounded into earth rods. The fuel handler should not be wearing any nylon clothing. A two pound Halon unit will be mounted in my EZ and it will be "IN HAND" or "WITHIN ARMS' REACH" each time the plane is fueled. If this fire had burned another few seconds the top of the tank may have melted away and then it might have been uncontrollable.

Alfred Tiefenthal of Norway and I have learned from a first-hand experience. I hope it will not happen again, anywhere, but I am sure that it will - Maybe to YOU, so please be prepared.

Herb Anderson
Montrose, Colorado"

EDITOR'S COMMENT

The above letter was sent in by Long-EZ builder/flyer, Herb Anderson of Montrose, Colorado after he had experienced a refueling fire. The only other case ever reported to us was written up in CP52 and CP53. We have refueled EZ's literally hundreds of times ourselves here at Mojave where it is very dry and static electricity is quite prevalent. You can get a nasty jolt just getting out of you car. For some reason we have never had a fire. Now that we know of two instances, it is obvious that we cannot go on without doing the best job we can to prevent such a disaster.

Refueling fires, surprisingly, are not all that uncommon, even in metal airplanes. In the military, for example, the gas truck is grounded, the nozzle has a ground strap that is connected to the fuel tank near the gas cap before opening the gas cap.

We can learn from this. We are equipping our Long-EZ's with a ground lug which is connected to the gas cap ring. This is where the gas truck will connect his groundstrap instead of onto the exhaust as he usually does. We believe that a ground wire should go into the tank from this ground lug or the gas cap ring such that it is immersed in fuel even when the airplane is parked nose down with minimum fuel in the tank. When we get ready to take on fuel, the procedure will be this: a short cable with alligator clips will be kept in the EZ and will be connected to the ground lug and to the gas truck's fuel nozzle BEFORE opening the gas cap. The gas truck's grounding cable will also be connected to this ground lug BEFORE the gas cap is removed. This will drain any static off the airframe, out of the inside of the fuel tank and also off the surface of the fuel in the tank where static can build up. Then we will open the cap and pump in fuel.

The friction of fuel through the nozzle and pouring from the nozzle to the inside of the fuel tank creates static electricity but this charge will drain away from the nozzle, the tank, and the surface of the fuel through our internal cable and ground lug, as well as through the truck's ground lines.

We are not experts in this area, however, we believe what we have outlined is a good common sense approach to eliminating the threat of a fire caused by static electricity arcing from the fuel nozzle. We are open to suggestions on this potentially serious problem, but what we have outlined above is what we are doing to our airplanes, and we believe every builder/pilot should do to his or her airplane before the next time you refuel it. In addition, as Herb Anderson has recommended, we will carry a good quality Halon fire extinguisher which will be available to the pilot or person refueling the airplane. Once the refueling operation is complete, the gas cap should be closed and locked before any ground strap is removed.

We would like to thank Herb Anderson for writing his report for the CP. Taking these actions now, before it happens to you, may save you from a potentially very, very serious problem.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON "STANDARD" AIRCRAFT 2" DIAMETER OR 3" DIAMETER GAS CAP ASSEMBLY (MIL-C-7244B)

SKETCH OMITTED

Top skin is spot faced through the ring. A reverse spot face is required to remove foam and glass from under the ring, as shown, to allow the steel tube spacers to clamp up tightly onto the ring for a good electrical contact. Care must be used to avoid contaminating the inside of the fuel tank.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON BROCK FUEL CAP ASSEMBLY

SKETCH OMITTED

Use a Dremel to cut a 3/8" diameter hole through the top skin of each fuel tank adjacent to the Brock fuel cap, as shown. Remove all foam and micro down to the inside skin, but do not penetrate inside skin. Fill this hole with flox - allow to cure. Drill a number 12 hole through the cured flox into the tank close to the edge of the Brock fuel cap ring, as shown. Care must be used to avoid contaminating the interior of the fuel tank.

From CP62-5 (CH21,CH33,CH38)
High Performance Antistatic Wax.

Appropriately named Zerostatic, this new product was developed by EZ builders for EZ's and it is excellent. You can wax your entire aircraft, including the canopy, and it will greatly reduce dust build up while parked in the hangar. It is a gel that is easily applied and, best of all, it reduces electrostatic buildup - meets mil-B-8170C specifications for static decay. As an example, a Long-EZ fuel strake, treated with Zerostatic gel and polished with a high speed orbital power buffer, will have essentially no static buildup. Try it, then place your forearm in close proximity to the strake. The hairs on your arm will not react with Zerostatic, but will stand up and tingle with any other wax. Should help reduce the risk of static discharge while refueling. Wicks & Spruce have this new product in stock. Give it a try.

From CP55-7&8. (CH21)
AIRLINER WINDOW KIT
"At Burt's Homebuilder Forum during Oshkosh '87, the green light was given for Plexiglass windows in the baggage strake floors. Several builders had made this modification to provide better ground visibility for backseat navigators who don't enjoy 90 banks to identify a checkpoint. Any size or shape is O.K., as Burt relates there isn't any structural member there.

One of Arnie's Army from Iowa but me on the trail of the Micro Mesh company as a possible source for inexpensive Plexiglass windows. I spoke to the President of Micro Mesh and learned that the lion's share of their companies profits don't come from selling their famous scratch removal kits, but rather from contract work restoring airliner windows. After about 6 years of high altitude exposure to UV light, the windows develop thousands of fine scratches known as "crazing". The windows are as much as $600.00 new, but Micro Mesh polishes them to crystal clarity for $100.00 each. The good news for us is that about 30% of the windows are rejected as too thin or they contain a small chip at the outer edge from a ham handed mechanic during removal. The $600.00 rejected windows are tossed in the dumpster!

They have recently sent me, (UPS collect), 50 rejected airliner windows for distribution to EZ'ers. The windows are about 11x15x1/4 inches, and of course vary from model to model, (it's fun just going through the boxes as most are labeled L1011, DC8, etc.). The Micro Mesh kit would be required to polish them out, (I did one in front of the T.V. in about 2 hours. The chipped windows all have some degree of crazing that would likely be unnoticeable under the wing, but knowing you guys, you'll want to polish these out also.

I am offering a FAA 51 percent approved kit containing everything you'll need except engine, prop, avionics, paint and airframe. No moving parts! Price is $599.95, (such a deal for you because I like you), unless you are a member of an EZ club or support group, (such as I.V.C.H.C., Squadron I (or II), Central States), in which case price is the UPS cost. I don't know where you live so send me $5.00 and I'll mail the change to you with the windows.

Buzz Talbot
222 Sunshine
Bolingbrook, IL 60439
312-759-1124

Table of Contents for Chapter 22, Electrical System

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Update Number 66 to Chapter 22, Electrical System

****From CP66-7 (CH22)****
AUTO FUSE USERS
Many builders/flyers are now using the small ATO or ATC auto fuses instead of the expensive, bulky aviation-type circuit breakers. Mike has used these for nearly five years in his Long-EZ with excellent service results. The only drawback is the fact that you have to remove a fuse to check it.

Well, that problem has just been fixed! EZ builder, Jack Mulqueen has sent us a stack of information on a direct replacement for ATO and ATC auto fuses which is a tiny resetable circuit breaker! The company is Snap Action, Inc. They currently have a $100.00 minimum order. The VB3-M circuit breakers cost $4.00 each in quantities of less than 100 and $3.05 each in 100 or more. They have a phone (201-654-4380) for information. The model we believe will work well is Snap Action Model VB3-M, a manual, resetable, push-in-type circuit breaker that is only a little bigger than the standard ATO auto fuse. Snap Action is also coming out with an even smaller model, the Mini Model "T". Not available yet but reportedly will be soon. Stay tuned.

****From CP66-9 (CH22)****
NEW ELECTRONIC INSTRUMENT
RAF has received several enthusiastic reports on the Rocky Mountain Instruments Micro Encoder featured in Avionics Review, Jan. 1991. While we have not tested one ourselves, at least one EZ builder/flyer whom we trust is very excited about this instrument. Scaled Composites has ordered one. One of the engineers at Scaled will be putting the kit together and it will be installed in ARES, If it works well, it may be used in other Scaled test aircraft. Mike Melvill and Doug Shane will be flying the unit in ARES and we will publish a report about the Micro Encoder in the next CP.

It is a 3.2"x3.2"x7.5" box that fits into a standard 3-1/8" instrument hole and gives airspeed, altitude, rate-of-climb, outside air temperature and will connect to any transponder and altitude encoder. It also gives true airspeed, true air temperature and density altitude at the touch of a button. Many user-programmable features, like V_{ne}, V_{no}, max. gear extend, max. flap extend, stall speed warning. Also, selectable rate-of-climb from 1000 to 6000 feet per minute with trend indicators on airspeed and rate-of-climb. Sounds almost too good to be true! Stay tuned.

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Update Number 67 to Chapter 22, Electrical System

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. Don't trust anyone else with your safety. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

****From CP67-8 (CH22)****
RUSTY FOSTER'S SPACE SAVER PANELS
The mold for the Space Saver panel is now at FeatherLite. Larry Lombard and Mike Dilley can supply a panel should you need one.

All of Rusty's face plates, switches, circuit breakers, wire, etc. were purchased by Gary Bryant of Bryant Avionics, 2500 1/2 E Graves Ln, Carson City, NV 89706, 702-885-9919. Gary is more than willing to help - give him a call.

****From CP67-8&9 (CH9,CH22,CH30)****

WICKS AIRCRAFT SUPPLY CO.

We have been asked us to let you know that they now carry in stock Real Gaskets, the 100% silicon rocker cover gaskets for Continentals and Lycomings. As we have said before, there is no better gasket and no better way to eliminate oil leaks at the rocker cover.

Also, Bud Meyers says they now carry the 5" axles (1-1/4" dia.) in a slightly longer version (6" instead of 5-3/4") to better fit the heavy duty Cleveland brake installation. They also have the wider spacer for the inboard side of the wheels to facilitate the use of the heavy duty brakes. These new axles have two cotter pin holes (at 90 degrees to each other) drilled in the threaded end. (An excellent idea. ED)

Bud has researched the Snap Action fuses and circuit breakers as mentioned in CP66 and has decided to stock the Snap Action MB-1. It is smaller and weighs less than other circuit breakers and is less expensive. Contact Wicks for more information.

Update Number 69 to Chapter 22, Electrical System

****From CP69-3 (CH22,CH41)****
THE AERO ELECTRIC CONNECTION
is a book published for people who desire a working understanding of aircraft electrical systems and components. It is produced as a periodical publication of chapters on specific topics. For example, issue #1 covers d.c. electrical fundamentals, batteries, engine driven power sources, voltage regulators and grounding. Issue #2 continues overvoltage protection, low voltage warning systems, wiring, wire terminations and circuit protection. This first of a series of simplified wiring diagrams for composite airplane with high capacity alternators was published with issue #2. Issue #3 added diagrams for airplanes with and without starters plus versions using small permanent magnet, dynamo type alternators. A series of do-it-yourself avionics articles and kits are in planning. An entire issue will be devoted to providing a customizable book form wiring diagram for your airplane.

Contact: The AeroElectric Connection
Medicine River Press
6936 Bainbridge Rd.
Wichita, KS 67226-1008
316-685-8617

****From CP69-4 (CH22)****
Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00

Contact: Larry Lombard or
Mike Dilley at
Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

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Update Number 73 to Chapter 22, Electrical System

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

****From CP73-7&8 (CH22)****
FROM "GENERAL AVIATION AIRWORTHINESS ALERT" FAA AC 43-16
LONG/VARIEZE - LANDING LIGHTS

Some owners/builders of the Long/VariEze are relocating the landing lights from under the fuselage to a position outboard in an attempt to improve lighting for night landings. Several instances have shown where the builders have created a separate cell in the fuel strake for the landing light.

The submitter of the Malfunction or Defect Report stated that this is a poor choice for a device that generates so much heat. Even without a fuel leak, the amount of heat generated by these lights in such close proximity to 26 gallons of fuel is very risky. If a short circuit should develop and the fuse or circuit breaker fails to trip, the short could cause sufficient heat to melt the resin and dissolve the foam that seals the tank causing a fuel leak into the light housing. A fuel leak from a simple bulkhead seam flaw could also cause ignition simply from the heat of the light.

High amperage circuits and heavy amperage consumers should never be placed in or around fuel lines or storage cells.

****From CP73-8&9 (CH22,CH41)****
OVER-VOLTAGE PROTECTION
Most modern homebuilts today have very expensive avionics in the panel, yet few have protection from a run-away alternator. Don't think this never happens - we have reports from two builders since last CP! The cause can be as simple as a loose or badly corroded connection on the "field" nut on the alternator. The result can be the total loss of such items as radios, transponders, lorans, intercoms, even Bose headsets!

A simple fix is to use one of Bill Bainbridge's linear voltage regulators with built-in over-voltage protection. Don't risk your expensive avionics - install some form of over-voltage protection before you fly again. A truly excellent source of information on things electrical is Bob Nuckoll's AeroElectric Connection.
Contact at: 6936 Bainbridge Road
Wichita, Kansas 67226-1008
316-685-8617

The service is offered by subscription; back issues are available and strongly recommended. The major effort now is to write and illustrate a book. Work in print right now totals about 200 pages with lots of illustrations. Chapters presently cover:

1 D.C. Fundamentals
2 Batteries
3 Engine Driven Power Sources
4 Voltage Regulators
5 Grounding
6 Over Voltage Protection
7 Electrical System Instrumentation
8 Wire Selection & Installation
9 Wire Termination & Connectors
10 Circuit Protection
11 Switches. Relays & Contactors
12 Lighting & Lighting Controls
13 Antennas and Feedlines
Appendix A List of Supplies for New & Surplus Parts
Appendix H Collection of Hot Flash Newsletters
Appendix K Collection of Do-it-yourself Avionics projects
Appendix Z Power Distribution Diagrams (Big Foldouts)

Future chapters will cover noise and interference, motors and controls, audio/intercom systems, ignition systems, system reliability, pilot workload reducers. electrical load analysis, failure mode effects analysis, and how to develop a customized wire-book for your airplane. Appendix K will continue to grow. Planned projects include an audio/intercom system, hall effect battery ammeter, an accurate, used calibrated fuel gaging system, expanded scale voltmeter, and many more. Appendix D is being planned to carry excerpts from various manufacturers' catalogs with detailed information on components and supplies. Appendix S will outline custom design, fabrication and documentation services to be available soon. Issues consisting of chapters to the book are supplemented by Hot Flashes from the AeroElectric Connection: a newsletter which addresses timely topics and carries errata information for the book.

The service will shift to quarterly newsletter when the book is finished. Newsletters will carry regular features in addition to timely topics and error corrections. A planned feature is a "Catalog Watch" column where items for sale and of interest to readers will be listed. We'll carry articles from readers on discoveries or ideas they wish to share. The newsletters will provide a vehicle for periodic updates, sometimes complete replacement of chapters in the book as new technology or information dictates.

Subscriptions are $10.00 per issue. Back issues should be ordered and they are always available. Issues #1 through #4 may be purchased as a group for $32.00. Subscriptions for other than USA or Canada should include $4.00 per issue for first class, air mail postage. Book material has been planned for at least 7 issues. The Connection is published in three-ring, loose leaf binder format; a "living" work that will be updated as technology advances and/or new information is found. From time to time, Hot Flashes will be mailed to subscribers when an important subject must be addressed between regular issues of the Connection.

Update Number 74 to Chapter 22, Electrical System

****From CP74-2 (CH22,CH30)****
"Dear RAF;
At the Long-EZ's annual this spring, I made some changes which caused me a lot of misery. Relating them might help someone else who might contact you with a similar problem. I decided to install a starter (lightweight), which I had never had before. After installing my new starter switch with the start position, my engine would not run on the right mag unless the right grounding wire was disconnected. I traced wires. I ohm-ed out wires. I replaced wires. I changed starter switches. I installed new series 4300 Slick mags as my 4100 series mags had 500 hours on them and were 14 years old. The mags would operate normally when the switch was hooked up but not installed in the panel, but the right mag would cut out when the switch was installed. I replaced the capacitor in the new right mag. **Finally, my friend Frank Caldeiro figured out that the right mag lug on the switch was grounding on my radio stack tray just above the switch.** Once the switch was insulated from the radio tray, the mags worked fine. Incidentally, Chief Aircraft who sold me the mags said that Lycoming recommended the 4370 right mag and the 4372 left mag for the O-235-L2C. The 4372 has only 15 degrees of lag when cranking the engine which gives ignition at 5 degrees BTDC when you set the timing at the 20 degrees BTDC called for on the engine's data plate. My old 4100 series left mag had about 25 degrees of lag which gave me spark at 5 degrees ATDC. Tomahawks (L2C) and 152's (L2A) have had a reputation for hard starting. My L2C starts much better now than it ever did, either hand propping or cranking. I highly recommend the 15 degree lag for the left mags on 0-235-L's.

Best wishes,
Fred I. Mahan"

****From CP74-8 (CH22)****
FLUSH, INTERNALLY MOUNTED ANTENNAS
A complete line of antennas, specifically designed for, and flight tested on, composite aircraft. The antennas are tuned for maximum performance and, in general those who have used them so far, report reception is doubled over standard external antennas.

VariEze builder/flyer, Bill Butters, has started a company to develop a full range of buried antennas. These are normally supplied with a BNC connector built into the actual antenna, but can be supplied without connectors to include enough length of co-ax cable to facilitate easy installation with minimum weight and bulk. Contact: Bill Butters
Advanced Aircraft Electronics
PO Box 4111
Florissant, MO 63032
1-800-758-8632

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Update Number 79 to Chapter 22, Electrical System

Information derived from CP79 published by RAF Oct 1994

****From CP79-1,2&3 (CH22,CH30)****

325 MILES NORTH OF THE ARCTIC CIRCLE.

Dick Rutan called me from London, Ontario where he was giving a talk and asked if I would be interested in flying up to Point Barrow, Alaska - Wow! Barrow is almost 72 degrees North Latitude and more than 325 miles north of the Arctic circle. Sally did not want to go nor did Chris, Dick's fiancee. So, what the heck, I arranged to meet Dick the next day on the Friday Harbor airport. Sounded like a great boondoggle to me!

I departed Mojave the next morning and flew direct toward Friday Harbor, an island northwest of Seattle, WA. **Primary navigation was GPS. My panel-mounted King KLN 90 GPS was backed up by a Flitemate Pro GPS driving Mentor Plus' Flite Star and Flite Map which ran on my 270C MacPowerbook. (The belt and suspenders approach!). The GPS antenna was velcroed to the top of the headrest - worked great!**

Unless you have flown with a color moving map that gives you almost unbelievably accurate knowledge of your position, you really can not appreciate how neat this is. This trip proved this system out to me as the navigation system of the future. This, or something very close to this, is what we will all be flying with in the future.

The weather was great from Mojave to Portland, OR but went bad north of Portland. The clouds went from the ground to 17000 feet, so I landed at Ellensburg, WA. To my amazement, when I taxied up to the gas pump, Dick was parked there topping off his fuel tanks! He had tried to get to Friday Harbor just as I had and had landed to check the weather and try to figure out how to join up with me. Just when I was wondering how in the world I could contact him!

We checked the weather and filed an ADCUS flight plan to Nanaimo, Canada where Dick has some friends and where the weather was excellent. We overflew the weather and landed at Nanaimo where we cleared customs. We then flew on to Qualicum, Vancouver Island. We spent a beautiful day fishing for salmon and enjoying the hospitality of Dick's friends, Bob and Cherry Ekoos. They have a beautiful home on the coast of Vancouver Island.

The next morning, we departed for Campbell's River, the nearest place where we could file a flight plan (all flights, VFR and IFR, must have a flight plan filed in Canada). We filed to Juneau, Alaska and flew up the coast in light rain and low ceilings. The coastline is very rugged, lots of islands with rocky coastlines and millions of trees. There were no roads at all and airports are few and far between. There is no VFR-on-top in Canada so we were forced to remain under the solid overcast until we reached Ketchican, AK where we climbed to on-top and flew on to Juneau.

We overflew the Mindenhall glacier in the foothills just behind the city of Juneau, then landed at Juneau airport and cleared customs. This cost $25.00 a piece for each Long-EZ - the US customs was much more of a hassle than the Canadian customs. We had lunch and checked the weather. It was good all the way to Barrow! We filed to Fairbanks and flew up the coast from Juneau to Skagway, then inland over Canada to Whitehorse, then roughly along the Alcan highway to Northway, Alaska, then on to Fairbanks. It was 87 degrees F at Fairbanks and the weather was perfect, however, it was below minimums at Barrow so we spent the night at a beautiful hotel near Fairbanks airport.

The next morning, 4th of July, 1994, we filed to Barrow where the weather was 400' overcast and 6 miles visibility. We ran into rain and low ceilings in the Brookes Range and poked our noses into several passes before finding one that was marginally VFR. We flew through the Anaktuvuk Pass and over a small Eskimo village of the same name where there was a short, gravel runway - not much good for us!

The weather improved a little north of the Brookes Range and we flew toward Barrow over country that was flat and covered with thousands of lakes. There are no trees and no roads, only tundra. This was the North Slope. Gradually, a scattered undercast became solid and, by the time we reached Barrow, we were between layers at 3000 feet. We shot an approach at Barrow and broke out on the centerline of the runway at 400 feet. **The GPS-driven moving map depicted this graphically and was very comforting!**

The North Slope Search and Rescue took us under their wing and found us a hotel room and provided us with huge parkas (it was 33 degrees F). Price Brower, a Barrow native and the Chief Pilot for Search and Rescue, treated us like royalty. He flew us to every single point of interest in a Jet Ranger helicopter and later invited us to his home where we had the dubious experience of eating maktak (the skin and blubber of a bowhead whale which had been captured by Price's village). We watched the Eskimo Olympic games which were being held in Barrow and went on around the clock since it did not get dark all night.

At almost 72 degrees north latitude, the ocean was frozen as far as we could see. All of the buildings in Barrow are built on pilings and are 6 feet above the permafrost. The high on July 4th was 33 degrees F! The sun does not set at this time of the year, it simply circles around the sky about 30 degrees above the horizon!

The next morning, we headed down the coast of Alaska toward Prudhoe Bay. We flew very low and followed the coastline looking for polar bear and caribou. We saw hundreds of caribou but no bears. We did fly by two DEW lines (early warning radar sites) that are no longer needed but were still manned with skeleton crews. A more remote place you will never see! We flew a low approach to Prudhoe Bay airport (Deadhorse), then turned and followed the gravel service road that parallels the oil pipeline.

We essentially followed the pipeline almost all the way to Fairbanks. We crossed the Brookes Range via the Atigan Pass and were fortunate to clear the highest point in the pass, 6500', due to rain and low ceilings. We decided to bypass Fairbanks and flew directly towards Anchorage. The weather really deteriorated and we flew through the broad pass from Nenana through Talkeetna to Anchorage with driving rain and less than 1 mile visibility. This was our longest leg, from Barrow to Anchorage, just over 6 hours, much of it flown in heavy rain. We landed at Merrill Field in downtown Anchorage where we were met by Fred Keller and his wife, Judy.

We stayed with Fred and Judy for two nights and Fred very kindly repaired my rain-damaged prop (Dick's is a B&T with the urethane leading edge and was essentially undamaged). They lent us a car and we visited the local points of interest. It was a neat time and we needed the rest.

We departed from Anchorage and flew south over the Portage Glacier to Valdez, then on down the coast which was much friendlier here with beautiful beaches and quite a few airports. We landed at Yakutat for lunch of fresh caught halibut. This is the place for fishermen. They catch several varieties of salmon and it is fairly routine to catch 400 lb. halibut here!

After lunch, we flew on down the coast and then inland to Glacier Bay. What a spectacular sight! We continued over Gustavus where the Glacier Bay Lodge is, on down the central islands to Sitka, AK. We spent two days at Sitka which is really a beautiful place and the site of the original Russian capital of Alaska. We saw all the historical sites (Dick is a fanatic about such things!), met some really fine people, and I can tell you this: I intend to return to Sitka, sometime, with Sally.

We departed Sitka on a rainy, cloudy day and flew low along the coast all the way to Arlington, WA where Dick landed to give a couple of talks at the Arlington Fly-in. I continued on to Madras, Oregon where I filled the tanks with 100 low lead and headed south across Nevada and down the Owens Valley to Mojave. 10.2 hours of flying with one stop - Sitka, AK to Mojave, CA - 1514nm, 1741sm.

We had flown more than 6000 miles in 8 days. I used 281 gallons of fuel and N26MS performed perfectly for almost 40 hours. We both made it to the most northern point in the USA where the Eskimos showed us great hospitality. A marvelous trip in the company of a good friend. All take-offs and landings were flown in close formation, as was the approach into Barrow. We flew more than the distance from Mojave, CA to London, England in only 8 days and this trip brought back, once again, what magical flying carpets the Long-EZs are! **For a trip like this, GPS is not a luxury and should be considered mandatory. The moving map was fabulous and it was very reassuring to <u>always</u> know exactly were we were.**

Plan long trips, and go for it!

Update Number 78 to Chapter 22, Electrical System

Information derived from CP78 published by RAF for April & July 1994

****From CP78-3 (CH22,CH30)****

BROKEN STARTER CASE?

Recently, we heard of a couple of builder/flyers with this problem. It reminded us of the time we broke the starter on the rear engine of the Defiant, in flight, resulting in a single engine return and landing.

Rather than try to reinvent the wheel, I would like to recommend an article in the July 1993 *Sport Aviation*. It is written by Bob Nuckolls and can be found on page 57. If you are close to deciding on a key locking, rotary mag switch, Bob's article entitled "Magneto switch options" is mandatory reading.

There is definitely a general misunderstanding about wiring magneto switches and a mistake here can be critical to the health and well being of your starter, your engine and, maybe, even your own body! This problem is exacerbated by the use of the modern lightweight starters that are becoming so popular.

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Update Number 76 to Chapter 22, Electrical System

****From CP76-4&5 (CH22,CH37)****

A CROSS COUNTRY TRIP WITH GPS

I recently installed a King KLN-90 GPS in our Long-EZ, N26MS. The installation was simple and, the best news of all, the antenna installation is a piece of cake! (Compared to a Loran antenna.)

The King GPS is, of course, pretty much the top of the line, state-of-the-art with all the bells and whistles, and it really makes navigating, VFR or IFR, easy. The amount of information available at your finger tips is simply mind boggling.

Our first cross country with the GPS was a couple of weeks ago when we flew back to Anderson, Indiana to attend a wedding of one of Sally's nephews. We departed Mojave early in the morning and climbed directly to 17,500 feet. Breathing oxygen through our cannula AEROX system, we flew to Pittsfield, Ill, non-stop, 1333 nautical miles (1533 statute miles) in 7 hours and 6 minutes at an average speed of 188 knots (215 mph). We burned exactly 48 gallons of gas for an average of 27.7 nmpg (32mpg). Try that in your foreign car - 215mph at 32mpg! Wow, the old Long-EZ is still awful hard to beat. N26MS has over 2030 hours total time and she is nearly 13 years old. Total flight time to Anderson was 8-1/2 hours. Total flight time back to Mojave from Anderson was 10 hours. We flew back at low altitude against a headwind and used 80 gallons coming west compared to 60 gallons going east. What a difference a tailwind can make!

The GPS performed flawlessly, the accuracy was amazing and rain, thunderstorms, lightening and low altitude scud-running (all the while running a CD player) had no effect whatever on its operation. (Our Loran used to drop off the line due to static build-up in bad weather, just when you needed it most!). The King even has a simple moving map mode that is really the way to go when running under the scud in low ceiling and low visibility conditions.

In spite of the military deliberately "dithering" the satellite signals, the GPS works much better than Loran. (We had a King KLN 88 Loran.) It is much more stable, ground speed readout is close to DME for stability, whereas Loran ground speed varies constantly. I believe the military will eventually be forced to quit the "dither" which will give incredible accuracy. I also believe that GPS will be ultimately the primary enroute navigation system. Already GPS is approved for some IFR operations, so if you are in the market for a navigation system, consider GPS over Loran for potentially greater accuracy, much better weather capability, easier installation and better reception in a fiberglass airplane.

If you do decide on a GPS (or Loran), consider this: Pick one with knobs, not buttons! Buttons are very difficult to use in turbulence, whereas your fingers can grasp and support themselves while turning a knob. For use in an aircraft, a database is a must. I believe a GPS or Loran without an aircraft-type database is of rather limited usefulness.

The GPS antenna works fine <u>inside</u> the fuselage which is a big plus. It does not have to be installed on the outside like a Loran antenna must be. Also, the ground plane is not critical at all. I mounted mine, a small, flat antenna about 2"x3"x5/8", on a bracket mounted on the foreword face of the F22 bulkhead, under the canard. It works great. The GPS reported accuracy of 0.02nm essentially all the way to Indiana and back. The worst accuracy I saw was 0.04nm! See me at Oshkosh '93 for more information.

Mike Melvill

****From CP76-5 (CH22)****

NEW STEREO INTERCOM

I recently installed a PS Engineering, model PM-2000 stereo intercom and, I must say, it is divine! I have used a Sigtronics stereo intercom since the early days of my VariViggen (1977!). They have worked quite well with the exception of a slow degradation that was not really noticeable until someone who had not been in the airplane for a while noticed how bad it really was.

I had installed a car-type, front loading CD player over a year ago and I was disappointed at the quality of the sound. More than that, the microprocessor in the CD player completely trashed my King Loran so it was either the music or the Loran. I am very pleased to report that the GPS appears to be immune from any interference for the CD player and the stereo sound on our new intercom is spectacular. The PS Engineering stereo intercom has two different modes of listening to the music. You can set it so that the music remains on continually for either or both people, or you can have it fade away each time someone talks in the plane or one transmits out of the plane or the radio receives any transmissions. After the transmission has ended, the music comes back on, not abruptly as in most intercoms (such as the Sigtronic), but ramps up gently to the previously set volume - pretty neat!

The intercom is crystal clear, with a very quiet squelch break. It is voice-actuated but has the best fidelity in the squelch circuit I have ever heard. What with a quality CD player, Bose headsets wired for stereo and the PM 2000 stereo intercom, cruising along on a cross county has taken on a whole new perspective! We literally have as good, or better, a sound system in our Long-EZ than we do in our living room at home!

Mike Melvill

From CP79-10(CH22,CH30)

CAUTION

Dick Rutan reported a failure of his starter solenoid recently. The problem was that the failure caused the starter to be permanently engaged! The solenoid welded itself in the <u>on</u> position so there was no way to shut the starter off! Fortunately, this occurred during normal maintenance with the cowling off. Dick saw the problem and shut down the engine. **He has installed a "hung starter" amber light on his panel similar to what some general aviation aircraft have, and he highly recommends this precaution to anyone with an electric starter.** Had this occurred during a start-up prior to a normal flight, he would not have known of the problem and the results could have been serious damage to the starter and ring gear and may have resulted in a fire!

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Chapter 22, Electrical System

Long-EZ Plans Changes

From CP27-7 (CH22)
LPC #49 MEO Page 22-6
On circuit breakers, change "roll trim" to "fuel pump".

From CP30-9 (CH22)
LPC #78 Section I, page. Antennas.
Nav. antenna DES should be cut into two equal lengths from a 48" piece. Change the length to 22.8" long, not 24".

From CP32-7 (CH22)
LPC #98 OBS, Section I, page 22-6, center drawing.
Delete "yaw trim bracket".

From CP34-7 (CH22)
LPC #106 DES
Section I, page 22-3, system II with alternator. The wiring diagram does not show an alternator circuit breaker between the B plus alternator terminal and the battery. This protection is very important and the circuit breaker should be sized to the maximum output of the alternator. For example a 35 amp alternator should have a 40 amp breaker.

From CP36-6 (CH22)
LPC #114, MEO, Section I, page 22-3
Gear and canopy warning wiring diagram. For clarification add the correct call outs for each connection to each switch, i.e. C (common), NO (normally open), NC (normally closed). See sketch pg 9.

Weight Control

FROM CP24-4 (CH22,CH25,CH30,CH34,CH36)
WEIGHT CONTROL - Too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap -- if you address each item as, "Oh, that's only one/half pound, it's a small percent of the empty weight", you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?". Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program -- the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transit it will put a lot less stress on your landing gear. Then if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modifications.

From CP27-4 (CH22,CH30,CH34)
IMPORTANT WEIGHT INFORMATION - LONG-EZ
The most disappointing thing about the VariEze experience has been the general lack of adequate weight control by most builders. It is necessary to use diligence in controlling and eliminating each gram in order to avoid an undetected growth of many pounds. It is a reliable prediction the many Long-EZs will be built over-weight and be limited to short range or single-place operation. An equally reliable prediction is that many Long-EZs will be built with little equipment, careful weight control, and will be considerably lighter than those now flying. They will enjoy a high useful load, great takeoff and climb performance and unexcelled range.

The following information is a complete analysis of the actual weight of Mike and Sally's Long, N26MS. If you are building a Long, it is very important that you study all this information before you plan your equipment installation that you be aware of the weight impact of any additional equipment. N26MS has excellent structural workmanship, thus, most airplanes with less attention to good layups will probably be heavier than the data shown below. Study the table below. Note particularly the magnitude of the additional equipment.

N26MS was built with two conflicting requirements that added considerably to its empty weight: (a) full electric start with large alternator, and (b) pilot weight of only 108 lbs. using no temporary ballast. While the heavy electric (number 4) and ballast provisions (number 7) had the major impact on their heavy final empty weight of 883 lbs., their utility has not suffered as much as one might think. The reason is the total weight of Mike and Sally is only 263 lbs.. Thus, using the 1425 gross (owners manual page 30) their allowable fuel load is 46.5 gallons giving 1,000 mile range at 75% or 1,550 miles at 40% power, with reserves. Their allowable fuel load at normal gross is 29.8 gallons. Consider this same airplane with two 190 lb. adults as crew and without the then unrequired number 7 ballast provisions. That situation leaves only 207 lbs. (34.5 gallons) fuel for a range at 75% of only 700 miles, with reserves, or 350 miles with a 1325 lb. take off. Obviously, with that 360 lb. crew weight strong consideration should be given to using the electrical system in number 2 and eliminating as many items as possible in number 6, and 8, to provide the high utility and long range available with the Long-EZ.

We encourage everyone to use the light electrical system as in number 2. This is the one installed in the RAF prototype N79RA. Then, add only the equipment you absolutely need and diligently refrain from seemingly - "small" additions.

Note that it is possible and advisable to have the Nav, Com and transponder with the small alternator and have an empty weight of less than 720 lb. However, if you front-seat pilot weight is less than 170 lb., you should use the 25 AH battery in the nose and accept the 19 lb. increase. This will be needed anyway to balance the aircraft. Also, if you are a very light pilot (less than 150 lb), be prepared to suffer a large penalty in empty weight if you want to install an electric starter. The starter, ring gear, alternator, brackets etc. mount way back at station 150+ and will require nose ballast for light pilots.

If you are successful in obtaining an empty weight of less than 730 lb you can fly two 180 lb people with the full 52 gallons of fuel and attain over 1800 nautical miles (2070 sm) range at economy cruise - a feat considerably in excess of any other light aircraft.

LONG-EZ EMPTY WEIGHTS BASED ON N26MS

1. BASIC EMPTY WEIGHT (BEW)

VFR instruments plus g meter and turn/bank gyro. No starter and alternator, graphite cowling. All equipment and components per plans. Conical engine mount and ram inlet. No avionic, cabin heat or lights. Small motorcycle battery to power warning system and fuel pump.	693.4	lbs.
2. BEW plus the small alternator (see CP 26), including wiring and regulator (4.9 lbs.).	698.3	lbs.
3. Number 2 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	713.7	lbs.
4. BEW plus standard 60-amp alternator, starter, ring gear, belt, brackets, mounting hardware, regulator, wiring, relays and 25 AH battery (68.5 lbs.).	761.9	lbs.
5. Number 4 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	777.3	lbs.
6. Number 5 plus additional equipment on N26MS including: 500 x 5 tires, dynafocal mount, NACA inlet, landing light, Nav lights, strobe lights, cabin heat, relief tubes, primer, intercom and stereo tape player (38.1 lbs.).	815.4	lbs.
7. Number 6 plus provisions to allow Sally (108 lb. pilot) to fly at cg=102.2 (1.8" fwd of aft limit). Includes a second 25 AH battery, wiring and switches to use the second battery, and 15 lbs. of lead permanently installed in front of NG 31 Bulkhead (44.8 lbs.).	860.2	lbs.

8. Number 7 plus some extras added because they were nice and "didn't hardly weigh anything". Misc. ranging from small covers and aluminum knobs, to heavier upholstery and different fuel caps (12 "small" items 22.8 lbs.). 883 lbs.

Miscellaneous

****From CP29-5 (CH22)****

SHOPPING

Aircraft Spruce has come up with a really nice placard sheet. It is black vinyl with white printing on it, and a sticky back. It has just about everything you will ever need to label your instrument panel. They have printed each item four times so if you ruin any you have some spares. You can cut them out of the sheet with scissors, peel off the back and stick the label in the appropriate position on your panel. There is even a complete checklist and a passenger warning sticker.

****From CP30-7 (CH14,CH22)****

Wiring From The Wing To The Centersection

Cut a 2" diameter hole in the outboard bulkheads in the centersection spar, opposite the point where the wiring comes inboard through the hotwired holes in the wing cores. Mike bought some pin male and female plugs and sockets from Radio Shack and wired nav. lights and strobe lights through these plugs and sockets, breaking the wiring bundle a few inches inside the centersection spar. This enables you to reach in through the hole in the bottom of the centersection spar, and pull the wiring bundle down and out so that it may be disconnected in order to remove a wing. The comm. antenna (s) should of course also have a BNC connector at the same location. Mike ran his Nav/Strobe light wiring bundle out through the wing, together with the comm. antenna coax and has no perceptible interference. All this wiring is now brought inboard through a hole cut in the CS6 and CS7 bulkheads (a 1" diameter hole is fine) and then inboard to just inside the fuselage sides at which point you can drill up to a 1/2" diameter hole in the forward bottom of the spar box, and run the wiring down through these holes into the area aft of the back seat bulkhead.

CAUTION! Do not drill through the lower spar cap.

****From CP34-8 (CH22)****

Mag Switch Location - Ken Clunis sent this in and it is an excellent idea. Ken put his mag switches on the left side of the roll over structure. In this position they are easy to see from outside the plane, particularly if you hand prop your engine and, they are convenient to operate with your left hand while seated in the front seat. Of course they are accessible to the back seat passenger, should the pilot ever become incapacitated.

****From CP34-8 (CH22)****

28 Volt Electrical System - The main advantage of going to a 28 volt system is that all of the wiring is 1/2 the size (actually 3 wire sizes smaller). This is a considerable weight savings. All lamps, strobes, radios, etc. are available in 28 volts and the used market prices are generally less than the more popular 14 volt. Two motorcycle batteries wired in series do an excellent job. They should be manifolded and 12 V - 15 AMP hours minimum, such as you would find in a Honda 350 cc. All of the wiring can be pushed through a lightweight plastic or teflon tube 1/2" to 3/4" diameter installed down either side, from the aft seat bulkhead to the instrument panel. These can be floxed or siliconed into place. If you ever have to add a wire or two, it is easy.

****From CP36-4 (CH18,CH21,CH22,CH30,CH37)****

N26MS - Mike and Sally's Long

With 521 hours on the Hobbs, 26MS is running like a dream and continues to prove what a reliable high speed transportation machine a Long-EZ is. **I recently got tired of my combination 12V/24V system which never did work correctly.** I cut the front cover over the instrument panel off and rewired the airplane to be a 100 percent 24 volt electrical system. It was intimidating thinking about how I was going to do this, but once started it was actually quite simple to do. I have also installed Wes Gardner's fuel sight gauges (see CP 35 page 10) and must say I am pleased with the result. Also installed Wes's oil separator breather and it has worked great! No more cleaning cowling after landing.

A few weeks ago a photographer from "Technology Illustrated" took a bunch of slides of my Long-EZ for the cover of the May edition. He wanted to light up the inside of the cockpit. He handed me a remote controlled flash unit with quite a heavy power pack. Like a dummy, I laid it on my lap, not tied down. In the middle of the photo session, I hit a strong bump, the flash unit sailed off my lap and crashed into the canopy cracking it badly just in front of my head. It cracked almost clear across with a hole a couple of inches square. It scared me but once I slowed down and pulled the cracked pieces back into place, I found it to be no immediate problem and was able to complete the mission.

Sally temporarily repaired it by laying up a huge fiberglass patch both inside and out. At least we could fly until the new canopy came in. Actually went to the IVHC Agua Caliente flyin this way! I talked to Dan Patch and Phil Cornelius, both of whom had been through repairing a broken canopy.

First we cut the plexiglass canopy about 1 inch above the rail all the way around (son Keith did the work, I supervised!). This removed the broken canopy. We turned the frame over and cut through the fiberglass just inside the edge of the plexiglass lip. This allowed us to peel out the fiberglass piece that fitted the original plexiglass bubble exactly. This thin glass "frame" was carefully layed into the new "bubble" and was used to layout where it should be trimmed in order to fit. While I cut the new bubble, Keith broke out the remaining plexiglass with a vice grip, a hammer and wood chisel and a dremel grinder. The plexiglass does not come out easily. After the frame was cleaned up, the new bubble fitted almost perfectly. We floxed it into the frame and let it cure over night. Next morning, I trimmed and sanded. I microed in all the voids and the layed up two plies of BID over the plexiglass up onto the inside of the frame. I let this gel up for a few hours, then reinstalled the whole canopy/frame onto the airplane. I locked it down and let it cure for two days. This assured that it would fit the fuselage. Later I removed it, cleaned it up and sprayed the charcoal Zolatone inside the canopy frame. I did not have to repair the outside frame. The new canopy gives me a little more head room (not all canopies are alike!) and the visibility without the fiberglass patch is superb!!

****From CP36-7 (CH3,CH22)****
Aircraft Spruce has the following new items available:
Electric cockpit heaters, same as Mike has in Long-EZ, N26MS, see CP35.

12V 14 Amp manifolded batteries Yuasha #YB14LAZ as called out in CP35.

B & D Tachometers, expensive but the best you can get, 2 1/4" electric, accurate, reliable, same as in Mike's Long-EZ N26MS.

Pizza Cutters, for cutting fiberglass, excellent. But must be used against a resilient material.

****From CP37-3 (CH9,CH21,CH22,CH30)****
Long-EZ builder, T. Dinneen has the following suggestion for obtaining an engine for your Long-EZ. He paid $7,500 for a 1978 Tomahawk in good flying condition. Not only did he get an airplane to fly and stay current in, but he also got:
1) A Lycoming 0-235 L2C engine complete, including a mechanical fuel pump with 920 hours total time
2) **A full gyro panel and instruments**
3) 500 x 5 wheels, tires, brakes, axles and master cylinders
4) **720 channel com, Nav and VOR head**
5) **Transponder**
6) **Nav lights/strobe anticollision light system**
7) **ELT** and seat belts
8) **Circuit breakers, engine instruments and battery**
9) Fuel plumbing, fuel valve, electric fuel pump etc.

In addition, he figures he can sell the airframe for about $1,000.00 after he has 'gutted' it. This means he has laid out $6,500.00 for the lot. On top of that you can bank finance the whole deal. Check Trade-a-Plane for "deals" on Tomahawks!

****From CP37-5 (CH22)****
Solar Panels designed by Solair Development Co., available from Aircraft Spruce and Specialty. $188.00

****From CP41-6 (CH22,CH39)****
A Long-EZ was seriously damaged after the engine failed a few moments after take off in Minnesota. The pilot executed a 180 degree turn and attempted to land on the runway he had just lifted off from. Unfortunately he misjudged his glide landing on the last 1/3 of the runway. A 15 knot tailwind did not help and he rolled off the end, down a slope into a ravine. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger suffered only minor cuts and bruises. There was no fire and in fact neither of the fuel tanks was even damaged. An FAA/NTSB investigation failed to reveal any clue as to why the engine had quit. The aircraft had had a similar incident occur just a few days prior to this accident. That time the pilot managed to execute a safe landing. A careful examination of the engine, mags and carburetor revealed nothing. The airplane was then successfully tested, and in fact had flown from southern California to Minnesota with no problem at all.

We talked with the pilot this morning and while driving his damaged airplane home, he had plenty of time to try to think of all that had happened and why it had happened. He came up with a theory that certainly could have been the cause. **This airplane had the mag switches (two toggle switches) mounted on the left side of the roll over structure.** The switches were not covered or protected inside the roll over structure. Two spiral bound note books were stored in the roll over structure. The pilots theory is that possibly one or both books moved against the terminals of the mag switches and possibly shorted the mags to ground. This would certainly cause the engine to quit. This will be investigated further, but it certainly is something to think about. If you have your mag switches installed in your roll over structure, insulate the back of the switches or install a cover over them to prevent anything from coming in contact with the bare terminals.

****From CP57-13&14 (CH22,CH41)****
ELECTRICAL WIRING AND ASSOCIATED PROBLEMS
Wiring an airplane is relatively easy for some builders and very difficult for others, depending on your background/experience. If you are one of the latter, try contacting Bob Nuckolls. Bob has been in electronics and aircraft wiring for over 20 years and is incredibly knowledgeable about the dumb little nit-picking questions I always seem to have. Finally, here is a guy that can answer these questions and not only that, but he speaks a language even I can understand! The best news of all is that Bob is now writing a neat newsletter called "The Aero Electric Connection". He plans on producing two of these a year and the subscription is $20.00 annually with a $2.00 deduction if you an EAA member and a further $2.00 deduction if you are a member of AOPA.

The first edition, Volume 1, number 1, is now out and we have it in our hot little hands! It is excellent. He encourages you to send him wiring problems or questions which he will research and answer in his newsletter. What a deal, this man knows his electrical stuff and we heartily recommend subscribing to his newsletter or, at least, writing him with your question.

Bob works with Bill Bainbridge of B&C Specialties and the linear voltage regulator Bill sells is one of Bob's designs. Contact Bob Nuckolls at "The Medicine River Press"
PO Box 12703
Wichita, KS 67277-2703.

****From CP60-3 (CH22,CH41)****
THE AERO-ELECTRICAL CONNECTION
Specifically, a very smart electrical engineer named Bob Nuckles, is alive and well. Bob can help with wiring and electrical problems and his newsletter is well worth subscribing to. Bob will be at Oshkosh and will be conducting a couple of seminars consisting mainly of question and answer sessions. If you have any electrical questions, wiring, radios, loran, etc., don't miss the opportunity to get help in person from Bob. His forums will be at 3:30 pm Sunday and Tuesday, and 10:00 am Thursday.

****From CP60-6 (CH22,CH39)****
A FLORIDA VARIEZE crashed during an attempted forced landing and the pilot, the only occupant of the aircraft was fatally injured. An eye witness reported that the engine cut out and that the pilot subsequently attempted to land on a road. A local EZ builder/flyer reported to RAF that he believed the pilot may have accidentally turned the mag switches off. The mag switches in this airplane were small toggle-type switches mounted high in the center of the instrument panel close to the air vent. The theory is that perhaps because it was hot, the pilot may have attempted to adjust the air vent and accidentally knocked the toggle mag switches off. Of course, no one will ever know for certain, but this theory is plausible and we have certainly seen mag switches mounted like this that could easily be inadvertently switched off.

Use only the "locking" type switches, the ones you have to pull out to move up or down. Or place the switches where they could not possibly be accidentally turned off or on without the pilot's knowing about it.

****From CP61-12&13 (CH22,CH41)****
"The Aero Electrical Connection", a homebuilders guide to the design and construction of aircraft wiring and electrical systems. This publication, a newsletter that, unfortunately, comes out rather infrequently, is positively the best source for anyone trying to wire up a homebuilt aircraft. It is especially good for those of us who are trying to complete plastic airplanes such as EZ's, Defiants, etc. Bob Nuckolls is an extremely knowledgeable electrical wizard who can and will answer your questions and help solve your problems. The newest newsletter, Volume 1, #2 has an excellent schematic wiring diagram in it, specifically for composite aircraft using an alternator and starter. Contact:

The Aero-Electrical Connection
PO Box 12703
Wichita, KS 67277-2703
Subscription is $20.00 per year.

****From CP63-4 (CH22)****
CAUTION - OVERHEATED NAV LIGHT SWITCHES
"Dear RAF;

During a recent flight in our Long-EZ, N888EZ, there was A sudden, terrifying smell of smoke! Turned off all power and made it to an airport. A careful examination of the electrical system disclosed a rocker switch (standard Cessna part) had overheated and melted. This switch had push-on, spade connecters, and apparently over the years, one connection had oxidized enough between one spade lug and the push-on connector to create a high resistance. This, together with a 7 amp current draw (nav lights), heated the lug and internal parts of the switch enough to melt the housing, rocker and some other plastic internal parts.

This switch is used in all single engine Cessna airplanes and is a SPST radio switch, P/N S2160-1. This switch is both UL and CSA (Canadian equivalent) approved. It is worth noting that it is a CSA requirement (but not UL!) that electrical components using plastic materials can not burn. They can smoke, but must not burn. Builders should look for the stamp SA on their plastic electrical components.

What did I learn from this? Probably that screw-type lug switches are the right type to use even though spade connectors are more convenient. These Cessna-type switches are cheap at only $2.15 each even at Cessna's inflated prices, but it could have cost a lot more in hardware and even human life if it had failed only one hour earlier when I was on a night IFR flight from Las Vegas.

I will quit writing now because I need to get to the store to buy some better switches - - - - -

Dick Kreidel

****Also see CP37-3 in the "Miscellaneous" section of this chapter.****
****Also see CP51-9 in the "Space Saver Panel" section of this chapter.****
****Also see CP30-7 in the "Instruments" section of this chapter.****
****Also see CP46-3&4 in the "Loran C" section of this chapter.****

****From CP25-4 (CH22)****
RETRACTABLE LANDING TAXI LIGHT INSTALLATION DRAWINGS FOR LONG-EZ - are now being shipped with Long-EZ plans. If you did not get this drawing with your plans, send a self-addressed-stamped envelope to RAF. This drawing is too large for the newsletter.

****From CP28-9 (CH22)****
Wicks Aircraft Supply and Aircraft Spruce report that they now have the Welen "single" flash wingtip lights, strobes and power supplies as per Long-EZ plans.

****From CP32-7 (CH22)****
We recently saw an excellent little panel light (very light weight), low drain and adjustable. This light is available from:

David Hoffman Products
1009 Old Mill Road
Auburn, AL 39830

****From CP33-7 (CH22)****
David Hoffman Products
1009 Old Mill Road
Auburn, AL 36830
(205)821-8942
Dave has very light weight cockpit lights for $12.50 each. Includes postage, or these lights can be bought from Aircraft Spruce, same price.

****From CP33-7 (CH3,CH22,CH30,CH38)****
Aircraft Spruce is now stocking the AOA oil analysis kits for $8.95. **The David Hoffman cockpit lights are in stock for $12.50 each.** They are changing to Latex gloves instead of vinyl, same price and they will also be stocking cotton liner for the Latex gloves.

****From CP49-6 (CH22)****
LANDING LIGHTS
Mike and Sally's Long-EZ has a 28 volt system and for the past 5 years, they have flown over 1130 hours including approximately 100 hours at night. They have always used a GE sealed beam, #4594 (100 watt, 28 volt) landing light, and Mike has always wished for more light. This would, obviously, be very beneficial in the event of a forced landing at night. Finally, a few weeks ago while visiting Dusty and Brenda's airplane parts store, Vista Aviation, on the Whiteman Airport, there it was, a 28 volt, 250 watt, par 36 landing light! He purchased and installed it immediately and reports a huge improvement. For those of you who have 14 bolt systems, Dusty has 14 volt, 250 watt, par 36 landing light sealed beam units. In fact, he has the whole range:

Part #4509-14 volt, 100 watt
Part #4313-14 volt, 250 watt (requires 25amp C/B)
Part #4594-28 volt, 100 watt
Part #4596-28 volt, 250 watt (requires 15amp C/B)

See VISTA AVIATION under "Shopping"

****From CP65-5,6&7 (CH21,CH22,CH33)****
LANDING LIGHTS AND COCKPIT NIGHT LIGHTING.
Why does the Long-EZ have its landing light where it is? Initially, the prototype Long-EZ had no landing light. It also had no navigation or strobe lights. When Dick Rutan wanted to try for the Closed Course Distance Record in the C1B class, it was obvious that night lighting would be required. Dick and Mike hurriedly designed, built and installed a "fold out" type landing light under the right thigh support which was somewhat similar to the present plans call-out for a Long-EZ.

The light worked quite well, but due to its design, it was difficult to extend and it took up storage space under the thigh support. This led directly to the present landing light design. While there are probably a lot of EZ drivers who have landed their EZ's at night, there are probably a lot more who have not.

There are several requirements for an effective landing light on an EZ. One of the most important is that it have the capability to be correctly pointed for landing and then re-positioned for taxiing. An EZ approaches to land, nose high. The Cessnas and Pipers that many of us learned to fly in, do not. Due to their flaps, they normally approach nose down. This means that a landing light on an EZ must point down to a much greater degree than the light in a Cessna. Once this angle is determined (by trial and error), it will be immediately obvious that this light is now essentially unusable for taxiing since it points at the ground directly in front of the nose of the aircraft and the pilot can only see forward for about 6 to 8 feet. If this light is adjusted to make taxiing possible, it becomes useless for a landing light. That is why it is adjustable and must be adjustable at least to these two positions.

This pretty well eliminated using the nose mounted landing light that Burt had called out for the VariViggen back in the early '70's. Some VariEze builders did use this type of light but not many used it to actually land at night. Those who use it regularly found they needed to have a two position adjustment, usually a cable driven, difficult-to-design and-build device.

A number of EZ's have the landing/taxi light mounted in the leading edge of the outboard fuel strakes. We rejected this idea very early on because we were concerned about these lights reflecting on the canard, lighting up the canard and blinding, or at least hurting, the pilots night vision. This editor would welcome constructive comments based on actual experience using this type of landing/taxi lights. One definite advantage would be to make it easier to flash a landing light while flying at cruise speed.

Using the Long-EZ plans landing light requires some practice and a couple of little tricks only learned by experience. If you have never used your landing light at night, you are in for a surprise! The first time you turn it on and extend it, it will probably light up the interior of the front cockpit! It will tend to blind you by glaring off the nose gear strut into the little plexiglas window between your legs. Here are a few ideas to help you with these problems.

First of all, you should paint the inside of the nose wheel well flat black. Also, the inside of the trough where the nose gear strut fits while the gear is retracted should be painted flat black. The aft face and both sides of the nose gear strut itself, including any nose gear doors or covers should be flat black. Make a small cover (a piece of engine baffle rubber works quite well) that can quickly and easily be installed over the plexiglas window through the lower instrument panel. Velcro works really well here. Do not permanently cover this window. For daytime and night flying, this window can save your butt by allowing the pilot to verify that the gear is indeed down. Extend the nose gear, extend the landing light, verify that the gear is down, then install the window cover to completely block any light. With the landing light on, you should get no reflected light through the plexiglas window or through the fiberglass wheel well. If you do, take whatever steps it requires to correct this.

The above evaluation should be conducted on the ground, at night. Before you go flying at night, you should address all of the above suggestions and satisfy yourself that you are comfortable with the landing light's effectiveness. Focus the light to an optimum taxi position and practice taxiing at night. Keep in mind that you will have to depress the light considerably from the optimum taxi position to the optimum approach-to-land position.

This editor has logged over 300 hours of night flight, many of those hours in a Long-EZ. The way I use the landing light is as follows: I slow to about 100kts on base and extend the landing light to what I feel is about the correct position. Once established on final, I fine-tune the landing light until I can plainly see the runway numbers illuminated by the landing light. (Mine is a 250 watt light and, as such, easily lights up the approach end of the runway). I continue to slow to reach touchdown speed just above the runway. I use a small amount of power right to touch down and I drive it on, rather than, flare for a "greaser" type landing. This avoids the problem of dropping it in and it also helps keep the landing light focused on the runway and not up in the sky (as it might be with a very nose high, fully flared touchdown). Once the nose wheel is rolling on the ground, I readjust the landing light to clearly illuminate the runway/taxiway in the 3 point position. So much for the landing light - if you have only a 100 watt light and you do actually fly at night, you should replace the 100 watt with a 250 watt. 14v 250w #4313, 28v 250w #4587.

Now to address the instrument panel lighting. An airplane with a canopy rather than a windshield presents a rather more difficult cockpit lighting problem due to the "fish bowl" affect. This is the result of all the panel light being reflected in the bowl shaped canopy and making it difficult to see outside. In this editor's opinion, the very best form of instrument lighting (to help cut down the fish bowl affect) is internal lighting in each instrument. Unfortunately, this is not available on most aircraft instruments but you should use it where possible such as VOR heads, engine instruments, etc.

The next best lights, I feel, are post lights. The least desirable form of lighting would be a flood light. A good dimmer switch is important, particularly when you are taking off or landing and need to maximize your ability to see outside. Dim the instrument panel lights down as much as possible while still being able to read the critical instruments. With post lights, there should be two to each critical flight instrument - airspeed, attitude, altimeter and rate of climb. These post lights can be turned to focus their small red glow to best illuminate each instrument.

Now, sit in your airplane at night with the canopy closed. You may be surprised to see just how much reflection you have in the canopy. You should obtain a piece of cardboard or fairly stiff paper, painted flat black, and cut it to closely fit into the forward end of the plexiglas canopy at the bottom edge of the plexiglas (where the plexiglas is retained in the canopy frame by fiberglass). You should ideally be able to secure this stiff paper in place with velcro or something similar. While seated in the normal position in the seat with the canopy closed, your eye should see only the aft edge of this cardboard or paper. It must not restrict your view of the instrument panel or your view outside through the canopy. You should now have zero glare or "fish bowl" affect on the canopy. Cut the aft edge of the flat black cardboard away as much as you can to give you more physical room but not so much that you get the glare on the canopy. This must be done at night with the cockpit lights on. You should experiment, by trial and error, until you get it right.

All this may seem like a lot of trouble to go to but, believe me, if you plan on flying your creation at night, you will be very glad you took the time. Just be sure that this paper glareshield does not restrict your visibility of the instruments or of the outside. It should be soft enough to collapse out of the way in the unfortunate event of an abrupt stop or accident.

One other point. Flying at night can be a beautiful experience. It can also become a terrifying and dangerous experience if anything at all goes wrong. Flying a single engine at night is considered by many to be an unacceptable risk. Away from an airport, an engine or prop failure at night will almost certainly result in an accident and the chances of surviving an off-field landing at night are so small as to be essentially non-existent. This is a decision you, the pilot, must make. The information in this article is to assist you should you decide to fly at night. It is absolutely not intended to encourage you to do so.

Alternators/Regulators

Also see CP34-3 in the "Loran C" section of this chapter.
Also see CP37-3&4 in the "Loran C" section of this chapter.
Also see CP40-3 in the "Loran C" section of this chapter.
Also see CP50-3 in the "Battery" section of this chapter.
Also see CP60-3 in the "Battery" section of this chapter.
Also see CP61-12 in the "Battery" section of this chapter.
Also see CP63-12 in the "Loran C" section of this chapter.

From CP26-11 (CH22,CH30)
B & C Speciality Products has developed a lightweight aircraft power generating system. This system was specifically developed for today's weight-sensitive homebuilt designs and has undergone extensive in flight service testing.

Two models are available, one is a gear driven alternator. This bolts onto the alternator pad on the accessory case of the C-85, C-90 and O-200 engines. The other alternator is belt driven, designed for the Lycoming O-235. Can also be adapted for other engines. The complete alternator system weighs only 4 1/4 to 4 3/4 lbs., depending on the type of drive.

B & C Specialty Products,
518 Sunnyside Ct
Newton, KS 67114
(316) 283-8662

Note: RAF is currently testing the B & C lightweight alternators on our VariEze and Long-EZ. Their kit is very nicely done and easy to install. Performance and support by Mr. Bill Bainbridge has been excellent. Many of you saw these at Oshkosh.
PHOTOS OF B & C ALTERNATORS OMITTED

From CP26-11 (CH22,CH30)
John Friling made his own lightweight alternator for his Continental powered VariEze. John purchased an alternator from a Yanmar Japanese garden tractor.
Part # 942131-41410 (stator)
Part # 942741-42299 (magnet wheel)
Part # 49-401-01 (Kohler regulator, 15 amp)
John used his old Continental generator shaft, bearings and flange, (see photos). John has a really nice set of drawings for those of you who would like to make one like his.
John Friling
852 Westgate Drive,
Addision, IL 60101

PHOTOS OMITTED

From CP39-7&8 (CH3,CH22,CH30)
B & C Specialty Products new Linear Regulator will be available in February. The regulator will work with their 35 amp alternator or your standard aircraft alternator. Also included are the following features:
1. Will work with standard aircraft alternators, or automotive type 14 or 28 volts.
2. Over-voltage protection with built-in logic to prevent nuisance tripping from inductive loads.
3. Flashing high-low voltage warning lights with 100 percent press-to-test of associated circuitry.
4. Uses linear type regulation to reduce RFI.
5. Ideal for use in composite aircraft with Loran C or ADF.
6. Regulator output is short circuit protected.

B & C is also selling the Apollo I Loran C for $1,590.00, which includes the preamp and radio tray. The Loran C is only 2" high, 6 1/4" wide and 11" deep.

If you want to save a lot of time when you are cutting your fiberglass cloth, try a heavy duty rotary cutter (similar to a pizza cutter). B & C has a special price of $11.00 for one knife with one extra blade. Additional blades are available for $2.50 each.

The Lightweight 12 amp gear driven alternator that B & C has been making for the Continental 0-200 is still available.

If you would like more information on any of these products please send your aircraft and engine type along with a long SASE to:

B & C Speciality
518 Sunnyside Court
Newton, KS 67114

****From CP49-4 (CH22,CH30)****
Bill Bainbridge of B&C Specialty has completed a two year development program on a lightweight starter for Lycoming O-235 through O-360's. This starter weighs 10.2 lbs and is about 8 lbs lighter than a geared Prestolite starter or about 6 1/2 to 7 lbs. lighter than a standard starter such as found on an O-235 or O-320. Fred Keller has installed two of Bill's new starters on his Defiant and he is very pleased. They crank the engines better in cold weather than the standard starters do, and he saved about 14 lbs. Bill will have his new starters at Oshkosh '86. **Of course, Bill still offers a full line of lightweight alternators well suited to EZ's as well as his really high quality linear voltage regulator which is highly recommended if you intend to install a Loran-C.**

Contact: Bill Bainbridge
B&C Specialty Products
518 Sunnyside Ct.
Newton, KS 67114
316-283-8662

****From CP51-8 (CH22,CH30)****
B&C lightweight Products - Bill Bainbridge
518 Sunnside Court.
Newton, KS 67114
(316)283-8662

We recently installed one of Bill's really fine LR-2 Linear Regulators (28v) and two of his 15 amp hour, 12 volt sealed batteries (never add water! - no drain required!) in our latest aircraft and, frankly, we are very impressed. We have, at times, cranked that aircraft engine (TIO-360, 210 hp, turbo-charged) for long periods with no sign of battery fade. The voltage regulator is the best we have ever seen and has built-in overvoltage protection. It also has a self-test feature and a low voltage warning light. Quality, as with all Bill's products, is truly superb. Bill's 10.2 lbs., 14 volt starter, of course, was the sensation of the show at Oshkosh last year and is really a fine unit. Fred Keller installed two on his Defiant and is very pleased with the weight savings and excellent cranking power. AVCO Lycoming is currently running an extensive test and evaluation on Bill's starters with a view of offering them on some of their engines. Bill is still working on the 28 volt model and hopes to have it available at Oshkosh 1987. Look for Bill and his electrical products in his booth (not far from the RAF booth) at Oshkosh this year.

****From CP64-4&5 (CH22,CH37)****
MOJAVE-WILKESBORO, NC-LONG ISLAND, NY-MOJAVE IN LONG-EZ N26MS
Sally and I had planned this vacation for months. We were ready and so was our Long-EZ.

We lifted off runway 7 at Mojave at 5:55AM and headed East. I climbed at 140 kts. indicated which, at our weight, yielded a 600 FPM climb. The Northstar showed a ground speed of 185 kts! Great tailwind even during the climb. We donned our oxygen cannulas (AEROX - simply the best - 11-1/2 hours duration with two people at 18000') and climbed to 17500 feet. Once we were level and trimmed out, we were looking at a true speed of 173 knots. while burning 6.4 GPH. The winds were pretty much on the tail giving us a ground speed that never fell below 200 knots for the first 1000 NM. At times, we saw 220 knot ground speeds on the loran.

Unlike the terrible weather I had experienced flying the 0-235 powered Long-EZ over approximately the same route (See CP63), we had glorious blue skies essentially all the way from Mojave to New York.

We stopped for gas in Rogers, Ark. then pressed on to Wilksboro, NC. Flying time was 9-1/2 hours. We used 63 gallons for an average fuel burn of 6.7 GPH. Not bad when you consider two climbs to 17500'! We averaged right at 30 NMPG (34 MPG) on the trip from Mojave to Wilksboro mostly due to strong tailwinds.

We had a marvelous 3-day weekend at a hot air balloon festival run by our old friend and VariEze builder/flyer, "Mule" Ferguson. We flew in hot air balloons, we chased hot air balloons all over the countryside and we had a ball. Thanks a million, Mule and beautiful wife, Debbie.

The trip from Wilksboro to East Hampton, Long Island, NY at 11500' took only 2.7 hours. Again, we got lucky and had a huge tailwind. We flew under the NY TCA at 500 feet, just off the beach. Quite an experience. You fly so close to Kennedy you can almost look into the windows of the airliners waiting to take off!

Although the route flown was not exactly the same, it was close. The 0-235 powered Long-EZ used 99 gallons and the trip took 18-1/2 hours. This time, our 0-360 powered Long-EZ used 83 gallons and the trip took 12.2 hours. The tailwinds had a lot to do with it, though - it took 16:10 to fly back to Mojave, bucking strong head winds and awful weather, at least to Ohio. Average fuel burn on the trip home was 8.8 GPH - the price you pay for the big engine if you can't go up high enough.

We stayed with a friend on Long Island and he and his wife saw to it that we had a splendoriforous time. We flew to Boston, then to Newport, RI. (Saw a completed Rutan Solitaire on the Newport airport.) We flew into New York City, flying down the Hudson river at, or below, 600 feet to stay below the TCA. We flew by the Statue of Liberty and landed at Linden, NJ. We spent 3 days in New York City and loved every minute of it.

We departed from Linden on a cloudy, low ceiling day and "scud ran" in driving rain for almost 4 hours! We landed for fuel in Burlington, IA and discovered that our voltage regulator had died. Sally called Bill Bainbridge of B&C Specialty in Newton, KS and he invited us to drop in. He also offered to trouble-shoot the problem, fix it or replace the B&C linear voltage regulator. He was as good as his word and, when he could not find the problem, he replaced the regulator. **As we lifted the broken one out of the nose, it was dripping water! Bill took the lid off and, low and behold, it was full of water! Stupidly, I had installed it directly under the access door in the nose and my door does not have a good seal. Flying for hours in pouring rain had somehow caused water to get into the regulator and shorted it out! A valuable lesson - do not mount your voltage regulator where rain can get to it!**

While I am on the subject of Bill Bainbridge and his B&C Specialty Company, I would like to thank Bill and his delightful wife, Celeste, for their hospitality and kindness. Bill really does have a neat little company in Newton. I got a tour of the facility and was tremendously impressed. The lightweight starters, the linear voltage regulators, the various alternators, etc., all are built with incredible attention to detail. You have to see these accessories going together to appreciate just how much superior they are to anything else out there. By the way, you can order a brand new Lycoming 0-235, 0-320, or 0-360 from the factory equipped with one of Bill's beautiful starters! Bill really cares about us homebuilders and he strives to provide us with excellent parts designed to not only provide excellent service but also to give us the best possible performance and long life. The linear voltage regulator also provides absolute protection from an over-voltage spike thus keeping your expensive avionics safe. Before buying less expensive starters, alternators and voltage regulators, take a hard, critical look at what you get - believe me, I speak from experience!

We flew out of Newton during a summer thundershower and ended up fighting thunderstorms and rain all the way to Gallup, NM. From Gallup to Mojave the weather was perfect except for a 30 knot headwind.

N26MS now has 1630 hours on her. She first flew in 1980 which makes her almost 10 years old.

We have been all over the lower 48 states as well as Alaska and our Long-EZ has served us well. No question, our lives would not be the same without her. She has been ready to fly us anywhere, virtually anytime we wanted to go. Airframe maintenance has been essentially zero. Engine maintenance with the 0-235 was more than it should have been. We topped it twice in 907 hours. This was probably due to my running it too hard! The 0-360 has required no maintenance during the last 720 or so hours. We have had to have both magnetos worked on and we had an alternator failure once. We are extremely satisfied with our Long-EZ and would not trade it for anything.

Mike and Sally Melvill

****From CP65-10 (CH22,CH30)****

LORAN INTERFERENCE PROBLEMS?

Mike recently installed a King KLN-88 loran in his Long-EZ, N26MS. At around the same time, he installed a new alternator because the old one stopped alternating! The replacement was identical in appearance but apparently something was different because the King did not work as well as his previous Northstar. After much testing and checking around, he was advised to install a Hisonic RFI-70 in-line noise filter. He obtained one through Pacific Air Radio in Van Nuys and installed it close to the alternator by cutting the main power wire from the alternator to the buss (battery) and running this wire through the Hisonic RFI-70 filter. The signal-to-noise ratios jumped up by a factor of 2! He is very happy with his King loran and recommends the Hisonic filter. They are expensive at around $100.00 ea. but are very effective. Dick Rutan has one installed in his Long-EZ with the same excellent results. Dick, in fact, was the person who advised Mike to try the RFI-70

Contact: San Val
7456 Valjean Ave.
Van Nuys, CA
818-786-8274
or

Pacific Air Radio
16143 Waterman Dr.
Van Nuys, CA 91406
818-786-8800

Space Saver Panel

From CP31-8 (CH22)
Rusty Foster has developed a very nice space saver console that fits on the right side above the stick. This prefab panel will fit into a VariEze or Long-EZ. See photos. This looks like an excellent idea, is light weight, and a practical method of getting more room on your instrument panel for avionics/instruments.
Contact: Rusty Foster
P.O. Box 4273
Ventura, CA 93004

From CP31-10 (CH22)(Photo Caption)
Rusty Foster's space saver side panel for Long-EZ. See page 8.

From CP36-7 (CH22)
Rusty Foster's Space Saver Panel
We recently got the opportunity to examine Rusty's latest Space Saver Panel Kit. It is excellent. The instruction booklet is very well layed out, clear, concise and also contains a lot of useful hints and ideas. We have seen several of these panels installed in both VariEzes and Long-EZs and they not only look great but they allow more efficient use of the instrument panel space.
Contact: Foster's Modular Design Co.,
P.O. Box 4941
Ventura, CA 93004
(805)642-6308

From CP42-8 (CH22)
Rusty Fosters Space Saver panel has been refined even more! Rusty has done a truly superb job with this prefab fiber glass panel and he sells it as a kit with an excellent set of instructions for the do it yourself builder or he sells it completely prewired, ready to install. Rusty recently moved from the Santa Paula area to northern California. For more information contact:
Rusty Foster,
P.O. Box 1569
Portola, CA 96122
916-832-5993

From CP47-13 (CH22)
Rusty Foster has a new, improved design for his well-known "Space Saver" panel. This panel is pre-wired and includes 20 circuits. All switches (rocker type) are rated at 20 amps - 14 volts, and the appropriate circuit breakers are installed and wired. A wiring diagram suitable for a Long-EZ or VariEze is included.
Contact: Rusty Foster (Foster's Modular Design Co.)
PO Box 1569
Portola, CA 96122

From CP50-4 (CH22)
Rusty Foster's Space Saver side panel is now better than ever. Rusty has redesigned it and it now looks like something off a space shuttle - really a beautiful piece of work. Puts all of your circuit breakers and switches on the right side above the control stick.
Contact: Rusty Foster
P.O. Box 1569
Portola, CA 96122
(916)832-5993

From CP51-9 (CH22)
SOMETHING NEW FOR EZ BUILDERS by Rusty Foster
The Space Saver Panel has been modified to keep up with EZ builders' new ideas. The switches are the same, except for an additional radio master switch. The original Space Saver Panel had 13 circuits and a 30 amp main breaker to protect the battery. The modified Space Saver Panel has 17 circuits plus a 35 amp main breaker that protects the alternator to comply with the B and C alternator circuit. 6 of the circuits use auto-type (ATO) fuses. The only drawback I see with these type fuses, is the minimum size fuse they manufacture is 3 amp so this would mean in-line fuses below 3 amp. The warning system and fuel system circuits were purposely installed on the radio master buss to prevent electrical spikes if you are using the Ayton Warning system or the Act Easy Fuel level gauges. Another change is the addition of the 12 watt rheostat using up to a 12 watt lamp. You don't need much light if it is in the proper place.

Manhours for wiring is what made the original Space Saver Panel expensive. The new Space Saver is assembled for you and the buss work done. No terminal blocks are provided and none are needed (except for the ground buss). Run your wires direct to the panel and hook them up. Using shielded wire is really not practical (except for the mag. ckts) running your wires through a grounded conduit would be easier to do. The instruction booklet comes with each unit showing you how to wire the Long-EZ using the Space Saver Panel. You have a choice of black anodized or gold (it's more bronze than gold) anodized face plates.

If you are using Zolatone paint in the cockpit, you may want the unfinished Space Saver Panel. - 35 ampere	$525.00
If you are using enamel in the cockpit, you may want the Gel-coat Space Saver Panel.	550.00
If you want the 60 ampere Space Saver add	25.00
If you want the Warning System installed, add	60.00
If you want the RST Voltmeter installed, add	40.00

If you want Special circuits - $20.00 per hour plus parts.

A $200.00 deposit is required (shipping and sales tax not included in the above prices). Allow 60 days for delivery.

Instruction Booklet	25.00
California Sales Tax	1.50
Shipping and Handling Charges	3.00
	29.50
Warning System Module only	20.00
California Sales Tax	1.20
Shipping charge	1.00
	22.20
Oil Pressure Module "B" only	20.00
California Sales Tax	1.20
Shipping charge	1.00
	22.20

The trend today is some of the builders are buying engines that came out of aircraft with 28 volt systems. Rather than change the system to 14 volt , it is an advantage to use the 28 volt system. For example, lets say you are using the 35 amp Space Saver 14 volt system. You have calculated your load to be 30 amps. Now without changing your load you decide on the 28 volt system. Your load then drops to 15 amps. Now you have two ways to go - one; you can reduce the wire size because you are not drawing as much current or, two; you can increase you load by 15 amps more. Most builders choose to increase the load. Another example, supposing you are using the 60 amp Space Saver 14 volt. You have calculated you load to 50 amps. Now you change to the 28 volt system, as before your load drops by one half or as in this case the load would be 25 amps.

The FAA acceptable methods manual, "EZ-AC 43,13-1A & 2A", provides us with a wire chart that shows a 12 ft run at 35 amps has to be #8 wire. A 12ft run at 45 amps has to be #8 wire. A 12ft run at 60 amps has to be #6 wire. 12ft is the approx. length from alternator to Space Saver Panel buss. A 14ft run at 10 amps can be #18 wire. A #6 wire 12ft long weighs 1.2 lbs. You can use 6-12ft lengths of #18 in a bundle for a 40 amp rating that weighs .4 lbs. For the 45 amp Space Saver, it would be better to use the #8 wire from the buss to the alternator and 4 #18 wires from the buss to the master relay (much shorter run). The load hog on the 35 amp 14 volt Space Saver and 45 amp 28 volt Space Saver is the 25 amp 14 volt and 35 amp 28 volt electric heaters. Turn them off when preparing for a landing. The disadvantages of the 28 volt system are you will need a 28 volt to 14 volt converter for some of your electrical needs that are rated at 14 volts only. Also a voltmeter in the range of 0 to 30 volts is a must. Now if you have read this far, I think you can choose wisely the Space Saver Panel that is best for you.

If you want the 45 amp 28 volt Space Saver, add	$25.00
If you want the 60 amp 28 volt Space Saver, add	25.00
If you want the cockpit light installed, add	25.00

The cockpit light installed in the Space Saver will provide enough light to read a chart and also can be directed on the airspeed indicator for monitoring airspeed at night. They were used in the Voyager for a primary source of light on its trip around the world.

Foster's Modular Design Co.
P.O. Box 1569
Portola, CA 96122
(916)823-5993

From CP59-9 (CH22)
RUSTY FOSTER'S SPACE SAVER PANEL (see several previous CP's), a really neat piece of gear, will be available only until December 31, 1989. Unfortunately, Rusty has decided to discontinue the Space Saver Panel then. If you want one, or want information on one, write or call: Rusty Foster

PO Box 1569
Portola, CA 96122
916-832-5993

Warning System

Also see CP51-9 in the "Space Saver Panel" section of this chapter.
Also see CP46-3&4 in the "Loran C" section of this chapter.

From CP33-7 (CH22)
Phil Supan,
1401 Market Street,
Santa Clara, CA 95050
Phil has a limited number of switches suitable for the warning system in a VariEze or Long-EZ. Phil will send them out post paid for $1.00 each.

From CP36-6 (CH22)
V/E & L/E: Gear up warning systems. It has come to our attention that several builders have installed the gear position micro switch so that it is contacted with the gear in the up position. This is totally unacceptable and is cause to ground your EZ until the switch is mounted such that the gear is down and fully locked when it contacts the switch. This is very important. You will have no warning if the arm has backed off from its safe over-center position.

From CP38-4 (CH22)
The following was sent in by Tom Williams.
"One of these days, in the confusion that can happen when landing, one of us less than perfect pilots could hit that gear warning DEFEAT switch and then ignore the gear warning light (if you have one). That's likely to ruin more than one day fixing your nose. I have designed an electronic circuit which will DEFEAT the DEFEAT in 60 seconds. The relay shown in the circuit is the same one shown in the plans. The timer chip and all of the other components are available at Radio Shack or just about any electronics supply store. The 60 seconds can be varied by changing the values but I believe you will find the 60 seconds just about perfect; longer might not give time enough to get your gear down on final and shorter will drive you up the wall in a long glide". **DIAGRAM OMITTED**

From CP45-6 (CH18,CH22)
Designed and built by Ian Ayton a Long-EZ builder/flyer, is a real neat plastic NACA cooling vent prefabed and ready to install in your canopy frame or in the side of the fuselage or under the baggage strake. This little gem has an adjustable ramp door that opens and closes to give perfect ventilation. It is made of ABS plastic and can be glassed or riveted into place.

Also designed by Ian, is a little black box that can be wired into your gear/canopy warning system. It will sound your horn in an intermittent manner rather than a continuous blast. At the same time the warning light will blink on and off. You can override the horn but not the blinking light. However, if after about one minute, you have not moved the throttle to recycle the warning system, the horn will again sound. This is a great idea and could save an embarrassing gear up landing. Mike has installed one on his Long-EZ and is very pleased with it.

Contact: Ian Ayton,
4061 Via Pavion,
Palos Verdes Estates, CA 90274
213-375-9269

From CP46-8 (CH22)
Ian Ayton's gear/canopy warning device - as recommended by Mike and Sally. A really neat, small self contained unit which is easy to install, that causes the warning light to flash and the buzzer to buzz intermittently - makes it hard to ignore.

Contact: Ian Ayton
213-375-9269

From CP47-13 (CH22)
Audio/visual warning system similar to that used and recommended by Mike Melvill in his Long-EZ, N26MS. This device gives a warning of a battery charge malfunction, low oil pressure, canopy unlocked or gear up by attracting the pilots attention to a flashing light and a loud buzzer. Pressing a defeat button will silence the buzzer for approximately one minute.

Control unit is .64" x 3.25" and is panel-mounted. Comes complete with oil pressure sender, three micro switches, gear-and-canopy-warning buzzer and simple installation manual. $139.50 (CA residents add $8.37 tax). Ian Ayton. Ayton and Co., 4061 Via Pavion, Palos Verdes Estates, CA 90274. 213-375-9269.

From CP50-3 (CH22)
Ian Ayton's gear/canopy/alternator warning device - a neat, easy-to-install, self-contained unit, it should be considered a "must" for all EZ's. The warning light flashes and the horn buzzes intermittently making it very difficult to ignore.

Contact: Ian Ayton
(213)375-9269

From CP51-8 (CH21,CH22,CH38)
Aircraft Spruce is now carrying the Braycote 601 fuel valve grease that Mike and Sally had. 2 oz. syringe cost $209.95 (enough to grease at least 20 EZs). **They also have a new, economical flight warning system for gear or canopy warning.** Please note that all EZ fiberglass prefab parts offered in the Spruce catalog are made by Larry Lombard and Michael Dilley of Featherlite, Inc., Boonville, CA.

Battery

Also see CP36-7 in the "Miscellaneous" section of this chapter.

From CP35-10 (CH22)
Batteries for VariEze and Long-EZ
We have recently tried a manifolded battery made by Yuasa General in Reading, PA, called a Yumicrom battery. It is supposed to last 4 years if properly cared for and puts out a lot of power for its size and weight. Mike has two, part # YB14L-AZ, 12 volt, 14 amp batteries in his Long-EZ, which is a 24 volt system. They easily handle the load of starting the O-235 Lycoming. In the Solitaire, we use a part #YB16-B, 12 volt, 19 amp which would also be excellent in a VariEze or Long-EZ with no starter. We obtained these batteries with a neat battery charger from:

Cycle Battery Supply,
8104 South Freestone Ave.
Santa Fe Springs, CA 90670
213-698-2211

The battery charger is pocket sized, plugs into 110 volt AC like a calculator charger, and features a snap connector that eliminates reverse connections, that is wired permanently to the battery.

The electric aircraft cabin heaters such as the one Mike has been testing in his Long-EZ, are now being manufactured and sold by:

Dolphin Marketing Ltd.,
9999 South 248th Street,
Kent, WA 98031
206-859-1999

From CP50-3 (CH22,CH30)
Bill Bainbridge now has available a really first class lightweight 12-volt starter which will fit any 4 cylinder Lycoming engine. Weighs only 10.2 lbs. It is beautifully made and really has some neat features. Bill still has his well known linear regulators and small alternators. **In addition, he how stocks excellent "Gelcell" or sealed, immobilized electrolyte batteries.** Two options are stocked, 28AH, 12V or 15 amp, 12V. These are supper little batteries and require zero maintenance. Contact Bill for more information:

B & C Specialty Products
518 Sunnyside Ct.
Newton, KS 67114
(316)283-8662

From CP60-3 (CH22,CH30)
B&C SPECIALTY PRODUCTS will be at OSHKOSH '89 in Booth C-11. Their lightweight starter is now STC - PMA'd for all Lycoming engines (0-235 through IO-360, 12 & 24 volt). The price is still the same for homebuilders while the STC'd version is priced a little higher. The Linear Voltage Regulator (low noise LR-2) **and sealed immobilized electrolite batteries continue to give good service.** Bob Nuckolls from the Aero Electric Connection will be giving forums on electrical systems (3:30am Sunday & Tuesday; 10:00am Thursday). These will be very educational open forums so bring your questions. If you can't make the forums, Bob will be at B&C's booth, C-11 to talk to you during OSHKOSH '89.

From CP61-12 (CH22,CH30)
To make it easy to install the new fuel boost pump with 37 degree flare fittings use a 90 degree elbow with 37 degree swivel nut and 37 degree flare. The Aeroquip part #2071-6-6S is for use in tight corners. Bill Bainbridge of B&C Specialties has promised to keep these in stock. This swivel elbow makes installing the fuel boost pump a simple proposition. **Bill Bainbridge, of course, still sells his LR-2 Linear voltage regulator (the very best we have seen) also, dry-fit sealed, immobilized Electrolite batteries. Mike and Sally use two of these (small 15amp/hour) for their 28v Long-EZ.** Burt uses two of the same for the 28v Catbird. These have been in continuous use for two years and have been flawless. Contact:

B& C Specialty Products
Box B, 518 Sunnyside Ct.
Newton, KS 67114
313-283-8662

Instruments

****Also see CP36-7 in the "Miscellaneous" section of this chapter.****
****Also see CP37-3 in the "Miscellaneous" section of this chapter.****
****Also see CP44-2 in the "Loran C" section of this chapter.****

****From CP24-7 (CH22)****
HOUR METER: Both Aircraft Spruce and Wicks stock a VDO hour meter slightly different than the VDO 331-011 we recommended in CP #22. It is the same size and has the part # 1763-002-016.

****From CP27-6 (CH22)****
Wiring the Rochester fuel pressure gauge.
Mike used Rochester gauges on his Long and they work well. The oil pressure and oil temp. gauges were straight forward to wire. However the fuel pressure gauge is a little different and some builders may not have received a wiring diagram. **SKETCH OMITTED**

****From CP28-9 (CH22,CH25)****
Aircraft Spruce reports that they now have in stock the following items:
Light weight electric turn coordinators (as used in N79RA).
Spray-Latt (peel-coat type canopy protection).
Zolatone "Splatter" paint for interior (as used in N26MS).

****From CP29-8 (CH22)****
If you elect to use Rochester electric gauges, be sure to run a separate ground wire from all the electric gauges to the firewall. This will assure accurate, non-fluctuating indications. Simply hook all the electric gauges ground terminals together and run one 22 ga. wire from the instruments to the firewall or engine.

****From CP30-7 (CH18,CH22)****
Wicks Aircraft
Now have brushable "Spray-Latt" canopy protective material in stock. They also carry the full line of VDO instruments and still have the Whelen strobe/nav light system (single flash) for Long-EZs.

****From CP30-10 (CH22,CH30,CH39)****
Engine Failure, On Top, Over Lake Michigan
A VariEze accident claimed the lives of a New York couple and their son enroute home from Oshkosh. The pilot was a low-time relatively new private pilot taking his first cross-country trip in the airplane, which had 49 hours total time. The following information is from a VariEze pilot who was flying with the Eze that crashed, and from FAA investigators.

The flight was heading east across Lake Michigan to save trip length even though it was over a solid under cast with tops at 10,000 feet. They were cruising at 11,500 feet directly over the center of the lake when the pilot noticed zero oil pressure. They continued another 10 to 15 miles when the engine lost power, then quit. The wingman noted that the pilot kept turning right during the trip and he had to keep instructing him to turn left to remain on course. He repeated this instruction as the pilot descended into the clouds in a right turn. Radio communication was lost when he tried to get him to switch to Muskegon Tower frequency for vectoring. Weather at the surface was a variable ceiling ranging from 500 scattered to 1,500 broken to 4,000 overcast.

It is not known whether the pilot became disoriented in clouds during the descent. The last call heard by the wingman was a very upset voice repeating 'engine quit, going down'. Flight service received a call of 'shoreline in sight' with no further communication. The aircraft crashed while in a turn in a down-wind direction at the far end of a 150 foot long clearing, immediately cartwheeling into trees. There was no way to survive a landing where the aircraft impacted. There was no fire. It is not known why the pilot selected the small clearing when the shoreline with alignment into the wind was apparently available to him.

Investigators determined the cause of engine failure to be oil loss through a broken oil pressure sender line. The line was aluminum tubing, flared with an incorrect automotive flaring tool. It fractured at the fitting sleeve where it had been previously bent 45 degrees.

The purpose of us printing details of this kind of tragedy in this newsletter is to alert those flying other airplanes to conditions that might cause another accident so that recurrence can be prevented. If you are flying an airplane that may have an engine installation that has not been inspected by a qualified A.I., ground it until it is adequately inspected for aircraft-approved installation materials and workmanship. All plumbing of oil and fuel lines must be of components approved for a certified installation. If you have aluminum tubing installed, replace it with approved flex hose before flight.

From CP35-6 (CH22,CH30)
VariEze and Long-EZ CHT
On these airplanes, with "updraft" cooling, when we measure CHT at the spark plug base, if we install the temperature probe (washer type) on the bottom plugs, which is usual, we are measuring over 40 degrees less than the temperature on the top plug. So keep in mind that if you have a marginally high CHT and are measuring at the bottom plugs, you may even be over the red line. For the record, Lycoming does not measure CHT at the spark plug base. All published data on Lycoming CHTs are taken at the threaded hole on the bottom of each cylinder head. When possible, this is the preferred pick off point.

From CP40-8 (CH22)
A variometer in your EZ. This is not as silly as it may sound. Especially if your live or fly in or around mountains, or high density altitude airports. Sailplane pilots are very aware of the benefits that are derived from a variometer. EZ flyers can get very helpful information from a vario. In simple terms, a vario is a very sensitive rate of climb. We have been testing a couple of Ball variometers, one in the Solitaire and one in the Long-EZ and have found them to be excellent. Ball makes a large variety of varios, some of them incredibly complex and sensitive. The one we tested is the simplest ones Ball makes. A 2 1/4" Ball model 601 which has a range of zero to 1000 feet and the other a 3 1/8" Ball model 501 with a zero to 1500 feet range. The rather low range gives greater sensitivity in the low rate of climb area, when you most need it while climbing in the vicinity of a mountain range. You will get positive information as to whether you will make it over the ridge or whether you should circle to climb. With practice you will find you can really take advantage of thermal lift or even wave lift. You can save gas by throttling back in strong lift and still maintain your ground speed. Try it, you will be pleasantly surprised.

Contact: Ball Variometers Inc.
5735 Arapahoe Ave,
Boulder, CO 80303
(303)449-2135

From CP47-11 (CH22,CH38)
VARIEZE O-200 OIL TEMPERATURES
Most VariEzes powered by the O-200 Continental engines, by all reports, have oil temperatures that, if anything, run on the cold side. However, every once in a while we hear from a builder/flyer with high oil temperature problems!

This has been a puzzle and no one has resolved it 'til now. How could some EZs run cold and others run hot? The answer may be in the oil temperature gauge. If you use a Westach or Westberg oil temperature gauge and you have had low oil temperatures, (maybe you have even wrapped the oil tank with an insulating cover?). Check your oil temperature by some independent means, a different gauge or even a candy thermometer. At the very least, you should calibrate your gauge against a known value.

Our experience here at RAF has been that in 3 different VariEzes using Westberg gauges, showing low oil temps all 3, in fact, have high oil temperatures. One had such high oil temps, the oil pressure would run at the minimum value of 30 psi!

The key is that if ever you see low oil pressure, check your oil temperature even if your gauge says it is OK. **This is particularly true if you are using the Westach or Westberg temperature gauges which in our experience over a number of years, have proven to be erratic and without frequent calibration, not to be relied on.**

From CP53-7 (CH22,CH33,CH38)
CAUTION: AIRSPEED INDICATOR INACCURACIES COULD CAUSE PROBLEMS ON A FIRST FLIGHT.
Fred Mahan, Long-EZ builder/flyer reports that on his first flight he was uncomfortable on final, felt too slow, decided to check his airspeed indicator. Using a water manometer, Fred discovered that his airspeed indicator read 200 kts. when the manometer said 200 MPH. This continued all the way down to 40 kts, so his airspeed had been mis-graduated by somebody. This meant that when he was indicating 75 kts., he was, in reality, only doing 65 kts.! This could have been a "gotcha"! Of course, it was great at the high end. Fred thought he was going really fast! Check your airspeed indicator before first flight. See the neat water manometer suggestion in this CP.

From CP53-7 (CH22,CH33,CH38)
HOW TO TEST YOUR AIRSPEED INDICATOR by Verne Vawter
This neat water manometer article is taken from the Long-EZ Squadron 1 newsletter.

One instrument in my airplane that has been a source of constant irritation is the airspeed indicator. For some reason mine always reads too low and my friends' airplanes, at least during hangar flying sessions, say they are always faster than mine.

On the verge of an inferiority complex. I decided to do some investigation which revealed that the airspeed indicators are based on a well known physical law and that it is feasible for owners to check and calibrate their own aircraft's speedometer.

Before I relate the principles of airspeed theory, based on Bernoulli's Law, let's get right into how simple it is to make an instrument called a manometer, which is easily put together of a little of this and that found at most hardware stores.

EQUIPMENT REQUIREMENTS:
1. Approximately 10 feet of clear plastic tubing preferably 1/8 inch to 1/3 inch inside diameter (it should cost between $1.00 and $1.25).
2. A board 30 inches in length suitable for mounting the plastic tubing in a "U" shape.
3. Some type of "T" fitting. This can be made by soldering small pieces of copper tubing together.
4. A yardstick.
5. A few ounces of water with a little bit of food coloring to aid visibility and a small quantity of detergent as a wetting agent.

TESTING PROCEDURES:

1. Examine the pitot tube carefully and if there is a small drain hole, cover it with tape.
2. Stretch the one end of the plastic tubing over the nose of the pitot tube (see Fig. 1).
3. Blow the manometer until the water level between the two sides of the tube has approximately 20 inches difference in heights. Pinch off the air supply tube and check for leaks. If the manometer and the static system are free of leaks the water level will remain constant.
4. With one person in the cockpit viewing airspeed indicator, bleed off the air by releasing the pinch referring to the chart (see Fig. 2) for proper water level differences. Start with a water level that is appropriate for the speed of your aircraft. For example, if your plane is capable of 180 mph, there should be 16.16" difference between the levels of water in the "U" shaped tube. If your airspeed indicator is reading 183 at the 16.16 inch differential level, you know it's 3 mph fast. Repeat the procedure at 160 mph, 140 mph, 120 mph and so on. Most airspeed indicators are usually two to three mph off somewhat in their range. Naturally if there is a leak in your airspeed system this is indicated by an inability to hold the water level. It is sometimes difficult to bleed the correct amount of air to reach the exact inch difference that you want. Often several attempts are required. The yardstick is moved up and down so as to measure the different levels that the water will reach.

DRAWINGS OMITTED

Bernoulli's Law: The controlling physical law of a manometer

$$hw = \frac{Pair}{Pw} \cdot \frac{V\text{-squared}}{2g}$$

hw = height of water inches
Pair = density air
Pw = density water
V = velocity air miles per hour
g = gravity

V (mph)	Hw (differential height of water in inches)
60	1.77
80	3.16
100	4.95
120	7.14
140	9.73
160	12.7
180	16.16
200	20.0
250	31.6

From CP58-10 (CH22)

DIGITAL TACHOMETER. In the past, we at RAF have not been too impressed with digital tach's, however, the current lack of a really accurate analog tach has prompted us to look at this situation again. The Braal Tach 1 is tiny, (1.2 x 2.17 x 2.67 deep) but easy to read. A digital tach which is accurate to plus or minus 2 rpm! It only weighs 8 ounces and uses an infrared sensor (optical reflective switch). This must be cleaned once a year. It is easy to install. It comes with sample rates of 1/2 second, 1 second, and 2 seconds which allows you to choose a tach to suit your needs. Probably the 1 second would be best for use in an aircraft such as an EZ. Very accurate leaning can be achieved with a tach as accurate as this, but if super economy is your bag, the 1/2 second tach might be the best choice.

For Lycoming installations, the installation kit includes bracketry to mount the optical sensor. For Continental powered EZs, you will have to build your own simple mounting bracket. The manufacturer recommends an internally lighted tach if you intend to mount it down low or horizontally on a console. We recommend you mount it as a "head's up" display as high as possible in your panel. For this, you can get away with a non lighted tach. Prices range from $165.00, non-lighted, to $190.00 for the internally lighted model. Both models have a one year warranty on parts and labor. For more information contact:

Braal Micro Instruments, Inc.
160 Eastman Lane
Petaluma, CA 94952
707-763-9377

NAVCOMs/Transponders/Antennas/Intercoms

Also see LPC #78 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP37-3 in the "Miscellaneous" section of this chapter.
Also see CP34-3 in the "Loran C" section of this chapter.

From CP24-7 (CH22)

SANTA PAULA AVIONICS. Santa Paula Airport, Santa Paula, CA 93060 can take an Escort 110 and change it to an intercom and adjust it to draw only 0.6 amps very reasonably. Bruce Tifft recommends it, he has not had to charge his battery since.

From CP26-7 (CH20,CH22)
LONG-EZ COM ANTENNA - At last, a high performance com antenna. Jim Weir from Radio Systems Technology developed a com antenna for the Long-EZ that fits in the winglet. (see photo) We have tested it in the Long-EZ N79RA and found it to have excellent range. We were able to use it at distances of over 80 nm. The antenna uses copper foil and RG58U lead in. It does not require a ground plane. It can be installed on the foam core before glassing and is completely enclosed within the winglet. Ours was placed on the outside skin after drilling some carefully-aimed holes. Install the antenna system before glassing the inboard side of the winglet. Cut 2 strips of copper foil 20.3" long, remove the protective backing and stick the foil to the foam one inch from and parallel to the trailing edge. Measure the rudder cut out area and bend the lower (2") end of the foil forward to miss the rudder. From where the two foil strips come together cut a slot just deep enough to hold the RG-58U/A lead in cable flush with the foam surface. Hold the lead in with toothpicks similar to the method used on page 19-7 rudder conduit. Be sure the three Ferrite Balums are installed just above the connection as shown. Solder the center wire of the RG-58U/A to the top foil strip and the outside "ground" braid to the lower foil strip.

Be sure the upper and lower foil strips don't touch or short out. Use about 1/8" separation. Check that none of the wire, ferrite balums etc. stick up above the foam surface, trowel in dry micro around the solder joints and other voids and glass the inboard winglet as per the plans.

Coil up the excess cable and thread it through the wing during winglet installation.

The antenna kit is available from:
Radio Systems Technology
10985 Grass Valley Avenue
Grass Valley, CA 95945

Antenna kit price -
Assembled - $25.50
(with BNC connectors)
Unassembled - $15.00

SKETCH OMITTED

From CP26-12 (CH20,CH22)(Photo caption)
Mike, installing the RST antenna on N78RA Long-EZ. Note: this antenna will not fit the VariEze.

From CP28-2 (CH22,CH30,CH36)
26MS - Mike and Sally's Long.
Currently we have 85 hours on our Long and it is literally running like a Swiss Watch. We are truly delighted with it in every possible way. We have been using it to commute to work every day for the past couple of months. From Techachapi to Mojave by road is 26 miles, about a 30 minute drive. It takes between 8 and 12 minutes in the Long, depending on the winds. We use two to two and a half gallons for the round trip. This is almost exactly what we use in our Honda Civic car. Besides the time saved the biggest thing is the 'fun' factor. There is a lot of enjoyment in flying across the desert in the early morning with glass smooth air, no traffic and the stereo tape deck playing in the head phones. Coming down-hill in the morning, we usually fly at very low power settings. The quiet, smooth exhilaration really makes it enjoyable to come to work.

All flight tests, engine break in etc., have now been completed. All systems work perfectly. **The Radair comm, nav, and transponder work very satisfactorily. The Sigtronics intercom and audio switcher work excellently in conjunction with our stereo tape deck. This also gives us the capability to transmit from either cockpit.** The newest piece of equipment recently installed is a Silver Fuelgard. This small instrument accurately reads out fuel flow in gallons per hour and you can look at fuel used with a momentary switch. This fuel flow meter is a TSO'd instrument and uses a flow-scan transducer. We installed it in the fuel line so that all fuel on board runs through it. It is accurate within +- 2 percent. So far it has verified the Owners Manual fuel flow information very closely. N26MS will burn 1.9 gallons per hour at minimum power required for level flight at 8000 ft (max endurance) and at 75 percent at 7/8000 ft it reads 6.7 gph. Take off, full rich at sea level is a shock, 11.7 gph!! On a recent cross-country, we went to Northern California, a straight line distance of 404 nm (471 sm). On the trip up north we had a ferocious head wind of 29 kt (33 mph) so we ran at approximately 70 percent power at 8500 ft for a fuel flow of 6.4 gph. This gave us a ground speed of 130 kts (150 mph) with a true airspeed of 159 kts (183 mph). Our time enroute was 3.1 hours and we used right at 20 gallons of gas. By contrast on the return trip we had a tail wind!! We climbed to 11,500 ft, where the tail wind component was 35 kts (40 mph). It took some will power, but we pulled the power back to approximately 48 percent which gave us a fuel flow of 4.4 gph, and a true airspeed of 133 kts (153 mph) which, with the tail wind, had us crossing the ground at 168 kts (193 mph). The time enroute was 2.4 hours and we burned a total of 10.6 gallons of gas! I honestly believe that a Long-EZ built to the plans will consistently give these kind of results. The airplane is incredibly comfortable, reasonably quiet, particularly with David Clark headsets, and is an honest to goodness, economical, high speed touring machine, with good baggage capacity, excellent high altitude capability and unbelievable range. All in all, looking back at the intensive effort required to build it, it was well worth it!! The Long continues to delight us, Sally takes it to her 99's meetings, I have been into terminal control areas, we have flown it quite extensively at night. We have flown over mountains, over ocean (to Santa Catalina) and it is just super. The Lycoming O-235-L2C has continued to run like a dream and to be honest, I have no regrets. If I had to do it again, I would build it exactly as we did, using the same engine. **The only thing I would not recommend is the electrical system we have.** The engine came with a 28 volt starter and alternator, and all the electrics on the airplane are 12 volt. We have got it working, but it was simply too much hassle for the average builder to have to put up with, when you don't have to. N26MS will be here at RAF on a daily basis, and we plan on attending most of the flyins, including Watsonville and Oshkosh.

From CP28-10 (CH22)
Q. Can I use a voice actuated intercom?
A. Yes, we heartily recommend doing this, and also using good noise attenuating headsets. This makes conversation between pilot and passenger varieze, and also enhances your ability to hear and understand ground controllers. Cockpit speakers should not be used in VariEze's and Long-EZ's. With good headsets (we use David Clark H10 type), the pilot-perceived noise level is considerably quieter than in a Cessna without headsets.

From CP29-7&8 (CH22)
COMM ANTENNAS - VARIEZE.
The Comm antennas that mount on the landing gear can break after some time in service. This is because most builders apply the copper foil to the underside of the strut. The strut flexes and bends under taxi and landing loads and will eventually fatigue the copper foil. This can be prevented by attaching the copper foil to the leading edge of the strut.

Larry Lombard installed an excellent loop-type comm antenna in his VariEze. It is made from 1/4 inch wide copper tape. It is a full loop antenna, and has no ground plane. This copper foil should be installed per the sketch below, and ideally you should start out with it about 102 inches long, and, using a SWR meter, optimize it by trimming it off in small increments. Larry's is approximately 99" long, but this may vary slightly from airplane to airplane and radio type. It is important to orient the copper foil as vertical as possible on each side, then let it form a "V" under the top cover and a "W" on the floor such that it clears the nose wheel well. A short piece of RG58-AU should extend from your radio to the fuselage side at approximately the mid point vertically. Solder one end of the copper foil to the center conductor of the RG58AU and the other end of the copper foil will solder to the shield of the RG58AU (after checking the length). Put one ply of light weight fiberglass or BID over the foil to protect it from damage, and you will have an excellent drag-free comm antenna. **SKETCH OMITTED**

From CP30-7 (CH22,CH24)
Transponder Antenna
The transponder antenna can be mounted under the front seat thigh support, and this is where quite a lot of builders have located it, however, Jim Weir of Radio Systems Technology has cautioned that it may be possible that high powered microwave energy may be radiating in very close proximity to a rather sensitive part of the pilots anatomy. To put it bluntly, it may be a little like sticking your fanny into a microwave oven! In any event, no qualified person to our knowledge has tested this, so it may be prudent to laminate a sheet of aluminum foil under the thigh support. Microwave energy will not penetrate the thinnest of metallic foils.

From CP33-6 (CH19,CH22)
Nat Puffer suggests a good place for a DME or transponder antenna is in the leading edge of the wing root. Simply hollow the wing leading edge out a little deeper, see Page 19-13, Section F-F. Do this similar to Section E-E on Page 19-14, and mount the antenna in the void.

From CP34-8 (CH22)
Ken Clunis mounted his transponder vertically in the right forward baggage strake, against the fuselage side. It is easy to read and easy to operate with your left hand. His antenna (RST type) is in the right side of the centersection spar, as far outboard as possible, ground plane must be horizontal with the antenna vertical and pointed down.

From CP35-5&6 (CH9,CH22)
From the desk of Jim Weir - Radio Systems Technology:
"NO ANTENNA FOIL ON THE GEAR LEGS. NONE, NO HOW, NO WAY. Get the idea? There have been a series of reports that the gear-leg antennas work very well when first installed, then gradually deteriorate over time. Actually, the "deterioration" seems most pronounced after a hard landing. The copper foil is not as resilient as the glass, and rather than flexing like the fiberglass, copper tape breaks. Net result - lousy antenna operation.

Instead of copper tape, use a copper braid similar to Radio Shack 64-2090 (use 2 strips side-by-side) or Belden 8664. Every bit as good, but slightly harder to make, is to strip the black jacket from RG58 coaxial cable, remove the polyethylene/copper center conductors, and flatten out the resulting braid. Install this on the gear leading edge or trailing edge, not at the maximum thickness, to avoid flex failures.

For those of you who have a broken antenna, I recommend removing as much foil as possible - - both elements of the dipole - - and glassing braid on the OPPOSITE leg. It would be a major job to strip the glass from the broken glass and remove it, so I suggest you just leave it alone.

Actually, if I was a-buildin' the airplane, and I didn't have the wing and winglet glassed yet, I'd go ahead with a winglet antenna like the Long-EZ has for the COM antenna.

Jim Weir"

On new construction VariEzes the "Long-EZ" comm antenna can be installed on the winglet and outboard wing as shown. Follow the instructions in CP 26, page 7 for the Long-EZ comm antenna.

Incidentally Jim recently checked the performance of a Long-EZ winglet COMM antenna and it's radiation pattern proved to be quite exceptional, much more uniform than the factory builts.**SKETCH OMITTED**

From CP37-4 (CH22)
Please note that prices for the Com. Antenna from Radio Systems Technology is a follows:

$25.00 for the assembled antenna
$15.00 for the unassembled antenna
plus $3.25 for shipping and handling

From CP39-7 (CH13,CH22)
VariEze and Long-EZ - Transponder antenna. Bob Beard installed his antenna forward of his right rudder pedal on the floor. An aluminum ground plane at least 5" in diameter (larger is better) is siliconed to the floor. The antenna is bolted to the ground plane so it sticks out through the bottom about 1". This antenna really works great.

From CP40-2 (CH20,CH22,CH32)
NEW RUDDERS FOR THE LONG-EZ
The plans for the new rudders for the Long-EZs have been very popular although there has been some confusion. We will try to clear up a few points.

First of all, these plans are strictly for Long-EZ. They absolutely do not apply to the VariEze or any other type aircraft. VariEze builder/flyers should be able to recall a mandatory change in CP 22, Page 8, that reduced the allowable rudder travel from the original plans call out of 3.5" to 2". This was because the rudder authority of a VariEze was powerful enough in some cases to depart the airplane. The VariEze is the last airplane that needs stronger rudders!

If you have not installed your comm antenna(s) in your winglet(s) on your Long-EZ and you would like to have the high performance rudders, do not install any antenna in the winglets until you have the plans for the new rudders in hand. If you are wanting to retrofit the new rudders to a Long-EZ that is already flying, or one that has the antenna already installed per CP 26, you will have to cut through the original antenna and install a new one forward of the new rudder hinge line. This is covered in the new rudder plans. We have made this modification now to 3 Long-EZs and in all 3 cases the old antenna is still under the glass skin, (cut through and disconnected) and the new antenna works very well. We have not been able to perceive any degradation in radio performance. In fact on two of the three, we seem to have improved range both transmitting and receiving!

The new rudders on the Long-EZ give at least twice the yaw authority of the original rudders and allow you to steer while taxiing at speeds as low as 25 to 30 knots without using the brakes. The main advantage of course is in a crosswind take off from a narrow runway. With the new rudders minimal braking is required for steering, so you can accelerate to rotation speed more rapidly. You can rotate at your normal rotation speed of 50 to 60 knots (depending on cg) in any amount of crosswind up to 20 knots at 90 degrees and lift off in essentially the same distance as you would with no crosswind. Quite a few homebuilt Long-EZs have flown into RAF with the new rudders and every one so far has been pleased with them.

From CP40-8 (CH22)
Radio Systems Technology has recently put out their 10th Anniversary issue of their kit avionics catalog. This is a very worthwhile catalog and has many items of interest to EZ builders. Most of you will be familiar with Jim Weir, founder of RST. He is the designer of all of the buried antennas that we use with such success on our EZs. He has also written several excellent articles on the subject, that have been published in Sport Aviation. RST is located on the Grass Valley airport, Grass Valley, California. For more information or to receive the new catalog,
Contact: Radio Systems Technology,
13281 Grass Valley Ave,
Grass Valley, CA 95945
(916)272-2203

From CP43-3 (CH22)
Narco Escort II, 720 Comm 200 nav, in one 3 lb package. Fits into a standard 3 1/8" diameter instrument hole. For a limited time only, factory fresh from Narco, delivered for $1149.00 (plus tax in Texas).
Contact: Chuck Jordan
502 E. Huitt,
Euless, TX 76040
817-267-2840

From CP44-4 (CH22)
VOR/LOC/GS ANTENNA
We recently tested one of these simple, light weight antennas (part #AD-1) on the Long-EZ and found it to be excellent. The distance from the VOR for usable navigation is increased and our left/right needle does not fluctuate as it used to. This antenna is installed exactly like the plans. It is essentially a copper foil antenna with a small "black box" with BNC connector in the center. Inside the "black box" are state of the art, micro electronics that allows better reception characteristics over the standard kit antenna.

Contact: Antennas Dynamics Inc.
1251 W. Sepulveda Blvd., Suite 268
Torrance, CA 90502
(213)534-1090, Ext. - 22

From CP46-8 (CH22)
Antennas for composite aircraft. VOR/Localizer Glideslope antennas, marker beacon, comm and Loran antennas.

Contact: Antenna Dynamics Inc,
1251 W Sepulveda Blvd
Suite 268
Torrance, CA 90502
213-534-1090 Ext-22

From CP49-4 (CH22)
VISTA AVIATION
Whiteman Airport
818-896-6442

Dusty Rhodes and Brenda own and operate this small but neat avionics-type store. Dusty is an authorized King dealer and carries a variety of avionics including ARNAV, Apollo, and Northstar Loran-C's. They also have a number of other items of interest to homebuilders, and in almost every case, the price is very competitive. The store is located on the Whiteman Airport and you can taxi up to the door.

Dusty built a very nice VariEze back in 1978 and is knowledgeable on homebuilts. He has been doing quite a lot of installations of radios and various avionics in homebuilts and can pre-wire an entire radio stack for you to meet your requirements.

Give Vista Aviation a try, we are very glad we did.

From CP53-4 (CH22)
Mike and Sally are upgrading their Long-EZ, N26MS, and installing a King KX-155 NAV/COM. This means their Edoaire 720 channel RT-662 COM-only 2.6" x 3.2" x 11-1/2" and the Radair NAV with VOR head, also only 2.6" x 3.2" x 11-1/2" will be for sale. Mike intends having both units checked out by an avionics shop so they will be in excellent condition. Both have worked very well, indeed, and being so small, fit easily into an EZ instrument panel.

Edo COM - $350.00
Radair NAV with VOR head - $200.00

Contact: Mike or Sally
(805)824-2645
Tuesdays or Fridays

From CP53-5 (CH22)
Dusty Rhodes of Vista Aviation on the Whiteman Airport near Burbank in southern California has recently done a number avionics packages for EZ's. Since Dusty built his own VariEze, he is quite familiar with our special requirements.

We were down there visiting Dusty and Brenda the other day when we saw a complete Long-EZ instrument panel on the bench. Dusty and Jeff, his avionics expert, were wiring the entire panel, including a full stack of radios and Loran - plus an HSI! Wow!

He showed us a really first-class "EZ" package consisting of the following:

King KX-155 NAV/COMM
King KI-208 VOR head
KING KT-76A Transponder
Apollo 612B Loran
Sigtronics SPA-400 Intercom

The "basic" package price, prewired and bench tested, is $4995.00. The trays are mounted together in a stack and all wiring is complete, including antenna wires and Loran antenna as well as mic. button and headphone jacks. All wires that you, the builder, must hook up (positive and ground) are correctly identified. Obviously, you will have to tell Dusty how long to make the leads to the mic. button and headphone jacks, as well as antenna wire lengths since each plane may be different.

If you want to substitute a KI-209 which includes a glide slope, add $400.00. If you want to substitute an Apollo 604 Loran for the 612B, add $300.00. If you want to substitute a Northstar M1 Loran for the 612B, add $1300.00. If you would like to include an encoder, Dusty will wire in and bench check a Narco AR 850, blind altitude encoder for an additional $400.00.

When you are all done and have flown off your hours, you can fly in to Whiteman Airport, taxi up to Dusty's store, Vista Aviation, and he will do the required ramp check of your transponder for $35.00. If you have an encoder, he can do the full transponder/encoder and pitot/static system ramp check for $125.00. (These prices do not include any repairs or adjustments that may be necessary). The above checks are mandatory before you operate your transponder in VFR or IFR conditions. You must have this check done every 24 months and have a log book entry to prove it, to be legal. Be careful. FAA are really hot on checking this kind of thing lately.

Dusty really does know EZ's and is a very knowledgeable avionics man. He suggests not buying your COM/NAV equipment to soon before first flight since your warranty may run out before you fly! Also, do not have your avionics gear in the plane during the finishing process, i.e. sanding and painting, you could ruin your avionics. If you have strobe lights, be sure to shield the power cable and locate it as far as possible from the COMM and Loran antennas. Be certain to ground all radio trays together and to a common ground to eliminate noise.

Contact Dusty or Brenda at:

Vista Aviation
Whiteman Airport
12653 Osborne St.
Pacoima, CA 91331
(818)896-6442

****From CP60-9&10 (CH22)****

STATIC RELATED RADIO "BLACKOUT"

"Some time ago, I read a report of a Long-EZ pilot who experienced static while in flight from New Orleans to somewhere in Texas. I thought I read it in the Canard Pusher, but I have been unable to locate it. (ED - see CP 53). Twice I have experienced both comm and nav "blackout" while flying in light and moderate rain during overcast conditions. The first time during a landing at Liberal, Kansas, in light rain, I thought that Unicom just was not attended at the time. After landing and sending my wife inside to monitor the frequency, I was able to transmit and receive while standing on the ground beside the Long-EZ.

Later that day after departing Liberal, rain was encountered and a 180 executed when all nav and comm was lost. After landing at Liberal, again sending my wife inside to monitor the frequency, I was able to transmit and receive while standing on the ground. A phone call to the FSS at Garden City revealed they had heard none of my transmissions.

I have discussed this "blackout" with several radio repairmen and other composite airplane flyers. All agree that it is likely that a static charge built up on the composite structure and effectively blocked the radio signal until the charge was bled off.

Just this week, I experienced a similar "blackout" at Garden City, Kansas. After talking to Garden City FSS about 15 miles out and deciding to land because of the rain in my intended path of flight, I went a few minutes toward the airport in light rain before calling for a landing advisory. I was unable to contact the FSS until after about a half dozen tries. By then, I was within 2 miles. A visit to the FSS revealed that they could tell someone was transmitting, but there was no intelligible message.

In discussing this problem with the FSS manager, he told me of his experience in the army when operating helicopters using FM communications. The helicopters had a large amount of composite materials in them and built up quite a static charge. To discharge this static charge before making a pick-up of a fuel cell, they simply keyed the mike for 20 or 30 seconds. After a few minutes of discussion, we surmised that the "blackout" might possibly be broken by simply keying the mike for a long period of time, that is 20 to 30 seconds versus the 2 to 5 seconds that might be used to make the initial callup. Perhaps that was how I finally got through just before landing, making repeated calls in a short period of time.

It is not easy to deliberately set up this condition, especially when I do not like to intentionally fly in the rain knowing that I may experience a "blackout". Perhaps others could report on their experiences in rain, and maybe have occasion to try discharging the static build-up by an extended keying of the mike. Wouldn't it be great if the system could be discharged this simply?

I have 280 hours and over 300 landings on N86PD. What a fine machine! We plan to be at Oshkosh this year."
D.W. Smith

Editor's comment. We don't get much rain flying being based in Mojave, CA, however, we have flown in the rain many times over the past 11 years in Long-EZ's, VariEze's and a Defiant, including an IFR flight from Mojave to San Francisco (Defiant). We were in some of the heaviest rain we have seen for about 30 minutes but never had any problems communicating with ATC or with any nav equipment. At no time can we recall a radio blackout such as Dave has reported. Has any other builder ever had such an experience?

****From CP60-11 (CH22)****

NEW BOSE ELECTRONIC NOISE ATTENUATING HEADSETS.

Bose is planning on introducing their long awaited electronic headsets at Oshkosh 1989. The first time we saw these headsets was during the Voyager program when Bose provided Dick and Jeana with the most comfortable headsets we had ever seen. In spite of the fact that they had a couple of minor problems, Dick has said the fact that he experienced little or no hearing loss during the grueling 9 day flight was due to the Bose headsets.

Mike and Sally have been evaluating a couple of pre-production Bose headsets for the past several weeks and will be flying to Oshkosh using them. So far, the verdict is that they are excellent. The comfort on a long trip is so superior to any other headset as to make it "no contest". The noise attenuation, with the electronics turned on, is superb, Significantly better even than the highest passive noise attenuating headsets available (27 DB reduction). They are impressive looking too! The easiest way to sell a set is to let a pilot put one on, power off. Let him feel the comfort, notice the good noise reduction, then turn on the power and watch his face! It is fun because the facial expressions vary from puzzlement to plain disbelief. Be sure to look up Mike or Sally on the flight line at Oshkosh and ask for their "demo". Then go and talk with the Bose people at their booth.

From CP54-4 (CH22)

HOMEBUILT WING-LEVELER (SINGLE AXIS AUTOPILOT)

We saw it at Oshkosh 1987 - Navaid Devices, Inc., single axis wing leveler/turn coordinator which can track a VOR and/or a Loran. I have known the designer and owner of Navaid Devices, Doug Spears, for several years now. He has been flying his VariEze for quite a number of years and he developed this little autopilot specifically for his own VariEze. He has been flying it in his VariEze for over one and a half years. He has done some pretty impressive testing of this device and, when he showed it to me at Oshkosh, I was very interested. The entire system weights only 2-1/4 lbs., including the servo actuator and turn coordinator/computer! Amazing! If you replace your electric turn coordinator or needle-and-ball with this auto pilot, you may actually reduce the weight of your EZ by a small amount!

Sally and I have been thinking about installing some sort of wing leveler in our Long-EZ for some time now. We have looked into the Century 1 and the S-TEC auto pilots, both excellent systems, but, frankly, out of our price range. Doug Spears' little autopilot is in the form of a kit, something like a "Heathkit", and you will have to build it yourself. It is about 1/3 of the cost of the simplest S-TEC single axis system. I believe Doug will build it for you if you are willing to pay him extra for his time, but I would strongly recommend that you do it yourself - it is fun!

Our kit arrived in the mail and I began to read the assembly manual. There is really no way to go wrong! The manual is quite the best thing of this kind I have seen. It leads you by the nose, step by step, and as you get each step done, you check it off - when you have all the steps done, it is ready to test!

The quality of the circuit board and components is first rate. All you need is a small soldering iron and a small pair of side cutters, available at Radio Shack, and you can easily put the whole thing together is a few evenings of your time. It took me four evenings, working, perhaps, 3 hours each evening. I work slow on things as intricate as electronic gadgets such as this. This line of work is not my strong point, but I must say, I really did enjoy putting the kit together.

I followed the instructions exactly and tested it per the book, using a car battery and battery charger and a digital voltmeter, which I borrowed from work. The installation into a Long-EZ or VariEze is straight forward - the most time consuming thing for me was threading the wiring from the panel to the engine compartment. By the time I had it installed and working, it took most of a Saturday.

First flight to test it, Sally went with me to watch for traffic while I had my head down calibrating the five (5) little trim pots that must be adjusted in flight. It worked perfectly, first time! But only for a short time - alas, I had done something wrong and it glitched! I could not figure it out, so I called Doug and he had me ship it back to him. He checked it out thoroughly and found where, in spite of my care, I had soldered a capacitor into one of the circuit boards backwards! What a bummer! Anyway, he shipped it back all nicely calibrated and it worked perfectly, right out of the box, requiring essentially no adjustment.

The wing leveler is really neat - now I can easily fold and unfold maps without having the airplane roll over! It does not have a heading hold feature, however it will do a very nice job of tracking a VOR and an even nicer job of tracking Loran in the approach mode! Really amazing, the silly little machine does a better job than I can do!

Doug does not recommend his autopilot for IFR use, he designed it for the day, VFR, sport pilot, to make your cross country flying more enjoyable, and it certainly does that. Don Shupe, founder of the VariEze Hospitality Club, has recently installed one in his VariEze and he is ecstatic about his. I really believe the thing is a great safety device since it does allow you to spend more time navigating, checking your map and your check points.

If you ever did inadvertently end in a cloud or fog bank, it would keep you upright and fly you back out into VFR conditions.

Used in the tracking mode, it will fly a much straighter course than an average pilot would, thus saving time as well as gas. I am very, very pleased with mine and I would recommend it for anyone flying an EZ and, for that matter just about any type of homebuilt. For more information contact Doug Spears. He really is a neat guy and is very knowledgeable and sharp on autopilots in general - and especially the lightweight one he designed.

Contact: NAVAID DEVICES, INC.
241 Signal Mountain Road
Chattanooga, TN 37405
1-615-265-7809

From CP54-13 (CH22)(Photo Caption)

Doug Spear's wing leveller servo actuator, mounted on Mike and Sally's N26MS centersection spar - capstan drives ailerons through 1/16" cable.

From CP58-1 (CH22)

The Catbird now has a fully functional S-Tec System 50, two axis auto pilot installed, thanks to Dusty Rhodes of Vista Aviation on Whiteman airport in the Los Angeles basin and to S-Tec of Mineral Wells, Texas. It took several iterations to get the auto pilot matched up to the rather zippy control rates of the Catbird but it was worth it. It works so great it has made all of us EZ flyers wish we had one! It is quite expensive but for anyone flying much IFR, it would be extremely helpful. Any Long-EZ or Defiant flyers who are interested in an auto pilot should give Dusty a call at Vista Aviation. He has installed several of the S-Tec System 50 auto pilots in Long-EZ's and other high performance homebuilts and was extremely helpful to us on the Catbird installation.

From CP62-1 (CH22)
DEFIANT FLYERS
John Steichen has just completed the installation of a S-Tec System 50, two axis auto pilot in his Defiant and reports that he is very pleased with it. He did have some problems getting it to work correctly in the Defiant, but thanks to the excellent support he received from S-Tec, and his own ingenuity, he has it working very well now. He has used it in the world of radar vectors and reports that the heading-hold feature is a real joy.

We can verify all he has said about S-Tec. We, at RAF, installed the same System 50 auto pilot in Burt's Catbird and it is a wonderful piece of equipment. John Steichen says he would be willing to help other Defiant flyers who may be having problems installing an auto pilot. John lives at 960 86th Street, Downers Grove, IL 60516. John has filed IFR several times now in his Defiant and says it is a gem. On two occasions, John has encountered very light rime ice and has found that his Defiant requires a very mild change in pitch trim due to the ice accumulation.

Burt has encountered light rime ice on several occasions in N78RA and his recollection was that the trim change was so small that he saw no need to retrim. There are at least 17 Defiants flying as of January 20, 1990.

From CP62-6&7 (CH22)
Dear CP,

I need help. My son is trying to build an autopilot for my Long-EZ based on a *Sport Aviation* article by Doug Garner - (1980).

Unfortunately, the thermistors required are only available in large quantities and large cost ($800.00) in Australia. The thermistors are: Fenwall GB 32-L1, may be superseded by Fenwall 112-202-EAJ-H01.

I would like to hear from anyone who may have built Doug Garner's autopilot and from anyone who may be able to sell me 2 to 10 of these thermistors.

Sincerely,
Jim Glindemann
34 Milford Crest
Frankston, Vic, 3199
Australia

Loran C

Also see CP39-7&8 in the "Alternators/Regulators" section of this chapter.
Also see CP49-4 in the "Alternators/Regulators" section of this chapter.
Also see CP49-4 in the "NAVCOMs/Transponders/Antennas/Intercoms" section of this chapter.
Also see CP53-5 in the "NAVCOMs/Transponders/Antennas/Intercoms" section of this chapter.
Also see CP65-10 in the "Alternators/Regulators" section of this chapter.

From CP34-3 (CH22,CH30)
LUCKY YOU FLY THE LONG-EZ

Would you like to take your Long-EZ from Honolulu to Oshkosh? And if you can get it together, go the 4,500 miles non-stop? I started planning on day one. The first cloth was cut 12 March 1981 and Oshkosh 82 looked like an easy goal. "Coffin Corner" goals in homebuilding are not recommended as they can unwind your main spring and money supply.

Long-EZ construction went along very easily. This was my third composite homebuilt. The first flight was on 7 June 1982. Oshkosh looked easy, but wait: The Loran wasn't working yet, neither was the ADF, nor the Compucruise, nor the SSB radio. It looked like the NAVCOM was inadequate for IFR. The new transponder was dead and 1344T needed 40 hours faster. It was flying great so I filled the tanks and by 16 June I took 1344T to the EAA Big Island Chapter 780 meeting with the first 40 hours flown off. It was looking good, but wait: **The Compucruise had been calibrated, however the Loran wouldn't work with it on.** With the Compucruise off, the ADF was only 20% effective and the Loran still wouldn't work. The core of the problem is that it's a fiber glass airplane and has no ground plane or counterpoise and none of the normal metal shielding found in aluminum airplanes. Add dirty power to this and the dirtiest electrical noise of all, the Compucruise, and a lot of time can be spent solving the noise problem. Actually once I got a system of detection, isolation and elimination going it was okay, however this cost me almost 30 days of down time. It can be done in less. Here's how I did it. Note: if you do not need any low frequency COM or NAV gear, you may disregard all of this and simply live with the noise as VHF is high enough not to be affected.

I started by disconnecting everything: battery, voltage regulator, alternator, p-leads at the engine, and all radios and appliances. I then used a small inexpensive transistor radio and tuned off a station. I started the engine many times checking for electrical noise using the transistor radio to ferret out each source, following up and down the wires inside both cockpits, into the engine bay and all over.

Here's what I went through. I replaced the mag switches as they were poor quality and arcing inside. I replaced the Kubota tractor alternator as it was noisy and short on output. I had to add a torroidal type coil and 2 capacitors to the Compucruise airspeed gizmo to quiet the oscillator and then seal the box with copper tape to keep the residuals inside. I then disassembled both mags and found a coil shorting in one. Then I removed the suppressors, because I didn't need them. The sneakiest noise of all was the voltage regulator. It sounded like ignition noise. This wasted a couple of days because my detection system broke down. I just couldn't believe it wasn't an ignition harness problem. The Prestolite transistorized regulator needed a coil and 2 capacitors which quieted it about 85%. It was never perfect. The Prestolite alternator had a whine that ordinary suppressors wouldn't quiet. I added 2 of the largest hash chokes available, which together with 2 capacitors and a lot of trial and error finally gave me fairly quiet power.

Back to the cockpit. Early in construction, before glassing, the single side band (SSB) HF antenna was run from the top tip of each winglet down the leading edge of the wings, wing strakes and around the nose. I installed a switcher so that the Loran could share the antenna except when transmitting on SSB. Sharing this antenna didn't work. Loran is too sensitive to noise and I still had a low level of noise. The Loran antenna placement problem eluded me until just a couple of days before departure. It was refusing to work in a fiberglass airplane. I had tried everything and was about to give up when it came to me. I dug a hole in the lower left winglet and put the Loran antenna pre-amp inside. I then ran a coaxial lead to the set and used 10 feet of .020 stainless wire with a small sinker out the aft of the lower winglet (trailing wire antenna). A quick test hop confirmed that the Loran was now working better than it ever had in the shop. I had essentially removed the Loran antenna as far as possible from all noise. The ADF required a lot of trial and error with the sense antenna. The best solution was a piece of copper foil tape from the nose up to the canopy rail and aft along the rail to the rear bulkhead. It was little short so I looped it up and over the head rest. Wrong. I wasted about a day of trial and error to figure out that I was too close to the voltage regulator with this antenna and had to keep shortening the length until I got it. The ADF now worked, but less than satisfactorily. It worked to Oshkosh, but prior to the Oakland-Honolulu return leg it quit, consumed a 200 dollar bill and worked much better. A prudent navigator always has a backup and on the return leg it was worth every cent of the repair. Let's flash back to getting ready.

Mid-July and I was still searching for an adequate bladder tank for the rear seat. It was an impossible search so I started foam and fiberglass auxiliary tanks Wow! This took a week. The front tank held 25 gallons, the rear 57. Luckily the plumbing and vent system was already in and approved. The auxiliary tank system test flight was go.

I haven't mentioned the Compucruise because it defied all efforts to quiet the noise. I simply turned it off to use the low frequency navigation or COM gear. This requires turning the Compucruise off and reprogramming it for use when you need it.

Shielding is a big part of noise control when going beyond a NAV/COM. I used shielded wire in the main power and regulating system and used it generously anywhere I suspected noise would be generated and transmitted in the wire bundle. Hindsight says I should have considered putting the wire bundle in an aluminum tube.

There were only two days left to departure. The NASA packet autopilot was almost ready. Before proceeding, the electrical noise was checked and flunked so I abandoned that effort. There wasn't time anyway.

The total effort was not without a lot of help. I never could have been ready without Sherry Emminger doing all the flight planning; Richard Emminger on weather; Sandy Moats on auxiliary tanks; Ann, my daughter, on programming the Loran and Rollie Moran and Jon Michelle on electrical problems. My wife Rosemary, bless her soul, ran the myriad of last minute errands.

The day before launch I still had to weigh the total loaded aircraft and work a weight and balance. It had weighed 755 pounds night IFR equipped and now weighed 1814 pounds with 137 gallons of fuel, me, the Loran, ADF, SSB, life raft, mae west, survival gear, candy, sandwiches and water. The weight and balance was dead center in the first flight box.

I told Sherry to plug in the 7 knot tailwind forecast over the Pacific and that I would work out the winds over the mainland when I got there. I went to bed at 1500 hours. Launch was scheduled for 0430 and I slept until 0400.

On the advice of a NASA flight surgeon, I wore a set of full length anti-embolism stockings and in addition, took an aspirin a day for a week prior to the flight to prevent clotting. Other than that, the only personal preparation was to wear warm loose clothing. Of special help was a down vest with removable, velcro attachable sleeves made by my daughter, Jill.

A last check of wind and weather showed no change so I started the last minute countdown. It didn't go too smoothly and I was an hour fifteen late on launch.

The Loran gave good track information and I split the Golden Gate, however, because of the Loran ground station layout and the fact that I went Loran station to Loran station (Honolulu to Fallon), crosstrack was sketchy and primarily DR. I had a couple of big shocks over the water. The first was 15+48, which was the over water flight planned flight time. There was no West Coast. Obviously the wind wasn't as planned. There was no VOR and no ADF information. Only the Loran said I was on course, so all I could do was keep trucking. Two hours later the shock sort of wore off. The moon had come up and gone down. Wow! It was dark and lonely out there by myself. The engine quit!! I changed from auxiliary to wing tanks very quickly and it started right up. I was two hours overdue on the flight plan to the West Coast and only had 12 hours of fuel left. How lucky I really was would not be realized for another two hours. It was almost 4 hours over flight plan before the over water portion ended. Almost any other airplane in this class would have gone down in the water. "Lucky you fly the Long-EZ".

I had picked up a 14 knot head wind versus the 7 knot tail wind forecast. It didn't take a lot of calculation to figure out what to do. It was quite obvious that it wouldn't go to Oshkosh as planned. So rather than cross the Rockies at night and then have to land in Nebraska, I stopped in Sacramento.

The next morning I went to prop the Long-EZ to depart for Oshkosh and discovered a piece missing from the prop. I called Bruce Tifft at Oshkosh for consultation. He said to take a like piece from the other blade and try it for balance. I filed the piece out (3" x 3/8") and gave them both a little varnish. It ran up okay so I launched for Oshkosh. The winds from RNO to STL were the first tail winds I'd had, but they shut off at STL. The Loran was working like a charm, giving me lat and long, steering info, miles off course, miles and time to go, mag heading and ground speed. I was going from way point to way point. It sounded the horn at each way point where I would punch the next and away I would go. This was living. The West Coast Loran stations stayed on until Nebraska then the Great Lakes chain came on. Loran coverage all the way. (The Loran used was a CLX95 from SRD Labs, McGlincey Lane, Campbell California 95008.). This particular Loran is a ferry pilot favorite, It is small, portable and has a 99 way point storage capability. I was able to pre-set all reporting points over water as well as enroute VOR's on the mainland from HNL to OSH and back to Seattle.

From Sacramento, it was 12 hours to Oshkosh to find the field closed for a thunderstorm. I diverted to Fond-Du-Lac and arrived after dark, meeting hordes of people in the same boat i.e., no place to stay. After 3 hours I finally slept in the airplane. It wasn't easy sleeping in the airplane. The worst part was that the airplane wouldn't hold a heading and I kept banking and turning for a long time even after I'd fallen asleep with one recurring nightmare. The engine would be droning away and suddenly go silent. I would wake up with real fear, open the canopy and let in more of those damn Wisconsin mosquitoes.

The numbers for Honolulu to Oshkosh were 4,497 statute miles, 32 hours, 125 gallons, 140 MPH, 3.9 GPH and 36MPG.

The trip back to Honolulu was not uneventful. The empty rear auxillary tank had a pinched vent line and imploded on let down into Oakland. Again "Lucky You Fly the Long-EZ". Ray Johnson of San Francisco, a Hospitality Club member, took my busted tank in at 9 in the evening and had it repaired by 11.

The launch from Oakland was late because of the auxiliary tank. A small leak, undetected in the initial repair, was easily repaired on the line with 5 minute epoxy, but required defueling and refueling which took about 2 hours of valuable air time. The lesson learned was: never launch late and force yourself to land at night after a long flight. Give yourself a break. A night arrival isn't tough, but things can go wrong. For me it was again the weather forecast. It turned out that I was two hours over my ETA, Honolulu, and in that two hours, there were lots of buildups, no really big ones, but it was raining in each, rough and dark. I certainly hadn't planned it that way. I knew on this flight I was shooting for a lot smaller target than the West Coast and these additional complications provided plenty of distraction and tension. I was in contact with Honolulu Center and they wanted to know where I was and my ETA, which was a really hard question. The Loran and ADF said, "Dead Ahead", but the ETA part was an unknown. I knew I was on track. I just didn't know where. Hey, relax, I had to keep telling myself and the Center. You're flying the Long-EZ with 12 hours of fuel remaining.

The Hawaiian VOR's came on one at a time and all ended well, but I had made it grossly harder than it had to be.

If you plan to make a similar trip, give yourself every break you can on landing as well as on launch. For example, I would never recommend take off or for that matter IFR flight at high overgross in visible moisture. This is a problem which is personal to individual Long-EZ's. To get the idea, load your Long with 140 gallons of fuel then try to pick up the nose. You are going to need help. It is heavy.

On take off and in flight, the wings and the canard together must lift the total load. If you have less than a perfect canard/elevator and if your Long-EZ pitches down in moisture, you will at some overgross reach a pitch control limitation. It may be at 2,100 pounds, it may be at 1,800 or way down at 1,600 pounds. Again this is personal to your craftsmanship. If you are considering long range, overgross operations in your Long, be sure to provide your very best flight test data pertinent to this problem in you owner's handbook.

As I was planning and getting ready for this trip, I was often asked, "Why?" It's not why. It's "why not?" Mountain climbers are for the most part forced to climb mountains others have already climbed. In a Long-EZ, you have countless originals to climb. Lucky you fly the Long-EZ.

W. A. "Rodie" Rodewald
68-361 Crozier Drive
Waialua, Hawaii 96791

September 30, 1982

From CP37-3&4 (CH22)

LORAN C IN A LONG-EZ

This is becoming more and more popular. We at RAF have no experience with the Loran C at all. Several builders have installed them and a few are flying. None that we know of work perfectly.

Loran C is very sensitive to noise. Electrical, generators, alternators, voltage regulators, Compucruise all put out noise. This noise is not noticed normally by your VHF equipment (nav and comm) but is is noticed by VLF like the Loran C. This can disrupt your reception and drop out the signal giving you erratic performance. Almost all of the problems we experience with Loran C with our EZs, do not occur with aluminum airplanes due to their inherent shielding and large ground plane. If you intend installing a Loran C, do everything to can to shield your electrical system. Every wire should be shielded. In addition, it is an excellent idea to run your wiring inside a metal conduit. Tom Williams, a Long-EZ builder/flyer suggests using 1/2" diameter copper refrigeration tubing. Run this from the battery to the aft face of the firewall, one piece down each side of the fuselage on the floor against the sides. All wiring except antenna coax and the positive wire to the starter, should go inside these conduits. Sweat solder a copper clamp to each end of these copper conduits (make a clamp from a 2 1/2" length of the same copper tube. Split it, flatten it out and wrap it around the conduit as shown). **SKETCH OMITTED**

Bolt a short length of #2 wire (for 12 volt systems, #4 for 24 volt systems) from the clamp on the forward end of one conduit to the negative terminal of your battery and the aft end should be securely grounded to the firewall, which in turn should have a braided ground strap to the engine. Thus you are killing two birds with one stone. The copper conduit serves as a ground wire from your engine to the battery, as well as an excellent shield for the wiring.

Rodie Rodewald, a Long-EZ builder from Hawaii has been working with Loran C in his Long for over a year. He finally cleaned up his electrical noise by installing one of B & C Specialities 35 amp alternators and their latest and quietist voltage regulator. He tells us it is an absolutely first class piece of equipment. Rodie has also tried many different types of antennas with varying success. Of course in Hawaii, he has the worst possible situation, since he is using one station on Hawaii and one on Guam! We figure if it works for him, it should work great for anyone here on the 'Big Island'! Rodie's antenna consists of RG-58U coax cable from the Loran C set to the preamp in the winglet. He buried his antenna preamp in the lower winglet. From the preamp he ran .025 stainless safety wire up past the rudder, keeping it as far as practical from rudder hinges, bolts, nutplates and wing tip lights/strobes etc. Once in the upper winglet, he zig zagged fore and aft going up until he used 108" of wire. This antenna has worked the best so far of any he has tried, including the use of the rudder cable in the wing.

Anyone with any more information on how to make a Loran C work well in a composite airplane, please drop us a line. This is not a real straight forward problem guys, if you think you can just bolt a whip antenna on the belly and have a flawless, reliable Loran C, you are in for a surprise. This will work on a fiberglass boat, but remember, a boat is sitting on the largest ground plane possible, the ocean!

We will continue to gather data on Loran C, as it really does seem to be the way to go. It would really compliment the excellent cross country capability of the Long-EZ making it even more of a utility airplane.

From CP37-4 (CH22)

The alternator and special regulator mentioned in the Loran C article is available from:

B and C Specialty Products
518 Sunnyside Court
Newton, KS 67114 (316)283-8662

From CP38-9 (CH22)

LORAN C IN AN EZ?

At Oshkosh this year there was much talk about Loran C in the fiberglass airplanes. There were even a couple of forums on the subject. It is quite obvious to me at least, that there is much confusion among even the so called experts. We at RAF, do not have a Loran C in any of our airplanes, but we do receive quite a lot of mail on the subject. Much of this mail is contradictory and even more confusing. Some builders report success by as simple a means as using one rudder cable for an antenna (insulated at the root of course). While this has worked for one or two people, it has been a dismal failure for others. It seems to be a function of how close you live and fly to a strong signal.

The antenna called out in CP 37, page 3 still seems to be the best so far. The big thing appears to be that a ground plane of some kind is required. The larger the ground plane, the better the performance. How to do the ground plane is the trick. Several competent radio specialists are working on this problem and we will report on it as we hear the results. One of the problems, as called out in CP 37, page 3 is electrical interference and anything you can do to shield every wire and any electrical noise source is going to help. For this reason, a Loran C in a VariEze with no electrical system (no starter, no alternator) just a battery and a Nav/Comm with a solar panel to trickle charge the battery, will sometimes work reasonably well, particularly in the vicinity of strong signals. However this may break up and drop the signal in other parts of the country. Obviously the Loran C is the way to go and the sooner someone comes up with a good workable solution to the problem, the better. Anyone who has a Loran C that works well even on extended cross countries, please let us know and we will try to keep everyone reading the Canard Pusher informed.

From CP39-2 (CH22)

LORAN-C - (Once Again!)

Jim Weir of Radio Systems Technology (the designer of the EZ Nav and Comm antennas) has recently written what is probably the definitive article on Loran-C antennas for plastic airplanes. His article will be published soon in Sport Aviation. This is a much needed article and will go an awful long way toward answering the many questions our builders have on the subject.

Meanwhile we continue to hear from builders and flyers who have tried to install Loran-C, some successful, others not so. Among them, VariEze flyer, Long-EZ builder, Bill Butters of St. Louis, MO. Bill is an EE and runs an RF lab for McDonnell Douglas, has had good success with a II Morro Apollo Loran-C in his VariEze. Bill has offered to help any builder who would care to write (don't forget to include a SASE).

Ray and Nova Cullen, owners of a beautiful VariEze "Rapid Rabbit", N22809, have a SRD labs MLX Loran-C. They could not get it to operate satisfactorily until they ran into Phil Stotts, who operates Western Avionics of Fresno (4995 East Anderson, Fresno, CA 93727, (209)255-4872). Phil is a Loran whiz and is very interested in Loran installations in EZs. Ray and Nova recommend Phil to anyone having problems with an MLX. Thanks, Ray, Nova and Bill.

Herb Sanders and Ray Cole (Ray is an avionics wizard and works in the avionics division of Federal Express) have been flying a Micrologic ML5000A Loran C Navigator in Herb's Long-EZ for about 7 months now and feel they have identified most of the major problems associated with the installation of Loran in the Long-EZ. Their installation is performing very well and has been used from the Loran "waste land" of west Texas to the northeast including the navigation required for the Dulles efficiency race. Signal to noise ratio and accuracy have been consistently very good. Ground speed readouts have been within one knot of the ATC report.

The ground buss is very important to the installation. In the composite airplane, the metal components connected to this buss will be the only counterpoise (ground plane) the receiving element will see. They insured the Loran Navigator was properly grounded to this point.

They can provide additional information about the Micrologic Loran C Navigator, (they are dealers) and are also willing to share their experience with Loran installation.

Contact: Herb Sanders,
3500 S. Mendenhall,
Memphis, TN 38118
(901)365-7606

From CP40-3 (CH19,CH22)

LORAN C UPDATE

Contrary to our thoughts that Jim Wiers super Sport Aviation article on Loran-C installations in composite aircraft would eliminate questions on the subject, it has only created more questions!! Please be aware that RAF is not an avionics shop, our expertise lies in aerodynamics and composite structures. Until recently we had never even flown behind a Loran-C. When we worked on the Army Long-EZ, we installed a T.I. 9100 Loran-C per the manufacturers instructions. This particular Loran is one of the best and most expensive available. It is also specifically designed for use in aircraft.

It worked perfectly parked on the ground, even in the hangar as long as the engine was not running. As soon as we started the engine, it dropped off the line. Apparently the electronic noise that runs around the electrical system in an aircraft that would normally be "damped" out or lost in the metal structure and skin (which is the ground), does not get lost in a composite airplane. The ground in the composite airplane in most cases, is only one piece of wire that runs the length of the aircraft from the negative battery terminal to the firewall.

What can be done about this? Get the ground plane (all the large metal parts) tied together electrically to form as large a ground plane as possible. This means, to attach pieces such as elevator torque tubes to each other and to the negative terminal of the battery. All of the wiring should run up and down each side of the fuselage inside either aluminum or copper tubes which will act as a shield for the wiring. The tubes should run from the battery negative terminal (or as close as practical, and then electrically bonded with a short piece of wiring) down the length of the fuselage and out through the firewall. On the aft side of the firewall, the tubes should be electrically bonded to the aluminum or stainless steel firewall. A length of automotive braided copper ground strap should go from the bolt that connects these tubes to the firewall, to a convenient bolt on the engine accessory case or oil pan. This will give you the largest practical ground plane you can get, short of installing Jim Wier's wires under the wing skin, which can only be done if the wing has not been skinned.

A recent innovation in Loran-C antennas is to buy an automotive windshield type antenna. This consists of a very thin wire centered on a piece of clear tape. This can be installed inside the top of the canopy, starting as far aft as possible and running down B. L. O, all the way to the forward edge of the plexiglass canopy. The Loran-C preamp must be mounted on the aft canopy frame, and the antenna wire should be connected directly to the preamp. The preamp will be connected to the Loran with a normal coax cable, RG-58 AU. This antenna is reported to work great and is the brain child of Phil Stotts of Western Avionics of Fresno, CA (209-255-4872). Phil is a clever guy when it comes to Loran-C installations and has quite a lot of experience with VariEzes and Long-EZs. If you are planning a Loran installation, give Phil a call.

VariEze builder/flyer, Wes Gardner is flying with the above antenna installed and reports that his MLX works like a charm. One strange fact is that if this auto windshield antenna is removed from the canopy and lowered into the fuselage, the signal will immediately become intermittent. Could it be that the glass is not as transparent to VLF as it is to VHF?

Of course it goes without saying that a noisy regulator or alternator will give you problems even if you follow the above suggestions to the letter. A good linear regulator such as Bill Bainbridge of B & C Specialty, Newton, KS. sells, will effectively eliminate this problem. Contact Bill at B & C Specialty, 518 Sunnyside Court, Newton, KS 67114.

RAF will continue to disseminate information on successful Loran-C installations. Obviously there are probably many ways to make a Loran-C work in an EZ. Those we have suggested are just a few.

On the Loran-C article in CP 39, page 2 we forgot to include Bill Butters address. Our Apologizes.

Bill Butters
1478 Urbandale
Florissant, MO 63031

From CP40-4 (CH22)

"Dear RAF,
After almost 500 hours in our Continental 0-200 powered VariEze, N13WM . We decided to give her a new heart. She made her first Lycoming 0-235 powered flight on the 16th of March, 1984. So far we are very pleased.

We were featured in an episode of "Blue Thunder", the TV series in February '84. N13WM and her identical twin N13MW played the part of the nasty drones.

After almost a year of frustration trying to make our MLX Loran-C work, and almost ready to give up on it, we read in CP 39 , Page 2 of Ray and Nova Cullen's success with their MLX, and decided to follow their advice. We contacted Phil Stotts of Western Avionics in Fresno (209)255-4872. He is definitely a whiz. With just a simple installation application of an auto windshield type antenna, our Loran-C works like a dream.

Sincerely,
Wes and Millie Gardner"

From CP44-2 (CH14,CH22)

Mike and Sally's Long - N26MS - is in the shop for a few changes and a face lift. This airplane has 925 hours and is over 4 years old. We are installing new upholstery, and will be repainting the whole airplane. While it is down, we are doing a few things to it that we have always wanted to do, but have never got around to. **We are installing a Loran-C, we chose a Micro Logic 6500. We are also installing a F-TEC ST-1A engine monitor meter. This promises to be a really neat multiple engine functions gauge as well as a great panel space saver.**

In addition, we have modified the trailing edge of the cowling, by extending it aft about 3" towards the prop. The goal here is (hopefully) a lower drag cowl with improved cooling. We have also moved our brake master cylinders up into the nose. This modification has been done by many builders, using several different methods. The advantages are better access to firewall area, mags etc, and for cg, weight on the aft end moved into the nose is better.

All of the above are now in the works. This is quite a major undertaking, requiring a new instrument panel. **Oh yes, we are completely rewiring the entire airplane!** Please don't call on any of these mods. We will thoroughly flight test all mods and report on the results in the next newsletter. We anticipate flying in about 6 weeks time.

From CP46-3&4 (CH13,CH22,CH25,CH30,CH38)

N26MS, MIKE AND SALLY'S LONG-EZ - the first 1000 hours.
As many of you (who attended the RAF flyin in June and also Oshkosh this year), will know we have given our "old" Long-EZ a face lift. It is hard to believe, but she will be 5 years old this December.

It all started when Mike decided (and the check book said ok) that we needed a Loran C!! After much looking around, we opted for the MicroLogic ML6500. Our reasoning included, easy to operate, fully automatic chain selection and a size and shape that would fit our panel. It turned out that the panel had to be cut out and a completely new one be designed, built and installed! While we were at it, we tore out all the wiring (it was done in a hurry and Mike was never very happy with it). Our panel night lighting was never very good, so we installed post lights over all the instruments, as well as a dimmer switch. Panel lighting at night is now superb.

In order to do all this work, we removed the wings and canard, cut out the side consoles, cut out the instrument panel, reshaped the nose to allow installation of brake master cylinders up front and optimum placement of the two 12 volt motorcycle batteries, that make up our 24 volt electrical system. We also reshaped the cowling extending it aft a full 3" to reduce the closure angle and hopefully reduce drag a bit.

The structure was given a very thorough inspection, wing attach hardpoints looked like the first day they were put together. We are extremely pleased with the composite structure. A few small cracks were found in the paint, all were examined, by removing all finish down to the glass. In no case did any crack extend into the glass, we are ashamed to admit that each crack was over a rather generous build up of Bondo! The moral here is use dry micro not Bondo. We did a little recontouring, filling with West System, sanding and priming with Mortons Eliminator. We installed the new Roncz 1145MS canard, carefully fairing it into the nose. We designed and built two battery access doors (they work nicely, but are not worth the amount of work it took). We installed the Loran C antenna in the left winglet. Then we wet sanded the original Imron finish down until the whole airplane was dull.

Mike sprayed the entire airplane with Imron using a slightly whiter white than we used last time, and we trimmed it in metallic gray instead of the green we used the first time. We had the seat cushions recovered in gray to match the trim. All the consoles were glued and glassed back into place, the interior was once again painted in charcoal gray Zolatone. **We installed the Ian Ayton's canopy/gear warning systems, (it flashes the warning light and buzzes the horn intermittently).** We cannot say enough about this system. It is really neat. It is small, easy to install and you absolutely cannot ignore it. If you override the horn, the light continues to flash, and in about 50 seconds, the horn starts to buzz again, a very worthwhile addition and one we both heartily recommend.

When we finally reassembled her, she looked like new! We did a careful weight and balance on 3 certified aircraft scales (naturally she had put on a little weight), then we rolled her outside, fired her up and went flying.

The whole face lift was supposed to take a few weeks and in fact ended up taking over three months. (It only took 5 1/2 months to build her from scratch!!)

The Loran C works well. We get SNRs (signal to noise ratio) of 99 on the master as well as both slave stations, with everything turned on, engine running and in flight. This is true in the Mojave, Bakersfield, Fresno area at least where the testing was done. Obviously there are many places where we cannot get these kind of optimum results. The antenna we use is a 3/16" O.D. hobby store brass tube. We sharpened the end, put it in an electric drill, and "drilled" it into the bottom of the lower winglet, pushing it all the way to the top of the winglet. It goes up the leading edge of the upper winglet. We soldered the preamp to the bottom of this brass tube, removed a wingtip light assembly, dug out a little foam and installed the preamp behind the wingtip light. We are very pleased with this simple, cheap antenna.

We recently installed miniature fuel and oil pressure gauges (1 1/4" dia) that read actual pressure (not electrons!). They are plumbed directly from the engine to the instrument. We used nyloseal tubing fittings. These are really great little instruments, a bit expensive, but worth it. (See page 206 in the Aircraft Spruce catalog). In addition we have an Electronics International digital CHT-EGT with a four way switch, so we can look at all four cylinders. We bought an oil temperature probe and connected the cylinder #1 EGT to the oil temp. Thus we have 4 CHT, 3 EGT and oil temperature in one gauge. Also in this small side panel, is a digital voltmeter by Davtron. Again, expensive but worth it. We know exactly how the electrical system, alternator charge, etc is doing, plus or minus 0.1 volt.

The only item that really required maintenance was the nose gear strut and associated pivots. Mike removed the top bolt and took the whole strut out. The bushings in the NG-6 assembly (NG-23 as shown on Page 13-1) were quite worn allowing considerable side to side play in the top pivot. Mike machined up two steel bushings, pressed them into the NG-6 casting then reamed them to be a very close fit on the NG-7 spacer. A grease fitting (Zerk) was installed in the NG-6 casting allowing future lubrication of this pivot without dismantling it. The two HM-6 rodend bearings in the shock strut were also somewhat worn, allowing some fore-aft movement of the nose gear strut. We replaced these rodend bearings with very expensive aircraft quality rodend bearings (approximately $25.00 each) which essentially eliminate any play.

The vertical pivot at the nose wheel fork had already been overhauled per CP 44, page 7. Thus the entire nose gear strut and wheel has received a complete major overhaul. It is now working flawlessly and we are very pleased with the above modification and repairs.

The brake master cylinders up forward modification was done for three reasons: To help move the CG forward, to allow better access for inspection and hydraulic fluid replacement, and to also allow better access to the magnetos.

Mike designed this particular installation, it works quite well, but if we were to do it again, we would use Debbie Iwatate's method. (See "for sale" this CP).

We did find one drawback to the forward mounted brake cylinders, that we had not foreseen. It is now quite difficult to adjust the rudder position for various size pilots. The original design used only adjustment to lengthen or shorten the cable aft of the pedal. Now we have to also adjust the pedal to brake master cylinder relationship, which with our design is awkward. As a result no one else gets to fly our Long - advantage or disadvantage?!?!?!

We have also done a lot of work on optimizing engine and oil cooling. At this point in time though it is too early for us to comment on the success. We are flying the airplane quite a lot, in fact since Oshkosh we have put over 100 hours on her. N26MS continues to meet or exceed our expectations. We have enjoyed nearly 5 years of fun flying, visiting faraway places and meeting interesting people. We are looking forward to the next 1000 hours.

****From CP46-4&5 (CH22)****

LORAN-C, SOME PERSONAL OBSERVATIONS

I am new to Loran-C and like most pilots I had heard the glowing reports on how great it was and how it would replace VORs. I never did read or hear any negative reports, so like many others I talked Sally into us spending the necessary dollars and before you could spell Loran-C, we had a MicroLogic ML6500 in our Long-EZ!!

I have used it on every flight for the past 4 months and the following observations are strictly my own for the better eduction of other pilots looking at Loran-C.

Before you buy a Loran of any kind, find out if your area is good for accurate Loran coverage. While Loran navigation is good in some areas, it can be essentially useless in others. I am not talking about the mid continent gap either. Ask your dealer to explain base line extension. This is in simple terms, when your airplane is positioned so that two of the three necessary stations "line up" thus giving the receiver on board excellent information in one plane and zilch in the other plane. This causes the unit to flash an unreliable signal and to give crazy ground speed readouts of as much as 50 knot errors and cross track errors as much as 40 miles. Distance to the stations remains somewhat reasonable, but still questionable and therefore for practical, accurate navigation, probably useless, especially in marginal rainy weather, when the rain upsets the Loran somewhat too, must to static? I have experienced this exact scenario many times in the area between Bullhead City, Arizona and Prescott, Arizona. Certainly this is not in the mid continent gap. I assume this to be classic baseline extension gremlins at work.

My other pet gripe is the fact that I can be flying along wings level with SNRs of 99 on all three stations, with all data showing good. I see something below that I would like my back seat passenger to see so I bank quite steeply to give her a better view and when I roll back to wings level on the original heading, the Loran has lost its mind. Ground speed is way off, cross track error is miles off, only distance to the station is reasonable. According to the manufacturer, this is due to the fact that the microprocessor does not update fast enough, and with the information changing rapidly due to the heading change, the computer does "tilt". It takes about 2 minutes of straight and level flight before the information is reliable again.

Oh well, nothing is perfect! In good Loran reception areas this is a neat navigation tool, but don't throw away your VOR equipment yet. Loran-C is very accurate <u>provided</u> it has been there before. That is to say, my Loran receiver has my hangar's position absolutely nailed. It will bring me back to the hangar plus or minus 60 feet (actually its more accurate than that in Mojave). If you look up the Lat/Long of a given airport or VOR in your handy Loran booklet, and dial it in, your Loran will sometimes bring you right to the spot, but most times will bring you only to within a mile or two. In VFR conditions you can always see where you were trying to get to.

I have found the distance to the station to be the most useful and reliable information displayed by my Loran receiver. If it's been there before and you are in a so called good area, it's great! I have talked with pilots who fly Apollo IIs, Arnav 21 and SRD Labs Loran-C receivers and generally they have had the same results I have spelled out in this article.

I would be interested in hearing from others with their experiences. I do not intend to discourage anyone from buying and installing a Loran, rather I hope I have given you food for thought, allowing you to make an intelligent decision and to help you understand some of the "quirks" of the so called 'lower-priced' Loran-C receivers. I have essentially no experience with the so called 'pro-line' type Lorans ($5,000.00 and more).

Generally speaking, I like my Loran. It is a neat navigation <u>aid</u>. I enjoy using it and most of my cross country flights are probably flown more accurately therefore my airplane is more gas efficient. As I get more familiar with it, learn about its good points as well as its bad points, I get more out of it. Would I do it again? You bet!! Mike Melvill

Following letter is from Judge King, a Minneapolis, Minnesota Long-EZ builder/flyer. Judge installed an Arnav 21 Loran-C receiver in his Long and from my conversations with him, he feels about the same way about his as I do about mine.

From CP46-5 (CH22)

<u>Retrofit A Loran-C For Your EZ - by Judge King</u>

The stories I had heard about the problems of installing Lorans in plastic airplanes almost discouraged me from attempting a retrofit for my Long. There were the ongoing antenna problems and the problem of where to put the unit. Claims of no panel space are a myth if one plans well in advance.

I decided to plan a Loran installation because the price was right compared to the new equipment that depends on VOR signals. I ignored all the stories about Lorans and electrical interference and did nothing special during my installation to eliminate problems discussed in many articles related to strobe lights, alternators etc.

The antenna is a straight piece of RG58 co-ax cable four feet long and installed in the winglet on the left side of the airplane. The top 24 inches of the cable is stripped of its outer insulation and shield. The lower 24" portion plugs into the preamp. Putting this in the winglet during construction would be a snap. It is also a snap in a retrofit.

1. Remove the position-strobe light assembly exposing the hole in the wing for running wires. If your Long was built per plans this hole is forward and below the upper winglet.
2. Using a .25 x 4 ft drill bit (the kind that burglar alarm installers use) drill a channel through this hole from the inside into the upper winglet staying as close to the leading edge of the winglet as possible. (My channel wandered and the drill bit came out the top of the winglet about half way aft). It is important to note that this hole is being drilled through a structural attachment point so one small hole is enough. The antenna co-ax was pulled through from the top.
3. Placing the preamp. Since the preamp has to be attached at the end of the antenna a cavity was carved in the same space behind the strobe light assembly to accommodate the preamp. (There is only styrofoam in this area - thus an easy carving job). The distance from the preamp to the Loran is less than 25 feet of fishing cable through the wing and center section spar and fuselage.

I had no cable fishing to do because I installed a comm antenna in the left winglet during construction which I never used, so I used the RG58 cable that was already there. With my antenna installed I turned to the problem of where do I put the unit. I got rid of my ARC radio and VOR head, lowered my transponder by 1" and was able to fit my 3.1" Arnav at the top of the stack of my new TXN960 (720 channel radio with locator and glideslope and VOR head all in one unit) and transponder.

The Arnav unit is higher than some other units but I was determined to make it fit because it has some features that others are lacking. I don't have to ask flight service for winds aloft anymore and I was aware that Arnav was in the process of a new safety feature which I just ordered for my R-21. Enroute to a distant waypoint I can punch in 911 and get immediate indication of bearing and distance to the nearest six airports.

Flying the VORs was great when that was all I had but I consider my R-21 Arnav the best thing since sliced bread.

From CP49-3 (CH22)
LORAN-C FOLLOW UP
Sally and I have been flying a Micrologic ML6500 Loran-C for the past 250 hours. Once you have flown Loran it would be difficult to do without it, to say the least. The Micrologic is an excellent Loran, and for the price, is probably as good as you can do. We had a home-made antenna in the winglet and, in retrospect, I believe this was a mistake. I believe the antenna should be a close as possible to the aircraft centerline. I say this because several EZ flyers I know who have the winglet antenna have the same complaint, drop out during maneuvering. Those with antenna on or close to the centerline do not report this problem.

Anyway, we sold our Micrologic and bought a new Northstar M1 from Dusty and Brenda. They have the best prices on the M1 that we could find. This Loran-C unit is the best I have seen, and I have flown most of them. It has an unbelievable data base of over 14000 waypoints and is the easiest to use of all the Lorans I have tried. Dusty provided the unit with the wiring including the antenna prewired to suit our Long-EZ. All I had to do was mount it and hook it up!

We bought the bent whip antenna with a tuned and matched pre-amp because we figured if we were going to spend this much money, we may as well go all the way to get the best possible performance. I installed the bent whip on the belly under the passenger's thigh support. I laminated a piece of copper screen about 20" x 30" onto the floor and layed up one ply of BID over this to hold it in place and to protect it. The antenna base is bolted to the copper screen as is the antenna pre-amp. In addition, I bolted a ground wire to the pre-amp, the antenna base, the Loran mounting tray and then directly to the battery negative terminal. This ground was in addition to the normal radio ground or 28 volt negative. The Northstar M1 operates on any voltage from 8 volts to 30 volts, and so far, we are ecstatic with our new toy!! We flew it on a cross country from Mojave to Twin Falls, Idaho, to Salt Lake City and back to Mojave and it performed flawlessly, never dropping out even during an aileron roll! This is without a doubt the neatest navigation device to become available to the homebuilder since the Long-EZ itself and I heartily recommend it. The general feeling about home-made antennas seems to be that the best results come from a wire stuck on the canopy. Bob Evans reports that he has tried them all and the one he likes best goes along the plexiglass just above the fiberglass frame from the front to the back, then over the top and back up the other side. The pre-amp must be for a long wire antenna and should be mounted on the canopy frame as close as possible to the antenna. Ground the pre-amp case and mounting tray directly to the negative terminal of your battery. If your alternator makes noise that interferes, you might try one of Bill Bainbridge's linear voltage regulators and/or a Loran filter in the main wire from the alternator to the battery. Mount this filter as close to the alternator as possible.

From CP50-2 (CH22)
LORAN UPDATE
Sally and I are continuing to build experience on our Northstar M1 Loran C. We are absolutely satisfied so far. On a trip to and from Oshkosh this August, we experienced no drop out at all! We had excellent, accurate data all the way there and all the way back. Our route was Loran-direct, essentially, Mojave - Las Vegas - Grand Junction, Colorado - Estes Park, Colorado - Sioux Falls, South Dakota - Oshkosh. We flew the entire flight at 17500', using our Aerox O_2 system. We had 30+ knots of tailwind and the trip was smooth and uneventful.

Coming back was similar but with a 15-20 knot headwind. We flew at 8500' to 12500', and even when flying in rain, our Northstar continued to run flawlessly. A point that no one I know of, who uses a buried homemade antenna, can claim! Apparently rain causes a static buildup on the skin and the Loran will drop off the line. Just like all other Lorans we have tried, the Northstar becomes uncertain if we fly from Bullhead city, Arizona towards the southeast to Phoenix - or anywhere from there to the Texas coast. This, I guess, is a fact of life until the FAA installs one or two more Loran transmitters to eliminate the so-called mid-continent gap. In summary, we both love our Northstar. There is not one feature we would change if we could except, perhaps, to have it recommend the best restaurants at our destinations!

From CP62-3&4 (CH22)
LORAN ANTENNA INSTALLATION
Although this subject has been covered in several CPs, RAF continues to receive requests as to what is the best or latest on Loran antennas. Well, this will hopefully be the last word on the subject.

This is a description of my Loran antenna installation on Sally and my Long-EZ, N26MS. There are at least two other Long-EZs flying with exact copies of what we did and all three have excellent Loran reception.

Right or wrong, I firmly believe that a Loran antenna must be outside the fiberglass skin of the airplane to work correctly. Sure, you can point to many installations in winglets, down gear legs, even in canopies that "work". They may work, but believe me, they do not give maximum performance to your Loran. If you intend using your Loran as Sally and I do, a primary means of navigation all over the USA, you should attempt to get the maximum performance available out of the antenna. After trying every antenna suggestion that has been in the CP, I have convinced myself that the antenna needs to be out from under fiberglass/epoxy skins. (Just as transponder antennas do). I believe the glass/epoxy skins attenuate the signal to some degree, thus compromising the performance of the antenna and worse yet, this compromises the performance of your Loran. It does not matter how cheap or how expensive the Loran, a poor antenna will a poor Loran make!

I took a hacksaw blade and cut the rear seat thigh support out flush with the floor of the rear cockpit. Since we have a flush NACA engine cooling inlet centered in the bottom of the fuselage, I decided to offset the antenna from the centerline so as not to compromise the NACA inlet's efficiency.

First things first. I believe to get the best out of a Loran (or a transponder) you should use the antenna supplied and matched by the manufacturer. Anything else will be a compromise. So I used the antenna pre-amp (a small aluminum box of magic that amplifies the incoming signal which in some locations can be very, very weak) as supplied by the manufacturer, in this case Northstar. Incidentally, I have flown ARNAV, Apollo and Micrologic Lorans and none compare to Northstar's M1 for overall performance, user friendliness and features in my opinion.

I cut through the floor of the rear cockpit where the thigh support would cover and protect the antenna and coax cable. (See sketch) Using a Dremel, I kept grinding away until the antenna could be installed from inside the cockpit, through the floor, so that the base of the antenna was perfectly flush with the inside glass skin of the cockpit floor. I then made an aluminum plate to match the base of the antenna. I sandwiched the ground plane (copper screen) between the base of the antenna and this aluminum plate. I applied a generous coat of DC4 grease to the aluminum base and plate prior to tightening the three bolts. This grease prevents arcing and corrosion of the aluminum and assures long term excellent electrical contact between the copper screen ground plane and the antenna base. I used exactly the same method to install the antenna pre-amp to the ground plane.

The ground plane (without which this type of antenna simply will not work at all!) is a single piece of copper wire cloth 16x16 mesh with .011 copper wire diameter. (I got it from McMaster-Carr, their part number is 9224T22, phone in LA, 213-692-5911, approx. $3.00 per square foot). I cut it to fit the rear cockpit floor from the back of the front seat bulkhead to the forward face of the rear seat bulkhead and from the left side to the right side. The bigger the ground plane, the better.

I simply micro'd the Northstar bent whip antenna into the hole I had made. You could use silicon or you could figure some way to make it removable but I don't think it would be worth the time and effort. If mine ever dies, I will just cut it out and get another one.

My antenna is about 2-1/2" left of the aircraft centerline and the antenna pre-amp is on the right side. Both are under the rear seat thigh support such that the highest point of the thigh support is directly over the BNC connector on the base of the antenna. This gives the most possible clearance for the RG-58 AU antenna coax cable.

Now, the most important part of all. You must run a separate ground wire (I used 18 gage) from one bolt on the pre-amp to one bolt on the antenna base. Then from there, directly to a bolt installed in the side or end of the mounting tray for the Loran unit. From this bolt, you should run this ground wire directly to the negative terminal of the battery. If you neglect to follow this grounding procedure exactly, you will have a compromised, possibly ineffectual antenna and thus, Loran. This separate ground is the key to a really successful Loran installation in a plastic airplane. There is no need for any other ground plane wires. There is no need for any electrical connections between metal parts on the airplane. It is possible that these two features may not hurt the Loran installation, but I do not have these features on N26MS and I have optimum reception, both signal strength as well as signal-to-noise ratio. A factory installation in a certified metal airplane does not get any higher numbers than I do in the same geographical locations.

I layed up one ply of BID over the copper screen both to protect it and to hold it firmly in place. The best possible way to install this would be to vacuum bag this ply down onto the floor, but I did not do this. I then micro'd the rear seat thigh support back into its original position and taped it down with one BID tape. I finished the rear cockpit floor area with charcoal gray Zolatone to match the rest of my interior.

Obviously, the antenna coax (RG58AU) must be installed per the manufacturers instruction. Be very conscientious about installing the BNC connectors to this coax cable, or better yet, have a competent radio shop do it for you.

I installed my Northstar as high as possible in my instrument panel because I use it as a primary navigation instrument and I believe it should be as visible as possible to the pilot while he is looking out of the canopy (as near as you can get it to a head-up display (HUD)).
Mike Melvill
SKETCH OMITTED

From CP63-12 (CH22)
YET ANOTHER LORAN UPDATE!
Just when we thought we had reported all we know! We now hear from a builder/flyer who tried Mike's loran antenna as described in CP 62. He built it exactly as shown and his Northstar performed poorly. Low signal-to-noise ratios. He tried all the usual things, alternator filter capacitor, voltage regulator, etc. Finally, a friend suggested that since he had his main electrical power wires running down one side of his fuselage, and his ground wire running down the other, that maybe this was causing a field (like an electric motor) with his loran antenna base right in the center of the field!! (We could not believe it either!). Anyway, he finally bit the bullet and ran a new ground wire on the same side as his power wire. The optimum wiring

scenario is to wrap the power wire around the ground wire at a spacing of two twists per foot of ground wire. This, in effect, eliminates the field caused by running the two wires parallel to each other. PRESTO - his SNR's were as they should be, high 80's and 90's percent for the Southern California area. Weird, but if you have tried everything else this is something to consider.

On the same subject, Mike's Northstar loran suddenly developed a case of low SNR's. Maybe he was forgetting, or ignoring, the fact that he had recently had to replace an alternator. (He had had the old one since 1980 and it was used when he got it!) His alternator is an Airborne aircraft-type, 28v, 60 amp. The rebuilt one, looking exactly like a new one and costing big bucks, was bolted on and it worked fine. At least, it was charging.

Anyway, when the loran signal-to-noise ratios declined, he assumed it was the filter capacitor. Upon removal, it was found to have a broken connection. A new one was purchased from Dusty Rhodes at Vista Aviation on Whiteman Airport in Los Angeles. The cost is about $26.00 and without one of these in parallel with your "BAT" connection and "Ground" connection on your alternator, your loran will never work much better than at 30% of its capability.

This helped, but did not cure the problem. The next purchase was a B&C linear voltage regulator from Bill Bainbridge of B&C Specialties in Newton, Kansas. This replaced the cheap looking Cessna-type regulator Mike had since building his Long-EZ in December of 1980. Well, to make a long story even longer, this did not do the trick either! Finally, he did what he should have done in the first place, he turned off the alternator field while in flight, while actually looking at the signal-to-noise ratios displayed by the Northstar in the self test mode. As you will have already guessed, these percentages jumped from the low 30's to the high 90's!! **A trip down to Vista Aviation and Dusty diagnosed bad diodes in the new alternator!**

After all that work and all those dollars! At least, now everything in the charging system is new and the linear voltage regulator is a much superior design from a noise standpoint. Aviall replaced the faulty alternator and now the loran is back to its usual excellent performance and usefulness.

Fuel Flow Indicators

****Also see CP32-2 in the "Cabin Heat" section of this chapter.****
****Also see CP34-3 in the "Loran C" section of this chapter.****

****From CP24-7 (CH22)****
"EZCALC" Electronic Instrumentation
The Long-EZ has such an impressive long range cruise capability that to fully utilize this unique efficiency we are developing an electronic unit that will give instantaneous fuel flow (gph) and average for the trip. This will also save panel space by displaying other engine data. Also displayed are: total fuel used/fuel remaining, fuel/distance/time remaining (pilot inputs ground speed), battery voltage, OAT, CHT, RPM, EGT, fuel low warning, clock local/Zulu, and approach timer. We installed a prototype in the Long-EZ for the trip to Sun-'n-Fun. We found it to be a invaluable aid in long range cruise control. For any given air speed and altitude we found we could lean for optimum and found my normal leaning technique was wasting fuel. An example, using my old technique at 180 mph true, I was using 6.2 gph, but using the "EZcalc" I could refine the mixture back to 5.56 gph for the same speed. Therefore we could easily exceed the advertised range for the aircraft. We learned a lot about leaning on the record flight using the Sears fuel counter and stop watch. But this unit gives a direct read out on fuelflow and you see it change as you move the mixture control. It's interesting to see the difference, with full rich at cruise power its 7+ gph and to be able to cut it back to 5.56 gph for the same speed is quite gratifying.

The "EZcalc" micro processor chip is now being designed and programmed for our special needs. There is a 15 week lead time on these new chips. We can expect availability of this unit by late summer. .

****From CP26-6 (CH22)****
EZCALC ELECTRONIC INSTRUMENT UP DATE
IN CP #24, page 7, we talked about an electronic unit that would give instantaneous fuel flow and trip average. Additional displays: Total fuel used/remaining fuel/distance/time to arrival and also to dry tanks. (Pilots in-puts ground speeds). Battery voltage, OAT, CHT, RPM, EGT, fuel low warning, clock, local, zulu time and approach timer. This all in a 3"x6" vertical oriented box. The developmental program is still in work, but delayed. We are currently expecting deliveries in February 1981. We should have an update in CP #27. Note: Long-EZ or VariViggen only. Installation requires fuel pressure, so this cannot be used on a gravity-feed VariEze.

****From CP27-7 (CH22)****
EZ CALC
The development of the fuel flow calculator is still underway but delayed somewhat due to parts availability. We expect to be testing a mock up unit in our airplane this month. We will also evaluate a new turbine fuel flow transducer in a gravity flow system to determine if it can be used in a standard VariEze. The dimensions are 3" x 6" x 1.5" mounted vertical and the unit will be detachable or can be flush mounted. See CP #24-7 and 26-6 for more complete details.

****From CP32-2 (CH22)****

EZ-CALC?? FUEL FLOW INDICATORS

The EZ-Calc system as discussed in several previous newsletters, has apparently been dropped and will not be available. A lot of builders have seen the Zemco Compucruise, an automotive driving computer, in the prototype Long-EZ and as a result, several VariEzes and Long-EZs have these installed. RAF has never come out and recommended this installation however, since we were and still are very concerned with the fuel flow transducer that comes with the Compucruise. This transducer has a tiny passage way for the fuel, and it would take only a minute piece of foam or other contaminate to shut off ALL fuel to the engine. This is not at all acceptable and any EZ pilot currently using this set up should ground his airplane until it has been changed. Also, the pressure drop is too great for a gravity system.

Byron McKean of Seguin, Texas, has done a lot of development work with the Compucruise and he has come up with a system that works great. I have one in my Long-EZ (N26MS) and am very satisfied with it. What it consists of is the basic Zemco Compucruise computer, but the transducer is discarded and an aircraft-type flow transducer, made by Flo-Scan, Seattle, Washington is substituted. Byron has also devised a neat little gadget he calls a 'Gizmo', that you can readily build yourself with parts from Radio Shack. This enables you to dial in your ground speed, and then you can get all of the functions out of the Compucruise. In effect this gives you a poor mans DME, with accurate fuel management information. I installed mine in my Long, in two pieces. I literally cut the Compucruise in half and remote wired it so that the keyboard is flush mounted into the right console just aft of the stick, and the display is mounted up at the top of my instrument panel. This was not difficult to do and it looks and works great. I have continuous information regarding fuel flow, in GPH, as well as fuel used and fuel remaining. I also have battery condition (voltmeter), inside and outside air temperature, a count up timer, and trip timer, and with ground speed and trip distance 'inputted', time to arrival, time to fuel exhaustion, etc. etc. On top of that it has an accurate digital clock. I am delighted with mine and would recommend anyone who is interested in a fuel flow indicator to go with this system.

Contact: Byron McKean
Rt 1, Box 429-B
McQueeney, TX 78123
(512)557-6575

For $12.00 Byron will send you a very complete letter with wiring diagrams, sources for parts, part numbers, prices, literally everything you need to know to do the installation. We must stipulate that we recommend this installation ONLY if you use the Flo-Scan fuel transducer. Do not use the Compucruise transducer.

****From CP34-9 (CH22)****

The Compucruise with the aircraft grade Flo-Scan fuel flow transducer, together with the "gizmo" to dial in ground speed, will soon be available from Byron McKean. It will be available in several different configurations. Byron will be stocking all 3 items and will build them to suit, that is, you can remote mount the keyboard or display, or mount them together. Contact Byron for brochure and order blank.

Byron McKean
RT #1, Box 429-B
McQueeny, TX 78123
(512)557-6575 NO collect calls.

****From CP35-10 (CH22)****

Byron McKean's Compuflight is now available as an integral unit or as a remote mounted unit ready to install, including the "gizmo". Write for an order form.

Basic Compuflight $229.95
Remote Compuflight $259.95

Contact:
McKean Systems Inc.
Route 1 Box 429-B
McQueeny, TX 78123
512-557-6575

****From CP36-7 (CH22)****

Byron McKean's popular Compuflight seen on more and more VariEzes and Long-EZs is available as a basic integral unit or as a remote mounted unit. Until July 1, 1983 prices will remain as follows:

Basic Compuflight	$229.95
Remote Compuflight	$259.95

After July 1, 1983 prices will be as follows:

Basic Compuflight	$249.95
Remote Compuflight	$279.95

Write to Byron for an order form:
McKean Systems Inc.
Route 1 Box 429-B
McQueeny, TX 78123
(512)557-6575

From CP40-9 (CH22)
The following is from Byron McKean, a VariEze builder/flyer from Texas and the person primarily responsible for adapting the automotive compucruise fuel flow computers to our EZs in the form of the Compuflight. Byron has done a superb job of preparing, marketing and servicing these very useful instruments for all of us, but now, unfortunately he finds himself unable to continue with this important program. If anyone is interested in getting involved in a program like this, please get in touch with Byron.

McKean Systems Inc.
Rt 1, Box 429 B
McQueeney, TX 78123
(512)557-6575

"The CompuFlight computer system that I have supplied to homebuilders for the past fourteen months has been very popular and I feel should continue to be available. However, I am unable to continue to furnish the system. What started out as a hobby, quickly grew into a small business that requires more time than I have available, so I am looking for someone who is interested in taking it over.

The CompuFlight very accurately measures fuel flow and increases the accuracy and consistency of mixture leaning. In addition it contains a quartz clock, alarm, elapsed time, battery voltage, inside and outside temperature in both Celsius and Fahrenheit, plus when you enter your calculated ground speed, all time, distance, and fuel requirements are available to you continually. All this for a very reasonable price.

Anyone interested in operating their own business, increasing their income, and being able to deduct as a business expense much of your shop, office, and flying expenses, please contact me.

Until someone takes over, there are no more CompuFlight Units available as I am completely sold out. I will continue to service those I have sold and answer questions. I will also keep a list of those interested in purchasing an individual unit and pass along those names to the new supplier.
Thanks,
Byron".

From CP47-5&6 (CH22)
FUEL FLOW INDICATORS
We have used several different brands of fuel flow measuring devices, and obviously for flight testing, they are essential. After flying with on of these gadgets installed and operating for awhile, we have found them to be very valuable, even for simple flight planning on a cross country. For a long time we used an automotive type "compucruise" with an aircraft grade Flo-scan transducer. This worked quite well, when it worked. In 4 years (600 hours) we replaced the electronic "guts" three times. Our main complaint we the flashing display and erratic indication. That is to say the gallons per hour was not stable, the tenths of a gallon continuously ran up and down several tenths. We also tested a 'Fuelguard' fuel flow/fuel used indicator, but it was much worse in the erratic display department and we could not recommend this instrument. Recently, we installed an Alcor fuel flow with the time and fuel remaining feature. At last, we have an accurate and extremely stable indication of fuel condition. By far the best we have used, the presentation is very good, a clear, large LCD screen shows fuel flow in gph on the left and gallons used on the right. A flip of a switch lets you read time remaining at present power setting on the left, and fuel remaining on the right. You can enter the fuel load very easily using one momentary switch. Back lighting is automatic and comes on as it gets dark. You can dim it as required with a built-in dimmer. The flow transducer is a Flow scan, and is a good one. Each transducer is individually calibrated to the electronic microprocessor and best of all, you can calibrate the instrument yourself to give extremely accurate information over a particular range of flow. You can also set the instrument to read in gallons, lbs./hour or imperial gallons/hour. The instrument is very light and quite small.

We are really happy with our Alcor and heartily recommend it to anyone who would like this kind of information available to them in flight.

Cabin Heat

Also see CP35-10 in the "Battery" section of this chapter.
Also see CP36-7 in the "Miscellaneous" section of this chapter.

From CP32-2 (CH22)
MIKE & SALLY'S LONG-EZ
N26MS has been spending more time in the hanger than usual due to bad weather, while the weather in Mojave is almost always acceptable it certainly is not in Tehachapi, so during the two to three months of winter type weather, we have been driving, and

what a pain that is! On top of that it actually takes more fuel to drive our Honda Accord to work and back, than it does to fly the Long!

Even so we have managed to put some time on her, she is just over one year old and has 320 hours total time. I did an annual inspection last month and found very little, I adjusted the rudder travel, relined the brake shoes, changed the oil, topped off the batteries, checked brake fluid level and that was about it. Engine health is excellent with compression like new on all four cylinders.

The airplane has proved to be exactly what I had hoped, a low maintenance, high utility, high speed, economical cross country airplane. **I have been testing a small electric cabin heater for the past month or so.** This heater is STC'd for any aircraft, and came to me from Steve Franseen, 1245 S. Tennyson, Denver, CO 80219. Steve is a Long-EZ builder and is the distributor for the heater. Contact Steve if you are interested.

The heater I have is a 12v 16 amp heater, with an advertised capability of heating a 50 cubic foot area. On the ground, static it is much more that you need. In the air at a normal cruise speed around 160 knots true, in my Long-EZ, it is marginal with an outside temperature of -14 C. This is primarily due to the many air leaks that I have, around the elevator tubes, the nose access hatch, etc. I am sure that with close attention to sealing the nose of your Long-EZ from all leaks, this little heater will do an adequate job. I am going to be testing a 24v 16 amp heater, which has an advertised capacity of 80 cubic feet, in the next few weeks and will report on the performance in the next CP. The heater is well made, has a built in fan and safety cut out. It is also internally fused. It completely eliminates the problem of carbon monoxide contamination, and is easy to hook up. I installed mine in less than an hour.

I have also recently installed a Compucruise and flo-scan fuel flow transducer. I elected to use a flow-scan series 100-A, which has a range from 1.5 gph to 15 gph. It is a real kick to fly with this gadget on board, as you can really keep track of your fuel management. Once calibrated, it is accurate, and measures fuel burn in 1/100ths of a gallon. The only apparent drawback I have found is that the Compucruise, even with the display turned off, will drain a 12 volt 25 amp hour battery in less than two weeks. This is no problem as long as you use the airplane at least once a week. But I would recommend a master switch to shut the Compucruise down completely if you don't intend flying for extended periods. This of course drops out the memory and your fuel flow calibration, but it is not difficult to reenter.

We have entered our Long-EZ in the Cafe 400 race, and are looking forward to it. We expect to be quite competitive, with the race being extended to about 400 miles from 240, and a requirement to climb from sea level to 10,400 feet and back. What with the Long-EZ's high aspect ratio and low induced drag, we should make a good showing.

Sally recently had a "#99's" meeting at the Bullhead City Airport, on the banks of the Colorado. This is a nice little cross country of about 190 nautical miles each way. We gassed up both the Long-EZ and the VariViggen. Son Keith went in the back of the Long with Sally and I flew solo in the Viggen. A beautiful day, with a 26 knot tail wind took us there at 7,500 feet indicating 120 knots with an average ground speed of 162 knots (187 mph). The return trip against a 26 knot head wind found us flying low, from 100 feet to 500 feet AGL. Crossing the desert at low altitude at 140 knots indicated is really fun, but in the Viggen it really burns up a lot of fuel. Which meant we had to land at Barstow-Dagget for gas. A quick low altitude dash from Barstow to Mojave and I tallied up the fuel burned in each airplane for comparison. While the Viggen with its 180 hp Lycoming, used 24.7 gallons, the Long with its 118 Lycoming, used exactly 12 gallons and carried two people. This is a good comparison showing the difference between a low aspect ratio (requiring lots of horsepower) VariViggen and a high aspect ratio, low induced drag (requiring very little horsepower) Long-EZ, both flying at the same speed and altitude, the Viggen averaged 8.8 gph, while the Long averaged 4.4 gph.

****From CP34-4 (CH22)****

<u>CABIN HEAT</u>

We have been testing the small electric heater mentioned in CP 32, page 2, for several months now. We have been satisfied with it. The one we have is a 24 volt - 16 amp heater and more than adequate. For a 12 volt installation, the 20 amp model gives approximately the same performance. These heaters are small, very light weight and put out adequate heat. They do however require an alternator. Our heater is mounted above the nose wheel well and blows heat forward at our feet. We have two manifolded motorcycle batteries and feel that the manifolded battery is mandatory with this type of heater since batteries do put out hydrogen gas while they are being charged. The manifolded battery dumps all gasses overboard.

The name and address given in CP 32, page 2 as a source for these heaters is no longer valid. Unfortunately as we go to print, there is no supplier. The guy who invented these heaters and built all of them so far, is just not set up for production. He is currently negotiating with a company to manufacture the heaters. As soon as we have a name, we will publish it.

****From CP35-10 (CH13,CH22,CH24)****

<u>Cabin Heat</u>

These are excellent heaters, small, lightweight and reliable. Mike gave his a good test a few weeks ago when he climbed to 23,000 feet to do some fuel flow testing. The temperature was -25 degrees C and yet he says his feet were quite comfortable.

The most important thing is to seal every little gap where air might blow in, as best you can. Make a cover to go over the top of the nose gear crank mechanism, between the NG30 bulkheads (2 plies BID). Seal around the canard to fuselage juncture, using RTV silicone. Seal the gaps fore and aft of the elevator torque tubes with soft sponge rubber, glue it to the canard and fuselage with RTV silicone. Be certain that there is <u>no interference or friction</u> with <u>full</u> elevator travel. Most important, you battery <u>must</u> be the manifolded type and it is <u>mandatory</u> that it is vented overboard. For 12 volt systems the 20 amp model will probably be best for most, while for 24 volt systems, the 16 amp model is fine. Mike uses a 24 volt, 16 amp model, since his Long-EZ is 24 volt. When using this cabin heater you must have at least 20 amp (10 for 24 volt system) alternator output above other drains.

From CP38-8 (CH3,CH18,CH22)
Aircraft Spruce now has in stock the electric cockpit heaters as tested by Mike Melvill in N26MS. Also a substitute for the now extinct Disston Abrader, a handy little tool for sanding and filing glass and foam. Also a new type of spray-lat for protecting plexiglass canopies. We tried it and it works great.

Instrument Panel Photos

From CP26-13 (CH22)(Photo caption)
Fred's cockpit.

From CP28-11 (CH22)(Photo Caption)
Instrument Panel on Mike and Sally's Long-EZ N26MS
PHOTOGRAPH AND LEGEND OMITTED

From CP35-11 (CH22)(Photo Caption)
From Switzerland, Paul Schneider's Long-EZ, now flying. Looks like a basic IFR panel. Note Space Saver Panel on the right.

From CP35-11 (CH22)(Photo Caption)
From "Down Under", Victoria, Australia. Jim Glinderman's idea of what a Long-EZ instrument panel should look like. Note circuit breakers on left console.

From CP35-11 (CH22)(Photo Caption)
From England, Ivan Shaw's instrument panel. Registration: G-IVAN!

From CP36-9 (CH22)(Photo Caption)
The "Real" George Scott's beautiful Long-EZ instrument panel. Note - engine instruments and intercom mounted in the right forward baggage area.

From CP36-9 (CH22)(Photo Caption)
Herb Sander's Long-EZ instrument panel. Herb managed to get it all on the panel - looks great.

From CP36-9 (CH22)(Photo Caption)
Dr. Robert Forest's "side" panel. Engine instruments, circuit breakers, switches and even his stereo tape deck fit nicely, freeing up the instrument panel for flight.

From CP38-11 (CH22)(Photo Caption)
Herb Sanders shows what can be put on a Long-EZ panel. 1 1/2" instruments are: EGT, oil pressure, tachometer, CHT, oil temp, manifold pressure, fuel pressure, OAT. Transponder is an RT887 and Nav Comm is an RT 563A. Herb sells these miniature engine instruments by B & D.

From CP39-9 (CH22)(Photo Caption)
This is Gene Scott and Jerry Hansen's instrument panel! Wow, everything fits and it really does not look crowded.

From CP41-8 (CH22)(Photo Caption)
How's this for a pretty panel? Dick and Sam Kreidel's Long-EZ. This is not only a beautiful Long-EZ, it is also the fastest stock 'Long' we have seen. Look for this one at Oshkosh '84.

From CP42-10 (CH22)(Photo Caption)
Rob Cook's VariEze instrument panel. Rob is coming right along and will fly soon.

From CP42-10 (CH22)(Photo Caption)
Bernard Verdon's Long-EZ instrument panel. Very nice! Uncluttered, simple and functional.

From CP43-7 (CH22)(Photo Caption)
Buzz Talbot and Mr. Gooch, partners on their Long-EZ, N112TG. Note the 720 channel "Becker" comm radio on the right. It fits into a 2 1/4" hole!

From CP43-7 (CH22)(Photo Caption)
Dick and Joy's instrument panel.

From CP47-14 (CH22)(Photo Caption)
Four beautiful instrument panels to wet your appetites!

From CP51-11 (CH22)(Photo Caption)
An Australian Long-EZ panel by John Sabadina and Susan McQuillan

From CP51-11 (CH22)(Photo Caption)
Long-EZ instrument panel by John L. Hayes of Euless, TX.

From CP51-12 (CH22)(Photo Caption)
Paul Siegal's Loran-C (King) and his fire extinguisher

From CP51-12 (CH22)(Photo Caption)
Paul Siegal's Long-EZ instrument panel - neat!

From CP54-13 (CH22)(Photo Caption)
Jim Stanley's very complete Long-EZ instrument panel

From CP55-11 (CH22)(Photo Caption)
Randy Pflanzer's excellent instrument panel layout.

From CP55-11 (CH22)(Photo Caption)
Harry Bawcom's outstanding instrument panel - very clean, well thought out layout.

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Chapter 23, Engine Installation

Note: Refer to Chapter 30 for other engine related information

****From CP37-4 (CH15,CH16,CH23,CH30)****
Section IIL - NOTE: The engine installation plans update and supercede information in Section I. Do not do any work aft of the firewall without having Section IIL in your hands. Section IIL also has lots of information on engines, which may help you to make your selection.

****From CP38-7 (CH14,CH15,CH16,CH23,CH30)****
<u>CAUTION</u> - Long-EZ
Note that the engine section of the plans, Section IIL updates Section I of the plans. Do not do any work in the area of engine mount installation, brake master cylinder installation or anything aft of the firewall until you have Section IIL in hand. Also - do not install the aluminum engine mount extrusions until you have the engine mount at hand and can clamp it to the extrusions while they cure in place. This assures a perfect match of engine mount to extrusions.

****From CP39-6 (CH23,CH30)****
<u>CAUTION</u>: A number of builders have not installed the metal shields in the wing root areas as called out in Section I, Page 23-3 of Long-EZ plans. It is possible that exhaust system radiated heat can damage the foam in the root of the wing. The metal shield eliminates this problem.

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Chapter 24, Covers/Fairings/Consoles

Long-EZ Plans Changes

From CP28-9 (CH24)
LPC #54, MEO
Page 24-1 Step 1, 3rd paragraph, glass with one ply of BID.

Miscellaneous

From CP26-7 (CH24,CH29)
LANDING BRAKE INSTALLATION - Page 24-1, the sketch showing LC1, does not show the cutout necessary for the seat belt clearance. Before bonding LC1 into place, make the cut out per the right side.

From CP27-3 (CH24,CH30)
NACA FLUSH INLET
Steve Woods and Tim Gheres (address: Wood & Gheres Inc. 105 Appleblossom Court, Orlando, FL 32807) are selling plans and providing builder support for those builders installing flush inlets. (see CP #26).

Mike installed one on his Long-EZ and used a 12 inch wide inlet, rather than the 14 inch size suggested for the 0-235. His 0-235 runs cool. We recommend using the 12 inch configuration for the 0-235 Lycoming. **Mike also installed an access panel aft of the main gear strut in the "top" (bottom?) of his NACA duct.** This panel is an oval shape, 5" x 10" and is constructed and installed using the same method shown on page 13-11 for the nose door. This allows inspection of main gear attachment and access to plumbing and wiring normally only accessible through the hole in the back seat bulkhead. This same panel can also be installed on a Long-EZ (or VariEze) without the NACA inlet, in the same place. Do not make the entire area removable this cover area is required for structural reasons and should not be omitted.

From CP28-8 (CH24)
Back Seat Thigh Support.
This little item really makes a difference to back seat comfort. This position works excellently for people from 5'4" to 6'4". Fabricate from R45 foam with 1 ply BID on each side. 1 pc. 4" x 19", 1 pc. 7" 19". **SKETCH OMITTED**

From CP30-7 (CH22,CH24)
Transponder Antenna
The transponder antenna can be mounted under the front seat thigh support, and this is where quite a lot of builders have located it, however, Jim Weir of Radio Systems Technology has cautioned that it may be possible that high powered microwave energy may be radiating in very close proximity to a rather sensitive part of the pilots anatomy. To put it bluntly, it may be a little like sticking your fanny into a microwave oven! **In any event, no qualified person to our knowledge has tested this, so it may be prudent to laminate a sheet of aluminum foil under the thigh support.** Microwave energy will not penetrate the thinnest of metallic foils.

From CP33-6 (CH24)
Installation of side consoles. Make all of the side consoles and fit them, but do not install them at this time. Install all the fuel lines, wiring, rudder cable conduits, relief tubes, the control system in it's entirety, the landing brake and the pitch trim system, before you glue the side consoles in permanently.

From CP33-7 (CH24)
O'Products, manufacturer of engine protective plug kits for Beech and Piper, are now offering similar kits for the homebuilder. Kits are presently available for the Long-EZ and can be custom made for the VariEze Long-EZ kits for aircraft either with or without a prop extension are being produced. They may also be ordered for either the "male" or "female" inlets. The 'A' kit (for aircraft with 3" prop extension) is priced at $85.95 and includes three plugs and storage bag. The 'B' kit (for aircraft with 6" prop extension) is priced at $124.95 and includes five plugs and storage bag. The storage bag fits snugly into the space behind the passenger's head and is available separately for $24.95 in red, blue and yellow Naugahyde. Add $10.00 to kit or bag price for special color bag. For further information, or to order contact:

Patrick O'Brien
O'Products Homebuilt Division
269 Marjori Avenue
Thousand Oaks, CA 91320
(805)499-7369

****From CP35-10 (CH13,CH22,CH24)****

Cabin Heat

These are excellent heaters, small, lightweight and reliable. Mike gave his a good test a few weeks ago when he climbed to 23,000 feet to do some fuel flow testing. The temperature was -25 degrees C and yet he says his feet were quite comfortable.

The most important thing is to seal every little gap where air might blow in, as best you can. **Make a cover to go over the top of the nose gear crank mechanism, between the NG30 bulkheads (2 plies BID).** Seal around the canard to fuselage juncture, using RTV silicone. Seal the gaps fore and aft of the elevator torque tubes with soft sponge rubber, glue it to the canard and fuselage with RTV silicone. Be certain that there is no interference or friction with full elevator travel. Most important, you battery must be the manifolded type and it is mandatory that it is vented overboard. For 12 volt systems the 20 amp model will probably be best for most, while for 24 volt systems, the 16 amp model is fine. Mike uses a 24 volt, 16 amp model, since his Long-EZ is 24 volt. When using this cabin heater you must have at least 20 amp (10 for 24 volt system) alternator output above other drains.

****From CP38-4 (CH24)****

Side Consoles

Make and fit all side consoles. Do not permanently install them yet. Make your plywood parts CS109 and CS118 and glue them to the side of the fuselage with 5 minute in the appropriate positions, using the side console for location. After the 5 minute cures, layup 1 ply of BID on each side of CS109 and CS118 (fore and aft) and lap onto the fuselage side at least 0.5". Allow to cure. Now make CS108 and CS118 (phenolic bearings) and bolt these into place. Install all of the pitch/roll control system from the front stick to aft of the firewall. Also install the fuel valve and all fuel lines. Also install conduits for electrical wiring. Do all of this before the side consoles are finally epoxied and glassed into position.

Update Number 73 to Chapter 24, Covers/Fairings/Consoles

****From CP73-10 (CH18,CH24)****
Custom cover for your Long-EZ. This neat design completely covers your prop, canopy and nose and only uses two straps. Made from space-age Evolution 3 material. Reasonable price.
Contact: Tony Brazier
PO Box 6478
Ocala, FL 32678
904-237-1811

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Update Number 67 to Chapter 25, Finishing

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. **It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily.** I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. Don't trust anyone else with your safety. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

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Update Number 71 to Chapter 25, Finishing

****From CP71-1 (CH2,CH3,CH25,CH33,CH38)****
WARNING - STRUCTURAL DEGRADATION OF FOAM CORES
We have noted that many of you have not been adequately inspecting your structure and may not be aware of how seriously the structure can be affected by a degradation or defect in the underlying foam core. For example, a 3-inch diameter depression or bulge in the skin due to damage in the foam (void, crush or de-lam) can weaken a winglet or wing (particularly a VariEze outboard wing that has no discrete spar) by as much as 50% or more! A skin dis-bond on an elevator or aileron can result in flutter failure even within the allowable flight envelope.

We have recently found foam damage to several of our own aircraft structures. One was due to the inadvertent intrusion of an agent used to clean a wing before it was primed and painted. Another was traced to a stress crack that was in the foam block, a flotation billet, not the proper fabrication billet. Never substitute a different material even if it seems to work okay. We have also had dis-bonds in control surfaces. These can grow rapidly when exposed to high altitude flight. (The void is trapped and expands at altitude).

The solvent-susceptible and easily-damaged cores we use need constant attention to maintain safety. We know of no accidents due to this problem, however, the potential is high if you are careless with the maintenance of your airplane. Please let us know what you find on your inspections so we can pass this on to everyone. Since these types of structures are used on non-RAF types, we are asking Sport Aviation to also publish this caution.

****From CP71-5 (CH3,CH25,CH33,CH38)****
MAN-GND
ADD THE FOLLOWING TO THE MAINTENANCE/INSPECTION SECTION OF VARI-VIGGEN, VARIEZE, LONG-EZ, DEFIANT AND SOLITAIRE OWNERS MANUALS.

PREFLIGHT CHECKLIST

Check all skin surfaces of wings, canard, winglets and control surfaces for cracks, dents, or bulges and for evidence of interior foam damage (skin moves when you push on it or has a dull thud if tapped with a coin). Do not fly if structure is damaged beyond the limits noted in the 25-hour inspection (page 46).

COMPOSITE STRUCTURE

WARNING - The foam core in composite control surfaces, wings, canard and winglets is easily damaged by solvents, including solvents found in paint primer, most cleaning products and, of course, oils and fuel. Never wash the structure with anything but soap and water. The smallest invisible pinhole through the epoxy surface structure can allow intrusion of liquids or vapors that will attack the styrofoam core. A void or dis-bond (separation from the skin) will weaken the structure and can result in a fatal accident. The foam core can also be damaged by local concentrated loads such as a dropped tool or by using your shoulder to set the gear. Never use a wing as a workbench or to stack luggage. Treat all composite skins like eggshells.

EACH 25 HOURS Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or if it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re-painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping with a 25-cent coin. Good core is indicated by a sharp "tap" or "knock" noise. Bad core is indicated by a "dull thud". Listen carefully as you tap and mark with a grease pen directly on the skin the boundary of any suspected dis-bond area. Ground the aircraft if any core damage area is larger than the following:
Fuselage, wing/canard - 3" diameter.
Winglet, control surface or VariEze outboard wing - 2" diameter.
Repair per instructions in the annual/100 hour below.

ANNUAL/100 HOUR Conduct a very careful 100% skin surface coin tap, surface stiffness and contour smoothness inspection. Include interior areas in fuselage, cowl and wing with wings removed. Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge (any

divergence from the intended smooth contour) must also be repaired and reinforced per the standard repair methods in the plans.

****From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)****

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

****From CP71-7 (CH25)****

"Dear RAF,

My Long-EZ, N60AK (Ser.#1172), has 900 hours since first flight in Aug. 1985. I have had no significant problems other than the Nylaflow brake lines which always leaked at the fittings on the brake end. I switched to Stratoflex hose and have had no problems since.

I have had some problems with paint bubbling, particularly on the upper surface of one strake. All bubbling is on the upper surfaces that are exposed to the sun (when we get it). The bubbling seems to get worse when I fly to the "lower 48" and is exposed to higher airport elevations, higher ambient air temps and more direct solar radiation then here in Alaska.

The airplane has been a joy to fly and is great for transportation. A couple summers ago, I flew up over the ice pack on the Arctic Ocean north of Alaska (just for kicks). Has anyone else done that with an EZ? That may be my only claim to fame in life, such as it is.

Jerry Nibler
Anchorage, AK"

****From CP71-7 (CH25)****

"Dear RAF,

Just a note to pass along some information that might be of interest to your builders.

I recently contoured my Long-EZ using West System epoxy and West System 410 Microlight filler rather than glass bubbles.

The 410 sands a little easier that "micro" and seems to be less prone to developing pinholes. The biggest advantage, however, is that it takes about 1/3 the time to mix with the epoxy and there is much less airborne loss while mixing.

Jim Smith
Logan, UT"

Editor's note: We have also used 410 Microlite filler and found it very easy to sand and essentially all the dust falls to the floor (does not become airborne particles nearly as bad as does micro). However, the 410 is softer than micro and more easily damaged. For this reason, it should never be used along any leading edges (wings, winglets, canard, nose area back a foot or so, etc.). The only other disadvantage is the cost - it is fairly expensive - but may be worth it since it mixes quicker and is much faster to sand to contour.

Update Number 72 to Chapter 25, Finishing

****From CP72-2&3 (CH2,CH3,CH25,CH33,CH38))****

FOLLOW-UP ON CP71 DISBOND/DELAM CAUTION

So far, we have received only one letter from a builder with a problem in this area. This aircraft is a Q-2 and, normally, we would not presume to comment on someone else's design but this particular problem could so easily have resulted in an in-flight structural failure that we felt morally obligated to say something about it.

During a landing that the pilot said was not any harder than other landings he had made, the canard (also the landing gear since the main wheels are mounted on the tips of the canard) failed. The top skin just inboard of the fuselage side, buckled and the canard folded. Subsequent sectioning of this area showed a large percentage of the foam had "melted". This builder/pilot suspected that this melting damage was caused by excessive heat from the sun while tied down outside in Florida. He included three photographs of the section of damaged canard.

We at RAF have not seen this canard, only the photos, but we have a different opinion. We believe this damage may have been caused by fuel leaking out of the fuel tank (above the canard) and seeping through tiny pinholes in the top skin and melting the foam. Styrofoam, be it blue or orange, fabrication billets or floatation billets, will melt when it comes in contact with any fuel, solvent, etc. Put a scrap of foam in a container of fuel and, in a short period of time, the foam will disappear. Pour a little fuel, avgas or mo-gas onto a block of foam and you will be amazed at the damage. The three photos supplied to us by this Q-2 builder/pilot, in our opinion, show classic fuel or solvent damage. One of Scaled's employees who has built a Quickie and a Q-2 informed us that the fuel tank is, in fact, mounted directly over the canard and that he had heard of this type of foam damage before.

All of the RAF designs have a fuel-proof barrier between fuel and Styrofoam. This barrier can be a sandwich panel of glass/PVC foam/glass, or glass/urethane foam/glass, but RAF feels it is absolutely essential to completely protect any Styrofoam core structure from exposure to fuel or any kind of solvent. In some cases, even the fumes of fuel or a solvent such as MEK or acetone can degrade a foam core to the point of causing a possible structural failure.

We have written a letter to this particular Q-2 owner and will be passing this information on to Jack Cox, editor of *Sport Aviation*. We are not criticizing anyone, it's just that this kind of damage is many times invisible and may not easily be spotted in a normal preflight. Any foam core, glass structure, while perfectly safe with an undamaged core, can become prone to catastrophic failure if the foam core is damaged. This kind of hidden damage could cause a serious accident. This is our only reason to bring this to everyone's attention.

To protect yourself from this kind of failure, it is critically important to prevent fuel from coming into contact with a glass structure that has a Styrofoam core. The same goes for any form of solvent, be it MEK, acetone, Prep-Sol, Acrylikleen, or whatever.

To check your structure for possible delamination or dis-bonds, move the airplane into the sun or, at least, to where it is warm. This will cause any disbonded areas to bubble up due to the air or gas in the void heating up and expanding. Carefully tap the entire area using a quarter (25-cent piece). Listen carefully for the telltale "hollow" sound when you tap an area that is disbonded or delaminated as opposed to the solid "click" sound of normal structure. By carefully tapping and using a felt tip pen to mark the perimeter of the damaged area, you can outline any areas that need repair then you can repair these areas, in most cases, simply by injecting a mixture of epoxy and micro-balloons, using a syringe. You will have to drill a number of small holes (to closely fit the needle) and inject the epoxy mix into one hole until it comes out of adjacent holes. Keep moving the syringe around until forcing it into any hole will make it come out of the holes closest to that one. Now, move the airplane out of the sun into a cooler area. Place some plastic (Visqueen) over the area, cover that with a piece of flexible material (.032 aluminum) and place a lead shot bag on top of that. As soon as the epoxy in the cup has kicked off, remove the lead shot bag, the aluminum and the plastic. Carefully scrape the excess epoxy off the paint using a plastic putty knife. After a full cure, you can carefully polish this area and repaint. Sometimes the visual damage is so little it does not require repainting. Recheck the area by tapping with a quarter to assure that you completely filled all void areas.

****From CP72-7 (CH25,CH33)****

IMPORTANT REMINDER

Do not omit the required placard for minimum pilot weight. Keep in mind that someone other than you may someday fly your airplane. If that someone is not as heavy as you are, he or she may take-off with an out of CG, aft condition that could cause an accident.

Update Number 77
to
Chapter 25,
Finishing

Information derived from CP77 published by RAF Jan 1994

From CP77-4&5 (CH25)

A DIFFERENT CONTOUR/FINISHING IDEA

This is presented as food for thought, not as the only way to do it. This idea was developed by Cory Bird, a very bright manufacturing engineer at Scaled. Cory is in the finishing stages of his exquisite original design and came up with this idea while working through the contouring stages on his airplane. I recently refinished my wood core/carbon composite prop and I used Cory's idea and I liked it! It worked great! Here it is.

The idea came when Cory compared the weight of a gallon of epoxy with a gallon of Featherfill. If you have not done this, do it, it will open your eyes! Even taking into account the evaporation of solvents in the Featherfill, there is a huge difference. Anyway, this is a process that starts when you have your airplane (or parts of airplane) structurally complete, in bare glass, and are ready to begin contouring. Sand the glass as usual, you are not looking for a structural bond such as you would need in a glass-to-glass bond, you just need to scratch the cured epoxy. Use at least 40 grit, 36 grit is better. Sand hard in one direction 10 strokes. Then sand hard at 90 degrees to the first sanding in the same area, 10 strokes. This is not a hard and fast rule, it is just a rule of thumb so that you can begin to see the kind of surface preparation you need prior to applying dry micro.

Before applying the dry micro, paint the area with pure epoxy. Wipe as much of this epoxy off as you can with a clean paper towel. This is the "glue" that will bond the dry micro to the cured substrate (skin). A good idea here is to only try to do a small area at a time, say a square foot or two. Mix up a batch of dry micro - the consistency of cake icing works well. Some people try to mix it so dry that it is almost impossible to apply. I don't agree with that. The gram or two of weight you might save per 8 ounce cup is simply not worth the enormous effort. Spread the micro (just like peanut butter) using a squeegee. If it rolls up behind the squeegee, it is a little dry but you can fix that with peel ply. Squeegee through the peel ply to get the micro even and where you want it. Once the whole surface is micro'd, allow it to cure.

Contour sanding should be done using a long sanding block. In the case of a wing, 3 or even 4 feet is not too long. Glue 36 grit sandpaper to the sanding block using 3M 77 spray adhesive. Sand until you hit glass, then stop. If you still have low spots, rough them up, fill them with dry micro and repeat the above until you have the smooth contour you like. Leave it in 36 grit scratches. Do not go to a finer grit sandpaper.

Now, mix up a little pure epoxy and, using a 6" wide soft rubber squeegee, spread this pure epoxy (no micro) all over the surface. The idea is to fill <u>all</u> of the 36 grit scratches with pure epoxy. Carefully squeegee as <u>much</u> of this first coat of epoxy <u>off</u> as you possibly can. Use a lot of force on the squeegee and wipe the edge of the squeegee often with a paper towel. Allow to cure for two hours or so. The first coat should be gelling but not fully cured when the second coat of epoxy is applied in exactly the same way. Continue with this ritual until you have applied five separate coats. At two hours per coat, obviously you will need at least 10 hours at one stretch. Of course, this will depend on the ambient temperature and on what epoxy you are using. Here in Mojave in the summer, using Safety-Poxy or PTM&W epoxy, two hours between coats is sufficient. Allow these five coats to cure for a full 48 hours.

At this point, you have filled all of the 36 grit scratches and you have a very thin film of cured epoxy over the entire surface. All that remains now is to final sand. You should not have any runs or thick lines of epoxy. Wet sand with 220 grit followed by 320 wet. You are now ready to paint! That's it, no Featherfill, no Morton's eliminator, nothing but epoxy all the way. This way, there are <u>no</u> pinholes, no voids, no place for a delamination to start, no place to trap moisture. All you need now is a quality paint. I would suggest at least a high quality urethane or epoxy paint. Keep in mind that your composite airplane is very flexible and will flex in turbulence and while taxiing over bumps. If you use a brittle paint such as enamel or lacquer, it will crack at all highly stressed areas.

For the toughest, most longlasting finish, you should use the same epoxy for the contouring method described here as you used to manufacture your airframe. However, this may be time consuming because sanding Safety-Poxy micro can be very hard work. The only way to speed this up, for those of us who are impatient, would be to use the fast West System (Gougeon Bros.) for the contour job. It will go much quicker, perhaps only one hour between coats, and it will sand much more easily - it will not be quite as tough, but it will certainly be adequate.

I would appreciate any feedback from anyone trying this system. - ED.

Update Number 78
to
Chapter 25,
Finishing

Information derived from CP78 published by RAF for April & July 1994

****From CP78-3&4 (CH25)****

BLISTERS IN THE PAINT

Our thanks to Ian Wilde (Long-EZ G-BOOX) from England for all of the carefully researched material on this subject. I guess we are pretty naive about problems like paint blisters living here in the very dry conditions in the Mojave desert. Paint blisters are rare in our neighborhood and just about any paint system seems to hold up quite well.

This is not at all true, however, in more humid areas of the US and, indeed, any other country including England. Ian reports having severe blistering problems over just about all of G-BOOX (except main gear legs and cowling). He had the paint job done by an experienced aircraft painter in an unheated paint booth. Contouring was done with epoxy and micro and lots of elbow grease! Featherfil (a polyester material) was used as a "fine finish" over the micro. Corlar epoxy primer was sprayed over the Featherfil (allowing plenty of time for the Featherfil to completely dry as Ian was very aware of the hygroscopic nature of polyesters and he is adamant that this care was taken). The Corlar was allowed to cure overnight (per the data sheet) then wet sanded and allowed to dry. The sanding <u>did</u> break through in a few places. They did <u>not</u> spray any Corlar over these areas (a mistake, I believe - ED). DuPont's Imron top coat was then sprayed overall, all of this done in accordance with the appropriate data sheets.

One wing blistered so badly that it had to be refinished within 6 months. The other blistered but it was 4 years before it required refinishing. The canard now needs refinishing after 5 years. WHY? The consensus from DuPont is that moisture was somehow introduced into the paint films. Apparently <u>all</u> paint systems have a process called "osmosis" which is the facility to allow moisture to pass back and forth through the paint films and <u>no paint system</u> is tight enough to prevent this process.

The possible sources of moisture suggested by DuPont are: 1) Moisture contamination from the compressed air system. The compressor tank may need to be drained completely and, depending on humidity and weather conditions, should be drained several times a day. Water traps <u>must</u> be used in the airlines. 2) Spray painting when the weather is bad - raining or very humid. 3) Using the wrong thinner. The correct thinner must be used with each and every coat of paint, the primer, the primer filler, the top coat. Do not use one manufacturers thinner with another manufacturers paint, however good either may be. It is even worst to use a cheap quality thinner since these materials often have a moisture content well above specified limits. 4) Flash point and drying times, as called out by the paint manufacturer, should be strictly adhered to. Many paint jobs are rushed, the painter thinking he is saving time but, in the long run, this can cause blistering. Applying a top coat too soon over a primer may not allow full evaporation of the thinner. This entrapped thinner will force its way through the top coat causing micro blistering and it may be months before conditions and temperatures are right for this to happen. GO SLOW, and follow the directions. 5) An even paint film weight must be used. If you sand through a primer, re-spray the primer. Low film weights are one of the most common causes of blistering, especially when combined with adverse environmental conditions as described above. 6) Contamination, such as salts (from finger prints) or from water containing minute quantities of salt, can cause blistering. 7) Applying a solid wax polish to paint when it is still fresh should be avoided. Wax can seal the surface of the paint and trap thinners which can, in turn, lead to soft top coats and possible subsequent blistering. 8) Finally, allowing the painted parts to "cure" in an area where there is high humidity can cause blistering later on because isocyanate activators are, themselves, "moisture seekers" and while not fully cured, can attract moisture.

What did Ian do to try to fix this problem? He used the following procedure: Sanded everything off the wing including the polyester Featherfil. He then applied a coat of wet micro and epoxy which was sanded to contour and, hopefully, would seal the wing. Corlar epoxy primer was applied, sanded and followed by the Imron top coat. The result: Five years later, <u>no</u> blisters. (Careful attention was paid to all of the suggestions above).

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Chapter 25, Finishing

****FROM CP24-4 (CH22,CH25,CH30,CH34,CH36)****
WEIGHT CONTROL - Too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap -- if you address each item as, "Oh, that's only one/half pound, it's a small percent of the empty weight", you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?". Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program -- the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transit it will put a lot less stress on your landing gear. Then if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modifications.

****From CP26-7 (CH3,CH25)****
FINISHING - CAUTION! Do not ever wipe paint thinners on any part of your structure. Minute pin holes in the epoxy/glass skin can allow the thinners to penetrate down to the styrofoam, which dissolves in thinners. This can cause the skin to debond from the core. For the same reason, care should be taken to fill any possibly dry areas (presence of air voids) or areas with pin holes, with epoxy, before applying featherfill or primer, both of which contain solvents that can attack the styrofoam. Epoxy wiped onto the surface with a rag should be sufficient to seal layups that otherwise maybe dry enough to allow thinners or primers to penetrate. The surface must be sanded after epoxy cure.

****From CP27-5 (CH25)****
Cockpit Paint - We have received a number of questions regarding ultraviolet protection of the glass structure inside the cockpit. Cockpit structure, like the external structure should never be exposed to direct sunlight without the protection of a suitable ultra violet barrier. A well maintained coat of color paint is adequate, but it is desirable to use primer over the fiberglass surface. Dupont type 70S provides the best UV barrier (high content of carbon-black), however type 100S will result in better adhesion to enamel paints. Mike and Sally used a Standard Paints product, called "Zoletone", Charcoal Gray in their cockpit. This material gives a beautiful spackle-type finish that hides minor irregularities and the glass cloth weave. This paint was sprayed directly on to the glass interior, after scuff sanding with no filling at 70 lbs. per square inch pressure.

****From CP27-8 (CH2,CH25)****
Aircraft Spruce would like to request that overseas customers order all finishing materials that they may require (featherfill, primer, surfacer etc.) with their initial order, so that all of it may be shipped by surface vessel. Flammable materials cannot be shipped by air due to regulations. So if you wait until you need finishing materials, you will not be able to get them very quickly, as they will have to go by surface vessel.

****From CP28-9 (CH22,CH25)****
Aircraft Spruce reports that they now have in stock the following items:
Light weight electric turn coordinators (as used in N79RA).
Spray-Latt (peel-coat type canopy protection).
Zolatone "Splatter" paint for interior (as used in N26MS).

****From CP29-2 (CH25)****
COLOR OF COMPOSITE AIRCRAFT
In spite of a number of composite airplanes showing up around the country with various color schemes, RAF does not approve any color but white. Trim colors must be limited to the vertical surfaces. Do not paint a dark stripe on the top of the wing. Since the introduction of the European glass sailplanes in 1961/62, there have been no cases of the composite sailplanes having any damage from heat, and all of them are white. They cannot be certificated if painted any other color.

There can be no doubt that a dark color will reduce the useful life of your airplane in the long-term, and could lead to even more serious consequences should the structure get too hot. White guarantees that your airplane will never go above about 10 degrees ambient air temperature.

The colors, even the lighter and metallic ones can get hot enough in desert ambient conditions to seriously weaken the epoxy matrix and degrade the foam core. Measurements taken at Mojave of several airplanes and trim stripes have shown the following results using a surface pyrometer.

Ambient	105 F
White (different shades)	110 F to 116 F
Light Yellow	128 F
Grey	135 F
Light Blue	130 F
Dark Blue	168 F
Dark Red	165 F
Dark Green	175 F

From CP31-4 (CH25)
We have recently tried an excellent substitute for featherfill. This product is a two part polyurethane primer filler and is manufactured by: Sterling Lacquer Mfg. Co, 3150 Brannon Ave, St. Louis, MO 63139 (314)776-4450. Contact the above for a local distributor in your area. Sterling primer filler (part # U-1761 and U-1762 and U-1014 thinner) is a high solids primer with excellent sanding and film thickness building properties. We have used it with up to 20% by volume mixed with micro balloons and were still able to spray it. It can also be brushed on. The good news is that it cures very rapidly, 45 minutes to 1 hour and sands nicely to contour. It also adheres very well. The bad news is the price. This is an expensive material, the price seems to vary considerably depending on where you are located.

From CP32-1 (CH25,CH35)
<u>SEMINAR IN FLORIDA</u>
In February Burt and I flew to Miami, Florida (in a Lockheed L-1011) where Burt was the speaker at EAA Chapter 37's annual banquet. I was lucky enough to tag along, and I must say I really enjoyed the banquet. The food was good, Burt's talk and slide show, as always, was great and being in the company of so many VariEze and Long-EZ builders and flyers was neat. Charlie Gray, a Long-EZ builder organized the whole affair, and did a super job. A really nice touch was that each person at the banquet received a water glass, with a Long-EZ printed on one side and the Chapter logo and date printed on the other.

The next morning Saturday, Charlie drove us to the Fort Lauderdale Executive Airport, where Burt and I gave a composite seminar to about 300 people. At least two Long-EZs and two VariEzes flew in and I was pleased to be invited to fly Jack Fehlings gorgeous VariEze "Yellowbird". Burt and I spent a couple of hours talking to builders, before the seminar, and several things were noted on both Long-EZs that were there. Smooth contour on wings, canards and winglets is really important if you are to get the performance you expect. **Paint stripes along the leading edges of wings and canards are only acceptable if there is <u>no</u> masking tape joggle.** A joggle like this can trip the boundary layer and transition good, low drag, laminar flow into high drag, turbulent flow. NASA tests on our Long-EZ has shown that destroying <u>all</u> the laminar flow can cost you up to 11 knots!

Prior to the seminar, Charlie Gray had got hold of a reject canard that we looked at and Burt agreed that it should not be installed on an airplane. We decided to do an informal static load test to destruction. So we called for people weighing about 175 lb. With Burt positioning each person for correct load distribution, we proceeded to try to fail the canard. We got 18 people (not an easy task, very little room!) on it before we finally got a few minor cracks. At this point, Burt calculated we had 11.54 g's on it, and it still would have got the airplane home. It did not fail catastrophically. Someone must have photos of the 18 people on it. We didn't get one, unfortunately.

The seminar went well, we both enjoyed the opportunity to answer questions, look at parts, and do some hands on, hot wire cutting, layups etc. When we went back to Charlie Gray's home, both of us were a little "hoarse" but it was fun. Sunday, on the way to the airport, we visited a couple of Long-EZ projects, wish we could have seen more of them. There are a lot of Long-EZs under construction in the south of Florida. Thanks to Charlie and his wife Betty for showing us such fine hospitality. Charlie should be flying his Long before to long.

From CP32-6 (CH25)
Zolatone cockpit interior paint, is now stocked by both Wicks Aircraft Supply, and Aircraft Spruce. This paint really dresses up the interior, and is easy to apply. Mike used Charcoal Gray #40-59, and applied the Zolatone directly onto the bare fiberglass. You should scuff the shiny glass interior with 40 grit sandpaper before spraying the Zolatone. Mike did not use a primer or undercoat, the Zolatone is adequate UV protection without a primer.

From CP34-4&5 (CH25)
Neil Hunter reports that he feathered in the paint stripes we saw on his leading edges and he picked up 7 mph (TAS)! Neil and his son flew their Long-EZ non stop from Merritt Island, Florida to San Juan, Puerto Rico in 7.9 hours. An average fuel burn of 5.3 gph gave a ground speed of 138 kts (159 mph). They spent the weekend with James Brandt, a Long-EZ builder who is almost ready to fly. Neil was able to check James out in his Long. James says he will be at Oshkosh '83. Neil flew his Long into Oshkosh '82 and to Kerrville, Texas.

From CP34-8 (CH25,CH30)
Sam Harris suggests leaving the hardener out of acrylic enamels on parts such as elevators and ailerons. The weight of the finish will thus be reduced by almost 50 percent. Sam also suggests substituting 601 fuel hose for the 303 called out, it is easier to use in the small space.

From CP35-7 (CH25)

Sterling Primer

We are still using and recommending the Sterling Primer filler. While a few builders have reported experiencing problems, our own use of the material has worked well. The two part material should be thoroughly mixed at a 50:50 ratio. DO NOT wait. You have only about 30 minutes of pot life. Either paint it on with a brush or spray it on. Do not leave it in your spray equipment for too long. This is a urethane material and if it sets up in your spray gun, that will probably be the end of your gun! One of the problems we have seen with Sterling has been pinholes. Dick Kreidel sent the following suggestion - do not use a cheap suction spray gun, these seem to produce many pinholes using the Sterling. Use a good quality spray gun such as a Devilbiss JGA502 with a pressure pot. Use fluid tip and needle "FF" with a #704 air cap. This is a very large orifice on the fluid tip and the #704 air cap provides a 12"-14" fan. The advantages of using a large fluid tip is that you need very little air atomization pressure to move a lot of paint. The best combination is 15 to 20 PSI on the pressure pot and 25 to 30 PSI on the air atomization. A big advantage of low air atomization is that the overspray is almost not existent. Most of the paint stays on the work. We were able to spray Sterling, mixed with up to 25% by volume with micro balloons.

Sterling can usually be sanded within an hour, compared to over 6 hours when using feather fill.

From CP41-4 (CH25)

Paint - Primer paint for composites. Originally RAF recommended Dupont 70S as a primer. This paint has a high percentage of carbon black and gives excellent UV protection, but it is not the best as far as a good base for the more expensive top coats, such as the polyurethanes. We were recommending Dupont 100S as a replacement for 70S, because it also gave good UV protection and much better adhesion to the top coat, but it has now been discontinued. Dupont 131S is the recommended replacement. Any of Dupont's top coats, acrylic lacquer, acrylic enamel or polyurethane (Imron) will go well with 131S.

We recommend a urethane paint over lacquer or enamel, simply because the urethanes are tougher, more flexible, and stick on better. We recently painted an airplane using Ditzlers Deltron Urethane. It went on well, it looks great and it is reportedly easy to repair.

Whichever top coat you decide to use, (we recommend a good brand name such as Dupont, Ditzler, Sherwin Williams, Sterling etc.), we would strongly recommend that you use the particular manufacturer's product from the glass structure out. In other words, you have contoured your airplane with dry micro and have gotten through the feather fill of Sterling contouring step and are ready for primer. Pick out a manufacturer such as Ditzler and use their recommended "system" from the undercoat or primer through to the top coat.

Our research has shown that this procedure will result in adequate ultra violet protection, and it will also give you the builder the best chance of a lasting finish that will not crack or peel. In the past, some builders have mixed manufacturers, such as Dupont primer and Sherwin Williams top coat. Normally this should work alright, but if it does not, you have no recourse to either of the manufacturers.

From CP41-4&5 (CH25)

Final Contouring - When you have contoured your aircraft according to the finishing section, using dry micro, and are ready for the "feather fill", here are a few suggestions.

Feather fill is a polyester product and it has been commonly recommended by RAF for over eight years. Recently we tried a few other similar products, one of them was Sterling primer/filler which does the same job as feather fill and it is a direct substitute. To compare the two materials, feather fill is a polyester and therefore has poor adhesive qualities. It is mandatory to scratch the surface with 40 grit sand paper to allow for a mechanical bond. Feather fill works best in dry conditions, such as we have here in the desert. Feather fill does not like humidity or moisture and you must not ever wet-sand feather fill. There have been a few cases of airplanes having their finish peel off in quite large pieces. The failure was at the feather fill to glass bond line, and invariably this kind of failure can be traced to moisture, high humidity conditions during application, wet sanding the feather fill etc.

Sterling primer/filler (U-1761, U-1762) on the other hand, is a urethane product. Urethanes are famous for their adhesive qualities and given a clean surface they will generally stick forever. Sanding the glass is still recommended however, as there is nothing more disappointing than having your beautiful finish peel off! Sterling can be applied in high humidity environments, even in a pouring down rainstorm. Wet sanding is recommended. In other words, the material is essentially impervious to moisture. Sterling is more expensive than feather fill and it does seem to be slightly more prone to having pin holes after final sanding. But these can be filled with more Sterling, or 3M Spot Putty. We at RAF have used Sterling on several aircraft over the past two years and we are generally quite satisfied with it.

Sterling's biggest attribute as far as we at RAF are concerned is the fact that it cures rapidly and can usually be sanded within 45 minutes to an hour.

Recently we tried a new material (to us), Morton's Eliminator. This is a dark gray polyester type material, rather similar to feather fill. Morton's Eliminator has a few special properties that make it quite desirable. It cures quite rapidly, and the cure can be accelerated with heat. It is formulated to provide an absolute moisture or solvent barrier. Any material applied over "eliminator" will not penetrate and get under it and cause it to separate. It is designed to eliminate pin holes. It builds up well and is a good contouring medium. It sands readily once fully cured. We have not finished a complete airplane with it at this time, but we have used it on some glass parts and have been impressed by its performance. We found that the following procedure worked best for us while using Morton's Eliminator. Sand the parts to provide a good scratch for a mechanical bond.

Spray a fog coat over the entire part and allow to flash off. Spray a medium cross coat over the part and before it dries, squeegee the wet material using a soft rubber squeegee. Use firm pressure to assure that the material is drawn into every scratch and pin hole. Smooth the surface with the squeegee as much as possible. Allow to flash off for 15 to 20 minutes. Spray a light cross coat over the whole thing, concentrating the spray wherever it obviously needs it, such as a particularly deep scratch or dent. Allow to cure per the instructions on the can. In a 70 degree F environment it takes 4 hours, 90 degrees F it takes 70 minutes. If you heat it to 105 degrees F, it will cure in 40 minutes. Sand with 180 grit wet or dry. It is now ready for whichever primer and top coat you have decided to use.

From CP42-4&5 (CH9,CH13,CH25,CH30,CH33,CH38)
LONG TERM MAINTENANCE ITEMS ON EZs
Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - **Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.**
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth. Of course this strips off about half the teeth on the wormgear.
Solution - Rotate wormgear 180 degrees and you back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of

any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

****From CP45-4&5 (CH25)****

BUILDER HINTS - Finishing Composite Parts.

We have been using a "new" material for the last year or so which was demonstrated and discussed at the seminar held here at RAF on June 8. This material is an epoxy and is manufactured by Gougeon Brothers Inc. 706 Martin Street, P.O. Box X908, Bay City, Michigan 48706. Phone is 517-684-7286. The epoxy known as "The West System" consists of a one gallon container of resin (part #105-B) and a one quart container of hardner (part #205-B (fast) or 206-B (slow)). In addition they sell a real neat little pump system, that screws into the tops of the cans, and dispenses the correct ratio of resin to hardner. This mini pump (part #301-B group B) costs less than $5.00 and is a real time saver. The total cost of a "one gallon" kit with ratio pump is $55.00 (not including COD or shipping charges). When you consider that you have got 1 1/4 gallons of epoxy and you will mix microspheres (glass bubbles) at a ratio of 200 percent microspheres to epoxy, by volume. (1 part epoxy - 2 parts microspheres eyeball is close enough). This in effect gives you approximately 2 1/2 gallons of filler material, the price is cheap.

Sand your glass part with 40 grit. We sand quite vigorously back and forth for about 5 seconds, then sand for a further 5 seconds at 90 degrees to and over your first attempt. This will not destroy the glass structure but will put enough scratches into your glasswork for a good mechanical bond. Vacuum all the dust off the part, and paint a very thin coat of pure West System epoxy all over the part. You are just trying to moisten the part with pure epoxy. Wipe half of it off with a paper towel if you get it too wet. Now mix up one pump shot of resin and one pump shot of hardner. Add one heaped full small paper cup (3 oz size) and stir until you have a mixture that resembles cake icing. Use a squeegee to spread this "putty" like mixture all over the part. Make sure you get it on thick enough to slightly overfill any low points, depressions or dings, and also to fill the weave in the glass. Using fast (#205-B) hardner, this dry micro mix will cure in 4 to 5 hours as hard as a rock. Using slow (#206-B) it will take 8 to 9 hours. Once cured it sands very nicely, does not gum up the sandpaper and allows the builder to obtain an excellent contour well within the criterion required to paint the part with Sterling, Mortons Eliminator, featherfill or some similar primer/filler. One coat of one of the above, occasionally two coats, will prepare the part for the primer and then the top coat.

We sand the West dry micro with 100 grit. We then paint on Sterling or Morton with a brush on small parts, or spray it on large parts. When this is cured we sand with 220 grit wet or dry, followed by 320 wet or dry. Your contouring is now complete, and should be as good as you can get it. The gray primer, such as Dupont 131S or Ditzler Preet 33 will not change contour, but when sprayed on, provides a base for the final top coat and does contribute some towards ultraviolet protection. The majority of your ultraviolet protection is provided by the final white top coat, such at Dupont's Imron, Ditzler's Durathane or Dupont acrylic enamel.

The use of the finishing method described above will provide you with a low cost, durable and relatively easy to do finish from the purely physical aspects (elbow grease!). West System dry micro is much easier to sand than Safe-T-Poxy dry micro and can be sanded in 4 to 5 hours without gumming up the sandpaper. If Safe-T-Poxy dry micro were used as described above in place of West dry micro, you would probably have a little more durable surface, but it would be two to three times more work.

This is because the Safe-T-Poxy dry micro is so difficult to sand and takes 3 or 4 days to cure to the point where it can be sanded.

We have done a considerable amount of materials testing and evaluation lately and the general consensus is as follows:

Option 1. Bare glass - West system dry micro - Sterling primer filler with up to 30 percent microspheres - pure Sterling sprayed on as an undercoat - Sterling "U" series, polyurethane top coats.

Option 2. Bare glass - West dry micro - Mortons Eliminator - Corlar 824 S - Imron.

Option 3. Bare glass - West dry micro - Sterling - Preet 33 - Durethane.

NOTE: Safe-T-Poxy dry micro can be used anywhere we have called out West dry micro - it would probably result in an even tougher, more durable surface. However the extra time and effort may not be worth the small gain.

There really is no "best for everyone" system. Take your choice. If you like Ditzler products, by all means use Option 3. If you like Dupont products use Option 2. There are many other excellent paints and finishes, check around, but try to use the complete company system from the dry micro on out to the top coat where possible. See below for a chart on some of the products we have tried. This is our opinion based on actual hands on testing side by side in the same environment, but is not in any way a scientific test. Use this chart as a guide only, then do your own test. **COMPARISON CHART OF FINISHING PRODUCTS OMITTED**

****From CP55-9 (CH3,CH25)****

All RAF designs - While waiting on cure cycles or parts to arrive, or while you are delayed for whatever reason, do little bits of finishing work on the parts you have done. Keep a one gallon kit of West System Epoxy handy. This is obtainable from Gougeon Brothers, PO Box X908, 706 Martin Street, Bay City, Michigan, 48706. Call 517-684-7286 or 6881 (orders only). Ask for 105-B resin, 205-B hardener (fast) and a 301-B mini mump set to pump the correct ratio out of a one gallon resin can and a one quart hardener can. They also sell a slow hardner 206-B but we believe the fast, 205-B, is more useful for mixing dry micro. (You will probably use about 2 gallons on a Long-EZ.)

We mix it as follows: One stroke of each pump into an 8 ounce paper cup, mix thoroughly. Add one heaped 3 ounce paper cup of micro balloons and stir thoroughly. Spread this mix of dry micro and West onto your wings or winglets, canard or whatever you have done, particularly in any low spots like next to a spar cap, etc. Trowel it on a bit thicker than you need and allow it to cure. A full cure normally takes less than 12 hours depending on the ambient temperature. Here in the desert, we can spread it on in the morning and sand it to contour in the afternoon. It is a good idea to dampen a handful of paper towels with West epoxy and moisten the part prior to troweling on the micro. Of course, the bare glass should be scuff-sanded with 36 or 40 grit sandpaper prior to wetting with West epoxy. Don't get it too wet, just moist for a good bond. The West system epoxy and micro will bond very well to Safe-T-Poxy and will be easy to sand (unlike Safe-T-Poxy and micro!!).

Doing a little finishing all the while as you are building will make the finishing process at the end of your project a lot easier to stomach! After all the parts are built, the engine and wiring and systems are all in and done, it is usually quite demoralizing to suddenly find yourself faced with the enormous task of sanding, filling, contouring, sanding, filling and sanding and painting all at once. A little filling done once or twice a week will leave you with a much smaller job at the end of the project. Try it, you will be glad you did!

From CP46-3&4 (CH13,CH22,CH25,CH30,CH38)

N26MS, MIKE AND SALLY'S LONG-EZ - the first 1000 hours.

As many of you (who attended the RAF flyin in June and also Oshkosh this year), will know we have given our "old" Long-EZ a face lift. It is hard to believe, but she will be 5 years old this December.

It all started when Mike decided (and the check book said ok) that we needed a Loran C!! After much looking around, we opted for the MicroLogic ML6500. Our reasoning included, easy to operate, fully automatic chain selection and a size and shape that would fit our panel. It turned out that the panel had to be cut out and a completely new one be designed, built and installed! While we were at it, we tore out all the wiring (it was done in a hurry and Mike was never very happy with it). Our panel night lighting was never very good, so we installed post lights over all the instruments, as well as a dimmer switch. Panel lighting at night is now superb.

In order to do all this work, we removed the wings and canard, cut out the side consoles, cut out the instrument panel, reshaped the nose to allow installation of brake master cylinders up front and optimum placement of the two 12 volt motorcycle batteries, that make up our 24 volt electrical system. We also reshaped the cowling extending it aft a full 3" to reduce the closure angle and hopefully reduce drag a bit.

The structure was given a very thorough inspection, wing attach hardpoints looked like the first day they were put together. We are extremely pleased with the composite structure. A few small cracks were found in the paint, all were examined, by removing all finish down to the glass. In no case did any crack extend into the glass, we are ashamed to admit that each crack was over a rather generous build up of Bondo! **The moral here is use dry micro not Bondo.** We did a little recontouring, filling with West System, sanding and priming with Mortons Eliminator. We installed the new Roncz 1145MS canard, carefully fairing it into the nose. We designed and built two battery access doors (they work nicely, but are not worth the amount of work it took). We installed the Loran C antenna in the left winglet. Then we wet sanded the original Imron finish down until the whole airplane was dull.

Mike **sprayed the entire airplane with Imron** using a slightly whiter white than we used last time, and we trimmed it in metallic gray instead of the green we used the first time. We had the seat cushions recovered in gray to match the trim. All the consoles were glued and glassed back into place, the interior was once again **painted in charcoal gray Zolatone**. We installed the Ian Ayton's canopy/gear warning systems, (it flashes the warning light and buzzes the horn intermittently). We cannot say enough about this system. It is really neat. It is small, easy to install and you absolutely cannot ignore it. If you override the horn, the light continues to flash, and in about 50 seconds, the horn starts to buzz again, a very worthwhile addition and one we both heartily recommend.

When we finally reassembled her, she looked like new! We did a careful weight and balance on 3 certified aircraft scales (naturally she had put on a little weight), then we rolled her outside, fired her up and went flying.

The whole face lift was supposed to take a few weeks and in fact ended up taking over three months. (It only took 5 1/2 months to build her from scratch!!)

The Loran C works well. We get SNRs (signal to noise ratio) of 99 on the master as well as both slave stations, with everything turned on, engine running and in flight. This is true in the Mojave, Bakersfield, Fresno area at least where the testing was done. Obviously there are many places where we cannot get these kind of optimum results. The antenna we use is a 3/16" O.D. hobby store brass tube. We sharpened the end, put it in an electric drill, and "drilled" it into the bottom of the lower winglet, pushing it all the way to the top of the winglet. It goes up the leading edge of the upper winglet. We soldered the preamp to the bottom of this brass tube, removed a wingtip light assembly, dug out a little foam and installed the preamp behind the wingtip light. We are very pleased with this simple, cheap antenna.

We recently installed miniature fuel and oil pressure gauges (1 1/4" dia) that read actual pressure (not electrons!). They are plumbed directly from the engine to the instrument. We used nyloseal tubing fittings. These are really great little instruments, a bit expensive, but worth it. (See page 206 in the Aircraft Spruce catalog). In addition we have an Electronics International digital CHT-EGT with a four way switch, so we can look at all four cylinders. We bought an oil temperature probe and connected the cylinder #1 EGT to the oil temp. Thus we have 4 CHT, 3 EGT and oil temperature in one gauge. Also in this small side panel, is a digital voltmeter by Davtron. Again, expensive but worth it. We know exactly how the electrical system, alternator charge, etc is doing, plus or minus 0.1 volt.

The only item that really required maintenance was the nose gear strut and associated pivots. Mike removed the top bolt and took the whole strut out. The bushings in the NG-6 assembly (NG-23 as shown on Page 13-1) were quite worn allowing considerable side to side play in the top pivot. Mike machined up two steel bushings, pressed them into the NG-6 casting then reamed them to be a very close fit on the NG-7 spacer. A grease fitting (Zerk) was installed in the NG-6 casting allowing future lubrication of this pivot without dismantling it. The two HM-6 rodend bearings in the shock strut were also somewhat worn, allowing some fore-aft movement of the nose gear strut. We replaced these rodend bearings with very expensive aircraft quality rodend bearings (approximately $25.00 each) which essentially eliminate any play.

The vertical pivot at the nose wheel fork had already been overhauled per CP 44, page 7. Thus the entire nose gear strut and wheel has received a complete major overhaul. It is now working flawlessly and we are very pleased with the above modification and repairs.

The brake master cylinders up forward modification was done for three reasons: To help move the CG forward, to allow better access for inspection and hydraulic fluid replacement, and to also allow better access to the magnetos.

Mike designed this particular installation, it works quite well, but if we were to do it again, we would use Debbie Iwatate's method. (See "for sale" this CP).

We did find one drawback to the forward mounted brake cylinders, that we had not foreseen. It is now quite difficult to adjust the rudder position for various size pilots. The original design used only adjustment to lengthen or shorten the cable aft of the pedal. Now we have to <u>also</u> adjust the pedal to brake master cylinder relationship, which with our design is awkward. As a result no one else gets to fly our Long - advantage or disadvantage?!?!?!

We have also done a lot of work on optimizing engine and oil cooling. At this point in time though it is too early for us to comment on the success. We are flying the airplane quite a lot, in fact since Oshkosh we have put over 100 hours on her. N26MS continues to meet or exceed our expectations. We have enjoyed nearly 5 years of fun flying, visiting faraway places and meeting interesting people. We are looking forward to the next 1000 hours.

From CP48-9 (CH25)(Photo Caption)
Marcus Borom positioned his Long-EZ almost vertically in order to prime and paint it! A neat idea, we did something very similar when painting the prototype Long-EZ, N79RA.

From CP55-6 (CH3,CH25)
FAA REGULATION CHANGES
Builder identification placards must be installed on your aircraft after March 7, 1988 (if you are flying now without one, you could be violated). According to the FAA, we aircraft owners must have a plate or placard on the exterior of the fuselage adjacent to the rear-most part of the canopy (door!), and it must be legible to a person on the ground. There are no letter or number size requirements and the information must agree with your stainless steel information plate in your cockpit. You are required to display your aircraft make and model designation, (Smith, Long-EZ or a Jones, VariEze, etc.). The serial number must also be shown. You can have a sign writer simply paint this information on the fuselage, or you could stamp it onto metal plate and bond/rivet it onto the fuselage.

If you plan on visiting a foreign country, even Canada, Mexico or the Bahamas as an example, you will be flying through an Air Defense Identification Zone (ADIZ). After March 7, 1988, you will be required to install 12" high registration marks for this trip. These can be temporary marks provided they do not come off during the flight. These are new Federal Aviation Regulations and all aircraft owners, including homebuilders, must comply after March 7, 1988.

From CP57-6 (CH25)
AIRCRAFT MARKINGS
Custom made "N" numbers, "experimental" signs and virtually any other application, such as fuel grades, capacities, "no step", or "no push" markings.
Aerographics in Denver Colorado make the best we have ever seen. They do lettering and numbers in 50 different styles and sizes from 1/4" to 24" tall in every color imaginable. Their letters can be slanted, made in script or even reversed for inside a window application. These stick-on letters and numbers are cut from very thin vinyl material, correctly spaced on a paper facing with a stick back. Unroll them, pull the backing off, stick 'em down and pull of the facing paper - Viola! Perfect "N" numbers. The stick-on letters are guaranteed for 7 years! If you prefer to paint your own, they also sell the masks which stick better than any we have tried.

For those who have seen Burt's Catbird, the "N" numbers and "experimental" sign were obtained from Aerographics who will ship 2nd day air if you call their toll free number: 1-800-336-9633.

****From CP57-7&8 (CH25,CH33)****
VARIEZE, LONG-EZ, VARIVIGGEN, SOLITAIRE, DEFIANT - ALL AIRCRAFT. Insert the following plans change.

MAN GRD; Photocopy, clip out, or otherwise clone the placard below and install one each in your appropriate owner's manuals and **easily viewed location in each cockpit, visible to each pilot and passenger seat.** Also, assure that the other placards in the owners manual (Pg. 22-VariEze; Pg 24-Long-EZ, Pg. 24-Defiant and Pg. 14-Solitaire) are installed.

As we have discussed previously in the Canard Pusher and as has been reported by ***Aviation Consumer*** *magazine, the experimental homebuilt airplanes have an accident record that is worse than that experienced with certificated, factory-built aircraft. This is due to a number of factors. There are more chances for non-conformality to occur, thus each airplane built is actually a new, experimental, research, high-risk article. This new research aircraft is often tested by pilots who have very little time in type and who often do not follow careful flight safety procedures in their testing. Also, because these aircraft are more fun to fly and have higher performance, many accidents are the result of improper aerobatics or other high-risk flying.*
For example, as we reported in CP47, seven of the eleven Long-EZ accidents occurred during low altitude buzzing or aerobatic maneuvers. Because many individuals, including those who may purchase one of these aircraft or may ride in one as a passenger may not be aware of the risks involved, we are including a plans change in this newsletter requiring placarding the aircraft and the owner's manual.

WARNING!
STATISTICS INDICATE THAT AMATEUR BUILT AIRCRAFT ARE MORE LIKELY TO HAVE AN ACCIDENT, INCLUDING A FATAL ACCIDENT, THAN FAA CERTIFICATED, MANUFACTURED TYPES. WHILE STRICT ADHERENCE TO OPERATING PROCEDURES CAN REDUCE THIS RISK, THE HAZARDS ARE SIGNIFICANT, PARTICULARLY DURING INITIAL FLIGHT TESTING OR WHEN OPERATED IN A NON CONSERVATIVE MANNER.

****From CP57-12 (CH25)****
PAINT 'EM WHITE
We are alarmed by the trend to paint composite aircraft dark colors. An orange or dark blue or dark red surface, can easily reach a temperature of 190 degrees on a warm sunny day with no wind. We saw at Oshkosh 1988, a deep orange Velocity and a dark red Lancair, parked, unprotected in the hot sun. We would not have flown in either of these aircraft for any reason.. All RAF airplanes use room temperature cured epoxy in their construction and these room temperature epoxies have a heat distortion point of only about 150 to 160 degrees F. All of the composite aircraft that we are aware of in the USA, at least, also are put together using room temperature curing epoxies or vinyl esters. Don't be lulled into a sense of false security by the examples of those who must not have considered the possible consequences of their actions. Paint your airplanes white.

****From CP58-10&11 (CH25)****
AEROGRAPHICS
Number 1 in aircraft lettering. We agree! The service is great, next day or overnight delivery is available on lettering or "N" numbers in 50 different styles in sizes from 1/4" to 24" tall in every color imaginable.

Call, toll free, to place an order or if you just have questions. We used Aerographics on Catbird and Scaled Composites' new mini business jet. The "N" numbers look beautiful and are easy to install and are as thin as paint. Call:
1-800-336-9633.

****From CP58-11 (CH25)****
LONGER POT LIFE FOR STERLING PRIMER FILLER.
Nat Puffer, VariEze builder and COZY designer/builder, reported to us that Wicks Aircraft will be stocking a new catalyst for U1761 Sterling Primer. Sterling makes an excellent urethane primer but in the past, it has been a material that many builders have found develops pinholes! By the hundreds! Pinholes! Also, the pot life has been very short, making it difficult to spray and clean your gun out in time. Well, Nat assures us that using the new catalyst U-1000C, the pot life is almost 6 hours and virtually eliminates pinholes. U-1000C is available in quarts as wells as gallons. Thanks, Nat.

****From CP60-11,12&13 (CH19,CH20,CH25,CH33)****
HOW TO CHECK IF YOUR AIRPLANE IS STRAIGHT.
So you have a few hours on your new EZ/Long/Defiant/etc., and you are buzzing around within your limited 25 mile radius of home base - why not spend the required hours you have left to take a close look at your airplane. Specifically, checking the rigging, the "straightness", if you will, of your brand new creation.

Assume you have built a "perfect" airplane, both wings are mounted to the fuselage at the correct incidence with zero relative difference, the canard is straight and at the correct incidence, and the two winglets are correct and exactly symmetrical relative to each other. This airplane should fly at cruise power, level flight, with the ball centered and both ailerons even and faired with the wing trailing edges. Depending on the CG and the speed, the elevator may also be perfectly faired with the canard tips. Since elevator position is a function of speed and, to a lesser degree, to CG position, I will limit this discussion primarily to rudder and ailerons.

How many of you have reached this goal? Not many I would bet. I know my own Long-EZ certainly is short of this state of perfection. How important is it to have a perfectly straight airplane? Difficult to say. Obviously, the straighter it is, the less control surface deflection there will be in high speed flight and the lower the drag and the greater the efficiency will be.

How do you check for a straight airplane? First of all, you will have to have a slip indicator, accurately installed. This can be a short length of yarn stuck to the canopy on the aircraft centerline with a small piece of masking tape (this will only work on gliders and pushers!). Place it about 12" up from the leading edge of the plexiglass canopy. If you have a needle and ball, a turn coordinator and ball, or just a ball, it must be mounted in the panel, ball centered with the wings exactly level. Be sure this is correct before attempting to evaluate the airplane.

Now, before you conduct the following flight test, check to see that the two elevators are rigged perfectly, relative to each other. You will have to remove the canard to check this out. Simply eyeball along the elevator trailing edges. They should be in a straight line. If they are not, you must correct this before doing the flight testing. Elevators rigged incorrectly will roll the airplane.

Also, stand behind your airplane looking at the center of the spinner. Raise or lower your head until your eyes can see along the top skin forward of the trailing edges of the wings. You don't want to be looking down on top of the wings or up at the bottom skins. You must be able to see the trailing edges and the top skins as a line. Now, without tilting your head, look from the right wing to the left. Any differences? Shouldn't be. If you can see more of the top of one wing, you have a relative incidence problem. Make a note as to which way it should roll and verify this in flight.

Take off and establish a high cruise in level flight, feet off the rudder pedals and ailerons perfectly centered (if you can't see your ailerons, take a passenger along to help you get them centered. Remember, your limitations allow you to carry a passenger if they are essential to the mission)! Now, look at the ball. Is it centered? Are the wings level? Probably not! Bummer, oh well, take comfort in knowing that almost everyone else is in the same boat! Keep the ailerons centered (visually verify this), and "step on the ball", that is, step on the rudder to center the ball. Step on the rudder opposite the direction of the yarn slip indicator. Lock your feet, ball centered (yarn centered), keep ailerons centered, and carefully observe the horizon and your DG (if you have one) to see if the airplane is flying a straight course over the ground or if it is slowly turning. If you have no turning rate and your wings are level with the horizon, you have one or both winglets attached to the wings slightly crooked. Even though you have a small error in your airplane, at least you know what is wrong and it can be corrected.

What if you are turning? Carefully null out the turn. Use just enough aileron in the proper direction to zero the turn. Verify this by watching for zero heading change on your DG or by observing a distant peak or other prominent object on the ground at the horizon. This takes a little time and patience but you can get it perfect if you try. With zero turn rate and the ball centered, check how much aileron and rudder deflection you have and in which direction. An assistant can be a great help here. Have them write down, for example, "right aileron up 3/16", left aileron down 3/16" and left rudder outboard 1/4", right rudder at zero." These dimensions can be quite accurately "eyeballed" with a little practice. If you doubt your passenger's ability to judge this, before you fly, have him or her sit in the passenger seat and you move the ailerons and rudders, using a scale and have them call out what they see. Now you know you have a relative wing incidence problem, as well as a relative winglet incidence problem.

Block the rudder out to whatever the eyeball estimate was by taping a small wood block to the inboard trailing edge of the winglet. When the rudder is released, it should close on this block and remain deflected outboard the estimated amount. Repeat the flight test and verify that the ball is centered with zero turn rate.

Now, in the case of a Long-EZ or Defiant, you will have to install shim washers on one of the outboard wing attach bolts such that the wing incidence is altered in the proper direction, i.e., in the example above of the right aileron trailing edge up, this wing would need to be shimmed by perhaps one thin washer (AN960-816L) on the bottom outboard bolt. The left wing probably should be left alone until you look at the results of this change in flight.

Fly it and see if this was enough and if it was in the correct direction. Remember, do this kind of adjusting only in small increments. Use thin washers or thin shim stock, one piece at a time, starting with the wing that appeared to be off when you eyeballed the airplane from behind, whichever wing needs to be shimmed to raise the trailing edge. If one washer on one wing does not do it, add one on the other bolt on the opposite wing. Keep both wings even by eyeballing from behind - do not get one wing much different than the other. Continue using small increments until the airplane flys wings level, ball centered with zero turn rate.

You now have a straight but ugly airplane! **Unfortunately, if you have already painted it, you will have some work to do. If it is still in primer, fair the fuel strakes to match the wing roots with dry micro (West System).** To fair the rudder with the upper and lower winglet (on a Long-EZ), use a hacksaw blade to cut through the outboard skin along the rudder hinge line to the top and bottom of the winglet. If necessary, widen this saw cut as required and cut through the foam core to the inside of the inboard skins above the rudder and below the rudder. Check that you can now flex the trailing edges of the top and bottom of the winglet til it lines up with the rudder (still in its blocked outboard position). Now, reduce the amount the rudder is blocked out by approximately 10 percent, fill the saw cuts with micro and force the top and bottom outboard to exactly match to the rudder. Clamp them in this position and allow to cure. Layup a 2-ply BID repair over the saw cuts and fill, sand and finish. Install a permanent block, full span along the inboard trailing edge of the winglet to block the rudder in its proper faired position. You can use wood or a piece of pre-cured glass here.

Your airplane should now fly straight and the winglet repair will not be detectable.

This works great on a Long-EZ, but what about a VariEze? Since it is not possible to adjust the incidence of the wings of a completed VariEze, you will have to do surgery to the TOP of whichever wing it takes to correct the tendency to roll. If it rolls left (ailerons centered), you will have to slit the top skin of the right wing, outboard of the aileron along the aileron hinge line and bend this trailing edge up as described for Long-EZ winglets/rudders. If you have to do this to your VariEze, call me at RAF and let's discuss it before you do it.

Well, I hope this is helpful and not too confusing. I'd be happy to discuss this with any builders or flyers who may find themselves having to make this kind of correction.

Mike Melvill

From CP63-5,6&7 (CH25)

HOW TO PAINT ZOLATONE

One of the most misunderstood and misapplied techniques used on our EZ's is the multi-colored, textured paint called Zolatone. If properly applied, surfaces are good looking and incredibly durable - but if it isn't done properly the results will be disappointing. Luckily, it it not a difficult process to master and is actually VariEze.

First off, the glass surface needs to be sanded dull (approx. 50%) before you begin; use 50 or 60 grit sandpaper - it is not necessary for the surface to be completely dull. The next step is important; the surface must be primed! RAF originally stated the primer was not needed but believe me, the adhesion and chip resistance without the primer is not good. You will need a quart of Zolatone Plastic Primer #99 and some plastic primer thinner for spraying. The primer must be cut about 20% with the thinner before use. This primer is (unfortunately) white in color but can be tinted using lacquer or acrylic lacquer tints. Tinting the primer will help hide the white from showing though after the colorcoat chips or wears. The primer goes on best with a standard external mix spray gun with siphon feed - it sprays like most lacquers. It is not necessary or desirable to put on a heavy coat or even to completely hide the glass underneath. A light coat is best. The primer dries rapidly and you can spray the color coat in an hour or two. Do not spray the primer more than 8 hours before you apply the color coat or else you will have to scuff sand the primer - a big, big, job!

A few words now about what Zolatone actually is will help you understand why the following procedure is important. Zolatone paint is actually a colloid, or in plain language, globules of colored nitrocellulose (lacquer) enclosed in clear "sacks", suspended in a water base solution. Zolatone calls these sacks aggregates and manufactures aggregates in three sizes: fine, medium and heavy. They have about 20 colors of aggregates and by mixing different colors of aggregates and by mixing different colors and sizes of aggregates, the factory can create an almost unlimited array of colors. Most of their standard colors use 2 to 5 different color aggregates in different sizes and proportions. In addition to the aggregates, some colors also have black, white, or green "flecks" which are like super big aggregates. These flecks appear as large streaks on the sample chips, it is possible to spray the base color and avoid flecks (if desired) by a variation of the technique.

Since this paint is a collection of aggregates or colored sacks floating in the water carrier, it is extremely important not to break up the sacks when you open the can and start to stir. Never use a power mixer or paint shaker - you will break all the sacks and will be left with a gallon of slushy mess. Gently stir the paint with a wide stick as little as possible, and then finish the mixing by "boxing" the paint; that is, gently pouring the paint from one container to another until the paint is uniform in consistency. Zolatone will not appear as you would expect to see (or like the finish surface) at this point - but keep the faith!

The biggest mistake that people make with Zolatone is using the wrong type of spray equipment. This stuff absolutely, positively must be sprayed using an internal mix, pressure feed system. Most people are unfamiliar with internal mix because these guns are generally the cheap ($20-30) ones. You can recognize this type by the slotted air cap instead of what you normally see at the business end of the gun. What makes these cheapies less than ideal for most Zolatone colors (the Lilithe Charcoal is an exception) is that when in the pressure mode, the fluid pressure and air pressure are equal. What you really would like to find is a "dual-regulated, internal mix, pressure" set-up. For those of you who want the ideal rig, it would be a Binks #2001 gun with #6633x200 nozzle assy.. internal mix air cap and a dual regulated one quart pressure cup. A remote tank with hoses to the same gun is even neater because the gun will spray in any position (in the strakes, upside down, etc.)

OK, you've borrowed, bought or otherwise found the correct spray gear, primed the cockpit and are ready to go . Zolatone is applied in a two steps process:

Step 1: This is the background color(s) step and utilizes high air pressure and low fluid pressure. Try about 40-45 psi on the air and 15-20 psi on the paint (fluid). Keep the gun 6"-12" from the surface and apply enough to cover the primer. You can alter the air and fluid pressure and change the appearance of the pattern - what's important here is the pressure differential between air and fluid.

Step 2: This is the pattern step and uses low air and high fluid pressures. This is when the large flecks and wild patterns are applied. If you don't want the big flecks you can minimize the pressure differential and obtain varying results. Assuming you want it to look just like the color chip, try 15 psi on the air and 30-40 psi on the fluid. Make sure you are 18"-24" away from the surface and apply the patterns until you have what you want. During this step, the more paint you apply the more fleck you will end up with so you need to carefully watch to make sure all areas are uniformly patterned. With both steps you can play with the air and fluid pressures and the distance from the surface and obtain very different appearances. It's always a good idea to experiment some with this stuff on some dense surface material (aluminum, masonite, etc.) before you start in on your plane to be sure of your technique and preference. Also, you should write down somewhere what air and fluid pressures you used for each step so that years later when you want to touch up some areas it will match perfectly - otherwise it won't!

Clean-up is as bizarre as the paint is - use water first and then lacquer thinner. Another interesting point is that since these colors are actually composed of multiple colors and sizes of aggregates, you can mix Zolatone standard colors (by boxing) to come up with your own special mix. Zolatone will make any color you want but insists on a 23 gallon minimum order - no exceptions!

There are about 12-13 colors that are standard other than the 2 or 3 stocked by Aircraft Spruce. You can contact Zolatone (aka Paramount Paint and Lacquer) in L.A. for their local dealer in your area.

To review a few key points:

1. The unique look is achieved by the splattering of the sacks as they impact the surface. In the gun and just before they hit, they are still discrete globules.

2. You need an internal mix pressure feed spray gun for the color. Since Murphy is alive and well, this gun is not great for the primer.

3. Use care in gently mixing the paint by initially stirring and boxing.

4. Don't allow the paint to freeze (water base) or you'll have a big mess!

5. Many builders find that painting the interior is easiest if the fuselage is supported upside down on a couple of saw horses - you crawl underneath and just do it!

Dick Kreidel

From CP64-5 (CH3,CH25)
WARNING- MODERN PAINTS CAN KILL
Scott Finnigan, a real up-and-coming aerobatic contender in a Pitts S-1-S died suddenly last December. There is a lesson that can be learned from this tragedy and you should be aware of what it is.

Last year, Scott painted some airplane parts in a small, unvented paint booth without using protective breathing equipment. Scott was spraying Imron. This material can be quite lethal and some of it got into his lungs. The damage was great and, sadly, incurable.

Be sure to use protective equipment whenever it is required by the manufacturer. Follow all safety guidelines - many of the modern painting materials are dangerous if not used in accordance with the manufacturers instructions. Modern polyurethane paint is just not like the old butyrate dope and enamels so many of us used to use.

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Chapter 26, Upholstery

Long-EZ Plans Changes

From CP26-6 (CH26)
LPC #39, MEO, page 26-1.
"VariEze canopy (Chapter 22)" should be "Long-EZ canopy (Chapter 10)".

Miscellaneous

From CP25-9 (CH18,CH26)
Ray and Nova Cullen have moved.
New address is now: Rt 1, Box 213 #26
Baker, OR 97814
(503)523-5096

They are now offering plans for their survival kit plus the custom VariEze/Long-EZ seats for $8.00. They will also supply some of the more difficult to locate items of the survival kit. They are still interested in supplying any builder support that is requested even though they are now in a very rural area.

The canopy seal they are using on the side rails of the canopy is a 3M Adhesive Weather strip part #021200-01235 Cat #1235, Stock #93011. It is sold in a few stores there in Oregon but is still hard to find. Nova and Ray have tried almost everything on 22809 to gain rain protection and this stuff is the best! Note: Ray and Nova keep their airplane out a lot in a very wet climate.

From CP34-4 (CH13,CH26)
Long-EZ First Flight Report
"Dear RAF,
First flight of Long-EZ N158TG was on September 3, 1982. It now has 21 hours on it with only minor problems and adjustments. With equipment shown including strobes, nav lights, landing light and big alternator but no starter, empty weight is 800 pounds. Performance appears to be right with the handbook with 0-235 L2C engine and B and T 62 x 66 prop.
I am 6 ft. 9 inches tall and pilot seating is very comfortable. **My seat cushion is 1" thick in the seat increasing to 2" in the thigh support and back seat.** Also, the rudder pedals are 4 1/2" forward of standard and the pedals themselves are 3" taller. I have been to 12,000 ft. and to 140 knots indicated which would be 185 mph true.

I am very pleased with the aircraft and wish to thank RAF again for the clarity of the plans and the quality of support.
Best wishes.
Tom Garrison"

From CP61-7,8&9 (CH26,CH33,CH39)
"Dear Burt,
I regret to inform you that VariEze Serial No. 235, N13EG, "Old Dog's New Trick", was destroyed in a landing accident at Blackhawk Airport, Cottage Grove, WI on Saturday, July 29, 1989.

After planning to fly to Oshkosh on Thursday, the weather wasn't reported as good until Saturday when the Washington FSS allowed as how it was good weather all the way to Oshkosh so I took off and flew to Findlay, Ohio, planning a fuel stop there. When I got to Findlay, they were giving Special VFR clearances from the FSS there. I called the FSS and when they answered my transmitter went out so I could not reply to them. So I flew on to Putnam County Airport about 30 miles west of Findlay, landed and called the FSS on the phone and explained the situation. As Oshkosh did not want you to talk to them, I decided to press on as I could receive very well. I then flew to Porter County Airport at Valparaiso, IN. Findlay FSS also gave me a good forecast for my route. After refueling at Porter County, I proceeded to the Peoria VOR and took up a 337 degree heading to miss the Chicago TCA. When I reached the town of Marengo, IL, I was due south of Oshkosh so took up a 360 degree heading. I had not been able to go higher than 3500 MSL after leaving Putnam County and the ceiling now started dropping. Soon it started to rain and I did a 180 and ran out of it again. Deciding that sitting it out on the ground would be the best idea, I started to look for airports on my chart and spotted Blackhawk about ten miles east of Madison. I was tuned to the Madison VOR and was on the 90 degree radial. According to my chart, there was a super highway running near Blackhawk so I flew until I spotted the highway and turned west, as I got onto base leg the rain started again. I could see alright out of my canopy except for the critical lower front area where I needed to see the runway. On my first pass, I could see that I was too low so I released the landing brake, added power and started a go-around. Just then I heard and felt a thump but the airplane kept on flying and climbed out. I checked what

I could from the cockpit and discovered that the front of my left winglet had a crushed area about the size of my hand just above opposite the top of the rudder.

The only thing I can figure was that I had hit a big bird as I was flying over a cornfield and there were no trees or poles in the field. I climbed out and then tried to land the other way. This time I was all set up but had closed the air vent to keep the rain out of my face and just as I came down final the canopy steamed up so it was another go-around. On my final pass I tried Runway 27 again. I was set up well and as the runway was 2600 feet I was trying for the numbers. I could see that I was to the left of the runway so I banked right to line up, just as I banked left again, I felt it hit.

What I hadn't seen in the rain was that Runway 27 had a 275' displaced threshold because of a mound with a cornfield and a road that was about two feet higher than the end of the runway. The main gear and the left wingtip hit the edge of the road and separated from the airplane. The fuselage then skidded across the grass and up the runway, stopping just on the right edge of the runway just before the displaced threshold markings. I was completely unhurt so unbuckled my harness, opened the canopy and stepped out into the rain. The ELT worked because even though the radio was tuned to 119.3 the sound of the ELT signal could be heard.

The destruction was almost total, the only thing that could have been salvaged was the canard and that had some tip damage. The left wing had been torn from the center section spar. The left side of the center section spar outboard of the fuselage had been torn off separately. The center section spar with the engine mount, engine, and fuselage tank had ripped loose from the fuselage and the fuel strakes, the only thing keeping it with the fuselage was the aileron torque tube. The right wing attach fitting was wrenched both at the wing and the center section spar. The fuselage lower aft cover was ripped off when the gear separated. It had the all glass gear tabs according to CP 14 and the tabs stayed in the airplane, although the gear legs did delaminate between the tabs. The nose gear failed to the right and crushed a small section of the lower nose. The belly of the airplane was surprisingly unscathed, just some paint scratches, at no point was the fiberglass abraded through. The engine sustained some damage, the main thing was the air intake pulled the carburetor with the intake spider attached loose from the case, breaking one bolt and cracking the boss where the other bolt was attached. The carburetor and intake spider stayed with the carcass held on with the fuel line. When the left wing separated, it swung in and dented the valve covers on cylinders 1 & 3. The propeller was shattered and the spinner had a few dents. I was lucky that it was raining as the center section spar coming loose dumped all the fuel into the engine compartment. The lower cowling and wheel pants disintegrated.

What should I have done? The first two things were lapses of memory. When I was getting the airplane ready for the trip I had planned to put RAIN-X on the canopy after polishing it but I left the RAIN-X home. The second item was that I forgot my handheld radio when I started on the trip. I'm sure that the canopy would have been easier to see through with RAIN-X and the handheld radio would have allowed me to go into a controlled field with long, wide runways. Next, when I ran into rain again I should have headed south again until I was well in the clear, there was plenty of fuel on board, having flown less that 2 hours on full tanks. Also I could have dialed up 7700 on my transponder and gone on ten miles to Truax Field which has an ARSA, I was definitely in an emergency situation.

To what do I attribute my luck in being unscathed? First of all to a great design, the one witness to the accident stated that the airplane came apart just as it was supposed to,. The fuselage cocoon ended up intact. The seat belt and shoulder harness helped. **Also had TEMPER FOAM cushions, even though the airplane hit with such force that it broke the bracket on the back of the radio stack the cushions absorbed the impact so that I could not feel it. I'm sure that the TEMPER FOAM saved me from serious back injury.**

Such is my sad tale and is the reason that I did not see you at Oshkosh this year.

Sincerely
James O. Eggleston"

Many thanks, Jim, for this accurate and honest accident report. We can all learn from an accident like this. Rain-X is a great idea when flying into rain, and carrying a hand held radio for emergency use is another. ED.

Update Number 68 to Chapter 26, Upholstery

****From CP68-7,8&9 (CH4,CH19,CH26,CH29,CH33,CH39)****
A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not positive of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. Do not fly a Long-EZ or VariEze without vortilons. In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on your particular aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power. Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the forward face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around. **SKETCH OMITTED**

This change is mandatory and should be completed before next flight. **Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats.** Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall crash that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

THE FOLLOWING IS AN ANALYSIS OF THE UTAH ACCIDENT
The Utah accident involved a deep stall, flat descent (angle of attack of about 80 degrees). The fact that the pilot survived and that a slower-than-expected sink rate occurred (confirmed by video tape evidence of the last 2.3 seconds of descent) presents somewhat of a dilemma. We are baffled as to why this can occur. A similar phenomena has been experienced during several deep stall accidents with the Velocity aircraft. All were survivable and one went into water with the pilot experiencing no injury at all! (See article in July '91 *Sport Aviation*.)

The Utah Long-EZ had a wing-loading of about 12.2 lbs./sq. ft. and, considering all its area, including the wings, strakes, cowl and fuselage, a "flat-plat loading" of about 9.2 lbs./sq. ft. (1150 lbs. divided by 125 sq. ft.). A basic calculation of the predicted rate-of-sink in a flat descent would use a flat-plate drag coefficient of about 1.2 and would predict a sink of about 4820 ft. per minute or 80 ft./sec. This would definitely not be survivable.

Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

1) Analysis of the video tape shows a sink rate of about 48 ft./sec. (2900 ft./min.). This required measuring the size of the airplane image and may be off as much as 30 percent. The post-crash video data show the rate of drift of dust from impact. Comparing this rate of drift of dust (wind was about 20 knots) to the rate of sink of the airplane (on video) confirms the approximate 48 ft./sec. estimate.

2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

Update Number 73 to Chapter 26, Upholstery

****From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)****
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

From CP73-13 (CH26)
Seen at Oshkosh. Beautiful leather seat cushions (also available in various fabrics) for Long-EZ, VariEze and Defiant.
Contact: Diana Davidson
Alexander Aeroplane Co.
900 S. Pine Hill Road
PO Box 909
Griffin, GA 30224
404-228-3901

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Supplemental Chapter 27, Back Cover of Plans

Long-EZ Plans Changes

****From CP25-6 (CH27)****
LPC #7, MEO, Back cover of plans.
Wing root leading edge should be 113.9", not 113.4"

****From CP25-6 (CH27)****
LPC #24, MEO, Back Cover
Nose gear CL is at W.L. -22 not -23.

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Supplemental Chapter 28, Appendix Drawings (18" x 24")

Long-EZ Plans Changes

****From CP25-6 (CH14,CH28)****
LPC #19, MEO, Page A4.
Engine mount extrusions "Chapter 6" should be "Chapter 14", 2 places.

****From CP25-6 (CH5,CH28)****
LPC #20, MEO, Page A5.
Clarification: The 15 ply BID pad for the aft gear attach angle should stop at W.L. 12.35 (Don't glass above 12.35)(Chap 5).

****From CP25-6 (CH4,CH28)****
LPC #22, MEO, Page A-3 correction.
Hole for gear retract drive tube should be 1" to the right of CL.

****From CP28-9 (CH5,CH28)****
LPC #58, MEO. Page A5.
On the main gear mounting pads bottom of page, two places shows only 1 ply. Should be 15 plies of BID.

****From CP30-9 (CH9,CH28)****
LPC #80 'A' drawings, page A-5.
2" x 2" x 1/4" aluminum ext. shown full size page 18-3, should be page 9-3.

****From CP30-9 (CH9,CH28)****
LPC #85 'A' drawings, page A5, to right.
"shown full size, page 18.3" should be "page 9-3".

****From CP32-7 (CH20,CH28)****
LPC #97 MEO, Page A-14, lower winglet, tip template.
The arrow pointing inboard is correct, the words, "this side for lt . . . . .", etc. are reversed. The side shown is for the right winglet, transfer numbers to the other side for left.

Miscellaneous

****From CP27-6 (CH5,CH28)****
Aft fuselage side shape. A number of builders have noted that the A-5 drawing has a different shape the that obtained when fabricating the fuselage sides per the page 5-1 dimensions. This approximately 0.2" error will not present a problem if you follow these instructions: Carefully follow <u>all</u> the dimensions on page 5-1. This will assure that the firewall will fit. Do use the 5.8 and 6.9 dimensions on A-5 and be sure the extrusions are perpendicular to the top longeron. Ignore the small difference between the bottom shape and that on A-5.

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Supplemental Chapter 29
Long-EZ Section VI, Landing Brake Plans

Long-EZ Plans Changes

From CP24-6 (CH29)
LCP #3, MEO, Sect VI
See landing brake bushing revision below under VariEze plans change.
GIVEN BELOW
Landing Brake. Brock part #LB10 has been supplied with #10 hole. It should be drilled out with a 17/64 drill and a CS13 bushing should be inserted and clamped with the AN3-7A bolt as shown. **SKETCH OMITTED**

From CP26-6 (CH9,CH29)
LPC #35, MEO, page 9-1.
Landing brake paragraph - after the word "installation" add the words "and other important landing brake details".

From CP29-7 (CH29)
LPC #65, MAN GRD
There are indications that the back injury noted on accidents (pg 3) may have been caused by the center speed brake diagonal being forced through the seat back after failure of the landing gear and the airplane's belly impacted the ground. Refer to the sketch and remove the portion of the plywood bulkhead (part #LB9) shown to allow it to collapse without piercing the seat bulkhead. Double check that the speed brake arm (#LB20 & #LB2) does not go over center with speed brake down - recheck the 40 lb. closure force. **SKETCH OMITTED**

From CP29-7 (CH29)
LPC #72, MEO
Section VI, Landing Brake Page 2, part number LB10 should be changed to make the "ear" 1/2" longer to avoid interference with LB3. If you bought this LB10 part from Ken Brock, this change has already been accomplished. **SKETCH OMITTED**

Miscellaneous

From CP26-7 (CH24,CH29)
LANDING BRAKE INSTALLATION - Page 24-1, the sketch showing LC1, does not show the cutout necessary for the seat belt clearance. Before bonding LC1 into place, make the cut out per the right side.

From CP26-7 (CH29)
SPEED BRAKE RIGGING - Due to the fuselage bottom on the Long-EZ being thinner than the VariEze you may have to shorten the LB21 pushrod (turn a few more threads on it with a die). When rigging the speed brake, be sure to obtain the correct amount of offset with the brake in the down position. The top rod end must be 0.4" aft of a straight line drawn between the upper and lower pivots. It is acceptable to vary the 0.4" dimension + or - .1" as required to obtain the 40 lb. brake closing force. **SKETCH OMITTED**

From CP28-10 (CH29)
Q. Why is my L.B. 12345 weldment from Brock, for my landing brake 1" too short?
A. It is not too short. You missed the instruction on page 9-1 and CP #26 page 6, LPC #35, to go to page 24-1, step 2, where you will find this called out. The reason is that this weldment was made for VariEzes originally, and they are 2" narrower at this point. Rather than make a new part, we accepted mounting the L.B. 18 brackets 1" left of center on the landing brake. We have tested it in this configuration and it works excellently.

From CP43-4 (CH29)
VariEze and Long-EZ - Landing Brake.
A few builders have reported noticing a softening or weakening of their brake. We checked ours here at RAF and sure enough, when we wiggled it fore and aft we could feel and "hear" the damaged urethane foam "working". The glass of course was not damaged and no builder has reported any more damage than this. This repair should be done within the next 25 hours.

The landing brake is called out to be made from urethane foam. Anyone who had not built the landing brake, should build it from PVC (Klegecel of Divinycel) 3 or 4 lb/cubic feet foam. Increase the length of LB19 (plywood insert) by 1 1/2" and taper it as shown to reduce the concentrated loads at the end. **SKETCH OMITTED**

If you have already built your landing brake or are already flying, an appropriate repair/reinforcement is as follows: drill several 1/16" or 1/8" diameter holes through the skin below (or aft) of LB19 plywood insert. Inject pure epoxy or a very liquid slurry into each hole, forcing the slurry/epoxy into the damaged urethane foam. When this cures it will greatly stiffen this area of damaged foam. Remove the LB18 brackets and layup 4 plies of UND over the plywood insert and down the inside skin of the landing brake as shown.
SKETCH OMITTED

Update Number 68 to Chapter 29, Long-EZ Section VI, Landing Brake Plans

****From CP68-6 (CH4,CH29)****
VARIEZE, LONG-EZ, DEFIANT MANDATORY GROUND
MODIFY THE LB-9 BRACKET AND INSTALL A 1/4" BIRCH PLYWOOD DOUBLER PER THE DESCRIPTION ON PAGE 8 OF THIS NEWSLETTER. ALSO, A MANDATORY WEIGHT AND BALANCE MUST BE DONE. NOTE: VORTILONS ARE MANDATORY ON THESE 3 AIRCRAFT.

****From CP68-7,8&9 (CH4,CH19,CH26,CH29,CH33,CH39)****
A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not positive of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. Do not fly a Long-EZ or VariEze without vortilons. In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on your particular aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power. Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the forward face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around.
SKETCH OMITTED

This change is mandatory and should be completed before next flight. Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats. Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall crash that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

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Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

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2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

Update Number 72 to Supplemental Chapter 29, Long-EZ Section VI, Landing Brake Plans

From CP72-8&9 (CH29)

AN ELECTRICALLY ACTURATED LANDING BRAKE BY MIKE MELVILL

This question has been asked many times. I remember discussing this with Burt on a number of occasions. The answer was always, "Why mess around with a nice simple, light-weight system that has never given any problems?". I agreed with this argument at that time and never seriously considered such an idea until recently.

Occasionally I heard from builders and flyers who had installed linear actuators but I did not take these seriously until my good friend and colleague, Doug Shane, made this modification to his own Long-EZ here at Mojave. He used a Warner electric linear actuator and told me it was rather easy to install and that it worked very well in flight. Being a gadget freak (my wife, Sally, repeatedly tells me I am) I decided I had to have one! I researched the Warner actuator that Doug used and was at the point of ordering one when another friend, Norm Howell, (also a Long-EZ builder) showed up at Mojave with a data sheet on a different electric linear actuator made by Pittman, one that was much smaller and lighter than the Warner. Also, it reportedly could generate more "push" power than the Warner. Norm wanted to order one for himself and offered to include an order for me. I gave him a check and commenced designing the mounting bracketry and hardpoints.

A couple of weeks later, I had the new actuator in my hands and I could not believe how tiny and how light-weight it was. The electric motor was 28 volts which is compatible with N26MS, my Long-EZ. Only one thing disappointed me about it and that was it did not have integral limit switches to shut the motor off at either end of its travel. Doug's actuator did have these limit switches included in the design which would make it easy to install and wire up. Instead of integral limit switches, this Pittman actuator was constructed in such a manner as to limit the total travel to 4" at which point the electric motor continues to run but the actuator stops. This occurs at both ends of the travel.

While this is not an ideal system, it will drive the landing brake down and up with at least 100 lbs. of actuating force and will support at least 225 lbs. while extended and static. This actuator takes about 5 seconds to go from one end to the other of its travel (4").

I first removed the manual landing brake actuating mechanism which included the LB-13 handle, the cables, the LB-1 steel weldment, the LB-21 pushrod and the LB-9 plywood gusset This left the landing brake hinged onto the bottom of the fuselage and the LB-18 brackets remained in place on the landing brake.

The Pittman actuator comes with a 1/4" rod end installed on the end of the actuator and, happily, this rod end fits perfectly in between the two LB-18 brackets mounted on the landing brake. The Pittman actuator fitted without interference through the 1"X2" hole in the floor throughout the travel of the landing brake. This left me with only having to figure out how to mount the motor end of the actuator to the aft face of the front seat bulkhead.

I elected to cut into the aft face of the front seat bulkhead for installation of the mounting hardpoint because this moves the motor end of the actuator forward partially into the bulkhead allowing a little more baggage room on the floor of the rear cockpit. Working on the aft face of the front seat bulkhead is much harder to do and were I to do it again, I may simply cut into the forward face. I removed glass skin and PVC foam and sanded the inside surface of the forward glass skin before floxing in a rather large solid glass insert (1/4"x3"x5"). After cure, I bevelled the foam and glass and laid up 3 plies of BID over this insert and lapping into the bulkhead. The reason I installed such a large insert is simply crash worthiness. I would not want the actuator to penetrate the front seat bulkhead in the event of an off field landing or crash.

I fabricated two small brackets from 1/8"x1"x1" 2023-T3 aluminum angle, bolted them to the top end mount of the actuator, held the landing brake firmly closed and drilled through these brackets and the insert in the bulkhead. After these brackets were installed, I found I had to make a small adjustment at the lower rod end to adequately snub the landing brake in the up and closed position.

I drilled a hole through the front seat bulkhead and ran two 20 gauge wires through this hole over to the left side and forward to the instrument panel. I mounted a momentary-on DPDT, center off switch on the left side of the panel just above the throttle when it is in the full throttle position. I wired the switch through a 3 amp fuse to the 28V buss. The "sense" of the switch is switch handle up, landing brake up. Switch handle down, landing brake down. With this particular installation, the landing brake is extended or retracted in 4-1/2 seconds while static on the ground.

ADVANTAGES. This is an easy retrofit or initial installation requiring only a couple of evenings of work. It is as light, or lighter, installation than the mechanical system. The main advantage in my opinion was that it allowed me to completely remove the LB-9 plywood bracket. This bracket has been the subject of two MAN/GND call-outs in the CP where the concern was that this plywood bracket may penetrate the front seat bulkhead in an off field landing or crash. I was very happy to be able to remove this LB-9 bracket.

DISADVANTAGES. Cost. This electric actuator is not cheap, none of the suitable actuators are cheap. My installation cost me $180.00 not including the cost of the original parts which I removed and discarded. Any electrically actuated mechanism may be more complicated and therefore less reliable than a mechanical mechanism. I don't worry too much about an electrical failure or motor failure because the landing brake is not critical to safe flight.

This change that I have made to my own personal Long-EZ is not a RAF or Burt Rutan approved change. As a gadget freak, I liked the idea so I designed it and made the change myself. If any builder/flyer out there is interested in making a similar modification, send a SASE to me at RAF and I will provide the name and address of the actuator manufacturer. Keep in mind that some manufacturers are very gun-shy of selling you anything that might be used on an airplane so some discretion is required when you purchase one of these.

FLIGHT TEST RESULTS. Testing has shown that the brake can be extended or retracted at any speed below 110 KIAS. Retraction or extension time is approximately 5 seconds. One shortcoming that showed up in flight test was that an appropriate amber warning light is required to warn the pilot anytime the landing brake is not closed. This is a mandatory requirement. I have not flown it often enough at this point to decide if I really prefer it over the manual mechanical system, however, knowing that the LB-9 plywood bracket is no longer installed makes it worth it.

Update Number 78 to Supplemental Chapter 29, Long-EZ Section VI, Landing Brake Plans

Information derived from CP78 published by RAF for April & July 1994

****From CP78-4 (CH29,CH38)****

CAUTION

A Swiss Long-EZ builder/flyer reports finding the four bolts that attach the landing brake hinge to the fuselage badly corroded. He had removed the brake to install an electric linear actuator and found these bolts heavily corroded. He has been flying for 5 years and has 350 hours on his Long. A regular inspection of these bolts is recommended and this is especially important if you live near the ocean or in a wet climate.

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Update Number 82 to Supplemental Chapter 29, Long-EZ Section VI, Landing Brake Plans

Information derived from CP82 published by RAF Oct 1995

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****

Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00

Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00

Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00

Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	**10.00**
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	10.00
Moldless Composites manual	14.50

Postage & handling included in price.

Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

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Table of Contents for Supplemental Chapter 30, Section IIL, Lycoming O-235 Engine Installation

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Update Number 66 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP66-3&4 (CH2,CH21,CH30,CH38)****

CAUTION

Check that what you order is what you get! Plastic fuel lines must be checked - often.

"Just re-read an article in the *Canard Pusher* about fuel lines in VariEzes. These "original call-out" urethane, flexible fuel lines have been reported to deteriorate over time and should be carefully inspected and replaced periodically. Unless the material for these fuel lines is the correct material, deterioration can be very rapid. Visually examining plastic tubing when it arrives from the supplier may not tell the builder/flyer that it is, in fact, the correct material. Even when the correct material is used, deterioration can occur and be invisible to all but an extremely thorough examination. Here is my experience:

Recently, I brought my VariEze home on a trailer and had it in the carport, nose down. It had been sitting there for quite some time awaiting my attention. When I finally got around to it and opened the canopy, I smelled fuel but could find no sign of liquid fuel. Later, I was checking fuel lines under the rear seat by squeezing them with my fingers to determine hardness or brittleness when the header tank fuel line fell off in my hand! This was the source of the fuel smell. With the nose down, fuel had slowly leaked behind the rear seat bulkhead and into the rear cockpit. All of the other fuel lines were discolored to a dark brown but still felt pliable. In removing them from the fitting, to my horror, they easily split and crumbled.

I had always assumed that deterioration would occur in low spots in the fuel lines where water may collect. These failures, however, were up high at the aluminum fittings. They had been installed in July of 1983 and flown for a total of 750 hours, so they were seven year old. I have used auto fuel, regular, when at home and 100LL Avgas when traveling. Lately, regular auto fuel is no longer available locally so I have been using auto unleaded (no alcohol). I have, on occasions, used Marvel Mystery oil as a fuel additive and, many years ago, I used TCP.

I believe that VariEze fuel lines should be changed at least every three years and great care should be taken to order the correct material. Also, make sure you receive the correct material. As a further safeguard, cut a few small pieces of the new fuel line and submerge some in a bottle of gasoline and some in a bottle of acetone. I check these samples from time to time for any obvious signs of deterioration.

Byron McKean"

Editors comment: Thanks for your report, Byron. We agree wholeheartedly with the suggestion to change plastic fuel lines at least every three years. Also, we have found that buying polyurethane-type tubing from a supplier like McMaster Carr (locations in Chicago, Los Angeles and New Brunswick, NJ) will get you a receipt that spells out part numbers. For example, according to McMaster Carr's catalog, Tygon tubing comes in at least two material types, one called out for fuel and lubricants, another for food and beverage! Each material has its own part number. Tygothane, the material originally called out in the VariEze plans, is recommended for fuels and lubricants. Using McMaster Carr, at least you have the verification of the part number on the receipt. We highly recommend this company as a source of an unbelievable variety of materials, tools, etc. Their catalog is an awesome tome!

****From CP66-4&5 (CH30)****

CYLINDER HEAD AND OIL TEMPERATURE CONTROL IN EZ'S

The problem is that the two rear cylinders run too cool and the forward two run too hot. After trying virtually every suggestion in the CP, and some others, with little success, Bill and Terry decided to do some serious testing and analysis of the problem. Using an airspeed indicator as a pressure gage (remember, an airspeed is simply an accurate pressure gage with the face marked in MPH or knots instead of PSI), six 1/8" ID clear plastic hoses were run from the cockpit aft through the firewall to various positions in the cowling. These hoses were numbered and tagged on each end and the cowling ends were reinforced with 1" lengths of 1/8" OD brass tubing and securely lashed to various supports as available. The six locations tested were the top and bottom of the left two cylinders (4 places), just inside the NACA cooling inlet (5th place), and right on top of the per the plans installed oil cooler (6th place).

It really takes two people to conduct this flight test. Data was taken at a range of airspeeds and altitudes with OAT, CHT on each cylinder, oil temperature and engine RPM recorded for each set of pressure (MPH) readings. These data were then plotted up on graph paper as a function of altitude on one graph and airspeed on another. Careful examination of the numbers and graphs revealed that under all conditions tested, the rear cylinder, bottom side, consistently had the highest pressure while the rear cylinder, top side, had the lowest pressure.

Assuming all cylinders are externally essentially identical, with new identical baffling at the time of the test, then each cylinder has the same inherent resistance to air flowing through the fins. The pressure difference, bottom to top, across the forward cylinders, was much lower than the pressure difference across the rear cylinders. This results in much lower cooling air flow though the forward cylinders than the rear cylinders and, therefore, higher cylinder head temperature.

Almost all of the cooling air was going through the rear two cylinders. Basically, what happens is that the cooling air rushes in through the inlet, follows the bottom of the cowling as it swoops upward at the back till it hits the vertical rear baffle where this high velocity air is abruptly slowed down, raising its pressure. On the top side of the two rear cylinders, the lowest pressure exists due to proximity to the cowling outlet and the scavenging action of the prop. There is high pressure under the rear cylinders, low pressure on top and, presto, most of the cooling air flows through and around the rear two cylinders leaving the forward cylinders with less cooling air and much higher temperatures.

Obviously, the way to improve the cooling of the forward two cylinders was to increase the resistance to cooling air flow at the two rear cylinders. This was accomplished with some trial and error by installing temporary baffles <u>forward</u> of the vertical rear baffles under the two rear cylinders and cylinder heads to cover all but about 2" of the fin area of those two cylinders. With these temporary baffles wired in place, another flight test was conducted and instantly the CHT's were much closer to being even. One more iteration of even more restrictive, under-cylinder baffles permanently solved the cylinder head problem.

The oil temperature problem, however, still existed on this 0-320 powered Long-EZ. Many ideas were tried. Some helped a little but nothing cured the problem until a second oil cooler was added on the right side. A "brute force" method to be sure, but one that worked incredibly well, although not too elegantly.

We would like to thank Bill Freeman and Terry Yake (both Long-EZ builders/flyers) for the above information and we can verify how well this method works on CHT problems based on personal experience. With a little "cut and try", all four cylinders can be within a couple of degrees of each other in level flight. Some differences still exist while in a steep climb but small compared to what we saw before. Obviously, it is essential to have a 4 cylinder CHT gauge installed in order to safely conduct these tests. Also, very important: keep in mind that, depending on the condition of the engine, indeed of each individual cylinder, you may have slightly different baffling requirements for your engine, or even each cylinder, than someone else has. Approach this test methodically and you will have excellent results.

From CP66-6 (CH30,CH38)
<u>ROCKER COVER OIL LEAKS?</u>
Burt's Catbird, N187RA, had moderate oil leaks at all four rocker covers. This is an TIO-360, 210 hp, angle valve Lycoming. We removed the rocker covers and the standard cork gaskets had flattened down to nothing at each attach screw and all were leaking badly.

A call to Doug Price of REAL GASKETS initially caused a bit of confusion as to exactly what gaskets were required. Apparently this engine is an oddball, updraft cooled with inlets on the bottom and exhausts on top. Turned out Doug had the gaskets in stock. He shipped them out UPS Red Label and we had them the next morning here in Mojave, in time to install them during lunch hour.

The rocker covers, themselves, were carefully scraped clean then polished with a Scotch Brite. The cork gaskets were peeled and scraped off the tops of each cylinder using a worn out wood chisel. This surface was then also polished with a Scotch Brite.

Now, and this is the critical part, we cleaned both surfaces with paper towel saturated in Acetone. (MEK would also be good). It is extremely important that <u>all</u> traces of oil are removed from the surfaces that these silicone gaskets will seat on, otherwise the silicone will extrude out from between the rocker cover and cylinder head. We used several fresh pieces of paper towel until there was no trace of oil. The screws were also cleaned in Acetone then each screw was treated with one drop of removable Locktite (Blue). The gaskets and rocker covers were installed and the screws were tightened with a large screw driver and a firm hand. (Don't know the exact torque, but the screws were tight). There should be no reason to have to keep tightening these screws each time you check in your cowl. If there are no oil leaks, leave these screws alone! Voila! No more leaks. Burt's Defiant has "Real" rocker cover gaskets, as does Mike and Sally's Long-EZ, and there has never been a drop of oil leaking from these rocker covers in over four years.

From CP66-7 (CH30)
TSO'd, Silicon Rocker Cover Gaskets - to fit all models of Lycoming and Continental engines.

Contact: Doug Price
Real Gasket Corp.
PO Box 1366
Laurel, MS 39441-1366
800-635-REAL
601-649-0702

From CP66-8 (CH30)
PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

From CP66-9&10 (CH30,CH38)
THROTTLE/CARB PROBLEMS ON A VARIEZE
"Dear RAF,

Enclosed is requested survey information on our VariEze, N222HK, SN 222. We are the original builders and continue to maintain and fly this thoroughly enjoyable aircraft. During our eight years of such, 222HK has proved to be remarkably free of serious problems. It has flown five times Utica, NY to Oshkosh. There are a couple of things I would like to relate, however.

The most sever problem which I can recall was with the throttle carburetor control. Very small diameter portals built into the carb (Marvel Schebler mounted on a Continental 0-200) became clogged to such an extent that they created hydraulic back pressure on the primer piston. The result was very sluggish response of the actuator arm on the carburetor with the following consequences: Failure to provide adequate prime on opening the throttle, this made for hard starting. Failure of the two springs to quickly move the throttle arm to full open on demand, - a serious problem in the event of a go around. Failure of the cable to push the throttle arm to full open.

During servicing the aircraft, I noticed when opening the throttle using the control handle the cable actually buckled up and the arm did not move. Probably with the engine running vibration caused the arm to move slowly and would only be noticed in the event a sudden surge of power was demanded. I believe the change was a slow process and very subtle indeed.

Disassembly of the carburetor revealed the clogged portal and the fact that the fuel injection piston could not force a stream of fuel into the carburetor during prime. I do not know what material caused the clogging, perhaps a small residue of epoxy.

Whenever the cowl is removed, a simple check can be made to insure that the carburetor arm responds quickly when the throttle handle is advanced. It may take two people to do this.

A second issue involves small particle fuel contamination which has been virtually eliminated in 222HK by installation of an in-line auto fuel filter. We didn't like the heavy gascolator so installed three low point quick drains and the filter. The filter is a glass enclosed cylinder about 1 inch dia. x 4 inches long and easy to service. The clear glass allows visual inspection whenever the cowl is removed. We have found particulates such as Teflon, fiberglass and other unknowns in spite of thoroughly cleaning all tanks before placing in service.

As original builders, we greatly appreciate the tremendous job you have undertaken in keeping us informed. We have built two more aircraft, a Kitfox Model I and a Zenair STOL 701. Neither of these can compare with the service we have received from you. Please accept our heartfelt thanks and keep it going as long as possible.

Sincerely,
Charles M. Hewison"

EDITOR"S NOTE: We certainly appreciate Charles' experiences, but instead of the in-line auto fuel filter we would recommend a Kinsler in-line fuel filter. These are available from:

Kinsler Fuel Injection
313-362-1145

The filter assembly, part #9020, costs $85.00 and extra filters, part #9023, costs $8.00 each.

These are quality parts, machined from solid aluminum and have Dash 6 (3/8") AN flared fittings machined on to each end. The internal paper filter is replaceable (Kinsler part #9023) and can be cut apart to look for particulates at each annual. These filters are made for fuel injected engines and work very well. Mike and Sally, Doug Shane and Dick Rutan are all currently using this in-line fuel filter.

From CP66-10&11 (CH30,CH38,CH39)

P-LEAD TO MAGNETO INCIDENT

"Dear RAF,

I took a trip last August in Norse Nomad, my Long-EZ, which has over 400 hours to date.

I had an uneventful flight to McKinney, TX from my home in Carbondale, IL to visit with my son's family. On the way home via Texarkana and Little Rock, I suddenly experienced a noticeable drop in rpm. Since I had put in 20 gallons of 100LL before departing, I suspected water in the fuel. I did a 180 degree turn and made it to an airport with the engine running rough and surging between 2400 and 2600 rpm's.

I removed the gascolator and found a half teaspoon of sand and sediment but no water. A quick test flight revealed that I had not found the problem. I decided to leave the Long-EZ, fly home commercially and return with a trailer. To make a long story short, when I got my Norse Nomad home, I started the engine and got a bad mag check on the right mag. The mags had checked perfectly on the previous two flights, but not now.

The culprit was a break in the shielded P-lead from the mag to the starter switch. where the wire made a 90 degree turn close to the switch. A single strand had cut the insulation and grounded the center electrode!

Knowing what I know now, I would have simply removed the P-lead from the mag and flown home. This would have left me with a "hot" mag but it would have been much better than the 650 mile trailer trip! Also, I did not check the mags in the air when I had the problem. That check probably would have revealed the problem. A sudden loss of about 10% of your rpm is, in most instances, a magneto problem. Another clue was that the cylinder head temperature on my number 4 cylinder was unusually low. This plug runs off my right mag.

Hopefully, this experience may help other EZ flyers who may run into similar problems. Remember, any sudden drop in rpm, check the mags, if possible, check individual cylinder head temperatures, land and disconnect the P-leads. Watch out no one touches the prop with the mags hot. This may get you home where you can affect proper repairs. Keep in mind that P-leads can shut you down if grounded! These wires should be shielded and installed very carefully to minimize any chance of accidental grounding.

Greeting to all at RAF,
Jake Bach"

From CP66-11 (CH30)

C BAYARD DU PONT'S DEFIANT

(RESEARCH NOT TESTED BY RAF)

Many CP readers will remember that Bayard had planned on installing Javelin Ford engines in his Defiant. Well, on August 28, 1990, Bayard made a successful first flight on his Defiant with Javelin Ford engines swinging 71" diameter by 82" pitch Sensenich wood props. Static prop rpm is 2200 hp. The Fords turn the props at essentially the same rpm as the Lycoming would, suggesting, obviously, that the Javelin Fords probably put out around 180 hp. However, the Ford engine weighs over 100 lbs. per installation more than a 180 hp. 0-360 Lycoming. That weight does include radiators and coolant.

Bayard reports that the engines run very smoothly and appear to cool OK. So far, he only has a couple of hours on his Defiant. He says the airplane flies well and his ground crew says that it sounds just like a P-38 Lightning!

Unfortunately, on the third flight, the front engine threw a rod totally destroying the engine. The resulting single engine approach and landing in the Defiant were no problem. Bayard had completely overhauled the rear engine but did not do the front engine. He feels that a nut came loose on one of the connecting rod bolts causing the problem. He has since obtained a replacement engine and is in the process of overhauling it. He is looking forward to flying his Defiant again soon and we look forward to a report on performance and perhaps a rundown of what the costs have been to get the Javelin Fords up and running in the Defiant. How about it, Bayard, a comparison of what the Fords cost compared to a pair of overhauled 0-360 Lycomings?

Congratulations, Bayard, on getting your Defiant in the air. As a flying testbed for an experimental engine, the Defiant probably is as reasonable a choice as you could have made.

ED: Note: Had this experiment been conducted in a single engine EZ, it would have almost certainly resulted in a serious accident.

Update Number 67 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
LETTER FROM VARIEZE FLYER
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. **I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc.** I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. Don't trust anyone else with your safety. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

From CP67-6 (CH30,CH33)

CAUTION

HAND PROPPING

"If your magnetos are not both impulse mags, be certain that you have the non-impulse mag turned off during hand propping. Lycomings usually have an impulse mag on the left and a non-impulse on the right. Small Continentals usually have two impulse mags. Check yours to be sure.

If you leave a non-impulse mag on while hand propping, it can result in a kick back with fingers in the way. I have personal experience with this. I had trouble starting one day so decided to use both mags. The resulting kickback caused a broken thumb and badly bruised fingers! Be careful."

Chuck McCleod

ED - We know of at least three EZ flyers who broke their hands the same way. One spent over $5000.00 in doctor bills getting his hand repaired! As Chuck says - be careful.

From CP67-7 (CH30,CH38)

EXHAUST SYSTEM CRACKS

We seem to be experiencing a rash of exhaust system cracks. After years of essentially no cracked weld or cracked pipes, suddenly, over the last year or so, we have received perhaps a half dozen reports - a couple in the last few weeks. A few have been Brock exhausts for Long-EZs, but most have been Sport Flight (Herb Sanders) VariEze as well as Long-EZ exhausts. Steve Franseen, VariEze builder/flyer in Denver had what he termed a Big Time Emergency when the outboard section of a Sport Flight VariEze exhaust system came off in flight and split the prop to the hub. He would like to warn builder/flyers to check exhaust systems very carefully around the welds. This is a real important preflight check item. With a pusher, a broken exhaust will almost always result in a forced landing.

Steve has requested information from anyone who is operating Sheehan Engineering piston and rings in an 0-200. His VariEze, N86EZ, has run without problems using these parts for over 2 years. He is interested in comparing information on higher time engines using this set up. Steve is also interested in sources for more of these high quality components. Anyone who would like to contact Steve can reach him at:

Steve Franseen
10196 W Keene Ct
Denver, CO 80235
303-987-1880 (H)

From CP67-8&9 (CH9,CH22,CH30)

WICKS AIRCRAFT SUPPLY CO.

We have been asked us to let you know that they now carry in stock Real Gaskets, the 100% silicon rocker cover gaskets for Continentals and Lycomings. As we have said before, there is no better gasket and no better way to eliminate oil leaks at the rocker cover.

Also, Bud Meyers says they now carry the 5" axles (1-1/4" dia.) in a slightly longer version (6" instead of 5-3/4") to better fit the heavy duty Cleveland brake installation. They also have the wider spacer for the inboard side of the wheels to facilitate the use of the heavy duty brakes. These new axles have two cotter pin holes (at 90 degrees to each other) drilled in the threaded end. (An excellent idea. ED)

Bud has researched the Snap Action fuses and circuit breakers as mentioned in CP66 and has decided to stock the Snap Action MB-1. It is smaller and weighs less than other circuit breakers and is less expensive. Contact Wicks for more information.

From CP67-10 (CH30)

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

From CP67-11 (CH30)

EDITOR'S NOTE

Bruce Tifft tells us his prop making business is booming. He has found a new supplier who carries an even better quality wood than his usual high standard. The move to Oregon (along with an increase in customers) put him a little behind in filling orders , but he is diligently turning out props as fast as his quality control will allow. He asks your patience and, as always, will try to work with anyone who finds themselves in a hardship situation. B&T Props has always been one of RAF's recommended suppliers because of the Tifft's personal integrity and the good workmanship that comes from that shop.

From CP67-11 (CH30)

NEWS OF A PROP SUPPLIER

We recently received several glowing reports from EZ and Defiant flyers about props they had purchased from Performance Propellers in Patagonia, Arizona. We wrote to Clark and Margaret Lydick, owners of this company and also Long-EZ builders and flyers. They used their Long-EZ as a flying test-bed for their props and have accumulated over 600 hours.

They make two and three-bladed props for VariEzes, Long-EZs and Defiants, for 0-200s, 0-235s, 0-320s and 0-360s. The have been making props for more than two years and their policy is to custom build the prop to suit your airplane. It is sent to you with no leading edge protection, just a coat of sealer. You then try the prop and determine the static and maximum RPM on your airplane. Send the prop back and they will fine-tune it to your desires, install a rain proof leading edge and finish the prop before sending it back to you. All of their props are done this way.

RAF has not had the opportunity to test one of these props and we recognize that we are not in a financial position to do so any more. We have, however, checked out this company to the best of our ability and have had several builder/flyers who had recommended Clark and Margaret - so we have included them in this newsletter. We solicit comments from flyers who may have tried these props or who have had any business dealings with this company. Since Great American went out of business, and in spite of Bruce Tifft's best efforts, there has been a very real problem getting quality props in a timely manner.

Anyone interested in more information contact:

Clark or Margaret Lydick
Performance Propellers
PO Box 486
Patagonia, AZ 85624
602-394-2059

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Update Number 68 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP68-3&4 (CH30)****
"Dear RAF;
Re: CP 67 page 11 and request for comments concerning Performance Props and the Lydicks.

I have known Clark Lydick for about 15 years and Margie since they were married - around 6 years perhaps. Clark and I flew radio controlled airplane models while he was still an active duty AF electronics engineer here in the Eglin AFB area.

You should know that Margie grew up around and helping airplane prop builder Bernie Warnke (her father) and his "Almost Constant Speed Props". Recently *KitPlanes* reported Bernie's props won overall in a prop competition. Margie and Clark worked with Bernie making props until about 3 years ago when they began their own business. Clark built and flew one of the most beautiful Long-EZs I've ever seen - including my own. I've been using one of his props for over a year now and can say it outperforms props I've used on my Long-EZ made by other manufacturers.

I strongly recommend that "Performance Propellers" be added to RAF recommended suppliers.

John L. Hicks"

****From CP68-4&5 (CH30)****
LONG-EZ EXHAUST SYSTEM
All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying on his Long-EZ for several years. It is very similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble free hours.

Hal Hunt
6249 Longridge Ave.
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a really fancy air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

****From CP68-6 (CH30)****
PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
375872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-924-7068

Ted Hendrickson
P.O. Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in *Sport Aviation.*

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Update Number 69 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP69-2&3 (CH30)****
LONG-EZ EXHAUST SYSTEM
All 321 stainless tubing 1-3/4" diameter with 1/4" thick stainless steel flanges. Pipes exit the cowling one above the other, two each side. Fits all Lycoming engines from 0-235 to 0-360 (no heat muff). This is the same exhaust system Dave Ronneberg designed and built and has been flying on his Long-EZ for several years. It is similar to the 4-pipe system Mike Melvill has on his Long-EZ, N26MS, for over 4 years and 600+ trouble-free hours.
Contact: Hal Hunt
6249 Longridge Ave
Van Nuys, CA 91401
818-989-5534

Note: Hal Hunt also makes and sells a neat air intake with filter and carb heat valve that provides filtered carb heat. Contact Hal for details.

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	**329.00**
Engine cowls, pr. (Kevlar)	**480.00**
Cowl inlet	**48.00**
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	160.00
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	**47.00**
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

****From CP69-4 (CH30)****
PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:
Bruce Tifft
B&T Props
375872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson

PO Box 824
Concrete, WA 98237
206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in *Sport Aviation.*

Update Number 70 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP70-3&4 (CH30,CH38)****
"This is a report of a stuck throttle "near-miss" incident. In hindsight, it is quite similar to the Don Patch report in CP 65 and the Charles Hewison report in CP 66. I consider I was lucky to not have pranged the airplane.

I have just converted my Long-EZ from an MA-3A (non-accelerator pump carb) to an MA-4SPA (accelerator pump carb) as part of a change from an 0-235 C2C to an 0-320 E2G. After about seven hours of uneventful flying, I sent the MA-4SPA away for an overhaul, including a new throttle shaft and a rebuilt accelerator pump. This greatly improved the smoothness and mixture control of the engine but the rebuilt carburetor requires about two pound of force to operate, when applied to the throttle bellcrank arm at the inner most hole, using the plans carburetor cable bracket. The force to operate the throttle bellcrank is about the same whether or not the engine is running (two pounds). The MA-3A carburetor springs itself to full throttle, since it had no accelerator pump; the non-rebuilt MA4SPA was much looser than the rebuilt one. The problem is that the throttle quadrant is not able to supply this much force at idle without help from a spring. With a spring, the throttle sticking problem never occurred with the engine shutdown, only with the engine running after the throttle had been pulled to hard idle, and then slowly advanced.

I found this out over several days of trouble-shooting when I noticed the throttle response of the engine was occasionally delayed when coming off a slow idle. I investigated by cycling the throttle and visually inspecting the system, but could not reproduce the problem or find a cause for it on the ground. Being foolish and thinking the problem had fixed itself, I went flying, landed, and when I tried to apply some power to taxi, I could not get any power response, only a very spongy throttle movement to about half throttle position (2 inches of throttle knob motion). My first stealth forced landing! After engine shutdown, throttle response was normal!
(Good thing he did not have to go around! -ED)
I then verified visually (top cowl removed) that engine movement was not binding the cable somehow. I increased the throttle spring tension, and slightly relocated the throttle cable clamp to perfectly position the cable at the throttle cable end bushing. These changes appeared to eliminate the slow response. I flew again, and on landing, still had some reduced amount of sluggish response off of idle. Suspecting a damaged cable, I made the force measurements on the carburetor and the cable using some string, a volunteer to make the measurements with the engine running, and a 1-10 pound fish scale. These measurements confirmed that the system could not operate the carburetor without a spring assist. Suspecting damage to the cable, I then removed the cable from the airplane for inspection (yes, it was floxed in every foot or so: no, my consoles were not removable: yes, hell of a mess and lots of swearing). The cable was not damaged, nor was the cable sheath. Interestingly, however, if you pull on the cable shroud from opposite ends, even as little as 2 pounds of force will stretch it some.

I really didn't want to put a spam can-sort of throttle system in, but it appears that something with greater push authority than the original design is needed. I don't want to just increase the throttle spring force since spring failure will mean possible throttle failure. Do you have any thoughts or suggestions?

Lew Miller"

Five years ago, Mike Melvill went to an aircraft push-pull throttle cable and has been pleased with the result. -ED

****From CP70-9 (CH30)****
<u>PROPS FOR EZ'S AND DEFIANTS</u>
RAF recommends the following prop manufacturers: Bruce Tifft
B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068
****NOTE CHANGE IN STREET ADDRESS FROM THAT GIVEN IN CP69****

Ted Hendrickson
PO Box 824
Concrete, WA 98237

206-853-8947

While we still have not had an opportunity to try one of Performance Propellers (Nogales, Arizona) props, we have now had a chance to see and touch several of them, and to talk with pilots who fly them. We have also received nothing but enthusiastic letters of recommendation for these props. See their ad in *Sport Aviation*.

Update Number 72 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

From CP72-6 (CH30)
AIRWOLF FILTER CORP.
After 4 years of design and testing, Airwolf Filter Corp. is proud to release to the homebuilt market their Lycoming remote mount oil filter. This remote mount filter was designed to replace the 4-bolt Lycoming P/N 69510, 68974, or 62815 oil screen housing at the rear of most Lycoming 0-235, 290, 320, 340, 360, 540, and 720 series engines. This adapter allows the user to locate the oil filter to the firewall and is a welcome relief since many Lycoming engine applications are unable to use the current spin-on adapters due to space restrictions. In addition this kit, including the oil filter, adds less than 4 pounds to the aircraft empty weight.

The AFC remote mount oil filter kit is available in three versions. 1) The basic kit includes only the oil filter adapter and remote oil filter mounting plate and retails for $495.00. 2) The deluxe kit includes the oil filter adapter, remote oil filter mounting plate, spin-on oil filter, Aeroquip steel braided hose and fittings, AN-8 fitting and bulkhead nuts, Vitron O-rings, Teflon washers and is priced at $695.00. 3) Remote filter adapter (allowing the homebuilder to use his own oil filter mounting base) for $395.00.

The entire remote mount filter installation should take only 1 to 2 hours to install in most applications.

The public release of this product will be at Oshkosh 1992 and our booth is 368E in the Fly Market.

From CP72-7&8 (CH30)
LONG-EZ OIL COOLING
High oil temperatures continue to be one of the most frequently reported problems from builders/flyers of Long-EZs. As reported in CP 66, page 4, a rather detailed engine and oil cooling test and analysis was conducted by Bill Freeman. He found that it literally took doubling the size of the oil cooler to keep the temperature of the oil at the desired level. There are three Long-EZs based at Mojave that are owned and flown by employees at Scaled. All three have varying degrees of high operating oil temperatures. These three have all made numerous changes to try to lower operating oil temperatures. Among these changes were: new Vernitherms (thermostat - VERY EXPENSIVE!), different positions of oil cooler in the cowling, various configuration of inlet and outlet ducting to and from the oil cooler, the use of Mobil 1 (an exotic, high temperature synthetic oil), larger flexible hoses between the engine and the oil cooler, etc. None of these changes reduced the operating oil temperature consistently to the 180^0-190^{0}F that is desirable.

On Mike and Sally's Long-EZ, N26MS, with the oil cooler mounted on the firewall above the centersection spar, the oil temperature would vary from 190^{0}F to 230^{0}F depending on the outside air temperature (at similar power settings). Mike put up with this situation for several years because these temperature ranges were within those specified by the engine manufacturer. Recently, a top overhaul was conducted on his engine and after this overhaul, oil temperatures ran at or above 245^{0}F red line.

Power had to be reduced soon after every take-off due to exceeding the oil temperature red line limit. A new Vernitherm made no perceptible change. Having Bill Freeman's test in mind, Mike installed a new oil cooler essentially twice the size of the stock cooler. This was installed on the lower cowl, left side, similar to the plans call-out. Oil temperature now remains between 180^0 and 195^{0}F even in a maximum power climb to 17,500 feet on a hot summer day. So far, the oil temperature has never gone below 180^{0}F even at low cruise power at high altitude during the winter due, presumably, to a correctly operating Vernitherm. Nor has the temperature gone higher than 195^{0}F and this only occurred in a full gross weight, maximum power climb in the middle of summer in the Mojave desert.

Dan Kreigh owns an 0-235-L2C powered Long-EZ here at Mojave and until he doubled the size of his oil cooler (by simply installing a second cooler in series) he had tried every one of the options in this article with little or no success. His oil temperature consistently ran close to or at the red line. The second cooler has eliminated the problem.

This article is aimed at those builders/flyers who may have high oil temperature problems. If your oil temperatures are normal please disregard this recommendation.

Update Number 73 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

From CP73-1&2 (CH30)
OSHKOSH 1992
Burt flew the Catbird non-stop from Mojave to Eau Clair, Wisconsin in 6-1/2 hours where he had a business meeting the day before the airshow opened. He had more than enough fuel remaining to have gone on to Oshkosh.

Many builders and flyers noticed that the right canard was missing on the Catbird. This was done to provide more static margin (distance that the center of gravity is from the neutral point) or to improve the longitudinal stability so that the S-TEC auto pilot's "altitude hold" feature would work. The test flight a few weeks before Oshkosh was a complete success. The altitude-hold worked great, so Burt elected to fly it to Oshkosh that way.

Mike and Sally flew N78RA, Burt's Defiant, and transported Burt's friend and attorney, Lee Horton from Mojave to Oshkosh via Chadron, Nebraska. The old Defiant does not get much use these days but it performed flawlessly, there and back. Mike and Sally's Long-EZ, N26MS, which first flew almost 12 years ago in 1980, had been to Oshkosh every year since then. Not wanting to break that string, friends and fellow Scaled employees, Beth and Jeff Holle, flew her to Oshkosh and back to make 1992 the twelfth consecutive Oshkosh. N26MS now has 1980 hours of flight time and still flies great.

During the bull sessions held near the Catbird each afternoon, many interesting subjects were discussed. **One subject was brought up that was disturbing. At least three Long-EZ pilots have had their engine mounts crack.** Since this is not just an isolated case, all Long-EZ flyers should remove their cowlings and closely examine the engine mounts using a bright light. Pay particular attention to each tube near where it is welded. Anyone finding a cracked or broken engine mount is requested to sent a full report covering number of flight hours, total time in service, nature of the failure and exactly where the failure is located. RAF will keep a file on this subject and will report our findings in future newsletters. If you feel any unusual vibration or hear a different noise, land immediately and carefully check the engine mount.

It is most gratifying to note that even though RAF has essentially been out of business for the past seven years, there were still more RAF designs at Oshkosh this year than any other, just as there has been for the past 10 years.

From CP73-2,3&4 (CH9,CH16,CH18,CH19,CH20,CH22,CH26,CH30)
APPROACHING 2000 HOURS
N26MS, MIKE AND SALLY'S LONG-EZ

The kit was picked up in July, first flight was December of 1980.

1980 hours of flight time and almost 12 years later, our Long-EZ is showing remarkably little signs of wear and tear. Just recently, I decided to install a new pitch and roll control system. Over the years, some play had developed in the phenolic bearings in the roll control system in the cockpits as well as in the wing roots. I have now installed ball bearings in place of all four phenolic bearings and, also, have replaced the three universal joints in the control system. I have also installed a ball bearing pivot in the forward control stick. There is now essentially zero play or slop in the pitch and roll flight control system. Part of the reason for doing this was to try to improve the performance of my Navaid wing leveller (auto pilot). Doug Spears, designer of this unit, had called me and explained that the biggest problem he had seen with his autopilot was in EZ's. He says that any play at all in the linkage from the autopilot servo to the actual control surface (aileron) will greatly degrade the authority of the autopilot and ruin its ability to track accurately. The other factor that really hurts autopilot capability is friction in the control system. The ball bearings have essentially eliminated any friction. I am looking forward to testing the Navaid 1 in the near future. While at it, I replaced all rod ends in the entire control system. There was noticeable play in all of these rod ends but none had excessive play. Now there is essentially no play.

I have carefully examined the entire airplane for signs of wear, fretting, etc. and I must say, I am surprised how little evidence there is of this. Over the past 12 years, we have made several improvements to our Long-EZ, some of which I will try to cover here.

One of the most useful things we have is a vinyl bag which fits closely into the area above the centersection spar behind the passenger's head. This bag, which has a strong zipper, was custom made for us and has been in continuous use since 1981. In it we store our tiedowns and ropes, control locks, cleaning rags, Zero Static polish (for paint and Plexiglass) as well as the waterproof canopy cover which we bought years ago from, Herb Sanders in Memphis. This bag, when full, fits snugly in the cavity over the spar and, I believe, contributes to reducing the noise level in the cockpit. I would highly recommend having a bag such as this made for your Long-EZ.

For several years now, we have had a gas strut installed in place of the throw-over strut on our canopy. At first, I did not like it much, but once I got used to it, I think it makes a lot of sense. I installed it so that when the canopy is closed, the gas strut actually applies a small amount of pressure, holding it closed. This means it takes several pounds of force to open the canopy the first several inches. The force goes to zero for a few more inches then gradually pushes the canopy with increasing force to the fully opened position. The gas strut firmly holds the canopy open allowing taxiing in the strongest crosswinds, with no problems. As my friend, Ralph Gaither, has pointed out several times, the gas strut is also probably safer than the throw-over strut since you can close the canopy simply by pulling it with one hand (in the event of an inadvertent canopy opening in flight, for example) whereas the throw-over stay requires two hands to close. The gas strut makes a nice, clean installation but it does require a heavy beef-up of the cross brace in the center of the canopy. The plans call out arrow shaft must be replaced by a heavier aluminum or steel tube which must be securely bonded into each canopy rail. (I had this cross brace fail 3 times before I finally got it strong enough.) The gas strut puts a lot more stress into the canopy frame just in normal use of the canopy.

Another item of interest on 26MS is the use of stainless flathead allen screws in the cowling, on all the aileron and rudder hinges and on the wheel pants. Many builders have asked about these and I have told them on an individual basis. After nearly 6 years of using these screws, I feel confident in recommending them. These are not "aircraft" screws - they have the standard 82 degree countersunk head and are installed using a chrome plated, brass countersunk washer (similar to a Tinnerman washer). The fiberglass cowl, or wing skin, is countersunk using an 82 degree countersunk (not a 100 degree aircraft countersink) just enough so that this chrome washer fits into the countersunk hole flush with the top skin and no more. These screws are available from Garrett Industrial Supply which has stores all over the USA. I used the store in the LA area.
Contact: Garrett Industrial Supply
6015 Randolph Street
Los Angeles, CA 90040
213-723-6777

The screws are stainless steel, flat head, socket cap screws, 10-32x5/8", part #30477. The washers are available from Aircraft Spruce or Wicks, part #NAS 390B10P. I bought 100 of each and found that I used almost all of them. I always install these screws in the cowling using Loctite. First, it prevents the screws from vibrating out into and damaging the prop. Second, it provides some lubrication which prevents galling during installation into the K-1000 steel locking nutplates. If you do not use Loctite, you will have these screws galling and ruining themselves. (Believe me, after 6 years using them, I should know!). I use the removable Blue #242 Threadlocker by Loctite.

For more than 1100 hours and six years, we have been flying with a bigger engine (a subject I can't cover!) but, more importantly, with an Ellison throttle body instead of the Marvel Shebler carburetor. To be absolutely honest, I went with the Ellison initially because it was physically shorter, more compact and would fit inside the cowling contour more easily. I had flown an Ellison on my 0-235 some years before and had not had much success. Ben Ellison had changed the design a little and made a couple of improvements since then so I decided to give it another try. I am very glad I did. With 6 years of experience in all kinds of conditions, I have been completely satisfied. The Ellison Throttle body works extremely well, a dramatic improvement over the carburetor. I get at least one gallon per hour across the board better fuel economy and much, much better mixture control fidelity. On top of that, the unit is lighter weight, much simpler design (far fewer parts) and has proven to be extremely reliable. Best of all, though, I have had extremely good support from the factory. There have been two "AD recalls" where I received a letter from the factory explaining a problem that had occurred on a few throttle bodies and that, if I sent mine in, it would be modified free of charge. In addition, I have had excellent response when I have had questions on installation and tuning.

On the negative side, I have had the o-ring seals on the mixture tube leak slightly which required replacement, and I have heard from several other owners that they had had similar problems. A few owners have complained about the Ellison to me, but I have noticed that they have not gone back to a carburetor! Nor would I - ever! What with all the fuss over the past several years about composite versus metal floats in carburetors, the Ellison does not even have a float bowl! One other thing, I have never experienced any sign whatsoever of induction icing with my Ellison. I cannot say the same about my 0-235 with a carburetor!

Another interesting improvement, especially in fuel efficiency, has been an electronic ignition system which I purchased from Klaus Savier over three years ago. I removed my left magneto and installed an aluminum plate over the hole. This provides a surprising amount of room between the engine and firewall for easier access. The installation of the triggers and magnetic coil pickups is fairly straightforward. Klaus provides an excellent installation and operations manual which should be followed closely to the best of your ability. You cannot afford sloppy workmanship here. My installation has required essentially no maintenance, I have never had to adjust the timing, it just simply keeps on running with incredible reliability. I am very please with the improvements, among them; considerably less fuel flow for the same power, much better and smoother idle, and a noticeably quieter running engine, particularly at altitude when it advances the timing to approximately 44 degrees before top center! The engine has been generally much easier to start also, Klaus' electronic ignition system is a capacitive discharge system (not an inductive system) and as such draws very low current. Sally and I were returning to Mojave from New York a year or two ago when our alternator quit charging. We stopped to see if it was just a loose wire (it was not, it was a voltage regulator which had got water in it during a two hour flight in heavy rain). We elected to fly over 400 nautical miles to Newton, KS, where we were repaired by Bill Bainbridge. The important thing here is that we were able to run, without any problem, for 2-1/2 hours, depleting the battery (no charge), and the electronic ignition ran flawlessly all the way.

Our airplane was the first Long-EZ to use the "heavy duty" Cleveland brakes, the 3/8" thick discs and the large diameter brake pad actuator. In fact, we flew for several years with these brakes before George Varga did the research through Cleveland's data sheets to come up with the current so called "heavy duty" brakes. The brakes we had came off Peter Garrison's "Melmoth" after it was destroyed in a bizarre accident at Orange County airport back in 1981 or '82. Recently, I installed some new brakes. These are designed by a VariEze builder/flyer, Phil Mattingly, who bought the business from Fred Rosenhaan. These brakes are quite different from the Cleveland design in that the 3/8" heavy duty disc is simply a flat disc that bolts to the wheel rim in 3 places. The brake assembly is a double puck arrangement, that is, each brake uses 4 brake pads and these are actuated by two hydraulic piston assemblies. The brakes are very powerful, smooth and, best of all, they seem to last a long time. I installed them 15 months ago, have over 250 hours of flight time on them and I still have not had to replace the brake linings! For me, that is remarkable. It seems I was always replacing the linings on my Clevelands. I have been extremely pleased with these Matco wheels and brakes (the wheels are slightly narrower than Cleveland 500x5 wheels and fit the Lamb tires better). You will have to purchase the whole set, including wheels, brakes and axles. Phil tells me this brake is standard equipment on some Glasair models and on the Venture.

The linear voltage regulator together with Bill Bainbridge's (B&C) lightweight starter pretty much caps it off. These have both been excellent value and I would go the same route again. The starter has been a gem - never misses a beat and cranks my engine in any amount of cold weather without fail. Other than getting water in the voltage regulator (my fault), it has been flawless as well.

We have an excellent instrument panel now, King KX-155 Nav/Com, King transponder, and King KLN-88 loran, together with a full gyro panel. This enables us to fly "California" IFR and, more importantly, to maintain IFR proficiency. We have an Alcor fuel flow meter (the simplest and the best in my opinion but, sadly, no longer available). Knowing your fuel state with complete accuracy increases dramatically the utility of an already very versatile airplane.

This airplane is in constant, at least weekly, use and has given Sally and me untold joy. It has carried us faithfully for probably over 300,000 miles through every state except Hawaii. I cannot imagine how we would manage without it.
Mike Melvill

From CP73-5 (CH30,CH38,CH39)

"Dear RAF:
This letter finds my aircraft N84GR VariEze up and ready to go anywhere. My years of enjoyment with this fine design are pleasant memories which nothing can replace.

I use my aircraft mostly for cross country flights. I rarely get into weather, but have the quals and gages if necessary. I find that 11,500 ft. is max when wet. Rain during takeoff always means an extra 500' roll before lift off. My stall when wet is 10 knots faster than dry....so I advise everyone to watch the wet stuff. Here in Florida we get our share of liquid sunshine. Always watch out for puddles on the runway....can pull you off runway and ruin your whole day (like my friend Byron McKean's previous report).

My only hangertale concerns a flight I took this last summer. I normally fly from Pensacola to Stuart, Florida to visit my family several times per year. It is such a routine flight now, I know the route by memory. I usually fly the VFR corridor just south of Eglin AFB along the beautiful white beaches to Panama City then direct to an intersection just west of Cross City and direct to Orlando...direct Stuart. The flight normally takes 3+00. I was at 9,500' just south of Orlando and waiting for a few more miles closer before beginning my enroute descent (35km) into Stuart when my trusty 0-200 seemed to change pitch and lose some power. I began checking into things not worried too much since I had over 750 hours on that engine and had only 100 plus hours before done a cermichrome overhaul on the top end. Mags checked okay....tank change did not help....(I have the Long-EZ fuel system with separate main tanks plus the emergency)....the emergency tank did not help....(I knew of one guy that had a clogging fuel filter and the higher point of the emergency tank gave more head pressure through the filter....plus RAF reports say the same)....boost pump was okay....oil pressure fine....so I backed the throttle a bit....then she began getting rougher....NO GOOD! I hit emergency search on the loran....(A nice feature to have even if you know your way) figured I best be getting on the ground asap....(I really wanted to go that next 80 miles to Stuart, but knew better....ole Navy flight training and common sense said..."Get it on the ground while she is still running") so....I landed at Sebastian (home of Danny Mayer and Velocity). A nice twin allowed me to have his place in the pattern after I said I had a rough runner. I landed a bit hot (lots of runway) with plenty of altitude in case of failure, but she was running fine at idle...no oil to be seen, so I taxied in to give her a good look-see. After a lot of looking and plenty of advice from Danny and other local folks the problem could not be immediately found. New fuel, plugs, etc...did not help. **The next day with the help of my cousin Tim and friend George of Aviation Propellers, Miami we found a *loose exhaust valve guide* on number two cylinder.** The keepers were still in and springs working fine. This allowed the engine to run fairly well at idle, but at high rpm the valve was floating some and causing loss of power. (2200 rpm static) Lucky for me the keepers stayed in and no significant damage was done. A new cylinder was shipped out (complete warranty replacement by cermichrome folks and my mechanic Don Freeman, Aviation Engines of Hueytown, Ala..thanks!). My cousin and friend drove up from Miami again and helped me put her together...I mostly watched...then after a short test flight returned to Pensacola....nonstop. This once again reminds us to believe what we have and don't push it. With only one engine back there and God only issuing each one of us one sweet life it is the prudent man/lady who is careful while hurling themselves through the air at tremendous velocities.

That's about it for now. Ken Forrest's old VariEze N84ST is well over 1000 hours now and still flying fine in the hands of my hangermate. Just a thought, I and many others are still awaiting a new 3-4 place bird from Burt which will run the pants off the competition....please.

Together for a GREAT AMERICA
Ralph Gaither"

From CP73-5&6 (CH30,CH38,CH39)
"Dear RAF,
I'm writing this letter in the interest of safety for all canard-pusher type designs. Please feel free to edit or paraphrase it at will; I just want to help others avoid the scare that I had. As a little background, I bought my Long-EZ about two and a half years ago with 400 hours on the airframe. Since then, I have put almost 300 more hours on it, including a trip around the borders of the US last summer. I love my plane, but my only regret is that I did not have the honor of building her myself.

Last week, after doing an oil change, I took off into a quiet Friday evening sky at my home field for a test flight. I climbed to 8,000 feet, where I spent about 15 minutes watching the sun set, after which I started my descent.

Suddenly, there was a loud bang, followed by violent vibrations. I immediately pulled the throttle to idle and shut off the mags as I pulled the nose up. The prop stopped quickly, and I was able to see in my rear-view mirror (a small convex mirror inside the canopy for looking at my passenger) that something had hit my B&T prop and that it was badly broken.

I decided to keep the engine off and glide back to my home field. Fortunately, I was at about 5,000 feet and only 10 miles from my airstrip, a mile-long asphalt runway. This would have been possible in any plane, but was an easy task in the Long-EZ with its great engine-out performance. I announced my problem on unicom and the FBO operator monitored my descent.

As I touched down on the runway, I was amazed as to how dark it was, for I'd forgotten that sunset at 8,000 feet occurs quite a while after it had on the ground at sea level. I rolled out without any problems and got out to inspect the damage and determine the cause.

It was immediately obvious that my right exhaust stack had broken inside the heat muff box and that was what had damaged my propeller. The damage to the prop consisted of complete loss of the plastic rain edge, a gouge out of the leading edge of the blade measuring about 1 inch by six long, and a 5 inch longitudinal crack propagating from the impact point towards the hub.

After pulling the cowlings and exhaust stack, I was able to determine that the cause of the problem had been entirely the result of the builder NOT FOLLOWING THE PLANS and my A&P mechanic and I missing a problem in the recent annual inspection (5.5 flight hours prior). The heat muff and been built as per the plans except that it had not been welded directly to the exhaust stack. Instead, it had been built to be a snug fit. The problem with this was that this design allowed it to vibrate, albeit in very small movements, and this slowly ground away at the wall of the exhaust stack. The groove was deepest on the inside wall of the muff. After almost 700 hours of use, the walls of the stack were paper thin and finally gave way, allowing a half-foot long section of the exhaust stack to separate and hit my prop.

Believe it nor not, this failure may have saved me from an even greater danger - that posed by carbon monoxide poisoning from exhaust gases leaking into my cabin air system.

Lessons learned:

1. With the engine off, I'm glad I have a Long-EZ, as she has a great glide ratio and handles like a dream.
2. I was glad that I had practiced simulated engine failures just the flight before; the practice really helps out.
3. Build your planes as per the plans. If you do buy a used RAF design, go over each and every step in the plans (which should be included as a condition of sale) to find where an error or oversight might have occurred.
4. Pay special attention to the dangers of very small vibrations; small movements over long periods of time can grind through very strong metals.

I hope that this information is of help. If there are any of you out there thinking of buying a used EZ, please call me. The designs are great, but, as experience has taught me, used homebuilts have an unusual number and kinds of pitfalls.

Have a great day flying, and thanks to the folks at RAF for their continuing support.

Sincerely,
Tom Staggs"

From CP73-8 (CH30, CH38)
CAUTION

Corrosion in the gascolator sediment bowl and even in the aluminum fuel lines is not only possible but has occurred more than once. Check you gascolator bowl often and, if ever you smell gasoline in the cockpit, do a thorough inspection of all aluminum fuel lines for leaks at the "B" nut fittings as well as leaks in the lines themselves due to corrosion.

****From CP73-9 (CH30,CH38,CH39)****
"Dear Mike,
On May 20, while doing touch-and-go's at Clark Co. airport in southern Indiana, my VariEze (N64SJ) was extensively damaged. I had elected to go around because of a slower aircraft ahead (C-150). While traveling along the right side of the active about half throttle in a very shallow climb, just past the take-off end of the runway, I moved the throttle to full power. The engine (0-200) started to respond then tailed off to nothing. I turned back toward the airport but came up about 50 yards short of the intersecting runway. It had rained quite heavily for several days previously and the sod was very soft.

The aircraft rolled several yards before the nose gear failed causing the plane to flip forward landing inverted and traveling another few yards before finally coming to rest, tail first, upside down.

Damage included -- Right wing broken just o/b of the wing attach fitting, left wing broken at mid span, Canard separated from aircraft taking a small part of F-22 bulkhead, the elevator control pushrod did considerable damage to the right side of forward fuselage before it finally broke, the canard has a small tension tear in the top skin at mid span, the main gear has some torsional damage, both winglets were broken near mid span, the taper pin holes in the top sides of both inboard sections of the wing attach fitting were slightly elongated from tension, other damage to canopy and cowling that I won't go into here.

After removing the cowling, the cause of the engine stoppage was obvious. **The aeroduct between the carb heat valve and the carb had collapsed.** A further check confirmed that both ends of the coiled wire were held tightly under the worm clamps. The wire coil had become completely disorganized and, in fact, parts of it looked somewhat like a Slinky that had been mistreated.

On a subsequent engine run, the engine repeated the in-flight shutdown. After removing the aeroduct, the engine ran normally.

I feel the shoulder harness and seatbelt and rollover structure worked very well as I was uninjured.

I can't say how much I enjoyed and miss my EZ. I would appreciate any advice you might have about possibly rebuilding.

Please pass on my experience with the aeroduct,

Best regards,
James Bierly"

****From CP73-10 (CH30,CH38)****
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

MANDATORY GROUND
VARIEZE AND LONG-EZ
Engine mount weldment inspection before next flight is required. Using a bright light, carefully examine the tubing close to each weld in the entire weldment. Look for hairline fractures or cracks. See page 1, this CP. Please report any cracking or failures found to RAF. If at any time during flight you should feel any unusual vibration, land and check the engine mount for cracks.

****From CP73-10 (CH30,CH38)****
ALL RAF DESIGNS - See Accidents and Incidents this CP, page 9 - aeroduct collapse.

Carefully check any aeroduct hose in inlet systems for security and condition. Suspect hose must be replaced before next flight
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Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

****From CP73-11 (CH30)****
AIRWOLF FILTER CORP.
After 4 years of design and testing, Airwolf Filter Corp. is proud to release to the homebuilt market their Lycoming remote mount oil filter. This remote mount filter was designed to replace the 4-bolt Lycoming P/N 69510, 68974, or 62815 oil screen housing at the rear of most Lycoming 0-235, 290, 320, 340, 360, 540, and 720 series engines. This adapter allows the user to locate the oil filter to the firewall and is a welcome relief since many Lycoming engine applications are unable to use the current spin-on adapters due to space restrictions. In addition this kit, including the oil filter, adds less than 4 pounds to the aircraft empty weight.

The AFC remote mount oil filter kit is available in three versions. 1) The basic kit includes only the oil filter adapter and remote oil filter mounting plate and retails for $495.00. 2) The deluxe kit includes the oil filter adapter, remote oil filter mounting plate, spin-on oil filter, Aeroquip steel braided hose and fittings, AN-8 fitting and bulkhead nuts, Vitron O-rings, Teflon washers and is priced at $695.00. 3) Remote filter adapter (allowing the homebuilder to use his own oil filter mounting base) for $395.00.

The entire remote mount filter installation should take only 1 to 2 hours to install in most applications.

The public release of this product will be at Oshkosh 1992 and our booth is 368E in the Fly Market.
Contact: Airwolf Filter Corp.
15401 Madison Road
Middlefield, OH 44062
216-632-5136

Update Number 74 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP74-1&2 (CH30,CH37)****
"Dear RAF;

Thought that you might be interested in knowing some of the details of another world record set by a Long-EZ during my flight to 30,500 ft. in N121DT. The flight has yet to be certified by FAI and NAA, however I see no problems at this time. After altimeter errors are computed in, expect to be certified to 30,370. (Editor's note: Verification from NAA has been received since this letter arrived at RAF).

My Long-EZ, fully equipped including oil, weighs 889 lbs. having no starter. Class C.1.a. has a max take off weight of 1102 lbs. including instrumentation to certify the flight. Needless to say, with fuel, added instrumentation and me at 175 lbs the aircraft would be about 50 lbs. over weight.

To make the flight, I removed the back seat upholstery, navigational lighting, wing-leveller autopilot, fire extinguisher, ELT, alternator, all radios, prop spinner, oil cooler, carb heat muff and 15 lbs. of body weight. Had to eat a lot of popcorn without beer to wash it down to bring my body weight down to 160 lbs. On a previous test flight I discovered that the vacuum pump still pulled almost 3 inches at 25,000 ft. so I elected to keep my vacuum pump and gyro instruments in case the inside of my canopy frosted over, which it did partly.

I added an electronic ignition made by Electroair and removed the right mag to give me advanced timing and performance at altitude which worked flawlessly. I also had a climb prop (70Dx46P) made by Performance Propellers for my Lycoming 0-290. The prop turned 2800 RPM on climb out and 2600 RPM at 30,000 ft. For communications with ATC and the ground during the flight, I fabricated a microphone into my oxygen mask and carried a hand held radio.

Weigh-in was 1099 lbs with 10.5 gallons of fuel, 8 gallons in the right tank for climb and 2.5 in the left for return flight. I also carried a video camera mounted over my right shoulder and a recording barograph in place of the back seat.

Take off from Camarillo airport was at 08:15 Dec. 5, 1992 with an initial climb rate of 2300 ft./min. ATC had been FAXed of my intentions for airspace more than 12 miles off the coast of California. So when I was handed off to LA Center they were expecting me and cooperated to keep me out of the Continental Control Area before climbing above FL180 VFR, as well as recording my mode C replies for the record. Interestingly, at 29,000, ATC asked if I was turbo charged!

Passing through 20,000 ft. I was climbing at 700 ft./min. However, it took me a couple of minutes to make the last 100 ft. to 30,500 indicated. I had reached my goal of breaking 30,000 so at 1 hour and 4 minutes into the flight, I leveled off and held that altitude for another three minutes The engine was turning 2600 RPM at approximately 8.5 inches of manifold pressure and I figured that I was developing about 30% power. Outside air temp. was -40C and my hands and feet were getting cold through my gloves, layers of clothes and snow boots.

Descent and return to CMA was uneventful. I found a warm reception waiting for me with Dick Freeborg, the National Aeronautic Association and FAI representative, the first one to shake my hand.

Note worthy is that this altitude record breaks the previous of record of 27,040 ft. set two years ago by Hoot Gibson, astronaut and space shuttle commander, in a modified Cassutt.

Dave Timms"

Ed. note: Hoot Gibson took his record away from Norm Howell, Quickie and Long-EZ builder, flying Terry Schubert's Long-EZ.

****From CP74-2 (CH22,CH30)****
"Dear RAF;
At the Long-EZ's annual this spring, I made some changes which caused me a lot of misery. Relating them might help someone else who might contact you with a similar problem. I decided to install a starter (lightweight), which I had never had

before. After installing my new starter switch with the start position, my engine would not run on the right mag unless the right grounding wire was disconnected. I traced wires. I ohm-ed out wires. I replaced wires. I changed starter switches. I installed new series 4300 Slick mags as my 4100 series mags had 500 hours on them and were 14 years old. The mags would operate normally when the switch was hooked up but not installed in the panel, but the right mag would cut out when the switch was installed. I replaced the capacitor in the new right mag. Finally, my friend Frank Caldeiro figured out that the right mag lug on the switch was grounding on my radio stack tray just above the switch. Once the switch was insulated from the radio tray, the mags worked fine. Incidentally, Chief Aircraft who sold me the mags said that Lycoming recommended the 4370 right mag and the 4372 left mag for the O-235-L2C. The 4372 has only 15 degrees of lag when cranking the engine which gives ignition at 5 degrees BTDC when you set the timing at the 20 degrees BTDC called for on the engine's data plate. My old 4100 series left mag had about 25 degrees of lag which gave me spark at 5 degrees ATDC. Tomahawks (L2C) and 152's (L2A) have had a reputation for hard starting. **My L2C starts much better now than it ever did, either hand propping or cranking. I highly recommend the 15 degree lag for the left mags on 0-235-L's.**

Best wishes,
Fred I. Mahan"

****From CP74-3&4 (CH30)****

BRUCE TIFFT, PROP MAKER

We first met Bruce and his wife, Bonnie, in 1979 at Mojave. He had brought up one of his props for Burt to test on the prototype VariEze, N4EZ. Bruce was a gyrocopter builder/pilot and had been building gyrocopter props for some time. He had started building a VariEze and was thinking of manufacturing props for the speedy pusher to help offset the cost of building his own example. It did take a couple of iterations to get the prop to work but Bruce persisted, and today, B&T Props builds lots of props each year, most of them for VariEzes and Long-Ezs with a few RVs Defiants and Glasairs thrown in.

Bruce and Bonnie lived in Ventura, California where B&T Props began. Their yellow VariEze was hangared and operated out of Santa Paula airport. Sadly, after some 700 hours of flying, an accident destroyed their VariEze at the Santa Paula airport (Bruce was not flying). Not having this swift method of visiting airshows and delivering finished props to their customers put a serious crimp in their lifestyle and their business. They resolved to build another VariEze. Meanwhile, the Long-EZ had come along. When Bruce got the opportunity to buy a partially built VariEze, he decided to combine the attributes of both aircraft. The result is their beautiful "Vari-Long", a highly modified VariEze with Long-EZ wings and winglets. A one-of-a-kind aircraft that embodies all of the remarkable skills of the quiet, unassuming prop maker, Bruce Tifft.

When we visited Bruce and Bonnie in Oregon at their neat little "Bend in the Creek Ranch", just outside Cottage Grove, Bruce very kindly demonstrated what goes into building a prop from start to finish.

First, and most important, he must have good raw material. Bruce lucked out here. It turns out that there is a lumber yard in Eugene, Oregon that willingly obtains, and keeps in stock just for him, premium grade, straight grain, Canadian Hardrock Maple. Not only that, but they plane it to the thickness and smoothness he requires, in lengths that he can use.

He starts off by trimming the ends of each board on his cross-cut saw to get rid of any cracks that sometimes occur in the extreme ends of these boards. He then cuts the board into appropriate lengths, depending on what prop he plans on building. It takes six boards laminated together to provide the blank from which he carves the propeller. The six boards are stacked neatly and he drills a small hole at each end. The holes will accommodate steel pins which locate the boards relative to each other while they are in the press during the glueing cycle. Glue is then hand rolled onto each surface of each board. They are then stacked back together and pinned to prevent slippage. This stack of maple is then placed in a special hydraulic press which Bruce designed and built himself. This press can accommodate up to three prop blanks. Each is separated by plastic film to prevent the blanks from sticking to each other. The nine hydraulic jacks are then slowly tightened, in sequence, until an enormous force is uniformly applied to the wet glued blanks. An amazing mount of glue squeezes out from between the boards as they are left to cure for at least 48 hours.

The cured blank is then cut square at each end and, using an appropriate template or pattern, Bruce marks the blank. Using a band saw, he removes material to arrive at a rough planform of the prop, as well as to come somewhere close to the shape of each blade. Bruce has literally dozens of patterns derived over the years that help him to produce his consistently excellent props.

Next, he lays out and drills "center" holes in each end of the blank and installs it in his wood-turning lathe which has been highly modified to trace a "master" propeller. This "master" is installed between centers about 2 feet behind the lathe and is driven by a chain and sprockets at the same RPM as the lathe. A large aluminum wheel traces the master and, in turn, drives a powerful circular saw in and out of the new blank. The lathe's automatic-feed moves this carbide saw from the tip of one prop blade, through the prop hub, and all the way to the tip of the other blade. It takes one roughing cut which removes one to one-and-a-half inches of wood and glue, and one finishing cut to complete the automatic tracer lathe part of this job. This machine is located in a small building behind the farm house and while it is running, you must wear hearing protection. The noise has to be experienced to be believed!

The "prop" is now ready for the extensive hand finishing that Bruce puts into his product. The carbide circular saw leaves a line across the blades and around the hub which Bruce sands off using various power sanders, as well as hand-held sanding blocks and sand paper. The trick is to sand only until these lines just disappear, and no more, otherwise the prop will not be exactly the same as the "master".

Prior to this sanding operation, Bruce drills the center hole through the prop; the counter bore that locates the prop on the prop extension; the six prop bolt holes and the counter bores for the drive lugs - using heavy steel drill fixtures designed and custom built for this job.

We could see that it would be very easy to ruin a prop at this point since a pusher prop and a tractor prop must have the counter bores on opposite faces!

Once the prop has been hand sanded to the required finish and balanced, Bruce uses a router to remove about 1/4" from the leading edge of each blade. He then casts a urethane leading edge in place, using a proprietary system that he developed (B&T Props pioneered the urethane "rain" leading edge since copied in some form or other by nearly all of today's prop makers). A sanding sealer, followed by many coats of clear Imron is carefully sprayed on while the balance is checked between each coat. Once fully dry, the B&T decals are installed and the prop is shipped to the customer.

Bruce and Bonnie have shipped their beautiful propellers all over the world during the past 14 years and there are hundreds of EZs (as well as many other homebuilt designs) currently being propelled by Bruce's craftsmanship. Bruce has had the advantage of first having his own VariEze and then his own Long-EZ on which to develop and test his props. One of the other very nice services Bruce offers is a repair/refinish for any wood prop. Also, as many of you know, Bruce can usually provide a "loaner" in the event of a damaged prop. Recently, with the demise of Great American Props, Bruce has been literally swamped with prop orders and has been having to try to complete his props on an "as required" schedule instead of a "when ordered" schedule. He asks that you have patience and that you let him know, as accurately as you can, when you will actually be needing your prop so that he can satisfy the builders who are ready to fly in a timely manner.

If you are in need of a wood prop for your project, give Bruce a call or drop him and Bonnie a line. They are neat people and Bruce knows more about fitting the right prop to EZs, regardless of what engine they have, than anyone else we know.

Contact: B&T Props
75872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

****From CP74-5 (CH30,CH38)****
MARVEL METAL FLOATS
Terry Schubert reports difficulty getting a new metal float to work correctly. It turns out that the tooling to manufacture these carburetor float bowls is very old and no two bowls are, in fact, identical, therefore, no one float will fit all bowls! Terry got a lot of help from Bill Smith of Consolidated Fuel Systems and highly recommends talking to Bill if you are having trouble in this area. Phone: 205-286-8551

****From CP74-5 (CH30,CH38)****
ENGINE MOUNT CRACKING (UPDATE)
Only one report has come in regarding a cracked engine mount. This one was a conical Lycoming mount. After 530 hours, the tube from the lower right engine mount bolt hole was found cracked completely through about 1" above the bolt. This was repaired by welding a sleeve around this fracture. The prop was dynamically balanced and there has been no further sign of a problem with 807 hours now. The vibration is noticeably less and an exhaust flange cracking problem has also been solved.

We have been talking to anyone we can regarding this engine mount cracking problem. We spoke with one very experienced builder/flyer who had a tube crack through on a Dynafocal engine mount. The fracture occurred about 1/4" from the weld between the tube and the right upper Lord mount cup. This kind of crack is usually caused by improper normalizing of a TIG welded 4130 weldment. There is simply not enough evidence at this time to point at whether this may be a design problem or a heat-treat problem.

Anyone who finds a crack or fracture in an engine mount, please report it to us here at RAF. In the meantime, a close inspection of you engine mount, using a strong light, every 25 hours is recommended. Any unusual vibration felt in flight is cause to land and check the mount. On the bright side, there are now dozens of VariEzes and Long-Ezs with accumulated flight times of more than 2000 hours with no engine mount problems whatever. Please do contact RAF if you hear of, or experience a problem like these.

****From CP74-5&6 (CH30,CH38)****
AEROQUIP SERVICE BULLETIN
TO OWNERS/OPERATORS OF ALL GENERAL AVIATION AIRCRAFT USING AVIATION GASOLINES (E.G., INCLUDING, BUT NOT LIMITED TO, 100 OCTANE LOW LEAD, HIGH OCTANE AUTOMOTIVE UNLEADED, ETC., HEREINAFTER REFERRED TO AS "AVIATION GASOLINE").

Aeroquip Corporation's Aerospace Group has recorded several failures of its 601-type hose over the past 12-month period. *The subject hose meets all required specifications,* however, based upon data accumulated to date, it appears that the use of this hose in fuel systems which carry AVIATION GASOLINE is adversely affecting the life expectancy and performance which Aeroquip has historically experienced with this type of hose. Aeroquip has seen degradation of the elastomeric inner tube

which has resulted in the tube cracking which, in turn, has caused leaking of the 601 hose in these limited types of applications. Based on data which Aeroquip has accumulated to date, it appears that this phenomenon is occurring after approximately two (2) years installation time (independent of actual service hours on the subject hose). *To the extent your aircraft may be affected by this phenomenon, Aeroquip recommends that you inspect your aircraft to determine:* (a) if your aircraft has 601-type hose fuel lines; and (b) the age and condition of said hoses. Aeroquip strongly recommends that any 601 hose, which is approaching, or has more than, two (2) years in an AVIATION GASOLINE application, be replaced in accordance with the recommended action outlined in this Service Bulletin.
Note: This Service Bulletin does not apply to applications using Jet A, JP4, JP8 grades of fuel commonly used for turbine/jet engines. It also does not apply to other fluids such as lubricating oils, REF. MIL-L-7808 or MIL-L-23699.

Editor's Note: It is interesting to note that this exact type of failure was reported as early as 1986 in the CP and several times since then. Do not use Aeroquip 601 series hoses for fuel lines. Use only Stratoflex Teflon lined, stainless, braided or equivalent MIL-H-8794 Hose, TSO'd to MIL spec. C53A.

From CP74-8 (CH30)
"Dear RAF;
Recently, when talking to the nice people at Feather Lite, Inc., I found that the Long-EZ cowling I wanted would cost a large percentage of the purchase price just for shipping. It seems that if the shippers know the material is aircraft parts, the price goes up dramatically! I have considered trying to build my own cowling, but I'm sure I'd fall short of the quality and light weight provided by Feather Lite.

The people I spoke to suggested that the shipping price could be greatly reduced if shared by two or more orders shipped at once, hence this letter. If there are any builders out there in the northeast who have not yet ordered their cowlings and would be interested in combining their orders to save money, perhaps they could contact me and we could arrange a combined shipment. The delivery of cowlings from a common location in this part of the country could be easily arranged. I can be contacted at:

David Kleinschmitt
5 Webb Road
Bethel, CT 06801
203-797-1081

From CP74-10 (CH30)
<u>*PERFORMANCE PROPS*</u>
While we continue to receive favorable reports from users of these propellers, we have received one very negative report. Warren North, Glendale, AZ bought one and tested it on his Long-EZ. He was not satisfied due to the blades cavitating/fluttering during a full power run-up on the ground. The prop also fluttered in flight at high power. He returned the prop for modification/repair together with a carefully prepared test report. When he got the prop back, it was no better and, in his opinion, was unsafe to fly. Warren is very experienced with a test pilot background.

We appreciate the report, Warren, and we continue to solicit reports on Performance Props from those who are flying them.

From CP74-11,12&13 (CH30)(Photo captions)
Bruce points to some of the templates or patterns for the various props he has developed over the past 14 years.

Trimming the cracked ends off a piece of Hardrock Maple. This old crosscut saw was used to cut up the material for Bruce's first prop.

Placing a pile of freshly glued boards into the hydraulic press.

Rolling the glue onto each face of each board. Every square inch must be evenly coated.

Driving in one of his special steel locator pins. This prevents the boards moving relative to one another while in the hydraulic press.

Applying the pressure! Note the copious squeeze-out between boards!

"Master" prop in the foreground, new blank in the background. Note the large amount of material removed in the "roughing" cut.

New prop blank on the left, "master" prop on the right. Note large aluminum wheel with lightening holes which follows the "master" prop as it revolves.

Bruce holds two freshly carved blanks. These have just been removed from the automatic tracer lathe. Ends need to be trimmed, holes need to be drilled and then entire prop must be sanded and clear coated.

Boring center hole and 2-1/4" counter-bored hole.

Drilling six holes using steel drill fixture.

First stage of sanding prop after carving on tracer lathe.

Blank

Update Number 75 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP75-2&3 (CH30,CH38)****
FROZEN CRANKCASE BREATHER
The following experience is reiterated in the hope that reading about it may prevent a similar problem, or at least allow someone unfortunate enough to run into this, to come through it undamaged.

Sally and I flew our Long-EZ to Telluride, Colorado this past February. We had planned five days of skiing in the San Juan mountains. We landed at Telluride airport which is at 9100 feet elevation. There was lots of snow and it was cold, especially at night. There was no hangar or tiedown available so we parked nose down, into the wind.

While we were there, it snowed four to six inches each night. The last night, we had 27 inches of snow. We had to dig the Long-EZ out of the snow before we could leave.

A careful preflight was conducted, followed by pulling the prop through enough times to show oil pressure on our mechanical gauge. The engine started easily and I warmed it up at low power. I did not taxi out for take-off until I had 120 degrees F oil temperature. We took off and headed directly toward Page, Arizona at 14500 feet.

One hour out of Telluride, I suddenly noticed the oil pressure gauge fluctuating. The oil pressure slowly fell from 85 to 60psi. At this point, I hit the Loran "nearest airport" button and headed for the brand new Black Memorial airport near the northeast end of Lake Powell.

We removed the cowl and found that the engine had only 1-1/2 quarts of oil left in the sump. We had left Telluride an hour earlier with 7-1/2 quarts! There was evidence of oil near the push rod tube seals, the rocker cover oil drains, but no oil in the vicinity of the main bearing/prop seal. The prop had some oil on it, but not nearly as much as I would have expected considering we had lost 6 quarts of oil!

We topped off the oil, ran the engine for 10 minutes with no sign of an oil leak. We replaced the cowling and headed toward Mojave. One hour later. we had an exact repeat of the problem! This time, we landed at Boulder City, Nevada. It was much warmer there. We went through essentially the same steps again; filled up the oil, replaced the cowl and headed for home. One hour and 10 minutes later. we landed at Mojave and found that we had not used a perceptible amount of oil!!!

Here is my theory but, I hasten to add that I have no conclusive proof of anything at all. We have one of Wes Gardner's breather systems installed and we have run this system for more than 1500 hours without a problem. For those who may not be familiar with this system. it consists of a 5/8" I.D. hose that runs from the crankcase breather elbow to an anti-backfire valve welded into the exhaust system. There is a "T" fitting in this hose from which a 3/8" I.D. hose runs to an automotive PCV valve, and then to the intake manifold (in my case, a fitting is screwed into the Ellison throttle body in the venturi). At low power, the anti-backfire valve does not open and the crankcase breathes through the PCV valve and into the carburetor, then into the cylinders where the crankcase gases are burned in the cylinders and go out the exhaust. At higher power, the PCV valve closes and the anti-backfire valve opens. The breather gases flow directly into the exhaust system, are burned and expelled through the prop.

I later found that the anti-backfire valve had carboned up to about 80% blocked. I believe that the moisture, normally expelled from the breather, <u>froze</u> in the partially carboned and blocked anti-backfire valve. With the very low temperatures at Telluride, particularly at night, this moisture froze hard. Even though I warmed the engine until the oil temperature read 120 degrees F, this did not help because the breather system is located entirely on the "cold" side of the engine baffles. This means the cold air being pulled through the cowling during the engine warm-up kept the frozen breather frozen. The flight at 14500 feet (minus 20 degrees C) continued to keep the breather frozen.

With the normal crankcase vent (the anti-backfire valve) plugged, crankcase pressure built up and began to force oil out of the seals, as well as <u>through</u> the PCV valve, into the carburetor, up through the manifold and into the cylinders where it was burned and expelled out of the exhaust. I believe this continued at a rate of 6 quarts per hour, or 0.1 quarts per minute. In other words, the engine <u>burned</u> most of the oil while some of it leaked out of the seals. The small amount of oil found on the prop, on the engine and in the cowling supports this theory although, to be honest, not everyone agrees with this hypothesis.

The temperature at Black Memorial airport was cold enough so that the frozen blockage did not melt. The temperature at Boulder City was in the low 80's - this finally melted the frozen breather ice and so we did not use any oil from Boulder City to Mojave.

I replaced every part of the breather system, new hoses, new PCV valve, new anti-backfire valve. I did not find anything wrong with the original parts, for what that is worth. I ran a 3/8" drill through the carboned up anti-backfire valve mounting and was surprised at the amount of carbon that came out. In the 40 hours flown since this incident, oil consumption has been normal (about 1 quart per 14 hours).

I intend to keep on using Wes Gardner's breather system. It has given excellent service for hundreds of hours. I will, however, do two things differently from now on. I will check the carbon build-up and clean it out every 100 hours and, I will pre-heat the engine compartment before starting it if it has been left out, overnight, in sub-zero weather. I would recommend that anyone using this breather system do the same thing.

I would value any and all opinions about this incident. Has anyone else out there has anything like this happen to them?

Mike Melvill

From CP75-3&4 (CH30,CH38)

LEAKY MA-3 CARBURETOR?

Once upon a time, I believed that OEM (original equipment manufacturer) made parts were the only reliable way to go. After all, if they made it originally, they should be the best equipped to make the replacement parts and have their good name, and day in court, to gamble if the parts are defective. This fairy tale usually ends with "and they all lived happily ever after". Reality is a bit different, I found recently.

My 0-235-C powered Long-EZ has over 1000 hours on it with the same badly worn MA-3 carburetor which was on it at first flight. I decided it would be a good time to comply with all the service bulletins and replace the throttle shaft, 2 piece venturi, and finally, change from the composite float.

Two hundred and seventy-five dollars later, I replaced the freshly overhauled carburetor and turned on the fuel puunp to leak check the installation. I was amazed to see fuel pour out the overflow hole at the bottom of the venturi. I returned the unit to the overhaul facility where the mechanic disassembled it and declared it was OK and to try it again. I installed the carburetor and the mechanic decided the needle and seat must be leaking. Sixty dollars later, I put the carburetor back on again. (I'm getting better at carburetor R&R.) Once again, the unit leaked like a sieve. I returned the unit and told the mechanic to lower the float level below what the OEM specified.

The lower float level helped. It passed the pressure test in the hangar. I took the airplane outside and started it up with great difficulty. After a 5 minute run. I shut the engine down and watched fuel run out of the carburetor again. By then, I was assured that Mr. Marvel and Mr. Schebler didn't know who their fathers were.

The mechanic said he had no idea what was wrong and left me to thoughts of getting my glider rating dusted off.

A chance encounter with Bob Wilson of the Ayling & Reichert Company, which manufactured the floats for Precision Airmotive, revealed the reason for my problems. It seems that Marvel-Schebler-Facet-Precision Airmotive are not manufacturers of anything. They just assemble parts that are produced by other manufacturers. I discovered the float I bought for $125.00 from Precision had been sold to them by Ayling & Reichert for $6.00. Who says there is no money in aviation?

I was told that Precision told Ayling & Reichert to manufacture a batch of floats and supplied original drawings. The newly manufactured floats did not fit in the carburetors and, consequently, stuck. Careful dimensional checking by Ayling & Reichert assured that their floats did agree with the Precision Airmotive supplied drawings. The only variable left was the carburetor bowl casting. Ayling & Reichert measured an assortment of MA-3 castings and discovered they varied widely. It was discovered that the original castings were made using badly worn tooling and that each carb casting was slightly different from the previous one. The end effect was that each newer carburetor had a slightly smaller fuel volume and less clearance between the float and the casing walls. I was told Precision Airmotive was informed of the wide dimensional variation problem but insisted on producing the floats to the original plan. Because of this, some MA-3 carburetor floats stick, thereby, causing leaks and very rich mixture settings.

The mixture can be so rich that the engine will not develop full power and runs very roughly. I've heard of cases where pilots have made precautionary landings because the engine was running so roughly that stoppage was predicted. I wonder how many "Engine lost power" accidents can be attributed to sticking floats in these FAA approved carburetors.

Now that the cause is apparently known - what is the fix? Bill Smith of Consolidated Fuel Systems had Ayling & Reichert make a batch of floats that supposedly do fit and work in the MA-3 carburetors with the undersize float chambers. Call him at 205-286-8551 or information.

To fix your existing Precision Airmotive float system, you might try Bob Wilson's suggestion. First, you need to determine where the float is sticking and then increase the clearance so it does not touch in the future.

To do this, you must remove the carburetor and drain it completely. Paint the float with Prussian blue toolmakers ink then reassemble and shake like crazy in all direction. Remove the carburetor top and look to see where the ink has been applied to the casting wall. Those spots are where the float has been touching. Clearance in those areas needs to be increased. I elected to Dremel the inside of the casting and then polish with succeedingly finer abrasive papers. Repeat the blue ink procedure until no more float contact is observed.

I suppose one might also alter the float but that is pretty risky business as leaks are easy to get and hard to fix.

I tried the trick of grinding out the inside of my float bowl and reinstalled the carb, knowing I'd finally solved the problem. Guess what? It still leaked.

I then screwed a fitting into the float bowl drain and rigged a clear tube sight gage to it so I could monitor fuel level while the carb was under pressure. I found the fuel level was moving swiftly up to the desired level and then SLOWLY moving higher and higher until it overflowed out the float chamber vent.

That indicated the brand new Precision Airmotive needle and seat assembly must be leaking. I replace it with an STC'd Consolidated Fuel Systems part and, PRESTO, the fuel level stayed right where it should have stayed. Ahh, so much for OEM high priced parts. Or so I thought.

I took the airplane out to run it up and it worked fine. I cowled it up and tried to start it. It acted too rich - and then I saw the puddle of fuel again!

I then sent it away to one of those high dollar repair places and for $158.60, I found the $3.00 clip that holds the needle to the float assembly was at fault. It no longer provided proper alignment between the needle and seat. I reinstalled the carb and it seemed to work properly. I now have two flights on it and nothing is running out the bottom of the cowl. Could it be the problem is solved?

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****From CP75-7&8 (CH30,CH38)****
ANOTHER REPORT OF A CRACKED ENGINE MOUNT
W. A. Theeringer, Long-EZ builder/flyer, discovered several cracks in, or adjacent to, the welds on his engine mount. After 650 hours of flight, per the CP73 recommendation for inspection, hair line cracks were discovered. The engine mount was returned to Ken Brock where it was repaired. So far, with 10 hours on the repaired engine mount, he feels less low frequency vibration and the mount is holding up fine.

Do not neglect to inspect for cracks in your engine mount. This is very important. If you find any cracks, do not fly until they have been repaired by a qualified welder. Also, please send a report in to RAF.

****From CP75-8 (CH30,CH38)****
CRACKING EXHAUST SYSTEMS
Tom Caughlin reports that there have been several examples of his own exhaust system, as well as Hal Hunt's exhaust systems, that have cracked. If you own one of these exhaust systems, please check it for cracks before your next flight.

Contact Tom Caughlin for further assistance:
10958 National Blvd. #1
Los Angeles, CA 90064

Editor's comment: Seven years ago, I designed and built a four pipe exhaust system for my own EZ. It was essentially the same as what Tom Caughlin and Hal Hunt subsequently marketed. I had numerous failures, cracked pipes, cracked supports, all kinds of problems, some of which caused severe damage to my prop! My own solution was to weld a Brock ball joint into each of the four pipes which allowed some movement in the exhaust system. The pipes were connected in pairs with a slip-type connection. (Not welded together). This system has been in service for over 1000 hours with only a couple of minor cracks and no loss of pieces - and no damage to the prop.

Any four pipe exhaust system would have slip joints or Brock ball joints in each pipe. If not, they will crack. Check yours before next flight and get it fixed.

****From CP75-10 (CH30)****
NEW FOUR PIPE EXHAUST SYSTEM
Nat Puffer has designed and tested a new exhaust system for his Cozy. He tells us it will fit any pusher, including a VariEze or Long-EZ. There are slip joints at the flanges to prevent cracking and stainless springs are included to retain the exhaust headers into the short slip joints. These exhaust systems can be ordered directly from the manufacturer: Custom Aircraft Supply
1318 Gertrude Street

San Diego, CA 92110
619-276-6954

$500.00 includes shipping, handling and packaging.

Nat has had good luck with a heat muff wrapped around both #2 and #4 exhaust headers. There may, or may not, be enough room in an EZ cowl to do this.

Update Number 76 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

****From CP76-4 (CH30,CH38)****

PROP BOLT TORQUE

Not again, you say? We are all well aware that there have been many admonishments in the CP over the years regarding the critical importance of correctly torquing your prop bolts, and of doing this often, and at regular intervals.

Recently a friend borrowed a wood prop from an EZ builder in a state where the moisture is much higher than it is here in Mojave. This prop was installed, the bolts were torqued to the recommended value, the bolt heads were safety wired. After only about 30 hours of flight here in the dry desert air of Mojave, this friend discovered that the safety wire had broken and that all six prop bolts were loose enough to be able to turn the washers under the bolt heads with his fingers! What happened? This prop lived for a couple of years in a damp climate. The wood absorbed some of this moisture and swelled a little. After a few weeks in the dry climate of Mojave, the wood lost most of this <u>excess</u> moisture and <u>shrank</u>. The bolts were no longer squeezing the prop between the crush plate and the prop extension flange. The prop began to move just a little, causing the face of the prop to char slightly. The bolts began to unscrew themselves and it literally would not have flown more than a few more minutes before this prop would have come off the airplane.

Wood props, used correctly and properly maintained, are very safe and have an excellent safety record over many years. However, the torque on the prop bolts <u>must</u> be checked regularly. If you have a new prop from a wetter climate than where you live, check the torque every 10 hours for the first 100 hours. Once the prop settles down, you can extend these checks to every 25 hours. Do <u>not</u> omit this simple safety check. It could be extremely costly if you do.

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Update Number 77
to
Supplemental Chapter 30
Section IIL,
Lycoming O-235 Engine Installation

Information derived from CP77 published by RAF Jan 1994

****From CP77-1,2,3&4 (CH9,CH30)****

ANOTHER CLOSED COURSE WORLD RECORD

"Ontario Approach, this is VariEze N99VE, 25 miles east of Homeland VOR at 10,500 ft. Request transition to Homeland for a 180 turn."

"VariEze N99VE, Ontario Approach. We've been waiting for you. Approved as requested. Will call your turn."

Two hours down and 14 more to go, I thought. All of that planning over the past 3 months is paying off. Fuel consumption and time are better than planned, the air is smooth, no significant wind, and the moon is full. Couldn't ask for better conditions. Looks like a go for the record....

It was almost ten years ago on the weekend of July 14 and 15th, 1984 that Jeana Yeager set the same closed course world's record for aircraft weighing between 661 and 1102 pounds in the same aircraft, N99VE. Jeana circled a course from Bakersfield, CA to Merced and back for a total of 8 laps and 2428 miles. Several hours later I followed up with a distance over a straight line departing Mojave, CA and flying non-stop to Martinsburg, WV just west of Washington, D.C. for a total of 2214 miles - two records in one weekend. Turning 50 this month, and needing a mid-life crisis thing to do, nothing seemed more appropriate than to test all the improvements I have made to the plane and getting both distance records in my name. In each of the old records, the plane had averaged about 150 mph and 50 miles per gallon. Since the fully loaded take off weight was right up against the maximum of 1102 pounds allowed for the class, my weight over Jeana's meant that I would be carrying about 10 gallons less. Aircraft improvements since that time had to make up for the difference.

Since 1983, I have been very active in the CAFE 400 events, taking my share of trophies like those shown in the October '93 *Sport Aviation* article. To be competitive with people like Klaus Savier in his very efficient and fast VariEze and Gene Sheehan with his highly refined Q200 prototype, took some dedicated effort to constantly modify and test, looking for every last knot of speed and efficiency. Major changes since the original records are the addition of custom designed high compression pistons for the Continental A65, lower drag wheel pants replacing the original "football" shaped pants, an Ellison throttle body injection carburetor, a modified oil tank and induction system to accommodate a low drag cowl, and an electronic ignition supplied by Light Speed Engineering with manifold pressure regulated spark advance.

Getting Ready

After I finish a typical modification, I try to gauge how much effort was expended for the speed gained; some mods are more successful than others. The wheel pants are perhaps the highest payoff of any mod to date adding about 5 knots to my top speed. The pants are carved from a single block of foam with a top planform using a 65-025 symmetrical airfoil. The side view is driven by the requirement for a constant pressure distribution at each station down the pant. To achieve this, the angle that the top and the bottom of the pant make with the waterline is the same as the angle that the left and right side make with the line of flight. All of the flow lines appear laminar, traveling straight aft without curling back. A plug and female mold were made on which two layers of glass were laid up to give a weight of about 1 1/2 lbs. per pant.

The original A65 was designed with 6.5:1 compression in the days when fuel for general aviation over 80 octane wasn't readily available. It is well known that the thermodynamic efficiency of a piston engine increases as a function of compression ratio. After several iterations (some not so successful), I designed and had constructed by a custom

automotive piston manufacturer, a set of forged pistons with a 9.0:1 compression ratio. Also, I installed a set of modern technology automotive rings with a 3-piece oil control ring and Total Seal gapless 2nd compression ring. As a result, I average about 25 hours per quart of oil and have a very low idle manifold vacuum reading of about 7 inches. Crankcase blow-by is almost nonexistent.

The Ellison throttle body injection unit has become a familiar piece of equipment in the homebuilding community. The ability to lean much beyond a conventional carburetor and still run smoothly gives nearly a 10% savings in fuel consumption. The Ellison is mounted horizontally in front of the oil tank to allow the installation of a low profile cowl. The induction tube passes through the tank and exits at the distribution spider. The induction air heating lowers volumetric efficiency somewhat (reduces maximum power) but provides a longer mixing length to give better fuel distribution prior to reaching the spider. Since efficiency is the primary goal, the trade off was worth it. Also an added benefit of oil cooling eliminates the need for an oil cooler.

Over the years, I have had three different engine cooling systems on the airplane. When originally built, being convinced that Burt's way was the only way, I installed a conventional EZ pitot cooling scoop. Since that time I have had the flush NACA scoop, and now the "arm pit" scoops. The arm pit scoops show a slight advantage over the flush scoops, but this is one of those modifications where the speed increase per hours spent is very poor. The place where this modification is a real winner is in the way it looks and how it cools the engine. Head temperatures in cruise are in the 260-280F range. Many other aerodynamic cleanup changes can be classified as attention to detail; such as fairings and leak sealing, contribute to the overall efficiency.

The standard magneto is designed with fixed timing to give detonation-free operation during worst case operation (maximum power, hot day, sea level condition). At high altitude, where conditions are cool and power is reduced, the optimum ignition advance is considerably higher to account for a much slower flame travel within the combustion chamber. The light weight electronic ignition supplied by Light Speed Engineering replaces one of the magnetos with an electronic processor and a set of ignition coils. The system senses manifold vacuum and adjusts spark advance up to a maximum of 17 degrees above the nominal setting. The effect of this advance is dramatically illustrated at altitude by noting a 50 RPM drop switching from the full advanced setting of 43 degrees back to the nominal setting of 26 degrees.

All of these efforts to increase efficiency have also paid off in speed. When first constructed, the plane would not quite reach 180 mph. Recently, at an EZ racing event held at Wendover, NV over the Bonneville salt flats, the airplane turned 204 mph on a 125 mile triangular course. Not too bad for a two-place plane with 170 cubic inch displacement engine at 7000 ft. density altitude.

Flying The Record

I had not given much thought to going after a second record and was even unsure that the aircraft had the capability of breaking the existing record until I received encouragement from Dick Rutan at this past year's Oshkosh event. On the trip home, I started doing some serious data taking. Calculations confirmed that indeed the aircraft had the range necessary to beat the old record if the empty weight had not crept up over the years. To my surprise, my attention to weight additions had paid off. The empty weight with auxiliary fuel tank installed was about 10 lbs. more than at the time of the previous record attempt, more than accounting for all those "essentials" such a LORAN and autopilot. I contacted Art Greenfield of the National Aeronautical Association (NAA) and received a package of all the forms necessary to sanction and certify a World's Record. Turnpoint verification can be accomplished by either a NAA certified observer or the FAA. I chose the FAA route and contacted the Approach Control people at both Phoenix and Ontario, CA. Both groups were delightful to work with and anxious to help in any way they could. I sent the forms for turn point verification that they were to fill out at each passage. The NAA, the United States certifying authority of the Federation Aeronautique Internationale (FAI), requires that an NAA observer must witness the aircraft weighing, barograph installation, gas tank sealing, takeoff, and landing. Klaus Savier, who is an NAA member and the present record holder for the 1000 and 2000 kilometer speed records in his VariEze, filled the requirements for a qualified observer.

Planning for the right time takes a little bit of common sense and a lot of luck. Since part of the flight occurs at night, I wanted the moon to be as full as possible in case an off-airport landing would be necessary. On the weekend of October 30/31, the moon was at its full brightness. The closed course turn points of Chandler, AZ and Homeland VOR on the eastern edge of the LA basin were chosen for the flat, low altitude terrain and the safety of paralleling Interstate 10 the entire route. As the time approached, the Santa Ana conditions that fanned the fires in the LA area were developing. The airplane gods were smiling, and what was supposed to be peak wind conditions all weekend actually turned out to be light and variable to 10 knots from the south at altitude.

Klaus flew to Phoenix in mid-afternoon on Saturday the 30th to help with final preparations of the airplane. We fueled up, less an anticipated 4 gallons and parked the plane. I went home to try to get some sleep. After a largely unsuccessful attempt to rest, I got dressed with borrowed ski pants, down booties and a warm coat. Leroy Castle, a local EAA member and keeper of the Arizona EAA Council platform scales, showed up at the airport at about 9 pm.

After rolling N99VE onto the scales, I climbed in with all the equipment that I would eventually take off with. After adding the necessary fuel to bring the total weight up to the 1102 pound class limit, Klaus sealed the tanks. Total fuel on board was calculated to be 49.3 gallons. My conservative "how-goes-it" chart said that I would need 48 of those gallons to make it four times around the predetermined course for the record. At 10:50 pm, I departed into the night for Homeland VOR. The rest is history. The plan went off without a hitch. Fuel flows, engine temperatures and all the electronics worked flawlessly. At each turn point, I exceeded my anticipated times, speeds and fuel flows. Taking data with a calibrated fuel flow meter at each point, I generated the following summary: **CHART OMITTED**

After all the concern for adequate margin, I landed with almost 7 gallons of fuel on board or almost 400 additional miles possible. At this writing, all the paperwork has been submitted for final approval by the NAA and FAI.

Gary Hertzler"
ED. Congratulations, Gary, attention to detail is everything! 58-1/2mpg at 157mph - WOW!

****From CP77-5&6 (CH30,CH38)****
CAUTION: FOD TO PUSHER PROPS
Foreign object damage to your EZ prop, such as a nick or gouge that you might tend to believe was gravel thrown up by the tires, probably is not from the tires at all but most likely is caused by something that fell out of the cowling (off the engine!). My 2100 hours of Long-EZ flight and over 700 hours of VariViggen flight have proven to me that almost invariably a ding in the prop, especially if inboard of 10 inches from the tip, was caused by something coming out of the cowling. A clipped end of safety wire, a washer, a nut, even a bolt and once an exhaust stud, nut and washer! My experience has shown that gravel/sand particles thrown up by the nose tire does cause tiny chips in paint and wood predominantly near the tips of a prop (the outboard 10 inches or so). The main tires seldom, if ever, cause anything to be thrown into the prop arc.

The point I want to get across is this: Any damage to your prop, heavier than sand and light gravel chips and generally inboard of 10" from the tips, is almost certainly caused by something falling out of your cowling and possibly off your engine. Do not ignore this type of damage, even if the prop damage is minor. Ground the airplane - remove the cowl and use a good flashlight to carefully and methodically check for missing screws, nuts, bolts, etc. You will be amazed how often you will find something missing. Over time, you will learn to be more careful about casually clipping a piece of safety wire and having it lodge in a wiring bundle on the firewall. Same goes for a dropped washer, nut or bolt. If it does not fall all the way to the ground - know that it lodged somewhere and will go into the prop disc sometime. With time, you will become an expert at finding lost washers in wing roots or in wiring bundles. Remember, the airplane will always try to warn you before it bites you! An unexplained ding in a prop blade is a warning! Pay attention - Fly safely. - ED.

****From CP77-11&12 (CH30)****
FOUR STACK STAINLESS EXHAUSTS
Further update on the all stainless steel 4-stack exhaust pipes. They are now available with springs and slip tubes at the flange or with ball joints, builder's choice, each still has the original slip tube support on each side to keep the pipes totally independent of each other. They have 1/4" type 321 stainless steel flanges and type 321 .035" stainless steel tubes. The tubes are "degreased" inside and out before they are purged or back-gassed with argon while being welded (others don't do these two very important steps). They fit Lyc. engines for any pusher aircraft, Ez's and Cozys, etc. - Cost - $500.00 plus $15.00 shipping and handling.

Also, if anyone would like to have ball joints fit and welded on their existing pipes, the cost is $150.00.

The RAM AIRBOX is still available at $325.00. Reuseable foam air filter - $20.00 plus $11.95 shipping and handling.

The increase of performance of both 4-stack exhaust pipes and airbox combination is very impressive, about 200 rpm on the average Long-EZ installation. Builders can call or send SASE for a flyer. Both items come with an installation sheet.

Contact: Hal Hunt
6249 Longridge Ave.
Van Nuys, CA 91401-2528
818-989-5534

Update Number 78
to
Supplemental Chapter 30
Section IIL,
Lycoming O-235 Engine Installation

Information derived from CP78 published by RAF for April & July 1994

****From CP78-1&2 (CH30,CH38,CH39)****

<u>*WES AND MILLIE GARDNER, APRIL 1994*</u>

Wes and Millie were very good friends and will be sorely missed by all who knew them. On Monday, April 4, 1994, Wes took Millie for her first ride in their recently completed E-Racer. After only a few minutes, Wes called that he had a problem and was returning to the airport. Sadly, he did not make it and they were both killed in the crash.

Several mutual friends have investigated this accident and have reported a consensus that the throttle linkage separated, allowing the engine to return to idle. Unfortunately, idle power was not enough to allow them to return safely to the runway.

All of you who had met Wes knew him to be a regular at the Jackpot, Wendover and Kanab EZ races. He was a truly dedicated and extremely competitive pilot and loved racing of all kinds, including boats and cars. He was one of the first to fly with an Ellison throttle body and an electronic ignition system. His VariEze was not only beautiful, it was very fast! Wes set the fastest time at the Flying Kilometer in Chandler, AZ in 1990 and he was thrilled!

Wes and Millie were some of the kindest, most generous people we ever knew - until we meet again, fly high and fly safe, Wes and Millie.

****From CP78-2 (CH30,CH38,CH39)****

<u>*ENGINE CONTROLS*</u>

We have talked about this subject several times over the years yet many builders continue to do less than their best work in this area. Pay close attention, Guys: Your ability to control your engine is second only to your ability to control your airplane. You do your very best work on the pitch, roll and yaw control system and you should do the same for the throttle and mixture controls.

Before you do your first flight, and at regular intervals thereafter, get someone to help you check that the throttle and mixture controls do, indeed, move the appropriate range to the full throttle/full rich positions and also to the idle/cut-off positions <u>without</u> the use of any helper springs. If you cannot get the throttle and mixture controls to work satisfactorily without springs, consider going to push/pull cables. I realize this is a hassle, but not nearly as much of a hassle as losing control of your engine at a critical time.

I installed a push/pull throttle cable when I installed an Ellison throttle body almost 1200 hours ago. (This is a mandatory requirement when you install an Ellison and not a bad idea for any carburetor). I carefully measured to determine the exact length required, then ordered a custom-made aircraft push/pull cable from Aircraft Spruce. I removed the throttle lever from the Brock throttle quadrant and scribed around it onto a piece of 1/16" thick 2024-T3 aluminum, adding about 2-1/2 inches to the bottom of the throttle lever. This was band sawed out and deburred.

A small rodend, screwed and jam-nutted to the push/pull cable end, bolts to this lower end of the new throttle lever. The outer cable is secured to a bracket mounted on the inside of the left arm rest (I used a "u" bolt located in the grove machined in the end of the outer cable).

At the engine end, the outer cable fits perfectly into a bracket mounted on the Ellison throttle body (provided by Ellison) and the cable end has an aircraft-type ball and socket. The "ball" bolts onto the throttle lever and the "socket" screws onto, and is jam-nutted to, the cable end. The "socket" fits onto the "ball" and is held securely in place by a threaded insert that can be tightened onto the ball and is safetied with a cotter pin.

Exactly the same system can be used for the mixture control. There are many acceptable ways to obtain reliable engine controls. Just be certain in your own mind that what you have installed is fully functional and safetied so that it cannot possibly come undone or separate in some way. Have other builders or an A&P look at your work, the more pairs of eyes that check your system, the less likely you are to have a failure and a failure in this area is not acceptable and will almost certainly result in, at least, a forced landing. Never forget that!

****From CP78-2&3 (CH21,CH30,CH33,CH38,CH39)****

WATER IN FUEL

A recent off-field landing in a Long-EZ, fortunately with no injuries, forcibly brought to mind the ritual of checking for water at all the drains. **A standard Long-EZ has a gascolator drain on the firewall which should be easily accessible through the cowling inlet.** This should be drained before each flight, once the airplane is in the level position (on all three wheels). There is a water drain at the forward end of each main fuel tank and these must be drained before each flight but <u>before</u> the airplane is moved. That is to say, while it is parked in the normal nose down position. Do <u>not</u> lift the plane up to the 3-point position until <u>after</u> you have checked these two water drains. If you are in the habit of normally parking your EZ in the level, 3-point position (tying the nose down), you should consider installing low point water drains in each sump blister and then check them religiously before every flight.

Where does the water come from? Sometimes, but rarely, from the gas pump (or gas truck), very rarely, if ever in a composite EZ-type, from condensation in a less than full fuel tank. This is common in metal airplanes. That is why it is normal to top off the tanks in any Spam Can after a flight. Because the fuel tanks in any RAF design are insulated sandwich construction, they are similar to a thermos bottle and condensation does not normally form on the inside of our fuel tanks. The most likely way for water to get into your fuel tanks is a leaking fuel cap on an airplane left out in the rain. The "O" rings on any of the commonly used fuel caps do not last forever. Far from it, in fact. Ozone, ultra violet light and many airborne pollutants attack these rubber "O" rings. Check them frequently and replace them as soon as you see small cracks in the outer edges of these "O" rings.

Be especially diligent about checking your water drains if you have left your airplane out in the rain. Also, if you fly into an airport on one fuel tank with no problems, consider taking off and climbing to a safe altitude on that same, known to be free of water, fuel tank. Switch to the other (unknown) tank only after you have plenty of altitude to allow a safe return to the airport in the event water may be in this fuel tank. This philosophy is an old one but a good one. For the same reason, if anything untoward happens when you switch tanks, <u>always</u> switch back to the first tank before you try anything else.

****From CP78-3 (CH22,CH30)****

BROKEN STARTER CASE?

Recently, we heard of a couple of builder/flyers with this problem. It reminded us of the time we broke the starter on the rear engine of the Defiant, in flight, resulting in a single engine return and landing.

Rather than try to reinvent the wheel, I would like to recommend an article in the July 1993 *Sport Aviation*. It is written by Bob Nuckolls and can be found on page 57. If you are close to deciding on a key locking, rotary mag switch, Bob's article entitled "Magneto switch options" is mandatory reading.

There is definitely a general misunderstanding about wiring magneto switches and a mistake here can be critical to the health and well being of your starter, your engine and, maybe, even your own body! This problem is exacerbated by the use of the modern lightweight starters that are becoming so popular.

****From CP78-8 (CH30)****

ORIGINAL REM 37 BY SPARK PLUGS. These are the short ones available up to mid 80's. New - $17.00 ea.

Contact: Steve Franseen
303-987-2985 (leave message)

From CP78-9 (CH30)

PARTING OUT A LONG-EZ

Lyc. 0-235 2400 TT, 46.6 hours since major. Landing gear with wheels and brakes, nose gear, stereo headsets with intercom and much more. Send SASE for complete list:

Contact: Barbara Raymond
Box 214
Big Oak Flat, CA 95305-0214
209-962-5752

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Update Number 79
to
Supplemental Chapter 30
Section IIL,
Lycoming O-235 Engine Installation

Information derived from CP79 published by RAF Oct 1994

****From CP79-1,2&3 (CH22,CH30)****

325 MILES NORTH OF THE ARCTIC CIRCLE.

Dick Rutan called me from London, Ontario where he was giving a talk and asked if I would be interested in flying up to Point Barrow, Alaska - Wow! Barrow is almost 72 degrees North Latitude and more than 325 miles north of the Arctic circle. Sally did not want to go nor did Chris, Dick's fiancee. So, what the heck, I arranged to meet Dick the next day on the Friday Harbor airport. Sounded like a great boondoggle to me!

I departed Mojave the next morning and flew direct toward Friday Harbor, an island northwest of Seattle, WA. Primary navigation was GPS. My panel-mounted King KLN 90 GPS was backed up by a Flitemate Pro GPS driving Mentor Plus' Flite Star and Flite Map which ran on my 270C MacPowerbook. (The belt and suspenders approach!). The GPS antenna was velcroed to the top of the headrest - worked great!

Unless you have flown with a color moving map that gives you almost unbelievably accurate knowledge of your position, you really can not appreciate how neat this is. This trip proved this system out to me as the navigation system of the future. This, or something very close to this, is what we will all be flying with in the future.

The weather was great from Mojave to Portland, OR but went bad north of Portland. The clouds went from the ground to 17000 feet, so I landed at Ellensburg, WA. To my amazement, when I taxied up to the gas pump, Dick was parked there topping off his fuel tanks! He had tried to get to Friday Harbor just as I had and had landed to check the weather and try to figure out how to join up with me. Just when I was wondering how in the world I could contact him!

We checked the weather and filed an ADCUS flight plan to Nanaimo, Canada where Dick has some friends and where the weather was excellent. We overflew the weather and landed at Nanaimo where we cleared customs. We then flew on to Qualicum, Vancouver Island. We spent a beautiful day fishing for salmon and enjoying the hospitality of Dick's friends, Bob and Cherry Ekoos. They have a beautiful home on the coast of Vancouver Island.

The next morning, we departed for Campbell's River, the nearest place where we could file a flight plan (all flights, VFR and IFR, must have a flight plan filed in Canada). We filed to Juneau, Alaska and flew up the coast in light rain and low ceilings. The coastline is very rugged, lots of islands with rocky coastlines and millions of trees. There were no roads at all and airports are few and far between. There is no VFR-on-top in Canada so we were forced to remain under the solid overcast until we reached Ketchican, AK where we climbed to on-top and flew on to Juneau.

We overflew the Mindenhall glacier in the foothills just behind the city of Juneau, then landed at Juneau airport and cleared customs. This cost $25.00 a piece for each Long-EZ - the US customs was much more of a hassle than the Canadian customs. We had lunch and checked the weather. It was good all the way to Barrow! We filed to Fairbanks and flew up the coast from Juneau to Skagway, then inland over Canada to Whitehorse, then roughly along the Alcan highway to Northway, Alaska, then on to Fairbanks. It was 87 degrees F at Fairbanks and the weather was perfect, however, it was below minimums at Barrow so we spent the night at a beautiful hotel near Fairbanks airport.

The next morning, 4th of July, 1994, we filed to Barrow where the weather was 400' overcast and 6 miles visibility. We ran into rain and low ceilings in the Brookes Range and poked our noses into several passes before finding one that was marginally

VFR. We flew through the Anaktuvuk Pass and over a small Eskimo village of the same name where there was a short, gravel runway - not much good for us!

The weather improved a little north of the Brookes Range and we flew toward Barrow over country that was flat and covered with thousands of lakes. There are no trees and no roads, only tundra. This was the North Slope. Gradually, a scattered undercast became solid and, by the time we reached Barrow, we were between layers at 3000 feet. We shot an approach at Barrow and broke out on the centerline of the runway at 400 feet. The GPS-driven moving map depicted this graphically and was very comforting!

The North Slope Search and Rescue took us under their wing and found us a hotel room and provided us with huge parkas (it was 33 degrees F). Price Brower, a Barrow native and the Chief Pilot for Search and Rescue, treated us like royalty. He flew us to every single point of interest in a Jet Ranger helicopter and later invited us to his home where we had the dubious experience of eating maktak (the skin and blubber of a bowhead whale which had been captured by Price's village). We watched the Eskimo Olympic games which were being held in Barrow and went on around the clock since it did not get dark all night.

At almost 72 degrees north latitude, the ocean was frozen as far as we could see. All of the buildings in Barrow are built on pilings and are 6 feet above the permafrost. The high on July 4th was 33 degrees F! The sun does not set at this time of the year, it simply circles around the sky about 30 degrees above the horizon!

The next morning, we headed down the coast of Alaska toward Prudhoe Bay. We flew very low and followed the coastline looking for polar bear and caribou. We saw hundreds of caribou but no bears. We did fly by two DEW lines (early warning radar sites) that are no longer needed but were still manned with skeleton crews. A more remote place you will never see! We flew a low approach to Prudhoe Bay airport (Deadhorse), then turned and followed the gravel service road that parallels the oil pipeline.

We essentially followed the pipeline almost all the way to Fairbanks. We crossed the Brookes Range via the Atigan Pass and were fortunate to clear the highest point in the pass, 6500', due to rain and low ceilings. We decided to bypass Fairbanks and flew directly towards Anchorage. The weather really deteriorated and we flew through the broad pass from Nenana through Talkeetna to Anchorage with driving rain and less than 1 mile visibility. This was our longest leg, from Barrow to Anchorage, just over 6 hours, much of it flown in heavy rain. We landed at Merrill Field in downtown Anchorage where we were met by Fred Keller and his wife, Judy.

We stayed with Fred and Judy for two nights and Fred very kindly repaired my rain-damaged prop (Dick's is a B&T with the urethane leading edge and was essentially undamaged). They lent us a car and we visited the local points of interest. It was a neat time and we needed the rest.

We departed from Anchorage and flew south over the Portage Glacier to Valdez, then on down the coast which was much friendlier here with beautiful beaches and quite a few airports. We landed at Yakutat for lunch of fresh caught halibut. This is the place for fishermen. They catch several varieties of salmon and it is fairly routine to catch 400 lb. halibut here!

After lunch, we flew on down the coast and then inland to Glacier Bay. What a spectacular sight! We continued over Gustavus where the Glacier Bay Lodge is, on down the central islands to Sitka, AK. We spent two days at Sitka which is really a beautiful place and the site of the original Russian capital of Alaska. We saw all the historical sites (Dick is a fanatic about such things!), met some really fine people, and I can tell you this: I intend to return to Sitka, sometime, with Sally.

We departed Sitka on a rainy, cloudy day and flew low along the coast all the way to Arlington, WA where Dick landed to give a couple of talks at the Arlington Fly-in. I continued on to Madras, Oregon where I filled the tanks with 100 low lead and headed south across Nevada and down the Owens Valley to Mojave. 10.2 hours of flying with one stop - Sitka, AK to Mojave, CA - 1514nm, 1741sm.

We had flown more than 6000 miles in 8 days. I used 281 gallons of fuel and N26MS performed perfectly for almost 40 hours. We both made it to the most northern point in the USA where the Eskimos showed us great hospitality. A marvelous trip in the company of a good friend. All take-offs and landings were flown in close formation, as was the approach into Barrow. We flew more than the distance from Mojave, CA to London, England in only 8 days and this trip brought back, once again, what magical flying carpets the Long-EZs are! For a trip like this, GPS is not a luxury and should be considered mandatory. The moving map was fabulous and it was very reassuring to <u>always</u> know exactly were we were.

Plan long trips, and go for it!

****From CP79-3,4&5 (CH30,CH38)****

At Oshkosh this year, we were shown photographs of a prop extension that had failed, catastrophically, resulting in the loss of the prop and a forced landing that seriously damaged the E-Racer which, while not an RAF design, is a similar pusher. The pilot and passenger were not hurt.

The engine was a Lycoming 0-360, 180hp. The prop was a B&T prop and it was driven by a Brock prop extension 6" long with a 7" diameter flange at the prop end. The fracture started right in the radius between the barrel and the aft flange and propagated across the extension. This fracture has been characterized by experts as being a high cycle, fatigue failure. The total time on this prop extension (and on the aircraft) was 72 hours. What caused this failure? Is it something we should be worried about?

A little history may be helpful here. Several years ago, a good friend who was an excellent engineer and VariEze builder, Bob Beard, experienced a large vibration while in flight, shut it down and glided to a safe landing. He discovered that his 8" long prop extension had an enormous crack in it. (See photo). **PHOTOGRAPH OMITTED** He analyzed the prop extension and found that it was machined from 6061-T6 aluminum instead of the required 2024-T351 aluminum. This happened on his original design aircraft, the <u>Two-EZ</u>, a large four-place <u>similar</u> to a Long-EZ. He had a Lycoming 0-360, 180hp engine and a wood prop.

About the same time, Danny Meyer was flight testing his Velocity, also a pusher, when he had almost exactly the same experience Bob Beard had. It turned out that both prop extensions had come from the same source. Both were made from 6061-T6, both were 8" long and both were using Lycoming 0-360s.

The difference in strength between 6061-T6 and 2024-T351 is only 18-20% so although the wrong material may have been the cause of this problem, at least on an 8" long prop extension, 18-20% is not much margin of safety.

Bob Beard designed a prop extension that had a 4.5" diameter in the middle as compared to a 3.25" diameter on his previous extension. He sent this editor a letter and a drawing of his new design and said that this 8" long extension would be just as stiff as a standard Brock 4" long extension and that its natural frequency should occur above 4000 rpm.

We purchased a billet of aluminum (2024-T351) and machined a 9" long modified Beard design which has a 5" diameter in the middle and which has been tested, in flight, to show that peak stress occurs at an rpm that is out of the normal operating range of the engine. The problem with this design is that it does not lend itself to economic manufacture.

We have borrowed a torsional order analyzer. This is a magic box that has a built-in x-y plotter and receives a signal from a magnetic pickup which is mounted close to the teeth on the starter ring gear. Basically, this machine measures the speed of each tooth passing by the magnetic sensor. As the engine drives the prop, it speeds up and slows down with each firing stroke and each compression stroke, this causes the crankshaft, prop extension and prop assembly to twist like a spring. This "spring" winds up and unwinds many times per second as the engine drives the prop. Now, obviously, the magnitude of this windup/unwind action is very small. In fact, this machine measures the rotational displacement in milidegrees, that is to say, thousandths of degrees. One of the uses of this machine is to determine if an engine/prop combination should have a "yellow arc" on the tach. A Grumman Tiger, for example, has a "yellow arc" from 1500 - 1800rpm. This means that the pilot should not operate within this yellow arc. He may pass through it in either direction but must not fly within the yellow arc.

We are concerned that there may be a yellow arc on some of our RAF designs and we have spent many hours flying several airplanes and a bunch of different engine/prop extension combinations. We have talked to experts in this field and the consensus is that a light weight, low inertia, wood prop <u>simply cannot damage</u> a Lycoming aircraft engine - good news! Introduce a prop extension, particularly an aluminum, spool-type, prop extension, and maybe you can have a problem! It turns out that a spool-type, aluminum extension is relatively soft, torsionally. It also turns out that a crankshaft, prop extension, prop assembly is what is called a first mode shape. This means there is only one node (a node is a point where there is no action or movement - if you grab a spring with one hand at each end of the spring and twist it, someplace in the spring, there is no movement - this is the node). It further turns out that the node in this assembly usually occurs between the crankshaft flange and the propeller. That is to say, most, if not all, of the twisting we are measuring takes place <u>within</u> the prop extension.

With all of the above in mind, we set out to run in-flight tests on Long-EZs with Lycoming engines, 6" long prop extensions and wood props. An 0-235 powered Long-EZ categorically <u>does not</u> have any measurable problem with a 6" aluminum spool-type prop extension. The same is true of a pusher, such as a Defiant, with an 0-320 and a 6" prop extension. It may not, however, be true that an 0-360 with a 6" aluminum spool-type extension on a pusher is as free of problems. (A Long-EZ with any engine larger than a Lycoming 0-235 is not approved by RAF).

We have not fully analyzed all of the data and we plan on generating a finite element model to help with this analysis. At this time, we are unable to say (as we can with the 0-235 and the 0-320) that a Lycoming 0-360 with a 6" or longer prop extension on a pusher-type aircraft is completely safe. Some facts: If you are in the market to buy a Lycoming 0-360 (for your new Defiant), we strongly advise that you purchase one that is equipped with a 6th order damped crankshaft.

We have designed, and are testing, a couple of prop extensions that show promise to eliminate this problem, however, there has been only one failure of a Brock prop extension with many hundreds out there in the field accumulating hundreds and, in some cases, thousands of hours. We will continue to test and evaluate and keep the builders and flyers informed.

The prop extension that did fail had three strikes against it. First of all, the radius between the flange and the barrel of the spool-type prop extension was too small. Other prop extensions we have examined, including several other Brock extensions, have 1/4" radii. The failed extension had only a 3/32" radius (less than half the normal radius). Also, in this radius, there were machine marks, tool "chatter" marks, in fact. Expert opinion says that chatter marks in a highly stressed part are bad news. These chatter tool marks are longitudinal "ridges" and are torsional stress risers. Also, the forward face of the prop flange was in the same plane as a change of inside diameter and this area had a sharp radius.

None of these features are good news - all of them in one prop extension are probably bad news. Add to that the possibility of a slightly out of balance prop and then throw in the possibility that the engine/prop extension/prop may have been running in resonance causing maximum stress in the aluminum prop extension.

The torsional order analyzer shows the rpm at which peak stress occurs, if there is such a point. We tested a long-service Brock 6" long prop extension on a Lycoming 0-360-A4A, 180hp engine (with no 6th order dampers) and measured a peak torsional displacement (windup) of 20 milidegrees at 2770rpm, yet at 2500rpm, the peak displacement was only 3 milidegrees. Running continuously at 2770rpm in this pusher aircraft would probably fail this prop extension. This same test was done using all the same parts, but with a Lycoming 0-360 with 6th order dampers installed, and the peak displacement was only 3-1/2 milidegrees!

With our modified Beard prop extension, these numbers changed significantly even with no 6th order dampers. Peak displacement is only 12.5 milidegrees at 2870rpm! (At 2770rpm, maximum displacement is only 6 milidegrees). This data is all the more impressive when you consider that this prop extension is 50% longer than the 6" Brock extension.

We have designed, and are having made, a 6" long prop extension that we believe will eliminate any problem associated with the 0-360 Lycoming. It has not been tested yet and is not available at this time. We will report on its performance in the next CP.

We would like to state that a correctly designed prop extension should run virtually indefinitely because peak stress would be below the maximum allowable stress. This is the key to the whole problem - the maximum allowable continuous stress must not be exceeded.

We have had the cooperation, not only of Ken Brock Mfg. in this endeavor, but also of Woofter Manufacturing (formally Woofter Custom Metal Fabrication) of Pembroke Pines, FL. We would like to thank Judith Saber of Woofter Mfg. for all of her help. She has machined and sent to us for testing five different prop extensions and she is currently machining a proprietary design which we hope to test soon. If you have not seen a Woofter prop extension, you are in for a treat! Judith runs the CNC lathe and machines all of the various prop extensions sold by Woofter Mfg.- and all of them correct the problems mentioned in this article. The radii are at least 1/4", there are absolutely no machine marks of any kind, and the I.D. has a really clever "S" curve transition from the smallest diameter to the diameter that fits your crankshaft. The workmanship is absolutely first-class and we are very happy to report that just as we were going to press with this CP, Ken Brock Mfg. has decided to order prop extension from Woofter Manufacturing. Stay tuned!

****From CP79-10(CH30,CH38)****

MANDATORY INSPECTION BEFORE NEXT FLIGHT.

If you use a 6" long or longer prop extension, remove the cowling and spinner and carefully inspect the prop extension using a strong light. Look for machine tool marks (chatter marks) in the two radii or a radius smaller than 1/4" or hairline cracking in the anodized finish in the radii. This is particularly critical if you have a Lycoming 0-360 engine. Discovery of any of these flaws is a ground-the-airplane problem. Contact RAF with a detailed description of your problem.

****From CP79-13(CH30,CH38)(PHOTO CAPTIONS)****
Left to right: Woofter Mfg. prop extensions; 6" long, 8" long, both with 7" dia. prop flanges in bare aluminum. Normally these extensions are black anodized. 9" long Bob Beard/Mike Melvill design has 7" dia. prop flange but the dia. in the middle is 5" as compared to 3-1/2".

This is the failed prop extension. Failure occurred at the radius where the 7" dia. prop flange intersects with the 3-1/2" dia. barrel.

Bob Beard's original 8" long prop extension made from 6061-T6 aluminum.

****From CP79-5&6 (CH30,CH38)****
<u>WOOD PROP FAILURES</u> Reprinted from: CLEAR PROP, the newsletter of EAA Chapter 49, Lancaster, CA.
Recent calls from Texas informed us of two Warnke wood props, installed on 180hp RVs, which cracked in flight. There was no perceptible vibration and the damage was not realized until the airplane was back on the ground. Both props were "high aspect ratio" models. Both cracked chord-wise, across the laminations, about 12" from the spinner, right where the urethane leading edge protection is routed into the wood. One prop had been in service 70 hours, the other 130.

Just as we were going to press, we learned of another failure involving a Warnke propeller. We contacted Mr. Warnke and, after some research, he found that this prop was a prototype and no others of the type were in service. (In this case, the blade failed completely on a 160hp RV-4 after 40 minutes of service and no operation above 2400 rpm. About 2/3's of the blade broke off and struck the right elevator, damaging it severely. The lower cowl was also badly damaged as the unbalanced engine thrashed around, but the pilot, in an excellent piece of flying, was able to maintain control and glide to a safe landing at an airport.

We don't know and can't speculate why these failures occurred, but since there seems to be a pattern forming, we felt that all users of the Warnke "narrow blade" prop should be aware that they have happened. We talked with Mr. Warnke and he assured us that he will be doing everything possible to find the cause. Meanwhile, he suggests extra care on both pre- and post-flight inspections. He also noted that, for other reasons, the "high aspect ratio" prop is no longer in production. There are hundreds of these props in use, some with over 500 hours.

****From CP79-6(CH30)****
<u>COOLING PROBLEMS (SOLUTIONS?)</u>
Oil and cylinder head cooling are probably the single largest source of letters to this editor. Several builders have resorted to installing two oil coolers in series which we are told definitely fixed the problem.

Mike obtained a much larger than normal oil cooler about 4 years ago and has been running it ever since. It is a Stewart Warner, part #10634R. It has 13 segments and is almost square in the top view. It is the same thickness as the standard 7 segment oil coolers. Contact Stewart Warner, Southwind Division, in Indianapolis, IN for your nearest dealer. This is an expensive oil cooler but it absolutely has cured the problem. It is mounted on the bottom cowling as called out in the plans.

Mike recently increased the radius of the lip of his NACA cooling inlet from about 1/4" radius to a 1/2" radius which actually reduced the size of the inlet but it dramatically improved the cylinder head cooling. A sharp radius on the intake is a no-no.

****From CP79-7(CH30,CH38)****
<u>LETTERS</u>
"RAF,
During a recent annual inspection, I found the rubber valve portions of my ACS carb heat box to be deteriorated to the point of separation. As you can see by the enclosed sample, it is obvious that a portion of the rubber is about to separate and could have been ingested into the engine causing a possible engine failure.

I purchased the carb heat box for my 0-235-L2C-powered Long-EZ from ASC in 1986 and my first flight was June of 1991. I had logged 450 hours on the airframe when the problem was discovered. I have since replaced the torn rubber with red silicone baffle material and it works fine.

I am writing you about this dangerous and potentially fatal situation so that you might follow-up and inform other ASC customers who may have bought this unit about the obvious flaw.
Sincerely,
Frank Nowak"

From CP79-9(CH30,CH33,CH38)
WHAT CAN I DO TO COMBAT THE HAZARDS OF 100LL FUEL IN MY 80 OCTANE CONTINENTAL 0-200 OR LYCOMING 0-235?
We have been asked this question a number of times and, over the years, we have accumulated a few answers for those whose engines simply were not designed to live on low lead fuel.

Use TCP as recommended on the can. Pure TCP can possibly harm glass/epoxy fuel tanks but we used TCP on the RAF Long-EZ prototype, N79RA, all of its life with no measurable problems and the TCP will definitely help your engine digest the modern low lead fuel.

Lean your mixture, even while taxiing. Richen it for take-off and then lean in flight using a good quality EGT gauge. A good rule of thumb is that you can lean aggressively above 8000 feet (below 75% power) or if you have a manifold pressure gauge, when you are below 22"MAP.

The bad news is that, in spite of these precautions, you should expect to have to remove your valves and ream the carbon build-up out of the guides every 300 to 400 hours. If you don't, you will experience sticking valves. If you can get 80 octane avgas, by all means, use it. Your engine was designed to run on leaded fuel and that is why you may be having these problems.

From CP79-10(CH22,CH30)
CAUTION
Dick Rutan reported a failure of his starter solenoid recently. The problem was that the failure caused the starter to be permanently engaged! The solenoid welded itself in the on position so there was no way to shut the starter off! Fortunately, this occurred during normal maintenance with the cowling off. Dick saw the problem and shut down the engine. He has installed a "hung starter" amber light on his panel similar to what some general aviation aircraft have, and he highly recommends this precaution to anyone with an electric starter. Had this occurred during a start-up prior to a normal flight, he would not have known of the problem and the results could have been serious damage to the starter and ring gear and may have resulted in a fire!

From CP79-12(CH30)
NEW STARTER FOR 0-200 CONTINENTALS
B&C Specialty introduced a beautifully made, 12 volt starter specifically designed to be installed into the accessory housing on a Continental 0-200 engine, or on an 0-240. This starter has been thoroughly tested at Teledyne Continental (more than 5000 start cycles without a single problem!).

Bill Bainbridge has these starters available for immediate delivery and they can be had STC'd or for homebuilts.
Contact: B&C Specialty Products, Inc.
123 East 4th Street
Newton, KS 67114
316-283-8662

PS If you did not see this jewel at Oshkosh 1994, you should try to see one soon. They are really objects 'd art! ED.

From CP79-13(CH30)(PHOTO CAPTION)
Bill Bainbridge's new Continental O-200 electric starter. Another beautifully engineered product from B&C Specialty Products.

Update Number 80
to
Supplemental Chapter 30
Section IIL,
Lycoming O-235 Engine Installation

Information derived from CP80 published by RAF Jan 1995

****From CP80-5 (CH21,CH30,CH33,CH38)****

STATIC FUEL FLOW TESTING

In CP79, we reported the results of a thorough static fuel flow test conducted on Mike and Sally's Long-EZ, N26MS. This test was conducted at two fuel levels, tanks with half fuel and tanks almost empty. This was checked with the boost pump running as well as with the boost pump turned off.

The results have been questioned by several builders who generally agreed on the flow with the electric boost pump running but who could not achieve any flow at all with the pump turned off, even with a full tank of fuel!

Well, it turns out that there may be a plausible explanation. We have published static fuel flow results over the years from the prototype Long-EZ, N79RA; from Burt's Defiant, N78RA and from Mike's, N26MS. All of these aircraft had used engines in them which also had used, and probably quite old, mechanical fuel pumps installed on them. All of these pumps were manufactured before 1988. In 1988, Lycoming began manufacturing the AC mechanical fuel pump themselves. All of these pumps have 4 ounce springs installed at both the inlet and outlet of each pump. It takes about 1 psi to open one of these spring-loaded valves. In order to accomplish this, the fuel head would have to be at least two feet above the mechanical fuel pump. Actually, even with full tanks, we only have a little more than one foot of head on a Long-EZ.

AC mechanical fuel pumps manufactured prior to 1988 had only 1 ounce springs installed at the inlet and outlet valves. One ounce springs at the valves will allow about 5 gallons per hour of static flow. We believe this solves the mystery of why some builders have easily achieved the fuel flows called out in the CP and others could not achieve any flow (pump off).

Mike is close to a major overhaul on his engine and will conduct these tests, once again, with 4 ounce springs in the mechanical fuel pump and we will report the results here in the CP. With your boost pump turned on, you should have at least 20 gallons per hour of flow, even if you have the new mechanical fuel pump.

The electric boost pump (Facet Square pump) allows fuel to flow through it even when it is not running, the problem is in the newer AC mechanical fuel pumps. It may be possible to design a fuel system that by-passes the mechanical fuel pump, but keep in mind, that a system like this requires a check valve in the system and check valves, themselves, have spring-loaded valves that require some pressure to open so you may not gain any redundancy. You can take some solace from the fact that every low wing aircraft (Cherokee, Grumman Tigers, Cheetah, Mooney, etc.) suffer from the same situation and we are not aware of any of these aircraft having engine failures due to a double failure (both fuel pumps fail at the same time). We welcome any feedback on this subject. As long as one, or both, fuel pumps are functioning, the engine will run to its maximum power capacity.

****From CP80-5&6 (CH30,CH38)****

ENGINE MOUNT CRACKING

Reports of cracked Dynafocal engine mounts continue to come in - not a lot, but enough to cause concern.

A little history may be in order, to put things in perspective. The original VariEze, N4EZ, was powered by a Continental 0-200. The engine mount and the interface between the steel tube weldment and the fuselage was designed to handle up to the Continental 0-200. Later, several builders began to install the Lycoming 0-235 on the VariEze. A group of VariEze builders on the east coast did the first installation and structural analysis. Burt later checked out their work and approved this engine installation and, in fact, the Lycoming engine installation instructions were produced by this group, not by RAF.

When the Long-EZ was designed, the VariEze Lycoming 0-235 installation plans were used as the basis for the Long-EZ engine installation. There were no modifications to the steel weldment (mount) or to the interface to the fuselage (aluminum extrusions). The plans-built Long-EZ, including the prototype, N79RA, have exactly the same engine mount as the VariEze (which was originally designed for the Continental 0-200 which weighed only 190 lbs.)

Many builder/flyers have seen fit to install larger engines than authorized by the plans. These builders must realize that they have now taken on the responsibility of designing their own engine installation. RAF has not designed the Long-EZ engine mount to handle any engine larger than the Lycoming 0-235 or the Rolls Royce Continental 0-240.

Simply bolting a larger engine onto the 0-235 engine mount is asking for trouble. The extra weight and, more importantly, the extra vibrating mass of the engine/prop extension/prop may eventually result in cracks in the tubular engine mount.

By all accounts, the first indication is what feels, to the pilot, like a rough running engine. Should you notice a sudden, unexplained roughness or harshness from the engine compartment, land as soon as possible, remove the cowling and conduct a thorough examination of every tube and weld in the engine mount weldment using a strong light. If any cracks are found, do not fly again until this problem has been repaired.

What to do about this? Unfortunately, RAF is no longer in a position to be able to design and test a new engine mount so, it really is up to each builder/flyer. At the very least, a few well-designed gussets, strategically placed, or even a six point mount, may be required - are there any mechanical engineers out there willing to take on this task?

In the meantime, inspect your mount often and please report all incidents of cracking to RAF.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

****From CP80-6 (CH30,CH38)****
LONG-EZ ALERT
Conduct a thorough inspection of your welded steel tube engine mount before next flight.

****From CP80-4&5 (CH30,CH33,CH41)****
SKY RANCH ENGINEERING MANUAL
(SECOND EDITION) BY JOHN SCHWANER
This is quite simply the best book on the subject of air cooled aircraft engines that we have ever read. Covering a variety of subjects including engine inspection, engine performance, cylinder repairs, lubricants and wear, hose assemblies, trouble shooting, performance limits, vibration and balance, and an excellent section on fatigue analysis, this book is easy to read and understand. It contains valuable "gems" of information derived from a lifetime of overhauling engines and a hobby of studying failures. It is an absolute must for anyone interested in operating and maintaining a Lycoming aircraft engine. There is a complete list of all Lycoming engines in the Lycoming engine specification chapter.

There are many operational techniques described from how to start the engine through proper leaning, to taxiing and shutdown techniques, oil and grease specification and uses, etc., etc. We highly recommend John's book.

Call: Sacramento Sky Ranch
916-421-7672

Update Number 81 to Supplemental Chapter 30 Section IIL, Lycoming O-235 Engine Installation

Information derived from CP81 published by RAF July 1995

****From CP81-3&4 (CH30,CH33,CH41)****
"Dear RAF,
Greetings from Houston... I had come across some information recently that would probably be of interest to EZ drivers and builders for your next CP.

I noticed in CP 79 your comments about using TCP to counter the effects of lead in the fuel. I had been suffering from sticking exhaust valves over the years in my 0-200 and finally had decided best to do a complete overhauls and install new (millennium) cylinders. The engine work was done by Dick Demars Aero in Fort Collins, CO. - they do excellent work and I highly recommend them to anyone contemplating an overhaul. At their suggestion, I've started using "Av-Blend" an oil additive that is supposed to be a big help in preventing exhaust valve sticking. Although it is too soon to tell (I've only 100 hrs. SMOH), I have been using it at each oil change and subjectively, (sound, smoothness) it seems to be helping. I'm told that TCP will help in the lead fouling area, but ultimately won't solve the "caking" of oil that occurs on the valve stems. The Av-Blend folks sent me some technical data on their product which I'm forwarding to you. I get mine from Engine Additives, Inc. in Humble, TX (800-672-7262), but it is produced by TechniFlyte Corp. in Chicago (800-209-0083). They've got some fairly impressive test results to back up their claims.

There are two very interesting NASA reports available to the public that were written in '85 and '86 on the results of the wind tunnel tests they did on the full scale VariEze and the 2/3 scale VariEze. One is about 80 pages, the other 60, and they are full of interesting data on the basic aerodynamic characteristics as well as the aircraft's stability and control parameters. I'm sure you at RAF have seen them - but it is not generally known that copies can be obtained by anyone wanting to add to their "canard-pusher library". They are excellent reference material for anyone flying an EZ. They are available through the National Technical Information Service by calling 1-800-553-6847. The first report is entitled "Wind Tunnel Investigation of the Flight Characteristics of a Canard General Aviation Airplane Configuration". The document number is NTIS No. N-87-10039. (NASA Technical Paper 2623). The second is entitled "Wind Tunnel Investigation of a Full Scale Canard Configured General Aviation Airplane (NASA TP 2382). The document number is NTIS No. N-85-19935. The only hitch is they aren't free - they are about $19.50 each, but they will take your order by phone at the NTIS 800 number if you use a credit card.

Deep Stall info update: I was perusing these wind tunnel reports recently when I noticed an interesting piece of data about high angle of attack characteristics of the EZ. I remember a couple of years back when we had our discussions about the Long-EZ deep stall incident that someone had asked about the possibility that engine power could aid recovery. At the time, I think we concluded it would not since the thrust line was basically through the cg. However, the wind tunnel data does show a fairly significant restoring moment is added in the pitch axis by going from idle to full power - about as much nose-down moment as the elevator provides, at the high angle of attach of a deep stall. A good piece of data to keep in your hip pocket should you ever encounter a deep stall inadvertently. Applying full power could aid in recovering an EZ - this is a characteristic of pusher prop configuration.

Well that's about all for now in the airplane department - I'm fully engaged in training for my next shuttle fight scheduled for this June. I've been assigned as pilot on the Atlantis crew with a mission to take two Russians up to the Russian MIR Space Station. We'll be making the first ever docking of a space shuttle with another space shuttle. Two 250,000 lb. vehicles will come together at little over 1/10th of one foot per second relative velocity. It's an interesting (and fun) flying task. This is also the first time we've docked with the Russians since Apollo-Soyez in 1975. We'll remain docked for 5 days and will leave the 2 Russian cosmonauts on board their MIR station and will bring home the 3 crew members who are up there now (2 Russians and an American - our first to fly on a Russian craft). They will have been there 90 days when we arrive so will probably be ready to come home. If all goes on time, I'll look forward to seeing you again at Oshkosh.

Fly Safe,
Charlie Precourt"

Ed. Note

We concur with Charlie on the use of engine power to aid in recovery from a deep stall in a canard pusher-type. In fact, we used this successfully on several occasions during high angle of attack testing of the Mercury aircraft, a development of the Microlite which was designed and built for Colin Chapman, Lotus Cars of England.

ACCIDENTS AND INCIDENTS

As always, the following reports are published for the sole purpose of helping others to avoid the same problems that caused the accidents.

****From CP81-4,5,6&7 (CH30,CH39)****
BRUCE AND BONNIE TIFFT

Synopsis of Accident - N115EZ was a highly modified aircraft based on the Long-EZ.

Powerplant--although there was no data plate installed, this appeared to be a Lycoming IO-360-B series, angle valve, 200 HP engine.

The accident occurred on the morning of March 18, 1995 on the Tiller Trail Highway approximately 20 miles east of Myrtle Creek and 30 miles southeast of Roseburg, Oregon, only 55 miles from their departure point of Cottage Grove, Oregon.

Weather in the Roseburg area at the time was reported to be 3000 ft. overcast with good visibility. The overcast began to break up south of Roseburg and it was CAVU south of Myrtle Creek.

Based on all of the findings, it appears that the engine was not turning at the time of impact. Therefore, it is assumed that an engine related problem drove Bruce to attempt an emergency landing on this rather narrow mountain road near Tiller, OR. He appears to have approached from the south, made a left base to the west to line up on the road. The blacktop road bed is only 20 feet wide with approximately 6 foot wide shoulders on each side. There is a rocky hillside on the left side and a steep drop-off on the right, sloping down to Elk creek which roughly parallels the road. The airplane struck the tops of several pine trees which flexed and gave way but, unfortunately, the left wing then hit a large oak tree which tore this wing completely off the airplane. This caused the airplane to roll/yaw left where it impacted against some rocks in a nose low attitude, with at least 90 degrees of left roll. It then bounced/slid down the slope into the rain swollen Elk creek where it came to rest. Forward of the firewall, the fuselage was submerged. The engine cowling, engine, right wing and right winglet/rudder were not under water. Both occupants were killed instantly by the impact and did not drown.

The prop was stopped in the horizontal position. The right prop blade was completely undamaged, while the only damage to the left blade was that the outboard 8" was bent/broken straight aft, not at an angle against the direction of rotation as it would have been if the engine was turning or developing any power. This damage to the tip was caused by the left wing root as it was torn aft by the oak tree. There is evidence of yellow paint on the prop tip as well as on the left exhaust stack which was dented by the left wing root as it departed the airplane. The cowling was essentially undamaged, as was the right fuel tank/strake, right wing and right winglet/rudder. The engine was undamaged and still attached to the engine mount and firewall. The main landing gear also suffered little damage. The left side of the fuselage, aft to the centersection spar, including the left fuel tank/strake, was destroyed. The right fuselage side was destroyed aft to the leading edge of the right strake. The canopy was also destroyed. The instrument panel was heavily damaged, making it impossible, except for the radio, to determine the position of any of the switches. The control system was severely bent and even broken in several places, but all parts were recovered and all failures were due to massive overload. It is believed that the airplane was under control until impacting the oak tree and, it is the opinion of several of the accident investigation team that the pilot would probably have landed successfully, if he had not struck the oak tree.

Considerable damage was done to the airframe by the salvage crew while removing the aircraft from the creek and transporting it to the police impound area in Myrtle Creek. Although this was taken into account during the investigation, we may have been able to learn a great deal more had the salvage been supervised by someone intimately familiar with this type of aircraft. The NTSB would not allow any examination of the wreckage by us until a representative from Lycoming, Mr. Greg Erickson, had completed his inspection. He, together with a representative from the FAA, arrived several days later, removed the cowling, and discovered that the engine had "non standard" cylinders, ignition systems and carburetor. Also, the engine data plate was missing. At this point he concluded his investigation and left. He later called Fergus Fay, who had requested to be present at the investigation (but was not notified) and told him of the "non standard" nature of the engine. He said that with no data plate, non standard cylinders, a non standard ignition system and "other modifications", he considered that it was no longer a Lycoming product. NTSB lost interest immediately, and within 48 hours the FAA turned the wreckage over to the insurance company who released it to the family who, in turn, gave permission to Ferg Fay to conduct an inspection of the engine.

Ferg removed the engine from the aircraft and transported it to his home where he suspended the engine in level flight attitude and drained the oil. There were only 3.8 quarts in the crankcase. The engine was initially very tight and it took a measured 1200 inch pounds of torque to break it loose. A compression check was conducted with the following results:
Cylinder #1 - 40/80 - leaking from the exhaust valve.
Cylinder #2 - 50/80 - leaking from the exhaust valve and the rings.
Cylinder #3 - 75/80 - slight leak by the rings but OK.
Cylinder #4 - 20/80 leaking from the exhaust valve and the rings.

The valve clearances were checked with the lifters compressed and were found to be between .028 and .066 (the Lycoming standard spec. is .028-.080). The three worst cylinders were removed (cylinder base nuts were found torqued to 450-500 inch/lbs.) and carefully checked with a micrometer and a dial indicator. The bore diameter and choke were consistent with Lycoming standards. Definite, light scoring was found in the upper cylinders. The top compression rings were removed from the pistons and the ring gaps were checked. They were found to vary from .010 to .040. These rings were found to have unusually sharp edges, particularly for so little running time.

There were no magnetos on the engine. The left mag hole was covered by an aluminum plate. In its place, a Jeff Rose electronic ignition system module was used. Instead of the right mag, there was an automotive type electronic ignition system of unknown origin. complete with distributor cap, rotor and automotive high tension cables. On disassembly, the distributor cap was found to be cracked and the center carbon was broken and found lying loose under the distributor cap.

Ellison throttle body (carb) looked OK but the throttle linkage had been bent during the crash making it impossible to move the throttle slide. There was fuel in the right fuel strake and, although the linkage had been badly bent in the crash, the fuel shutoff valve was in the on position. When the fuel line was disconnected at the firewall, fuel ran out.

The crankshaft flange was checked, using a dial indicator, and the total indicated runout was only .002". The case was not disassembled because, at this point, the family sold the engine.

Analysis

Bruce had recently overhauled this engine using four new Superior millennium cylinders, pistons, valves, guides, etc. He had reported that the engine was running very hot but that it was using no oil! It is not normal for a newly overhauled engine to use no oil. The condition of the baffling verified the report of a hot engine. It was obvious that he had been working hard on tightening up all baffle leaks. There was an extraordinary amount of RTV all over the baffling and cylinders. We have learned that Bruce had ordered a new digital scanning cylinder head temperature gauge just the day before the accident (further indication that he had high temperatures). There are no logs to verify the engine running time since the overhaul but it is believed that he had only flown it about 5.5 hours before departing for Mojave, CA around 7:30am on March 18.

The crash site is 55 miles south of the Cottage Grove airport suggesting that they probably were airborne for only about 20 minutes. Assuming Bruce topped off his oil, which was his usual habit, how could he have used 3 to 4 quarts of oil in only 20 minutes? There were none of the usual signs of heavy oil use, the tops of the pistons were not heavily carboned up, nor were the exhaust stacks excessively oily or sooty. The light, but definitely noticeable, scoring in the upper portion of the new cylinders is indicative of tight rings; the unusually sharp edges found on the compression rings indicates excessive wear caused by tight rings and/or overly expanded pistons, caused by excessively high cylinder head temperatures. Compression ring gaps were measured at .010-.040 (Lyoming spec. calls for a minimum gap of .030-.045 in a nitrided, choked cylinder barrel). There is, however, no evidence that the engine actually seized (at least, in the cylinders).

Compression reading as low as 20/80 in essentially new cylinders is indicative of possible ovalizing of the barrels due to extremely high cylinder head and cylinder barrel temperatures. This condition would cause unusually high pressure in the crankcase due to ring blow-by and could have blown a lot of oil out of the breather. Since Bruce's breather system dumps into the exhaust system, all evidence of this loss of oil would be eliminated by being burned in the exhaust stack.

It could not be determined if the cracked distributor cap or the broken carbon existed prior to impact, so it is not known if the experimental ignition systems contributed to the cause of the accident. It is a fact, however, that if Bruce had suffered a complete electrical failure, both of these ignition systems would have eventually cease to function. The battery was never found and it is assumed that it is at the bottom of the creek.

Summary

While weather was probably not a direct factor, the ceiling between Cottage Grove and Roseburg was reported to be around 3000 ft; we assume that he remained below these clouds. This would account for the fact that he did not have enough altitude to glide west to more favorable terrain. From 7500 ft, for example, he could have reached open, flat fields near Canyonville, east of Interstate 5. From 3000 ft, he was little more than a normal pattern altitude above the Tiller Trail, leaving him with no other choice. On reaching clear skies, southeast of Roseburg, he may have initiated a climb. Adding power at this point may have exacerbated the high cylinder temperatures problem and he may soon have felt compelled to reduce power to near idle. The engine might have stopped because of the internal friction evident by the upper cylinder scoring and ring wear. Had the engine been developing any power at all, it is certain that Bruce would have nursed it over to one of several airports that were less than 20 miles away., His radio was still on 122.8, the frequency used at Cottage Grove. He probably did not have time to switch to 121.5 and declare an emergency.

Bruce was the epitome of the experimenter and was always testing some new idea on his airplane. In this case, however, what with two different electronic ignitions systems, two different types of spark plugs, new design, relatively un-proven cylinders, a non standard crankcase breathing system, etc., maybe he was simply trying too many new things at one time. Bruce had a history of high oil temperatures with this engine, even before this latest overhaul, and he had installed a larger than normal oil cooler. This oil cooler was installed in an unusual position - just inside the engine cooling air inlet, in the cowling, where it looked as though it would impede the flow of cooling air to the cylinders. This is not a normal oil cooler installation and may have contributed to his high temperature problems.

Perhaps the lesson for those of us who fly these little airplanes is to try only one new idea at a time. We need to recognize the wisdom of FAA's requirement to test any "major alteration" in a suitable test area prior to returning to "normal" operations. Completely evaluate each new idea, one at a time, accept or reject it, then go on to the next new experiment.

Mike Melvill

PS. I have recently been in touch with the person who bought Bruce's engine and he has a few interesting observations. First of all, he says the weather in Cottage Grove that morning was much worse than the weather reported at Roseburg. He believes that there was no more than an 800 foot ceiling with poor visibility. Furthermore, he says at least one other aircraft departing from Cottage Grove to fly to Roseburg that morning, was forced to return to Cottage Grove due to low ceilings and bad visibility.

While he has not torn down the engine, he did look at the mechanical fuel pump. He found that it contained only water, no fuel. This may, or may not, be significant. Since the aircraft ended up in a river, it is possible that the fuel system got water in it directly from the river. However, I can think of no way that water could get into a mechanical fuel pump if the pump is not operating, (The engine was not turning at impact) especially if the fuel lines between the mechanical fuel pump and the carburetor were intact. The same person, who has the hangar next to Bruce's on the Cottage Grove airport, says that Bruce fueled up his airplane the night before his planned flight to Mojave, by way of two Jerry cans. He had never seen Bruce do this before and it is possible that one, or both, cans may have had water in them. This scenario would require that only one fuel tank got contaminated by water and that they took off on the "clean" fuel tank, then switched to the tank with water close to the accident sight.

All of this is supposition, none of it is hard proof, and I am very sad to say that we may never know exactly what it was that caused us to lose our friends, Bruce and Bonnie. They were neat people and will be sorely missed by all of us in the sport aviation arena.
Mike M.

From CP81-7&8 (CH13,CH30,CH38,CH39)
A Texas VariEze which was not built by this pilot but was purchased as a completed airplane, crash landed short of the runway due to a throttle control system anomaly that this pilot was unfamiliar with. This VariEze was equipped with an electrically operated nose gear system. Letter follows:

"On April 8th, my VariEze was force landed after the throttle stuck in the closed position while approaching Addison Field for a landing.

The pilot had been practicing formation flying with a Long-EZ flown by a friend. The pilot had been cleared for an approach, as a flight of two, into Addison. Approximately one mile from the runway, the tower requested that the flight reduce speed to the minimum possible to enable a twin on right base to land ahead of the flight. In complying with this request, power was reduced to a minimum. Shortly before this power reduction, the pilot noticed that the knob of the throttle control lever had dropped off. One part of the knob was retrieved and placed under the pilot's thigh for safety.

When the time came to open the throttle to maintain altitude and continue the landing procedure, it was found the throttle would not open more than a half inch. A determined effort to force the throttle open was unsuccessful. The limited opening provided insufficient power to maintain altitude and it was not possible to stretch the glide to reach the runway. It was difficult to try and resolve the problem and fly the aircraft safely at the same time, so the decision was made to concentrate on landing safely. A field that seemed to have fewer wires and other nasties, became the option. The landing was made safely and the aircraft rolled three hundred and fifty feet before being launched back into the air by a sharp rise in the ground. The aircraft then flew over a road and landed on a bank on the other side of the road. The impact came with the plane level but descending almost vertically - what might be termed a genuine pancake. The distance between impact and final stopping place was about ten feet. Damage was extensive; nose gear, which did a great job in absorbing kinetic energy; main gear, folded back; and extensive damage to the fuselage in the attachment area. The landing gear fork, broken by the impact and then folded back under, came through the fuselage floor, through the thigh support and the seat and cut into the pilots right thigh. Far more destructive was the remains of the electric landing gear which tore loose and destroyed the instrument panel bulkhead, both the radio and transponder, the turn and bank as well as severely bruising the pilot.

The cause of the throttle problem: The aircraft had had a plans built cable throttle originally. This was later changed to a push/pull, Morse cable which was different from the original in requiring a straight motion from the bottom attach point of the lever. This was achieved by making a second lever, longer from the fulcrum to the lower attach point than the original but using the same fulcrum and control knob pattern. Instead of removing the original lever, the second lever was placed alongside the original, such that both moved together, although the original was now no longer functioning or attached to a cable. When the knob which went through both levers came off, there was no longer any restraint to prevent the levers from moving independently. One fowled against the other and jammed.

With more altitude and thus more time to fiddle around, the problem might have been overcome, or if the pilot had been aware of the way the system had been installed, he might have come up with a way to overcome the jamming. On the other hand, given the circumstance, making the decision without delay and maintaining control probably was a contributing factor in the limited damage the pilot and aircraft sustained.

I am concerned that builders who have installed electric nose landing gear activation may be in for a rude shock if they ever have an off field landing. The operating mechanism is heavy, and potentially a lethal weapon if it comes loose in an accident. I would strongly recommend to those contemplating the use of this gear to have another think. The only thing that saved me from injury from the gear was the almost zero forward speed on impact. I do not want to think about what that bloody great torpedo shaped missile would do to one in a frontal impact situation. When this aircraft is rebuilt, it will definitely have a plans built nose gear."

From CP81-8&9 (CH8,CH21,CH30,CH39)
A Southern California Long-EZ crashed shortly after departing from the Santa Monica airport. The pilot survived but was badly injured.

A careful post-crash investigation revealed that this airplane's fuel system had been extensively modified by removing the engine driven mechanical fuel pump as well as the electric boost pump. The fuel tanks had been plumbed together to form a gravity fuel system similar to a Cessna 150.

This pilot had also modified the front seat shoulder harness attach point and had installed a "Y" type shoulder harness, installed using a single bolt in the center of the seat bulkhead. There was no provision to carry the crash loads, no hardpoint and no beef-up of the bulkhead skins. The result was predictable. This single bolt pulled through the seat bulkhead and the should harness provided zero restraint. The seatbelts were installed per the plans and survived undamaged.

This is an absolute No-No! *RAF* Thoroughly explored the possibility of a gravity fuel system for the Long-EZ back in 1979 using the prototype, N79RA. Flight test results forced us to conclude that the margin of safety using a gravity fuel system was too slim and we opted to use a fuel system similar to a Grumman Tiger or Cherokee that includes two separately selectable fuel tanks, an electrically powered in-line fuel boost pump and an engine driven mechanical fuel pump. All of the above are mandatory in order to provide reliable fuel delivery to the carburetor on a typical Lycoming-powered Long-EZ,. This information was published in several *Canard Pushers* as well as in the plans and engine installation instructions. The following is taken from page 3 of the Section IIL of the Long-EZ plans:
"The most important item to consider is the mechanical fuel pump. The Long-Ez's fuel system is designed to <u>require</u> the use of an engine driven mechanical fuel pump, backed up by an in-line electric pump. This is a mandatory requirement and there is no acceptable way around it."

This important safety requirement was not just dreamed up, it was derived from a carefully conducted flight test program - do not try to second-guess the designer's motives behind critical systems such as the fuel system. The plans built fuel system on the Long-EZ is an excellent, trouble free system that is known to work on hundreds and hundreds of airplanes.

If you know of someone who may be contemplating a change to his or her airplane like this, get involved, help him or her out, don't let another unnecessary accident happen.

From CP81-10 (CH30)

FEATHER LITE HAS BOUGHT BRUCE'S EQUIPMENT FROM B&T PROPS AND WILL MAKE AN ANNOUNCEMENT SOON AS TO WHEN THEY EXPECT TO START PRODUCING PROPS. HOPEFULLY VERY SOON.

Update Number 82
to
Supplemental Chapter 30
Section IIL,
Lycoming O-235 Engine Installation

Information derived from CP82 published by RAF Oct 1995

From CP82-1 (CH30,CH37)

Oshkosh or bust by gosh

One of our South American friends reproduced the flight of an aviation hero, set four new records and entertained air show tourists in the U.S. with Long-EZ antics all within four months.

Brazilian pilot, Andre J, Deberdt, began the adventure in his hometown, Sao Paulo on April 21, '95. After landing his 1989 Long-EZ in Natal, Brazil, the native Frenchman. who has lived in Brazil for forty years, took off for a long-distance flight across the Atlantic Ocean to Dakar, Senegal on the African coast. Flying at an average speed of 130 Kts, Andre covered 1627 NM in little over twelve hours. That was the first leg of a four month odyssey that swept him across the Atlantic four times, through Africa and parts of Europe, over Iceland, Canada, and eventually landed him in Oshkosh, Wisconsin for the annual fly-in.

PPZAD, or "01 'ZAD" as the airship is affectionately called, is the first Brazilian experimental homebuilt to fly from Brazil to Africa non-stop and to tie South America to Europe with only one fuel stop.

Joao Ribeiro DeBarros, a famous Brazilian pilot who made the Atlantic crossing in a twin-engine Amphibian Savoria Marchetti on April 28, 1927, served as prototype-pilot for the early part of Andre's voyage. "What is little known is that DeBarros made the crossing 22 days before Lindbergh," Andre explained. "But the difference was that Lindbergh was flying (between) two important cities, New York and Paris, and also he had the American media, which was very good. This poor guy had little media. At the time he was famous, but the Brazilian don't seem to have memory for their hero. I am trying to change that."

Andre waited two days on Isl de Sal in the Cape Verde Islands just to cross on the same date as DeBaffos - April 28th. "Looking at the weather, of course," he added.

Andre chose to cross the ocean by night. "As Dick (Rutan) told in his forum, what you do not see, you do not fear," he explained with a hearty laugh, "it's psychology." The shorter nights while traveling east and the ability to spot far-off lightening and heavily traveled traffic patterns also played a role in his decision. "By night it is cooler, and the engine works better," he said. "You can fly at higher altitude, and the sight is just beautiful."

An intelligent, gregarious guy, Andre had no problems making friends and influencing people even while crossing the wild blue yonder at an average of 12,000 feet. "Anytime I could not contact the controls by HF radio, I called on International Emergency Frequency and asked the big boys over there to help me, and use their radar," he said. "There are many airplanes crossing at the same time. You get many, many answers every time you call. One of them, from Swiss Air, had a Long-EZ so we were discussing the virtues of each EZ for an hour or so."

Foreign flying permits were relatively easy to come by, according to Andre, who serves as a judge for a Brazilian Rally team as well as an International judge for the FAI. "In South America (it is) completely free, as easy as here in the United States," he said. "The difference being that taxes are high and fuel more expensive, but it's a simple matter of filing an international flight plan."

Andre said there are four Long-EZs, two Cozys and one VariEze flying in Brazil. Two Velocitys are currently under construction.

He was only questioned once during his sojourn, while trying to fly over Morocco. "Three hours into the flight after leaving Tenerife, Canary Control called me and told me, 'Casa Blanca wants to know if you have permission to overfly their country.' And then I answer with another question, 'Ask them if they know that it's the new regulation of International Organization for Civil Aviation (IOAC)?'

"But there was no way. They wouldn't let me overfly the country, So I had to discuss with Spanish Authority (a way to) vector me direct to Spain."

Andre said the airplane never failed, but he lost his ADF and Altitude Encoder at one point, landing by GPS and the feel of the airplane. It was repaired by RMI as soon as he arrived in the States. "The NARCO ADF was also repaired there," he said, "and I had to transfer the NDB data's for the IFR landing procedure in Iceland into the data base of the GPS, and I then completed the instrument landing there with no problems."

As for the 118 hp Lycoming 0235-L2C engine, "it works like a fine Swiss watch," he said. "I have the Klaus ignition, of course, and that is a big factor in the fuel efficiency."

A surprise encounter with ice south of Greenland was a new experience for Andre. Flying at 12,000 feet with a headwind, Andre said he felt that the airplane was a handling nose-high. While he noticed a little rime ice on the leading edge of the wing and the winglets, he did not consider it a significant problem. However, a short flight-test soon shattered his calm. The airplane shuddered, forcing Andre to cut power and descend to 8,000 feet. "Then suddenly I heard two big, loud bangs," he said. "After a while I figured out I had much more ice on the canard that I couldn't see, of course. It melted and (left) the wings. I had an aft CG, and I almost entered a deep stall because of that. This was quite an experience."

"I once had an experience of icing of gasoline over Chile in 1993. I lost my engine. Mike Melvill had the same problem over Alaska. He told me "Well, you are from the tropics. You do not know this phenomenon. At the high latitude it happens frequently." Since then I was careful to add some additive to each leg over Iceland just to avoid icing."

After the Iceland episode, Andre made a stop in Gander, Newfoundland before heading to Oshkosh.

"I was not going to come to Oshkosh '95," he said. "But Terry Schubert (President & Editor, Central; States Association) told me you cannot do that, you have to be part of our team for the Glass Overcast."

Indeed, he did. Andre and ZAD flew as part of the Lone Eagle Flight Team's display during Saturday's air show.

Andre, who is married with two daughters and two granddaughters age 13 and age 6, said he claimed four more distance records, which are about to be confirmed. by the FAI, as he headed home from Oshkosh to Sao Paulo. The return home was uneventful, he reported, and "very enjoyable if not a bit tiring."

For now ZAD is temporarily grounded "by popular demand - my wife," he said, for a much deserved rest. But in 1997 Andre plans to fly the long-distance courses again, this time to close the loop through Australia.

Good luck Andre, we will listen for you on the airwaves.

****From CP82-9 (CH30,CH39)****
Fuel Pump Fire
We recently had an event with our Long that may be of interest to other builders that use Ellison carburetors. We were out in front of our hangar starting our Lycoming 235. After turning on the fuel pump to check its operation I cracked the throttle, primed the engine, fooled around with the primer awhile getting it re-seated, and then hit the starter. The engine did not start immediately and I waited a few seconds then tried again.

The second time the engine back-fired but did not start. Thinking that it was flooded I opened the throttle and was waiting again when I noticed a puff of smoke drift by. This caught my attention immediately!

Fortunately the wind was blowing from behind so I could see the smoke. We were able to extinguish the fire with the use of two big C02 extinguishers but the damage was significant. All the wiring from the firewall (aft) was destroyed, the skin and foam were destroyed around the inlet and the cowling damaged.

Upon investigating the cause it was found that if the fuel pump was turned on and the throttle was advanced any amount above idle cutoff gas would pour from the carb. This had obviously been going on during the starting process and had resulted in fuel gathering in the bottom of the cowl which was then ignited by the backfire.

The carb was returned to Ellison for repair and they determined that some fine dirt and microscopic aluminum particles had gotten under the ball valve which allowed gas to flow even when the engine was not running. They said that a finer filter was required upstream of the carb to prevent this. The carb has a final filter built in but that is not good enough to protect the carb. The built-in filter is rated at 70 microns and there is a 25-micron filter in the Aircraft Spruce catalog that is stated to be approved for the Ellison carb so I guess that the problem is not altogether new even though Ellison seems surprised that we had a fire.

It seems bad practice to put a final filter in a system that is not good enough to protect the downstream components. It has been my practice to start with coarse "rock catchers" and then have increasingly finer filters downstream. The coarse filters then prevent large particles from clogging the finer filters and the final filter protects the system.

To prevent this problem from re-occurring we are installing a drain from the bottom of the aeroduct overboard through the lower cowl. This will not only prevent fuel puddling but it will also let us check for proper operation of the ball check by turning on the fuel pump, advancing the throttle, and looking for fuel from the drain before getting in the airplane.

Once Burned Always Careful,
Owen G. Morris

****From CP82-11 (CH19,CH30,CH38,CH39)****

Broken exhaust threatens wing!

This happened to be a Cozy MKIV, but the wing attach system, exhaust system, and engine cowling area are essentially the same as the Long-EZ and Defiant. RAF is publishing the story here in the hope that this knowledge may prevent a similar incident in one of our airplanes.

While flying at 10,000 feet over the Gulf of Mexico near Pensacola at night, the exhaust pipe on cylinder number 4 broke off. Fortunately it remained, in the cowling and did not go through the prop. However, hot exhaust gases traveled between the wing and the center-section spar, heating the epoxy in the wing near the wing-attach hard points. The epoxy softened enough for both wings to move upward at the wingtips, 1/8 inch on the left wing, and 3/8 inch on the right wing.

The spar caps were not damaged, but the shear web on the right wing actually fractured near the out board wing-attach point, allowing the wing to move to a new dihedral angle.

Unfortunately, the pilot was unable to land when he first heard the exhaust let go, but had to fly for nearly an hour to the nearest suitable airport. It is possible that an immediate landing would have prevented the damage and resulting enormous repair job.

The pilot reported that the engine sound made an abrupt change. Performance was not affected, but the noise level was obviously higher, and led him to suspect a broken exhaust system. He throttled back to 1,800 RPM and continued on. He noticed that cylinder head temperatures on 2 and 3 settled down to around 300 degrees F, but cylinder 4 remained up around 400 degrees F.

He landed safely, and had the exhaust stack repaired. He did not notice the wing problem until the next day. There was considerable foam shrinkage (due to heat) all around the hard points. He found a small hole in the inboard glass rib, near the aileron torque tube bearing, and the heat had gotten into the wing through this hole. The only visible damage anywhere in the cowling was a small blister on the cowl itself. Fortunately all of his fuel lines were fire-sleeved, and his wing ribs were protected with 1/8 inch fiberfrax glued on with high-temp silicone. None of the glass on the firewall or in the wing roots were damaged.

What can be learned from this incident? First of all, exhaust systems are subject to vibration and high temperatures and are vulnerable to cracking, even in an type-certificated aircraft.

Inspect your exhaust stacks often and carefully, using a strong flashlight. All visible glass in the cowling area, firewall, center section spar aft face , wing roots, etc, should be protected using fiberfrax. The 1/8 inch-thick material is best, and it should be cut to fit perfectly, and then glued onto the glass using red (high-temp) silicon, available at any auto parts store.

Seal all possible paths for hot air, such as the gap between the center section spar and the wing, and any holes you may have made in the wing root ribs. All of the air, hot or cold, should have to exit the cowl around the spinner in front of the prop, except the air that flows through your oil cooler.

If you ever hear an abrupt, unusual increase in the noise level from your engine compartment, make a precautionary landing at the nearest suitable airport and remove the cowling for a thorough inspection.

Do not fly until you comply with the plans change section on page 15 of this newsletter.

****From CP82-13 (CH30)****
Feather Lite, Inc. is proud to announce another product to re-introduce to EZ builders: The original Space Saver Panel by the late Rusty Foster. This is a bare fiberglass panel with a molded recess for builder installation of an aluminum flat stock electrical panel. $40.00

Contact: Michael Dilley or Larry Lombard
(both former RAF employees and EZ builders and flyers)
Feather Lite, Inc.,
PO Box 781
Boonville CA 95415
(707)-895-2718

Feather Lite bought Bruce's equipment from B&T PROPS and will soon make an announcement as to when they expect to begin producing props.

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****
Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00
Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00

Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	10.00
0-235 engine installation	**21.50**
Roncz Canard	42.50
Flush belhorns	10.00
Moldless Composites manual	14.50

Postage & handling included in price.
Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

****From CP82-15 (CH30,CH38)****
Plans Changes

Do not fly until you comply with the following plans change.

MANDATORY GROUND for All RAF DESIGNS until the following changes are made on your aircraft -

All RAF designs
Check Fuel Pump
Fuel draining out of the carburetor, as reported by Owen Morris (see Reader Mail on page 9), be it a Marvel Schebler, an Ellison, or a Bendix fuel injection system is a potential catastrophic fire hazard! It is very important to create a small drain hole at the low point in the induction hose. Fuel must be able to drain into the cowling, and you must drill a hole in the low point of the cowling, so that this fuel can drain on out of the cowl.

The fuel comes from priming the engine, prior to and during the start cycle. The worst offender is the carburetor with a throttle pump installed. Some pilots pump these throttles several times just before cranking with the starter. The throttle pump squirts a fine mist of raw fuel up into the intake manifold, but most of the fuel runs back out of the carb, and if the engine backfires during the start sequence you have a fire. Even manually-primed and injected engines can and do have raw fuel drain down the intake manifold tubes and out of the carb or throttle body. You as the aircraft manufacturer are responsible to provide a path for this fuel to get out of the manifold/throttle body/air filter/inlet hose/whatever, and out of the cowling onto the ramp.

This problem only occurs while starting and normally is not an in flight problem. Check your aircraft and if this has not been taken care of, fix it before your next flight.

****From CP82-15 (CH30)****
VariEze, Long-EZ, Defiant
Inspect & Comply
Inspect and comply with the additional sealing and heat insulating areas on the rear engine installation as described on page 11.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may discover as you go through the building process.

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Supplemental Chapter 30
Section IIL, Lycoming O-235 Engine Installation

Long-EZ Plans Changes

From CP24-6 (CH30)
LCP #1, MAN-GRD, pg 21-8
The Bendix fuel pump called out does not have a means of safetying the bottom cap. This is done on certified aircraft as follows: Bend the small tab shown 90 degrees, drill a #50 hole in it, safety with .032 stainless safety wire, tied to the fitting. **SKETCH OMITTED**

From CP25-6 (CH2,CH4,CH15,CH30))
LPC #25, DES, Page 4-3 and Page 2-2.
Aluminum can be substituted for the steel firewall, don't install fiberfrax now. **Wait until after cowling installation.** This allows you to wrap the fuselage skin around onto plywood and allows you to layup the 1 ply inside lip on the cowl lip. You will then have to remove things bolted to the firewall to install the fiberfrax and aluminum. Install fiberfrax with silicone rubber, <u>not</u> epoxy.

From CP27-7 (CH4,CH18,CH30)
LPC #48 DES, Firewall, page A4
Increase size of firewall at top as shown to assure adequate height to fit cowling. **SKETCH OMITTED**

From CP28-9 (CH30)
LPC #61, MEO.
Section IIL, Lycoming Engine Installation, bill of materials Page 37. Engine mount hardware - under 8 #71032 rubber bushings, add: <u>OR</u> 8 #6083 rubber bushings. This choice will depend on the size hole machined into your engine.#71032 for 1" diameter hole and #6083 for 7/8" diameter hole.

From CP28-9 (CH30)
LPC #63, MEO
Section IIC, Lycoming Engine Installation Page 3. Third paragraph on the right. MA3-SPA should be MA3-PA.

From CP29-7 (CH30)
LPC #66, MEO
CP #28, Page 9, LPC #61, the part #6083 should be #60883.

From CP29-7 (CH30)
LPC #69, MEO
Section IIL, Page 14, Conical engine mount. The 7/8" O.D. x .049 cross brace tube must be moved down in order to clear the fuel pump. It is shown in the correct position on page 15.

From CP31-5 (CH30)
LPC #92 MEO, Section IIL.
Oops! We neglected to cover installation of the ram inlet scoop. This prefab part should be installed onto the bottom cowl, permanently. It is floxed into place, and has a flush "pop" rivet approximately every 2" around the flange. After cure, one ply of BID is layed up inside lapping 1" onto the cowl and the ram inlet.

From CP31-5 (CH30)
LPC #93 MEO, Section IIL, page 36, bottom left.
AN823-4D should be AN816-4, also aeroquip 496-4 should be 491-4.

From CP31-5 (CH30)
LPC #94 MAN-GRD, 25 HOUR.
Remove the following aluminum fittings:

AN822-6-2D	2
AN816-6D	2
AN823-6D	1
AN912-1D	1
AN823-4D	1

Install the following steel substitute fittings:

AN822-6-2	2
AN816-6	2
AN823-4	1
AN823-6	1
AN912.1	1

Refer to the adjacent circled items from Section IIL, page 36 to identify effected parts. Make the appropriate changes to Section IIL, pages 13, 18 and 37.

From CP32-7 (CH30)
LPC #100 MEO, Section IIL, page 6, left side, center of page. "you will now have 4 AN509-10R8 screws....." should be 3 AN509-10R8.

From CP32-7 (CH30)
LPC #101 MEO, Section IIL, page 37.
Add to the Brock parts list - two spacers, part #SP-5. These spacers are used as stand-offs to bolt the gascolator to the firewall.

From CP35-9 (CH30)
LPC #108, MEO, Section IIL, pages 7 and 13.
The brake master cylinder is shown mounted on the inboard side of the CS73 bracket on Page 7, which is correct. It is incorrectly shown outboard of CS73 on Page 13.

From CP40-6 (CH30)
LPC #117, Section IIL, Page 10.
The Lycoming #STD 619 washer should be replaced with an AN970-6 washer. The Lycoming washer has too large a hole allowing it to slip over the 1.84" long spacer. This allows the rubber bushings to be crushed more than they should be.

From CP43-4 (CH30)
LPC #120, Section IIL, Page 6, 2 paragraph. There should be 4 AN509-10R8 screws in each top attach point. LPC #100, CP32, page 7 incorrectly called this out as 3 screws.

From CP49-6 (CH15,CH16,CH30)
LPC #131 MAN-GRD Modify the roll and yaw control systems between the firewall and the aluminum protective ribs at the wing roots by substituting 4130 steel or any stainless steel for all aluminum components with thicknesses less than 0.1 inches. This includes tubes, pushrods (with inserts), pulley brackets and bellcrank brackets. Apply Ocean No.1644 Flexibilized - Intumescent Fireproof Coating Compound to the engine-side surface of the aluminum wing root shield ribs. Apply Ocean 1644 Intumescent to the aft surface of the centersection spar including interior flange surfaces between the existing firewall and the wing root rib. If your Fiberfrax shield is aluminum rather than the stainless steel option, coat its aft surface with Ocean 1644 Intumescent. **Inspect all fuel system plumbing and fuel system components for approved fireproof components. Substitute approved fireproof components (steel or stainless) for any aluminum components and be sure that fireproof sleeves are used on all hose components.** Any exposed aluminum tubing or fittings should be corrected with approved stainless steel or steel aircraft fitting. If your gascolator bowl is aluminum, wrap it with approved fire sleeve material similar to the hose sleeves.

From CP51-7 (CH30,CH38)
LPC #132, MAN-GRD
Inspection of engine mixture control system. Before flight, remove the cowling and remove any spring installed on the mixture control and the throttle control which is used to assist the control arms to go to the full rich or the full throttle positions. With the springs removed, pull the mixture control to idle cut-off and the throttle to idle, then push the levers forward and confirm that the mixture positively moves to least the mid range (well rich of idle cut-off) and the throttle moves to at least to two-thirds power without the assistance of any spring. Then re-install springs and put the aircraft back in service.

From CP65-7 (CH21,CH30,CH38)
PLANS CHANGES/INSPECTIONS

LONG-EZ MAN/GND
Polyurethane fuel and vent lines. Mandatory Inspection before next flight - See article on this page.
Throttle/mixture springs. Mandatory inspection next 10 hours - See article on page 13.

From CP65-7&8 (CH21,CH30,CH38)
VARIEZE POLYURETHANE FUEL LINES
A VariEze builder/flyer recently reported to RAF that while conducting an inspection of his VariEze, he found all of the polyurethane fuel lines in his VariEze were cracked and when he squeezed these lines in his fingers, they crumbled to pieces. This VariEze is 10 years old and has been flown fairly regularly.

He has removed and replaced every piece of the urethane fuel line. This is a serious matter and for that reason RAF is making it a mandatory requirement to carefully examine every inch of urethane fuel line in all VariEze's. Use a strong light to check for cracks or crazing and squeeze the line at the same time. If the normal resilience is not felt, if the fuel line feels stiff or has any sign of checking, cracking or crazing, it should be removed and discarded. Any fuel lines forward of the firewall could either be soft aluminum tubing, using AN fittings, or as an option, could be new fuel compatible clear polyurethane tubing, or transparent yellow Tygon tubing. McMaster-Carr Supply Co. sells both of these products.

Any fuel or vent lines aft of the firewall should be stainless steel tubing or firesleeved aircraft-grade fuel line, such as Stratoflex stainless braiding over teflon tubing with stainless end fittings. Under no circumstances should there be any urethane or rubber hose in the engine compartment and all fuel hoses in this area should be protected by installing fire sleeve.

Section II, General

From CP26-1 (CH30)
Section IIC Lycoming Installation.
When we ran out of this section this fall, we decided to prepare a new edition, incorporating modifications and improvements for the Long-EZ. We have held up final layout and editing on this until Mike completes his Long-EZ dynafocal engine installation. Thus, the new edition will be thoroughly checked for accuracy, but will not be available until at least mid November. If you absolutely need one before that we can xerox you a copy of the old edition, but we strongly recommend you wait for the latest.

From CP27-4 (CH30)
Plans for Installation of Lycoming Engines in Long-EZ
As many of you know, we have not had a Lycoming engine section available since June. Section IIC was written in 1977 by an outfit on the east coast who first developed the Lycoming VariEze installation. We found many fit-related problems with this section when we used it to install the engine on the Long-EZ prototype, N79RA. Also, the Long has a number of major changes involving the fuel system, exhaust system, baffles, dynafocal mount and carb controls. Since it was evident that major changes were needed and that some of them would have to be flight tested, we decided last June to use Mike's Long-EZ to check the changes and to hold up printing the new plans until every detail had been flight tested.

Presently, Mike's engine is being fitted with EGT and CHT probes on all four cylinders to check inlet distribution. By the time you read this all testing will probably be complete. Because of the extent of the revisions, we will be publishing an entirely new section, Section IIL, for Lycoming. Section IIL will be available in early February 1981. As soon as it is received from the printer it will be mailed to those who have a Section IIC on back order.

Some of you Long-EZ builders have purchased, and received a Section IIC before the supply ran out last June. Do not use IIC to install your Lycoming in a Long-EZ. Return your IIC to us, we will replace it with a new IIL at no charge.

From CP37-4 (CH15,CH16,CH23,CH30)
Section IIL - NOTE: The engine installation plans update and supercede information in Section I. Do not do any work aft of the firewall without having Section IIL in your hands. Section IIL also has lots of information on engines, which may help you to make your selection.

From CP38-7 (CH14,CH15,CH16,CH23,CH30)
CAUTION - Long-EZ
Note that the engine section of the plans, Section IIL updates Section I of the plans. Do not do any work in the area of engine mount installation, brake master cylinder installation or anything aft of the firewall until you have Section IIL in hand. Also - do not install the aluminum engine mount extrusions until you have the engine mount at hand and can clamp it to the extrusions while they cure in place. This assures a perfect match of engine mount to extrusions.

Miscellaneous

From CP26-13 (CH30)(Photo caption)
Super immaculate engine installation on Fred Keller's VariEze.

From CP41-7 (CH3,CH30,CH39)
VARIVIGGEN NEWS
We have heard from two Viggen builders this time. Wayne Wilkins reports that his Viggen is rapidly approaching completion, but that although he had high hopes of flying to Oshkosh 1984, it is just too soon. Too bad Wayne, last year we had 3 Viggens at Oshkosh, it would be nice to get a few more all parked in a row.

Arthur Schwartz has repaired his Viggen "Birdie" after his gear failure and subsequent trip off the runway and says that this year he will be at Oshkosh. He plans to fly in the company of his friend Sid Stiber who will be flying his recently completed Long-EZ. We are looking forward to seeing both aircraft at Oshkosh.

We recently heard second hand, of an incident with a VariViggen in southern California. Charles Cowan reportedly took off with a friend from Rialto airport with the intention of visiting the island airport in the sky on Catalina Island. As he overflew the airport at Corona, he experienced a severe vibration, a loud bang and the engine quit abruptly. He whipped his Viggen around and landed successfully on the Corona runway. The Viggen was not damaged, but the engine was shot. **Apparently the cylinder base nuts had worked loose, due to excessive paint on the flanges. One cylinder actually fell off, and the resulting damage essentially destroyed the engine.** This is a potentially serious problem and all of us should check all nuts, bolts and screws on our engines for correct torque.

This VariViggen was dismantled and trailered back to the shop, there builder Bill Campbell did a very thorough inspection of the airframe. No damage was found. However, this inspection did turn up a few cracks in the end grain of the composite outboard wing stub spar. These were caused by shrinkage of the spruce. In this case the exposed end grain of the stub spar had no moisture protection at all and the dry desert air had caused the exposed portion of the end grain to shrink and develop several cracks. The fix was to "wick" warm epoxy into these cracks and paint several good wet coats of epoxy over all of the wood that was exposed.

Wood aircraft are subject to changes in humidity and it is very important to protect every bit of wood by coating it with a moisture barrier. In the past this was usually spar varnish or something similar. We believe that the best possible protection is Safe-T-Poxy. All exposed wood surfaces should be coated with a good moisture barrier. Inspect your VariViggen carefully all over for any signs of wood shrinkage or surface cracking. Sand all such surfaces and coat liberally with Safe-T-Poxy.

****From CP42-11 (CH30)(Photo Caption)****
Bill Durland, working on his engine installation on Long-EZ at Sedona, AZ.

****From CP47-2&3 (CH30,CH33,CH39)****
<u>ARE HOMEBUILTS SAFE</u>?
FAA accident statistics show that per hour flown, a homebuilt is at least three times more dangerous than its general aviation store bought certificated counterpart. We have studied the accident records of these aircraft and have found some specific information that highlights the reasons for this large difference. The reasons are these general categories.

1. <u>Low Flying/Buzzing/Aerobatics</u>
This cause results in a relatively small percentage of accidents for the Cessna, Cherokees etc. We are astounded to see that the <u>vast majority</u> of serious homebuilt accidents fall into this category (3 out of 4 Long-EZ fatal accidents, 7 out of 11 total accidents/ incidents). It seems that the homebuilts are such fun to fly that the pilots take risks that they generally do not take when flying their Cessna 172.

2. <u>Engine/Prop Failure</u>
Engine failures on homebuilts occur much more often than factory-builts, basically because many homebuilders do not apply adequate workmanship in the engine installation. A homebuilder who is not an A and P should get one to inspect his work and better yet, have an FAA designated IA approve the installation as would be required for a certified aircraft.

Note that the 2 categories described are items that you as a homebuilder pilot have complete control of <u>if</u> you fly your aircraft as you would your Cessna and inspect and maintain your power plant as you would your Cessna. Your exposure to the risks of an accident should be as good or probably better than that for the general aviation average. It is a shame that while we see many cases of a homebuilder being spared <u>because</u> he was in a homebuilt (safer stall characteristics and longer glide after engine failure), we still, due to things <u>under his control</u>, find him in a much riskier environment.

****From CP50-4&5 (CH21,CH30,CH33,CH38,CH39,CH41)****
A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally <u>fuel associated</u>. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating from the plans is probably the most common reason. Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. Tony Bengelis' book Firewall Forward is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

From CP57-3,4&5 (CH9,CH30)

SOME REFLECTIONS ON 3 MONTHS OF THE EZ LIFE

On the sixth of July of this year, my Long-EZ N316DB flew. Thus ended some 7 years of anticipation, occasionally very intensely focused work, and an inordinate outlay of cash. And thus began a probable lifetime of very enjoyable flying, occasionally very intensely focused work, and monumental expenditures.

The pressure was on. I had to complete my 40 hours of test flying (all within a 25-nm circle with an airplane of range of about 50 times that) within 15 days in order to make my departure deadline for The Big Trip.

The Big Trip was what had kept me motivated for the previous seven months or so. Back in December of 1987, Sid Stiber (Shelter Island, NY) and Mike and Sally Melvill and I had discussed a tour of the east coast after Oshkosh '88. I had never been to New England, or many of the areas we planned to tour, and so it was the perfect motivation. Plans were set.

And so the Runabout (as I call my Long) and I departed Mojave on 22 July bound for Kansas City. I left early for Oshkosh in order to attend my 10th high school reunion. I climbed directly to 17500 ft and averaged about 165 ktas into (of course) about 15 kt of headwind. As I crossed Colorado, it became apparent that I was going to have to slow down in order to make the trip nonstop. By the time Great Bend, Kansas arrived, I ran the left tank dry, and has about 6 in the right. Playing the fuel flow against the time-to-go (thank you, Alcor and Northstar), I was able to arrive at Johnson County Industrial airport with about 20 min fuel left (2 gal). Total flight time was 7 hours, 50 minutes. The distance was 1180 nm, and I used 50 gallons of fuel. I was, to say the least, extremely pleased. This was the first time that the Runabout had been away from its test area, and it had gone more than halfway across the country nonstop! I was amazed to find that I was not particularly fatigued, and I felt that after a pit stop I could have gone for several more hours.

After several more days of flying around the Kansas City area, I continued to Oshkosh. There the final details of our trip east were cemented. Mike & Sally decided that they would not be able to go after all, so Bruce and Bonnie Tifft, Sid, Dick Kreidel, and I left Wittman Field on Tuesday, 2 August for Montreal (aka the Great White North). Four-and-a-half hours later, the flight of four made a tower-requested low approach at the international airport in Montreal, and landed at St. Hubert's. Kay Kreidel joined us that evening (via airlines) in Montreal. I must say, the people that we met in Montreal went out of their way to make our visit enjoyable. It was, however, still over 450 degrees Fahrenheit outside. Sadly, this was our last experience with air conditioning for two more weeks.

After a quick trip to Burlington, VT to clear customs, we proceeded to Rockland (Owl's Head), Maine. Dick Kreidel hadn't eaten (whole) lobster before, and videotapes of the spectacle are available from Squadron 1. On to Wiscasset (Bath), ME, then to Boston (or is it Bastun?), then the Runabout and I made a ceremonial pilgrimage to Martha's Vineyard and Nantucket islands. The group rejoined at East Hampton airport, where Sid bases his Long. The next day we were joined by Peter Magnuson and his USAF Thunderbird Fighting Falcon Long-EZ. Peter and Dick and I enjoyed flying formation and 1v1v1 combat maneuvers over the coast of Long Island. Then a trip to Mattituck, to visit where Dick's engine was assembled. The next day, it was on to Linden, NJ (New York City) via Central Park, the Hudson River, and the Statue of Liberty (at 500' agl, no less!). Several days were then spent being poached in and around Central park.

Well, so far so good. The return to Kansas City went well (nonstop from Linden to Columbia, MO). It looked like a trivial trip back to Mojave. And then...

Dick and I were descending together into Farmington, NM (our planned fuel stop) when, as if by magic, the Runabout was no longer hitting on all four. We informed the tower of my problem and were cleared to land. We were about six miles out, I guess, and about 4000 ft agl. The engine was still making power (some), but the CHT on the #4 cylinder was way lower than the rest. Nothing in the usual litany of procedures produced any good results, so I pressed on to a high overhead approach to the west. Still high, a lot of slipping, but the airspeed was high on final (about 90 kt). Better to be high than low, but this is silly. The engine won't idle below 1500 rpm or so (on the idle stop). Touch down, no problem, some crosswind but don't notice it, roll out, plenty of brake. Made it. Taxi back, park, shutdown.

Wow, bad day. I got out and went back to look at the engine area. No oil, but the prop is really beat up. Wow, Now what? **Must have broken a valve, and the pieces went out the exhaust pipe and through the propeller.**

But the worst came next. I looked down at the right main gear and imagine my surprise to find the wheel and wheel pant sitting about 90 degrees from where they should be. Much worse news than the engine problem!

So the trip ended with the airplane in a hangar at Farmington, and me riding home in the back of Dick's Long-EZ.

THE FIX
I was all set to get a trailer and take the Runabout apart and haul it home. I envisioned having to take the engine off, flip it over, and put a new strut in. Also, who knew what kind of engine work lay ahead?

Fortunately, I know more rational people. Dick Rutan, who had once trailered his Long home, said that no matter how much work he had to do away from home, he would never trailer his again. Burt said the same thing. Mike was convinced it could be fixed there. So it was.

Mike and I flew to Farmington in his Long-EZ the next weekend with three critical parts. First, a replacement propeller. Second, a new cylinder and all its attendant parts. And the really important one, The Splint.

Mike had made The Splint from some 1/4 inch 4130 steel strap, sort of roughly formed over his right main gear strut. The plan was to remove the axle, bend the strut back straight-ish, and install The Splint to sandwich both sides of the gear strut. The axle then would be mounted outboard of the steel piece with longer bolts.

It worked. We had thought ahead and brought two industrial strength heat guns, and these were mandatory in order to reheat the gear strut to bend it straight, for although the fibers were failed locally, the resin had rehardened to a startling degree.

I should digress and describe the failure more thoroughly. Apparently, I had used more braking than I thought during the landing (due to both landing fast and the high idle speed). Also, the other tire was low, which required more right brake. And I had the shimmy damper adjusted too tight, requiring even more brake. Finally, since the Runabout is a bit on the hefty side, I have the big brakes. More heat. The failure was in an arc, the same size and shape as the brake disk, and the mode of failure was resin burnout from direct heading of the brake disc.

The Splint worked admirably. The cylinder change went without difficulty (the piston hadn't broken, and there was no metal in the screens). In fact, the entire time on-site was less than 24 hours. The next afternoon, the Runabout completed her trip east, a cross-country of well over 6000 nm. She had 89.5 hours on the Hobbs (in less than 60 days).

After returning to Mojave, we repaired the gear strut. A particle board fixture was made for the inboard side of the gear strut, and bondoed in place. A body grinder was used to grind away about 2/3 of the S-glass strut at the bottom, tapering to nothing about 12 inches up the strut. Some dry S-glass roving (see your neighborhood Defiant builder) was wet out on a piece of visqueen and then put in place and mummy-wrapped in peel ply to hold it. The next day, the axle holes and brake cutout were transferred from the inside of the strut to the outside. Then, the inside of the strut was ground away, and more S-glass was put in place, essentially replacing the lower part of the gear strut with new material. The next day, the per-plans torsional wraps were put on, the brake line and relief tube bonded back into place, some bodywork, and Presto! a 3-day gear repair.

The next magical trick was to install a 1/8 thick aluminum plate between the axle and gear strut. This fan-shaped plate extends upward to just above the brake disc, and is intended to protect the strut from the direct radiant heat of the brake disc. The usual Fiberfrax and aluminum tape were reinstalled. The aluminum plate may seem like overkill, but I don't ever want that to happen again.

The prop was sent back to Great American for repair...$120 later, it was fixed.

Anything else? **Oh yes, I replaced the other three exhaust valves with new Superior model 17540 units.** I had so many people tell me how dumb I was not to put NEW exhaust valves in my engine instead of the unknown-history USED valves I ended up using, that you might think I'd have listened. But no. Instead of spending the several hundred dollars up front, I spent them later, plus about 700 more for a new cylinder, a couple of hundred for hangar rent away from home, a hundred more for the prop, and a lot of anxiety dollars for the landing duress and gear malady. But the lessons you learn, huh?
Doug Shane.

****From CP57-14 (CH30,CH41)****
<u>*TIME FOR AN OVERHAUL? TIRED OF LEAD FOULING YOUR PLUGS?*</u>
If you have an O-235-L2C and it is getting tired or fouls its spark plugs in spite of using REM37BY Champions, this may be something to consider.

Light Plane Maintenance, October, 1988, Vol. X, No. 10, page 21, suggests an interesting compromise. You can get rid of the -L2C's tendency to lead-foul spark plugs by having Engine Components, Inc., 9503 Middlesex, San Antonio, TX 78217, 512-828-3131, convert your engine. ECI has STC's to convert your present 7/16" exhaust valves to O-320 1/2" valves and to machine an anti-lead-fouling valve pocket into the cylinder heads. This pocket increases the cylinder volume by approximately 5% which enables you to install the -F high compression pistons without ending up with too high a compression ratio. Your standard -L2C has 8.5:1 compression, the -F has 9.7:1, but the above conversion would give approximately 9.2:1.

According to *Light Plane Maintenance*, "This might offer the best of several worlds: A little higher horsepower (122hp approx.) reduced lead fouling problems and better knock resistance than the 125hp -F engine." You should get <u>more power</u> and <u>longer life</u> out of your O-235-L2C.

This mod is not recommended for the low compression O-235-C2C which does not suffer from lead-fouling and is generally extremely reliable. Also, these older O-235 LYC's do not have crankcase through-bolts. High compression pistons would certainly result in a lower TBO, or worse. Contact Engine Components, Inc. for prices, and keep in mind, with the extra horsepower, you will need one-to-two inches more pitch in your prop. (Submitted by Buzz Talbot, Long-EZ builder/flyer - Thanks, Buzz).

A subscription to *Light Plane Maintenance costs* $72.00 for 12 issues (expensive, but worth it), PO Box 359135, Palm Coast, FL, 32035.

****From CP59-13 (CH30)(Photo caption)****
Long-EZ Pilot's nightmare come true! Joe LaCour's 0-235 engine after dropping a valve. Yes, he did glide back to the airport and greased it on the numbers, prop stopped. It's enough to make you change oil more frequently!

****From CP63-7,8&9 (CH30,CH38,CH41)****
COMPRESSION TESTING
There are two accepted methods of testing the compression in a cylinder of an internal combustion engine. One is the "direct" method, generally used by auto mechanics on auto engines. This method uses a pressure gauge which is connected directly to the spark plug hole and the engine is than turned over with the starter or the engine and is run at idle. The peak pressure is read directly from the gauge. This method works but the results are not as precise as the method know as "differential compression" testing. This method is what is normally used in aircraft engines and requires the use of a tester consisting of two separate pressure gauges, a pressure regulator, a calibrated restrictor orifice, and an on/off valve. (See schematic) A source of compressed air (a compressor with a storage tank capable of a minimum of 100 psi) is required to perform the test. When you buy your differential compression tester, be sure it has a restrictor orifice of .040" (assuming your engine has less that 1000 cubic inches of displacement. An 0-235 has 235 cubic inches, and 0-360 has 361 cubic inches). Your can find several suppliers of good reliable differential compression testers at Aircraft Spruce or Wicks, or even "Trade-A-Plane".

****SKETCH OMITTED****

Continental, Lycoming and the FAA all agree that the compression test should be performed with the engine hot. This assures that you get optimum piston ring and valve seating. In any event, you should try always to use exactly the same procedure with each cylinder and each time you check your compression, if your testing is to give meaningful and comparable results. Careful and regular compression testing say, every 100 hours, can be one of the best, most cost effective preventive maintenance procedures. It is very important that accurate records are kept of which compression reading was for which cylinder! You can read the number of each cylinder at the base of the cylinder. Note that Lycomings and Continentals use a different numbering system.

Remove the top spark plug from each cylinder and, for safety, remove each ignition lead from the bottom plugs. Rotate the prop by hand, in the normal direction of rotation (anti-clockwise for an American engine) until one of the cylinders comes up on compression. You can determine this by placing your thumb over the spark plug hole and feeling for a pressure buildup. Now, install the adapter (normally supplied with the compression tester) in the spark plug hole of the cylinder to be tested. Be certain that the air shutoff valve on the tester is off and connect the differential compression tester. CAUTION: Be absolutely certain the shutoff valve is closed and that you have a firm grip on the tip of one blade of the prop before connecting the system to your source of compressed air.

You will now have to find top dead center on the cylinder being tested. The easiest way to do this is to adjust the pressure regulator to about 20 psi and open the air shutoff valve. Carefully rotate the prop in the normal direction of rotation against the 20 psi pressure until you feel a "flat spot" or rapid loss of turning resistance. If you go too fast, back up beyond top dead center and try again. It is critical that you reach TDC with the prop turning in the normal direction of rotation, not while backing the prop up since this would unseat the piston rings. The piston rings must be at the bottom of their lands in the piston with the piston at the top of its travel.

Now, be certain you have the prop tip securely held. This is a good time to have a second person to help you. The air shutoff valve should be open and the pressure regulator adjusted to show exactly 80 psi on the pressure regulator gauge. Use caution because if you let the prop move in either direction beyond TDC, it will rapidly begin to rotate and it could beat the tar out of the unfortunate person who should have been holding it securely! Now, gently move the prop tip back and forth, just a tiny amount. Watch the cylinder pressure gauge and take a reading from it at its peak steady pressure. Again, this will be while moving the prop in the normal direction of rotation. Be certain that the regulator pressure gauge is holding precisely 80 psi. You should have a differential pressure reading of between 60 and 78 over 80. Repeat this test as consistently as possible on all cylinders.

You should now have a series of numbers something like this, depending on the condition of the engine: 76/80, 74/80, 73/80 and 75/80. These numbers, hopefully, will be fairly close to each other in magnitude. What are the limits? What constitutes a bad (too low) cylinder? It is generally accepted that a cylinder reading below 60/80 would require removal from service. There is no rule or law that says this is the case. In fact, the FAA as well as the two engine manufacturers have no such requirement.

You should probably continue to operate the engine and check the compression every 20 hours or so if the compression is 50/80 or above. Before you remove any cylinder, it would be a good idea to borescope the cylinder. That is, to look inside through a spark plug hole using a light and a special optical device known as a borescope.

A single compression test does not necessarily mean anything. A single oil analysis also means very little. No single diagnostic test should ever be used to decide the health of your engine. The key is to do these tests regularly and keep good records of what you see. Compare each test and make your decision based on several tests conducted over a reasonable period of time.

If you have an abnormally low cylinder, you should start the engine and run it on the ground or even fly around the pattern once. Test it again. If it is still low, use a length of garden hose as a "stethoscope" and listen at the exhaust of the ailing cylinder. If you hear a hissing escape of compressed air here, you have an exhaust valve that is not seating. Similarly, listen carefully with the "stethoscope" at the carb or intake airbox. A hissing sound here would indicate leakage under the intake valve. If neither of these areas is leaking significantly, listen at the breather or oil dipstick/filler tube. A leak in this area is indicative of ring blow-by. This could be ring wear, barrel wear or scoring, or all the ring gaps may be lined up. Hissing between cylinder cooling fins is bad news, possibly a cracked cylinder. Valve leakage is the most commonly found cause of a low cylinder.

The differential compression test has its limitations but it still remains one of the best, most cost effective preventive maintenance procedures available to the builder/flyer. The method described here is simple and it works. Done every 100 hours regularly, you could save big bucks in the long run.

If you would like to learn more about this procedure and many other cost saving tips for keeping your engine in good shape, you could not do better than to obtain a copy of "Top End" from the Light Plane Maintenance Library.

Write to: Light Plane Maintenance
1111 East Putnam Ave.
Riverside, CT 06878

****From CP63-11&12 (CH30)****

CONTINENTAL ENGINE OWNERS

We have heard from several Continental engine owners of a problem they ran into when rebuilding their engines. It has to do with the camshaft. Specifically, the gear on the end of the camshaft that normally drives a vacuum pump or a fuel injection pump. Since most EZ drivers don't have vacuum pumps or fuel injection pumps there is a tendency to remove this little gear and install the camshaft without the gear. This is fine, but if you decide to do this, be aware that it is critically important that you install the 6 small screws that would have held the gear in place and safety wire them together. If you omit this step, you will find to your frustration, that when you start your newly rebuilt engine that you have ZERO oil pressure! This is because the six drilled and tapped holes in the end of the camshaft intrude into the main oil galley in the end of the shaft and it is a requirement that all 6 screws are in place to retain the high pressure oil. You don't need the gear, but you absolutely do need the screws.

Weight Control

****FROM CP24-4 (CH22,CH25,CH30,CH34,CH36)****

WEIGHT CONTROL - Too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap -- if you address each item as, "Oh, that's only one/half pound, it's a small percent of the empty weight", you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?". Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program -- the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transit it will put a lot less stress on your landing gear. Then if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modifications.

****From CP27-4 (CH22,CH30,CH34)****

IMPORTANT WEIGHT INFORMATION - LONG-EZ

The most disappointing thing about the VariEze experience has been the general lack of adequate weight control by most builders. It is necessary to use diligence in controlling and eliminating each gram in order to avoid an undetected growth of many pounds. It is a reliable prediction the many Long-EZs will be built over-weight and be limited to short range or single-place operation. An equally reliable prediction is that many Long-EZs will be built with little equipment, careful weight control, and will be considerably lighter than those now flying. They will enjoy a high useful load, great takeoff and climb performance and unexcelled range.

The following information is a complete analysis of the actual weight of Mike and Sally's Long, N26MS. If you are building a Long, it is very important that you study all this information before you plan your equipment installation that you be aware of the weight impact of any additional equipment. N26MS has excellent structural workmanship, thus, most airplanes with less attention to good layups will probably be heavier than the data shown below. Study the table below. Note particularly the magnitude of the additional equipment.

N26MS was built with two conflicting requirements that added considerably to its empty weight: (a) full electric start with large alternator, and (b) pilot weight of only 108 lbs. using no temporary ballast. While the heavy electric (number 4) and ballast provisions (number 7) had the major impact on their heavy final empty weight of 883 lbs., their utility has not suffered as much as one might think. The reason is the total weight of Mike and Sally is only 263 lbs.. Thus, using the 1425 gross (owners manual page 30) their allowable fuel load is 46.5 gallons giving 1,000 mile range at 75% or 1,550 miles at 40% power, with reserves. Their allowable fuel load at normal gross is 29.8 gallons. Consider this same airplane with two 190 lb. adults as crew and without the then unrequired number 7 ballast provisions. That situation leaves only 207 lbs. (34.5 gallons) fuel for a range at 75% of only 700 miles, with reserves, or 350 miles with a 1325 lb. take off. Obviously, with that 360 lb. crew weight strong consideration should be given to using the electrical system in number 2 <u>and</u> eliminating as many items as possible in number 6, and 8, to provide the high utility and long range available with the Long-EZ.

We encourage everyone to use the light electrical system as in number 2. This is the one installed in the RAF prototype N79RA. Then, add only the equipment you absolutely need and diligently refrain from seemingly - "small" additions.

Note that it is possible and advisable to have the Nav, Com and transponder with the small alternator and have an empty weight of less than 720 lb. However, if you front-seat pilot weight is less than 170 lb., you should use the 25 AH battery in the nose and accept the 19 lb. increase. This will be needed anyway to balance the aircraft. Also, if you are a very light pilot (less than 150 lb), be prepared to suffer a large penalty in empty weight if you want to install an electric starter. The starter, ring gear, alternator, brackets etc. mount way back at station 150+ and will require nose ballast for light pilots.

If you are successful in obtaining an empty weight of less than 730 lb you can fly two 180 lb people with the full 52 gallons of fuel and attain over 1800 nautical miles (2070 sm) range at economy cruise - a feat considerably in excess of any other light aircraft.

<u>LONG-EZ EMPTY WEIGHTS BASED ON N26MS</u>

1. BASIC EMPTY WEIGHT (BEW) VFR instruments plus g meter and turn/bank gyro. No starter and alternator, graphite cowling. All equipment and components per plans. Conical engine mount and ram inlet. No avionic, cabin heat or lights. Small motorcycle battery to power warning system and fuel pump.	693.4 lbs.
2. BEW plus the small alternator (see CP 26), including wiring and regulator (4.9 lbs.).	698.3 lbs.
3. Number 2 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	713.7 lbs.
4. BEW plus standard 60-amp alternator, starter, ring gear, belt, brackets, mounting hardware, regulator, wiring, relays and 25 AH battery (68.5 lbs.).	761.9 lbs.
5. Number 4 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	777.3 lbs.
6. Number 5 plus additional equipment on N26MS including: 500 x 5 tires, dynafocal mount, NACA inlet, landing light, Nav lights, strobe lights, cabin heat, relief tubes, primer, intercom and stereo tape player (38.1 lbs.).	815.4 lbs.
7. Number 6 plus provisions to allow Sally (108 lb. pilot) to fly at cg=102.2 (1.8" fwd of aft limit). Includes a second 25 AH battery, wiring and switches to use the second battery, and 15 lbs. of lead permanently installed in front of NG 31 Bulkhead (44.8 lbs.).	860.2 lbs.

8. Number 7 plus some extras added because they were nice and "didn't hardly weigh anything". Misc. ranging from small covers and aluminum knobs, to heavier upholstery and different fuel caps (12 "small" items 22.8 lbs.). 883 lbs.

****From CP48-2&3 (CH30,CH34)****

LECTURE TIME! EXCESS WEIGHT/WORKMANSHIP

We have not had a weight lecture in a long time, so please bear with us! We have seen quite a number of airplanes and parts of airplanes recently, and there are a couple of things that are showing up. The good news is that the average workmanship (glass work) is good, much better than it was a few years ago. We still see an occasional example that makes us wince, but generally, the quality of glass layups is very good.

The bad news is that most builders, VariEze and Long-EZ, seem to have lost the incentive to build light airplanes. We see heavier and heavier examples. 700 lbs. VariEzes and 950 to 1000 lb. Long-EZs!! This is very bad, guys. **Perhaps this is in part due to the tendency to put bigger and bigger engines in these airplanes?** Whatever it is, keep in mind it is a snowball, the heavier you build, the more it takes to make it go and the heavier that makes it! There is no way to get ahead taking that route. The solution is to be very conscientious about weight all the time while building.. Resist the temptation to add "fru-fru", unnecessary items that just add weight.

We have flown dozens and dozens of examples of both VariEzes and Long-EZs. Without exception, regardless of engine/HP installed, the lightest examples are always the best flying, most fun to fly.

Keep in mind that the prototype VariEze N4EZ weighed 594 lbs. and the prototype Long-EZ weighed 790 lbs. (and this airplane had a 50 lb. center-section spar due to the "plug-in" wings it had when first flown!). There are a number of EZs flying that beat these numbers easily. A 1,000 lb. Long-EZ is like flying the prototype all the time with a 200 lb. passenger on board! Regardless of the engine/power installed, it is still more fun to fly the prototype and much, much more economical!

Engine Selection

****Also see CP48-2&3 in the "Weight Control" section of this chapter.****

****FROM CP24-4 (CH30)****

ROTORWAY RW-100 UPDATE

You may have noticed that Rotorway has, once again, started their advertising blitz alluding that the RW-100 is now approved for the new Long-EZ. We understand there have been some changes in the engine and some further testing. However, we have not seen, nor do we have any first hand information on the engine as it is now. The advertising mentioning the Long-EZ/VariEze was done without our knowledge or consent and until we have had the opportunity to evaluate/test the engine first-hand we cannot recommend its use in any of our aircraft. We encourage new engine development and wish Rotorway success in their efforts. When the RW-100 is approved for Long-EZ/VariEze use it will be reported in this newsletter.

In our attempt to gather information on the acceptability of the Rotorway engines, we have been trying to access the reliability and maintainability of the helicopter version of the engine. If you know of a Scorpion owner willing to discuss his engine service record, please let us know his address so we can contact him. All information will be in confidence, we merely want to compile data on the engine's reliability.

****From CP25-1 (CH30,CH37)****

DICK AND MIKE'S LONG-EZ's By Mike Melvill

We like the Long-EZ so much that Dick and I decided to get together and build two of them. We rented a building, fabricated a couple of tables, the wing jigs and centersection spar jig and ordered complete raw material kits from Aircraft Spruce and complete prefab parts from Ken Brock. We picked up the parts and materials on June 14th. Since this is our own project and we are doing it as a recreation and hobby type thing, we only work on them during our spare time, after work and weekends. Today, 12 days after receipt of kits, we have two fuselages assembled and glassed on the outside with speedbrakes and are laying out centersection spar parts. We are building them as quickly as possible, as we both want them for economical transportation machines, and we would like to have them flying as soon as possible. Neither of them will be "Grand Champion Quality" by any stretch of the imagination, rather they will be "plain vanilla" Long-EZ's built as light as possible to be flying as soon as possible. **I have obtained an engine already, a Lycoming O-235 L2C, 118 hp at 2800 rpm out of a wrecked Cessna 152.** Unfortunately this engine is not ideal for a Long-EZ in that it does not have a fuel pump, and does have a full-flow spin-on oil filter. The filter projects 1" into the centersection spar, and a fuel pump is mandatory on a Long-EZ. I am currently looking for an O-235-C accessory case! The O-235 L2C come as above only from Cessna 152's. The same engine from a Piper Tomahawk or Grumman trainer is fine and does have the fuel pump. Dick is still looking for an engine for his Long-EZ. We will continue to report progress on our two Long's in future Cps.

From CP25-2 (CH30)

MECHANICAL FUEL PUMP FOR LONG-EZ

The Long-EZ fuel system must have a mechanical fuel pump. The gravity fuel system used on the standard VariEze will not work on the Long-EZ. Most O-235 Lycomings and the Rolls Royce O-200/O-240's have pumps. The Continental O-200 and some Lycoming O-235's that came out of the high wing Cessnas don't have mechanical fuel pumps nor are the cases machined to accept them even if you had a pump in hand. So if you are looking for an engine be sure it has a mechanical pump. However, if you have a "blue" high wing Cessna engine you can adapt a pump by one of the following methods.

1. The most preferred method is to have the cases machined and install the cams and push rods as necessary to convert it to a standard mechanical fuel pump configuration. Check with a certified engine overhaul shop for the conversion. This method requires total engine tear down. The machining and parts are expensive. If the engine is in for overhaul have the modification done before reassembly.

2. We have been told that a Thompson Vane Type pump series # TF1900 will mount on the vacuum pump pod and provide the necessary fuel pressure. But we have not tested it. The pump is a standard aircraft pump with A.N. fittings but must be adjusted back to a lower 2-8 psi pressure. The pumps are somewhat expensive, but available. Contact Dick Davy at Precision Aero, 2749 E. Wardlow Road, Long Beach, CA 90801, (213) 595-6377 for the Thompson pump.

3. We are working with Rex Taylor from H.A.P.I. V.W. engines to adapt a Volkswagen fuel pump to run off the vacuum pump pad. We have a prototype of this conversion in service test on N4EZ and it's working satisfactorily at this time. However, the V.W. pump has automotive fuel lines, not aircraft A.N. fittings. This will be the least expensive method. Rex is also working up an adapter to run a standard aircraft AC fuel pump off the vacuum pump pad. You can contact Rex directly by calling (714) 357-6342. Note: This method is still in the development stage and may not prove satisfactory. We should have something more definitive next CP.

From CP26-2 (CH30,CH36)

LARGER ENGINES FOR LONG-EZ?

A number of builders have asked if it is feasible to install the 160hp Lycoming O-320 engine in a Long-EZ. At this time we must respond that this installation is definitely not approved. In order to approve this we would have to do a new structural analysis and possible beef up of a large portion of the airframe, install the engine, then conduct new tests to confirm structural adequacy and to develop the cooling, induction, vibration, exhaust, propeller matching, expansion of aerodynamic envelope, etc. Unless these tests and development are done it would not be known if it were feasible, much less recommended.

A larger engine will make the airplane tail heavy and lower the useful load. Higher horsepower would result in a small increase in speed and a large increase in climb. However, the Long-EZ's ceiling of over 19000 ft at gross and demonstrated 27000 ft at light weights, makes it the last light plane that needs better climb! Lycoming engines have their best fuel efficiency at about 70% power. If an O-320 were throttled down to 51% power, to cruise at the same cruise speed as the O-235, it would burn more fuel than the O-235. The calculated comparison below shows that the O-320 saves only 18 minutes on a 500-nm trip, but costs $9.11 more in fuel. This is over $30 cost per hour of saved trip time.

	115hp O-235	160hp O-320
75% power cruise	161 kt	179 kt
75% power fuel flow	6.7 gph	9.32 gph
Nautical mi/gal @75%	24	19.2
Nautical mi/gal @127kt	37.3	36
Range @ 75% power (45 min reserve)	1150 nm	920 nm
Flight time-500nm trip	3 hr 6min	2 hr 48 min
Fuel cost-500nm trip	$36.46	$45.57

From CP27-5 (CH30)

Continental O-200 Engine for Long-EZ?

As you have read in recent CP newsletters we are strongly recommending the Lycoming over the Continental for the Long-EZ. This is not to say the O-200 will not work - its installation is well-tested in VariEze airframes and, with the addition of mechanical fuel pump should operate well. However, with the O-200 you may find it a difficult and expensive modification to adapt an approved mechanical pump. Also, you will not be taking advantage of our recent development effort the last six months in refining and flight testing all the components in the Lycoming installation (Section IIL). If you have an O-200 you might consider trading it up for an O-235. O-200's are bringing an excellent price now days.

From CP28-2 (CH22,CH30,CH36)

26MS - Mike and Sally's Long.

Currently we have 85 hours on our Long and it is literally running like a Swiss Watch. We are truly delighted with it in every possible way. We have been using it to commute to work every day for the past couple of months. From Techachapi to Mojave by road is 26 miles, about a 30 minute drive. It takes between 8 and 12 minutes in the Long, depending on the winds. We use two to two and a half gallons for the round trip. This is almost exactly what we use in our Honda Civic car. Besides the time saved the biggest thing is the 'fun' factor. There is a lot of enjoyment in flying across the desert in the early morning with glass smooth air, no traffic and the stereo tape deck playing in the head phones. Coming down-hill in the morning, we usually fly at very low power settings. The quiet, smooth exhilaration really makes it enjoyable to come to work.

All flight tests, engine break in etc., have now been completed. All systems work perfectly. The Radair comm, nav, and transponder work very satisfactorily. The Sigtronics intercom and audio switcher work excellently in conjunction with our stereo tape deck. This also gives us the capability to transmit from either cockpit. The newest piece of equipment recently installed is a Silver Fuelgard. This small instrument accurately reads out fuel flow in gallons per hour and you can look at fuel used with a momentary switch. This fuel flow meter is a TSO'd instrument and uses a flow-scan transducer. We installed it in the fuel line so that all fuel on board runs through it. It is accurate within +- 2 percent. So far it has verified the Owners Manual fuel flow information very closely. N26MS will burn 1.9 gallons per hour at minimum power required for level flight at 8000 ft (max endurance) and at 75 percent at 7/8000 ft it reads 6.7 gph. Take off, full rich at sea level is a shock, 11.7 gph!! On a recent cross-country, we went to Northern California, a straight line distance of 404 nm (471 sm). On the trip up north we had a ferocious head wind of 29 kt (33 mph) so we ran at approximately 70 percent power at 8500 ft for a fuel flow of 6.4 gph. This gave us a ground speed of 130 kts (150 mph) with a true airspeed of 159 kts (183 mph). Our time enroute was 3.1 hours and we used right at 20 gallons of gas. By contrast on the return trip we had a tail wind!! We climbed to 11,500 ft, where the tail wind component was 35 kts (40 mph). It took some will power, but we pulled the power back to approximately 48 percent which gave us a fuel flow of 4.4 gph, and a true airspeed of 133 kts (153 mph) which, with the tail wind, had us crossing the ground at 168 kts (193 mph). The time enroute was 2.4 hours and we burned a total of 10.6 gallons of gas! I honestly believe that a Long-EZ built to the plans will consistently give these kind of results. The airplane is incredibly comfortable, reasonably quiet, particularly with David Clark headsets, and is an honest to goodness, economical, high speed touring machine, with good baggage capacity, excellent high altitude capability and unbelievable range. All in all, looking back at the intensive effort required to build it, it was well worth it!! The Long continues to delight us, Sally takes it to her 99's meetings, I have been into terminal control areas, we have flown it quite extensively at night. We have flown over mountains, over ocean (to Santa Catalina) and it is just super. **The Lycoming O-235-L2C has continued to run like a dream and to be honest, I have no regrets. If I had to do it again, I would build it exactly as we did, using the same engine.** The only thing I would not recommend is the electrical system we have. The engine came with a 28 volt starter and alternator, and all the electrics on the airplane are 12 volt. We have got it working, but it was simply too much hassle for the average builder to have to put up with, when you don't have to. N26MS will be here at RAF on a daily basis, and we plan on attending most of the flyins, including Watsonville and Oshkosh.

From CP28-5&6 (CH30)

How much Power?

One of the basic functions of the aircraft designer is the sizing of the aircraft such that the selected powerplant is correct. An engine too-small for the aircraft results in inadequate climb in high-altitude summer conditions or an unacceptably long takeoff roll. Too large an engine is wasteful of fuel because either the high cruise speed is at an inefficient flight condition for the airframe (low cruise lift-to-drag ratio), or the engine itself is inefficient when throttled back to obtain the speed for a good lift-to-drag ratio.

If a designer attempts to select an engine for optimum cruise efficiency, i.e. at a flight condition for maximum miles-per-gallon he finds the engine inadequate for climb. This situation is not unlike that of the automobile designer who finds his vehicle is cruised at a speed far in excess of that for the best mpg. However, the designer knows that the airplane should not operate at best L/D (or best mpg) anyway, since this is not practical unless you are setting a distance record. Increases in speed above but near the best mpg speed result in only small losses of mpg. But, as the speed increases considerably above the best mpg condition, the mpg drops drastically. The big question, then, is how fast should you really fly? If this question can be answered, then the designer can size the engine for this practical speed.

Aerodyanmicist, Dr. B. H. Carson of the U.S. Naval Academy has published an excellent analysis of the fuel efficiency of light planes (AIAA publication 80-1847) and has presented theoretical rationale for practical cruise efficiency. His interesting technical treatise is beyond the scope of this article, but the summary of findings is of interest to pilots. Rather than focusing on the cost per distance (mpg), he finds the speed that gives the minimum cost per speed. This "cruise optimum" speed corresponds to minimum outlay in extra fuel (over best mpg) per increment in additional speed. This speed corresponds to the closest approach of the airplane to a "technology barrier" of efficiency proposed by Gabrielli and Von Karman in an article "What price speed?" published in Mechanical Engineering Vol. 72 October 1950.

This "cruise optimum" s ed, at 32 percent over the speed for best mpg, results in a 16 percent increase of total fuel used, requiring a 52 percent increase of power and saving 24 percent of flight time. This speed is regarded as the most productive use of excess fuel for cruising. The pilot should consider it his best "economy" cruise speed.

Accepting this theory, lets see what the resultant engine size is for the Long-EZ. At 8000 ft. altitude and 1325lb. weight the "cruise optimum" speed is 139 kt. (160 mph) and required 47 thrust horsepower (55 brake horsepower). This is a power setting of less than 48 percent power when using the 118 hp O-235 Lycoming. This suggests that, for 65 percent power cruise (to allow operation at lean side of peak EGT), the ideal engine for a Long-EZ should have 86 BHP. However, here is where the theory breaks down. The "Long" is a fast aircraft for a fixed-pitch prop application. Thus, with the low prop efficiency at slow speeds, it requires a 100 BHP engine for satisfactory take off performance.

The larger engines, 160 BHP for example, are wasteful of fuel at any speed. This is because specific fuel consumption (SFC) increases as the engine's power is reduced below 75 percent. The accompanying graph obtained last month shows this trend. Data are for best economy setting, about 50 degrees F on lean side of peak EGT.

If a Long-EZ is cruised at "cruise optimum" speed, its O-235-L2C engine will bum 8 percent less fuel than would an O-320-B at the same speed. (48 percent power for the O-235 and 36 percent for the O-320). If both engines were run at 65 percent power the O-320 would burn 22 percent more fuel than the O-235 for a given trip.

The following table shows data from a computer printout using the performance parameters for the Long-EZ, and assuming sfc equal 0.5.

Long-EZ weight equal 1325 lb.
Sea Level. * denotes 8000 ft.

Data for sfc equal 0.50

True Speed Knots	Indic Speed Knots	Req'd THP HP	Induc THP HP	Prop eff Percent	Req'd BHP HP	Fuel Flow GPH	Naut Miles/ Gallon	L/D Ratio
90	90	21.8	7.7	65.7	33.2	2.76	32.58	16.8
100	100	26.2	7.0	70.7	37.1	3.09	32.34	15.5
110	110	32.0	6.3	74.9	42.7	3.55	30.96	14.0
120	120	39.1	5.8	78.5	49.8	4.15	28.94	12.5
130	130	47.7	5.4	81.3	58.6	4.88	26.62	11.1
140	140	57.8	5.0	83.4	69.4	5.78	24.23	9.9
150	150	69.6	4.6	84.6	82.3	6.86	21.87	8.8
160	160	83.2	4.4	85.0	97.9	8.16	19.61	7.8
170	170	98.7	4.1	84.6	116.7	9.72	17.49	7.0
180	180	116.2	3.9	83.4	139.3	11.61	15.51	6.3
*90	79.8	20.9	9.9	65.7	31.8	2.65	33.97	17.5
*100	88.7	24	8.9	70.7	34	2.83	35.33	16.9
*110	97.5	28.2	8.1	74.9	37.6	3.14	35.08	15.9
*120	106.4	33.5	7.4	78.5	42.7	3.56	33.71	14.6
*130	115.3	40.1	6.8	81.3	49.3	4.11	31.67	13.2
*140	124.1	47.9	6.3	83.4	57.4	4.78	29.26	11.9
*150	133	57	5.9	84.6	67.4	5.61	26.72	10.7
*160	141.9	67.5	5.5	85	79.5	6.62	24.17	9.6
*170	150.7	79.6	5.2	84.6	94.1	7.84	21.69	8.7
*180	159.6	93.2	4.9	83.4	111.8	9.31	19.33	7.9
*190	168.4	108.5	4.7	81.4	133.3	11.11	17.11	7.1

GRAPH "FUEL SPECIFIC AT BEST-ECONOMY MIXTURE" OMITTED

From CP29-3 (CH30,CH36,CH39)
ACCIDENTS
Power Loss - A south eastern VariEze crashed into trees after power loss on its first flight. **The power plant was a conversion of a Chevy Corvair automobile engine.** The aircraft was destroyed. The pilot was not injured.

From CP29-8 (CH30)
Several builders have enquired about using the Rolls Royce 0-240. We have never tested this but it should be an excellent engine for the Long-EZ. It is certificated for use as a pusher, it comes standard equipped with a mechanical fuel pump and weighs 246 lbs. complete with starter and alternator. The only drawback that is immediately obvious is that the induction system comes up over the top of the cylinders which will necessitate a blister on top of the cowl on each side. We should see one or two installed in Long-EZs within the next year or so, and we will publish any data we get in future CPs.

From CP32-4 (CH30)
LYCOMING 0-235 ENGINE INSTALLATION
If you bought a new engine from Avco Lycoming and specified it for a Long-EZ, your engine should be set up correctly for an oil cooler and a standard oil screen housing, not a full flow oil filter, which will not fit.

Those builders who purchase a used engine should check the following items: If you have a full flow spin on oil filter, it must be removed, so must the AC adapter that is bolted to the accessory case. There is a thin aluminum plate between the AC adapter and the accessory case, this must also be removed.

Now you need to purchase a standard oil pressure screen housing, Lycoming Part #68974, and oil screen, Lycoming Part #62817, and a gasket for the screen housing, Lycoming Part #61173.

The assembly should be bolted to the accessory case, and your oil temperature probe installed in the tapped hole in the aft end of the screen housing. If you install an oil cooler, you will also need to purchase a spring, Lycoming Part #69436, a plunger, Lycoming Part #62415, and a gasket Lycoming Part #STD-294. The plunger and spring should be installed under the large plug screwed into the top left of the accessory case. Not all accessory housings have this port. However if housing is machined for cooler it is provided. The plunger and spring are required if you have a standard oil screen and housing and an oil cooler. The plunger regulates oil to the cooler (oil cooler bypass).

There is another option available and it is an oil screen housing with a thermal valve assembly port built into it, together with a tapped hole for your oil temperature probe. This housing is Lycoming Part #69510, screen is Lycoming Part #62817, and thermal valve assembly is Lycoming Part # 75944.

If you choose to use this screen and housing you must not install the plunger and spring (#62415 and #69436). This is a situation with either one system, or the other, never both. If you choose not to install an oil cooler, you need only to install the standard oil screen and housing (#62817 and #68974). You should install the plunger and spring, or the thermal valve assembly and housing. However, your oil temperature will run hot, close to or at the red line, which means excessive wear in your engine.

****From CP32-4 (CH30)****
0-235 L2C Engines From Cessnas 152s These engines do not have provision for a mechanical fuel pump. The fuel pump is mandatory for a Long-EZ, so you either have to get your accessory case machined (Avco Lycoming will do it and so will Air Engines, Florida) or buy an accessory case from any 0-235 that is already machined. Be careful about using an accessory case off an 0-320 or 0-360. While these parts will bolt on perfectly, they may not have the correct oil ways machined into them to lubricate the idler shafts. Again Air Engines, Florida can do this for you. You will also require a timing gear with the cam lobe on it and a pushrod.

****From CP36-4 (CH30)****
FROM THE BUILDERS
Don Foreman from England (one of the builders of the first VariEze (G-LASS) to fly in the UK), is about ready to fly his Long-EZ (G-RAFT). Don has installed a Continental O-240, 130 hp. by Rolls Royce. His empty weight is 847 lbs with starter and alternator. As of this date (April 14) Don has run his engine and will be at the airport within two weeks for taxi testing and flight testing.

****From CP36-6 (CH30)****
L/E: Accessory case machining for fuel pumps/oil coolers. Vance Atkinson went to Hankcock Industries, 2551 Willow Street, Long Beach, CA (213)424-3795. This is a small father/son shop. They do good work at reasonable prices.

****From CP37-3 (CH9,CH21,CH22,CH30)****
Long-EZ builder, T. Dinneen has the following suggestion for obtaining an engine for your Long-EZ. He paid $7,500 for a 1978 Tomahawk in good flying condition. Not only did he get an airplane to fly and stay current in, but he also got:

1) **A Lycoming 0-235 L2C engine complete, including a mechanical fuel pump with 920 hours total time**
2) A full gyro panel and instruments
3) 500 x 5 wheels, tires, brakes, axles and master cylinders
4) 720 channel com, Nav and VOR head
5) Transponder
6) Nav lights/strobe anticollision light system
7) ELT and seat belts
8) Circuit breakers, engine instruments and battery
9) Fuel plumbing, fuel valve, electric fuel pump etc.

In addition, he figures he can sell the airframe for about $1,000.00 after he has 'gutted' it. This means he has laid out $6,500.00 for the lot. On top of that you can bank finance the whole deal. Check Trade-a-Plane for "deals" on Tomahawks!

****From CP38-11 (CH30)(Photo Caption)****
Don Foreman's beautiful Long-EZ ready to go to the airport. This is the first Long to fly in England and it has a Rolls Royce O-240, 130 hp engine!

****From CP43-2 (CH3,CH30,CH35,CH41)****
HOMEBUILDER RESPONSIBILITY
Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you the homebuilder should be aware of what you are taking on when you build your own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft, is in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues a airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meetings, talk with other EZ builders. Many good books are available from EAA. Supplement your plans with a few, such as Tony Bingalis' "Firewall Forward". After you have got something built, get as many people as you can, to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them only from the recommended suppliers.

The same philosophy is also true for engines. Almost daily we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ we recommend any model of the Lycoming 0-235. If you wish to install some other engine, please do not call us. We can not help you. As an experimenter, you can of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You the builder have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what material, power plants, etc. go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials and therefore cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer, is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

From CP44-3 (CH30,CH33,CH36)

WARNING

We have recently learned that some Long-EZ operators have been attempting to overextend the intended capability of the aircraft by installing larger engines than the O-235 and/or by attempting overweight operation. These practices are hazardous and cannot safety be conducted on the aircraft. A re-design to allow this operation would not be just a simple replacement or beefup of a few components.

A major development for adequate airframe/propulsion mounting/landing gear/brakes would be required, as well as wing area increase to meet reasonable energy limits for forced landing. In short, you would be talking about a new aircraft and a new test program.

Overweight operation will definitely result in structural problems with landing gear, brakes and possibly airframe.

From CP46-2&3 (CH13,CH19,CH30,CH33,CH36)

HOMEBUILDER MODIFICATIONS

Recently we have noticed a trend towards homebuilder modified Long-EZs, particularly the long nose and heavier engines. These are not RAF approved modifications and we are concerned that most pilots may not be aware of what they could possibly be getting into. First of all, the longer nose IS destabilizing in pitch as well as directionally (yaw). How much of it may influence your particular airplane is not known. We believe you as the pilot should know just how stable your own airplane is. We strongly recommend to anyone who has modified their own aircraft in this way, that first of all you should install vortilons on the main wings. The vortilons allow a little more stall margin. Secondly, you should put on a parachute, and climb to at least 10,000 feet above the ground and at that altitude, you should fully explore the stall/full aft stick characteristics of your airplane. Do it first at a mid cg position, then ballast to the aft limit, (103") and do it again. In this way at least you will be aware of any possible unpleasant stall behavior or unstable tendency, and you would be a lot less likely to later discover any nasty trait at low altitude with no margin for a safe recovery.

We are really concerned when we hear that a particular builder has done a major modification to his airplane. For example, a larger, heavier engine and a longer nose. Then he goes out and flies it for a few hours and then tells all the builders in his area what a neat thing he has done. Now some of these builders decide, based on his results to do the same thing. Meanwhile, the original experimentor never did test his airplane at aft limit cg, at full aft stick, with aggravated control inputs, or at the red line or at limit g so he never knew for a fact that his airplane was safe. Another builder, influenced by the first experimentor makes similar changes, goes out and while demonstrating the much touted stall characteristics to a passenger, enters a deep stall condition at low altitude, does not have enough room to recover, and so he and his airplane become another statistic and make not only the Long-EZ look bad, but also puts a blot on the accident record of all homebuilts.

To sum up: If you must make changes to your aircraft, keep in mind that you now have a different airplane than the original plans built Long-EZ prototype. Your new design may have perfectly safe aft cg, high angle of attack flying characteristics, but it may also have unsafe, nasty characteristics, just waiting to bite you at an inopportune time. To protect yourself, and any future passenger you may take for a ride, 1) you should install the vortilons, 2) you should thoroughly test your airplane at aft cg, high angle of attack (full aft stick) with aggravated control inputs. If your airplane does not handle well, limit your aft cg. You do not have to go back to the published limit. If you are not comfortable at 103, try 102 or 102.5. If it is good there, limit it there, note it in your log book, placard the airplane, and don't ever exceed this (or any other) limitation. Remember, each Long-EZ, or any other homebuilt design, is different. Don't assume because Joe Blow did it and was safe, that you will be. You may not be and that really can take the fun out of the whole project. Don't ever lose sight of the fact that, that is what this whole thing is about - having fun!! FLY SAFE AND ENJOY.

From CP50-5&6 (CH3,CH30,CH40)

MAJOR CHANGES - YOU AND THE FAA

Quite a number of EZ builders have been making "major" changes to their EZ's and not working with the FAA, either because they don't realize they are required to or because they don't realize that what they have done is a major change. A classic **example is an engine change to a larger engine.** Now RAF cannot recommend a change such as this, but we don't like to see our builders getting into trouble.

If you decide to make such a change after you have already had the airplane licensed and signed off, you must contact your local FAA and work with them to keep yourself and your aircraft legal. "Who will ever know?", you may say! "We did not even change the cowling.", you say! Well, here is the straight skinny. As soon as your make a major change as defined by the FAA, your airworthiness certificate is automatically invalid. Worse than that, your insurance is also invalid.

If you should have an accident that would damage someone else's property, your insurance will not pay - you or your survivors will pay. That could be a really nasty problem. On top of that, the FAA takes a very dim view of this sort of thing and they will prosecute you. The penalty is not some little thing to laugh off, either. The fine is $1,000.00 per flight!!

As you can see, very obviously, it is not worth the risk, especially since it is so easy to comply and keep everything above board and legal. All you have to do is to inform your local FAA what it is that you are planning to do. They in turn, will issue you a new, temporary, airworthiness certificate which will again limit you to within a 25 mile radius of your airport for a certain number of hours. Normally, this will be from 5 to 25 hours depending on the change and on the local FAA official. After you have successfully completed your test flying in the local area, or have flown off the hours, the FAA will issue a new "permanent" airworthiness certificate, and you are back in business, and your insurance is valid.

Do yourself and the homebuilt movement a favor, comply with the regulations and keep yourself and your airplane legal. It is an inconvenience and may take a week or two but, in the long run, you will be much better off and you may save yourself or your family untold grief.

From CP53-7 (CH30,CH35)

USERS OF ROTORWAY RW-100 ENGINES - John S. Derr is forming an association for those EZ flyers who are using the above engine. Please send your name, address, daytime and evening phone numbers, serial number of engine, type of plane and status of project, any photos or written material you would like to share. If John gets enough response, he will underwrite the first issue of a newsletter. John is a professional scientist and is used to gathering data and presenting it in a reasoned way.

If you have a Rotorway engine and are interested in such a newsletter, contact: John S. Derr
706 Partridge Circle
Golden, CO 80403

From CP55-3 (CH9,CH30,CH37)

Excerpt from Ivan's letter to Mike Melvill

"Dear Mike,

Please find enclosed a photograph of my latest project, the Shaw "TwinEze", thought you may be interested.

G-Ivan started life as a VariEze that I built in 1980-81. After 350 happy hours flying, I decided to convert it to a Long-EZ then, inspired by Starship, got carried away with twin engines and retractable gear.

The engines are British fully certified units - three cylinder, inline, water cooled, two strokes giving 77 bhp at the prop. They were designed and built my Mike Hewland for the ARV Super Two aircraft. Both engines have completely separate systems, batteries, etc. and left fuel tank feeds left engine, right feeds right.

To date, I have completed approximately 10 hours flying with the only problems being getting the cooling air to go where I wanted it to go and some fuel vapour (sic) locking that has only been completely cured by running on 100LL instead of MOgas. The good news is that it flys superbly, just like the Long-EZ, the noise level and vibration is less. Control on a single engine could not be easier, 350 fpm climb and a VMCA wings level of 56 knots on the critical engine. I have not opened up the envelope speed-wise yet but one thing I am sure of and that is it's going to be fast. The main gear is a retractable unit of my own design that tucks the wheels aft through 115 degrees to where the engine used to be, it is powered by hand hydraulic.

The technical challenge has been everything and more that I expected. The bureaucratic hassle has been something you have to live through to believe. After static load testing the aircraft to 5 g's, gear drop tests to beyond FAR part 23 requirements, engine mount static load test, 25 hours of ground running, taxi, runway hops, my approved inspector clearing it as airworthy, after all this, it took a further six months to get permission to commence a test flight program. I was actually told that I could not do this because, "it has not been done before". What a sorry state of affairs for a country that once led the world in innovation.

My flight testing continues. I will keep you updated on my progress.

Thanks, Burt, for the inspiration,
Ivan Shaw"

From CP55-11 (CH9,CH30,CH37)(Photo Caption)
Ivan Shaw's Twin-Eze, a modified VariEze/Long-EZ retractable twin.

From CP59-13 (CH30)(Photo caption)
Bayard DuPont's Defiant - What in the world engine is that? A radiator, too - surely not.

Firewall/Fireproofing

Also see LPC #131 in the "Long-EZ Plans Changes" section of this chapter.

From CP25-4 (CH4,CH15,CH30)
FIREWALL - LONG-EZ AND VARIEZE
We now approve the use of fiberfrax (a space age ceramic material) as a replacement for asbestos. Since fiberfrax is as good a fire barrier as stainless steel, we approve substituting .016 2024 T-3 aluminum for the stainless. This saves almost 2 lb at the firewall. Both Wicks and Aircraft Spruce are now shipping kits with fiberfrax and aluminum.

Installation of fiberfrax is as follows: Complete airframe construction through cowling installation, then remove everything from the firewall bulkhead, and install fiberfrax with a bead of silicone around the edge of the bulkhead. Do not wet out fiberfrax with epoxy. Now install the .016 2024 T-3 aluminum which is required to protect the fragile fiberfrax, from local damage, abrasion etc. See plans changes section of this newsletter.

From CP38-7 (CH15,CH30)
CAUTION
There is a product being sold that supposedly can be used in a liquid form and painted on in place of the recommended firewall. RAF does not approve the use of this material on a VariEze or Long-EZ. While this material is fire proof, it has virtually no insulating qualities. This means the cockpit side of your firewall bulkhead can be almost as hot as the engine side during a fire. The spontaneous flash point of the epoxy system is only about 850 degrees F, so it is possible to have a fire inside the cockpit area, even thought the fire did not burn through. The insulating qualities of the fiberfrax is required to keep the temperature on the cockpit side of the firewall bulkhead below the flash point of the epoxy.

From CP49-3 (CH15,CH30)
Ocean No. 1644 Flexibilized - Intumescent Fireproof Coating Compound, a remarkable heat protection paint for use on firewalls, wing roots and engine cowling areas, is available from:

Wicks Aircraft
410 Pine St.
Highland, IL 62249
618-654-7447

From CP49-5 (CH15,CH16,CH30)
FIREWALLS AND FIRE PROTECTION OF FLIGHT CONTROLS
The study of VariEze accident history has always shown considerably reduced incidents of fire as a result of an accident than the conventional metal aircraft with the engine on the front. The reasons for this are relatively obvious in that the sources of ignition of the fire are more remote to the major impact. Another feature that has been considered safer than the tractor aircraft is the airflow pattern through the engine area which pulls the fire away from the aircraft rather than impinging it toward the firewall. There have been no accidents or incidents in the VariEze or Long-EZ that have been caused by fire destroying aircraft structure or flight controls. There may be, however, a possibility of this occurring and this possibility is something that we feel obligated to address and, thus, are recommending specific modifications to the VariEze, Defiant and Long-EZ to reduce, as much as possible, the exposure to this risk.

Several years ago, we tested a product called Liquid Firewall and found it did not provide satisfactory fireproofing/insulation and, thus, did not recommend its use and, in fact, specifically cautioned those who would attempt substituting it for the recommended firewall. A couple of weeks ago, Wicks Aircraft sent us a new product (Ocean 1644 Intumescent) to evaluate. This material is intumescent which means it swells up to a very thick layer of high temperature insulation and provides surprising results in that it will protect an aluminum surface from fire damage for a considerable time period. We do not have the equipment to specifically qualify this material to FAR 23 regulations, however the torch tests we have conducted have convinced us that it can provide a considerable barrier to deterioration by fire to aluminum or composite structure. The other good news is that this material costs considerably less than the previous liquid protection product.

Because of our concern that it may be possible to suffer unacceptable structural damage or loss of flight controls, we are recommending mandatory changes in this newsletter to all our designs except the Solitaire. This is particularly important in the VariEze and Long-EZ where both yaw and roll systems pass through the engine compartment. Loss of roll control on a Defiant may allow recovery using rudder.

From CP50-5 (CH15,CH16,CH30)

Clarification of changes to VariEze and Long-EZ control systems aft of the firewall called out in CP 49.

As any plans owner knows, the aileron control system aft of the firewall consists of aluminum pushrods and several thin aluminum brackets. The intent of the plans change is to assure that an EZ pilot will retain, at least, roll and pitch control in the event of a serious engine compartment fire. Obviously, pitch control would not be effected by an engine fire, but it may be possible that an aluminum pushrod or aluminum bracket might be melted thus robbing an EZ pilot of lateral (roll) control in the event of a serious but otherwise survivable engine compartment fire. For this reason, we have carefully evaluated the control system for fire survivability. We have decided to only preserve the lateral (roll) control system, and to let the directional (rudders & brakes) system go. Our reasoning is that in such a serious situation as a bad engine compartment fire, the most important thing is for the pilot to retain sufficient control to be able to safely execute an immediate emergency landing. Pitch and roll control are all that are absolutely necessary for this. Stopping, once on the ground, can be accomplished by collapsing the nosewheel.

Toward this end, we are recommending in the strongest possible terms, the direct replacement of all aluminum pushrods aft of the firewall, with 1/2" O.D. x .028" wall 4130N steel tubing. The CS-1 aluminum threaded inserts in the ends of the aluminum pushrods should be replaced by steel inserts (part #CS-50). These inserts should slip inside the 1/2" O.D. x .028" wall steel tubes and should be fastened with four (4) stainless steel pop rivets, such as Cherry #CCP-42. Your existing dash 3 rod-ends can be screwed into these CS-50 inserts. In addition the four CS-127 aluminum brackets on the aft face of the VariEze centersection spar and in the wing root of the Long-EZ must be replaced by steel parts fabricated from .032 4130N steel. Ken Brock will have both of these parts available by mid November. They will be cadmium plated steel per RAF's specification.

Since this was published in CP 49, we have received all kinds of mail, mostly wanting clarification. Hopefully, the above has done that. We also received a few derogatory letters suggesting we were simply trying to "cover our -ss". Obviously, anyone is entitled to his opinion, but you should know that a decision to make such a change as this one is not taken lightly. First of all, RAF's agreement with Brock means that RAF has to buy all remaining inventory such as CS-127 aluminum brackets and CS-1 aluminum threaded inserts.. Secondly, a change like this is always confusing to many builders and our workload on builder support goes up dramatically. Thirdly, and most importantly, we have tried and will continue to try to make any change necessary to make flying RAF designs safer, no matter what it costs or what anyone thinks. We have an awful lot of friends out there and are very sincere in our efforts to provide any information to make flying these airplanes safer. Last but not least, we cannot force anyone to make any changes, we can only print the suggestions in the CP. It is up to you whether you comply or not. Naturally, we hope every one will because these changes are not made on a whim. However, we do not have the authority to force you to ground your airplane and make the change, only the FAA can do that and then usually only when it concerns certificated airplanes.

From CP50-6 (CH15,CH30)

"Fire-Proofing" your firewall: by Arnie Ash (Reprinted from Central States Newsletter).

"The arrival of the latest Canard Pusher just two days before leaving for Oshkosh and also just prior to mounting my engine for the final time was indeed timely. The following is an account of a few thoughts regarding the purchase, application and protection of Ocean 1644 "fireproof coating".

To coat to the proper thickness your firewall and side "heat shields" you will need more then one quart of 1644 but less than two. Wicks prices this material at $25.00/quart or $60.00/gallon. It would seem that perhaps three EZ's could be treated with one gallon so you may want to consider splitting the cost of a gallon with a couple of your buddies. You will also need the special thinner which sells for $15.00/half gallon. (You'll use less then a cup of this material though).

Application: Grab the oldest spray gun you can find - you don't need to break out the high priced equipment. Thoroughly mix the 1644 and draw off approximately 3/4 of a quart. Cut this by about 5 percent with the special thinner. Set your spray gun up in the suction mode with about 50 lbs. pressure at the gun. The material seems to flow on best at a range of only 5-7 inches from the part being sprayed. To get the required material thickness you'll have to spray 7 to 9 coats (depending on the thickness of each coat). Allow a few minutes between each coat for the material to "tack" and you'll avoid any runs. (If all goes well you'll have the firewall coated to the required thickness in less than 45 minutes. Wear a good mask and be sure to protect the rest of your airplane from any overspray). This material needs a couple of days to really give you the feeling it's dry.

Once dry you'll have a nice white firewall - - until the first time you touch it with dirty hands or spill a little oil on it. This material appears to be pretty porous and thus absorbent. I called the manufacturer, Ocean Chemical, Savanna, Georgia, inquiring as to the availability of a top coat to help keep the firewall looking nice.

Although they apparently have a product, their lab suggested an excellent top coat would be Imron 500-S Clear polyurethane enamel, sprayed to a thickness of about 3 mills. The problem: If you go to your local paint dealer and buy the smallest container if Imron 500-S and the 192-S activator required you will have as much invested as the Ocean 1644 and you'll only be using about six ounces!!

ONE SOLUTION: Ask the paint dealer who his biggest customer for Imron is and go tell this "end user" your tale of woe. In my case it was the local "Big Truck" body shop and enough Imron 500-S and 192-S cost me a case of Pepsi!

Mix the Imron at a ratio of 3 parts of 500-S to 1 part 192-S. The firewall will take about 4-5 ounces. Application is handy using one of those $3.00 aerosol "touch-up" bottles you can pick up from the guy who told you who his biggest "end user" was. (At least he sold you something!) Spray this material just as you would any "lacquer type" material. This stuff will run easily so best to spray a light coat and let it tack for 10-15 minutes then follow up with successive coats until you achieve the desired thickness.

One last thing: Even though you will only be spraying a few ounces do not under any circumstances attempt to spray this material without a very good mask. I used a good mask and pumped fresh air from a bottle into the mask to create a positive internal air pressure, and I still got a mild headache. This is nasty, nasty stuff. Be careful. . . . Arnie

P.S. At normal room temps. the Imron will take at least two days to cure to the point where you can work on the firewall. Total cure, they tell me, takes about two weeks."

Engine Mount/Engine Alignment

Also see LPC #61 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #66 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #69 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #100 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #108 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #117 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #120 in the "Long-EZ Plans Changes" section of this chapter.

From CP26-13 (CH30)(Photo caption)
The Lycoming on Mike's Long. Due to the tight fit on many parts we are shifting the engine down and aft. These changes will be reflected on Brocks mount and on the new edition of Section IIC.

From CP28-8 (CH30)
Long-EZ - Prop Position
The forward face of the prop hub should be at F.S. 158.8" and at W.L. 21.83. This includes the recommended 3" prop extension.

From CP31-5 (CH2,CH30)
Caution - Nat Puffer would like to share a problem that he has run into. He bought an engine mount and a cross over exhaust system from a supplier (not one of RAF's designated suppliers) and has had problems. The supplier has refused to make good or to refund. Nat is a member of the VariEze Hospitality Club, and anyone interested in the exact nature of his problems should contact Nat Puffer.

From CP32-5 (CH14,CH30)
CAUTION
When installing your engine mount, we tell you to set the mount on the extrusions leaving approximately .030 gap between the mount and the firewall, see Section IIL ,page 7. This is true if the mount is perfectly straight, however you should check to see that it is, by measuring from the firewall to the aft of the engine mount and verifying that the mount is at the correct fuselage station as shown in Section IIL, page 14 for conical mounts and page 15 for dynafocal mounts. Bear in mind that even though the mount is accurately welded up on a fixture, when it is normalized by heat treating, it is possible for the weldment to warp, creep or otherwise move enough that if you rely on the .030 measurement, you may have an engine that is not correctly located. Correctly installed, your engine crankshaft should be aligned with the zero buttline, plan view. Side view, the crankshaft should have 2 degrees of down thrust, (± 1 degree) that is to say the spinner end is higher than the accessory case end.

From CP38-5 (CH30)
Engine Alignment - VariEze and Long-EZ.
The engine should be mounted with the crankshaft center line right on B.L. 0 looking down at a plan view. There is no side to side offset. Looking at a side view, the engine is mounted with down thrust. That is to say, the prop flange is higher than the magneto end of the engine. Ideally this is a 2 degree angle. Plus or minus 1 degree will be okay. When you install your engine mount, do not assume that the four forward tubes are square and true. Clamp the mount to the aluminum extrusions and measure from the firewall back to the flanges (conical mount) or to the donuts (dynafocal) and do not drill in the mount until you have it positioned correctly.

From CP46-6 (CH30,CH38)
MAINTENANCE ITEMS
VariEze and Long-EZ engine mounts. Ray Cullen, VariEze builder/flyer reports a cracked engine mount. He says his wife noticed a change in the sound of the engine, so he returned to the airport. A subsequent careful inspection of the engine area revealed a crack 1/4" aft of the weld at the upper left attach point. Ray says he almost missed spotting it as it was hidden behind the brake arm. He and his mechanic had completed an annual inspection of this area just 20 hours previous to this, and both failed to find it. Evidently this crack had existed for some time and Ray suggests that the engine mount area should be closely examined on a regular basis.

This is the third known case of an EZ engine mount cracking. One was a Long-EZ (with unauthorized engine), the other also an 0-200 powered VariEze. All were conical mounts, we have never heard of a dynafocal mount cracking. We have carefully examined all of the RAF aircraft and even though they are all high time aircraft, we have found no signs of any cracks.

Inspect your mount regularly, especially the hard to see places around the welds near the firewall. If you notice a change in engine noise or a vibration, land and check the mount and the prop. Please report any findings to RAF.

****From CP50-1&2 (CH30)****
VOYAGER UPDATE
As most of you will know by now, the Voyager has suffered a serious setback in its schedule. Things were going very well. A full dress rehearsal for world flight take-off was successfully flown out of Edwards Air Force Base at the heaviest weight flown to date.

This flight brought out a few points that required one or two more engineering test flights before a world flight could be attempted. During one of these flights, while flying level at 9,000 feet a moderate cruise power setting, one blade of the front engine's propeller separated from the hub. The ensuing vibration was so intense that several instruments came out of the panel and the rear engine's spinner thrashed enough to run into the cowling. The front engine mount broke in two places and every tube was bent. The engine remained on the airplane, fortunately. **Both engines had safety cables attaching them to the firewalls.** Dick's biggest problem was determining which engine was in trouble.

Obviously, he did not want to shut down the wrong engine! The chase plane was able to identify it for him and he subsequently caged the front engine, declared an emergency with Edwards and made a safe landing on their runway 40.

The Voyager was flown, single-engine, back to Mojave the next morning after substituting a good old reliable B and T wood prop for the variable pitch prop on the rear engine. The front prop, which had failed, was removed and sent away for inspection and evaluation. The manufacturer, as well as the prop shop that did the post mortem, think that some prop rework that had been done by the Voyager team in an effort to improve performance, may have contributed to the failure. It is also possible that the drying of the wood in the desert environment resulted in the loss of shank retention. We adjust for this with our fixed-pitch, wood props by routinely retorquing the bolts. This adjustment is not available on any of the variable pitch wood propeller types.

The Voyager team removed both engines. Beech provided transportation to Mobile, Alabama where Teledyne Continental began an immediate teardown/inspection and complete rebuild. Hartzell Propellers agreed to build up two special props using the latest John Roncz airfoil section blades. Bruce Evans and his team commenced to build a new front engine mount and to repair and modify cowlings to fit the new prop/spinners. Incredibly, this dynamic group will probably fly their next test flight by the end of October! An unbelievable feat in the face of overwhelming disappointment. The support that they have received from Continental, Hartzell and Beech is no less amazing - marvelous - Go for it, Voyager!

What can be learned from a problem like this? First of all, you can see why Burt has been so adamant about the use of variable speed/constant speed props on our experimental airplanes. To use any manufacturers variable or constant speed prop without conducting a full, in-flight, strain gauged vibration survey is probably courting disaster. **Second, anyone who may still insist on doing some of this kind of testing should, at the very least, install a 3/16" diameter safety cable to retain the engine in the event of a failed engine mount** - it could save your life. RAF categorically does not recommend any variable or constant speed props on any RAF designed airplane.

****From CP51-3&4 (CH30)****
We recently worked with Bob Callender of Barry Controls regarding the vibration isolators (engine mounts) for three different engine installations including Mike and Sally's Long-EZ. Mike is very, very pleased with the Barry mounts and reports a noticeable decrease in vibration/noise and a marked improvement in smoothness throughout the RPM range.

Barry wrote us a letter in which he has shared some pearls of wisdom. Since he is an expert in the field, we have printed his letter below. For special or problem installations, contact: Barry at 818-843-1000.

"Dear Mike:
I hope by now you've had a chance to flight test your EZ along with the other installations Barry sent you parts for. I'd like to review your findings someday.

As we discussed, there are some facts and "general" rule of thumb guidelines to be aware of and follow regarding the use of engine vibration isolators.

Normally, each engine, propeller and truss combination will have a unique vibration signature and natural frequency. A change in any one of the three will change the vibration characteristics of that installation.

Under perfect conditions, the elastomeric "mounts" or vibration isolators are designed to suit these individual combinations on a installation-by-installation basis. Choice of elastomeric compounds and spring rates (stiffnesses) are also determined by the overall flexibility matrix of the individual installation.

Just because an isolator physically fits an installation envelope and related mount hardware doesn't necessarily make it the proper part.

So much for perfect conditions!

The real world (especially homebuilts) requires a combination of best effort and budgetary restrictions when choosing a suitable isolator. The best starting point for most installations is to use the same or cross-referenced equivalent isolator as used in the aircraft the engine came out of (especially if it's a factory airframe). Another choice is to find a factory aircraft using that engine and use isolators normally installed on the chosen aircraft.

New isolators should have current cure dates less than one (1) year old to ensure best performance. Ambient air alone will cause elastomers in installed isolators to lose their resiliency and deteriorate. Once the isolators are installed, they need to be inspected for wear and fatigue at the same time as other external engine parts.

Isolators should be kept free of dirt, oil and other petroleum based fluids at all times. Oils will soften the elastomer making them ineffective. Spilled fluids can be cleaned off using isopropyl alcohol or electronic contact cleaner.

Prolonged temperatures over 200 degrees will dry out and harden most elastomers over time. Heat will initially cause the elastomer to soften and "drift", but will eventually harden it, making the isolator ineffective. Extreme ambient temperatures during tie down and storage are just as destructive to the elastomer, and contribute to short service life.

Isolators should be changed every time the engine is removed from the airplane. They will take a permanent "set" within 48 hours of installation and are virtually impossible to replace in an identical fashion.

Wear for installed isolators varies with flight hours, and is not consistent from aircraft to aircraft. Each inspection should include looking for debonds and tears in the elastomer.

Debonds are a physical separation of the metal outer or inner plate from the elastomer. A good rule of thumb is 30 percent circumferential or 30 percent depth separation.

Tears or splits will show in the bulged or center portion of the isolator and follow the same rule of thumb. They should not exceed 30 percent circumferential, 30 percent elastomer depth or 30 percent elastomer width separation. Any one of these conditions is cause for replacement, at which time all isolators should be changed. Equal spring rates and loads are essential to proper isolator performance.

Since no two installations are identical, and aircraft hours per year are so different, service life is reflective of those conditions. At very best though, five year old isolators or installations should be changed out. Other items for inspection include excessive deflection, mounting bolt integrity, security and tightness.

Mounting trusses should be made as stiff as possible. This normally allows a "softer" ride. Full ringed trusses are best. They also keep engine deflections to a minimum. The "horseshoe" type trusses are very flexible, and usually require stiffer isolators. This in turn allows more engine deflections, that require larger cowlings.

Actual truss members need to be checked during installation for non-concentric bolt attachment and engine mounting flange points. When a truss "leg" or member is pre-loaded during installation to center the bolt or isolator, undue stresses are put into the isolator that can cause it to prematurely fail. Be sure to look for this especially on rear mounting engines without a completed truss ring at the isolator mounting plane.

We have an 0-200 isolator configuration in place on Bruce Evans' EZ, and have an installation in the works for an 0-290. I'm gathering data and will keep you informed. So far, Bruce seems very happy. Sketches showing the modifications are available if you would like to publish them in the Canard Pusher.

If you have any question, or if any of your builders have questions on engine isolators, don't hesitate to contact me.

Regards,

BARRY CONTROLS
A Unit of Barry Wright

Bob Callender
Sales Engineer
Engine Vibration Isolators"

From CP54-6&7 (CH30)

Some thoughts on Dynafocal rubber mounts - sent in by Long-EZ builder/flyer, Dick Kreidel, a founding member of Long-EZ Squadron 1 in the Los Angeles basin.

"As you may or may not know, the Lord mounts, Barry Control mounts, (even the cheaper imitations such as sold by Aircraft Spruce) have a stamped hole in the metal ring that is bonded to the rubber sandwich. The purpose of this hole is to index the rubber/steel bonded sandwich mount to the welded Dynafocal motor mount to prevent it from rotating as the bolt is torqued up, and also to correctly orient the spacer. On all Cessna and Piper mounts I have seen, there is a 1/8" diameter x 1-1/4" long roll pin pressed into each corner of the Dynafocal ring to engage the hole in the metal of each rubber sandwich. See the sketch below for the position of this pin. **SKETCH OMITTED**

There are four different Lord mounts that will work on an EZ. The main difference is the spacer: Lord p/n J7402-1. Lord p/n J7402-5, Lord p/n J-7402-16, Lord p/n J-7402-24. **SKETCHES OMITTED**

Note that the lengths of the steel spacers are all different resulting a varying pre-loads on the bonded rubber and steel sandwiches. Most EZ builder/flyers in Long-EZ Squadron 1 have found that the J-7402-1 with the rectangular rubber spacer is best for the Lycoming 0-235. I have tried all four with my 0-235 and I, also, found -1 to be best. Currently, I am using the -24 spacer and find it to be satisfactory, however at $260.00 per set compared to about $120.00 for the -1, -5, and -16, they probably are not worth the extra dollars.

One last point, the rectangular spacers for the -1 version are designed to be oriented as shown below for maximum effectiveness. The 1/8" roll pin assures this and prevents torsional windup of the rubber block bonded to the spacer. **SKETCH OMITTED**

According to the Lord Manufacturing Co., provisions must be made to allow the engine to move in its mount up to a maximum of plus or minus $2^{\circ}25'$ laterally from a vertical C_L (roll). Under thrust loads, it should be able to push into the mount as much as .070". Vertical displacement, under heavy 'G' loads, it should be able to move as much as plus or minus .34" measured at the engine CG, about 15" aft of the crankshaft prop flange. You should be certain that your engine can move up to these maximum call-outs without interference with cowling, baffling, etc." Thank you, Dick, for the effort in obtaining this information.

Starters/Alternators/Regulators

From CP26-11 (CH22,CH30)
B & C Speciality Products has developed a lightweight aircraft power generating system. This system was specifically developed for today's weight-sensitive homebuilt designs and has undergone extensive in flight service testing.

Two models are available, one is a gear driven alternator. This bolts onto the alternator pad on the accessory case of the C-85, C-90 and O-200 engines. The other alternator is belt driven, designed for the Lycoming O-235. Can also be adapted for other engines. The complete alternator system weighs only 4 1/4 to 4 3/4 lbs., depending on the type of drive.

B & C Specialty Products,
518 Sunnyside Ct
Newton, KS 67114
(316) 283-8662

Note: RAF is currently testing the B & C lightweight alternators on our VariEze and Long-EZ. Their kit is very nicely done and easy to install. Performance and support by Mr. Bill Bainbridge has been excellent. Many of you saw these at Oshkosh.

PHOTOS OF B & C ALTERNATORS OMITTED

From CP26-11 (CH22,CH30)
John Friling made his own lightweight alternator for his Continental powered VariEze. John purchased an alternator from a Yanmar Japanese garden tractor.
Part # 942131-41410 (stator)
Part # 942741-42299 (magnet wheel)
Part # 49-401-01 (Kohler regulator, 15 amp)
John used his old Continental generator shaft, bearings and flange, (see photos). John has a really nice set of drawings for those of you who would like to make one like his.
John Friling
852 Westgate Drive,
Addision, IL 60101

PHOTOS OMITTED

From CP30-11 (CH30)
We have had two of B & C Specialty's excellent little alternators on test for over a year now. The belt driven type for Lycomings has been running on the prototype Long-EZ N79RA for over 340 hours, and has been trouble free. The Continental, gear driven alternator has not missed a beat in the prototype VariEze, N4EZ for over 100 hours. Many of the alternators are installed in homebuilt VariEzes and Long-EZs, and we are not aware of any failures. Bill is to be commended for his excellent solution to our need for lightweight electrical power. Send Bill a SASE for a brochure with color photos.
B & C Specialty
518 Sunnyside Ct,
Newton, KS 67114
(316)283-8662

From CP31-8 (CH30)
John Frilling, who sells a set of plans to make a light weight alternator, as reported in CP 26 page 11, has recently moved. John's new address is:

John Frilling,
743 Annoreno Road,
Addison, IL 60101

From CP34-3 (CH22,CH30)
LUCKY YOU FLY THE LONG-EZ

Would you like to take your Long-EZ from Honolulu to Oshkosh? And if you can get it together, go the 4,500 miles non-stop? I started planning on day one. The first cloth was cut 12 March 1981 and Oshkosh 82 looked like an easy goal. "Coffin Corner" goals in homebuilding are not recommended as they can unwind your main spring and money supply.

Long-EZ construction went along very easily. This was my third composite homebuilt. The first flight was on 7 June 1982. Oshkosh looked easy, but wait: The Loran wasn't working yet, neither was the ADF, nor the Compucruise, nor the SSB radio. It looked like the NAVCOM was inadequate for IFR. The new transponder was dead and 1344T needed 40 hours faster. It was flying great so I filled the tanks and by 16 June I took 1344T to the EAA Big Island Chapter 780 meeting with the first 40 hours flown off. It was looking good, but wait: The Compucruise had been calibrated, however the Loran wouldn't work with it on. With the Compucruise off, the ADF was only 20% effective and the Loran still wouldn't work. The core of the problem is that it's a fiber glass airplane and has no ground plane or counterpoise and none of the normal metal shielding found in aluminum airplanes. Add dirty power to this and the dirtiest electrical noise of all, the Compucruise, and a lot of time can be spent solving the noise problem. Actually once I got a system of detection, isolation and elimination going it was okay, however this cost me almost 30 days of down time. It can be done in less. Here's how I did it. Note: if you do not need any low frequency COM or NAV gear, you may disregard all of this and simply live with the noise as VHF is high enough not to be affected.

I started by disconnecting everything: battery, voltage regulator, alternator, p-leads at the engine, and all radios and appliances. I then used a small inexpensive transistor radio and tuned off a station. I started the engine many times checking for electrical noise using the transistor radio to ferret out each source, following up and down the wires inside both cockpits, into the engine bay and all over.

Here's what I went through. I replaced the mag switches as they were poor quality and arcing inside. **I replaced the Kubota tractor alternator as it was noisy and short on output.** I had to add a torroidal type coil and 2 capacitors to the Compucruise airspeed gizmo to quiet the oscillator and then seal the box with copper tape to keep the residuals inside. I **then disassembled both mags and found a coil shorting in one.** Then I removed the suppressors, because I didn't need them. **The sneakiest noise of all was the voltage regulator.** It sounded like ignition noise. This wasted a couple of days because my detection system broke down. I just couldn't believe it wasn't an ignition harness problem. The Prestolite transistorized regulator needed a coil and 2 capacitors which quieted it about 85%. It was never perfect. **The Prestolite alternator had a whine that ordinary suppressors wouldn't quiet.** I added 2 of the largest hash chokes available, which together with 2 capacitors and a lot of trial and error finally gave me fairly quiet power.

Back to the cockpit. Early in construction, before glassing, the single side band (SSB) HF antenna was run from the top tip of each winglet down the leading edge of the wings, wing strakes and around the nose. I installed a switcher so that the Loran could share the antenna except when transmitting on SSB. Sharing this antenna didn't work. Loran is too sensitive to noise and I still had a low level of noise. The Loran antenna placement problem eluded me until just a couple of days before departure. It was refusing to work in a fiberglass airplane. I had tried everything and was about to give up when it came to me. I dug a hole in the lower left winglet and put the Loran antenna pre-amp inside. I then ran a coaxial lead to the set and used 10 feet of .020 stainless wire with a small sinker out the aft of the lower winglet (trailing wire antenna). A quick test hop confirmed that the Loran was now working better than it ever had in the shop. I had essentially removed the Loran antenna as far as possible from all noise. The ADF required a lot of trial and error with the sense antenna. The best solution was a piece of copper foil tape from the nose up to the canopy rail and aft along the rail to the rear bulkhead. It was little short so I looped it up and over the head rest. Wrong. I wasted about a day of trial and error to figure out that I was too close to the voltage regulator with this antenna and had to keep shortening the length until I got it. The ADF now worked, but less than satisfactorily. It worked to Oshkosh, but prior to the Oakland-Honolulu return leg it quit, consumed a 200 dollar bill and worked much better. A prudent navigator always has a backup and on the return leg it was worth every cent of the repair. Let's flash back to getting ready.

Mid-July and I was still searching for an adequate bladder tank for the rear seat. It was an impossible search so I started foam and fiberglass auxiliary tanks Wow! This took a week. The front tank held 25 gallons, the rear 57. Luckily the plumbing and vent system was already in and approved. The auxiliary tank system test flight was go.

I haven't mentioned the Compucruise because it defied all efforts to quiet the noise. I simply turned it off to use the low frequency navigation or COM gear. This requires turning the Compucruise off and reprogramming it for use when you need it.

Shielding is a big part of noise control when going beyond a NAV/COM. I used shielded wire in the main power and regulating system and used it generously anywhere I suspected noise would be generated and transmitted in the wire bundle. Hindsight says I should have considered putting the wire bundle in an aluminum tube.

There were only two days left to departure. The NASA packet autopilot was almost ready. Before proceeding, the electrical noise was checked and flunked so I abandoned that effort. There wasn't time anyway.

The total effort was not without a lot of help. I never could have been ready without Sherry Emminger doing all the flight planning; Richard Emminger on weather; Sandy Moats on auxiliary tanks; Ann, my daughter, on programming the Loran and Rollie Moran and Jon Michelle on electrical problems. My wife Rosemary, bless her soul, ran the myriad of last minute errands.

The day before launch I still had to weigh the total loaded aircraft and work a weight and balance. It had weighed 755 pounds night IFR equipped and now weighed 1814 pounds with 137 gallons of fuel, me, the Loran, ADF, SSB, life raft, mae west, survival gear, candy, sandwiches and water. The weight and balance was dead center in the first flight box.

I told Sherry to plug in the 7 knot tailwind forecast over the Pacific and that I would work out the winds over the mainland when I got there. I went to bed at 1500 hours. Launch was scheduled for 0430 and I slept until 0400.

On the advice of a NASA flight surgeon, I wore a set of full length anti-embolism stockings and in addition, took an aspirin a day for a week prior to the flight to prevent clotting. Other than that, the only personal preparation was to wear warm loose clothing. Of special help was a down vest with removable, velcro attachable sleeves made by my daughter, Jill.

A last check of wind and weather showed no change so I started the last minute countdown. It didn't go too smoothly and I was an hour fifteen late on launch.

The Loran gave good track information and I split the Golden Gate, however, because of the Loran ground station layout and the fact that I went Loran station to Loran station (Honolulu to Fallon), crosstrack was sketchy and primarily DR. I had a couple of big shocks over the water. The first was 15+48, which was the over water flight planned flight time. There was no West Coast. Obviously the wind wasn't as p nned. There was no VOR and no ADF information. Only the Loran said I was on course, so all I could do was keep trucking. Two hours later the shock sort of wore off. The moon had come up and gone down. Wow! It was dark and lonely out there by myself. The engine quit!! I changed from auxiliary to wing tanks very quickly and it started right up. I was two hours overdue on the flight plan to the West Coast and only had 12 hours of fuel left. How lucky I really was would not be realized for another two hours. It was almost 4 hours over flight plan before the over water portion ended. Almost any other airplane in this class would have gone down in the water. "Lucky you fly the Long-EZ".

I had picked up a 14 knot head wind versus the 7 knot tail wind forecast. It didn't take a lot of calculation to figure out what to do. It was quite obvious that it wouldn't go to Oshkosh as planned. So rather than cross the Rockies at night and then have to land in Nebraska, I stopped in Sacramento.

The next morning I went to prop the Long-EZ to depart for Oshkosh and discovered a piece missing from the prop. I called Bruce Tifft at Oshkosh for consultation. He said to take a like piece from the other blade and try it for balance. I filed the piece out (3" x 3/8") and gave them both a little varnish. It ran up okay so I launched for Oshkosh. The winds from RNO to STL were the first tail winds I'd had, but they shut off at STL. The Loran was working like a charm, giving me lat and long, steering info, miles off course, miles and time to go, mag heading and ground speed. I was going from way point to way point. It sounded the horn at each way point where I would punch the next and away I would go. This was living. The West Coast Loran stations stayed on until Nebraska then the Great Lakes chain came on. Loran coverage all the way. (The Loran used was a CLX95 from SRD Labs, McGlincey Lane, Campbell California 95008.). This particular Loran is a ferry pilot favorite, It is small, portable and has a 99 way point storage capability. I was able to pre-set all reporting points over water as well as enroute VOR's on the mainland from HNL to OSH and back to Seattle.

From Sacramento, it was 12 hours to Oshkosh to find the field closed for a thunderstorm. I diverted to Fond-Du-Lac and arrived after dark, meeting hordes of people in the same boat i.e., no place to stay. After 3 hours I finally slept in the airplane. It wasn't easy sleeping in the airplane. The worst part was that the airplane wouldn't hold a heading and I kept banking and turning for a long time even after I'd fallen asleep with one recurring nightmare. The engine would be droning away and suddenly go silent. I would wake up with real fear, open the canopy and let in more of those damn Wisconsin mosquitoes.

The numbers for Honolulu to Oshkosh were 4,497 statute miles, 32 hours, 125 gallons, 140 MPH, 3.9 GPH and 36MPG.

The trip back to Honolulu was not uneventful. The empty rear auxillary tank had a pinched vent line and imploded on let down into Oakland. Again "Lucky You Fly the Long-EZ". Ray Johnson of San Francisco, a Hospitality Club member, took my busted tank in at 9 in the evening and had it repaired by 11.

The launch from Oakland was late because of the auxiliary tank. A small leak, undetected in the initial repair, was easily repaired on the line with 5 minute epoxy, but required defueling and refueling which took about 2 hours of valuable air time. The lesson learned was: never launch late and force yourself to land at night after a long flight. Give yourself a break. A night arrival isn't tough, but things can go wrong. For me it was again the weather forecast. It turned out that I was two hours over my ETA, Honolulu, and in that two hours, there were lots of buildups, no really big ones, but it was raining in each, rough and dark. I certainly hadn't planned it that way. I knew on this flight I was shooting for a lot smaller target than the West Coast and these additional complications provided plenty of distraction and tension. I was in contact with Honolulu Center and they wanted to know where I was and my ETA, which was a really hard question. The Loran and ADF said, "Dead Ahead", but the ETA part was an unknown. I knew I was on track. I just didn't know where. Hey, relax, I had to keep telling myself and the Center. You're flying the Long-EZ with 12 hours of fuel remaining.

The Hawaiian VOR's came on one at a time and all ended well, but I had made it grossly harder than it had to be.

If you plan to make a similar trip, give yourself every break you can on landing as well as on launch. For example, I would never recommend take off or for that matter IFR flight at high overgross in visible moisture. This is a problem which is personal to individual Long-EZ's. To get the idea, load your Long with 140 gallons of fuel then try to pick up the nose. You are going to need help. It is heavy.

On take off and in flight, the wings and the canard together must lift the total load. If you have less than a perfect canard/elevator and if your Long-EZ pitches down in moisture, you will at some overgross reach a pitch control limitation. It may be at 2,100 pounds, it may be at 1,800 or way down at 1,600 pounds. Again this is personal to your craftsmanship. If you are considering long range, overgross operations in your Long, be sure to provide your very best flight test data pertinent to this problem in you owner's handbook.

As I was planning and getting ready for this trip, I was often asked, "Why?" It's not why. It's "why not?" Mountain climbers are for the most part forced to climb mountains others have already climbed. In a Long-EZ, you have countless originals to climb. Lucky you fly the Long-EZ.

W. A. "Rodie" Rodewald
68-361 Crozier Drive
Waialua, Hawaii 96791

September 30, 1982

From CP34-9 (CH30)
B & C Specialty Products
518 Sunnyside Court
Newton, KS 67114
(316)283-8662
B & C has several different alternators to fit both Continental powered and Lycoming powered VariEzes and Long-EZs. 12 volt, 8 amp, 10 amp, 12 amp and 35 amp alternators are available.

B & C Specialty Products is proud to make available a new and better way to cut your fiberglass cloth! It is a heavy duty knife with a rolling disc blade (similar to a pizza cutter). It can be used with either hand, may easily be used with a straight edge and will cut glass, cloth, leather, paper, vinyl, etc. The knife also has a built in retractable safety cover. The blades are replaceable and are made out of high quality tungsten steel for long life (1 3/4" diameter). Use a piece of styrene plastic as a cutting surface. The knife comes with one blade for $9.00. Extra blades are $3.50 each. Special Introductory Price:

1 - knife with blade	$9.00
1 - Extra blade	$3.50
Shipping and handling	$1.75
Total	$14.75
SPECIAL	$12.75

From CP34-10 (CH30)(Photo Caption)
35 Amp alternator kit for a Lycoming powered Long-EZ. Total weight = 9.3 lbs.

From CP34-10 (CH30)(Photo Caption)
B & C Specialty Products 12 volt 8 Amp alternator, mounts on the vacuum pad of any Lycoming engine. Total weight = 3.8 lbs.

From CP39-7&8 (CH3,CH22,CH30)
B & C Specialty Products new Linear Regulator will be available in February. The regulator will work with their 35 amp alternator or your standard aircraft alternator. Also included are the following features:
1. Will work with standard aircraft alternators, or automotive type 14 or 28 volts.
2. Over-voltage protection with built-in logic to prevent nuisance tripping from inductive loads.
3. Flashing high-low voltage warning lights with 100 percent press-to-test of associated circuitry.
4. Uses linear type regulation to reduce RFI.
5. Ideal for use in composite aircraft with Loran C or ADF.
6. Regulator output is short circuit protected.

B & C is also selling the Apollo I Loran C for $1,590.00, which includes the preamp and radio tray. The Loran C is only 2" high, 6 1/4" wide and 11" deep.

If you want to save a lot of time when you are cutting your fiberglass cloth, try a heavy duty rotary cutter (similar to a pizza cutter). B & C has a special price of $11.00 for one knife with one extra blade. Additional blades are available for $2.50 each.

The Lightweight 12 amp gear driven alternator that B & C has been making for the Continental 0-200 is still available.

If you would like more information on any of these products please send your aircraft and engine type along with a long SASE to:

B & C Speciality
518 Sunnyside Court
Newton, KS 67114

From CP49-4 (CH22,CH30)

Bill Bainbridge of B&C Specialty has completed a two year development program on a lightweight starter for Lycoming O-235 through O-360's. This starter weighs 10.2 lbs and is about 8 lbs lighter than a geared Prestolite starter or about 6 1/2 to 7 lbs. lighter than a standard starter such as found on an O-235 or O-320. Fred Keller has installed two of Bill's new starters on his Defiant and he is very pleased. They crank the engines better in cold weather than the standard starters do, and he saved about 14 lbs. Bill will have his new starters at Oshkosh '86. Of course, Bill still offers a full line of lightweight alternators well suited to EZ's as well as his really high quality linear voltage regulator which is highly recommended if you intend to install a Loran-C.

Contact: Bill Bainbridge
B&C Specialty Products
518 Sunnyside Ct.
Newton, KS 67114
316-283-8662

From CP49-4 (CH30)

LIGHTWEIGHT ALTERNATORS FOR LYCOMING ENGINES.
Made by Pelican Aviation of Costa Mesa, CA and sold by Aircraft Spruce of Fullerton, CA, these alternators come in 35amp (4-3/4" dia, 7 lbs) or 55amp (5-1/2" dia., 9 lbs). The alternator brackets are machined from solid aluminum and are anodized and stressed for aerobatics. Both are available in 12 volts or 24 volts.

Contact: Aircraft Spruce
Box 424
Fullerton, CA 92632
914-870-7551

From CP50-3 (CH22,CH30)

Bill Bainbridge now has available a really first class lightweight 12-volt starter which will fit any 4 cylinder Lycoming engine. Weighs only 10.2 lbs. It is beautifully made and really has some neat features. Bill still has his well known linear regulators and small alternators. In addition, he how stocks excellent "Gelcell" or sealed, immobilized electrolyte batteries. Two options are stocked, 28AH, 12V or 15 amp, 12V. These are supper little batteries and require zero maintenance. Contact Bill for more information:

B & C Specialty Products
518 Sunnyside Ct.
Newton, KS 67114
(316)283-8662

From CP51-8 (CH22,CH30)

B&C lightweight Products - Bill Bainbridge
518 Sunnside Court.
Newton, KS 67114
(316)283-8662

We recently installed one of Bill's really fine LR-2 Linear Regulators (28v) and two of his 15 amp hour, 12 volt sealed batteries (never add water! - no drain required!) in our latest aircraft and, frankly, we are very impressed. We have, at times, cranked that aircraft engine (TIO-360, 210 hp, turbo-charged) for long periods with no sign of battery fade. The voltage regulator is the best we have ever seen and has built-in overvoltage protection. It also has a self-test feature and a low voltage warning light. Quality, as with all Bill's products, is truly superb. Bill's 10.2 lbs., 14 volt starter, of course, was the sensation of the show at Oshkosh last year and is really a fine unit. Fred Keller installed two on his Defiant and is very pleased with the weight savings and excellent cranking power. AVCO Lycoming is currently running an extensive test and evaluation on Bill's starters with a view of offering them on some of their engines. Bill is still working on the 28 volt model and hopes to have it available at Oshkosh 1987. Look for Bill and his electrical products in his booth (not far from the RAF booth) at Oshkosh this year.

From CP56-4 (CH30)

B&C SPECIALTY PRODUCTS suppliers of alternators & voltage regulators for the VOYAGER are pleased to announce that their light weight starters in 12 volt & 24 volt are now STC'd for all LYCOMING O-235, O-290, O-320, O-360, & O-540 engines. The sealed lead acid batteries they stock are also highly recommended.

From CP60-3 (CH22,CH30)

B&C SPECIALTY PRODUCTS will be at OSHKOSH '89 in Booth C-11. Their lightweight starter is now STC - PMA'd for all Lycoming engines (0-235 through IO-360, 12 & 24 volt). The price is still the same for homebuilders while the STC'd version is priced a little higher. The Linear Voltage Regulator (low noise LR-2) and sealed immobilized electrolite batteries continue to give good service. Bob Nuckolls from the Aero Electric Connection will be giving forums on electrical systems

(3:30am Sunday & Tuesday; 10:00am Thursday). These will be very educational open forums so bring your questions. If you can't make the forums, Bob will be at B&C's booth, C-11 to talk to you during OSHKOSH '89.

****From CP65-10 (CH22,CH30)****
LORAN INTERFERENCE PROBLEMS?
Mike recently installed a King KLN-88 loran in his Long-EZ, N26MS. At around the same time, he installed a new alternator because the old one stopped alternating! The replacement was identical in appearance but apparently something was different because the King did not work as well as his previous Northstar. After much testing and checking around, he was advised to install a Hisonic RFI-70 in-line noise filter. He obtained one through Pacific Air Radio in Van Nuys and installed it close to the alternator by cutting the main power wire from the alternator to the buss (battery) and running this wire through the Hisonic RFI-70 filter. The signal-to-noise ratios jumped up by a factor of 2! He is very happy with his King loran and recommends the Hisonic filter. They are expensive at around $100.00 ea. but are very effective. Dick Rutan has one installed in his Long-EZ with the same excellent results. Dick, in fact, was the person who advised Mike to try the RFI-70

Contact: San Val
7456 Valjean Ave.
Van Nuys, CA
818-786-8274
or

Pacific Air Radio
16143 Waterman Dr.
Van Nuys, CA 91406
818-786-8800

Magnetos

****From CP32-4 (CH30)****
BENDIX MAGNETOS IN A LONG-EZ?
This question comes up more and more in spite of the subject being covered in Section IIL, Page 3. The fact is that we tried to install Bendix mags on a Long-EZ and there was an interference between the left mag (right of airplane) and the aluminum extruded angle on the right side. This interference occurs right in the area required for timing adjustment, so we called out only Slick mags. Slick mags are smaller and much lighter and in our opinion and experience every bit as reliable, particularly the newer rebuildable Slicks. We do admit though that we never really researched into the problem, possibly there might be a relatively simple fix that would allow the use of the Bendix mags, anyone who has seriously addressed and solved this problem should let us know. We do not want to get into any changes to the engine, adapter plates etc., since engine reliability is of paramount importance, and we can not recommend a change that may hurt reliability.

****From CP32-5 (CH30)****
CAUTION - Left Magneto Confusion
This is a problem that could lead to a serious injury. We at RAF have always considered the left and right mags to be as called out by the engine manufacturer. Even though this puts the left mag on the right side of a pusher aircraft, it is still correct to wire your mags and mag switches according to the engine manual. If you wire your EZ switches reversed from the above, obviously you will not have problems, but should you ever sell your EZ, or lend it to another pilot, he or she could get hurt if they tried to start it on the wrong mag (without the impulse) this is particularly true with Lycomings, most Continentals have both mags with an impulse. The impulse allows the spark timing to be at top dead center for easy starting, then advances for normal running. If a pilot attempted to hand prop his engine with the timing set at 25 degrees before top dead center, which is what he would have if he had the right mag switch hot, instead of the left, on a Lycoming powered EZ for example, he is likely to have the engine backfire and injure his hand. It is for this reason the Lycomings and some Continentals are always started on the left mag. If your engine had a tendency to backfire check to see that you have the correct mag grounded.

****From CP52-5 (CH30,CH38)****
HIGH CHTS
Recently we have had two separate cases where builder/flyers had been battling with really high cylinder head temperatures. Talking to them on the phone, we discussed baffling, cowling inlet and outlet sizes, carburetion, and spark plug heat range. Frankly, we, and they, were running out of ideas. Amazingly, both of these EZ flyers had obtained their engines in the same way, removed from a factory airplane with relatively low time and running fine when removed. As a result, both of these engines were installed in the EZs and flown as they were received.

The cause of the high CHT's was finally traced to one or both magnetos being timed too far advanced. In one case, one mag was timed 15 degrees ahead of normal. In the other case, both mags were 25 degrees too far advanced!! Beware, guys, some of the supposed FAA approved mechanics, A&P's and even AI's may not be any smarter than you are when it comes to timing magnetos.

In both cases, once the mag timing was adjusted to the normal position, CHT's were immediately reduced to normal. There is a lesson here. No matter where you obtain your engine, whether it is a factory new one, a rebuilt one, or a "used one running well when removed", check the timing before you go flying. If you don't know how to do this, get help from an experienced person who does. Assuming that the timing is correct could be a very expensive mistake.

From CP54-6 (CH30,CH38)

HOW TO REMOVE AND REPLACE SLICK MAGNETOS EASILY ON A LYCOMING POWERED VARIEZE OR LONG-EZ

Have you ever spent an hour just trying to remove or replace the distributor cover on you magnetos? I have and it is very, very frustrating. The main problem is removing and replacing the three (3) slotted-head screws that hold the cover on to the mag. The magnetos are so close to the firewall that it requires a 90 degree screwdriver to get at the screws. Getting the screwdriver into the head of the screw when you cannot see the screw is very difficult, maddening, and time consuming. You can probably tell I hate this job on my airplane and, over the years, I have had to do it more times than I care to remember.

I don't know why it took so long to figure it out, but as I said, the main problem is the three slotted-head screws in each distributor cap. So the easy way to cure that problem is to go to Allen head screws! So simple, yet so effective. I bought 100 screws, they are stainless steel, flat head, socket cap screws and are 10-32 thread, 1" long. It took 20 minutes to remove 3 of the original screws and less than 1 minute to install all 3 of the new Allen screws. I fitted each screw on to the short end of the 3/32" Allen wrench, reached around the mag and simply wound the Allen wrench round and round with my finger until it was tight! Astonished me how easy it was to do!

I do not know of a source of these screws in lots of 6 which is all you need, but I bought mine from Garrett Industrial Supply. They are made by Soc-Pro and cost $16.00 per 100 which was the minimum order. Perhaps a group of 16 could get together and buy 100 at a time. Or better yet, I have 94 left and I know where to get more. I would be glad to mail a set of 6 to anyone who would like a set and would be willing to send me $1.00 plus a SASE.

Write to: Mike Melvill
Building 13 - Airport
Mojave, CA 93501

From CP55-9&10 (CH30,CH38)

MAGNETOS - TIMING-REMOVAL AND REPLACEMENT

Our experience here at RAF is confined almost exclusively to the Slick magnetos due to Slicks being easier to fit in the confines of an EZ, also due to their being lighter in weight. Since most EZ flyers will have Slicks installed, this discussion will concern only the Slick magneto.

We will start out with the installation of the magneto since this may be the most confusing area, leading to the most starting problems, etc. based on the calls and letters we receive. The older style, 4050 and 4051, "throw away" models probably should be traded in on the newer 4250 and 4251 rebuildable mags. They are more reliable, more readily obtainable, and are easily repaired or rebuilt even by the owner/builder. Basically the differences between the original "throw away" and rebuildable mags is size. The "throw away" being smaller than the rebuildable. Also, when timing the magneto, prior to installing on the engine, you must "spark out" the "throw away" model by spinning the timing gear to set the magneto on cylinder number one. On the newer, rebuildable magneto's, Slick supplies a little "pin", a T-118 timing pin, which is used to set the magneto timing to the number one cylinder. With the distributor cover off, look into the forward end (on a EZ!) of the mag, you will see two holes in the plastic molding, the top one marked for left hand rotation (L), the bottom on for right hand rotation (R). Look on the data plate on the body of the mag for its direction of rotation. Left rotation is normal for a Lycoming O-235, O-320, or O-360. Now, gently push the timing pin into the hold marked (L) until it bottoms. Rotate the timing gear on the shaft of the mag opposite the direction of normal rotation until you feel the pin drop into a hole.

If you have to rotate the magneto very far, you will feel the timing pin trip over a bump inside the mag. Don't force it to rotate. Gently back the timing pin out a 1/4" or so to clear the bump, rotate the shaft and gently push the pin back in. Continue rotating until the pin locates in the hole. The magneto is now internally set on cylinder number one. It is not a bad idea to tape the pin in place with a piece of masking tape. In any case, the pin must remain in this position, without the distributor cover installed, until the magneto is actually in place on the accessory case.

Now, you must set your engine at 25 degrees before top dead center on the number one cylinder (or whatever angle your data plate calls out, 28 degrees for O-235-L2C). Remove the top spark plug from the number one cylinder, hold your thumb over the hole and rotate the engine in the direction of normal rotation until you feel pressure under your thumb. Continue rotating the crankshaft until the advance timing mark (20, 25, or 28 degrees, check your data plate) is exactly opposite the small hole located at the 2 o'clock position on the front face of the starter housing. (This is for Lycoming engines with a starter and starter ring gear installed.)

NOTE: If the prop is accidentally turned in the direction opposite normal rotation, you must repeat the above procedure since accumulated backlash in the timing gears will make the final timing incorrect.

At this point, the engine is ready for assembly of the magneto's. With the timing pin still in place, carefully fit the magneto into its hole. When it sits flush on the machined surface of the accessory case, pull the timing pin out (rotating the prop at this point may shear the timing pin off) and, while holding the mag firmly in place, install the toe clamps, flat washers, lock washers and nuts and tighten until finger tight. Repeat for the other magneto, being certain that the prop has not moved.

Use a battery powered magneto timing light such as a model E50 from Eastern Electronics (available from Spruce). Connect it to a convenient engine case bolt (ground) and to each magneto terminal (the same stud your mag switch is connected to). If the mag switches are wired up, you will have to make both mags "hot" (mag switches to the normal engine running position even though the distributor cover is not yet installed). Make sure the fuel valve is off and the mixture is at idle cut off, and always treat the prop as you would a loaded gun!)

Rotate each magneto in its housing until the timing light comes on. Now slowly turn it in the opposite direction until the light goes out. Slowly turn the magnetos forward again until the timing light just goes on. Tighten the nuts a little.

Now, back the prop off enough to turn both timing lights off. Slowly bring the prop back in the direction of normal rotation until both lights come on. They should come on simultaneously, or very close to it. Now check and see if the appropriate timing mark on the starter ring gear is in perfect alignment with the hole in the starter housing. If it is, tighten the magneto hold-down nuts firmly (maximum torque is 150 inch/lbs., minimum is 110 inch/lbs.). Recheck that the timing lights come on together at the proper time and you are ready to install the distributor caps. If you are working on a Long-EZ, this is the hard part! The distributor covers are so close to the firewall that a 90 degree screwdriver must be used on the standard Slick screws. Believe it or not, this can take an hour or more to do! The Allen head screws Mike called out in CP 54 make this job easy (less than 30 seconds per screw) and he still has a supply of stainless steel Allen head screws suitable for this job. Send $1.00 plus a SASE for 6 screws.

There you have it! If your airplane has a Lycoming engine and no starter or starter ring gear installed, you will need a timing indicator such as model E25 and a top dead center locator (both available from Aircraft Spruce) or an equivalent protractor-type indicator.

This type indicator fits onto the spinner or prop (does not need to be centered) and has a weighted pendulum-type pointer. Use the top dead center finder in the top spark plug hole on cylinder number one, set the protractor indicator so the pointer points at 0 degrees or top dead center (TDC), then turn the prop backwards to about 35 degrees before TDC, then come slowly forward to 25 degrees (or 28 degrees) to be certain to get rid of all backlash.

If you have a Continental engine with Slick mags (O-200 VariEze), the main difference is that the crankshaft flange on Continental engine is marked every 2 degrees from 24 degrees to 32 degrees. You must look on your data plate to determine which to use (O-200 is 28 degrees BTDC). There is also a mark for TDC. It is a line across the edge of the prop flange between the letters TC.

You will need to make a triangular aluminum pointer on which you must scribble an index line that is perpendicular to the base and passes through the apex. The base of this metal pointer should be placed on the machined front surface of the crankcase with the index line exactly on the split in the crankcase halves. Rotate the prop in the normal direction of rotation until the index line points at the 28 degree mark (O-200A). This sets the engine with the number one cylinder at 28 degrees before top dead center which is the point at which you install the Slick magneto (which is also timed to the number one cylinder) per the instruction for the Lycoming.

If you have an older 4051 Slick mag that needs to be "sparked out", remove the bottom vent plug. The distributor cover must be installed and you must find the high tension lead marked T1 or B1 on the spark plug nut. Hold the lead wire spring 1/16" to 1/8" away from the magneto body and turn the impulse coupling one "click" at a time until you see a strong spark jump between the spring and the magneto body. Stop turning the shaft right at the point where the impulse trips and the spark occurs. You may have to do this several times to get it correct. It will not shock you if you do it right!

Now, reverse the rotation about 25 degrees until you can see the timing pin hole through the vent plug hole. Insert the timing pin which will hold the rotor and line the pin up with the center of the vent plug hole. Now install the magneto onto the accessory case.

On a 4050 Slick mag with no impulse, you must turn the shaft vigorously counterclockwise (LH rotation) until a strong spark snaps from the spring to the magneto body.

From CP55-11 (CH30,CH38)(Photo Caption)
Slick 4250 magneto - note timing pin in top hole for left hand rotation.

From CP57-12&13 (CH30,CH33,CH38)
MAGNETO WIRING CHECK PRIOR TO SHUT DOWN.
The other day, Burt came in from a flight in his Defiant and reported a broken wire on the right rear magneto. He discovered this condition because, it has always been his habit, he conducted a magneto wiring check just before he shut the engine down.

How many of us do this with any regularity? How many do it at all? If you have never done this check, you may possibly have a "hot" magneto, even though you have both mag switches turned off. This is a potentially dangerous situation. Anyone who moves the prop may suffer a prop strike. Many people during the history of aviation have been seriously hurt, even killed, by a "hot" magneto.

The procedure to check if both of your magnetos are correctly grounded, is as follows: Just before you pull the mixture to shut down your engine after a flight (be sure the avionics master switch is off), momentarily flip both mag switches off and then back on. This only needs to take a second or so. The engine should instantly quit. If it continues to run, you have one or both magnetos "hot" or not grounded. Remember, a magneto is always hot unless it is connected to ground. **Your mag switches should connect each magneto to ground when they are in the off position. Check the wiring at the magnetos or between the firewall and the magnetos.** This is the most likely place for the wiring to fail due to the movement of the engine during start-up and shut down. Be sure to have adequate strain relief for the wires, and don't have the wires from the firewall to the engine too tight - you need adequate length to allow for the considerable movement of the engine relative to the airframe.

Try to develop the habit of conducting this test each time you shut down; power to idle, avionics off, both mags off for a second, engine should abruptly quit, mags back on, engine should catch and run, then mixture to idle cut off as normal. Knowing, for a fact that your magnetos are indeed grounded and that anyone, including yourself, is not likely to get surprised by the engine suddenly firing when the prop is moved is very comforting.

****From CP58-12 (CH30,CH38)****
MAGNETO COVER SCREWS
Ever tried to remove the mag covers on an EZ? 90 degree screwdrivers, skinned knuckles, one or two hours of cussing and, finally, you get 'em off. Right? If you have been there, you will love these Allen screws - direct replacements - uses an Allen wrench - remove all six screws in one minute. Send $1.00 and SASE for 6 screws to:
Mike Melvill
Bldg. 13 - Airport
Mojave, CA 93501

Spark Plugs

****From CP35-6 (CH30)****
Spark Plugs
The new Champion REM37BY plugs are approved for both the Lycoming 0-235 and Continental 0-200. On the 0-235 L2C they are highly desirable due to the excessive lead fouling in these engines. For VariEze builders with close tolerances between cowling and spark plugs, the REM37BY plugs are 3/8" shorter than the standard REM40E plugs, which can mean the difference between having to install blisters on the cowl or not.

****From CP35-7 (CH13,CH15,CH17,CH30)****
FROM THE BUILDERS AND FLYERS
First flight from Debbie Iwatate.
"Long-EZ N455EZ flew for one hour on it's first flight October 31, 1982. It went so smoothly that we found ourselves thinking, "is that all there is to it!", after the landing. A big reason for having an uneventful first flight was our friendship with Bryan Giesler (VariEze 90331). By the time we were ready for flight testing the Long, I had accumulated almost 15 hours of back seat time and 3 hours of solo time in his aircraft ..... that does wonders for a persons confidence! **The only changes we have made to the plane are to change to REM37BY plugs**, modify the upper brake arm (BA) to make it an inch longer to increase the braking effectiveness, and change the pitch trim spring lengths to gain more nose down trim authority. I have flutter tested up to 198 mph IAS, stalls are at 60 mph engine idle (straight forward and smooth) and 55 mph power on. We are burning about 4 - 4 1/2 gallons per hour average.

It took us about 2,000 hours to build the plane (325 for the finishing) and that was spread over 21 months. We didn't cut too many corners on cost and our final cash outlay was around $18,000 (well worth every penny). Many thanks to you Mike, for your assistance every time I called for help.

Incidently, the nose (side) airvents work very well! Leading the air into the cockpit through eye-ball vents, we are getting fantastic ventilation. In addition we added "extra air" vents on the sides above the CC spar "deck".

We have 33 hours on the plane now and have been signed off by the FAA. Now we can settle into the maintenance routine and get our fly-in schedule made up for the summer of '83. Many thanks to Burt for making such a project possible to folks like us. Take Care, Debbie Iwatate".

Debbie is the first female builder/flyer to complete and fly a Long-EZ. Congratulations!!!

****From CP38-5 (CH30,CH38)****
Spark Plugs for Hard Starting Engines - VariEze and Long.
Bill Price, a VariEze flyer with over 450 hours on his VariEze, reports that for 400 hours his engine was a real beast to start, particularly while hot. He switched to platinum plugs and reports that his engine is now pure pleasure to start, idles smoother and runs better. Platinum plugs are quite expensive, but last a long time. Mike Melvill had REM40E massive electrode plugs in his Long-EZ engine, an O-235-L2C (as called for by Lycoming) and found that every 10 to 15 hours the bottom plugs would lead foul. Instead of platinum (which may have worked), Mike used Champions REM37BY (extended tip) and the problem disappeared. In fact, the plugs were not cleaned for 260 hours, with no problems.

****Also see LPC #1 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #63 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #101 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #132 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP25-2 in the "Engine Selection, General" section of this chapter.****
****Also see CP32-4 (O-235L2C Engine...) in the "Engine Selection, General" section of this chapter.****
****Also see CP35-10 in the "Oil Breathers/Separators/Oil Filters/Dipsticks" section of this chapter.****
****Also see CP36-6 in the "Engine Selection, General" section of this chapter.****
****Also see CP37-3 in the "Engine Selection, General" section of this chapter.****

****From CP24-5 (CH30)****
STROMBERG CARBURETOR
Last CP we reported a problem with a Stromberg carb in a VariEze. We have no experience with the Stromberg and had asked if any out there had used it successfully. We found 4 using the Stromberg carb ok but they reported that the float level is critical. Also the float valve opening is different for pressure and gravity systems. Be sure yours had the gravity valve. If you are anticipating using a Stromberg, we suggest you contact those using them in VariEzes.

Steve Stuff, 517 Roberts Street, Monroe, WA 98272	Gary Hertzler 2507 E. Balboa Tempe, AZ 85282
Fred Keller SRA Box 2385 Q Anchorage, AK 99507	Bruce Tuttle 4471 S. 1625 W. Roy, UT 84067

Float needle valve seat part # 384585 has a .113 dia. seat to accommodate 2-4 psi pressure at the carb. Part # 383911 has a .187 dia. seat for the half psi or gravity pressure at carb. (VariEze float level 13/32. For a C85-12 engine carb should be a NA-S3A1 Stromberg part # 380167, venturi 1-3/8, main discharge jet #22, main air bleed #66, main meter jet #45. But be sure the float needle valve seat is for the gravity system.

****From CP26-1 (CH16,CH30)****
NEW BROCK ITEMS
Ken Brock Manufacturing now stocks a new stick grip that fits VariEzes and Long-EZs. It is styled after the ski pole grip that nests the lower side of your palm, resulting in a comfortable, low-fatigue grip. Part no. LESG1. **Ken also has in stock, the new square style 12 volt fuel pump. This pump can be substituted for the Bendix electric pump with a small weight savings and at less than half the cost. Part no. is EFB. We have recently finalized the engine mount design for the Lycoming dynafocal configuration. By the time you read this, Brock will have this item available.**

****From CP27-6 (CH30)****
We put a Marvel Shevler MA3-spa carburetor on N79RA without a primer system and since have accumulated over 350 hours on the airplane. The MA3-spa carb has a built in accelerator pump which really makes starting the engine a lot easier, particularly in cold weather. If you plan on operating your 0-235 Lycoming in cold climates, an accelerator pump or primer should be considered almost mandatory.

****From CP28-7 (CH30)****
Carburetors for Long-EZs
Most 0-235 Lycoming engines come equipped with a Marvel Schebler carburetor without an accelerator pump. This carb is a MA3A and various configurations (10-xxxx numbers) are found. N26MS has a Marvel Schebler MA3A and the configuration number is 10-5199. This carb has no accelerator pump and we therefore have to use a primer to start the engine. A direct replacement for this carb with an accelerator pump would be a Marvel Schebler MA3PA - 10-5220. If you wish to order a brand new Lycoming engine from a Lycoming dealer we feel that probably the optimum engine for a Long-EZ is as follows:

Lycoming 0-235-L2C
Must have mechanical fuel pump.
Can not have spin-on oil filter,
instead must have standard oil
screen and housing.
Marvel Schebler MA3PA Carburetor
Part # 10-5220.
No provision for primer required.
Must have Slick magnetos,
Bendix will not fit into the mount.

If you already have an 0-235 engine with the standard MA3A carb (no accelerator pump) you can use a primer, which works fine, or you can get an MA3PA. Various other 10-xxxx numbers can possibly be used. According to Avco Lycoming, the following numbers have all be used on 0-235 engines:

MA3PA 10-5257 or 10-5220 E*	Economy jets, slightly different at full rich
MA3PA 10-5267 or 10-5220 EN* or 10-5257 N*	Approx. 4% leaner

* E, EN and N designate field modifications to these carburetors.

From CP31-6 (CH30,CH39)

Composite Structure Fire - There were no instances of fire on any VariEze type structure in over 200,000 flight hours of operation - until last fall. Here's the report from Ron Walter:

"I pulled in front of my hangar, shut down the engine and put the plane on its nose. Looking back I noticed flames coming out the back and proceeded to get an extinguisher to control the flame. This was to no avail and resulted in completely destroying the plane within approximately 12 (more) minutes."

A fellow VariEze builder arrived on the scene after the entire engine area and cowl were involved and he offered the following, cautioning that some is conjecture.

"At runup area engine did not sound normal. After several tries at runup he taxied back to hangar parking. Time of run was about seven minutes. On shutting down the engine with the idle cut off he noted smoke from engine compartment. He retracted the nose gear, got a small fire extinguisher and emptied it into the fire. By that time however the fire was out of control."

"Fire definitely was well along in the engine compartment when aircraft was shut down. It might have been arrested if fuel valve had been closed when smoke was detected and fuel burned through engine. **Initial cause was stuck float in carburetor which kept feeding fuel to point of overflow (conjecture).**"

"The aircraft was headed west and wind was from 240 degrees about 3-5 knots. This fact inhibited the fire somewhat but I was surprised at the slow propagation of the fire, about 2 to 3 inches per minute forward on both wings. The heat softened the upper wing strake to the point that when the gas in the tanks ignited there was only a large "poof" - no contained explosion or any shattering. Even at this point neither the outer wing spars nor the center section box, showed deformation. Obviously they were getting soft but no sag. Within the next minute the fuel from the tanks intensified the fire to where everything melted down and completed burning forward to the front cockpit. At this point the main gear softened and gave up. Fire truck arrived and put out remaining fire.

Findings: Carburetor completely melted down to point of distortion - recognizable, but that's about all. Fire wall took a lot of heat before allowing fire to progress forward. Fuselage tank failed through sight gauge first. I could not tell whether the fuel feed line from the tank to the shut off valve had softened and burned feeding the fire. Engine mount distorted but intact. Top of wing tanks burned but bottom remained intact until almost complete collapse of main gear."

Ron also shared with us a poem written after the fire by his wife.
"You were the diversion he needed in times of stress.
You were solace to him when he was not at his best.
When the world was to much for him to cope,
He turned to you, and you gave him hope.
In the wee small hours when sleep wouldn't come,
You were there - always something to be done.
You and he saw the world from a different view,
When you soared together to the distant blue.
You're gone now - no more obsession.
Only memories left - the only possession.
You were the joy and the pride of his life.
I can't fill the void. I'm only his wife".

From CP32-7 (CH30)

CLARIFICATION

Section III, page 37. Part #LL-4 is used to stand off the mixture cable clamp, and is shown as a 5/8" long stand off tube on page 16. Part #LL-3 (page 37) is used inside the AN111-4 bushings in the throttle & mixture arms, and is shown as a 1/4" x 3/16" x .25" spacer on page 17.

From CP34-9 (CH30)
Wes Gardner
1310 Garden St.
Redland, CA
(714)792-1565
Wes has available a reusable carb foam air filter that is suitable for VariEzes and Long-EZs. Mike Melvill and Dick Rutan have these filters on their Long-EZs and are pleased with them.

From CP41-6 (CH30,CH38)
CARBURETOR FLOATS
RAF has recently received two or three reports from EZ pilots who have experienced problems with floats that become fuel logged and sank in the float bowl. This of course will result in a very over-rich condition and could kill the engine unless the mixture is immediately pulled out to almost idle cut off. RAF has tried to find out what could be causing this problem and we hear rumors that a major AD (Airworthy Directive) is in the pipe line and should be published soon concerning this problem. Apparently the composite floats installed in virtually every Marvel Schebler carburetor is susceptible to this problem and may have to be replaced with a metal float.

Keep a sharp eye out for an unexplained over-rich condition. The engine will generally start to run rough, and may even quit. If this occurs, try leaning the mixture control. If this helps, get back on the ground and pull the carburetor. Have it inspected by a competent carburetor rebuild company. If you have recently noticed you are leaning your mixture more than you used to, suspect that this may be the problem. Do not continue to fly. This can be a very serious problem. The company that owns Marvel Schebler carburetors is:

Facet Aerospace Products Co.
#1410 Highway, 70 Bypass
Jackson, TN 38301
(901)423-2500

This company has issued a service bulletin #A1-84A. This bulletin says the float must be replaced at the next 100 hour inspection or if any of the following three symptoms are seen.

1. Evidence of a flooding carburetor.
2. Rough running at low throttle settings.
3. Inconsistent engine shut down.

If your engine is doing any of the above, contact your local carburetor dealer. Here is southern California, our dealer is:

Aeromotive Carburetors
475-479 Riverside Drive
Burbank, CA
(213)845-7455

Tell them the model of Marvel Schebler carburetor and they have a repair kit which includes two or three gaskets, a clip and pin and a new metal float. For the MA3 carburetor, the repair kit part number is #666915.

From CP43-3 (CH30)
Learn to Fly in a Long-EZ?
Dick Prentice built his Long-EZ as a non-pilot with the intention of using it to obtain his pilots license. Dick built his Long in the San Diego area, a hot bed of EZ activity. When it was complete, he trucked it to Brown Field, where VariEze builder/pilot, Al Coha did the first flight in May 1984.

Dick installed a throttle, mixture and push-to-talk transmitter switch in the back cockpit. He found an excellent instructor who was very interested in the Long-EZ who gave him dual, soloed him and signed him off for his cross countrys and night flying. Ultimately Dick was signed off for his private check ride, when a possible stumbling block was thrown at him. The FAA could not decide if Dick should be issued a restricted license, since he had not done any stalls! After some hassling around, Dick decided to end the problem by renting a Cessna 152 for 1 1/2 hours. During this time his instructor put him through all the required stalls and finished up his night flying requirements. He took his private check ride in his Long-EZ and received a normal private pilot certificate.

This is the first case we know of, of a builder obtaining his pilots license in his own Long-EZ. Congratulations Dick! Dick would like to give credit to his wife, Joy, who was the driving force behind getting the Long-EZ built and who is now taking flying lessons in their Long. He also wants to thank the EZ Squadron in San Diego for all their help and encouragement.

From CP44-7 (CH30)
LONG-EZ/DEFIANT - The mechanical fuel pump has two large threaded holes (fuel in and fuel out) as well as a third smaller threaded hole or vent. This vent port should be vented overboard. If a diaphragm ruptures, gas may run out of this vent. A hose should be run from this vent hole through the bottom cowling, so any venting fuel will not spill inside the cowling.

From CP44-8 (CH30,CH38)
INDUCTION AIR FILTER AD
In January 1985, the FAA put out an Airworthiness Directive #84-26-02 concerning induction air filters. This AD covers almost every civil airplane in the US including homebuilts.

Any induction air filter should be changed at least every 500 hours. This is good practice and all builder/pilots should comply with this. If you are uncertain of how long the filter has been in use, it should be changed within the next 100 hours.

From CP47-12 (CH30)

CAUTION

Long-EZ electric fuel boost pump. Be sure to use the proper pump with a maximum of 6 to 8 psi. A float type carburetor cannot handle the high pressure pumps found on fuel injected engines. A 15 to 28 psi pump will flood a normal carbureted engine and shut it down. This has already caused one Long-EZ to land short of the runway! The small square shaped 'facet' electric pumps sold by Wicks, Aircraft Spruce and Brock are all fine and are set to limit below 6 psi.

From CP48-4 (CH30)

CAUTION

Low Fuel Pressure on Cont. O-200 Powered Long-EZ's

The mechanical fuel pump on a Continental engine is prone to being heated by hot cylinder air. This can reduce fuel pressure to near zero, particularly at altitudes above about 8000'. This fix is to build a cooling shroud from 3 plys of BID, to fit around the fuel pump with about 3/8" clearance all around. A 1" diameter blast tube, ducting cold, high-pressure air to the BID shroud will correct this problem.

From CP48-4 (CH21,CH30)

Wes Gardner is still selling his excellent, reusable foam air filters. Wes has some other neat "EZ" items. A retrofittable fuel sight gauge, for those with poor translucency in their gauges. An oil separator system for the Continental O-200 and the Lycoming O-235 that is guaranteed to remove all traces of breather oil mess on your cowling. Contact Wes for more information:

Wes Gardner
1310 Garden Street
Redland, CA 92373
(714) 792-1565

From CP49-4 (CH30,CH38)

CAUTION

On a Marvel Schebler carburetor equipped with an accelerator pump, there is a small "half moon" shaped bowl held on with two screws. Byron McKean reported that while he was inspecting his carburetor float bowl, which had absolutely nothing in it, he removed this little cover under the accelerator pump and found it literally packed with sediment. It had not caused any problems at that point, but obviously it is something to watch for during inspections.

From CP49-4&5 (CH30,CH38,CH39)

A Long-EZ in Illinois landed in a row of trees after the engine quit. The pilot was on a 1/2 mile final at 300 feet at idle power due to another plane in front of him. When he added power, the engine quit. Two attempts were made to start the engine using the electric starter, to no avail. He hit a small electric wire, then landed in a row of trees planted as a wind break. The canard broke on both sides, the right wing broke at 1/2 span, the left wing was damaged near the strake. The main gear was still attached but bent aft. The left wheel/axle was sheared off breaking all four bolts. The pilot received a small cut on his hand and that was all. No cause for the engine quitting has been determined. The first thing that comes to mind, of course, is the engine idle speed. This may or may not have had anything to do with this accident, but we have seen airplanes set up with such low idle speeds that they do have a tendency to quit on short final. However, that is normally an occurrence in the flare where it is only an annoyance as far as taxiing after the landing. An excessively high idle RPM is not satisfactory in that it makes it tough to land an airplane with the L/D of a Long-EZ. In general, if your engine will idle OK on the ground, it will idle even easier at approach due to inflow assisting the propeller.

* These values are probably incorrect as a Long-EZ can easily glide 1/2 mile from 300 feet while decelerating 10 knots.

From CP50-3 (CH30)

A 12V as well as a 24V pump is now available from Wicks Aircraft, both of which have male dash 6 fittings integral with the pump body! This makes it a piece of cake to attach fuel lines since you don't need AN elbows or 45 degree fittings, and it gets rid of the problem of 1/8" pipe threads which most of the of the original Facet pumps had. Part numbers and prices from Wicks are:

#40108 - 12V with 37 degree male fittings	$29.75
#48610 - 24V with 37 degree male fittings	$32.50

Contact Wicks Aircraft for further information.

From CP50-6 (CH30)

Long-EZ builders/flyers have known for a long time that the number 4 cylinder usually runs hottest. Many of you have speculated that the firewall mounted air filter and associated scat hose to the carburetor may be blocking the cooling air to number 4. Dick Kreidel has designed, built and quite thoroughly tested a neat solution to this problem and it really works well. Mike is in the process of building one just like it. It is so simple you will wonder why no one else has thought of it!

A 1/16" thick 2024-T3 aluminum plate is the :base". Two aluminum extruded angles are riveted to this "base", see photo number 1. An AN4 bolt connects the two angles with an aluminum tube spacer over the bolt and between the angles to allow the AN4 to be tightened. These angles are shaped to "nest" against the starter. Two stainless worm gear clamps (hose clamps) go around the starter body and around the aluminum spacer tube to hold the "base" firmly against the starter. In these photos, Dick has an Amsoil foam filter but the standard paper filter will do. The stock Brock carburetor heat valve assembly is used just like it was on the firewall to hold the filter in place with four tension springs.

Photo number 2 shows the scat hose inlet duct with fiberglass elbow and the scat hose going to the carburetor heat source. The carburetor heat valve return spring is hooked at a small bracket on the alternator mounting bolt.

This set-up is sanitary, simple and puts the air inlet filter where the highest pressure cooling air is, right up against the aft lower baffle. This, also, gives you a nice, clean, roomy firewall. Dick has found that his cylinder head temperatures run more even, too. It certainly looks like it is worth a try, especially for anyone who has a very crowded firewall or a hot number 4 cylinder.

From CP50-9 (CH30)(Photo Caption)
Photo #1 - Dick Kreidel's intake system showing method of clamping to starter and foam filter - view is from right side.

From CP50-9 (CH30)(Photo Caption)
Photo #2 - Dick's intake system from left side. Brock carb heat valve assembly is used. Dick has a carb heat shroud over his left exhaust - he reports complete satisfaction with this system.

From CP50-7 (CH30,CH38)
CAUTION - MECHANICAL FUEL PUMPS
It has come to our attention that the FAA has received numerous reports of these pumps leaking; to complete in-flight pump failures; even to in-flight fires. Apparently, the most common cause of this type of problem is the loosening of the diaphragm screws. It has been reported in several national publications that A.C. will no longer be producing these mechanical fuel pumps due to the liability problems associated with such a failure. New pumps are already becoming scarce and rebuilt kits are no longer available anywhere to our knowledge.

Take care of your A.C. fuel pump. Keep it clean. Inspect it carefully for leaks. Be sure that the A.C. pipe thread adapters are tight and the "o" rings are in good condition and are sealing properly. There should be no fuel stains (leaks) anywhere, the AN fittings should be steel and should be tight and have no leaks. It may not be a bad idea to substitute aircraft quality AN-3, drilled-head bolts for the screws and lock washers. Be careful not to overtorque these bolts and do safety wire both bolt patterns.

If anyone has more information on A.C. fuel pumps, repair kits, etc., we would appreciate hearing from you.

From CP50-7&8 (CH30,CH33,CH38)
"Dear Folks at R.A.F.
I am very pleased to announce that N721EZ made it's first flight earlier in September and as with many of the other builders the initial flight went off perfectly. Performance has been without exception, right out of the owners manual.. Basic empty weight is 853 lbs., with starter, wheel pants, and a 25 amp/hr gell cell up front. 125kts IAS @ 2500 rpm fits very well within the 65% power range. I now have over 22 hours of very enjoyable time and look forward to completing the required time.

Although I'm happy to report the excellence of this design, I actually wrote to describe a problem I had after the fourth hour. Having made the modifications to the flight controls in the last CP (LPC 131) and coating the firewall with the intumescent paint, I had the crankshaft seal split and lost two quarts of oil over a one hour period. Fortunately, I kept my first 10 hours down to one hour segments. On removal of the cowling, **I decided to run a short inspection and discovered very small fuel stains running down the firewall from the Facet fuel pump.** Had I not had the new firewall paint on, I might not have noticed the stain. The stain was reddish and did not coincide with the 100LL fuel which confused me at first. The stains were not very much at all and I was almost going to dismiss them but I elected to turn on the fuel pump and watch it for awhile. After 5 minutes, a single drop of fuel dripped out from the back case of the pump.

A few drops of fuel over a 5 minute period does not seem like much but it was enough for me and off came the pump. Close inspection did not show any fuel coming from either of the fittings so I pried open the back of the pump and there found a surprise. The central core of the pump was wrapped with coils of enamel coated wire (red) and then finished wrapped with cloth. The cloth was soaked with fuel and stained red I presume from the fuel acting on the enamel wire insulation. It's anybody's guess what further progress this may have taken. I am in the process of returning the pump for inspection.

Since the last newsletter had important information the fire hazards, I thought I would pass this information along to you.

If I may make any suggestions to builders on their initial flight test program, keep the first few flights short and near airports in the restricted areas. Also, even though the cowlings may be a small inconvenience to take off, during these first few hours remove them and check things over.

Once again many thanks,
Rick Glos"

From CP51-6 (CH30,CH38)
MIXTURE CONTROL RETURN SPRING PROBLEM
There have recently been two cases of engine failure resulting in forced landings (luckily without damage) caused by failure of return springs in the engine mixture control linkage. These, we believe, are due to improper installation of the bracket supporting the push/pull cable at the carburetor. The springs as properly designed are intended only to snub the system and improve the fidelity of the mixture control by eliminating free play. The springs should never be required to move the mixture control away from the idle cut-off position. In both instances, the springs had failed or lost their force due to fatigue and vibration. Properly installed, the swage at the cable end should sit very close (within 1/2") to the cable conduit clamp when the

mixture is in the idle cut-off position. If your bracket allows excess exposed cable, then the mixture control cable may buckle rather than positively force the arm away from idle cut-off in the event of a spring failure. Do not depend on the spring to bring the mixture control into the mid range, well away from idle cut-off. If you do, the engine can fail due to a spring failure. If your aircraft does not pass the test shown in the plans changes section of this newsletter, ground it immediately and rebuild your conduit clamp so that the exposed cable is short, allowing the mixture lever to force the arm to at least mid range without assistance from a spring. This is required on the throttle as well as the mixture control.

From CP51-8 (CH30)
Wicks Aircraft has, also, now got in stock the Facet fuel pumps with built-in 37 degree 3/8" J1C flare (-6 aircraft)
FP-40108 - 12 volt 6 psi
FP-480610 - 28 volt 6 psi (this part number was incorrect in CP50)

From CP53-3 (CH30,CH38,CH39)
A southern California VariEze was taking off when it lost power at approximately 400 feet. The engine was leaving a trail of black smoke. The pilot was unable to make it back to the airport and crashed on rough ground about one-half mile from the airport. The airplane was severely damaged and the pilot sustained moderate back injuries.

The pilot believes that the plastic float in his Marvel-Schebler carburetor became "fuel logged" and sank causing the engine to run so rough it quit. He was aware that there have been some problems with these floats, but he said that the important thing was that he never thought it could happen to him! We appreciate such honesty and frankness and hope this will strike a firm note and prevent more pilots from suffering the same fate. See CP 41, page 6, for details on the float problems and things to watch for.

From CP54-8 (CH30)
Electric Primer For Long-EZ
While this is not a new idea, it does seem to work well. Mike and Sally recently installed an electric solenoid valve into the primer system of their Long-EZ, N26MS. This simple, on/off valve allows them to use the electric boost pump to prime the engine while the starter is cranking, thus getting the fuel into the cylinders where it belongs.

These little electric solenoid valves are available in 12 volt as well as 24 bolt. They are manufactured by Skinner, the part number is: B2Dx62 (12 volt or 24 volt). You must specify the voltage. An excellent source for these valves is:

Norman Equipment Co.
Bridgeview, IL
Toll free, call: 1-800-323-2710

The Skinner valve must be placed in the primer line such that it can allow fuel, under pressure from the boost pump, to enter the primer lines to each of the cylinders.

Mike made a simple "T" fitting which he installed in the fuel line between the boost pump and the engine-driven mechanical pump. He was unable to find a suitable off-the-shelf "T". The problem is that the primer lines are dash 2 (1/8") size, whereas the fuel line downstream from the boost pump is dash 6 (3/8"). Therefore, the "T" would have to look like this: **SKETCH OMITTED**

If anyone knows of a source for such a fitting (in steel), please let us know and we will put in the CP. Mike made his "T" fitting like this: **SKETCH OMITTED**

5/8" x 5/8" x 1" drilled and tapped with one 1/8" NTP thread, and two 1/4" NTP threads. This worked fine, if a little heavy. **SKETCH OMITTED**

The B2Dx62 Skinner valve should be wired to a momentary switch on the panel near the starter switch. This lets you crank the engine and "blip" the primer as required. Of course, the boost pump must be on for this to work.

Why an electric primer? Well, first of all, it eliminates having primer fuel lines in the cockpit. It is simple and lightweight. This system is commonly used on general aviation aircraft, for example, the Beech Duchess (BE-76). The only disadvantage we can think of is if your battery was flat you could not prime the engine to allow you to hand prop the engine. This system may not be as good on an engine with no starter. It is primarily intended to be used in conjunction with an electric starter. Mike is very happy with his and he knows of a least two other Long-EZs with the same installation and they work great as well.

From CP55-6 (CH30,CH38)
CARB AIR INTAKE HOSE PROBLEMS
Jake Bach, a Long-EZ builder/flyer reports that for almost a year he had an unexplained loss of about 100 RPM. He checked everything he could think of - timing, compression, plugs, etc., to no avail. Then he decided to modify his air intake system and when he took the intake hose off (which looked perfect from the outside), to his amazement, it had imploded! All the wire on the inside of the hose had come loose and had balled up in the hose restricting the engine's ability to breathe. A new hose completely cured the problem.

This is another good point, one that has been covered in the CP before and, also, one that, in fact, caused an accident in a VariEze some years ago. Part of the problem is in the installation of the hose. It is critical that the spring wire inside the hose be bent in such a way that it can be securely trapped under the hose clamps at each end. We like to bend the wire 90 degrees so it comes straight out of the end of the hose, then bend it 180 degrees so it comes out of the hose around the edge and back along the outside of the hose. Then the hose is installed over the filter tube or carb intake tube and the hose clamps are slipped on so that the wire and the outside string wrap are held securely in place when the hose clamp is tightened. This should eliminate any chance of the wire "spring" coming loose from inside the hose, however at least an annual inspection of the outside, as well as the inside, of this hose should be conducted.

****From CP57-7 (CH30,CH38)****

LONG-EZ, DEFIANT--remove, inspect & if necessary, replace the Facet fuel boost pump per page 11 in this newsletter.

****From CP57-11 (CH30,CH38)****

LONG-EZ, DEFIANT, ELECTRIC BOOST FUEL PUMP ALERT.

Returning to his home base airport after a flight, a Southern California Long-EZ pilot was approaching the 45 degree entry to downwind when, abruptly, his engine quit. He was unsuccessful in getting it restarted but, to his credit, he flew the airplane, announced his situation and made an uneventful, successful landing. Feeling a little weak around the knees, he pushed his airplane into his hangar and went home.

The next day, he conducted a careful examination of the aircraft and discovered that the Facet solid-state fuel pump was completely blocked and would not allow any fuel to pass through to the engine driven mechanical pump! One of the two valves in the pump had deteriorated in the 100LL fuel and had worked its way out the metal cage that normally prevents this, and had been sucked into a position that prevented the flow of fuel. The part number on the mounting flange of this pump was 480615. The plunger valve was made of VITON - this pump is no longer being manufactured.

Before next flight, check the part number of your pump. If you have one of the following part numbers 40023, 480615, 480616, remove the pump and replace it.

The most desirable Facet solid-state pumps that we recommend are part #40108 for 12 volts and part #40154 or 480610 for 24 volts. Both pump fuel at a regulated maximum 6 psi, and the valves in these pumps are *pure nylon* which, other than swelling very slightly in avgas, are not affected nor do they deteriorate. The design of these valves (the foot valve and the plunger valve) are such that they cannot physically get into a position where they can prevent fuel from flowing through the boost pump. Both the above pumps have AN-style 37 degree flare fittings which fit 3/8" tube, AN 818-6, nuts.

Facet manufactures over one hundred variations of the small square solid-state fuel pumps. The above two pumps have AN-type flare fittings machined right on the pump bodies and we prefer this type because they are easy to install (no elbows or nipples required), but also because these two models have <u>only</u> nylon valves, no rubber, Buna, or Viton. Many of FACET's other models have Viton plunger valves or Buna N check valves and these <u>will</u> deteriorate in avgas. These are specifically for use in some other liquid known not to affect these materials.

To check your pump, remove it and look into the inlet and the outlet using a small flashlight and verify that the inlet valve (foot valve) is a round, white dome or ball (nylon), <u>not</u> a flat, black rubber disc. Verify that in the outlet there is a white nylon valve under a steel pin which crosses the port and retains this valve. If this valve is dark gray or black (Viton), remove the pump before next flight and discard it. If you have a pump with female pipe threads (to accept elbows or nipples) due to your firewall layout, choose one with 3/8 NPT female threads rather than the 1/8 NPT female threads, but examine it <u>closely</u> to be sure it has white nylon valves in the inlet and the outlet ports. Discard it if there is any black or gray Viton, Buna N or rubber valves.

If you have had your Facet fuel pump more than a year or so, you probably have one that could go bad. AT a cost of approximately $30.00, it is not worth the risk. Remove it, discard it and install a new one as called out. We believe that the serious consequences that could result from a fuel supply stoppage, more than justifies the immediate replacement of any suspect pump.

We have replaced the boost pumps on Burt's Defiant and on Mike and Sally's Long-EZ and *we recommend in the strongest possible terms that you do the same.*

****From CP58-5&6 (CH30,CH33)****

PREVENTING CARB ICE using a Teflon coated throttle plate, shaft and screws plus a gasoline icing inhibitor.

Long-EZ builder/flyer Ken Clunis sent us a copy of *Mechanical Engineering Report LR-536* from the National Research Council of Canada titled "Aircraft Carburetor Icing Studies" by L. Gardner and G. Moon. This report is quite extensive and obviously very carefully researched. The summary of the test results states: "A study has been made of the effects of gasoline icing inhibitors on aircraft carburetor icing. An engine test was developed and used to evaluate various types of icing inhibitors. The results obtained showed that aircraft carburetor icing can be prevented by the inclusion of additives in the gasoline.

The use of a Teflon-coated throttle plate to prevent ice adhesion was studied and found to virtually eliminate any ice formation on the plate. The use of ethylene glycol monomethyl ether (EMGE) at 0.10 to 0.15% by volume in the gasoline and the Teflon-coated plate was shown to prevent both carburetor and fuel system icing".

Ken has followed up on this report and has had his shaft, screws and throttle plate Teflon-coated. He is currently running his Long-EZ with these parts installed and is using Prist "Hy-Flow" (not "Lo-Flow" which is alcohol based and may be hard on your epoxy in the fuel tanks), which he says is the best source of EMGE. He has installed a carburetor temperature gauge and is very pleased with his results so far.

Ken says that he had his carburetor shaft, screws and throttle plate Teflon-coated (black) at:

Durable Release Coaters, Ltd.
4 Finley Road
Bramalea, Ont., L6T 1A9
Canada
416-457-2000

His contact there was Dave Lund, himself a well informed expert on carb icing. There is a $75.00 minimum charge. If enough people wanted to get it done, the price would run about $15.00 for shaft, screws and plate in quantities of 10. We sure appreciate the effort Ken put out to obtain this information. It sounds like an excellent preventive measure that EZ/Defiant pilots may wish to try.

****From CP58-6&7 (CH30,CH38)****
FUEL BOOST PUMP UPDATE
CP 57's fuel pump alert caused many letters and phone calls and there still appears to be much confusion.

RAF recommends, as a first choice, a Facet boost pump with 37 degree x 3/8 flare fittings and with a nylon foot valve on the inlet side and a nylon plunger valve on the outlet side. The Facet part numbers for this pump are:
40108 - 12v 6 psi max. 4.5 psi min. 37 degree flare
40154 - 24v 6 psi max. 4.5 psi min. 37 degree flare

If you do not want to install the aircraft style 37 degree x 3/8 flared fitting type pump, due to plumbing requirements or space or whatever, the next best choice would be to use a pump with 1/8 - 27 national pipe thread internal or female threads, requiring elbows such as AN822-6 to go to 37 degree x 3/8 flared fittings.

40106 - 12v 6 psi/4.5 psi, 1/8-27 NPT internal threads.
40082 or 40164 - 24v 6 psi/4.5 psi, 1/8 -27 internal threads.

Facet does not manufacture a 3/8 - 18 internally threaded pump that meets the 6/4.5 psi fuel pressure requirement with nylon valves. For this reason, RAF is not recommending the larger internal thread style pumps. Anyone who is using one of these pumps should be very aware of the fact that while the outlet plunger valve may be nylon, the intake valve is Buna or rubber and is a check valve, not a foot valve. A check valve will maintain full fuel pressure on your fuel system down stream of the fuel pump and against your needle and seat float valve in the carb. This is not necessary nor is it desirable in any RAF design. If you are using one of these pumps, a careful inspection of the intake valve at least once a year is strongly recommended.

Ian Wilde from Olney, England, a Long-EZ builder/flyer, sent this information in and we have included it here to help those builder/flyers of RAF designs in England. "Facet fuel pump, 40108 is not easily obtainable here in England, however, I am told by the Facet agents that #40105 is the replacement for 480615 and that this pump has all nylon parts. (40105 has a maximum fuel pressure of 4.5 psi which should be OK - all the pumps RAF is now recommending have a 6 psi maximum). Price in the UK is 30.00 Sterling. Better still, the plunger assembly of #480615 can be replaced with an all nylon assembly as per 40105 at a cost, including labor, of 10.93 Sterling, including tax and postage. I have had mine modified and I am very happy with it. Anyone interested should contact the Facet agent:

FSE (Fuel System Enterprises)
180 Hersham Road
Hersham
Walton-on-Thames
Surrey, KT12 5QE
Phone: 0932 231973
Telex: 925109 Fuelit

My contact was Mr. Peter Huxley"

****From CP58-13&14 (CH30,CH33,CH39)****
A California VariEze suffered an engine failure over the airport and crash landed short of the runway in two to three feet of water. The airplane flipped over and the pilot did not survive. The FAA has stated that their initial findings are that carb ice was probably the cause.

This was carefully looked into by people much more expert in these matters than we here at RAF, and their report to us was that, yes, they would have to agree with the FAA. The weather was conducive to induction icing with light rain, fog and high humidity. This pilot was in the process of fine-tuning his EZ with the intention of entering it in the CAFE 400 efficiency race. With this in mind, he was after fuel efficiency at medium power setting. He made a number of improvements to his Continental 0-200 engine but one of these changes was probably very significant in light of the accident. **He altered the intake manifold to include an expansion chamber, or plenum, downstream of the carburetor or, in this case, a**

throttle body. While throttle body types, in general, are highly resistant to carb ice, it is strongly suspected that the induction ice in this case probably formed in the plenum downstream of the throttle body. Tests have shown that allowing the fuel/air mixture to rapidly expand after it comes out of a venturi, or throttle body, can cause immediate and severe induction icing in the plenum and intake tubes, yet not form any ice in the carburetor or throttle body.

In view of the situation, this is very likely what happened. The builder/pilot had been experiencing power related problems since installing the new plenum -type intake manifold and had, in fact, been working on a carb heat system. He arrived over head the destination airport and reported having lost power. Visibility was poor, but he was seen on short final, gliding toward the runway threshold. Tragically, he was about 50 yards short and touched down in 2 to 3 feet of water on the extended runway centerline. The EZ pitched nose down and flipped on its back where it remained until rescuers lifted it out of the water. The plexiglass canopy was broken, the canopy frame was undamaged as were the latches and hinges. The canard failed aft on both sides, leaving a short center section of the canard still attached to the fuselage. Left and right pieces of the canard from the fuselage sides out were torn off. The fuselage was damaged below and aft of the canard. The wings and winglets were not damaged. After drying out the engine, it started and ran OK although a magneto was replaced due to waterlogging.

What can we learn from this tragedy? The pilot was unable to exit the airplane, either because it was inverted with its nose and canopy imbedded in the mud on the bottom of the shallow bay, or because he may have been incapacitated by the impact, or both. Obviously, this situation was very bad and the chances of surviving a crash landing in shallow water are very slim. Since this accident, RAF has received a number of calls and letters wanting to know how to ditch an EZ. We honestly do not know of a safe way to ditch any fixed gear airplane. The possibility of nosing over is very high with fixed gear since the gear dragging in the water produces a powerful nose down pitching moment.

If we were faced with an unavoidable water landing, we would put the nose gear and landing brake down and we would fly into the water as slowly as possible while still maintaining control. We would <u>not</u> unlock the canopy because when the nose dives under water, a 60 mph jet of water entering under the canopy and striking the pilot in the face, would almost certainly be incapacitating. We would recommend carrying a canopy breaking tool such as a heavy, short bladed knife, kept where the pilot could easily reach it. After the airplane has come to rest, be it upright or inverted, if the canopy was intact, the canopy breaking tool should be used to break the plexiglass, making a large enough hole to exit through. Since an EZ will almost certainly float, particularly if it remains mostly intact, the surface would not be far away.

Prior to touch down, declare an emergency and, if possible, give an accurate position report. (A Loran would sure be handy here, since you could broadcast your latitude and longitude position.) Tighten your seat belt and shoulder harness as tight as you can bear it and brace yourself as best you can. Try for the slowest <u>controlled</u> touch down, no fancy stalling maneuvers, these will usually only compound the problem. Since the EZ-types will almost certainly nose over, be prepared for this. Remain calm, release your seatbelt, break out and swim to the surface.

Better yet, since a successful water landing is so uncertain, perhaps we should all seriously consider remaining within gliding distance of land at all times. EZ's were never designed with landing in water as one of the goals, and they are almost certainly not at all suited for this activity.

One other VariEze crash landed in water. The cockpit area broke up and the pilot found himself swimming. He made it to the beach but had a fractured back and wound up in a body cast for two months. His EZ was severely damaged and he never did rebuild it.

Surprisingly, or perhaps not surprisingly, one of the phone calls we got suggested we, or someone, should conduct a test by deliberately crash landing an EZ, preferably by remote control, in water!

****From CP59-2,3,4&5 (CH30)****
<u>LONG-EZ 84</u>
<u>ABOVE AND BEYOND THE OUTBACK</u>
"While the Northern Hemisphere braced for winter weather, the folks Down Under were busy celebrating their Bicentennial Year and the promise of Summer. Among the many and varied events which commemorated Australia's Bicentennial Year was an Air Race unlike any other ever run in Australia. It's fitting that an air race should have been part of Australia's celebrations as aviation has played such an important part in Australia's pioneering growth. The vast distances and remoteness which are such a part of Australia make aviation a vital part of life in the land Down Under. Without the airplane, the prosperity and well being of Australia would not be what it is today.

The "Aviation Event of the Decade", as one newspaper called it, was actually known as the GE Bicentennial Around Australia Air Race. Sponsored by General Electric (USA), the race lived up to its name as it covered more than 6100 nautical miles and virtually circled Australia. More than an air race, it was a "Bicentennial Event" which brought the celebrations to remote places and people in the vast Outback of Australia, as well as to its capital cities.

105 competitors took the starters flag in Narromine, New South Wales for the first race leg to Toowoomba, Queensland. The lineup was quite a spectacle as military and civilian single and multi-engine aircraft taxied into line to await their flag-off. Among the competitors were some noteworthy vintage aircraft and four homebuilts; a Thorp T-18, two Long-EZs, and a VariEze. The highest finishing of these was Long-EZ '84', built and piloted by Queensland businessman Magna Liset. His copilot and navigator was Wayne P. Johnson, a US Army Captain and Flight Instructor on exchange to to the Australian Army Aviation Centre in Magna's hometown of Oakey, Queensland.

Long-EZ 84 crossed the finish line at Rockhampton to capture ninth place at the end of the fi st day's racing. It was an indication of the aircraft's true potential. 84's aircrew had decided to restrict maximum rated power to climb only, thereafter throttling back to 75% power to conserve the engine and ascertain if the aircraft would be competitive. It became very clear from the outset that this would be a long race, one in which the fleet of wing might not necessarily be the victor. Speed and endurance were to be critical elements of any winning combination.

Second day's race leg was somewhat shorter, run from the coastal plains of Rockhampton to the dry inland cattle ranching area of Longreach, home of the "Stockman's Hall of Fame". Over this leg, Long-EZ 84 managed a higher average speed than in the previous leg and secured fourth place for the effort. This was partially due to guessing the winds aloft better than some of the competitors, and to the use of a ram-air plenum which had been fitted to the aircraft prior to the race. **The newly fitted ram air system was good for an additional 50-125 RPM in cruise flight. The resultant difference in true airspeed can easily be appreciated.**

The departure from Longreach early on the morning of the third day wasn't without some drama. A crack was discovered in the prop spinner during last minute preparations and a decision was made to stop-drill it until more permanent repairs could be made. These were planned for the end of the day at Alice Springs, where we hoped time and resources would allow such an effort. Unfortunately the vibration generated by running the engine at continuous high RPM made the crack worse, as was evidenced by its singing in the navigator's ear during cruise flight. As it turned out, there was an unexpected delay during the intermediate stop at Mount Isa. The copilot-navigator donned his A&P hat and raced off to find an FBO equipped to make airframe repairs. Spinner repaired and polished, Long-EZ 84 sat in the 38 degree C mid-day sun awaiting its starting time. Long-EZ 84 crossed the finish line at Alice Springs late in the afternoon with what its crew felt would be a good performance. The aircraft had flown predominantly low-level over the longest the most remote race leg of the entire event, using thermals enroute to enhance true airspeed. This was possible because the winds aloft were forecast as either headwinds or crosswinds. Given the aircraft's rather sluggish climb performance, but excellent cruise and turbulence penetration, it was decided to gamble on a low level leg with an accent on precise great circle navigation. The ride for the "guy in back" wasn't conducive to the stubby pencil routine or computing, but the pilot accurately flew the directed headings and courses and '84' maintained its great circle route within one-quarter mile throughout the entire leg. The Race Director's announcement that M. Liset in Long-EZ 84 had won the Longreach to Alice Springs leg was its crew's first indication that they were truly in the running. It had been a good day! The first of several.

Analysis of aircraft climb and cruise performance during the first three days convinced both navigator and pilot that the contest would effectively be over once the high performance twins, especially the Royal Australian Air Force's entries, reached conditions favoring higher altitude cruise performance. The winds aloft during the timeframe of the air race were predominantly westerlies and northwesterlies. Obviously, an aircraft with good low-level performance, accurately flown along its shortest route, would fair much better than a high performance aircraft better suited to upper-level cruising.

Long-EZ 84 made the most of its 'tactical advantage', winning the fourth leg from Alice Springs to Darwin, as well as the fifth and sixth legs from Darwin to Broome and Broome and Canarvon. This run of success put the little homebuilt into second place as the fleet reached Perth, only 20.42 points behind the Ted Smith Aerostar 601P of Ted Rear. By the time the race reached Perth, it was a National event with considerable attention from the news media. While Perth Businessman Ted Rear enjoyed the attention of his hometown press, Magna Liset and the 'Unusual tail-first homemade airplane from Queensland", weren't short of curious onlookers, well wishers, and radio and TV commentators. In fact, by the time it reached Perth, anyone remotely interested in the air race knew about the little plastic airplane built by some fella from Queensland. What's more, they wanted to see and touch it for themselves. All of this instant notoriety, although flattering, was a little troublesome at times. Everyone wanted to leave fingerprints all over the canopy. The navigator spent most of his time rescuing Magna from the upteen thousandth redundant question or (re)polishing the canopy. About two hours of this and your fun meter was just about pegged out!

As predicted, once the race turned eastward and tailwinds became the order of the day, the big boys got on with it and left the less well endowed struggling to catch up. Long-EZ was now hard pressed to hold its own and, in fact, lost ground slowly. It was very disappointing to watch the ground speed figures, knowing that the big guns were doing much better at higher altitudes, and had been doing so longer. Add the fact that as the day wore on, the winds aloft typically lost intensity. All of which meant that the early birds definitely got the best worms.

It turns out that Long-EZ 84's left magneto developed a 'leak' while crossing the Nullabor Plains. The crew thought that the hard full-power running at low altitudes prior to Perth had taken a toll on the rings and valves, which accounted for the noticeable, but then unexplained loss of revs. The magneto problem was only confirmed after the race..

When all was said and done, Long-EZ 84 wound up capturing the 3rd place prize, good for $4,000.00. Or as Magna put it, "This air race stuff is okay!"

You may be wondering how the race was run. Funny you should ask. The navigator asked the pilot the same question, and spent the first two days figuring out the answer. Simply put, it was a handicap race based upon manufacturers' design specifications and 75% cruise performance. The resultant calculations yielded each competitor's handicap True Air Speed (TAS). Each day the Race Director would announce the handicap winds aloft figures used by the timing and scoring section; generally a question of worst or best case from actual area forecasts. It was then up to the individual competitor to achieve the best ground speed (shortest time interval) given their handicap TAS corrected for the handicap winds aloft forecast. To keep the race within the reach of all competitors, altitude was limited to 10,000 ft AMSL. Competitors seemed to honor this restriction, although there were unconfirmed reports of some of the high flyers and fast movers sneaking above the mark to 'have a look'.

Long-EZ 84 represented the breed very well. It's average TAS was 161.64 Kts. The highest recorded TAS was 170.39 Kts. The highest recorded groundspeed was 251.76 Kts, achieved while crossing the Nullabor at 10,000 ft AMSL between Forrest and Ceduna. Bear in mind that the aircraft consistently took off with the highest all up weight of the two Long-EZs in the race. Fuel capacity was never a problem; however, the very long distances of some of the legs, combined with rather stringent VFR fuel reserve requirements in Australia, made for a heavy aircraft on occasion. This was particularly evident in climb performance, especially since the aircraft was fitted with a Great American Propeller Company cruise prop. On one of the legs, an unexplained loss of TAS and groundspeed became evident as the flight progressed. Engine instruments said everything was operating at full potential but the navigator's computer said .04 Kts slower than anticipated. The culprit turned out to be a thin coating of salt brine on the aircraft's surfaces which effectively gave it a fine sandpaper finish. Washed and rewaxed, the elusive knot found its way back to the airspeed indicator. Smiles all 'round! **The Lycoming 0-235 engine was run at 2,900 RPM during cruise flight with ram air applied.** Descents were made at Vne with the actual descent point/gradient dependent upon the known and forecast winds aloft. Let's just say that Long-EZ 84 made an impressive finish at the end of each leg, as witnessed by many spectators on the ground. From the back seat, it sounded quite spectacular to hear the en ine at full chat on the downhill slide. The old prop really sings!

In essence, the GE Bicentennial Around Australia Air Race was just that - a race. Those competitors who were serious about racing and winning had to push themselves and their aircraft. In the final analysis, it was the optimized integration of man and machine which spelled the difference between success and "also ran". Anyone who came thinking they could 'cruise' around Australia and do well just didn't understand the problem. Long-EZ 84's success was the culmination of much hard work by a man who spent five years of his life building a dream. The aircraft is one of the finest aerodynamic examples you'll find anywhere. The pilot flew the aircraft to its potential, and the navigator kept it on track along carefully plotted great circle routes. One of the critical keys to success was the aircrew's use of very accurate 1:250,000 JOG-AIR maps. Although this meant considerable map preparation prior to each leg, and 131 map sheets at the start of the race, the navigational accuracy and appreciation of winds aloft and groundspeed made the result well worth the effort. There were times when the navigator was planning until 2:20 AM and getting two hours sleep prior to wake-up call. Likewise, the pilot spent his rest days checking, double checking and cleaning the aircraft for the next day's competition. The reward was to get within 20.42 points of leading the air race overall, and earning third prize in the end.

History will record that an aircraft designed by an American named Burt Rutan, built and piloted by Magna Liset and navigated by a United States Army Exchange Officer came within a stone's throw of leading the most prestigious air race in Australia's history. It came home third and made a lot of people very proud. It generated a lot of interest and excitement and put the homebuilt crowd in the spotlight. And it surprised a lot of people with their very expensive single and multi-engined aircraft.

In most forms of human endeavor, there is some element of that stuff called luck. One competitor was overheard in Perth as he observed how "lucky that Liset chap is." A friend of Magna's caught the comment and added, "Yeah mate, and the harder he works, the luckier he gets." It's refreshing to hear people who appr iate that building an aircraft is no small task. Doing it well deserves respect, if not admiration. It was one helluva air race. You should've been there!"

by Wayne P. Johnson

****From CP60-8 (CH30,CH38)****

INSTALLING THE RECOMMENDED NEW FUEL BOOST PUMP

The Facet fuel pumps, part #40108 and #40154 which have the 37 degree flares, have caused some builders to feel that the old pump with the 1/8" female pipe thread was easier to install. We have always preferred the 37 degree dash 6 fitting and do feel it offers the advantage of a large passage for the fuel (less restriction in the line. We had new flex hoses (Stratoflex) made up with 90 degree gooseneck fittings on one end to make the installation easy, however, there is a simple alternative. Aeroquip makes a steel elbow with a swivel nut that fits 37 degree flares that really make this installation straight forward and economical. The part number is 2071-6-6S. They are hydraulic, steel fittings made by Aeroquip and marketed by hydraulic dealers who handle Aeroquip parts. Bill says he will have a few of these swivel fittings with him at Oshkosh and would be happy to get them for anyone who wants them.

We would like to thank Bill Bainbridge for this gem of information.

****From CP61-7 (CH30,CH38,CH39)****

A New York VariViggen crash landed in the Piconic Bay shortly after take-off when the engine quit. The pilot, an experienced Viggen flyer attempted two re-starts but could not get it to run. He then turned into the wind and executed a near perfect gear up water landing.

The Viggen floated and the pilot was quickly rescued by some pleasure boaters. The Viggen was towed to the beach and, after spending some 20 hours in salt water, was returned to its hangar. The left wing root was heavily damaged and the builder probably will not rebuild. The pilot was bruised and shaken up but not seriously hurt.

The cause of the engine failure was traced to the mixture outer cable attach point near the carburetor. This attachment had been perfect for seven years and almost 600 hours but failed at 600 feet over the bay shortly after take-off. This failure was such that the mixture lever arm on the carburetor was pulled to the idle cut-off position. The pilot was unable to richen the mixture, or even to move the mixture at the carburetor, in spite of his best efforts.

What can we learn from this accident? Engine controls are every bit as important and critical to flight safety as flight controls are. Check your engine controls for correct travel and try to imagine what you could do to make sure that no matter what fails, the mixture fails to full rich and the throttle fails to full power. The opposite result is simply unacceptable. A spring that pulls mixture and throttle arms to full rich and full power could prevent such a problem. At least with full power you could use the cockpit mixture lever to regulate power (it works just like a throttle) or even the mag switches to cut power off to facilitate a landing. Using mag switches to regulate power is not as good as using the mixture control. Above all, check that the clamp that secures your throttle outer cable and mixture outer cable are as near perfect as your ability and skill allows. A failure here is not acceptable.

****From CP61-11 (CH30,CH38)****
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION
VARIVIGGEN Check engine control cables for secure attachment at the engine as well as at the throttle quadrant. Install springs to guarantee that carburetor controls fail safe.

****From CP61-11 (CH30,CH38)****
The engine control cable check called out for the VariViggen applies equally to the Long-EZ.

****From CP61-12 (CH22,CH30)****
To make it easy to install the new fuel boost pump with 37 degree flare fittings use a 90 degree elbow with 37 degree swivel nut and 37 degree flare. The Aeroquip part #2071-6-6S is for use in tight corners. Bill Bainbridge of B&C Specialties has promised to keep these in stock. This swivel elbow makes installing the fuel boost pump a simple proposition. Bill Bainbridge, of course, still sells his LR-2 Linear voltage regulator (the very best we have seen) also, dry-fit sealed, immobilized Electrolite batteries. Mike and Sally use two of these (small 15amp/hour) for their 28v Long-EZ. Burt uses two of the same for the 28v Catbird. These have been in continuous use for two years and have been flawless. Contact:

B& C Specialty Products
Box B, 518 Sunnyside Ct.
Newton, KS 67114
313-283-8662

****From CP65-11&12 (CH30,CH38)****
LETTERS
"Dear RAF,
Just thought I would drop you a note concerning a problem that I experienced in my VariEze on the way back from Oshkosh that might be of significance to other Ez's. Fortunately, the only harm done was a few minutes of inconvenience instead of what could have been a serious problem. I made a normal landing at Douglas, WY after a 4.5 hour flight from Duluth, MN. After rolling clear of the active runway, I found that advancing the throttle resulted in only a 100 rpm increase over my normal engine idle speed. Surprise! I had just successfully completed my first forced landing without even knowing it!

A check under the cowl revealed that one of the two throttle springs (the one with the most mechanical advantage, naturally) had cut its way through the aluminum bracket attached to a vacuum pump stud on my Cont. 0-200. The second throttle spring was within a whisker (a few thousands) of also cutting through the bracket. Wear at the other end, on the thicker (also aluminum) throttle bracket was quite evident but well short of failure. A check of all other engine related springs showed essentially no wear, so it is pretty obvious that my particular combination of throttle springs was resonating under the influence of the engine vibration, greatly accelerating the wear rate on these brackets. Total time on the installation was just over 800 hours. About 25 hours prior to the failure, I had switched back to a prop that I hadn't used for several years. If anything, this propeller runs smoother than the one that it replace, so I doubt that the "new" prop was a major factor. I would like to think that this problem developed after my last annual inspection (at 730 hrs.), but must admit that it looks like I missed seeing it despite the detailed check list that I use that explicitly includes all the engine controls and cables. I always go over the engine with a clean rag and (I thought) a sharp eye at every oil change looking for trouble, but didn't catch it at 765 hrs. either.

The following lessons suggest themselves to me:

1. Very careful attention to the condition of all engine related controls, as you have pointed out numerous times (e.g., CP61 pg. 7), is critical. A careful inspection of the engine, controls and exhaust system at every oil change could save your plane and/or life.

2. Ideally, the throttle and mixture controls should not require springs to open the throttle or enrich the mixture. This is difficult to accomplish with the Continental 0-200 using a single cable system because of the force required to overcome and positively actuate the accelerator pump.

3. Regardless of whether item 2 can be accomplished, springs <u>are</u> needed as a fail safe backup in case something else breaks (like the cable or outer cable clamp).

4. I believed that either spring alone was strong enough to actuate the throttle arm. With fuel in the carb, this wasn't the case. Instead of having a backup spring in case one failed, I actually doubled my chances of experiencing a throttle linkage failure by having two interdependent flight critical items. Obviously, other EZ builder/pilots need to inspect their particular installations to assure themselves that their controls will function reliably with any single spring failed. In my particular case, even if a single spring had been sufficient to open the throttle, only a few more hours of operation would have passed before the second spring also cut through the bracket.

5. Hindsight engineering makes is pretty clear that my brackets were plenty strong enough to carry the spring loads, but were not designed to withstand (or prevent) high rates of wear.

6. Finally, as my flight instructor told me long ago, "Don't count on being able to add power to make the runway."

To close on a more positive note, I love N862DP. So far it has made eight trips from San Diego to Duluth in nine years, with two side trips to Oshkosh, plus many other places all over the West. Last year I made it from here to Duluth with one stop in Rawlins, WY, and one-day trips over this 1500 nm route are the rule rather than the exception. Three years ago my daughter made the trip back with me when she was not yet five years old. I have and regularly use the Aerox system-it's great! Living in San Diego, I get lots of chances to climb out or land through our coastal stratus. So far, I have accumulated over 25 hours of actual IFR in N862DP. My plane does experience a definite pitch down trim in or near precipitation that requires significant retrimming.

This Spring I really enjoyed attending the EZ fly-in at Kanab, UT and Burt's birthday fly-in at Kern Valley (plus Oshkosh, of course). Enclosed is a picture of a flight of Southern Calif. EZ's returning from Kern Valley fly-in. Sorry I missed you at Oshkosh.

With best regards, Don Patch"

From CP65-13 (CH30,CH38)
<u>*THROTTLE AND MIXTURE CONTROL SPRINGS*</u>
Referring to Don Patch's letter above, we agree with Don's comments and we really appreciate his bringing this to our attention so that we can bring it to all the EZ builder/flyer's attention. As we have said many times, having perfect control of your engine is just as critically important as having perfect control of your elevators, your ailerons and your rudders. Anything less is almost certain to cause an accident which could result in the loss of the aircraft and possible the loss of life.

The bracket that Don refers to is a 1/16" thick aluminum bracket which he had mounted on his vacuum pump pad. He had drilled several 1/16" diameter holes through this bracket in order to "hook" the two springs through the bracket. Over the 800 or so hours of operation, the vibration had caused these springs to slowly "saw" their way toward the edge of the bracket. One of the springs had, in fact, "sawed" through almost 3/16" of the bracket until it broke through the edge. The other spring was almost at this point.

While this method of attaching a spring works OK (indeed, it was the same method used on Burt's prototype, N4EZ), it is prone to this kind of vibration induced failure. A preferred method is to install an AN-3 bolt through the aluminum bracket with a short spacer. The spring should be installed so that the loop of spring is supported by the spacer. See sketch .
SKETCH OMITTED

We have used this method successfully on several installations, some of which have been in operation for many years, with no failures.

The throttle and mixture both should be set up and adjusted so that they will work with no springs installed. The springs should be installed so that they pull the throttle to full power and the mixture to full rich in case of a cable failure.

These springs, cables and all engine controls should be carefully examined and checked for correct and full operation each time you remove your cowling, whether it be for an oil change or for whatever reason, or every 25 hours.

If you have these springs installed in a similar manner to what Don Patch had, you should check to see that you do not have the same failure, or close to failure, that he had - before next flight.

****Also see LPC #93 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #94 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP64-10&11 in the "Oil Coolers/Lines/Seals/Screens/Gaskets" section of this chapter.****
****Also see CP65-7 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP29-3 (CH21,CH30)****
LONG-EZ FUEL SYSTEM
Do not change the fuel system. This system was carefully and thoroughly flight tested at all attitudes, and works very well as per plans. Several builders have asked if they could convert the fuel system to a "both on" situation. Absolutely not! Both fuel tanks feeding the carb together will only work on a gravity system. The Long-EZ does not have enough fuel "head" to use a gravity system. Therefore we use a pumped system. That is, the primary pump is a mechanical, engine driven pump, backed up by an electrical boost pump. This is similar to most low wing airplanes, Grumman Tigers, Cherokees etc.

If you try to pump fuel out of two tanks at the same time, it can draw from one tank only, until it is dry then you will get air, and in spite of having one tank almost full of gas, you will flame out and have to land because of fuel starvation.

Be very careful of fuel systems, they must be absolutely fool proof in order to work reliably and consistently.

****From CP31-5 (CH30)****
Warning: Possible fatigue or installation failure of aluminum fittings in engine plumbing. We have had failure reports of aluminum fittings that support hoses or transducers on the vibrating parts of engines. This is a very serious concern, requiring us to recommend a grounding change that replaces certain fittings with equivalent steel parts. Refer to the plans-changes section of this newsletter for the new fittings. Do not fail to install the new steel parts, a failure can be fatal.

****From CP31-8 (CH30)****
This layout (from Section IIL, page 36) shows the aluminum to steel fitting changes - circled items: **SKETCH OMITTED**

****From CP34-8 (CH25,CH30)****
Sam Harris suggests leaving the hardener out of acrylic enamels on parts such as elevators and ailerons. The weight of the finish will thus be reduced by almost 50 percent. **Sam also suggests substituting 601 fuel hose for the 303 called out, it is easier to use in the small space.**

****From CP49-5 (CH30,CH33,CH38,CH39)****
A Long-EZ on its first flight after installing a newly overhauled engine suffered an inflight engine fire and was unable to make it back to the runway. The engine quit on approach and the pilot attempted to land in a housing tract. There was not enough room and he rolled into a car which also burst into flames. He landed under control, thus, inflight structural failure or control failure are not suspect. Sadly, the pilot was killed by fire. The fire was so intense in the engine/cowling area the the FAA accident investigator was unable to determine what could have started the fire. The fuel pumps, carburetor, etc., were consumed. The airplane had been airborne for only a few minutes. Reportedly, the engine was an 0-320 and he was using auto fuel. **We may never know what caused the fire, but it is easy to overlook a loose fitting - we have done it ourselves.** A fuel leak, particularly auto fuel, could be ignited by hot exhaust or any number of things. Always try to have at least one other person go over your work, especially engine related work like plumbing or control systems. The more pairs of eyes that look at your engine installation, the better chance that you will catch some overlooked items. This is specifically important if you are developing new, unapproved installations.

Never, ever, cowl an engine that has been worked on without a brief engine run to check for leaks. We, here at RAF, have more that once found fairly drastic leaks during the leak-check engine run.

****From CP49-7 (CH30,CH33,CH38)****
FUEL LEAKS IN THE ENGINE COMPARTMENT
We recently heard from a Long-EZ pilot who had just installed new fuel lines in his airplane. While on a cross country flight, he noticed that his cylinder head temperatures were way down from where they normally ran, and they continued to run cool for the duration of the flight. Upon landing, he removed the bottom cowling and found that the engine looked as though it has been steam cleaned! He turned on the boost pump and a fine mist of fuel sprayed out of one of the new fuel lines. These were stainless braided fuel lines, supposedly aircraft quality, and yet, one of them had several tiny pinhole leaks that had allowed a fine spray of AV gas to drench the engine. Apparently, the high speed cooling air, mixed with fuel, had literally scoured the engine clean as a whistle! Why no fire? Perhaps it is the relatively high flash point of AV gas which is much higher than auto gas. According to Popular Science, March 1986, it is becoming increasingly commonplace to boost octane ratings by dissolving cheap "light ends" such as butane into auto fuel. This increases vapor pressure and volatility and lowers the flash point. If this Long-EZ pilot had been using auto fuel, he may not have been so lucky. See "Accidents" in this issue.

Fuel leaks aft of the firewall are potential killers. If you have recently broken your fuel lines, or if you are in a new, untried installation, it is mandatory that you conduct a short engine run with the cowling removed.

Carefully inspect all the lines and fittings for leaks (including oil leaks) while the engine is running (watch out for the prop!) and fuel and oil is under pressure. It is common to find one or more fitting loose and you would be surprised how much oil you can lose through a finger tight (but not correctly tightened with a wrench) oil line nut.

Some years ago, Dick Rutan had a fuel line fitting break in flight during a speed record attempt. He lost most of his fuel over board before he became aware of the problem. When he landed, the entire aft end of the cowling and wings were stained with 100LL blue stain. This was the result of mounting an electric fuel pressure sender directly to the carburetor. The vibration failed the aluminum fitting. It is very important that fuel pressure and oil pressure senders be remotely mounted with flexible, aircraft quality hoses connecting them to the engine.

Use only steel elbows, nuts and nipples aft of the firewall in the fuel system. In certified aircraft, only steel or stainless steel fittings and tubes are used between the firewall and the engine, and all fuel and all oil flexible hoses have fire sleeves covering them. The reason is that in the event of an engine fire, the fuel and oil system will not burn through, thus allowing the pilot enough time to execute an emergency landing. Other than an inflight structural failure, an inflight fire would have to be the scariest thing that could happen to a pilot. As the builder of your own airplane, you owe it to yourself to do the best possible job you can on your engine/fuel/oil system. If in doubt, have an A&P or AI mechanic look it over. At least, have other EZ builders look at your engine installation. Many times, in spite of our best efforts, we miss something important which may be easily spotted by someone not so close to the project.

****From CP51-8 (CH30)****
Wicks **also stocks 1/4" x 3/8" O.D. x .035 wall stainless tubing for fuel lines.** The plans call-out for Defiant pitot static has become so expensive in the order of $280.00!!) that we have approved the following "under wing" "L" shaped pitot statics:

AN5814-1 - 14 volt $165.00
AN5814-2 - 28 volt $165.00

****From CP52-5 (CH30,CH38)****
CAUTION - Aeroquip 601 Hose Leaks.
We have yet another report of one of these rubber, reinforced-with-stainless-steel, outer, braid hoses that has suddenly sprung a massive leak. Again, it happened after the airplane had not been flown for a while. Our own experience with the Grizzly was that the airplane was not used for almost one year, then when we turned on the fuel valve and the boost pump, fuel ran out of the cowling just as though a line had been removed. A fuel line, an Aeroquip 601, was leaking at one of the fittings. This hose had never leaked before and no one had touched it between flights. We have now heard from at least four builders with this problem.

Here at RAF, we have gone over to Stratoflex Teflon hoses and we order them made up to the length we want. We have them pressure checked and have fire sleeves installed on each fuel line. These fuel lines are more expensive but we believe they are a much safer way to go. We have been getting our hoses from Aircraft Spruce and they are available from dash-3 to dash-8.

Check all your hoses aft of the firewall, both oil lines and fuel lines, frequently, especially if you have Aeroquip 601 hoses and even more frequently if you made these up yourself. A fuel leak aft of the firewall must be considered one of the most hazardous situations that can occur and must be taken care of before it happens while airborne. Replace any suspect fuel/oil lines. Have them pressure tested and have fire sleeves installed on each line.

****From CP57-11&12 (CH30,CH38)****
AEROQUIP GENERAL AVIATION ALERT NOTICE.
RECALL ON AEROQUIP 601 HOSE.
This week, we received a notice in the mail with the above title. If you look back through past issues of the CP, you will find that we have been reporting incidents with Aeroquip 601 hoses since 1986 (see CP49, and CP52).

We have had these hoses spring a leak in the middle of the hose (not at a fitting), and we recommended Stratoflex hoses instead. We use nothing but Stratoflex hoses on all of our aircraft here at RAF and that is still our recommendation.

This notice says, essentially, that if you made up the hoses yourself, as we have often done, and you obtained the hose from between April 1984 and May 1988, remove it from service and replace it. If you had these hoses made up professionally, they should have a metal identification band. On this band will be an assembly date and cure date shown as follows:
A2Q87 - assembly date, 2nd quarter, 1987
1Q87 - cure date, 1st quarter, 1987.

If you have such a set of numbers you can identify, remove the hoses if the cure date is between the first quarter of 1984 and the third quarter of 1987. Contact an authorized Aeroquip hose shop and they will supply you with new hoses. You will be billed for these until the authorized distributor receives your removed, suspect hoses, then you will be credited in full.

This note is more than a mandatory AD. A leaking hose could easily cause a fire which could have tragic results. Check your hoses and don't fly until you have replaced them.

From CP59-12 (CH30,CH39)

"Dear RAF:

I now have about 200 hours on Long-EZ N88LE which was completed in June 86. I have been very satisfied with its book performance and reliability. I was pleased to receive "best homebuilt" at the Eastern Regional Fly-In in Orange, Mass. this past June 88. My most memorable "incident" occurred while flying on a cross-country a few months ago. While over Michigan, shortly after I had switched tanks, the engine went silent and could not be restarted. I was vectored by Grand Rapids to Sparta Airport. The Long-EZ is truly an excellent glider when the chips are down, and handles nicely. Water was found in the gascolator and was found to have come from the tank filled at the last fuel stop. I don't know how this could have been prevented. The suggestion of being within reach of a landing site when switching tanks or having plenty of altitude certainly holds true. **I would also like to mention that when I constructed the EZ, I installed a fuel filter after the electric fuel pump.** Even though I was extremely careful to keep the wing tanks cleaned at all times during construction, I am still finding very small (1/32 inch dia.) pieces of blue foam in the filter. I have found extremely small trace amounts also in the carburetor filter. I am convinced that frequent inspection of the carburetor filter is critical, and I would recommend the additional filter. I installed it so that it can be viewed easily before flight, and can be easily removed and cleaned.

Keep up the good work with the CP. I've found it to be an invaluable "extension" of my Long-EZ.
Bill French"

From CP64-9&10 (CH30,CH38)

I thought I would write to report an **exhaust failure** on our Defiant that could have been quite serious.

This involved the front engine with about 200 hours on it. The exhaust was a unit purchased from Wag Aero. It is a standard wide deck exhaust for a Grumman Tiger.

The failure occurred at two places on the unit. One spot was on the exhaust stud coming from the right rear cylinder. It was a total fatigue fracture about 1/2" below the weld to the flange.

The other failure spot was on a lower left juncture of the combined pipes as they went into the muffler.

I could not determine which crack was primary and which was secondary, but I suspect one of them caused the other. What was interesting was that the cylinder near the site of the failure had been pulled by a repair facility when an intake valve cracked.

I did not oversee the repair since it was on a standard engine and muffler combination. After a discussion with Aero Fabricators who repaired the muffler, I came to the following conclusions: When the cylinder was pulled, they probably did not loosen the entire muffler from all the other cylinders. When the cylinder was replaced, the muffler was sprung back into place in a stressed condition and was bolted into place. Aero Fabricators suggested that when the exhaust system was reinstalled after repair that it be loosely bolted into place and then heated by running the engine until it was good and hot. In this hot state, the cylinder bolts and sleeve clamps are then tightened to appropriate torque.

This exhaust system was only about 200 hours old. Since this was a certified muffler on a standard engine, things point strongly to an error in installation procedures. This caution might be relevant to other exhaust systems that are somewhat rigid between multiple cylinders.

We are also going to be balancing both engines in the near future since both starter ring gears were not part of the engines when we bought them. What was really scary was that we had a fuel line failure on the same flight on the same engine, within only 1 hour of each other.

The fuel line failure by the way was one of those fancy expensive lifetime custom made all stainless steel lines that come from Aircraft Spruce. It appears that the failure was a combination of a poor weld on the stainless steel tube and vibration failure. I am considering replacing them with good old rubber Aeroquip rubber lines that you periodically throw away. At least I never saw a rubber line fatigue.

Did you ever notice that it is all that metal on our fiberglass airplanes that seems to brake all the time? I think I am ready for fiberglass engine mounts and ceramic engines.
John Steichen

Exhaust System/Heat Muff/Turbochargers

Also see CP64-9&10 in the "Fuel Lines/Hoses/Fittings" section of this chapter.

From CP25-5 (CH30)

LONG-EZ LYCOMING EXHAUST SYSTEM

The adjacent drawings show the system now being tested on N79RA. This system is very similar to the original one which we welded up ourselves, with the addition of a "ball" joint on each stack to take care of vibration. It is working well so far, and looks like the way to go. This system is made and sold by Ken Brock, and can also be used on Lycoming powered VariEzes. Note: Lycoming flanges and tube sizes are shown. If you have a Continental engine, refer to Section IIA and build a similar exhaust system to exit the lower cowling just below the trailing edge at B.L. 19.5". A Continental version is not available from Ken Brock at this time. (Drawings on page 7 and 8) **DRAWINGS OMITTED**

From CP25-11 (CH30)(Photo caption)
New Brock exhaust installed on Long-EZ.

From CP26-4 (CH30,CH38)
FROM RAY RICHARDS, TOLEDO, OHIO - "After 150 flight hours (VariEze) I disassembled the carb heat muff and found the carbon steel door spring broken into a dozen pieces. To replace, I wound 0.40 stainless wire into a spring on a lathe mandrel. Works great... other than that all is fine and N48EZ behaved faithfully."
Has anyone else had carb heat spring deterioration? Do check for this, it may be possible to ingest a piece into the engine.

From CP27-11 (CH30)(Photo Caption)
Mike DeHate, from San Diego has installed this "quiet" exhaust system on his VariEze. It was designed and built by Rudi Kurth, and Mike reports that it is quieter than the standard exhaust system. Anyone interested in this should contact Rudi Kurth, Langgasse 51, CH-3292, Busswil, Switzerland.

In Switzerland, homebuilts have to meet strict noise controls, and Rudi has developed this system on his own VariEze and has over 200 hours on it now.

From CP28-8 (CH30)
Exhaust gaskets. It is an excellent idea to use blow-proof exhaust gaskets on your VariEze or Long-EZ or VariViggen. If you plan on installing cabin heat, blow proof exhaust gaskets should be considered mandatory. These are available from Aircraft Spruce or Wicks Aircraft, and for your small Continental engine order part nbr 627429, for all Lycoming engines order part nbr 77611.

From CP31-4 (CH30)
Caution - Exhaust system modifications, particularly those causing large bumps on the lower cowl (like cross-over or muffler-under-engine) can result in a performance loss as great as 15 mph due to aerodynamic drag, caused by airflow separation aft of the cowl modification.

From CP32-6 (CH30)
CAUTION
Carb heat on Continental 0-200 installation. If you have a Continental 0-200 in your EZ, you should test the carb heat for effectiveness. This can be done by slipping a thermometer into a small hole in the hose that connects the carb heat valve with the carburetor. This takes two people, a pilot to sit at the controls and hold the brake while he pushes the throttle to maximum power. The other person should stay well clear of the prop and should insert the thermometer into the induction hose and note the temperature rise after carb heat is applied. There should be a heat rise (carb heat temp. minus ambient temp.) of at least 90 degrees F. If not, you should increase the size or efficiency of your carb heat muff on the exhaust system. **Lycomings are not nearly as prone to carb ice as are Continentals, but do not take chances, check your carb heater.**

From CP34-6 (CH30,CH38,CH39)
A VariEze pilot from Northern California flying from Stockton to Florida, heard a 'different' noise but before he could do anything, one exhaust stack (original style) cracked off and went through the prop removing about 17 inches of one blade. The vibration was so severe that it broke both mag wires and failed the mixture cable/spring assembly. He pulled the mixture and switched off both mags. When this did not work, he turned off the fuel valve and finally the engine stopped. He made an uneventful landing on a highway near Zuni, New Mexico. He found that the top engine mounts had failed and the engine was lying in the cowling. This pilot stayed very cool, flew the airplane and kept thinking all the way. Don't forget to fly the airplane.

From CP34-8 (CH30)
CAUTION - Ray Cullen painted his exhaust system white using Krylon high temp paint, per the instructions. After about 3 hours of flight, the engine abruptly stopped on the take off roll and could not be restarted. Complete disassembly of the carburetor disclosed the problem. The carb induction tube and venturi area were full of white paint chips, which had flaked off the exhaust system. Apparently when carb heat was used, the paint chips were drawn into the induction. The air filter was clear. Ray blew the carb out with air and sand blasted the exhaust. The engine started immediately and he has since flown 60 hours with no problem. The moral: do nothing to your exhaust system that could possibly introduce foreign material into the carb heat system.

From CP35-9 (CH30)
Turbo Chargers and EZs
This subject is starting to come up more and more lately. Review - first, RAF does not recommend a turbo charger on a VariEze or a Long-EZ. These aircraft, when operated within the normal envelope and at normal gross weights are probably the last aircraft to need a turbo charger. They are excellent high altitude airplanes having the capability to climb well over 25,000 feet. Turbo chargers and their associated parts are heavy, 20 to 25 lbs for an average installation. This is right on the tail, absolutely the worst possible place to add weight.

A turbo charger installation without a constant speed prop is self defeating. If you keep your standard prop, your engine will over rev at altitude. If you install a larger prop to take advantage of the additional horsepower available at altitude, your engine will not be able to turn up enough RPM static, and you will have marginal, possibly even dangerous take off performance. Remember your turbo will not help at lower altitudes, (unless you overboost - a certain way to destroy your engine).

For acceptable take-off performance, you must be able to turn at least 2400 RPM static, (2500+ RPM is better). Constant speed props are not recommended at all. Weight, complexity, initial expense, maintenance cost, and unreliability while running in the wake of the wing/centersection are excellent reasons not to fool with these props. Use good judgement - the simple, lightweight, wooden, fixed pitch props have a good history and with care and attention to checking bolt torque at required intervals, can give long, reliable service.

From CP38-4 (CH30)

Carb Heat Muff

Aircraft Spruce sell an excellent little carb heat muff. A simple tube that can be slid onto the Brock exhaust system, right side, forward header and clamped in place with two worm gear clamps. Ken Clunis turned this in and it is easy to do and works great.

From CP39-6 (CH23,CH30)

CAUTION: A number of builders have not installed the metal shields in the wing root areas as called out in Section I, Page 23-3 of Long-EZ plans. It is possible that exhaust system radiated heat can damage the foam in the root of the wing. The metal shield eliminates this problem.

From CP42-4&5 (CH9,CH13,CH25,CH30,CH33,CH38)

LONG TERM MAINTENANCE ITEMS ON EZs

Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth. Of course this strips off about half the teeth on the wormgear.
Solution - Rotate wormgear 180 degrees and you back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

From CP42-9 (CH30)
Torrance Airport Noise Abatement
Mike and Sally recently flew their Long-EZ, N26MS into the Torrance Airport in southern California. This airport has a full time noise measurement system installed and they measure the noise level of every airplane that departs from the runway. Since they simultaneously record the tower transmissions, they know which airplane is making the noise.

They record the loudest one second period during the take off, the maximum allowed is 82 decibels, 83 is a violation. N26MS recorded at 66 decibels. They also factor the noise level over the entire take off period. This is called a Senel scale and the maximum allowed is 88 decibels. N26MS recorded 75 decibels on the Senel scale. This makes the Long-EZ a relatively quiet airplane and certainly well within the limits set by the city of Torrance. This Long-EZ was loaded with two people and about 1/2 fuel and 20 pounds of baggage at the time.

If you fly into Torrance and would like to know what your noise level is at take off, contact David Roelen at the Noise Abatement Center, west of the tower on the Torrance airport. This Noise Abatement Center is run by the City of Torrance and they are always interested in measuring noise levels in different types, particularly homebuilts. Dave Roelen is a very helpful and interested individual, give him a call at: (213)325-0505.

From CP46-7 (CH30)
Ralph Gaither, Safety Officer for the Navy and a high time VariEze pilot, reports what he considers to be a possible flight safety problem for pilots using a product call Thermeeze Tape (high strength ceramic tape). He purchased this product from Sport Flight in Florida. Ralph installed this tape per the instructions, to his exhaust pipes (this EZ already had over 800 hours of flight time). Within 100 hours the cowling was burned completely through in close proximity to the ceramic tape. In addition the tape crystallized broke down to a powder and generally fell apart into the cowl.

Ralph is very concerned that with this condition and the use of carburetor heat, some of the powdered ceramic tape could be ingested into the engine, possibly causing engine stoppage. In addition to this, Ralph noticed no benefit whatsoever to the operation of his engine.

RAF has never recommended this tape or any other similar material. If you are using it, we suggest an immediate, careful examination of the tape before next flight. Sport Flight has been informed of this problem.

From CP52-5 (CH30,CH38)
CRACKED WELDS IN EXHAUST SYSTEMS
We have heard of only one instance of cracks in a Brock Long-EZ exhaust system. It occurred at the flange where the pipe is welded to the flange. Careful inspection is necessary to find this type of crack. You may even need to lightly sandblast the area to detect these cracks. After these cracks were welded, there has not been any further sign of a crack but it is being inspected regularly.

There are several types of exhausts that are currently being used on EZs. Our own experience is limited to the exhaust systems made and sold by Ken Brock and to systems we have welded up ourselves. Exhaust systems, even on certified airplanes, are generally on-going maintenance problems. A simple, four separate pipe exhaust system we tried recently has been plagued with cracks. In fact, every time we have taken the cowling off, we have found cracks all the way from minor, little cracks to major cracks, all the way through one tube. So far, we have severely damaged the prop only once, when a rather large piece went through the prop, but we have been fortunate to catch potential problems before they became serious by careful inspection.

Any and all exhaust systems should be removed to be very carefully inspected at least every annual. If you have a history of exhaust system, cracks, check it every 50 hours.

The most reliable exhaust systems we have used on the VariEze were made by Herb Sanders of Memphis, TN, who sold out to Sport Flight which is now located in Florida. On the Long-EZ, by far the most reliable exhaust system has been the one made by Ken Brock Mfg.

From CP59-9 (CH30,CH38)

EXHAUST SYSTEM CRACKS

Lew Miller, Long-EZ builder/flyer, reports finding hairline cracks across the flanges and around one exhaust stack after 250 hours of operation. This was a Brock exhaust system and he had been smelling a faint exhaust smell while climbing with the cabin vent closed for sometime and had searched high and low in the engine compartment before he found the almost invisible cracks. He welded up all cracks and has had no more problems and no more smell but says he is not confident he won't have this re-occur since he has done nothing to fix the cause.

We have not heard of a Brock exhaust system cracking before but an exhaust system can, and will, crack if you have excessive vibration. Watch out for this - any exhaust smell in the cockpit is cause to examine the exhaust system with a bright light and possibly a magnifying glass. Please report any cracks to RAF so we may report them in the CP.

From CP60-9 (CH30,CH38)

EXHAUST SYSTEM CRACKS

Since we mentioned a crack in a Brock exhaust system in the last CP, we have had four letters from EZ flyers who have had similar cracks. All report that they are hard to see and generally occur around the weld at the flanges.

Next time you remove your cowling, take a bright light and carefully examine the exhaust system, paying close attention to the flanges. Look for a light grey deposit on the pipes or flanges. Any cracks should be welded up before next flight. TIG welding is required for Stainless steel exhaust systems. Do not ignore a crack in any exhaust system. It may cause carbon monoxide to seep into the cockpit, or a piece of the exhaust pipe may depart the airplane and tear up your prop!

Keep in mind that exhaust systems do not last forever, not on homebuilts, not on factory builts, not even on cars! The constant hot gasses, heating to red hot, than cooling, all the vibration, etc., makes for a hard life. Check you exhaust system often and fix it if it is bad.

From CP61-5 (CH30)

EXHAUST THOUGHTS

Ever since Mike and Sally installed a four separate stacks exhaust system on N26MS in July of 1985, RAF has received many inquiries as to where to get one of these systems. Well, Mike built it himself, was impressed with the noticeable power increase but had problems getting the 4 pipe system to stay together. It seemed that each time they landed after a flight, the exhaust system had yet another crack in it. Time has gone by, several more exhaust systems have been built and tested. Vance Atkinson, VariEze and Cozy builder built and tested one for his Cozy and made the statement at Jackpot, NV, that it was the single biggest improvement he made to his Cozy. On the other hand, Dick Kriedel built one and reported essentially no change on his Long-EZ. Doug Shane has one of Mike's on his Long-EZ with over 400 hours on it now and no cracks or failures. Mike has probably got 250 hours on the latest configuration with no cracks, so maybe it is something for the person who wants to experiment and is not afraid of the work that will be involved in making the exhaust fit the cowling! This is not a trivial task, by the way.

Anyway, making one of these exhaust systems is a lot of work, and none of RAF's present suppliers are set up to do this work. However, we were down at Santa Monica airport recently and we saw Dave Ronneberg's welding fixture and several examples of his version of the 4 separate pipe exhaust system. They look very nice. He has done a lot of development work himself on his own Long-EZ and most of his friends and associates are running one of his systems. Dave is a very knowledgeable Long-EZ person, having built, helped build, and generally worked around more Long-EZ's than anyone we know. If you are interested in a 4 pipe exhaust system for your Long-EZ, give Dave a call or drop him a line at:

Experimental Aviation
3021 Airport Blvd. #109
Santa Monica, CA 90405
213-391-1943

From CP61-6 (CH30,CH38)

WARNING-EXHAUST SYSTEM CRACKS

We have recently seen two sets of Brock exhausts for Long-EZs with cracks around the flanges, in one case the flange itself was cracked in half. We have also received a written report from one other builder who had a similar problem. We do not understand why, suddenly, there are some failures of these exhaust systems. We ran two of these systems for over 1000 hours each here at RAF and Dick Rutan has almost 1700 hours on his Brock exhaust system to date. The Long-EZ was introduced in 1980, the first homebuilts started hatching in 1981 or so. Not one report of a cracked exhaust system until recently. While we do not believe this to be a major problem, we do believe that your exhaust system should be very carefully inspected using a bright light. If any sign of exhaust gas leakage is found anywhere on the exhaust pipes, the entire exhaust system should be removed and thoroughly cleaned and then carefully inspected, paying particular attention to the welds and especially the welds holding the stainless steel flanges on to the tubes.

If any cracks are found, they may be TIG welded if they are not too bad. However, if the exhaust has very much time on it, even the TIG welding won't hold for long due to contamination. In this case, it may wise to simply install a new exhaust system. In any case, new exhaust gaskets must be used when installing any exhaust system unless you use approved re-usable gaskets. Keep in mind that if there is an exhaust system leak inside the cowling, it may be possible for some carbon monoxide to find its way into the cockpit. A carbon monoxide cockpit indicator is an excellent idea.

****From CP62-7 (CH30,CH38)****
PLEASE NOTE NEW FORMAT
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN VARIEZE LONG-EZ DEFIANT	MAN/GND	Each time you remove your cowl for routine maintenance, carefully inspect your exhaust system using a bright light. Pay particular attention to the weld at the flanges. Sometimes small cracks develop in this area and they are difficult to see. Exhaust systems should be carefully inspected at least every 50 hours.

****From CP62-8 (CH30,CH38,CH39)****
We have just received a telephone report of an engine compartment fire in a Long-EZ just after it landed. The fire was apparently caused by a Sport Flight exhaust system failure. Although exact details are not known at this time, the exhaust header broke for some reason and allowed a hot jet of exhaust gas to impinge on the cowling which caught fire.

Fortunately, this occurred on the ground and a good quality Halon gas fire extinguisher was available to put out the fire - damage was confined mainly to the cowling.

An exhaust system failure in any aircraft is cause for serious concern. Theoretically, if the pipe breaks off in flight it should not cause an immediate fire due to the high speed air being forced through the cowling and "drowning" the fire. However, as you slow down, like on a landing roll, this feature gets to be less and less of a factor and a fire can result.

If you hear a sudden, much louder than normal engine noise, assume you have a problem and that it could be a broken exhaust. Head for the nearest airport but keep your speed up. Land as soon as practical and consider killing the engine as soon as you touch down.

The EZ flyer who called in this report promised us a detailed report on what happened once he has had a chance to really look into it. We will report it to you in a future CP.

****From CP63-4&5 (CH30,CH38)****
SPORT FLIGHT EXHAUST SYSTEM FAILURE/SEPARATION AND FIRE ON GROUND - LONG-EZ, N80EZ

"I had just taken a passenger for a ride. The preflight and run-up were normal as was the full power run-up at take-off. At cruising altitude, I could hear an occasional unusual ticking sound in the headphones, but at the time it seemed like one the those sounds you get on a dark night or when over water (not in my Long-EZ, of course).

Return and landing were normal, as was the taxi in. However, being the ever vigilant, I decided to make a post flight run-up on the ramp. My friend, who is a very highly experienced pilot, was watching. As I was making the run-up, the RPM began decaying and the engine quit! At the same time, my friend called out 'fire!' I immediately shut off the mixture and fuel valve and hastily egressed while lowering the nose.

Unfortunately, I had left my Halon extinguisher in the hangar which was about 200 feet sway. I ran, retrieved my Halon - the hangar-mate next door brought his and we used both on the fire.

I don't know how long it takes to run 400 feet, but in that period of time the fire had a very good start. Both Halons were discharged and the fire was controlled.

I know there was not an in-flight, or taxi-in fire as my friend was watching. There was probably a crack in the exhaust system which was the sound heard in my headset.

The post flight run-up probably caused the final separation of the exhaust system and, of course, the fire. If I had suspected an exhaust leak, I would not have made the run-up. However, I'm glad it failed on the ground at run-up rather than in the air.

This, of course, is a very serious situation because of the total separation of the right exhaust system and the ensuing fire caused by the direct torching effect of the exhaust emission.

The torching effect probably would not cause a fire while flying because of the airflow, however, the metal parts separating from the aircraft is a sure problem.

This aircraft has a Lycoming 0-320B engine with a Sport Flight exhaust system circa '84. Total time on system, 225 hours.

The engine compartment was uncowled and checked 10 hours previously, with no <u>apparent</u> cracks or breaks.

The break was on the right rear exhaust at a point where the small 'S' tubing is welded to the larger straight exhaust pipe. The break was not in the weld. The break was right outside the weld on the larger pipe. It appears to be fatigue rather than a bad weld. What's puzzling to me is the springs that held the front tubing into the slip joint flange had stretched and given way. So now we have a total separation of the right exhaust system.

I'm sending the exhaust system to RAF for analysis. To my knowledge, this is not a common problem with a Sport Flight system.

I know the gentleman who produced the original system and consider him to be conscientious and capable. However, all systems should be checked. In the meantime, I will endeavor, with help from you folks, to determine the cause.

The damage is repairable. It was confined to the cowling, rib heat shield, right exhaust and finish on the prop. All systems and components in the engine compartment will have to be checked.

I've seen some EZs operating without all the called for heat shields on the spar and ribs. Having these installed on mine helped, as did the fire sleeves on the fluid lines. One fire sleeve was damaged. If it had been unprotected, who knows?!

Some possibilities are:

1) Excess vibration causing the break, although none was detected.

2) The front springs letting go caused the total load to be carried by the welded area.

3) Exhaust system rubbing on the cowling during engine torquing. I did leave adequate clearance and also had someone run-up the engine while I checked the clearance.

4) Simply age fatigue of the system.

I'm sure RAF will have their suggestions to go along with my article. If anyone has had a similar problem, please contact RAF or me at the address below.

Hope to be back in the air soon. The EZ is a great aircraft.

Good luck, fly safely,

Bob Frazier
308 Bayshore Dr.
Cape Coral, FL 33904
813-945-4824

Oil Coolers/Lines/Seals/Screens/Gaskets

Also see CP32-4 (Lycoming O-235 Engine Installation) in the "Engine Selection" section of this chapter.
Also see CP36-6 in the "Engine Selection" section of this chapter.

From CP28-10 (CH30)
Q. Can I substitute a Stewart Warner #8406J oil cooler for the recommended Harrison #8526250?
A. Yes.

From CP30-10 (CH22,CH30,CH39)
Engine Failure, On Top, Over Lake Michigan
A VariEze accident claimed the lives of a New York couple and their son enroute home from Oshkosh. The pilot was a low-time relatively new private pilot taking his first cross-country trip in the airplane, which had 49 hours total time. The following information is from a VariEze pilot who was flying with the Eze that crashed, and from FAA investigators.

The flight was heading east across Lake Michigan to save trip length even though it was over a solid under cast with tops at 10,000 feet. They were cruising at 11,500 feet directly over the center of the lake when the pilot noticed zero oil pressure. They continued another 10 to 15 miles when the engine lost power, then quit. The wingman noted that the pilot kept turning right during the trip and he had to keep instructing him to turn left to remain on course. He repeated this instruction as the pilot descended into the clouds in a right turn. Radio communication was lost when he tried to get him to switch to Muskegon Tower frequency for vectoring. Weather at the surface was a variable ceiling ranging from 500 scattered to 1,500 broken to 4,000 overcast.

It is not known whether the pilot became disoriented in clouds during the descent. The last call heard by the wingman was a very upset voice repeating 'engine quit, going down'. Flight service received a call of 'shoreline in sight' with no further communication. The aircraft crashed while in a turn in a down-wind direction at the far end of a 150 foot long clearing, immediately cartwheeling into trees. There was no way to survive a landing where the aircraft impacted. There was no fire. It is not known why the pilot selected the small clearing when the shoreline with alignment into the wind was apparently available to him.

Investigators determined the cause of engine failure to be oil loss through a broken oil pressure sender line. **The line was aluminum tubing, flared with an incorrect automotive flaring tool.** It fractured at the fitting sleeve where it had been previously bent 45 degrees.

The purpose of us printing details of this kind of tragedy in this newsletter is to alert those flying other airplanes to conditions that might cause another accident so that recurrence can be prevented. If you are flying an airplane that may have an engine installation that has not been inspected by a qualified A.I., ground it until it is adequately inspected for aircraft-approved installation materials and workmanship. All plumbing of oil and fuel lines must be of components approved for a certified installation. If you have aluminum tubing installed, replace it with approved flex hose before flight.

****From CP31-5 (CH30)****
Caution- Oil pressure line should have an orifice fitting at the engine end. We have not been able to find a source of these fittings, but we have made up an acceptable substitute by making a small plug for the pipe thread end and drilling a #60 hole in it, installing it in the AN fitting and staking it into place.

****From CP32-7 (CH30)****
For those who would like to purchase an orifice fitting, rather than make one (CP 31, page 5, 2nd paragraph). The orifice fitting (a 45 degree elbow) required in the oil pressure - sensor line is available from:

Yingling Aircraft
P.O. Box 9248
Mid-Continental Airport
Wichita, KS 67277
(316)943-0231

Order Part #0752037-3 for $21.50 plus $2.00 for postage and handling.

****From CP43-6 (CH30,CH38)****
Lycoming O-235 Main Bearing Oil Seals
We have had two reported cases of these seals blowing out and falling into the cowling. This is a serious situation, which in one case resulted in an off-field landing with considerable damage to the airplane. At least one of these occurrences was the result of the wrong seal being installed. The O-235 crankcase is machined with retainer groove as shown. **SKETCH OMITTED**

The correct oil seal (Part #LW13792) has a corresponding retaining "lip" that should 'pop' into the groove in the case. The Lycoming O-320 seal does not have this lip to mechanically retain the seal and it could pop out if inadvertently installed in an O-235. Oil seals do occasionally come out but it is rare, according to Lycoming. When they do, it is generally because the breather has become blocked or restricted, or the wrong seal was installed, or the retainer groove in the case had become caked and filled with old permatex and was not cleaned out properly prior to installing the new seal and of course the new seals 'lip' was not able to snap into the groove.

The best way to install these seals is to thoroughly clean the inside of the crankcase where the seal will go with MEK solvent. Use a bent wire or small screw driver to clean out the retaining groove. Don't neglect the crankshaft. It should be cleaned and polished where the seal will be. Clean the new seal thoroughly with MEK as well. Use Goodyear Pliobond (contact cement) and paint the seal and the inside of the case with two coats (allow the first coat to tack). Press the seal into the case while the Pliobond is still wet, and do not run the engine for at least 24 hours.

Carefully check your breather system. If you have an oil separator, be sure that there is no restriction in the line. Check that your plastic breather line is not kinked or folded over. Be sure this cannot occur once everything gets hot. It is very important that the breather line is kept open and clear so that no pressure can build up in the crankcase.

****From CP45-7 (CH30,CH38)****
CAUTION
All Lycoming Engines. When checking or cleaning the oil screen, it is critical that the gasket between the oil pressure screen housing and the engine accessory case is oriented correctly. If you should inadvertently install it backwards, you could burst your oil cooler or starve the main and rod bearings of high pressure oil.

Tony Gittes of Guayaquil, Ecuador experienced this problem and went through a lot of time and money trying to figure out what the problem was. Don't let it happen. Pay close attention when you check the screen as to which way the housing and gasket was oriented when you remove it and replace it the same way.

****From CP46-7 (CH30)****
Lycoming Rocker Cover Gaskets - Mike now has approximately 120 hours of time on a set of four gray colored rocker cover gaskets, manufactured and sold by the REAL Gasket Corp. Doug Price designed, developed and is in the process of getting STCs for most Continental and Lycoming rocker cover gaskets. This is an area in our experience that has always been prone to minor, but annoying oil leaks. These silicone rubber gaskets have absolutely eliminated any sign of oil leaks. These gaskets are quite expensive, but if treated reasonably they are reusable. Doug Price has a supply of these gaskets that are not STC'd, that he is

prepared to sell to homebuilders for $12.50 a set. (They normally sell for $8.91 each). These are the same as Mike used on his Long-EZ and the method he used to install them is as follows: Clean the two faces (rocker cover and cylinder head) until they are absolutely dry, with no oil on them. Install the gaskets dry (no sealer of any kind), put a drop of Loctite on each screw and tighten the screw using a normal screw driver until they are good and tight - by hand, no torque wrenches. Do not retorque at all, leave them be and thy will last a long time and will not leak. Caution: DO NOT TIGHTEN THESE SCREWS IF THE ENGINE IS HOT. For further information contact:

The Real Gasket Corp.
P.O. Box 14852
Portland, OR 97214
(503)231-0341

Talk to Doug Price and tell him you are interested in his homebuilder special as discussed with Mike Melvill at RAF. Doug has gaskets for Lycoming 0-235, 0-320 as well as Continental C-75, C-85, C-90 and 0-200.

From CP50-3 (CH30)

Tired of your rocker covers leaking oil? The only cure we have ever seen are REAL valve cover gaskets. Mike has a set of these on his Long-EZ engine for over 300 hours with no trace of a leak. They are reusable, too! Made from silicone rubber, they should last through TBO on any Lycoming or Continental engine.

Contact: Doug Price
The Real Gasket Corp.
P.O. Box 14852
Portland, OR 97214
(503)233-1613

From CP53-5 (CH30)

Rocker/Valve Cover Gaskets - stop all leaks with 100% pure silicone "real" gaskets from The Real Gasket Corp.
P.O. Box 1366
Laurel, MS 39441-1366
(601)649-0702 or
1-800-635-REAL

Anyone who saw Doug's display at Oshkosh this year should be convinced for sure. They must be installed dry, no oil, no Permatex, and they will not leak. Mike and Sally have had a set on N26MS now for more than two years with no leaks. They are not cheap though, running about $30.00 a set for a Lycoming 0-235, 0-320, 0-360, etc., but are worth every penny since they are good for 2000 hours.

From CP56-4 (CH30)

Valve Cover Gaskets for Lycomings and Continentals.
Made from 100 percent pure silicone, these gaskets will absolutely solve the age old problem of oil leaks at the rocker cover to cylinder head gasket area, especially on Lycomings! Contact:

Doug Price
Real Gasket Corp.
PO Box 1366
Laurel, MS 39441-1366
800-635-REAL or 601-649-0702

Doug has recently come out with a silicone gasket for the small Continental engines to fit between the oil tank and the bottom of the crank case. He is very happy with its performance.

From CP64-10&11 (CH30,CH38,CH39)

"Dear RAF,

"LUCKY YOU FLY A LONG-EZ " - AGAIN!

This is to relate to you an incident that occurred last Saturday, May 21.

I was flying PP-ZAD enroute to a fly-in in the south of Brazil at 8500' under positive control area and enjoying, in advance, my participation in the fly-in and the amazing performance of the Navaid Devices autopilot.

I suddenly smelled burning oil and, looking back, I saw some smoke in the cockpit and two trails of oil coming out of the oil filler door. I immediately reduced power to minimum and began to look for a place to land.

The only airport close by was under rain and no safe approach could be attempted due to mountainous surroundings.

Losing altitude slowly (what a splenderous glider is the Long!), it soon became apparent that the only safe place was a new open-to-traffic freeway with not much traffic on it. After some low passes to make clear my intentions (oil pressure was at this time around 40 PSI down from 80 PSI), I was able to make one of my best landings, not even touching the brakes and with only 20 PSI oil pressure even taxied one more mile to an adequate place clear of the traffic to park.

Some 5 quarts of oil poured from the cowling when I lowered the nose. Next day we put in new oil, ran the engine and we observed the oil coming out from the hose connecting the oil cooler to the engine. A new hose was put on, engine checked carefully and I departed from the freeway again to my home airport.

Now, this airplane is very special to me and no efforts nor expenses were spared in all phases of its construction and choice of parts which had to be always of the best quality, not bothering with prices. Even a brand new engine was ordered from Lycoming.

When it was time to choose the hoses, I decided to use the "stainless steel hose assemblies" as advertised on page 84 of Aircraft Spruce's catalog (very expensive) instead of the regular rubber material. These hoses were made to order for the sizes I supplied (copy of invoice enclosed).

I am sending the failed hose to Jim at Aircraft Spruce to have it inspected by the supplier and I also already substituted all other hoses, even those carrying fuel, with standard Aeroquip shielded hoses.

These hoses were not abused in any way and were installed by a certified mechanic of our air club.

I hope that this may help any other builder who may decide to use these hoses in their airplane.

Thanks again for a wonderful airplane that is making me more confident every day in its capabilities and anticipating my hours of safe, enjoyable flying (not quite my wife's opinion).

Next day I was on a national coverage TV network - try to imagine answering all those phone calls!
Andre J. Deberdt"

****From CP65-9 (CH30)****

If you have oil leaks in the area of the rocker covers on your engine, Mike Melvill strongly recommends the use of silicone rubber, reusable gaskets manufactured by the Real Gasket Corp. Mike first tested these gaskets a number of years ago on his VariViggen. They completely eliminated all rocker cover oil leaks. Since that time, these gaskets have been installed on Mike's Long-EZ and Burt's Defiant with the same excellent results, namely zero oil leaks. This is one product that really works. Be certain to follow the installation directions exactly to obtain the best results.

Contact: Doug Price
Real Gasket Corp.
PO Box 1366
Laurel, MS 39441-1366
1-800-635-REAL
1-601-649-0702

Oil Breathers/Separators/Oil Filters/Dipsticks

****Also see CP48-4 in the "Carburetors/Air Filters/Primers/Fuel Pumps/Gascolators" section of this chapter.****

****From CP31-4 (CH30)****

We had always had a small oil slick on the cowl from the breather on our Long-EZ, not enough to notice any oil loss on the dip stick, but enough to be unsightly and aggravating. We cured this by running the breather line forward and up to the top of the forward engine baffle, looping it around and back down and aft to the normal breather exit shown in Section IIL. This necessitates using about 4 feet of 3/4" ID x 1" OD hardware store vinyl tubing. This is tied to the forward baffle brace and the engine lift point. To assure that this tube would not kink and pinch closed, we installed a 5/8" OD screen door spring, stretched out til the coils are 1/2" apart, inside the vinyl tube. This works like a separator, and even after a long flight, we have a clean cowl.

****From CP35-10 (CH21,CH30)****

Wes Gardner is still selling his excellent, reusable foam air filters. Wes has some other neat "EZ" items. A retrofitable fuel sight gauge, for those with poor translucency in their gages and an oil separator system that takes the place of the starter cover on an O-200 Continental and this is guaranteed to remove all traces of breather oil mess on your cowling. **Wes is still working on a similar one for the Lycoming engines.** Mike will be installing it shortly on his Long, N26MS. Contact Wes for more information:

Wesley Gardner
1310 Garden St.
Redland, CA 92373
714-792-1565

****From CP36-4 (CH18,CH21,CH22,CH30,CH37)****

N26MS - Mike and Sally's Long

With 521 hours on the Hobbs, 26MS is running like a dream and continues to prove what a reliable high speed transportation machine a Long-EZ is. I recently got tired of my combination 12V/24V system which never did work correctly. I cut the front cover over the instrument panel off and rewired the airplane to be a 100 percent 24 volt electrical system. It was intimidating thinking about how I was going to do this, but once started it was actually quite simple to do. I have also installed Wes Gardner's fuel sight gauges (see CP 35 page 10) and must say I am pleased with the result. **Also installed Wes's oil separator breather and it has worked great! No more cleaning cowling after landing.**

A few weeks ago a photographer from "Technology Illustrated" took a bunch of slides of my Long-EZ for the cover of the May edition. He wanted to light up the inside of the cockpit. He handed me a remote controlled flash unit with quite a heavy power pack. Like a dummy, I laid it on my lap, not tied down. In the middle of the photo session, I hit a strong bump, the flash unit sailed off my lap and crashed into the canopy cracking it badly just in front of my head. It cracked almost clear across with a hole a couple of inches square. It scared me but once I slowed down and pulled the cracked pieces back into place, I found it to be no immediate problem and was able to complete the mission.

Sally temporarily repaired it by laying up a huge fiberglass patch both inside and out. At least we could fly until the new canopy came in. Actually went to the IVHC Agua Caliente flyin this way! I talked to Dan Patch and Phil Cornelius, both of whom had been through repairing a broken canopy.

First we cut the plexiglass canopy about 1 inch above the rail all the way around (son Keith did the work, I supervised!). This removed the broken canopy. We turned the frame over and cut through the fiberglass just inside the edge of the plexiglass lip. This allowed us to peel out the fiberglass piece that fitted the original plexiglass bubble exactly. This thin glass "frame" was carefully layed into the new "bubble" and was used to layout where it should be trimmed in order to fit. While I cut the new bubble, Keith broke out the remaining plexiglass with a vice grip, a hammer and wood chisel and a dremel grinder. The plexiglass does not come out easily. After the frame was cleaned up, the new bubble fitted almost perfectly. We floxed it into the frame and let it cure over night. Next morning, I trimmed and sanded. I microed in all the voids and the layed up two plies of BID over the plexiglass up onto the inside of the frame. I let this gel up for a few hours, then reinstalled the whole canopy/frame onto the airplane. I locked it down and let it cure for two days. This assured that it would fit the fuselage. Later I removed it, cleaned it up and sprayed the charcoal Zolatone inside the canopy frame. I did not have to repair the outside frame. The new canopy gives me a little more head room (not all canopies are alike!) and the visibility without the fiberglass patch is superb!!

****From CP47-9 (CH30)****

Lycoming oil dip stick to long? Well, you can buy a shorter one or you can cut it down yourself. First you must determine how much shorter yours needs to be. For a Long-EZ, a VariEze or even a Defiant, you will probably need to shorten it around 3". Use a pin punch to drive the retaining pin out of the yellow dip stick screw-on cap. Pull the dip stick out of this cap. Cut 3" off the cap end of the dip stick (or whatever dimension will work for you), note that the end that was inserted into the cap is machined down to approximately 3/16 (.1875). This will have to be done to your new shorter dip stick and will require the use of a lathe. Press the dip stick back into the cap, drill a #40 size hole through the dip stick using the cap as a drill guide, and drive the old pin back into place. Peen the cap to prevent the retaining pin from vibrating out. Now, using the short (3") piece of dip stick as a guide, cut the proper length out of the middle of the plastic dip stick tube using a fine tooth hacksaw. **SKETCH OMITTED**

Use Hot-Stuff instant glue (or similar Crazy Glue, etc.) to join the two pieces together. Hot Shot or Zip Kicker makes this job easy. Now sand at least two inches each side of the joint very thoroughly with 40 grit sand paper. Cut a piece of BID glass 4" x 16", wet it out with epoxy then wrap it around the plastic tube, centered over the joint. Roll the tube using all 16" of BID. Now wrap peel ply over the wet glass layup and pull it tight. Allow this to cure, remove the peel ply and paint it black with high temp spray paint. Screw the tube back into the engine and safety the lower end. Screw in the dip stick and you are done. We have used this method on all of the Lycoming powered airplanes we have built here at RAF over the past 10 years with no problems at all.

****From CP47-12 (CH30,CH38)****

CAUTION

Breather hose must be clear! This is critical, do not allow the breather hose to kink or fold onto itself. Keep all curves as smooth as possible and for bends use the largest radius possible. Do not neglect to insert a "stretched" spring into the breather hose per CP31, page 4. This will help to eliminate any tendency for the hose to "fold" or kink when it is hot. The "stretched" spring consists of 5/8" O.D. screen door type spring (hardware store quality), which you will stretch until it yields and takes a set with the coils about 1/2" apart.

If your breather hose kinks or becomes clogged in some way, the build up of pressure inside the crankcase will blow the main seal (behind the prop) out and will rapidly pump most, if not all of your oil overboard. Oil temperature will rise and the engine will seize if you continue to fly. Even at idle, the engine might seize!

From CP56-4 (CH30)

SHOPPING

Oil Breather Systems and Retrofittable Fuel Sight Gages for EZs.

Contact: Wes Gardner
1310 Garden St.
Redlands, CA 92363
714-792-1565

From CP56-5 (CH30)

Breather System for Lycoming.

Mike has been using this system now for over 1000 hours and is very satisfied at this point. Wes Gardner has been running his for several years. He is the designer, builder and supplier of this rather unique system.

The breather hose goes from the engine to an optional (in Mike's opinion!) oil separator mounted on the firewall and drains back into the engine from there. The breather hose then goes to a "T" fitting and on to a one way check valve which is welded into the exhaust header. A smaller hose goes from the "T" through a PCV valve to a fitting in the intake manifold. It sounds complex but it really is not. You will have to have a stainless tube welded into one of your exhaust pipes and you may have to tap a 1/8" NPT pipe thread into the intake manifold, or Wes can supply you with a part that clamps between the carburetor and the sump to take care of the problem. Mike does not use the separator itself rather, he just accepts the loss of oil that goes out of the exhaust. It is so small in his case that you cannot tell which of the four exhausts it is draining into. Wes, on the other hand, is very happy with the separator and recommends it.

What does this system do? Well, it takes your breather and its associated messy oil stains on the cowling and dumps it through the exhaust system where all the oil vapors and oil are burned, and thrown out of the exhaust pipe, leaving no oil on the cowl. In addition, and perhaps more significantly, it lowers the pressure in the crankcase to below ambient pressure which causes any small oil leaks you may have to disappear due to the fact that these leaks now leak into, and not out of, the crankcase. Obviously, this slight reduction in internal pressure cannot take care of a major oil leak, but it is amazing how all the annoying little oil leaks dry up!

This is not a Lycoming recommended system, but it is a system that Wes has tested now for several years and one he has had running on several airplanes, including Mike and Sally's Long-EZ. Mike has not wanted to recommend this system in the past even though he has been running it for a number of years, but since Wes included the PCV valve in the system, the few little reservations Mike had have gone away. See "Shopping".

From CP59-5 (CH30)

REMOTE MOUNTED SPIN ON OIL FILTER

Many builders have inquired about such a device and, in fact, several builders have built their own system. Lycoming has the parts necessary to accomplish this but they are incredibly expensive. Long-EZ builder, Mel Hinson (N160EZ), has purchased the tooling to build the adaptors that bolt directly to the accessory case in place of the oil screen housing and your present Vernitherm valve will screw right into this adaptor. These remote filter adaptors will fit all 0-235, 0-320, 0-360 and 0-540 engines. In addition, Mel has tracked down the remote filter mount (a Cessna part) and he plans to make these two parts available for around $180.00. You will have to provide the AN fittings (elbow, nipples, etc.), the high pressure hose (Stratoflex is best), the Vernitherm valve, and the gaskets.

This will give you a remote spin on oil filter (adaptor uses an approved Champion aircraft filter) built from approved aircraft parts with built in bypass valve and will allow 50 hours between oil changes and should extend the life of your engine. For more information or to place an order, call or write Mel. He is presently flying one on his Long-EZ. Contact:

Mel Hinson
Rt 20 Box 316
San Antonio, TX 7821
512-828-0551 (H)
512-651-5086 (W)

From CP59-8&9 (CH30,CH39)

A Los Angeles Long-EZ pilot/builder installed a breather system from his engine to one of his exhaust headers, similar to the system developed, tested and sold by Wes Gardner and similar to one Mike and Sally have had on their Long-EZ for over 5 years now (with excellent results). The only difference was the fact that an anti-backfire valve (one directional check valve) that Wes calls out and that Mike and Sally have installed, was omitted. On top of that, this aircraft was known to have one cylinder pumping oil (turned out to be a seized piston ring). Oil consumption was very high and this pilot had filled it with 8 quarts prior to taxiing out for take off. Just prior to taking off, the tower informed the pilot that smoke was coming from the engine. His rear seat passenger looked back and saw flames coming from the cowl near the wing root. The tower dispatched a fire truck and the fire was quickly extinguished.

The Long-EZ was seriously damaged, all engine compartment wiring was burned and the foam was melted out of the wing root. It will take several months of hard work to fix.

What caused this fire? Well, this pilot and Mike, at RAF, don't fully agree. The builder feels that the breather tube welded into the exhaust header cracked, allowing oil onto the outside of the hot exhaust, which caught fire.
Mike believes, based on his own experience, that without the anti-backfire valve, the hot exhaust gases went into the breather line, melting or burning it off. Since the engine was burning excessive amounts of oil, this line probably had oil in it and when the rubber hose caught fire, it also ignited the oil which then turned into a hot fire causing lots of damage including melting the rudder cable pulley and bracket. Mike speaks from experience! When he first installed his breather system, he also tried it without the check valve, or anti-backfire valve. He was lucky, he ran it on the ground and, when the hose melted through, he saw it before any more damage could occur. There was no fire in his case, probably because his engine was not using much oil, but the hose from the crankcase to the tube welded into the exhaust was melted/burned beyond recognition in a matter of minutes!

If you are planning on installing a breather system such as Wes Gardner's, be absolutely certain you do it right! He has lots of experience with this, so contact him, better yet, buy his kit and install it exactly per his instructions, and you will have an excellent breather system that does not throw oil all over your cowling.

****From CP63-11 (CH30)****
<u>*CAUTION*</u>
When using the breather system that Mike recommended in CP 56.

Several builders/flyers have informed us of a noticeable drop in fuel pressure, especially at low power. Mike had also noticed this and attributes it to the reduced pressure inside the crankcase acting internally on the diaphragm in the engine driven pump. Mike has been flying this system for 640 hours now with no problems, however, you should be aware that it may be possible to reduce your fuel pressure almost to zero at low power, particularly if you have a new, tightly sealed engine. Contact Wes Gardner for more information.

Oil Analysis

****From CP30-3 (CH30,CH38)****
<u>Engine Oil Analysis</u>
Gary Hertzler, owner of VariEze N99VE, has made arrangements with Spectro-Chem, P.O. Box 29074, Phoenix, AZ 85036 to do oil analysis for Eze owners at FBO cost price. Contact Lou Brand, and identify yourself as a Eze owner/pilot, and Lou will send you sample kits for $7.95 each in lots of 12 or more. The kits include a sample bottle and mailer. You send a sample of your oil, attention Lou Brand, and in return you will receive an analysis sheet showing metal present in parts per million. Spectro-Chem has built up quite a history on aircraft engines, and can comment on your results with some authority.

This is an excellent preventive maintenance procedure and we thank Gary for setting this deal up so the Eze flyers can take advantage of it.

****From CP32-8 (CH30,CH38)****
<u>Spectro-Chem, Oil Analysis</u>, a service we mentioned in CP 30, page 3, has had a price increase. Their price is now $8.95 per kit in lots of twelve or more.

Spectro-Chem
P.O. Box 29074
Phoenix, AZ 85036
(602)253-6515

Contact Lou Brand and identify yourself as an EZ builder/pilot.

****From CP33-7 (CH3,CH22,CH30,CH38)****
Aircraft Spruce is now stocking the AOA oil analysis kits for $8.95. The David Hoffman cockpit lights are in stock for $12.50 each. They are changing to Latex gloves instead of vinyl, same price and they will also be stocking cotton liner for the Latex gloves.

Propellers/Extensions/Spinners

****FROM CP24-4 (CH30)****
<u>PROPS FOR VARIEZE AND LONG-EZ</u>
We have approved and recommended the following prop manufacturers.

Larry Weishaar	Ted's Custom Props
1924 No. 6th	Ted Hendrickson
Springfield, IL 62702	9917 Airport Way
(217)544-6086	Snohomish, WA 98290
(Homebuilt prop)	(206)568-6792

B & T Props,
5746 Ventura Ave.
Ventura, CA 93001
(805)649-2721

Bill Cassidy
4652 Montview Blvd,
Denver, CO 80207
(303)322-3423

Ray Hegy
Marfa, TX 79843
(915)729-4249

Most of our testing has been done using Ted's props, and therefore we tend to compare everyone else's to Ted's. Ted reports that he has finally caught up his VariEze prop production to where he can offer much better delivery than he has been able to over the past year or so. He also reports that, lately he has been supplying steeper pitch props to O-235 Lycoming powered VariEzes in the form of a 58 x 74 and in some cases 58 x 76 prop. A couple of builders using these props have reported good results. We are presently using a Ted's 58 x 72 on the Long-EZ.

Any potential prop makers who would like us to recommend their props on either the VariEze or the Long-EZ or both, should send us a representative prop, which we will test on our prototypes, and if it comes up to our standards, we will keep the prop for further testing and approve and recommend it in the Canard Pusher. If it does not meet our standards it will returned freight collect.

From CP25-2 (CH30)
PROPELLERS
We are happy to announce a new propeller company to add to our list of recommended propeller manufactures.

The Great American Propeller Co.
555 West Mont Drive #212
San Louis Obispo, CA 93401
(805)481-4450

We evaluated their 56 x 68 on the VariEze prototype N4EZ Continental O-200 and found it's performance to be as good or slightly better then anything we have tested so far. The quality of workmanship of the prop is excellent and should give good reliable performance.

We have been working with Bruce Tifft "B & T Propellers" trying to optimize a prop for the O-235 powered Long-EZ. We just completed an evaluation on his 60 x 66 prop and found a significant improvement in cruise speed (5 mph) without a loss in climb performance. Note, our airplane now is flying faster then the Owner's Manual data. Bruce's quality of workmanship is excellent and his unique leading edge protector make it impervious to rain erosion. Bruce's extra effort in this area is appreciated very much.

B & T Propellers
8746 Ventura Ave,
Ventura, CA 93001
(805)649-2721

From CP26-6 (CH30)
PROPELLERS
In CP #25 we announced the Great American Propeller Company (GAPC) as a recommended propeller manufacturer. Their 56x68 prop was one of the best we have tested on the Continental 0-200 VariEze.

We have just completed an evaluation of their 58x65 prop on the Lycoming 0-235 powered Long-EZ. The prop gives excellent performance and meets or just slightly exceeds the speeds listed in the owners manual. We are happy to recommend this prop to any Lycoming 0-235 powered Long-EZ flyer. The following is a current list of recommended propeller manufacturers:

Larry Weishaar
1924 No. 6th
Springfield, IL. 62702
(217)544-6086
(Homebuilt Props)

Ted's Custom Props.
Ted Hendrickson
9917 Airport Way,
Snohomish, WA 98290
(206)568-6792

B & T Propellers
5746 Ventura Ave,
Ventura, CA 93001
(805)649-2721

Bill Cassidy
4652 Montview Blvd,
Denver, CO 80207
(303)322-3423

Ray Hegy
Marfa, Texas 79843
(915)729-4249

The Great American Propeller
555 West Mont Drive #212
San Luis Obispo, CA 93401
(805)481-4450

From CP27-9 (CH30)
FLIGHT TEST DATA
Capt. Ken Swain of Travis AFB, CA., has recently conducted an extensive set of tests to document the performance of his O-235-F VariEze using his newest-configuration Scmitar prop. Data for his super-performing VariEze are presented below. Of significant note is the passive "constant-speed" action of the prop: full power climb at 80 mph results in 2800 rpm and at maximum speed in level flight (217 mph) rpm is only 2950. This results in a significant improvement in takeoff performance over a conventional prop that lugs the engine down to 2500 rpm at low speeds. Scmitar props have been flying since the 30's. However, they have not had adequate structural reliability. If a reliable full-Scmitar prop can be built, we will see very substantial low-speed performance increases in our high-speed fixed-pitch aeroplanes.
CHART OF SCMITAR PROP DATA OMITTED

From CP28-9 (CH30)
B & T Props, 8746 Ventura Avenue, Ventura, CA 93001.
Reports that they are really getting busy and asks that anyone wanting a prop to please order at least three months ahead of time.

From CP29-2 (CH30,CH33,CH38)
Warning - Loss of Prop!
Dick recently had an experience with his Long-EZ that would raise the hair of the most experienced pilot. He lost the entire prop and spinner while cruising at 10,000 ft. over a solid cloud deck. After watching the prop cascade away he received radar vectors from center to allow a successful approach to an airport, under weather conditions of 1/4 mile visibility in fog. Investigation revealed that the all-important bolt tension (required to transmit torque through faceplate friction) had been lost when the prop dried out in desert conditions after exposure to the humid-wet Caribbean climate at his world-record arrival location. Note the added caution in the plans-change section of the newsletter. Also, do not, do not exceed the recommended interval on prop bolt torque check. (Owners Manual, Appendix III).

From CP30-5 (CH30)
Six-inch Prop Extension
Last summer we learned from Rudi Kurth of Switzerland, Ed Hamlin and Bruce Tifft, that a longer prop extension spool would reduce the cockpit noise level and possibly increase performance. We collected accurate baseline data, then removed the standard 3-inch extension and installed longer ones. We have tested 4-inch, 5-inch and 6-inch extensions.

Most of our data was for the 6-inch extension. Results are as follows:
As compared to 3-inch, sound level at pilot's station and rear seat was reduced two and a half to three DBA at high speed cruise and climb conditions. Oil temperature on all three airplanes tested with the long extension was increased. Cylinder temperatures on one of the airplanes increased. There was no measurable change in the performance of any of the airplanes due to extension length. We have been reluctant to recommend the long extensions because any change in the propulsion/drive system of an aircraft must be thoroughly tested for long-term durability. We now have a total of 300 hours 6-inch time on Long-EZs with no indication of problems, and since the two 8-inch extensions on the Defiant have run 600 hours it appears that no mechanical problems are indicated. Thus, if you can stand a 20 to 30 degree rise in engine temperatures you can, with a 1.5 lb. weight penalty, achieve a significant noise reduction by using a 6-inch extension. Note that we have tested this only with Lycoming engines and cannot predict the durability of a Continental application. Also note that since the Brock spinner mates to the front flange of the 3-inch extension, it is not as well supported when using the long extension. Brock is now developing an aft bulkhead for his spinner to provide firm centering support regardless of extension type.

From CP30-6 (CH30)
Question: Can I use a constant speed or variable speed prop on my VariEze or Long-EZ?

Answer: We do not recommend the use of this type prop, for several reasons. (1) weight on the tail (2) complexity and (3) the prop on a pusher like an Eze, gets a fore/aft bending load on each blade, twice per revolution as the propeller passes through the wake of the wing/centersection. This input can resonate and fail a metal prop or metal hub assembly. Only the solid wood prop is known to have an adequate safety history for this application. An "experimental" variable pitch prop recently destroyed the Q2 prototype. Also, as the following letter indicates, many or most prop developers experience failures which can prove fatal:

Gentlemen,

Rudi Kurth of Busswil, Switzerland who has a VariEze, has been working on an electrically actuated variable propeller. When completed he tried it in the Eze as a ground test stand. The propeller came apart within a few moments and ripped the engine out of the mounts doing considerable damage to the aircraft.

Whether this was due to poor design of the hub or the whirl mode I am not sure, but the propeller busted and that, for whatever reason, is vindication of the facts you presented to me. Again, thank you.
Sincerely,
James B. Fleming

From CP31-7 (CH30)
NOTE FROM B AND T PROPS
Bruce recently retooled his prop drilling jigs and asked us to inform anyone with a B & T prop, shipped prior to January 1, 1982, if you are checking balance, to use only the 2 1/4" dia. hole, do not use the 3/4" through hole, since it may not be concentric. Props shipped after the above date, you can use either the 2 1/4" dia. hole, or the 3/4" dia. hole or both to balance the prop. Please don't hesitate to contact Bruce or Bonnie if you have any questions at all concerning your prop. 805-649-2721

From CP32-5 (CH30)

CAUTION

Spinner/prop extension compatibility. This is a real gotcha! We installed a new prop extension on N79RA, which was not manufactured by Brock. We then installed a Brock spinner on this extension. The center hole in the spinner backplate was a close fit on the center locator on the prop extension. Unlike a Brock prop extension, this one had a rather large radius machined at the flange face, which did not allow the spinner backplate to slide all the way on, see sketch below. **SKETCH OMITTED**

This is a dangerous situation, and difficult to detect because the flow guide prevents a visual inspection. We installed the prop, torqued the bolts to the 18-20 ft/lbs. we normally use, and tracked the prop tips accurately. At this point, the prop bolts were tight, the prop ran true, but the prop was not being squeezed against the prop extension. Rather it was pressing only against the spinner back plate, in this cas a very stiff 1/8" thick backplate, that was able to support the torque value of the bolts, without going back against the prop extension.

We flew the airplane for several hours, blissfully unaware of the problem. Last week Dick used N79RA to take a business associate to the Santa Monica Airport. On his was back he got to within 20 miles of Mojave when a strong vibration became apparent. It steadily worsened, to the point that he elected to turn back to the closest airport at Rosamond. The vibration became much worse and then abruptly went away. Dick thought he had thrown a rod, set himself up for an emergency, dead stick landing on the 2300 foot, Rosamond runway. Dick touched down on the numbers, made the turn off and rolled into an empty tie down. Not until he got out did he realize he had lost the prop and spinner.

Looking at the marks on the drive lugs it is plain to see what happened. The 1/8" aluminum back plate gradually gave way, allowing the bolt tension to relax. Without this friction between the crush plate and prop extension flange to drive the prop, it begins to be driven by the drive lugs and prop bolts in shear. This state of affairs can only continue for a very short space of time, before the bolts fatigue and then of course, the prop/spinner comes off.

This is a very serious situation and anyone who has a Brock Spinner mounted on a prop extension that is made by someone other the Brock (obviously the Brock extension is completely compatible with a Brock spinner) should immediately ground their airplane and check this out. The problem can be cured by decreasing the radius in the prop extension, or increasing the diameter of the hole in the center of the spinner back plate.

From CP33-6 (CH30,CH38,CH39)

ANOTHER PROP INCIDENT

Ray Johnson from the San Francisco Bay area, flew his VariEze to Las Vegas, where it was parked in the desert sun for 5 days. He then took off and headed south at 12,500 feet. About 20 miles north of Apple Valley airport, a horrendous vibration set in. Ray throttled back, pulled the mixture to idle cut off and pulled the nose up to slow down. When the engine stopped turning, the vibration went away. Ray glided in to a landing at Apple Valley. Other than the Cessna that pulled out in from of Ray on final, causing him to have to land off to one side of the runway, it was uneventful. Ray's prop was still on the airplane, 5 bolts had sheared, one was bent but still holding and the spinner retained the prop.

This is a classic case of flying from a moist ocean climate to a dry desert climate. The wood prop shrinks just a little bit, the bolts no longer have the correct torque, so the prop starts to move and in literally seconds, the bolt holes and drive lug holes become elongated, and the bolts break off at the drive lug due to fatigue.

Check your prop torque, it should be between 18 ft/lbs. (216 inch/lbs) and 20 ft/lbs. (240 inch/lbs). With a new prop, you should check the torque after one flight. Then again after 10 hours, then at 25 hours, and thereafter every 25 hours.

From CP33-6 (CH30)

LONG-EZ PROPELLER UPDATE

We have been testing a few different props on the Long-EZ, and we are finding the best all round performance for the 0-235 Lycoming to be a 62" dia. x 66" pitch. This is a larger diameter than the maximum diameter called out on the back page of the plans, however, we have several hundred hours on two of these props, on N79RA and N26MS and we have not encountered any problems. These props are available with the urethane "rain proof" leading edge from the following two companies:

Ted's Custom Props	B & T Props
9917 Airport Way	8746 Ventura Avenue
Snohomish, WA 98290	Ventura, CA 93001
(206)568-6792	(805)649-2721

We have had one each of these props on test for over a year, and both perform flawlessly and are very close in performance. Be sure to get your prop order in at least three months prior to your estimated first flight date. Don't let yourself be caught with a finished airplane and no prop to fly with.

From CP36-3 (CH30)

PROP EXTENSIONS

As described in CP 30, page 5, the 6 inch prop extension has continued to provide trouble free operations. We have sufficient time on these extensions on two Long-EZs here at RAF to feel confident in recommending the 6 inch extension as well at the 3 inch extension.

Note that we have only tested these on Lycoming engines. Due to the smaller crankshaft diameter of the Continental engines and the lack of data, we cannot recommend anything but the thoroughly tested 3 inch extension for Continental engines.

The 6 inch extension does reduce the noise level in the pilot's seat by as much as 3 decibels (DBA scale). However it also increases cylinder head and oil temperatures slightly. The worst case is a new or recently overhauled engine, in a new airplane. It is possible that engine temperatures could go out of acceptable limits during the first few hours of operations, especially during ground testing. We have noticed on an engine with hundreds of hours, that if we are forced to run the engines standing still on the ground for extended periods of time, in excess of 30 minutes or so, the cylinder head temperature can climb right to the red line. Using a 3 inch extension this will not occur.

To summarize: We recommend both the 3 inch and 6 inch prop extension for the Lycoming engines and only the 3 inch extensions for the Continentals. You, the builder must decide which to use in your application.

From CP37-3 (CH30)

CAUTION: Testing experimental props may be a hazardous thing to do. A Long-EZ builder/flyer was testing a pretty fancy, thin bladed, flexible prop when both blades failed just outboard of the hub. Fortunately this particular prop had a ply of Kevlar wrapped over the prop full span. Only the Kevlar stopped the blades from departing the airplane, the pilot made a safe landing.

From CP37-4 (CH30)

Propellers

We recently tested a Great American prop on our 0-235-L2C (118 hp) powered Long-EZ and found it to be an excellent prop. Performance was virtually identical to the best Ted's prop we had previously tested. Takeoff distance was slightly shorter, climb slightly better and top speed was only down about 1 mph.

Contact: Great American Props.
555 Westmont Drive
San Luis Obispo, CA 93401
(805)481-4450

From CP38-5 (CH30,CH38)

Prop Damage - VariEze and Long-EZ

Remember, flying a pusher airplane, anything that comes off the airplane might possibly go through the prop. This includes cowling screws, loose pieces of safety wire, nuts and washers left loose in the cowling, even wrenches inadvertently left in cowling! Be careful. Be conscientious about working on your airplane. You are the qualified mechanic doing maintenance on the airplane and it is absolutely your responsibility to do the best work you can. A cowling screw or a fuel cap going through the prop, can cause sufficient damage to the wooden prop, that you may have to land and wait for a replacement prop.

From CP38-5 (CH30)

Prop Bolts - VariEze and Long-EZ.

If you are using a standard Brock prop extension with threaded drive lugs and crush plate, and a prop that is approximately 3 3/4" thick at the hub, (Ted's, B&T, etc) you will need 6 prop bolts. AN6H-51A will work fine and are much cheaper than the AN76 prop bolts.

From CP38-9 (CH30)

PROPELLERS FOR LONG-EZS

Since last newsletter, we have flight tested 7 different props from four different manufacturers. Most of these props work well, keeping in mind that on an airplane as clean as a Long-EZ, any prop is a compromise. After all, we stall at 51 knots and we can indicate 165 knots at sea level. That is a very large speed range for a fixed pitch prop to handle. So, in order to get acceptable take off and climb performance, we have recommended that a minimum of 2400 rpm static should be available. This is done on a gravel free patch of taxiway, brakes locked, full throttle and mixture leaned to best power (max. rpm). Our experience has shown that if you don't have at least 2350 rpm static your take off run will be excessive, particularly at gross weights and even more so at high density airports.

Now at the other end of the scale, if we have our 2400 rpm static, obviously, with a fixed pitch prop, we will be able to over rev the engine at high speed, particularly at low altitude. Our criterion here has been to accept a full throttle, best power mixture at 7500 feet (MSL) in level flight with 2900 rpm as our optimum goal. This is 100 rpm over the engine manufacturers red line, but we use a very lightweight prop, and our static thrust is half what these same engines see in the factory airplanes they are installed in. We have been running these engines at high rpm and low manifold pressure for a long time, with no problems. So, the optimum prop would be one that turned 2400 rpm static and 2900 rpm at full throttle at 8000 feet. This is a difficult design goal for the prop maker and each one is different. Also each individual Long-EZ is different and a prop that may work perfectly on Mike's Long-EZ may not be as good on your own Long-EZ.

With all of this in mind, and with no intention to try to recommend one manufacturer's prop over another, we present a summary of the results of the tests of these different props. All tests were done on N26MS. Choose a prop for your airplane based on your expected flying conditions. If you are based at a short field, or high density airport, you would not choose the same prop as a person who was based at an 9000 feet long runway at sea level who would fly mostly high speed cross country to similar airports. Probably the best bet is to have two props!

Manufacturer	Size	Static RPM	RPM at max power at 7500' MSL
Hendrickson	62" x 66"	2360	2900
B & T	63" x 67"	2300	2920
Sensenich	64" x 72"	2150	2860
Great American	62" x 62"	2520	2925

There is only a 3 mph true airspeed difference in these four props at the top end. The fastest props turn the highest rpm generally, the best take off performance comes from the prop turning the highest static rpm. All of these props are of excellent quality, but vary considerably in blade design and method of measuring pitch. Leading edges also vary, some have solid polyurethane leading edges which withstand rain erosion very well, others have epoxy leading edges, while others have a wrap of kevlar. All will hold up quite well in rain, if you throttle back to 2400 rpm or so to keep the tip speed down.

Ted's Propellers,
9917 Airport way,
Snohomish, WA 98290
(206)568-6792

B & T Propellers,
8746 Ventura Ave.
Ventura, CA 93001
(805)649-2721

Great American Props
1180 Pike Lane #5,
Oceano, CA 93445
(805)481-9054

John Benjamin Propellers
P.O. Box 216
East Petersburg, PA 17520
(717)569-2687
(Made by Sensenich)

NOTE FROM B & T PROPELLERS

"First of all, let us say many thanks to all of our patient customers. A variety of circumstances during this last year have definitely thrown our prop order list way out of kilter. Since getting so far behind on the orders, we've simply been trying to make propellers for the builders that have notified us that they are close to completion on their airplanes. Knowing many of the orders were from builders who were far from being finished and requiring a prop, we bypassed these in order to get the builders flying that had completed airplanes. Consequently, many of you that ordered a long time ago have not received your props or heard from us lately. We definitely felt an explanation was due all of you and wanted to let you know what is happening. Therefore, we would like to ask you to call or drop us a note when you feel you are getting close to completion so that we can get your prop ready. We apologize for any inconvenience and appreciate greatly the cooperation and understanding all of you have extended to us. Beginning in January, we will be making the props on a full-time basis and should be able to get caught up on our back log in addition to getting back to a decent delivery schedule. Thanks again!

Bruce and Bonnie Tifft"

From CP39-3 (CH30)

Change of address for B & T Propellers

As of March 1, 1984, B & T Propeller's operations, (along with all our personal worldly goods and possessions) will be relocating to our new home and shop in central California. Our new address and telephone number will be:

3850 Sherrod Road,
Mariposa, CA 95338
(209)742-6743

Until March 1, we can still be reached at 8746 Ventura Ave, Ventura, CA 93001 (805)649-2721.

Since January 1, we have been in the prop business full time, and after the move north are looking forward to lots more time for faster delivery, research and testing, and lots and lots of EZ flyins with travels around the country visiting EZ people in our new "Vari Long" - "The Beez II". Bruce and Bonnie Tifft.

From CP40-4&5 (CH30,CH39)

A southern California VariEze was seriously damaged during a forced landing caused by the catastrophic failure of a home made kevlar prop. The pilot suffered a serious foot injury.

This propeller was reportedly designed and built by the pilot. The laminate consisted of multiple plies of kevlar layed up with room temperature cure epoxy, similar to that used to build the VariEze. The prop had a total running time of approximately 3 minutes when during the first take off, one blade failed completely near the hub.

Composite props may eventually be built that will be safe for us to use on our homebuilt airplanes, but we must caution builders that composite props require careful design and very, very thorough testing under controlled conditions. Propellers especially on a pusher, operate in a very stressful environment, the average homebuilder simply does not have the facilities at his or her disposal, necessary to tackle such a project.

From CP40-8 (CH30)

GREAT AMERICAN PROPELLER CO

Mike and Sally flew over to San Louis Obispo on the west coast where they met with the guys from the Great American Company. Mike tested two of their props on his Long-EZ, N26MS. Mike's Long-EZ has the high compression pistons installed (9.75:1) so it is a 125hp Lycoming O-235 now and Fred Griffith of Great American had designed and built a prop specifically for this engine/airframe combination. Although both props were good, one was the best Mike had flown. This prop, a 62x64 was carved from a Canadian hard rock maple blank. This blank is glued up using about 30 thin plies of wood, bonded under high pressure using Resorcinol glue. The prop looks very attractive with all the thin laminations joined with the dark resorcinol glue. After the prop is carved to shape and balanced, it has 70 percent of its blades wrapped in Kevlar. This is a time consuming process and each prop takes 11 days to go from start to finish.

The Great American Propeller Company was started in 1977 mainly building decorative clock propellers. Later they got into building props for homebuilts. In July 1983, the owner sold the company to three of his employees, Fred Griffiths, Kevin Ruediger and Bert Ruediger. These guys have worked hard to come up with a really excellent product and are justifiably proud of their product. Attention to detail is the watch word, the props are checked and rechecked for balance. The bolt holes are reamed a few thousandths oversize to that you can slide the prop bolts through easily with your hand.

Great American is concerned about the care that is give to wooden props. They believe, and RAF agrees with them, that it pays dividends to preserve and protect your prop. If it gets damaged by gravel or a rock, repair it and seal the wood. A properly cared for wood prop should provide many years of safe flying. For this reason Great American has a repair and refinishing service. They will refinish a wood prop and balance it for $49.95. They will do a complete rebuild, strip to bare wood, repair minor damage, refinish and balance (provided the basic prop is sound) and issue a new warranty on any of their props for $99.50. In addition to this Great American keeps a loaner Long-EZ prop, 62x62. They will ship it to anyone who needs a prop to get them home, provided the recipient pays the shipping both ways. This is a great service and could really be a boon to someone unfortunate enough to break a prop away from home. For more information, contact:

Great American Propellers,
11180 Pike Lane, #5
Oceano, CA 93445
(805)481-9054

From CP41-5&6 (CH30,CH33,CH38)

PROPELLER TALES!

Propellers are very important. Check them carefully every flight, and handle them with great caution, they can bite. Check your prop bolt torque regularly. The first check should be done after the first flight on a new prop, then at 10 hours then at 25 hours and thereafter every 25 hours. The recommended torque is between 18 ft./lbs. (216 inch pounds) and 22 ft./lbs. (264 inch pounds). The proper torque on your prop bolts is very important, if the torque gets much below 12 to 15 ft./lbs. it is possible to loose your prop! Recently we were getting the original VariEze prototype out for a flight. It had not been flown or had the prop torqued in almost one year. All six prop bolts were literally finger tight! There was no measurable torque on any of the bolts.

Once the prop has been in operation for a hundred hours or so, you will seldom find the bolt torque low, except when you have flown from a wet or humid area into a dry climate. Check your prop bolts regularly and save yourself from what could be an embarrassing situation to say the least!

There have been one or two EZ pilots recently who have had their hands or fingers hit by the prop. Hand propping an aircraft engine particularly on an EZ is not difficult, but there is not room for carelessness or lack of concentration. The prop should always be treated like a loaded gun. Be especially careful when "backing up" the prop, such as is commonly done to clear a flooded engine. This problem appears to be associated with the larger engines (0-320) more than with the standard 0-235 engines. However, it can happen and if it does it can cause painful cuts and abrasions and even broken bones and will also result in a broken prop. Be careful. Use good safety procedures and never move an aircraft propeller unless you are ready and in position for it to fire.

From CP42-5 (CH30)

LATEST PROP INFORMATION

The following information (in alphabetical order) was supplied by the respective prop manufacturers at RAF's request and is current information as of October 19, 1984.

B & T Propellers (209)742-6743
Bruce Tifft,
3850 Sherrod Road,
Mariposa, CA 95338

Bruce says that his best all around props are the following:

Continental O-200 VariEze	- 58 x 70
Lycoming O-235 VariEze	- 58 x 72
Lycoming O-235 Long-EZ	- 62 x 66
Lycoming O-235 High compression Long-EZ	- 62 x 68

Bruce was the first of the homebuilt prop builders to provide urethane leading edge protection on his props and it is the best rain erosion protection available. Bruce is now full time in the business of carving props and had built and flown a VariEze and is currently flying his new modified Long-EZ.

Great American Propeller Co (805)481-9054
1180 Pike Lane #5
Oceano, CA 93445

Fred Griffith reports that their props are now cut from FAA certified blanks. These blanks are made from 31 laminations of Canadian maple, glued together with phenolic based glue and are very hard and tough. With one of these props, the prop bolts can be torqued to 20 to 22 foot lbs (240 to 264 inch lbs) and experience has shown that this amount of torque does not crush the prop hub, with the torque remaining consistent over 25 to 50 hours of flying. In addition, these props have a covering of Kevlar on the outer 70 percent of each blade. While the Kevlar provides excellent splitting protection, you should throttle back to 2500 rpm or less in rain. Great American includes a flyer on prop installation and care with each prop shipped out. Be sure and read this information. Fred informs us that they now have in stock and available, loaner props for most EZ/engine combos.
Best all around props are:

Continental O-200 VariEze	- 56 x 68
Lycoming O-235 VariEze	- 58 x 65
Lycoming O-235 Long-EZ	- 62 x 62
Lyc O-235 high compression Long-EZ	- 62 x 64

Teds Custom Props (206)568-6792
9917 Airport Way,
Snohomish, WA 98290
Ted Hendrickson was the first supplier of props for VariEzes back in 1976. He has consistently supplied high quality props for all types of engine/EZ combinations. All of Teds props are supplied with his version of the urethane "rain" leading edge. Ted reports about a 90 day delivery time, but that he will work with you in an emergency.
Ted's best all around props are:

Continental O-200 VariEze	- 56 x 70
Lycoming O-235 VariEze	- 58 x 74
Lycoming O-235 Long-EZ	- 62 x 66
Lyc O-235 high compression Long-EZ	- 62 x 68

From CP42-5 (CH30,CH38)
CAUTION
Do not neglect to check your prop for the correct torque. We have had this caution in the CP before, but we continue to hear of EZ flyers who have had props come loose or even loosing a prop. As an example, we had not flown the prototype VariEze N4EZ for almost 9 months. It was stored in a hangar on the Mojave airport. The desert dry air caused the prop to shrink and when we checked it prior to flying it, there was essentially no measurable torque on any of the bolts. Mike checked the prop bolts on his VariViggen, N27MS after it sat in the hangar for almost as long. The torque was less than 50 percent of what was normally required. A homebuilder checked the torque, went flying and lost the prop, all six bolts had broken. All six bolts were bottomed out on the threads and were not tight on the prop! This is a real gotcha! Be sure that bolts are not too long. Add a washer or two if they are. Do not ignore this problem. If you do, it will definitely bite you.

We at RAF normally check a brand new prop after the first flight, then after 10 hours and then at 25 hours. Now, after a prop has 100 to 200 hours on it, it is usually compressed and stabilized and in fact, we seldom find any discrepancy in the torque on airplanes that are flown often. However, we still check them, and we strongly recommend you do the same. This is very important and could save you and your airplane from a serious problem, that can be avoided with a few minutes of preventive maintenance.

From CP44-4 (CH30)
Great American Props has made a video tape which covers how to install a wood prop and many other related items. A $25.00 deposit is all that is required to be able to see this informative tape. You pay the postage and your deposit will be refunded when you return the tape.

Contact: Great American Props
1180 Pike Lane #5
Oceano, CA 93445
(805)481-9054

From CP45-7 (CH30)
WARNING
Non-wood props. Many builders are not aware of the fact that when a new metal prop/engine/aircraft combination is developed, the prop is considered unsafe by the manufactures of the prop and airframe until an inflight stress survey and vibration survey is conducted. The magnitude of the oscillating stress (a function of the airframe - particularly critical on a pusher) is what effects the fatigue life of a metal prop. The only way we get away with not doing these tests on the Long-EZ and Defiant is because the fatigue characteristics of wood are more forgiving. We have installed metal props on a pusher for the first time - the prototype Defiant will be tested this month with Hartzels. We are warned by Hartzel to not fly more than 20 hours before Hartzel does the stress survey. It is possible that the survey will show high stresses and that a different design blade will be required, so we do not know when (or if) anything but the original wood props would be approved.

From CP45-8 (CH30)(Photo Caption)
WOW! How about this? Don't ask! The owner/builder designed and built it himself and he is still testing **4 BLADE PROPELLER**

From CP46-8 (CH30,CH38)
NON RECOMMENDED PROPS
We recently heard from an EZ builder pilot who was using a non RAF recommended prop and after only 22 hours of operation, upon noticing a new feeling or vibration, closely examined the prop and found compression failures in the wood about 8 to 10 inches out from the spinner on the forward face of both blades. Remember, most times you will get some type of warning before the prop really lets go. Pay attention. Any new noise or vibration should be investigated. We are becoming more and more advocates of the so called "multi-laminate" Canadian maple wood props. In our experience these props are stronger and allow more torque to be applied to the prop bolts without crushing the prop hub. We have routinely used 300 inch/lb of torque on the 3/8" prop bolts found on Lycoming O-235 and Continental O-200 with these props with no problems at all. Caution: Do not use more than 220 inch/lb of torque on the older style four or five laminations of birch type props. Also, remember to check the prop bolts quite frequently, particularly when the prop is new.

From CP46-8 (CH30,CH39)
The following is an incident report from VariEze builder/pilot and Defiant builder, Emerson Grooters of Norway. It concerns the failure of a propeller and points up the importance of selecting a good reliable prop. If you want to experiment with untested or unusual props, do yourself a favor and follow the Formula one racing guys lead, install a safety cable on your engine. **This is at least a 1/8" aircraft cable that ties the engine to the airframe. If you lose a prop blade, and don't get the engine shut down in time, the engine could come loose from the firewall.**

"During testing of a new wood prop which I intended to use for some altitude and speed records, the prop failed with multiple fractures in the root area of both blades - forward face. The prop was not one recommended by RAF, however, I think that there may be a good point here for everyone - that is, just because you have a wooden prop don't think that it will automatically work with your aircraft/engine combination. I has 2.15 hours on the prop when I retorqued the bolts prior to an altitude test of the aircraft, my RR O-240 powered VariEze. I took off, climbed to 10,000 feet and checked various power/cruise settings for about 25 minutes. I then climbed direct to 20,000 feet and started full throttle cruise test prior to further climb. At about 107 KIAS and 2700 rpm I noticed an increase in vibration from the engine. The vibration was not severe; however as it was a change from the norm, I cancelled my next planned step to 25,000 feet, reduced power to about 1/4 throttle and descended for landing. Total flight time 1.25 hours and total on the prop, 3.40 hours. On landing I saw the cracks in the prop. I was also glad that I had just had my chute inspected and repacked, even though I hadn't had to use it.

Last summer, my wife and I stopped to talk to another couple about their new beautifully executed homebuilt. They were both dead about 15 minutes later in a crash resulting from losing most of a prop blade. It was a one piece wooden prop recommended for their type aircraft - not a RAF type. I mention this because, just because you have a nice looking wood prop does not mean that you are home free. Also any change from the normal operating conditions of your aircraft should be fully investigated as soon as possible. A precautionary landing may be inconvenient and take a little time but it could save your aircraft and yourself.
Emerson Grooters"

From CP47-12 (CH30,CH38)
PROP DAMAGE
Pusher aircraft are probably more prone to prop damage generally speaking, than tractor aircraft. As the builder/pilot and mechanic on your own EZ, you should be aware of this and should pay particular attention when you have been working on the engine, or inside the cowling. Leaving a small wrench on top of the engine can really ruin your day! When it comes out, it will really do a number on your prop. Before buttoning up the cowl, always do a very careful inspection for loose washers, nuts, bolts, even clipped ends of safety wire. All should be removed before starting the engine. Be sure not to leave a wrench or nuts or bolts on the wings or centersection/strake area - (don't laugh, it happens.) Unless you have a spare prop, the result can be a 6 to 8 week period of waiting for a new prop!

One other thing, if you see damage to your prop, a small gouge or nick, do not assume that it was thrown up by the gear. It may have been, but in our experience if there is a gash in the prop, it almost certainly was caused by something coming out of the cowl. A screw, camloc, washer, whatever. Remove the cowl and carefully inspect the whole engine. Look for missing rocker cover screws or exhaust nuts. Almost without exception, when this has happened to us, we have found a place where something came loose. Be very conscientious about cleanup and tidiness in your engine compartment. Be sure and use new lock washers every time you remove the exhaust system. Check your rocker cover screws for tightness, and safety wire any bolt or screw that you have any doubts about. Above all, don't be careless about laying tools on top of the engine. Be careful and you will get excellent utility and life out of your props.

From CP48-2 (CH30)
GREAT AMERICAN PROPS APPROVED IN AUSTRALIA
Fred Griffith, president of Great American Props reports that after a recent trip to Australia where he visited a number of EZ builders, he has received notification from the Australian equivalent of the FAA that Great American Props are now approved for use on both VariEzes and Long-EZs.

This is good news for Aussie builders. All GAP props for EZs will be carved from certified multi-laminate hard maple blanks. The number of laminations has recently been doubled because Fred now orders 1/16" laminated blanks instead of the 1/8" laminates they have used up 'til now.

Great American Props recently subjected a few of their props to an extremely thorough physical properties test by the engineering department of Cal Poly in San Louis Obispo, CA. These props came through with flying colors. Any builder choosing to use one of these props can rest assured that there is no stronger wood prop available. If you are using one these props, you can torque the prop bolts to 300 in./lbs., the normal limit for a 3/8-24 aircraft bolt, without crushing the hub at all. If you are using one of the early GAP props using only 5 laminations of birth, you are limited to a maximum of 220 in/lbs. If you exceed this limit, you will crush the hub and then the bolts will be loose. This is also true of any other propmaker's product which uses the 5 laminate birch, beech, or maple prop blanks.

****From CP48-4 (CH30)****

RAF RECOMMENDED PROP MANUFACTURERS

The following are manufactures of props that have been "tried and tested" by RAF and are considered your best buys.

B and T Propellers
Bruce Tifft
3850 Sherrod Road
Mariposa, CA 95338
(209) 742-6743

Teds Custom Props
9917 Airport Way
Snohomish, WA 98920
(206) 568-6792

Great American Props
1180 Pike Lane #5
Oceano, CA 93445
(805) 481-9054

****From CP49-3 (CH30)****

UP-DATE FROM B & T PROPELLERS (and "The Beez") June 1986:

"Since it's been a while, thought we'd write an up-date on what's been going on with B & T Propellers since relocating to the beautiful foothills of Yosemite (central California).

We've found that many of the builders are doing lots of different and innovative things with their airplanes, engine-wise, these days and we've been busy keeping up with all these creative people. We've really been enjoying working on a more customized basis with many of the builders in getting the most efficient prop for their particular airplane.

We've been able to accomplish this by roughing out a prop - having them test it for performance data - refining and finishing it up from those figures. It takes a little more time and effort, but the results seem to make it worth it.

We have also developed and tested a new design for the Long-EZ with the standard O-235 engine and are really happy with the results. This new design is of a lower pitch, wider tip, and a new blade angle which has raised the static rpm and still maintains top-end performances. We have also changed the tips on our propellers which has reduced the noise level considerably.

We offer the props in either the five-laminate or multi-laminate. Both are made of maple, and both perform basically the same. We personally prefer the five-laminate because it tends to flex a little more and helps the take-off performance somewhat. However, the multi-laminate are beautiful, so it is mostly just a builder preference. A note we would like to emphasize is that although the multi-laminate does hold torque a little better due to all the glue, it is still absolutely necessary to check your prop on a periodic basis. Periodic checks and maintenance of your propeller is just good common sense no matter if it's five or multi-laminate.

Our props are all manufactured with the rubber leading edge which has proven so effective against rain erosion damage. We ship props worldwide, and have been certified in Australia, England, Canada, etc., for many years.

By the way, that yellow streak, alias Earl Wilson's Yellow EZ - Tuff, that has won the Jackpot, Nevada unlimited race both years that it's run (1983 & 1985) is propelled by a B & T.

We are still thoroughly enjoying our travels and adventures in our "Vari-Long" and look forward to the '86 flying season and seeing all the great "canard" people.

Bruce & Bonnie Tifft"

****From CP49-4 (CH30,CH38)****

CAUTION - PROP BOLT OVER-TORQUING

We continue to hear of various abuses being committed on prop bolts - the latest is over-torquing! A standard O-235 uses 3/8"x24 (AN6) bolts. The recommended limits for these bolts is 225 in/lbs (minimum) and 300 in/lbs (maximum). If you over-torque this size bolt to 400 or 450 in/lbs, you will fail the bolts at the threads. The recommended torque value is 200 to 250 in/lbs (18-21 ft/lbs) for the 5-laminate wood props or as much as a maximum of 300 in/lbs (25 ft/lbs) for the newer, multi-laminate wood props. A quality thread lubricant should be used on prop bolt threads. A 50/50 mix of 50 weight engine oil and STP is also good.

BE CAREFUL AND CONSCIENTIOUS ABOUT PROP BOLTS - THE LOSS OF A PROP CAN BE POTENTIALLY LETHAL.

From CP51-5 (CH30,CH38)
PROP BOLT TORQUING
Some builders seem to think that by "overtorquing" their prop bolts they can get around having to check the torque. This is simply not true. There is no way around the fact that you have to periodically check your prop bolts for correct torque. Overtorquing makes no sense and can crush the prop hub over a period of time until the bolts run out of thread and bottom out! Very dangerous since you are not now gripping the prop! Your prop, once badly crushed, may not run true anymore leading to vibration. Also, it is possible to ruin the threads in the drive lugs. The correct prop torque value for 3/8"-24 bolts is 200/250 inch/pounds (18-20 ft/lbs) for any 5 laminate wood prop, and 300 inch/pounds (25 ft/lbs) for the new multi-laminate wood props.

For Defiants and those using the 7" diameter flange with 1/2-20 bolts, we have used 400/500 inch/pounds (33/42 ft/lbs) with no sign of crushing the new multi-laminate props. Even so, you still have to periodically check your prop bolt's torque. This is true whether you fly a factory built Champ, Cub, or whatever. If it has a wood prop, it must be checked every 50 hours or so. If you move from a wet climate to a dry climate, check it more often.

From CP51-5&6 (CH30,CH38)
COMPOSITE SPINNERS - GOOD, OR NOT SO GOOD?
Mike obtained a Kevlar spinner a couple of years ago and has been running it on his Long-EZ, N26MS, on and off since then. At first it really seemed like the answer to crack-prone aluminum spinners but now, he is not so sure. This spinner was hand layed up inside a mold and looked like perhaps one ply of Kevlar and at least one, probably two or three plies of glass BID using Safe-T-Poxy. After several hours of flight, the attach screws were found to be a little loose. They were tightened and were noted to have crushed the glass/Kevlar/Safe-T-Poxy locally. A month or two later, the same thing happened. This time, when the screws were tightened, they really "bit" into the spinner. To make a long story shorter, after several such iterations, several of these screws pulled through the spinner!

It was removed for repair before it left on its own! Carefully sanding the inside and the outside of the spinner, a uni-directional glass layup was vacuum bagged inside and outside the spinner. Again, Safe-T-Poxy was used and the spinner was post-cured at 250 degrees F for 2 hours. Much sanding and filling was required to make it fit the Brock spinner backplate/bulkhead and it never did fit as well or look as good again.

This time it lasted almost a year before the same problem occurred to the point where it almost departed the airplane! It has been removed and retired forever and Mike, at least, is very disillusioned about composite spinners. He is currently fitting an aluminum one.

Mike's theory on this is as follows: The screws are tightened and bite into the epoxy/glass/Kevlar and even crush it some. After all, it is not nearly as hard as aluminum. Then, after a flight, the Long-EZ is parked nose down. All the heat in the engine rises out of the back of the cowling and is conducted into the aluminum prop extension - and then into the spinner bulkhead. Feel it sometime ten minutes after you have shut down and parked! This heat then gets into the Safe-T-Poxy spinner and the Safe-T-Poxy softens, allowing the glass/Kevlar laminate to crush thus giving the appearance of loose screws! So we tighten them and the same thing happens. It takes a while, but after a year or less (250 flight hours) the screws are through the spinner and it can come off.

If you are flying one of these hand layed up spinners (obtained from Sport Flight when they were in Memphis), check it often and remove it if it is doing what Mike's did. Use large diameter Tinnerman washers to spread the load. Maybe what we need is a high technology, pressure cured (in an autoclave), high temperature, epoxy-type spinner. Until then, maybe the old aluminum spinner isn't dead yet!

From CP52-5 (CH30,CH38)
PROP BOLT TORQUE PROBLEM
Long-EZ builder, Art Bianconi from Staten Island, NY sent in this hint. While he was torquing his prop bolts, he noticed a suspiciously high torque reading even though the bolt heads had not bottomed on the crush plate. Each bolt was an easy slip-fit in the holes in the wood prop hub and each bolt was an easy fit through the aluminum crush plate. On closer examination, Art noticed that the black anodize finish in each hole in the crush plate was worn off inside the holes, but only in one spot, on the outermost surface of each hole. This indicated that the bolt circle in the crush plate was too small in diameter! He simply drilled each hole out .015" larger and that cured the problem.

It is possible that more crush plates like Art's are out there in the field, so if your bolts are tight, or even difficult to install through the crush plate and prop, take a look at the inside of each hole. If there is a polished spot on one side or the other, consider running a .015" oversize drill through the crush plate. It is very important that there is no such interference to give you a false torque reading on your torque wrench when you are checking your prop bolts. We appreciate this tip from Art Bianconi.

From CP52-7 (CH30)
GREAT AMERICAN PROPS
Great American is pleased to announce that they have completed a development program on a protective leading edge for their props. This is available on a new prop for $75.00 additional cost, or for $150.00 if you send your old prop in for a rebuild. This includes repairing, refinishing, and balancing with the new tough urethane leading edge. The urethane wraps around the

leading edge and extends back almost an inch, giving a very large bond area, and offering exceptional protection from rain erosion.

Contact: Great American Props
1180 Pike Lane #5
Oceano, CA 93445
805-481-9054

From CP55-7 (CH30,CH39)

A Southern California Long-EZ was involved in a forced landing resulting in considerable damage to the plane although the pilot suffered only minor cuts and bruises. **The cause of this accident was the use of a molded plastic prop that came apart a few minutes after take-off.** This resulted in a forced landing where there was no airport.

This is silly, People. Long-EZs and VariEzes are not good airplanes to test new-fangled props or engines. With a stall speed close to 60 knots, your chances of making a successful forced landing when (NOT IF), when, the plastic prop breaks or the engine quits (because it will, make no mistake about it) are very, very low. If you are into testing new plastic props or constant or variable speed props or auto engines, please, please, do all homebuilders a favor, and do yourself a favor (you may even save your life), use a Piper Cub or at least a factory built Cessna 150 or something with low wing loading that gives the best chance of making a successful off-field landing when you have your failures. At least, then this will not result in a blot on the record of homebuilt accidents but rather, will go down against factory built airplane accidents or incident statistics.

All of us who build and fly homebuilts must have in mind at all times that it is us, all of us as a group, who have the responsibility of policing our own actions and making sure that we do not end up as ammunition for those who are against us and who use every incident against us to shut us down and prevent us from flying and enjoying our creations.

We are not against experimenting, on the contrary, that is the business we are in and we encourage it. However, an experiment such as the above accident was virtually guaranteed to end in failure from the beginning and it should not have been conducted on an airplane as poorly suited for this type of experiment as a Long-EZ.

From CP55-7 (CH30)

SHOPPING FOR A PROP?

B & T PROPS
Bruce and Bonnie Tifft
3850 Sherrod Road
Mariposa, CA 95338
209-742-6743

Bruce builds custom wood props with a urethane leading edge for VariEzes, Long-EZs and Defiants.

GREAT AMERICAN PROP CO.
1180 Pike Lane #5
Oceano, CA 93445
805-481-9054

Fred Griffiths' company cuts wood props for EZs, Defiants, etc. An option is a urethane leading edge or Kevlar wrapped blades.

TED'S CUSTOM PROPS
9917 Airport Way
Snohomish, WA 98290
206-568-6792

Ted Hendrickson is one of the earliest suppliers of EZ props and makes excellent wood props with a urethane leading edge for rain erosion protection.

The above three prop manufacturers are the only prop builders that RAF recommends.

From CP55-10&11 (CH30)

HOW TO CHECK FOR THE CORRECT PROP

With any of the RAF designs, matching a perfect prop to your new plane is not real easy but it is not all that difficult, either. The main problem is that the stall speed and the maximum cruise speed in level flight are quite far apart, and getting a fixed pitch prop to cover the whole range perfectly, is not possible. You have to accept a compromise.

With the engine thoroughly warmed up, park on a clean piece of hard surface in the runup area, lock the brakes, and smoothly go to full throttle. If you are at a high density airport, you will have to lean slightly to get maximum static RPM. If you do not see at least 2350 RPM, your prop is already suspect! 2400 RPM is better and 2500 RPM is not unacceptable. Of course, all of this assumes you have an accurate, easily read tack without which this test cannot be conducted. Now, taxi out and make a normal full throttle take-off. Observe the RPM during this take-off roll (make sure you watch where you are going, use only an occasional glance at the tach). The RPM during the roll and early part of the climb should be the same, or actually increase slightly. Maybe 100 or so RPM above static.

Use a normal climb speed, best rate or even a little higher for good engine cooling and better visibility. The RPM should hold at your static or a little better all the way to 8500 feet MSL. As a rule of thumb, your normally aspirated aircraft engine will develop approximately 75 percent power at 8500 feet at full throttle, mixture leaned to peak RPM.

At full throttle, leaned to best power, concentrate on maintaining exactly level flight at 8500 feet (altimeter set at 29.92), fly for several minutes in this condition to allow the airplane to accelerate to its maximum speed. When you are certain it won't go any faster in level flight, read the indicated airspeed and OAT (just for your own reference, since this is your maximum 75 percent cruise speed and you can figure your true airspeed if you know the airspeed calibration error and instrument error). The RPM at this point should be 50 to 100 RPM over the factory recommended maximum RPM. If it is not, you will probably never realize the full take-off and climb potential of your airplane. Now, obviously, most people would not want to fly at over the factory red line, and that is good, you don't have to. This is just a test to see if you have as close to an optimum prop as possible. If your prop meets the above RPM limits, you have the best possible prop for all around performance, good take-off and climb and good high speed performance.

You must now decide if you want to sacrifice maximum speed and shortest take-off and climb performance for something more of a cruise prop, say 2300 RPM static and 2700 RPM at full power at 8500 feet. This will let you cruise at a reasonable speed, good economy and a fairly quiet cockpit but you will give up take-off and top speed performance. On the other hand, a 2500 RPM static and 2900 or even 3000 RPM flat-out at 8500 feet will give you excellent take-off and climb and a very high top speed - it all depend on what you want! You can not have everything with a fixed pitch wood prop but at least you do get a reliable, safe, economical, easy to maintain prop.

You must do this test at 8500 feet because 75 percent power is the reference point for maximum cruise speed on all light planes and because this is the easiest way for you to know you are putting out 75 percent power. Doing all of this at 3000 feet or 5000 feet really does not tell you anything at all unless that is where you always intend to fly.

Keep in mind that this is a quick and easy rule of thumb type method that will work well for most homebuilders. It is not the absolute epitome in accurate testing methods but it does give surprisingly close results.

One other comment: We have seen some props that only turn up 2100 RPM static and 3000 or 3100 RPM at V_h (maximum speed in level flight). The performance results with these props, in our opinion, are not acceptable and the designers of these props need to go back to basics and learn how to really design a good wood prop, such as the three prop manufacturers we have listed in this CP, produce.

FULL THROTTLE HP AT ALTITUDE
(Normally Aspirated Engines)

Altitude Ft.	%S.L. H.P.	Altitude Ft.	%S.L. H.P.
0	100	10,000	70.8
500	98.5	11,000	68.3
1,000	96.8	12,000	65.8
2,000	93.6	13,000	63.4
2,500	92.0	14,000	61.0
3,000	90.5	15,000	58.7
4,000	87.5	16,000	56.5
5,000	84.6	17,000	54.3
6,000	81.7	17,500	53.1
7,000	78.9	18,000	52.1
8,000	76.2	18,500	51.4
9,000	73.5	19,000	50.0

From CP59-7&8 (CH30)

CAUTION - 8" PROP EXTENSIONS

There have been two failures of 8" long prop extensions that we know of! Neither of them occurred on a RAF design but both were on pusher aircraft. Both prop extensions were purchased from Sport Flight in Florida. We understand that this company manufactures their prop extensions from 6061-T6 aluminum. All RAF-designed (Brock manufactured) prop extensions are machined from 2024-T3 aluminum which is approximately 20% stronger. The sizes of the radii between the flange and barrel are critical. At least one of these failures probably was due to a resonant vibration at the natural frequency of the prop/prop extension. This could be a serious matter and RAF is currently working with experts in this field on just what magnitude the problem is, or isn't. Burt ran his Defiant with 8" Brock prop extensions for over 900 hours with no sign of a problem. We should have a lot more info on this subject in the next CP. If you are currently running an 8" Sport Flight prop extension, our recommendation would be to remove it and replace it with a Brock 2024-T3 prop extension before next flight.

From CP60-4,5&6 (CH30,CH39)

PROP BOLT TORQUE. (Letter from John Bridges to Arnie Ash passed on to RAF)

"How many times have we been cautioned about checking the torque on wooden props, especially when climates change? Here's the new wrinkle that happened to me.

My Long-EZ, N642JB, has been flying since July, 1987, and has accumulated 283 hours. I have made several trips from Michigan to Phoenix, been to Sun-&-Fun twice, and many more short hops like Rough River and Oshkosh. It has been a great joy to fly and share with others. While in Phoenix, about a year ago, I talked to Great American about the poor climb performance with my 62x62 prop and 0-235C1 engine. They recommended a change to a 60" pitch would solve the problem. I flew to San Luis Obispo on the next day and Fred Griffith met me at the airport where we installed the new prop. I must add that Fred is a super guy and really helped to solve my problem.

The new prop did the job - better climb performance and I could see 2800 RPM at full throttle.

Returning to Phoenix, I removed the spinner and re-torqued the bolts. After returning to Michigan, I checked torque again at 10, 25 and every 50 hours.

Last November, I flew the airplane back to Phoenix for the winter. The airplane stayed in Phoenix until I headed for Sun-&-Fun on April 6th. I checked the prop torque on April 5th to make sure the dry climate wouldn't come back to haunt me. Prop torque was perfect and had remained unchanged all winter.

I arrived at Sun-&-Fun on April 6th and stayed until April 13th, and then flew home to Michigan. During the next week, I changed oil, cleaned the airplane and checked prop torque - no change.

On April 23rd, I flew over to visit a friend at another airport. Upon departing that airport, I could not fully retract the nosewheel. It was rotated 90 degrees from normal. I tried twice to coax it back into position without success. Since I only had 20 miles to go, I decided to leave it partially retracted. This was the first time this had happened. About 10 miles later (about 1000 AGL), I started to make a climbing turn to the left and reduced RPM to 2000, and all hell broke loose. I thought I had been hit by another airplane.

These were my thoughts as the airplane began shaking violently. I looked out - both wings still on - something's wrong with the engine - shut everything off - slow so vibration stops - look for a place to land. The City of Rochester was in front of me so I did a 180 degree looking for a place with no houses, people, cars, wires or trees. There it is, green grass - looks flat - plenty of open field - set up for landing - gear down - slow it down - trees at the other end of field - set it down. Snap, the nosewheel assembly departed the the strut - canopy shattered - nosewheel collapsed, mains folded - wheel pants (Sport Flight) stuck into wings - now I was totally a sled - started turning to the right - left tip of the canard dug in, cut into the fuselage and broke - left wing tip dug in - wing broke at corner of wing spar to inboard aileron cutout - went a few more feet and stopped.

FAA came out to investigate and stated I had picked the best place around but, if I had kept it up another 30 feet I would have missed the tire ruts that I couldn't see, and probably saved the aircraft.

What caused the sudden vibration? One prop blade broke off at the hub. Why? The threads on the prop bolts had bottomed out. Why? Apparently, the prop hub was a little thinner. The prop dried out during the Phoenix winter and the bolts could have been about 1/8" shorter. I was reading torques, but there was no clamping pressure on the prop. I also feel the nosewheel hit something on take-off and threw it into the prop, causing damage to the blade and when I retarded the throttle, it was all over.

Let this be a lesson to all of us, not only to check prop torque, but to also recheck bolt length to ensure any slight variation in hub thickness will not result in running out of threads.

PS I suffered a minor cut on the forehead (no stitches) and a very sore shoulder - it cracked the left side of the fuselage."
John E. Bridges.

Editor's comment. Many of you will recall a similar incident that happened to Dick Rutan while flying the prototype Long-EZ, N79RA, (See CP 32, page 5). Due to the spinner backplate interfering with a radius on the prop extension, the prop bolts did not provide any squeeze up or crush between the crush plate and the prop extension. Neither the drive lugs nor the prop bolts have anything to do with driving a wood prop. Only the friction between the flange on the prop extension and the forward face of the prop, plus the friction between the crush plate and the aft face of the prop, drives the prop. Once you lose the friction grip on the prop by bottoming the bolt threads, as John did, the prop is free to oscillate slightly with each piston firing stroke. This begins to elongate the drive lug holes in the prop and causes vibration. If the pilot allows this to continue for more than 30 seconds or so, the bolts will break at the base of the threads and the prop will depart the airplane (which is what happened to Dick!). The damage to the prop is usually quite graphic, huge elongation of the drive lug holes which causes the bolts to bend back and forth and ultimately break, but also usually the prop face will have evidence of charring. - Yes, lots of heat is generated by the oscillation and it burns the wood! We believe John's problem was bolts bottomed on the threads. Therefore, little or no gripping pressure between the crushplate and the extension flange, therefore prop oscillates, elongates drive lug holes, perhaps chars the wood, vibration sets in and John shuts the engine down. Prop stopped near vertical and when the gear folded the lower blade broke off when it struck the ground. The loss of one prop blade almost certainly did not occur in flight. We would be most interested to examine John's prop, but the above is our opinion here at RAF based on many accident investigations as well as some personal experiences.

From CP61-13 (CH30)

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

Bruce Tifft
B&T Props
3850 Sherrod Rd.
Mariposa, CA 95338
209-742-6743

Great American Propeller Co.
1180 Pike Lane, #5
Oceano, CA 93445
805-481-9054

RAF has received feedback from a number of builders who have had difficulty getting a prop. We contacted our recommended prop suppliers and all of them are having varying degrees of difficulties obtaining quality wood or wood blanks. Our best advice concerning props is to pick out a supplier you like and place an order at least 4 months before you think you will need it. You can always store the prop (store it level, not vertical). If you don't have one and can't get one, and you have your airplane complete and ready to fly, it could be very frustrating.

From CP61-14 (CH30)(Photo caption)

David Orr's Long-EZ sporting one of Klaus Savier's "Hershey Kiss" spinners.

From CP62-7 (CH30)

PROPS FOR EZ'S AND DEFIANTS

RAF recommends the following prop manufacturers:

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

Bruce Tifft
B&T Props
3850 Sherrod Rd
Mariposa, CA
209-742-6743

From CP62-9&10 (CH30,CH39)

Dear RAF;

My Defiant now has 350 hours on it and I've had a couple of experiences that remind me of why I built the Defiant, i.e. I've had to go single engine twice and it was a piece of cake as far as safety goes and ease of flying the airplane.

The first instance was last Spring when my rear engine broke an exhaust valve that then went thru the exhaust and splintered one blade of the rear prop. I was at gross with 4 aboard at 10,000 feet over hostile Arizona terrain and all of a sudden there was a pitch change and a slow degradation in airspeed. As I had been suspicious of #4 cylinder because of a wet spark plug and some "shavings" seen inside of the valve cover I was monitoring the EGT on 4 and it rapidly went from 1450 to 1200 or so and told me which engine lost power. I shut down the rear engine and turned around and flew the 20 miles back to Scottsdale uneventfully. On final, my 12 year old daughter, Sara announced that "her whole life just passed before her eyes". The point is that this was basically a no sweat situation due to the design of the plane and with fixed pitch props and 50% power on the front engine was all that was needed to get us home with a 9.000 foot descent. Now there is a learning point here - I had my cylinder checked out with an A&P professional and was told the shavings were from the exhaust valve springs wearing on a washer and that the wet cylinder was due to the ring slots lining up. What I should have done was to have pulled the cylinder and investigated further. By the way, about 6 weeks before this I'd switched from Aeroshell to Mobil 1A total synthetic oil. Aviation Consumer has an article that cautions that in engines with time on them, you may mobilize sludge and perhaps have problems. Aeroshell is designed to keep particles in suspension--guess what oil I'm now using.

The second incident occurred this Fall when I was commuting to Santa Maria from Scottsdale for a few weeks of work in my field of Anesthesia. I was coming home and 100 miles out over Lake Alamo, I started smelling smoke. I was at 11,000 feet and glad I was alone and not too happy, I shut down the front engine and the smoke smell went away. I've had a nuisance oil leak for 300 hours from my front engine and since it is updraft cooling it gets on the windscreen. I'd noticed that lately there had been some black streaks in the oil and figured that it was oil that was being carbonized from cylinder head heat. So I flew the plane on home and was only able to maintain altitude at 90 KIAS without the oil temp going plus 200 with the prop windmilling. So I stopped the prop but there was a strange air sound so I let her windmill and brought her on home and by descending to 7000 feet, maintained 110 KIAS and had adequate cooling. After investigation, I discovered 2 broken prop bolts and an almost-to-fail prop, the hub of which was charcoaled. The black streaks on the windscreen was prop wood. Now I had 40 hours on this prop from Great American and about 10 hours since retorquing to 40 ft. lbs. I almost checked the torque when I was in humid Santa Maria but decided, if anything, the wood would have swelled and therefore any checking could be done in Scottsdale. When I got the prop from Great American, the lug holes were too shallow and I deepened them with a plug cutter and flew all this time with what probably was a prop that may not have compressed all the way to the flange of my 8" extension. The second thing is that I relied on advice that grade 8 hardware bolts may be OK for prop bolts. I now question this and feel personally that the extra expense my be worth it, especially to all of you single engine pilots out there.

Other than these problems, the Defiant has been a delight to fly and the only advice to you other Defiant builders is that I would do a fixed windscreen for safety like Johnny Murphy did and would do a fixed front gear that would be similar to the Wheeler Express with a wheel pant. The speed penalty might be very small and the gear box could be done away with.

Mike, I'll be seeing you at Jackpot.

George (Best)

EDITOR'S NOTE; Grade 8 bolts have no place on an airplane, especially as prop bolts. They are much too hard and therefore too brittle. Aircraft bolts are ductile, not brittle!

From CP63-10 (CH30)
PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
3850 Sherrod Rd.
Mariposa, CA 95338
209-742-6743

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

Unfortunately, we have to report that Great American Props has gone out of business. There does not appear to be much hope that they will recover at this time. We will, of course, keep you informed in this publication.

Bruce Tifft of B&T Props is, of course, inundated with orders at this time. He is doing his best to get the orders out as soon as he can but he has requested that we let you know that as of April 1990, his delivery time is a minimum of 3 months after receipt of order. He has requested that if you need a prop, get your order in early. If you are about ready to fly and you have not ordered your prop, you are already in trouble!

Bruce has also asked us to pass on to you that if you already have received your prop and, particularly if it is a multi-laminate prop, you should store it by bolting it onto the prop extension. This will help prevent the wood in the hub from swelling in a high humidity area. If this happens, the prop may not fit onto the drive lugs due to the counterbored holes having closed up a little.

Bruce is very much into the wood prop manufacturing business and is constantly testing new ideas on his own Long-EZ. He is very knowledgeable on EZ props and is more than happy to advise you on which prop you might need for your VariEze, Long-EZ or Defiant.

As far as we know, Ted Hendrickson is still in the business of manufacturing wood props. Ted has been in the prop business for many years and he is well known for building really marvelous examples of special one-off, three and four blade props of wood for old biplanes. We saw a stunning example, mounted on a Kinner engine, in a Fleet biplane on Long Island, NY. Of course, he also makes the more conventional two-blade, EZ-type propellers

With Great American Props gone, there is going to be some tough times ahead. GAP probably had the lion's share of the homebuilt market, shipping about 50 props a month. RAF has always advocated having two props. Let's face it, it is not unusual to damage a wood prop, particularly on a pusher like an EZ. If you have a spare, you can keep flying while you repair/refinish your spare prop. If you only have one, you may be grounded for quite awhile.

Whoever you decide to order your prop from, get your order in early! Don't wait until the last minute - you may be very disappointed.

From CP64-6 (CH30)
PROPS FOR EZ'S AND DEFIANTS
RAF recommends the following prop manufacturers:

Bruce Tifft
B&T Props
375872 Mosby Creek Rd.
Cottage Grove, OR 97424
503-942-7068

Ted Hendrickson
PO Box 824
Concrete, WA 98237
206-853-8947

From CP64-11 (CH30)
PLEASE NOTE CHANGE OF ADDRESS FOR B&T PROPS:

BRUCE AND BONNIE TIFFT
B & T PROPELLORS
75872 MOSBY CREEK ROAD
503-942-7068

From CP65-9 (CH30)
PROPS FOR EZS AND DEFIANTS
RAF recommends the following prop manufacturers:

Ted Hendrickson
PO Box 834
Concrete, WA 98237
208-853-8947

Bruce Tifft
B & T Props
75875 Mosby Creek Rd
Cottage Grove, OR 9742
503-942-7068

Propeller Balance/Engine Vibration

From CP35-7 (CH30,CH38)
Engine Vibration
Occasionally a builder/flyer will call with a mysterious engine vibration. Our own experience in this area has included, prop balance (never assume even a new prop will be in perfect balance), spinner not running true, baffling touching the cowl (the aluminum, not the neoprene asbestos, which obviously must lap onto the cowl), exhaust system touching the cowl, and one more we had not seen before which Nat Puffer sent in, the hose clamp around the intake manifold rubber sleeve (Lycoming 0-235) was touching against one of the lower dynafocal engine mount donuts. This was not apparent at rest, nor did it occur at run up. Once the engine was turning up a high power, the torque was twisting the engine enough to touch at this point. The result was a high frequency vibration, that was extremely annoying, even worrying.

From CP36-6 (CH30,CH38)
V/E & L/E: John Sheffles (Long-EZ N682S) reports that he recently was able to get his engine checked for vibration on a helicopter balancer. At 2000 RPM his Long-EZ had a reading of '3', about average for a light plane. By adding a nut and bolt of the correct weight at the proper location on the starter ring gear, this reading was reduced to 0.5! John reports a noticeably smoother and quieter airplane.

Any FBO with a helicopter rotor balancer should be able to do this, or stop by Great Falls airport, in Montana. "Rocky Mountain Air" can do the job for a reasonable price. All it takes is a couple of hours - sounds like a great suggestion John, thanks.

From CP48-6 (CH30,CH38)
DYNAMIC PROP BALANCING ACT
A few weeks ago, Jim Fackler brought a Chadwick balancer up to Mojave to check the balance on the props of the Voyager. While he was here, Bruce Evans persuaded him to check the balance on his own VariEze prop and one thing led to another and before poor Jim knew what had happened, he had a flock of VariEzes, Long-EZs and a Defiant waiting in line!

Jim told us that he really did not do this kind of thing for a living. Basically what he does is sell the Chadwick/Helmuth balancing equipment, but said he would be willing to help out the EZ flyers who may be interested in getting this done. He does it on his own time and an appointment would have to be made with him. Jim charges around $100.00 and what you get is a very accurate tachometer check (he uses a strobe) plus, he checks the track of the prop, that is, while it is running the two blades are running in the same plane. If not, he can tell you how far out they are. Then he mounts an accelerometer to the engine and has you run the engine at several different RPMs. His equipment prints out a graph which shows all the vibration characteristics of your engine/prop/spinner combination. Then you shut it down, while he calculates how much out of balance your particular prop may be. He will mount a washer or two on an AN4 bolt through the starter ring gear and have you run it again. That is usually all it takes. With a particularly badly out of balance airplane, he may require one more engine run.

There were six of us who had their airplanes checked by Jim a few weeks ago. All of us were very pleased with the results. Noticably smoother across the board. We did notice however, that after four or five flights in the airplane that the advantage that we had gained seemed to go away. Bruce and Mike noticed this and decided to remove the bolt and washers Jim had added. One flight without the added balanced weight was enough to convince them that it really had made a significant difference and that it was worth the time and the money.

Even if the difference is not all that noticeable to the pilot, you can see on the "before and after" graph printouts that Jim will provide to you, that the vibration peak of the prop is reduced considerably. This must mean less stress on the whole engine/airframe over the long term - see photos for details.

If you would like to get your engine/prop dynamically balanced, a couple of things you can do to help you get the most out of it, is to carefully balance your prop (statically) and check the track when you mount it on the airplane. Keep in mind that Jim will balance the prop even if it is way out of balance. Once this is done, you will have to leave the prop "out of balance" or you will have to have it done again. Give Jim a call after work in the evenings at his home - (818)285-2064.

From CP48-7 (CH30)(Photo Caption)
The Chadwick/Helmuth spectrum analyzer in action, printing out a graph showing "g" peaks and valleys.

From CP48-7 (CH30)(Photo Caption)
Jim Fackler checking out his Chadwick/Helmuth prop balancing equipment.

From CP48-7 (CH30)(Photo Caption)
Accelerometer mounted on Burt's Defiant, rear engine.

From CP48-7 (CH30)(Photo Caption)
N78RA, Defiant during wiring for the dynamic prop balancing run.

From CP48-7 (CH30)(Photo Caption)
Jim Fackler (left) and Bruce Evans discussing the best location on the wires to the accelerometer shown just aft of the starter ring gear.

From CP48-7 (CH30)(Photo Caption)
Sam Kreidel watches Jim as he checks prop tip runout with his strobe on Sam's beautiful Long-EZ.

Cowling/Baffling/Cooling

Also see LPC #25 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #48 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #92 in the "Long-EZ Plans Changes" section of this chapter.

From CP25-2 (CH30)
VARIEZE BOAT-TAILED EVALUATION
There has been a lot of interest in the "boat tail" since Steve Woods ran his in the VariEze race at the Sun-n-Fun. We obtained a boat tail shell from Ken Forrest and ran a very close evaluation to determine if there was any performance advantage to this modification. Our evaluation with and without the boat tail shows no perceptible difference in performance.

Steve Woods also has a NACA engine air cooling intake scoop which involves extensive additions to the fuselage and cowl. Steve has asked to make it clear that the flush scoop will not adequately cool the engine. Steve had to develop extensive baffling modifications to get the good cooling he now has. We are following Steve's developments and are particularly interested in his cooling baffle configuration.

From CP25-11 (CH30)(Photo caption)
Where does it all go? Burt and Dick inspecting the various baggage and nose baggage areas in the Grand Champion "Pegasus" VariEze. Norm Ross and friend Glenne Campbell stopped by RAF recently on one of their many trips. Norm has flown the Grand Champ more than 300 hours since Oshkosh '79! During their stay Norm flew the Long-EZ and Mike, Dick and Burt flew Pegasus. We can now say first hand that this airplane performs and handles excellently. Even though it is well equipped, it is one of the lightest EZ's flying. Norm has the empty weight down to less than 600 lb. now, with alternator removed. Norm is the recognized expert in weight control. **He fabricated intercylinder baffles by wetting out 1 ply BID with silicone rubber, then (after cure) mounting them with silicone - presto - a fatigue free baffle that is lighter than aluminum.** Norm's CHT runs less than 350 degrees F on the O-200. It can be done, with good baffle workmanship.

From CP25-11 (CH30)(Photo caption)
This photo shows the extensive baffling on Steve Woods' O-200. An article on Steve's work will appear soon in Sport Aviation magazine. Also shown is the tufts on Steve's boat tail (photo by Steve from the back seat of the Long-EZ). The amount of turbulence is similar to the standard cowl. Whetted area is greater. The inlet itself is lower drag than standard.

From CP25-11 (CH30)(Photo caption)
Initial cowls out of the new metal tooling for VariEze and Long-EZ.

From CP25-12 (CH30)(Photo caption)
Boat-tail tested on VariEze N4EZ - Also installed is the new Great American Prop.

From CP26-5 (CH30)
GEHRES AND WOOD'S NACA INLET - TESTED ON VARIEZE N4EZ
Due to the interest many of you have expressed in the flush scoop we decided to evaluate it ourselves. We got the plans from Tim and Steve. They are oriented to installing the inlet on an already completed airplane, but may be used on a new construction project. First, we drained all fuel and oil and removed both batteries, removed the wings, and the canopy. Then we flipped the fuselage over, sat it on two saw horses and weighting the nose to keep it stable. Following the plans pretty close, we sanded the bottom, built cardboard dams, poured 2 part "pour-in-place", urethane foam, carved it to shape, cut down the existing bottom cowl and used blocks of urethane, as well as "pour-in-place" to build it up to the new shape. After it was carved to our satisfaction, it was glassed, filled and painted. The entire operation was accomplished in about 35 man-hours.
TESTING - Before installing the Gehres/Wood mod we carefully conducted baseline tests of ground cooling, climb cooling, cruise cooling and Vh (max speed with best power mixture at several altitudes). We repeated these tests after installing the engine baffling, then again after installing the flush inlet. Two CHT gages and four probes were used. Based on the Gehres/Wood testing, we had expected a large improvement in cooling due to the baffles and some loss of this improvement due to the flush inlet. The Gehres/Wood test results also agree with logic.

However, our test with N4EZ showed no cooling improvement with the baffle modification. A slight reduction in CHT was observed after we curled up the edges of the baffle pieces as shown in CP #22, page 4. Also, we obtained a definite improvement (30 to 35 degrees F) in cooling (CHT) when we installed the flush inlet. We contacted the other two VariEze owners known to be using the flush inlet (Johnny Murphy's Long-EZ and Ken Forrests' VariEze) and they both report an improvement in cooling. The reason for this is unknown, since theory and NACA test show that flush inlets do not have as good pressure recovery as ram scoops.

Our performance test were carefully run to accurately measure the speed change due only to the flush scoop. Full-throttle speed increased an average of 2 1/2 to 3 knots at density altitudes of from 4,000 ft. to 12,000 ft. Ken Forrest reported no speed change, but it's possible his test were not as accurately run. Johnny Murphy reported a larger speed increase, but he made other improvements at the same time.

To summarize: You can pick up a little speed (approx. 3kt.) and your engine will probably run a little cooler in level flight with the modification. A lot of people like the look of the airplane better with the "flush" NACA inlet (we call it the "female EZ"). Plans for the installation of new baffles and a NACA inlet for a VariEze or Long-EZ, are available for $20.00 from:
Wood and Gehres Inc.
105 Appleblossom Court,
Orlando, FL 32807

The plans are well done and easy to follow. They require you to discard the normal cowl-inlet and patch into your existing lower cowling. If there is sufficient interest in the NACA inlet we may consider investing in tooling to produce a new bottom cowl (or forward part of a bottom cowl) and the inlet (two molded parts that will bond to fuselage). If you would like us to see if these parts are available, please write in to RAF.

From CP26-11 (CH30)(Photo caption)
These photos show the Woods/Gehres designed flush scoop installation on our VariEze N4EZ. It blends to meet the standard cowling.

From CP27-3 (CH24,CH30)
NACA FLUSH INLET
Steve Woods and Tim Gheres (address: Wood & Gheres Inc. 105 Appleblossom Court, Orlando, FL 32807) are selling plans and providing builder support for those builders installing flush inlets. (see CP #26).

Mike installed one on his Long-EZ and used a 12 inch wide inlet, rather than the 14 inch size suggested for the 0-235. His 0-235 runs cool. We recommend using the 12 inch configuration for the 0-235 Lycoming. Mike also installed an access panel aft of the main gear strut in the "top" (bottom?) of his NACA duct. This panel is an oval shape, 5" x 10" and is constructed and installed using the same method shown on page 13-11 for the nose door. This allows inspection of main gear attachment and access to plumbing and wiring normally only accessible through the hole in the back seat bulkhead. This same panel can also be installed on a Long-EZ (or VariEze) without the NACA inlet, in the same place. Do not make the entire area removable this cover area is required for structural reasons and should not be omitted.

From CP27-5 (CH30)
Advanced Composite Lightweight Cowling
Graphite (carbon-fiber)-reinforced cowlings for the Lycoming Long-EZ will soon be produced and available through Aircraft Spruce and Wicks. Differences between these and the standard cowl are shown below.

	Standard	Graphite
Materials:	Gel coat	Glass Cloth
	Glass Mat/cloth	Graphite Cloth
	Polyester resin	Epoxy

Weight:	18 lb	12 lb
Cost: (both halves)	Approx. $245	Approx. $360

We have tested a prototype of this graphite cowl and are pleased with it. The part numbers are as follows for all cowls, standard and graphite.

Part #	Materials	Aircraft	Engine	Top/Bot
CCT	Glass	VariEze/Long	Cont	T
CCB	Glass	VariEze/Long	Cont	B
LCT	Glass	VariEze	Lyc	T
LCB	Glass	VariEze	Lyc	B
LCT-L	Glass	Long-EZ	Lyc	T
LCT-LGrap	Graphite	Long-EZ	Lyc	T
LCB-LGrap	Graphite	Long-EZ	Lyc	B
LCT-Grap	Graphite	VariEze	Lyc	T
LCB-Grap	Graphite	VariEze	Lyc	B
LCB-L	Glass	Long-EZ	Lyc	B

From CP27-6 (CH4,CH18,CH30)
Long-EZ Cowl and Canopy fitting.
As will be shown in the new Long-EZ Lycoming engine installation section (IIL), the Lycoming cowl has been moved aft 0.7" from where it was in a VariEze. This was done to provide better clearances. With the new dynafocal engine mount, the engine is moved aft also, to provide good magneto clearances and an acceptable structural arrangement for the mount tubes. The new Section IIL will show you how to fill the cowl-firewall gap when mounting the cowl using the method used on N79RA and on Mike and Sally's Long. Cowling manufactured for Long-EZs after December 20, 1980 have the lip extended to allow easier installation. These cowlings can be identified by checking the dimension shown below.

SKETCH OMITTED

(OLD COWL=32.0)
(NEW COWL=32.7)

This cowling move has resulted in a miss-match of cowl-to-firewall at the top of about 0.2". Mike faired the miss-match in with dry micro, since he had already fabricated the canopy aft cover piece (Chapter 18). To avoid this micro fill, we suggest that you: Trial fit your cowling to the firewall before carving your canopy aft cover piece. If you have not cut out your firewall, make it taller at the top and trim to fit your cowl during Chapter 18. (see LCP #48).

From CP28-8 (CH30)
Cowling storage
When you get your cowling you may not be ready to use it right away, in fact some builders store cowling for months, occasionally years! A cowling left laying around can change shape considerably. For easy fitting when you need it, clamp both cowl halves as shown to a length of 2" x 4" lumber. This holds the cowl in the correct shape to prevent long-term warping.
SKETCH OMITTED

From CP28-10 (CH30)
Advanced Composite Lightweight Cowlings
We announced the availability of these cowlings in CP #27 page 5. Unfortunately the supply of graphite woven cloth has since become much more difficult to obtain and almost twice the price. This means that we have had to turn to Kevlar cloth. Any builder ordering a graphite cowl, should be aware that unless he gets an early one, he probably will receive a Kevlar cowl. It is within 1 lb. of the weight of the carbon cowls. The Kevlar cloth is covered, both inside and out with fiberglass, to avoid the sanding/fraying problems experienced with Kevlar. We have approved the use of Kevlar in the cowlings, in fact we have one on display here in Mojave for inspection.

From CP28-10 (CH7,CH30)
Q. I want to install the NACA inlet. Can I do it before glassing the bottom of the fuselage?
A. No. The normal glass on the bottom of the fuselage is required structure. The NACA inlet per Tim Gehres and Steve Wood's plans is purely an inlet-shape add on, and provides no structural tie between the bottom longerons.

From CP29-3 (CH7,CH30)
NACA FLUSH INLET
We are getting a lot of inquiries about this and frankly we really cannot make your decision as to whether or not you should install it on your VariEze or Long-EZ. Here are the facts. This is all we can tell you. Please do not ask us to help make your decision.

1) You have to build the bottom of your fuselage per plans whether you use the NACA inlet or not, since this is required structure to tie the two bottom longerons together. The NACA inlet is an aerodynamic cosmetic add-on, and provides no structural tie between the fuselage sides. The NACA inlet is homebuilder-carved (no prefab parts are available) and spliced in to the standard cowl. You will not need the "CI" cowl inlet part.

2) The NACA inlet works well for cooling and is lower drag than the ram scoop, adding about 3 knots more airspeed. Since the fuselage sides are lower in the area of the main gear you get a better aerodynamic juncture between the main gear and the fuselage.

3) The sex change operation (going from the "male" ram scoop to the "female" NACA inlet) will add about 4 to 6 lb weight.

4) You may elect to install the flush inlet for aesthetic reasons only. We like the side profile view of the female EZ very much, and almost everyone who has seen it agrees.

5) RAF did not develop this installation, and therefore we cannot support you in building it. Tim Gehres and Steve Wood did all the work on it, they sell the plans, and they will support you if you have any builder questions. Contact Tim or Steve at:

Wood and Gehres Inc.
105 Appleblossom Ct.,
Orlando, FL 32807

Plans cost $20 and are very easy to follow.

From CP34-8 (CH30)
If you are installing a VariEze cowl on your Long-EZ, you may find the bottom cowl does not match well to the wing root, after cutting the cowl to the correct width. Paul Adrien came up with a neat solution. He simply glued a piece of styrofoam or urethane foam to the wing root. Then shaped it to fit the gap between the wing root and the lower cowl. Glass over the foam with 2 plies of BID. This makes a nice transition without reshaping the cowl and leaves more room in the cowl for the exhaust. See Photos. **PHOTOS AND SKETCH OMITTED**

From CP34-11 (CH30)(Photo Caption)
Dr. Paul Adrian's Long-EZ wing root to cowling joint. He had a VariEze cowl and used this very neat method of matching his lower cowl to the wing and left himself plenty of room for his exhaust system. See "Builder Hints", page 8.

From CP35-6 (CH22,CH30)
VariEze and Long-EZ CHT
On these airplanes, with "updraft" cooling, when we measure CHT at the spark plug base, if we install the temperature probe (washer type) on the bottom plugs, which is usual, we are measuring over 40 degrees less than the temperature on the top plug. So keep in mind that if you have a marginally high CHT and are measuring at the bottom plugs, you may even be over the red line. For the record, Lycoming does not measure CHT at the spark plug base. All published data on Lycoming CHTs are taken at the threaded hole on the bottom of each cylinder head. When possible, this is the preferred pick off point.

From CP37-4 (CH30)
VariEze/Long-EZ Cowlings.
The aft stiffener rib that runs across the inside aft edge of the cowlings, both top and bottom should be taped in with a 1 1/2" wide BID tape all around. These ribs are floxed in but may pop loose due to vibration.

From CP38-8 (CH30)
Plans for the NACA flush inlet, for Long-EZ and VariEze. $20.00 for a set of drawings.
Contact: Tim Gehres,
105 Apple Blossom Ct.
Orlando, FL 32806
(305)275-7897

From CP41-2 (CH30,CH38)
RECORD SETTING EZ'S
July, Friday 13, 1984. Gary Hertzler's VariEze, N99VE with Jeana Yeager at the controls, took off from Bakersfield attempting to break the CI-A closed course record held by Leeon Davis in his Dave DA-5. Davis' record was 2262 statute miles. Jeana took off at 6:40 p.m. and flew throughout the night between Meadows Field and Merced Airport. This meant she needed to complete 8 laps to break the record, we were hoping for 9. After 8 laps, she figured she could just get in the 9th and in fact she flew over halfway towards Merced before she decided to play it safe and return to Meadows. The rules say you must land at the airport you took off from for a closed course record. So she will only be credited with 8 laps, a distance of approximately 2424 statute miles. Actual distance flown was almost 2700 miles.

Gary's VariEze was flown back to Mojave and given a thorough preflight which included removing the cowling, changing the oil, tightening the alternator belt and retorqueing the prop. **One cowling screw was missing. It was replaced using Loc-Tite!**

At 11:46 p.m., Gary Hertzler took off from Mojave airport in an attempt to set a back to back record this time the straight line distance record in the C1-A class (maximum gross weight = 1102 lbs). Gary had head winds until almost Albuquerque, where they switched to light tailwinds. He had lots of weather, including thunderstorms. After a nasty experience with a thunderstorm over the Smokie Mountains, he decided to call it a day. He landed with almost two hours worth of fuel on board at Martinsburg, West Virginia, approximately 14 hours and 50 minutes after departing Mojave. The straight line distance measures approximately 2227 statute miles, which easily breaks Al Lesher's 1975 record of 1835 statute miles in his Continental O-200 powered Teal.

The important thing to remember is that these results are provisional, and are pending ratification from the FAI. We are confident of ratification though, because in both cases the barograph functioned correctly and all the turn points and landing points were verified.

We are very proud to have these records back in the "fold" so to speak. For those of you who may not remember, Dick Rutan, flying Burt's Volkswagen powered original prototype EZ, broke the closed course distance record during Oshkosh 1975. Leeon Davis broke Dick's record and has held it ever since. Thanks to Jeana and Gary, this record once again belongs to a VariEze. Congratulations guys, you did good!!!

From CP42-3&4 (CH30)

SOME THOUGHTS ON COOLING

The following observations are based entirely on my own experiences over 900 hours of flying in my Long-EZ, N26MS.

Since first flight in January of 1981, my engine, a Lycoming O-235-L2C, baffled exactly per section IIL of the Long-EZ plans, has run with cylinder head temperatures that were not even, to say the least. Cylinder #4 (forward right side) had always run the hottest. Cylinder #1 (aft left side) had always run the coolest. At normal cruise power in level flight there was normally a disparity of up to 100 degrees F between these two cylinders. Cylinders #2 and #3 ran within 5 degrees of each other at all time (#2 is aft right side and #3 is forward left side). This problem was not entirely as bad as it sounds in that even the hottest cylinder #4 never did exceed or in fact even come close to the red line temperature as called out by Avco Lycoming. (500 degrees F as measured at the bayonet fitting under the cylinder head, not at the base of a spark plug).

On an average cross country trip, in stabilized level flight, my cylinders would run as follows: #1 - 280 degrees F, #2 - 345 degrees F, #3 - 341 degrees F, #4 - 413 degrees F. We flew the airplane for over 700 hours with this condition. Over this period I tried many small ideas in baffling, tightening the baffles, loosening the baffles, sealing every single little gap in the baffles. None of these changes made a really significant improvement.

Sure I picked up 5 and 10 degree increments from time to time, but I was trying to cure a 100 degree difference! There is not enough space here to list all the different ideas I tried, but they included removing the intake duct completely, and installing a throttle body fuel injector instead of a carburetor.

Finally I tried a small deflector plate, consisting of a piece of .032 aluminum approximately 4" x 5". I bent it so I could rivet it to the inside of the lower cowling lip. I mounted it off center on the right side, under the #4 cylinder, hoping perhaps it might aim the incoming, high velocity cooling air directly at the #4 cylinder. See sketch. **SKETCH OMITTED**

I test flew it, with little enthusiasm and was amazed to say the least. #4 was now the coldest cylinder. Unfortunately #2 was not too hot, however I now knew I was onto something. To make a long story short, I tried 6 different iterations of various width and height of deflectors in several positions on the lower cowling. Currently I have 3 deflectors, one on the left side, one on the right side, and one on the centerline, aft of the carburetor. See sketch. **SKETCH OMITTED**

These deflectors are made of foam and glass (1 ply of BID over pour-in-place). My results at this time, with 150 hours of flight time on the above, maximum power climb to 12,000 feet, #3 cylinder is the hottest at 435 degrees F, #4 is the coolest at 395 degrees F. In level flight at 8500 feet, at an economy cruise power setting (approximately 60 percent) of 17" manifold pressure, 2500 RPM, indicating 121 knots for a true airspeed of 136 kt/157 mph (OAT plus 1 degrees C) fuel flow was 4.4 gph. Cylinder #1 - 345 degrees F, #2 - 31 degrees F, #3 - 338 degrees F, #4 - 343 degrees F.

On another trip at 8500 feet at maximum available power (approximately 75 percent) 21.4" manifold pressure, 2850 RPM, indicating 146 knots for a true airspeed of 163 knots (OAT +4 degrees C) fuel flow was 6.4 gph. Cylinder #1 - 363 degrees F, #2 - 361 degrees F, #3 - 364 degrees F, #4 - 363 degrees F.

So it can be seen that with a little trial and error, the cooling air deflectors can be made to work rather well. I don't claim that they will work for everyone, but I believe that if you are having similar cylinder head temperature disparities, it may be worth a try. I must emphasize that this test was done on a Long-EZ with a flush NACA cooling inlet and a Lycoming O-235 engine. Whether or not this idea would work on an airplane with a standard ram inlet, I can't say, but again, it may be worth a try. Remember that I have all four cylinders instrumented with CHT as well as EGT with a calibrated digital gauge, so I knew at all times what was happening with each change.

From CP44-2 (CH13,CH22,CH30)

Mike and Sally's Long - N26MS - is in the shop for a few changes and a face lift. This airplane has 925 hours and is over 4 years old. We are installing new upholstery, and will be repainting the whole airplane. While it is down, we are doing a few things to it that we have always wanted to do, but have never got around to. We are installing a Loran-C, we chose a Micro

Logic 6500. We are also installing a F-TEC ST-1A engine monitor meter. This promises to be a really neat multiple engine functions gauge as well as a great panel space saver.

In addition, we have modified the trailing edge of the cowling, by extending it aft about 3" towards the prop. The goal here is (hopefully) a lower drag cowl with improved cooling. We have also moved our brake master cylinders up into the nose. This modification has been done by many builders, using several different methods. The advantages are better access to firewall area, mags etc, and for cg, weight on the aft end moved into the nose is better.

All of the above are now in the works. This is quite a major undertaking, requiring a new instrument panel. Oh yes, we are completely rewiring the entire airplane! Please don't call on any of these mods. We will thoroughly flight test all mods and report on the results in the next newsletter. We anticipate flying in about 6 weeks time.

****From CP45-6 (CH2,CH9,CH13,CH30)****
PREFAB GLASS PARTS
Larry Lombard, owner/builder of VariEze N15LL, one of the highest time EZs we know of with over 1200 hours, is now on line and is making Long-EZ main and nose gears and is set up to make Defiant gear.

Larry is working on tooling for Defiant cowlings and fuel strakes and would appreciate hearing from Defiant builders who would be interested in these parts.

He has available tooling for Long-EZ cowlings and wheel pants, VariEze cowlings and wheel pants and can take orders for these parts. We would request however, that if you are ready and need a cowling or a pair of wheel pants, that you contact either Aircraft Spruce and Wicks Aircraft first, since they may still have a few of these parts in stock and we would like to deplete their stock before Larry starts.

Mike Melvill and Michael Dilley flew up to northern California and spent the day with Larry, checking out his equipment and also helped him run the first Long-EZ gear. Larry has built a really nice hanger/shop right on the Boonville airport which is north of San Francisco and west of Ukaiah. He has just completed a first class oven in which to cure the gear. All of the equipment worked well and he is now ready to accept orders.

Larry will be handling all of these parts directly and you should contact him at:

P.O. Box 781
13451 Airport Road,
Boonville, CA 95415
707-895-2718

Larry has a very extensive background in working with composites. He had built several homebuilt aircraft including his own VariEze, and worked here at RAF for two years during which time he helped build the Grizzly and Solitaire. Larry will be working in close conjunction with RAF and we are confident that he will produce high quality parts at reasonable prices.

****From CP46-3&4 (CH13,CH22,CH25,CH30,CH38)****
N26MS, MIKE AND SALLY'S LONG-EZ - the first 1000 hours.
As many of you (who attended the RAF flyin in June and also Oshkosh this year), will know we have given our "old" Long-EZ a face lift. It is hard to believe, but she will be 5 years old this December.

It all started when Mike decided (and the check book said ok) that we needed a Loran C!! After much looking around, we opted for the MicroLogic ML6500. Our reasoning included, easy to operate, fully automatic chain selection and a size and shape that would fit our panel. It turned out that the panel had to be cut out and a completely new one be designed, built and installed! While we were at it, we tore out all the wiring (it was done in a hurry and Mike was never very happy with it). Our panel night lighting was never very good, so we installed post lights over all the instruments, as well as a dimmer switch. Panel lighting at night is now superb.

In order to do all this work, we removed the wings and canard, cut out the side consoles, cut out the instrument panel, reshaped the nose to allow installation of brake master cylinders up front and optimum placement of the two 12 volt motorcycle batteries, that make up our 24 volt electrical system. **We also reshaped the cowling extending it aft a full 3" to reduce the closure angle and hopefully reduce drag a bit.**

The structure was given a very thorough inspection, wing attach hardpoints looked like the first day they were put together. We are extremely pleased with the composite structure. A few small cracks were found in the paint, all were examined, by removing all finish down to the glass. In no case did any crack extend into the glass, we are ashamed to admit that each crack was over a rather generous build up of Bondo! The moral here is use dry micro not Bondo. We did a little recontouring, filling with West System, sanding and priming with Mortons Eliminator. We installed the new Roncz 1145MS canard, carefully fairing it into the nose. We designed and built two battery access doors (they work nicely, but are not worth the amount of work it took). We installed the Loran C antenna in the left winglet. Then we wet sanded the original Imron finish down until the whole airplane was dull.

Mike sprayed the entire airplane with Imron using a slightly whiter white than we used last time, and we trimmed it in metallic gray instead of the green we used the first time. We had the seat cushions recovered in gray to match the trim. All the consoles were glued and glassed back into place, the interior was once again painted in charcoal gray Zolatone. We installed the Ian

Ayton's canopy/gear warning systems, (it flashes the warning light and buzzes the horn intermittently). We cannot say enough about this system. It is really neat. It is small, easy to install and you absolutely cannot ignore it. If you override the horn, the light continues to flash, and in about 50 seconds, the horn starts to buzz again, a very worthwhile addition and one we both heartily recommend.

When we finally reassembled her, she looked like new! We did a careful weight and balance on 3 certified aircraft scales (naturally she had put on a little weight), then we rolled her outside, fired her up and went flying.

The whole face lift was supposed to take a few weeks and in fact ended up taking over three months. (It only took 5 1/2 months to build her from scratch!!)

The Loran C works well. We get SNRs (signal to noise ratio) of 99 on the master as well as both slave stations, with everything turned on, engine running and in flight. This is true in the Mojave, Bakersfield, Fresno area at least where the testing was done. Obviously there are many places where we cannot get these kind of optimum results. The antenna we use is a 3/16" O.D. hobby store brass tube. We sharpened the end, put it in an electric drill, and "drilled" it into the bottom of the lower winglet, pushing it all the way to the top of the winglet. It goes up the leading edge of the upper winglet. We soldered the preamp to the bottom of this brass tube, removed a wingtip light assembly, dug out a little foam and installed the preamp behind the wingtip light. We are very pleased with this simple, cheap antenna.

We recently installed miniature fuel and oil pressure gauges (1 1/4" dia) that read actual pressure (not electrons!). They are plumbed directly from the engine to the instrument. We used nyloseal tubing fittings. These are really great little instruments, a bit expensive, but worth it. (See page 206 in the Aircraft Spruce catalog). In addition we have an Electronics International digital CHT-EGT with a four way switch, so we can look at all four cylinders. We bought an oil temperature probe and connected the cylinder #1 EGT to the oil temp. Thus we have 4 CHT, 3 EGT and oil temperature in one gauge. Also in this small side panel, is a digital voltmeter by Davtron. Again, expensive but worth it. We know exactly how the electrical system, alternator charge, etc is doing, plus or minus 0.1 volt.

The only item that really required maintenance was the nose gear strut and associated pivots. Mike removed the top bolt and took the whole strut out. The bushings in the NG-6 assembly (NG-23 as shown on Page 13-1) were quite worn allowing considerable side to side play in the top pivot. Mike machined up two steel bushings, pressed them into the NG-6 casting then reamed them to be a very close fit on the NG-7 spacer. A grease fitting (Zerk) was installed in the NG-6 casting allowing future lubrication of this pivot without dismantling it. The two HM-6 rodend bearings in the shock strut were also somewhat worn, allowing some fore-aft movement of the nose gear strut. We replaced these rodend bearings with very expensive aircraft quality rodend bearings (approximately $25.00 each) which essentially eliminate any play.

The vertical pivot at the nose wheel fork had already been overhauled per CP 44, page 7. Thus the entire nose gear strut and wheel has received a complete major overhaul. It is now working flawlessly and we are very pleased with the above modification and repairs.

The brake master cylinders up forward modification was done for three reasons: To help move the CG forward, to allow better access for inspection and hydraulic fluid replacement, and to also allow better access to the magnetos.

Mike designed this particular installation, it works quite well, but if we were to do it again, we would use Debbie Iwatate's method. (See "for sale" this CP).

We did find one drawback to the forward mounted brake cylinders, that we had not foreseen. It is now quite difficult to adjust the rudder position for various size pilots. The original design used only adjustment to lengthen or shorten the cable aft of the pedal. Now we have to <u>also</u> adjust the pedal to brake master cylinder relationship, which with our design is awkward. As a result no one else gets to fly our Long - advantage or disadvantage?!?!?!

We have also done a lot of work on optimizing engine and oil cooling. At this point in time though it is too early for us to comment on the success. We are flying the airplane quite a lot, in fact since Oshkosh we have put over 100 hours on her. N26MS continues to meet or exceed our expectations. We have enjoyed nearly 5 years of fun flying, visiting faraway places and meeting interesting people. We are looking forward to the next 1000 hours.

From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)

<u>PRE-FABRICATED COMPOSITE PARTS</u>

<u>Lombard's</u>, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its completion he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS
Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, **Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester.** Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING
From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE
For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS
We are pleased to announce three new products to our line.
1. Pre cut foam cores, Long-EZ (new canard or GU) at $99.50. Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.
Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415
(707)895-2718

Editor's Comment - **Larry and Michael are really building a fine Kevlar cowl.** Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

From CP46-14 (CH30)
Larry Lombard, Michael Dilley and Jamie Ferretti, the folks at Lombard's. Long-EZ Kevlar cowling, both halves with stiffening ribs weigh 12.5 lbs.

From CP47-5 (CH2,CH30)
"LOMBARD'S" UPDATE
Larry Lombard and Michael Dilley have been turning out EZ cowlings and shipping them as fast as the orders come in. EZ cowlings have always been a bit of a "beast" to install. It seems that they never fit quite right. Michael is building a Long-EZ and he studied the problem. He came up with the theory that the aft rib was stiffening the cowl halves so much torsionally that the cowling could not be forced to fit the shape of your airplane. As a result, the job of installing a cowling has developed rather a bad reputation.

The decision has been made to ship cowlings with the aft rib not installed. The best method is to completely install the cowling, then flox the prefab rib into the upper and lower cowl. After it cures, lay up one ply of BID at 45 degrees over the whole rib, lapping onto the cowling 1" all around.

Using this method, the cowling is much easier to install and you get a nice fitting cowling into the bargain. All cowlings shipped by Lombard's since January 1, 1986, have been and will be, shipped with the aft rib loose and you will install it yourself per the above.

Larry was down here at RAF taking all the measurements on Burt's Defiant necessary to enable to them to build cowlings that will fit a homebuilt Defiant using any combination of 150hp, 160hp, or 180hp engines with either fixed pitch wood props or constant speed feathering props such as the Hoffmann propellers installed on Burt's Defiant. Due to the almost infinite possibilities of engine/mount/prop extension/prop and spinner, the chances of building one cowling (especially the front cowling) to fair perfectly from the spinner to the firewall are essentially zero. Therefore, Larry and Michael will be supplying the front cowling about 4 to 6 inches short of the spinner. The builder will mount his or her engine/moun rop extension/prop and spinner, then the cowling will be jigged and mounted. The spinner and prop will be protected with gray tape. Foam blocks will be cut and fitted between the cowl and spinner and carved to a perfect faired fit. Four plies of BID will be layed up to lap onto the cowl. After cure, the cowl will be split, the foam cleaned out and one ply of BID will be layed up on the inside of the cowls to tie things together and, presto! you have a perfect fit, no matter what combination of prop, extension and spinner you may have. The rear cowl does not have the same design constraints and will be shipped ready to install. The only change that may be necessary, depending on your particular engine/prop/spinner combination, would be to trim the trailing edge or shorten the cowling to match to your spinner.

Larry and Michael are also working on a pair of low-drag main wheel pants for the Defiant. These will probably look like something between Burt's prototype and Fred's Defiant.

Last, but not least, Larry and Michael have formed their small company into a corporation. As of now, this corporation will be known as FEATHERLITE PRODUCTS, INC., P.O. BOX 781, 13451 AIRPORT ROAD, BOONVILLE, CA 95415. Be sure to write or call for a quote and compare prices and quality with any of the bootlegger outfits. Keep in mind that Larry and Michael are the only RAF approved and recommended manufacturers of prefab glass parts for all of the RAF designs.

From CP47-10 (CH30)
MORE THOUGHTS ON COOLING
Cooling is a rather controversial subject, certainly one that has caused more consternation than most. We have done a lot of testing recently using several different VariEzes and Long-EZs.

This is a brief summary of what we found: If you only have one CHT probe, install it on the most forward cylinder, cylinder #4 on a Lycoming, cylinder #1 on a Continental. In a normal EZ per plans engine installation, the forward two cylinders will invariably run hotter than the aft two. We have consistently found the most forward cylinder running as much as 100 degrees F hotter than the most aft cylinder.

If you have a four probe CHT system, one you can rely on, that has been calibrated and is known to be accurate, you can experiment with "ramps" on the floor of the lower cowl, as shown in CP42, page 3. The deflector ramps will dramatically change the cooling pattern of your engine, depending on the shape, size and position of these ramps. It would be difficult and maybe even foolhardy to try this without good instrumentation.

The way the cooling in an EZ cowl works is apparently not the way it works in a Cessna 150. For example, in an EZ, ram (male) scoop or NACA flush scoop, the high velocity cooling air enters the cowl and most of this air runs up the slope of the lower cowl, hits the aft vertical baffle, and squirts up through the fins of the two aft cylinders.

Since most of the incoming air has gone, at high speed, through the aft two cylinders, in most cases overcooling these two cylinders, the forward two cylinders do not get enough cooling air, so it follows that they run too hot. This is the way it is, at least, on the several EZs we have closely examined.

If you accept the above scenario, it follows that a ramp or several ramps installed on the lower cowl, positioned and shaped to deflect the high-speed, incoming, cooling air cause it to go up and through the forward two cylinders, should do the trick. In all cases we have tested, we have been able to reverse the hottest and coldest cylinders! This is pretty significant and what it tells you is that with some experimenting, you can get all four cylinders running within just a few degrees of each other. Everyone who has seriously tried this has reported the same results. This has included some real skeptics.

In the last two weeks, we have tested 6 EZs, two VariEzes and 4 Long-EZs, using a water manometer. We used a stock Cessna 150 as a kind of "baseline". We found that a standard ram inlet EZ compares very closely to an EZ equipped with a flush NACA inlet, provided both have well-built, close fitting baffling and both have the same size, stock cooling outlet. Changing the size of the outlet will change the pressure drop across the cylinders.

Of course, there is a lot more to cooling than the pressure drop across the cylinders. "Blockage", or the resistance to the flow of cooling air caused by the baffled engine is a big driver. Very poor baffling or no baffling at all, obviously will result in a very low pressure drop. Very tight baffling forcing the incoming high pressure air to slow way down will obviously result in a large pressure drop. This differential is called the delta'p' and is measured in inches of water.

Lycoming says that for a Lycoming 0-235 engine, you need a delta 'p' of about 4" of water. The curves shown below are the results of our recent tests. **CHART OMITTED**

Note that the two Long-EZs with the lowest delta 'p' across the cylinders (only 3" delta 'p' at 160), do in fact, have good cooling. Both are well equipped with 4 probe calibrated CHT gauges. What does this prove? Only that if the baffling is excellent, tight with absolutely no leaks, the cylinders will cool acceptably even with only 3" of water delta 'p', also, note that both of these Longs have smaller than normal cooling air outlets.

The temperatures on the above airplanes are measured at the bayonet cylinder head fitting on the Lycomings and on the top spark plugs on the Continentals. One of the Lycoming engines is really well instrumented, with probes on all four cylinders at the bayonet fittings, and on the bottom spark plugs as well as on the top spark plugs. The results of this test are as follows: Maximum power setting (mixture slightly rich for the climb) results in the bayonet probes averaging 360 - 380 degrees F. Bottom spark plugs average 400 - 420 degrees F. Top spark plugs average 440 - 460 degrees F. At 10,000 feet, OAT = +10 degrees, in level flight at maximum continuous power, (mixture leaned to best power max. EGT), the bayonet probes average 330 - 350 degrees F. The bottom plugs average 360 - 380 degrees F and the top plugs average 430 - 450 degrees F. In spite of an average difference of 70 - 100 degrees F from the bottom to the top of each cylinder, this is probably about as good as you can do and is quite acceptable, according to Lycoming.

The optimum baffling for an EZ engine is probably not possible due to the mechanical difficulty of building it, but you can come close. For a Lycoming 0-235 or Continental 0-200, try to baffles as close to the sketch below as you can (NEXT PAGE) **SKETCH OMITTED**

From CP47-11 (CH30)
OIL TEMPERATURE PROBLEMS
Dick Rutan has been doing a lot of cooling related testing on the Voyager and during his test for optimum oil cooling, he discovered an interesting method to improve cooling air flow through an oil cooler. Using the Voyager water manometer, Dick found that with an oil cooler mounted on the inside of a cowling, such as a Long-EZ does, where the cooler is in the high pressure plenum of the cowl, and vented to the free stream, the following delta 'p' measurements were true.

With NO reverse scoop over the oil cooler (you can see the cooler from outside) the pressure differential was 1.8" of water. He installed a reverse scoop per plans, still 1.8" of water delta 'p'. He moved the reverse scoop forward, exposing half of the oil cooler - 3" of water delta 'p'! A dramatic improvement to say the least. Next he moved it forward enough to expose the whole of the oil cooler - 3.8" of water delta 'P', and much cooler oil temperatures. If you are having oil temperature problems in your EZ, try this neat trick. **SKETCHES OMITTED**

We would like to thank Dick and the Voyager program for this very helpful hint and also for his help and use of his instrumentation for the previous article on engine cooling.

From CP51-5 (CH30)
EXHAUST SYSTEMS
For Long-EZs we have used the Brock prefab, plans-type stainless exhaust header with "ball swivel" joints. On the prototype, as well as Dick Rutan's and Mike and Sally's Long-EZs (well over 3,500 hours total time), we have never had a single problem with this setup. For VariEzes, we have always recommended this same system for Lycoming O-235 powered EZs' for Continental O-200, we recommend the exhaust system originally designed, fabricated, and sold by VariEze builder, Herb Sanders, through his company, Sport Flight.

Generally, we have had very little trouble with either of these systems. In the interest of cooling the engine, we have always recommended a rather small clearance hole around each exhaust pipe where it goes through the cowling. Recently, we were testing another system consisting of four separate exhaust headers that exit the cowling two on each side, one on top of the other.

We wanted to see if there was any power advantage using four headers instead of a two-into-one system. In fact, there is a small power gain, between 50 and 75 RPM at full throttle at 8000 feet in level flight, but that was not the interesting discovery. During the testing, we simply cut enough cowling away that the exhaust did not touch the cowl. We inadvertently cut more cowling away than we had intended, and during the flight, we noticed a considerable drop in cylinder head temperature! Yes, lower CHT's, in spite of a relatively large leak in the pressure cowling. We sealed up the leak using engine baffle neoprene/asbestos glued to the cowling and fitting almost perfectly to the exhaust pipes. The CHT's went up higher than ever! We cut away the neoprene a little at a time. The more we cut away, the larger the high pressure air leak, the lower the CHT's became! We ended up with a full 1/2" of clearance between the cowling and the four exhaust pipes. Amazingly, this amounts to about 7 square inches of "leak" area on each side of the cowling! In spite of this leakage, we have excellent cooling.

How could this be? Perhaps the leak so far aft, even aft of the engine, gets the cooling air mass moving aft at a fairly high velocity then, of course, all of the incoming cooling air cannot escape out through the "leak" area, so it has to go through the cylinder cooling fins just as the engine baffling intended it to. For whatever reason, this does work, and not on just one airplane. We know of at least 3 EZ owners who have tried opening up the clearance holes around the exhaust pipes and they saw the same results - cooler cylinder heads!

****From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)****

FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	**283.00**
Kevlar engine cowling (top/bottom)	**448.00**
weight saved, approx. 6 lbs.	
cowl inlet (not used with NACA inlet)	**30.40**
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert.500 x 5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	99.50
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.

Contact: Michael or Larry at: FeatherLite, Inc.
P.O. Box 781
Boonville, CA 95415
(707)895-2718

****From CP52-6 (CH30)****

NACA FLUSH INLET FOR EZ'S

PLEASE NOTE: Tim Gehres has decided not to sell anymore plans for the flush inlet. He has gone out of business. There is no known source of the plans and RAF cannot assist you in trying to build a flush inlet.

****From CP53-1&2 (CH30)****

DEFIANT NEWS

We were visited recently by Dr. George Best and his son, Michael, in their truly magnificent Defiant. Mike was very lucky to be offered the opportunity to fly this beautiful aircraft and he was very, very impressed! George had previously built an excellent example of a Long-EZ, his first homebuilt, so the Defiant was not an unknown to him. He says he really enjoys the contouring and finishing, if you can believe that! The contour perfection of George's Defiant must be seen to be appreciated. Quite the best Defiant we have seen! George had some help from one of the most innovative homebuilders there is, Tom McNeely, who laid out a really superb instrument panel, and also a very nice, clean and simple rudders-in-winglets installation. Tom also did the cowlings which are real works of art, flowing perfectly into the fuselage. **The rear cowl has a flush NACA inlet and the outlets are on top, similar to the front cowl. The aft end is completely sealed. Really wild looking and, so far, works rather well.** This Defiant is very smooth and quiet, particularly at a low cruise. As an example, Mike checked a couple of points at 10,500 feet, a normal cruise with both engines turning 2500 RPM, a total fuel burn of 11.5 GPH with an indicated 140 KTS (160 MPH) gave a true airspeed of 168 KTS (193 MPH) for almost 17 MPG. A low, economy cruise with both engines turning 2100 RPM, a total fuel burn of 8 GPH, indicating 98 knots (113 MPH). George's Defiant holds 120 gallons of fuel, so at this power setting, he could fly over 2000 statute miles!

George originally had installed Hoffmann constant-speed, feathering, 3-blade propellers. He, like everyone else who had tried these props, had many problems trying to get them to hold RPM. These props have very small pistons inside the hubs, and therefore require very high oil pressure to hold maximum RPM and, of course, as soon as the oil comes up, the governor seals and main bearing seals allow enough leakage so that it is not possible to hold the pressure required. George had special high volume governors with a modified ratio installed and felt he just about had the problem whipped when disaster struck! The nose gear collapsed on take-off, the NG-2 weldment failed allowing the gear to retract. Of course, the front propeller was reduced to splinters and some minor front cowling work was required to get it back in the air. George ordered two fixed-pitch, wood props from Great American, and even though these were a first cut and not optimum for this Defiant, they work so well George will be sticking with the fixed-pitch, wood props and getting rid of the Hoffmanns.

He says that he was never really very satisfied with his Defiant with the heavy constant-speed props. It was heavy, did not maneuver well (keep in mind George is a Long-EZ driver). When he installed the lightweight wood props, he reduced his empty weight by 110 lbs. and, suddenly, the airplane flew like he thought it should, light, quick, and fun to fly. Mike flew it with the Great American fixed-pitch props and was impressed with the performance.

The failure of George Best's nose gear retraction link, NG-2, was what prompted the mailing of the mandatory change in NG-2 to a welded tube structure with no rod ends. The rod ends are not very strong if they see a side load. When the nose gear hit a curb-type bump or a chuck hole which caused the aft load to go directly along NG-2, the weak rod end bearings bent inward which allowed the main tube, NG-2B to bend. This let the rod ends bearings bend inward enough for one, or both, to fail, either causing the nose gear to be very difficult to retract and extend, or to collapse.

Charlie Gray had only one rod end fail on the way to Oshkosh. He replaced the NG-2 and made it to Oshkosh in the very slick Defiant he built for his friend, B. J. Jordan. He brought the failed NG-2 to Burt and Mike at the RAF booth where it was examined. Mike Cardinale of Merritt Island, Florida had the misfortune to run off the runway when his rudder/brake pedals pulled up out of the floor. The aft load on the retraction link, NG-2 caused exactly the same failure as Charlie Gray's and George Best's. The original Defiant, N78RA, built by Burt does not have these rod end bearings in it at all, rather, it is exactly like the mandatory change drawing sent out to all Defiant plans owners dated September 15, 1987. Do not neglect to make this fix. If you do not fix it, your NG-2 retract link will fail. When it does, the nose gear will collapse and your Defiant will end up sliding on its nose. Depending on the speed and the type of surface, this could easily result in the lower cowling being ground away to the point of grinding on the carburetor bowl. If that should happen and fuel could escape from the ground away bowl, the result will almost certainly be a fire. This, obviously, could result in the total loss of your aircraft and maybe you. Ground your Defiant until you have completed this change.

Please note that on page 2 of the four page nose gear modification, sent to all Defiant plans owners, that the caution note pertaining to NG-4 stating the the bolt in NG-4 is the stop is not correct. Please ignore this caution note. When retracting or extending your Defiant nose gear, it is important that you grasp the gear handle and squeeze the NG-4 and hold it until the gear is either up or down, then release NG-4. Do not release NG-4 in the middle of the gear retract or extend cycle since this could possibly allow the NG-7 uplock link to flip over and jam the gear. Rodie Rodewald reported this problem to us. It happened to him twice in his Defiant. Fortunately, he was able to force the jammed gear down each time but he said it caused quite a little flutter in his heart for a minute or two!

A number of Defiant builders have reported problems in rigging their ailerons correctly. The plans change DPC #26 in CP 45, page 4, is incorrect and should be ignored completely. There is no differential in the Defiant aileron control system. To rig the ailerons, follow this procedure, in order: Rig the C-7 belcranks at exactly neutral as shown on page D-48. Lock them in this position with two small 'C' clamps. Both control sticks should now be firmly locked. Now, rig the C-27 welded crossover tube by adjusting the length of the cables from the stick assemblies to make the C-27 look exactly as it is shown on page D-26 (top left). Now, adjust the aileron pushrod tubes (rod end bearings) to the proper length to set both ailerons exactly at neutral. That is it! You will now have approximately + or - 19 degrees of aileron travel both up and down. (+ or - 2.3" at the aileron inboard trailing edge). Variations of up to + or - 0.3 at the trailing edge (i.e. 2" to 2.6") are okay.

****From CP53-6 (CH30)****

High cylinder head temperatures

Bob Hansen, 0-235 Long-EZ builder/flyer, has had high CHT's since day one. He says he has tried every suggestion in the CPs and many more to not much avail. Finally, in desperation, he cut two "reverse" scoops on top of the cowling with the leading edges pointing between the two cylinders on each side (see sketch). His first test flight after this operation was a pleasant surprize, 70 degrees to 85 degrees of temperature reduction at cruise. Bob's Long-EZ is equipped with a stock TASK cowling, has a NACA flush inlet with 45 square inches of inlet area, a 3" prop extension and an 0-235-L2C engine. Since Bob's success, fellow Sedona resident, Gordon Diehl, cut smaller openings in the top of his cowling (1" x 3") and he saw a 50 degree reduction at cruise. Of course, this amount of temperature drop is at cruise and is only about 1/3 as good in a steep climb since it is so velocity dependant.

Test results:	CYL #1	#2	#3	#4
Previous best:	420 deg	450 deg	460 deg	425 deg
After cowl cutouts:	350 deg	380 deg	375 deg	355 deg

SKETCH OMITTED

From CP54-13 (CH30)(Photo Caption)
Sculpturing a foam plug for Doug Shane's Long-EZ cowling.

From CP57-15 (CH30)(Photo caption)
Baffling! .032 6061-T6 aluminum. This is how it should be done. The neoprene/asbestos material still has be installed.

From CP58-10 (CH30)
WICKS AIRCRAFT SUPPLY
Wicks has Neoprene and fiberglass baffle material in stock, Part #CCM36. This is an excellent material to seal the gap between the aluminum baffles and cowling.

From CP61-13 (CH30)
FEATHERLITE, INC., LARRY LOMBARD'S AND Michael Dilley's composite company, producers of the prefab composite parts for EZ's, Solitaires, etc. announced that they are currently working on a NACA inlet cowling kit for the Long-EZ. This will be similar to Mike and Sally's N26MS which has a 12" wide NACA flush inlet. The cowling will have the NACA lip mounted on it.

Michael and Larry have one set only of Defiant pre-cut foam cores. Also, one set only of prefab Defiant fuselage bulkheads, plus a few other bits and pieces. First come, first served. Call: FeatherLite 707-895-2718

From CP62-2 (CH30)
OVER-HEATING OF ENGINE ACCESSORIES
Such as magnetos, voltage regulators mounted on the upper firewall, etc. An EZ's updraft cooling system does indeed cool the engine accessories while in flight. The lower side and accessory case end of the engine are immersed in cold air in flight. When you stop and park nose down after a flight, the air surrounding the engine and accessory case is trapped between the firewall, the accessory case and the top cowling. The temperature of this air, rapidly increases to as high as 350 degrees F or even 400 degrees F - try it yourself - use a "template" stick-on temperature indicator, stick it on a magneto and go fly. Park it for a few hours, then pull the top cowl and read the "template". You may be surprised, even shocked!

The Slick Magneto people have told RAF that the Slick mags will break down and probably have premature failure of the high tension coil if the temperature of the mag gets much over 300 degrees F!

How to fix this problem? You could do what Mike has done on N26MS. He installed his oil cooler on the firewall and exits the cooling air through the oil cooler and out of the top of the cowl. This is not the best spot for an oil cooler, (his oil runs between 190 degrees F and 210 degrees F) but it did achieve something else, it allowed hot air in this area to "chimney" out through the oil cooler and top cowling. Hot air rises, cold air comes in through the intake on the bottom of the fuselage and, presto, you have cool magnetos and anything else you may have mounted in this area. Mike's magnetos have never gone over 175 degrees F during the past 600 hours of flight. We are not necessarily suggesting moving your oil cooler - so what else can be done? A "drop in" door could be installed. While we at RAF have never done this to a Long-EZ, we certainly have on several other airplanes and they work well. A "drop in" door is a door hinged with the hinge running parallel to the aircraft centerline. The door is made like your oil check door, but it opens into the cowling. It must be restricted from opening more than 15 to 20 degrees. It does not have a latch or spring to hold it open or closed. It opens by gravity when parked or taxiing but it will close when you take off and fly due to high air pressure in the cowling. If you have very high temps on your mags, or you have had premature mag failures, you may consider such a door. If nothing else, try opening your oil check door when you park, but PLEASE don't forget to close and latch it before you take off!

Engines For Sale (Approved for Long-EZ)

From CP26-10 (CH30)
O-235-Cl OSMOH, 2000 hours total time. $3,350 plus crating charge.
Harvey Bolin
Brandon, MN
(612)524-2229

From CP28-9 (CH30)
Lycoming 0-235-L2C with fuel pump.
Contact: Howard Libersky, (305)464-6020

From CP29-5 (CH30)
Lycoming O-235 1600 SMOH, 800 STOH in storage new crankshaft and cam at major overhaul.
Call: Bill Clark
(301)889-5092
(301)256-5671 (after 6pm EDT)

From CP29-5 (CH30)
Lycoming O-235-C1 0SMOH, new crank, new cam, new bearings, chrome cylinders, fuel pump. Zero time, slick mags. Modified for 100 Oct. $4000 plus shipping.
Call: Charlie Gray,
(305)822-5040

From CP29-5 (CH30)
Lycoming O-235-L2C factory remanufactured engines specifically set up for a Long-EZ. They include fuel pump, MA3PA carb with accelerator pump, oil screen and slick mags. Also has new Lycoming engines to your specification.
Contact: Norm Bender
804 Meadow Lane
P.O. Box 30343
Memphis, TN 38130
(901) 365-6611

From CP29-5 (CH30)
Dick Waters of Florida can supply Lycoming engines to suit your requirements, and is also working on an accessory case to accommodate a mechanical fuel pump. This will be very useful for builders who have engines without fuel pumps.
Contact: Dick Waters
1325 W. Washington St., Bldg B-8
Orlando, FL 32805
(305) 422-0188

From CP30-11 (CH30)
For Sale: 108 hp O-235-C1 Lycoming, 60 hours SMOH plus all accessories. $2950.
Contact: Dennis Jacobs,
526 Ridgecrest Dr,
Yellow Springs, OH 45387

From CP30-11 (CH30)
For Sale: Zero time O-235 Lycoming, for more information contact:
Ted A. Miller
1561 Fairlawn Street,
Oshkosh, WI 54901
(414)231-8232
This engine was overhauled through the Aviation Explorer Post 2692, Boy Scouts of America - all logs and parts replaced can be had from Ted.

From CP31-8 (CH30)
For Sale: 8 Lycoming O-235-L2C engines. Zero time per specs for Long-EZ. With Lycoming warranty. $6695 outright, freight paid inside the USA.
Memphis Aircraft Power Service,
P.O. Box 38304
Germantown, TN 38138
901-754-0214

From CP32-7 (CH30)
For Sale - Lycoming O-235-C1, 1200 total time, zero since major. Standard crank and cylinders, oil pump. A.D. complied with. $4,500 - call 707-433-6480.

From CP32-8 (CH30)
For Sale - Lycoming or Continental Engines.
Norm Bender
Box 30343 AMF
Memphis International Airport
Memphis, TN 38130
(901)794-0032

From CP32-8 (CH30)
For Sale - Lycoming O-235 (80 octane), 600 hours total time since new. NO recent Ad's apply, removed from Piper Clipper and pickled. $1,800.00.
Dan Duncan
405-439-2473

From CP33-7 (CH30)
Norm Bender
Box 30343
Memphis, TN 38130
(901)794-0032
Contact Norm for Long-EZ 0-235-L2C, new or factory remanufactured engines. Norm says that a Lycoming price increase is imminent!

From CP33-7 (CH30)
Dick Waters
1325 W. Washington St.
Orlando, Fl 32805
(305)422-0188
Dick has rear cases to bolt on Cessna 152 engines that will accommodate mechanical fuel pumps and oil cooler. These cases are available outright or exchange.

From CP33-7 (CH30)
Memphis Aircraft Power Services,
3734 Winchester Road,
International Airport, Hanger #5,
Memphis, TN 38116
901-345-2850
Bob Norville, has several O-235-L2C engines.

From CP34-9 (CH30)
Fred Sanders
3207 Wildwood Dr.
Huntsville, AL 35801
(205)534-8186
Lycoming O-235 Cl - approximately 100 hours since chrome major.

From CP35-10 (CH30)
Factory fresh Lycoming O-235-L2C specifically built for Long-EZs.
Contact: Norm Bender
P.O. Box 30343
Memphis, TN 38130
901-794-0032

From CP35-10 (CH30)
In the crate, new Lycoming O-235-C2C, 80 octane $6500.
Contact: Bruce Tifft,
8746 Ventura
Ventura, CA 93001
805-649-2721

From CP35-10 (CH30)
1978 Lycoming O-235-L2C complete. 320 TT since new. $4900. Engine has been nitrited and all AD's complied. Call Tracy - 805-822-4668.

From CP35-10 (CH30)
Lycoming O-235-C2C - 1540 TT. All accessories.
Contact: Big Sky Aircraft
P.O. Box 538
Lewiston, MT 59457
406-538-8150

From CP35-10 (CH30)
Lycoming O-235-C2C - 1466 TT. All accessories except flywheel.
Lycoming O-235-C2C - Zero since major, complete
2 Continental O-200 - Zero since major, complete
Contact: Frank B. Johnston
Box 32245
San Antonio, TX 78216
512-494-6608

From CP35-10 (CH30)
Lycoming O-235-C - 36 hours SMOH, complete. $3700
Contact: Gary Klippenstein
Box 533
Altona, Manitoba, Canada ROG OBO

From CP36-7 (CH30)
Lycoming O-235-L2C still in the crate - $5700
Contact: Erwin Oertli
6186 West 10050 North
American Fork, UT 84003
(801)756-2864

From CP36-7 (CH30)
Lycoming O-235-C2C, 640 hours since new, logs, carb, mags and fuel pump. Partially disassembled for a top overhaul (valves and jugs done and ready for assembly). $2695 includes crating.
Contact: Danny Schultz
P.O. Box 823
Arcadia, FL 33821
(813)494-3118

From CP36-7 (CH30)
Lycoming O-235-C1 zero hours since major, ready for Long-EZ, includes fuel pump, Slick mags and Brock mount.
Contact: Gordon Jones
4257 Findley Way
Livermore, CA
(415)447-1549

From CP36-7 (CH30)
VariEze original main gear strut, plus numerous assorted EZ parts. Also a factory new, in the crate Lycoming O-235-C2C.
Contact: Bruce Tifft
8746 Ventura Ave.
Ventura, CA 93001
(805)649-2721

From CP37-5 (CH30)
Brand new - direct form the factory 0-235-L2C - $8,695.00
Contact: Norm Bender
(910)794-0032

From CP37-5 (CH30)
Lycoming Engines - call for pricing information
Contact: Aircraft Spruce and Specialty
(714)870-7551

From CP37-5 (CH30)
0-235-L2C Lycoming, 200 hours since major, all accessories. Crankshaft bent (flange) .008, will need to be tore down and straightened. $3,500.00

From CP37-5 (CH30)
0-235-L2C - 1180 total time since new. All accessories, $3,500.00

From CP37-5 (CH30)
0-235-C1 Lycoming - needs to be rebuilt. $2,000.00
Contact: Al Head, (213)426-8309 for all three of the above.

From CP38-8 (CH30)
Lycoming 0-235 CIB. 187 hours since major. Bendix mags. Log books $3,500.00
Contact: Max Lopez
811 North High Street
East Haven, CT 06512
(203)469-0726

From CP38-8 (CH30)
Lycoming 0-290-G Converted to -D, 30 hours since major. MA3-SPA carb, mechanical fuel pump, Slick mags, shielded harness and prop flange reinforcement. $2,800.00
Contact: Jack Huffamn
15737 E avd Y-4
Llano, CA 93544
(805)944-4790

From CP38-8 (CH30)
Lycoming O-235-L2C, brand new, $8300.00
Contact: Pat Saffron
(216)254-4683

From CP39-7 (CH30)
Brand new Lycoming O-235-L2C, removed from C-152s. Low time - $4200, high time - $3200
Contact: Heimo Trathnigg
P.O. Box 2122
Farmington, NM 87499

From CP39-7 (CH30)
Lycoming O-235-L2C, 1310 hours total time, removed from a Tomahawk. With all accessories, flange ok. $3200.
Contact: Trev Zander
(314)296-4157

From CP39-7 (CH30)
Lycoming O-235-L2C, 1945 hours total time.
Contact: John Cova
(503)862-2492

From CP39-7 (CH30)
Lycoming O-235-L2C, 1400 hours total time, Removed from Grumman TR2. Includes carb and Slick mags.
Contact: Bruce Evans
(805)824-2645

From CP40-9 (CH30)
Lycoming O-235-C2C, 2000 hours total time, zero since major. Complete with logs, carb, mags, starter, alternator, fuel pump and vacuum pump.
Contact: Doug Shane
(805)824-4680 Evenings.

From CP40-9 (CH30)
Lycoming O-255-L2C, 798 hours total time, complete with logs. Best offer. After 6:00 pm, no collect calls.
Contact: Paul Sticker
703 E Sunrise
Roswell, NM 88201
(505)623-5769

From CP40-9 (CH30)
24 volt starter and alternator for O-235-L2C. 200 hours total time on each. Both for $250.00 or $150.00 each.
Contact: Tim Crawford
(205)767-3493

From CP40-9 (CH30)
Accessory case for Lycoming O-235-L2C, machined to accept a mechanical fuel pump.
Contact: Pete Simmons,
(203)535-2040

From CP40-9 (CH21,CH30)
Continental O-200, zero time, disassembled, includes mags, VariEze Sanders exhaust system, oil separator system, engine mount, etc.
Contact: Wes Gardner,
1310 Garden Street
Redlands, CA 92373
(714)792-1565
Wes also sells **oil separators** for Continental O-200 as well as Lycoming O-235, **lifetime foam air filters**, fuel sight gauges and fuel caps.

From CP41-6 (CH30)
Lycoming 0-235-C1 zero since major. Set up for Long-EZ with new Brock mount and 6" prop extension. $4,000.00 or equivalent Canadian.
Contact: Phil Carter
P.O. Box 1356
Canmore, Alberta
Canada TOL OMO

From CP41-7 (CH30)
Lycoming 0-235, 78 hours since factory remanufacture. Complete with accessories.
Contact: Sam Quinn
Box 837
Estacada, OR 90723
(503)630-2518

From CP41-7 (CH30)
Accessory case for Lycoming 0-235 machined for fuel pump. $175.00.
Contact: Dave Petrosino
(503)296-9404

From CP42-8 (CH30)
Lycoming O-235-C. 800 hours since major includes all accessories. $2500.00
Contact: Don Jackson
213-373-5717

From CP42-8 (CH30)
Lycoming O-235-C, 166 since major. New chrome choke bore cylinders, new 100 octane valve guides. Cylinders are currently not installed on the engine. $1500.00
Contact: Brian
818-705-4314

From CP42-8 (CH30)
Lycoming O-235-L2C, 500 hours total time, all logs and accessories. $4250.00
Contact: Jim Rodrian
Grafton, WI 414-375-1755

From CP42-8 (CH22,CH30)
Attention Defiant Builders!!
Lycoming O-320 H2AD, 875 hours since major, all logs and accessories $2900.00.

Lycoming O-320-A3B, 3221 hours total time, 1108 since major - all logs and accessories. $2500.00

1 set 600 x 6 Cleveland wheels and brakes #199-46. $430.00

30 Grimes post lights $10.00 each
3 lighted compasses C-2300 DL4 $40.00
1 Oil screen assembly for Lycoming O-235 - $20.00
Contact: Steve Franseen
1245 South Tennyson,
Denver, CO 80219
-922-6081
-399-8793

From CP43-3 (CH30)
Lycoming O-235-L2C, runout 2400 hours since new. No damage. Complete except for carburetor, with logs. $3000.00.
Contact: 714-241-1809

From CP43-3 (CH30)
Lycoming O-235-C1, 115 hp with all accessories including primer lines. 40 hours since major. Super clean, removed for more power. $4000.00
Contact: Bob Orhletz
714-681-4488

From CP43-3 (CH30)
Lycoming O-235-C2C, zero since major by A & P. 1900 total time. All accessories, mags, starter, alternator, carburetor, fuel pump and vacuum pump. Includes logs. $4850.00/or best offer.
Contact: Doug
805-824-4541 (work)
805-824-4860 (home)

From CP44-4 (CH30)
FOR SALE
Lycoming 0-235-L2C, 1240 hours total, disassembled - $2650.00 as is. Includes logs, rebuilt mags, carb and rebuild kit.
Contact: Joe Heapy
(213)947-3889 - work
(213)895-7943 - home

From CP46-8 (CH30)
Lycoming O-235-C, 760 hours total time complete with accessories. $2300.00
Contact: Herb Peterson
327 Carol Road
New Lenox, IL 60451
815-485-8036

From CP46-8 (CH30)
Lycoming O-235-L2C as removed from a Cessna 152 (no damage). 1880 total time since new. Includes additional case for mechanical fuel pump. $2400.00.
Contact: Dan Mason
213-390-3444 - office
213-202-1882 - home

From CP47-13 (CH30)
Lycoming O-235-L2C 118hp. 190 hours since new. Complete with all accessories including a 6" prop extension, B&T prop, and spinner. For Long-EZ. $5000.00. (Engine only - $4700.00)
Contact: George Kelley
213-596-3051

From CP47-13 (CH30)
Lycoming O-235-C1. 80 hours since major overhaul. Includes starter, generator, and carburetor. Make offer.
Contact: Guy Selman
113 Earl Hall Ave.
San Ysidro, CA 92073
619-428-4211

From CP47-13 (CH30)
Rolls Royce O-200, 100 hp engines (Continental O-200 built in England by Rolls Royce). Two complete engines presently disassembled, will sell as is or will assemble.
Contact: Paul Martin
Ottawa Muni Airport,
Ottawa, KS 66067
913-242-5310

From CP48-4 (CH30)
TWO (2) Lycoming O-235-C2C engines with logs. Both "runout". These engines were running when they were removed from the Voyager. Yes, these are the two engines RAF installed on the Voyager for its initial flight testing. $2500.00 each. FOB Bldg 13, Airport, Mojave, CA 93501. Contact Mike or Joan 805-824-2645.

From CP49-4 (CH30)
Lycoming O-235-C2C, 115 HP. 1535 hrs. total since new. Includes all accessories plus new mags. $3500.00 or will include Long-EZ engine mount, B&T prop, spinner & prop extension for $3800.00. Call: Mac, 213-834-8850.

From CP50-4 (CH30)
Long-EZ firewall aft. Includes Lycoming 0235-L2C, 245 hrs. SFREM, mount, 4" extension, exhaust, Great American Prop, oil cooler, 35 amp alternator, baffling and all engine instruments. Donating our Long-EZ to a museum and building a Defiant.
Call: Ron Van Bladeren with best offer
(503)642-3307

From CP51-9 (CH30)
Lycoming 0-235-L2C - Remanufactured for Long-EZ, includes mount, exhaust, Great American prop and prop extension. TASK fuel/baggage strakes - $8,000.00 firm. (805)925-2870 - ask for Don.

From CP51-9 (CH30)
Lycoming 0-235-L2C - 450 hours total time since factory new. Includes 3" prop extension, new Great American prop and spinner. This engine was on my Long-EZ and has been well cared for. The whole package for $5,700.00.
Call: Dr. George Best
(602)991-0476

From CP56-5 (CH30)
Lycoming O-235-L2C, 2450TT, 95 since extensive top overhaul by Lycoming dealer, Hagelin of Long Beach. Includes all accessories, prop extension, prop and spinner. This engine won the stock Long-EZ race at Jackpot 1988. $5500.00. Contact:
Bob Brown
818-961-9871 (w)
714-525-8032 (h)

From CP58-12 (CH30)
FOR SALE
Lycoming 0-235-L2C. 600 SMOH in my Long-EZ, 125 hp, "F" pistons, exhaust system, prop extension, prop, spinner, oil cooler, baffling, vacuum pump, B&C 35 amp alternator. $5900.00 Contact:
Gus Sabo
2842 Brockington Dr.
Las Vegas, NV 89120
720-454-0078

From CP58-12 (CH30)
FOR SALE
Lycoming 0-235 Zero SMOH. Set up for Long-EZ $4600.00. Many other Long-EZ parts. Contact:
Edwin F. Goad
CCNP PO Box 786
Pinehurst, NC 28374
919-692-3813

From CP59-10 (CH30)
Continental 0-235, 2340 TT, 160 SMOH, B & C 10 AMP alternator - $3600.00

From CP62-6 (CH30)
FOR SALE

Lycoming 0-235-L2C, 350 hrs. SMOH. Presently running in my Long-EZ - $6500.00
Contact: Peter Simmons
219 Pendelton Hill Rd
North Stonington, CT 06359
203-535-2040

Lycoming 0-235-L2C, 703 hrs. TTSN, with logs. Zero hub runout, chrome cylinders with new steel rings. New Slick mags and harness. 30 amp alternator with regulator, starter, carb with intake system. Baffles, oil cooler, boost pump, vacuum pump with regulator. 4" prop extension with crushplate and prop bolts, polished spinner for Great American prop. All out of a Long-EZ - $5200.00. Write for a list of miscellaneous instruments and new Terra radios, Apollo 612B Loran, etc. Contact:
Richard Dean
777 Bocage Lane
Mandeville, LA 70448
504-845-3648

Lycoming 0-235-L2A, 1188 TTSN, with mags, carb, alternator, fuel pump, starter, oil cooler, etc. $2750.00 or best offer.

Continental 0-200, 100 HP, 248 hrs SMOH, with mags, alternator and carb. $3200.00

Also miscellaneous parts and accessories for EZ's.
Call for list: Don Bates
2742 Swansboro Rd.
Placerville, CA 95667
916-622-1886 (H)
408-365-5541 (W)

Attention European CP Subscribers

Lycoming 0-235-C2C, 1482 TTSN, - $3000.00.

Lycoming 0-235-L2C, 362 TTSN, Zero STOH, preserved, no corrosion. $7000.00

Also some 0-235 engine accessories, King KX-175/KI 208 and KT 78.

All above are located in West Germany. Contact:

Norm Howell
Mulchenstrasse 1
5506 Zemmer
Bundes Republik
Deutschland

Lycoming 0-235-L2C with 24 volt starter and alternator, mags but no carb. Run out, $2750.00.

Contact: Dan Kreigh
Hangar 78 - Airport
Mojave, CA 93501
805-824-4541

****From CP62-7 (CH30)****

TRADE

Run out 0-320-H2AD Lycoming for 0-235-L2C (can be run out).

Contact: Jacque Elliott
512-425-8913

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Table of Contents for Supplemental Chapter 31, Optional Special Performance Canard Plans

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Update Number 66 to Supplemental Chapter 31, Optional Special Performance Canard Plans

****From CP66-3 (CH3,CH11,CH31,CH38)****
ALERT! POSSIBLE CORROSION IN ELEVATOR TORQUE TUBES IN EZS.
We have one report from a VariEze builder/flyer who lives and hangars his EZ in Ohio. He noticed small bumps rising up on the top of each elevator along the aluminum torque tube. He could depress these bumps a little with his finger. He has removed each elevator and cut the glass and foam away along the top of each elevator, exposing the aluminum torque tubes. He reports that he has found "severe corrosion pits where each bump was located." We have not seen this corrosion yet - he is sending us a sample of the affected tube. We will report further in the next CP. He says that this corrosion occurs only under the foam and glass. These is no corrosion at all on the exposed ends of the elevator torque tubes.

Pitch control is absolutely critical to safe flight. For this reason, any report such as this must be taken seriously. All EZ, Defiant and Solitaire flyers should inspect the leading edges, the tops and the bottoms of both elevators for bumps such as we have described here, before next flight. If any evidence of bumps or corrosion is found, ground the airplane and remove foam and glass locally. Inspect the aluminium tubing under a bright light. Please report any problems found to RAF as soon as possible.

Any builders who have not yet built the elevators should treat the aluminum tubing with Alodine before starting on the foam and glass elevators. Do not omit this step! Remember, the corrosion, if it exists, is not visible on the exposed part of the tubing. It is under the foam and glass and cannot be seen without removing the foam and glass. Do not remove foam and glass without evidence of bumps or swellings that may or may not be soft. Do let RAF know of any evidence of corrosion.

The above report came out of Ohio where it is hot and humid in summer and cold and damp in winter. Anyone who lives where there is much humidity and/or near the coast should be especially concerned and should check the area called out before each flight.

We have checked all of the EZs at Mojave with no sign of any problems but that probably was to be expected, this being a desert with only a few inches of rainfall in a good year.

****From CP66-11 (CH10,CH31)****
VORTEX GENERATORS ON CANARDS.
Since Magna Liset of Oakey, Australia reported on his epoch trip across Australia, we have had numerous requests for information on his modification (vortex generators).

Magna has been good enough to send us a sketch of what he did. Essentially, he glued tiny vortex generators (aluminum angles) to the top skin, forward of the elevators, approximately 40 of them on each side, at specific angles and positions This reportedly completely eliminated the annoying pitch trim changes he used to experience every time he flew into, or out of, rain or visible moisture. This was also done on the Voyager prior to world flight for the same reason.

The Roncz 1145MS canard will also achieve the same result but for anyone who might be interested in Magna's information, we can send a copy if you send a SASE with your request to RAF.

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Update Number 67 to Supplemental Chapter 31, Optional Special Performance Canard Plans

****From CP67-4&5 (CH10,CH13,CH18,CH21,CH22,CH25,CH30,CH31)****
<u>*LETTER FROM VARIEZE FLYER*</u>
"Dear RAF;

I recently installed a set of Liset vortex generators on the canard of my VE N02GR and have experienced good luck with the modification. During normal no-rain days the a/c flys as before with no noticeable change in any flight situation. The big step is with the rain...works great! I did get a very obvious pitch change during wet conditions and now have none. Guess this speaks for itself. For all the VariEze drivers, I think it is a good mod. Hats off to Liset.

Regarding the aging VE, I am the builder of my first VariEze which I later sold. My second EZ was Ken Forrest's which I flew for 300 hours (after Ken had put over 650 hours on it.) I presently own the VariEze that Robbie Grove built. It has over 700 hours now. I have installed my own engine and panel, vortex generators, etc. It was painted with Ditzler Durethane. The paint has held up very well with some chipping on the leading edge (due mostly to rain) and some cracking at points of 90 degree angles such as the NACA scoop to fuselage points. She is always hangared, but after 10 years of flying still looks great. I like this paint as it sprays like lacquer and touches up easily. I fly an 0-200 with Lord mounts and must change mounting rubber every couple of years as the sag drops the whole engine alignment up to 2 degrees putting the exhaust pipes into the lower cowl, etc. I installed a small NACA scoop just to the right of center in the canopy frame next to where the normally plan-fitted scoop would be. This keeps the rain out of my eyes and the bugs off of my teeth, plus blows all air over my right shoulder to the backseater. With a ball vent valve, it makes a great source of air and is right where you can get your hands on it.

My prop is a Ted's built originally for Ken Forrest. This prop has over 1400 hours on it. I had Ted install the urethane leading edge on it a couple of years ago and now experience only a little paint loss during rain.

I find that I must check my tire pressure very often to insure the proper inflation is held. I removed the small aluminum plate off my nose wheel years ago and use my nose wheel/gear strut as a speed brake putting it down at 140 knots, thus keeping the engine rpm a bit higher during fast let downs. I continue to be amazed how difficult the VE is for others to see even when they know exactly where to look. Just always figure they do not see you...fly defensively.

I have a Long-EZ type landing light which I use for landing and taxi. It is a 100 watt lamp and has worked fine during my many hours of night flying. I find that the ability to angle the light between the full up and full down position allows me to pick up the runway better.

I have had one of my fuel caps come off twice and both times when I depended on someone else to secure them...while I watched. Just a lesson for us all. <u>Don't trust anyone else with your safety</u>. Fortunately, I have always had all caps safety wired with stainless chain (normally used for holding big game fishing hooks...very strong and available at any salt water tackle shop) and have never lost one through the prop.

Two years ago, I did a top overhaul on my 0-200 and had the new Cermichrome cylinders installed. It costs a bit more but has greatly reduced my oil usage. Recent pressure tests show 78 over 80 on all cylinders after 230 hours of use. I use platinum plugs which has reduced plug fouling to a forgotten subject...starts so easy too.

I have been flying for over 32 years in everything from Piper Cubs to F48 Phantoms and this little VariEze has to be the finest plane of the bunch when everything is taken into consideration. Thanks, Burt, for such a fine design.

Keep lots of runway in front of you and altitude below ya. Just fly EZ.

God bless,"
Ralph Gaither

****From CP67-5&6 (CH11,CH16,CH19,CH20,CH31,CH32)****
<u>*CONTROLS - RIGGING*</u>
Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should <u>not</u> be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most

comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons {aileron stall}).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees <u>more</u> in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you <u>must</u> be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and <u>no more</u>. (More travel gives <u>less</u> lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept <u>any</u> friction in the pitch control system. If you have friction, <u>do not fly</u> until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on every pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

****From CP67-11 (CH9,CH10,CH31)****

<u>AN INTERESTING OBSERVATION</u>

"After flying my VariEze for over 400 hours with the small tires and no wheel pants, I changed to the Lamb tires, still with no wheel pants. Guess what? With small tires, it pitched slightly nose up in rain but with the larger Lamb tires, it now has a slight nose down pitch trim change in rain!
Gordon Hindle"

Update Number 69 to Supplemental Chapter 31, Optional Special Performance Canard Plans

****From CP69-2 (CH10,CH31)****
<u>*CAUTION*</u>
We were shocked to see an example of a prefabricated canard for a Cozy/Long-EZ at Oshkosh. The workmanship on this canard was the worst we have ever seen. This canard was not built in accordance with the plans, it was grossly overweight and,as poorly as it was built, had it been flown on an airplane, it might have caused a life-threatening accident. If you have purchased a prefabricated canard from Fitzgerald Composites, Inc. of Bristol, WI, we would strongly recommend that you not fly it. At the very least, weigh it. If it weighs more than 19 lbs. (canard only), cut 3" off one end, outboard of the outboard elevator hinge, and carefully examine the structure. If it is not built precisely per the plans, discard it and build one yourself. If a canard fails in flight, there is no possibility of survival.

****From CP69-3 (CH2,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****
LONG-EZ PARTS PRICE LIST FROM FEATHER LITE

Main gear strut	$ 349.00
Nose gear strut	58.00
Engine cowls, pr. (glass)	329.00
Engine cowls, pr. (Kevlar)	480.00
Cowl inlet	48.00
Wheel pants (3.5x5)	150.00
Wheel pants (500x5)	180.00
Above item in Kevlar	215.00
NG 30 cover	21.00
Pre-cut canard cores	**160.00**
Pre-cut wing & winglets	1199.00
Leading edge fuel strakes with bulkheads	524.00
Strut cover SC	19.50
Nose wheel cover NB	19.50
Sump blister	19.50
NACA inlet	47.00
3" extended nose gear	70.00

Contact Michael Dilley or Larry Lombard (both ex-RAF employees and EZ builders and flyers) at:

Feather Lite, Inc.
PO Box 781
Boonville, CA 95415
707-895-2718

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Update Number 71 to Supplemental Chapter 31, Optional Special Performance Canard Plans

****From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)****

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

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Update Number 80 to Supplemental Chapter 31, Optional Special Performance Canard Plans

Information derived from CP80 published by RAF Jan 1995

****From CP80-7 (CH10,CH19,CH31)****
MOLDED VORTEX GENERATORS
CCI is pleased to announce the availability of pre-molded generators. Specially engineered for aircraft application, the 1" long by 0.40 high device is injection molded from U/V resistant polycarbonate material.

The design has been engineered so the "sail" is stiff enough to impart the desired energy into the boundary layer but flexible enough to resist breakage from "hangar rash" and the curious. Because they are molded from light weight polycarbonates rather than cut from extruded aluminum, these pieces are less likely to cause injury, chip paint or cause propeller ingestion damage on pusher aircraft. Available in white, they can also be custom molded in quantity to match specific paint colors for aircraft manufacturers and OEM suppliers. Coloring does not compromise their ability to withstand harmful ultra-violet radiation.

The gluing surface of each generator is flexible and slightly concave to facilitate adhesion to either cambered or flat surfaces. The perimeter of each base is feathered to blend seamlessly onto the surface to which it is attached. After installation, the sail appears to be molded an integral part, rather than and "add-on". The final result not only looks better, it performs better than typical hand-made aluminum fences. Molded vortex generators adhere better, do not corrode, require no painting and are easy to install: one Long-EZ canard can be equipped with a full span of generators in less than 90 minutes.

Effective may 15, 1994, a kit containing fifty generators is available for a price of $25.00 plus $2.00 shipping and handling per kit. **Two kits are sufficient to equip the full span of a typical canard (i.e. Long-EZ, Dragon-Fly, et al) or both ailerons on either canard or conventional planforms.** Documentation is included. Please send check or money order to:

CCI
PO Box 607
Plainfield, NJ 07061-2318

Please allow 2-3 weeks for delivery, Sorry, no COD's. For more information 6:00-10:00pm EST, Mon.-Fri.

908-757-9573
908-755-9639 FAX

Note: These vortex generators are not TSO'd for use on type-certificated aircraft.

****From CP80-8 (CH10,CH16,CH19,CH31)****
TITANIUM ACCESSORIES AVAILABLE!
Custom anodized in 15 different colors,
Rudder and aileron gust locks - $20.00-30.00.
GU canard full span vortex generators with layout template - $170,00. These are hot looking !
Contact: Mike Rhodes
PO Box 1052
Grover Beach, CA 93483-1052
805-489-8155

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Update Number 82 to Supplemental Chapter 31, Optional Special Performance Canard Plans

Information derived from CP82 published by RAF Oct 1995

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****

Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llx17)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00
Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00
Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	**42.50**
Flush belhorns	10.00
Moldless Composites manual	14.50

Postage & handling included in price.

Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

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Supplemental Chapter 31, Optional Special Performance Canard Plans

Long-EZ Plans Changes

****From CP27-7 (CH2,CH10,CH13,CH31)****
LPC #53 MEO Page 2-1
Add CLI and NG5 to Brock list.

****From CP33-4 (CH11,CH16,CH31,CH33)****
VariEze and Long-EZ MEO
Owners Manual appendix three add "CAUTION friction in the pitch system can seriously degrade flying qualities". Also add ditching procedure shown on next page.

****From CP46-6 (CH31)****
LPC #122 MEO New canard plans, page B top right, third paragraph down. AN2-21A bolt should be AN4-21A. Also the 2 1/2" long spacer should be 1 3/4" long.

****From CP46-6 (CH31)****
LPC #123 MEO New canard plans, page C1 right corner of the page - the dimension 64" should be 65" and the dimension 10" should be 11". The elevator lengths shown are correct and should NOT be cut down.

****From CP46-6 (CH31)****
LPC #124 MEO New canard plans, page C4 shows 7 x 14 x 64 foam block. Clarification: FB-1 should be 7" x 10" x 54", FB-2 should be 7" x 9 1/2" x 14" and FB-3 should be 4" x 7" x 54" - NOTE: Inboard cores (with spar troughs 54" long) are cut out of FB-1. Outboard cores (no troughs) 11" long are cut from FB-2. Elevators are cut out of FB-3.

****From CP46-6 (CH31)****
LPC #125 MEO New canard plans, page C4 calls out the length of the 3/16" stainless hinge pins, NC-8R as 36". This is correct. On page C, bottom right it is called out as 34", this is not correct but will work ok if you have already cut the material.

****From CP48-6 (CH31)****
LPC #129 Long-EZ Roncz 1145MS Canard Plans. The NC-2 elevator hinge inserts must be installed correctly as shown in the full size cross section drawing, page C1. The hinge pin hole should be aft as shown. **SKETCH OMITTED**

****From CP57-8 (CH11,CH31,CH38)****
MAN GRD: Conduct an inspection or provide a certification that the elevator quality regarding correctness of laminate schedule, orientation of plies, numbers of plies and workmanship relative to the weight of the layup and straightness of the primary surface is correct. This should include inspection or verification that additional filler materials have not been added to increase the elevators weight and thus change is natural frequency of oscillation. If you have purchased structure from someone else and cannot otherwise verify the structural quality and conformance, conduct a dissection of the elevator skins to assure the proper structure, or better yet, discard the elevator and build new ones that you know are in conformance with the tested and approved configuration. Any variance in weight, stiffness, or shape should be suspected of being dangerous and not allowing you to rely on the testing that was conducted to verify freedom of flutter. The weight limits shown are absolute maximums. A properly fabricated, accurate core with a properly squeeged minimum-resin laminate will result in weights well below the limits shown in CP 21 pg 5. In order to provide more margin for variables in this extremely important area, we are now recommending that any elevators that require additional mass balancing beyond those weights shown for the basic configuration be discarded and new elevators fabricated. If you are unable to build elevators that can be balanced by the basic balance weights, both inboard and outboard, you are possibly unable to produce adequately safe flying components. Do not compromise by using up to your margin of safety by merely increasing balance weight. This increases the weight of the elevator and lowers the frequency of its oscillation. Above all, be certain that your elevators meet the balance hanging angle of 12 to 20 degrees after painting. If there's any doubt that they are absolutely perfect, discard them and start over. It is possible, with proper tube orientation, to retain the aluminum tubing when building new elevators.

****From CP57-9&10 (CH11,CH12,CH31,CH38,CH39)****
A CENTRAL CALIFORNIA VARIEZE experienced in-flight severe flutter of the elevator and canard which caused a structural failure of the canard, and the pilot was killed when his VariEze crashed on a wooded hillside. He had about eight hours in his VariEze before the crash.

He had not built the airplane but had purchased it with all of the structure done. He then completed the finishing and systems installation. The elevators were carefully checked for correct balance and some weight was added inboard on each elevator to bring the elevators into the proper balance tolerance.

Prior to the fatal flight, the pilot had removed the canard to check something in the nose. Previously, a friend had helped him to install the canard and noted that he had had great difficulty in getting the canard attach bolts to line up and thread into the nutplates.

A very careful post crash investigation by the FAA, as well as by RAF, determined that the probable cause of the catastrophic flutter was that one of the canard attach bolts was not correctly installed. Either it was not torqued up at all, or it was cross threaded. In any case, it did not clamp the aluminum lift tab to the F-22 bulkhead. This resulted in the natural frequency of the canard being lowered considerably since it was only firmly attached on one side. A gust, or something, excited the elevators driving the canard into a divergent destructive flutter mode.

Although the elevators were balanced, they were very heavy, having been modified from the original short chord design to the long chord by the addition of a large heavy piece of balsa wood and several plies of BID. This caused the elevators to have a lower natural frequency of oscillation. Thus, these overweight elevators may have contributed to this accident, however, the primary cause was the failure of the pilot to properly install the canard.

This tragic accident brings it home to all of us, just how careful we must be as we work on our aircraft. When you are doing a critical job such as installing a wing or a canard or a control surface, you, and only you, are responsible to ensure that all fasteners are correctly installed and properly torqued. Too often we get sidetracked while working on a critical installation when we get interrupted by a friend or passerby. Should this happen to you, do not stop until you have the critical part installed and safetied - even if you have to be rude to your visitor.

Accidents such as this have been caused by an interruption or disruption of your thoughts while working on an important aspect of the aircraft. A simple example is changing the oil. The oil is drained, the drain plug replaced, then a visitor shows up with a bunch of questions - you forget to fill the sump with fresh oil and - presto - a destroyed engine when you start it. It happens so easily, it seems so unlikely, but it happens. Be conscientious, use checklists, be very particular and careful if you have removed a canard or wing or canopy, etc. Be absolutely certain you have adequately completed any task you do on your airplane. Last of all, be very conscientious about doing a thorough preflight on your creation before you commit you, and perhaps a member of your family's or a friend's, life to your workmanship.

As you know from past Canard Pusher newsletters, the subject of flutter has been a major concern for years. CP numbers 17, 18, 19 and 21 have reported discussions and/or warnings relative to the importance of conformality in the fabrication of the canard and elevator system. *It is extremely important to be aware that elevators improperly fabricated, too heavy or with the incorrect bending or torsional stiffness characteristics which result from improper materials, or fiber orientation, cannot be balanced with any method.*

A mass balance called out for the elevator and the specification for balancing them, applies only to an elevator fabricated with the same weight and stiffness as that which has successfully passed all the flutter testing. It is extremely important, and life-critical, that the manufacturer or owner of each VariEze, Long-EZ or any plane for that matter, assure, without a doubt, that the control surfaces are conformal to those which have passed flight tests and been shown to be flutter free.

The advisory shown in the plans change section must be followed to assure that there are no non-conformal elevators that could contribute to, or result in, an accident. Do not take this situation lightly. As we have indicated before in the CP, - IT COULD KILL YOU.!

Prefabricated Parts

****From CP44-4 (CH31)****

Ken Brock Manufacturing reports that they are now on line with Defiant prefab metal parts. Ken also has the "S" glass roving wetting wheels (see Page D-58) available. These are well made and run dead true and include the knife edge wipes. **Ken is currently working on the prefab metal parts required for the new R1145MS canard.** He will have these available around June 1, 1985.

****From CP46-8&9 (CH2,CH4,CH9,CH10,CH13,CH19,CH20,CH21,CH30,CH31)****

PRE-FABRICATED COMPOSITE PARTS

Lombard's, a facility based at Boonville, California airport, (a 3000 foot paved community strip just one valley west of Ukiah) was built during the summer of '84 and spring of '85. When the Rutan contract became available (spring of '85) the facility was not quite completed but parts needed to be manufactured. A few customers were inconvenienced from that shift as work on the building became a second priority and spooling up the business took precedence. Just as work got into full swing, Rutan Aircraft made the announcement of their intentions to discontinue plans sales. This created panic among some builders who sent in orders. About the same time, Oshkosh also created interest and orders.

To the good fortune of Lombard's, Michael Dilley joined up from RAF about the time Lombard was going bald (from pulling hair) and assisted in forming "Lombard's".

A bit about Michael: In the early '80s he became intimately involved in the construction of the Rutan designed Amsoil racer. After its comple on he signed on at RAF working during the finishing mode of the Grizzly. By the time the Grizzly was flying, Burt had catalyzed the Solitaire design. Michael assisted not only with construction of that model, but also in drawing plans and handling the builder support program. He is building a Long-EZ in his spare time!

Larry Lombard, also of Lombard's got his first composite experience by building VariEze N15LL with his wife Janet in Sacramento ('78). Larry also worked on primary flight structures of the Amsoil Racer and hired on at RAF about mid-way of the racer completion. His first year at RAF was working on Grizzly, then onto construction and through first flights of Solitaire. After another two years working with Quickie Aircraft at Mojave, he shortened his Sacramento commute by over two hours after moving to Boonville. N15LL has logged well over 1300 hours and really likes the low wind and density altitude of the California north coast.

PARTS

Lombard's is manufacturing all parts to Rutan's specifications of materials and workmanship. We are continually up-grading the quality of parts when possible. For instance, Kevlar cowls are now being made with more Kevlar and less glass using epoxy and not polyester. Landing gear are also manufactured with the same time-proven materials and techniques that RAF intended. We have been able to trim some weight from the 500 x 5 wheel pants. In early September, Lombard's purchased molds (see photo) from Ray Latslaf, a Long-EZ builder to provide an improved fit of the nose cover and strut cover.

Ray also developed a new NG30 cover that should reduce cockpit airflow and dirt in the retract mechanism. This cover is $19.95 and is a prefabricated version of the cover built and recommended by Mike Melvill on N26MS. Ray did a fine job of refining these parts for the Long-EZ as I am sure all the builders who install the new parts will attest. We owe him a "thanks".

We have been building new molds for the Defiant main gear which are 4 inches shorter and smoother than the originals, saving the builder the trouble of cutting the gear as well as allowing a more aerodynamic strut. They will go into service this week. (October 14, 1985).

PRICING

From the demand for parts created by the change over of suppliers and our desire not to hold up builders projects, we agreed to supply all parts at 1984 prices and sell the cowls, wheel pants, strut cover, sump blisters, nose wheel box and cowl inlet direct to the builders. After building some parts and pricing the materials we found we could hold the price on most items. Those that have to increase are the VariViggen cowl halves (from $129.95 to $139.00). We are however, able to DROP the price on two items, the Long-EZ main landing gear (from $344.00 to $324.00) and the nose gear (from $61.70 to $55.00). This reduction is possible from a better source of supply of materials.

REBATE

For our customers who have already purchased their Long-EZ main and nose struts from Lombard's, a $20.00 rebate will be applied to a Long-EZ Kevlar cowl set OR leading edge fuel strake kit. We appreciate the business!

NEW PRODUCTS

We are pleased to announce three new products to our line.

1. **Pre cut foam cores, Long-EZ (new canard or GU) at $99.50.** Wings and winglets to follow soon at $779.00.
2. Long-EZ bulkhead kits at $655.00.
3. Long-EZ leading edge fuel strakes and bulkheads at $499.00.
4. NG-30 cover at $19.95.

Our future plans consist of shortening the lead time on orders as well as developing new products. First on our list of product development is the Defiant parts. We are currently working on leading edge strakes and cowls for fixed pitch or Hoffmann constant speed props. These cowls will fit both 0-320 and 0-360 engines. Wheel pants are on the drawing board and we are looking at the possibility of tooling the Defiant from the longerons up. This would be an expensive part but eliminate many of the problems associated with building several pieces (instrument cover, canopy frame, turtleback and both upper cowl halves) allowing a smoother flow of lines. Please drop us a line if you would be interested in this part, we will only develop it if we receive some positive feed back from the builders.

The Solitaire molds are in our shop and we have had some requests for parts. Unfortunately this presents both a challenge and a major problem. In order to build the fuselage halves for a Solitaire, we would have to build a larger oven and set up with pre-pregs and honeycomb cores. To make purchasing these materials feasible we need a run of several ship sets. Anyone with a set of Solitaire plans that is considering building one of these fine ships should contact us at Lombard's so we can organize a run of Solitaire kits, since we are not planning a second run in the near future.

Lombard's is open 8 to 5, Monday through Friday and being stationed on an airport, we invite drop in visitors.

Michael and Larry"

Contact Lombard's at - P.O. Box 781, Boonville, CA 96415
(707)895-2718

Editor's Comment - Larry and Michael are really building a fine Kevlar cowl. Their Long-EZ cowl complete with stiffening ribs weighs just 12.5 lbs. The layup schedule consists of one ply of BID on the outside (to allow for any sanding during finishing), two complete plies of Kevlar BID and a thin glass ply on the inside. The matrix is Safe-T-Poxy, which allows a builder to tailor the cowl to his airplane using a heat gun. To our chagrin, we have discovered that the so called Kevlar cowls manufactured for our builders previously consisted in fact of only one skimpy ply of Kevlar, the rest being fiberglass matt in a matrix of polyester. (Dupont does not approve Kevlar and polyester). We are shocked to find this out, it is too late to do anything about it, but the fact is that the new Lombard's Kevlar cowlings are an enormous improvement over any previously available. Larry and Michael are doing an excellent job up in Boonville and we at RAF encourage you to support them, both are ex RAF employees, both are composite experts, we heartily recommend Lombard's for your prefab needs.

From CP51-8 (CH2,CH4,CH9,CH10,CH13,CH21,CH30,CH31)
FEATHERLITE, INC. - The only RAF recommended manufacturer of prefab glass and Kevlar parts for RAF designs, is pleased to announce that they are setting up to make a run of Solitaire kits. The Solitaire's method of construction is much different than that used in VariEze and Long-EZ parts and uses pre-preg glass and nomex honeycomb. Due to the expense of this material, it is really not efficient to try to run one Solitaire kit through. At least 6 kits are needed at a time - so, if you have ever thought that the Solitaire might be the "one for you", give Michael or Larry a call.

Solitaire Kit Complete	$4360.00
Long-EZ gear strut	324.00
nose gear strut	55.00
glass engine cowling (top/bottom)	283.00
Kevlar engine cowling (top/bottom) weight saved, approx. 6 lbs.	448.00
cowl inlet (not used with NACA inlet)	30.40
wheel pants 3.5 x 5 set (used with Lamb tires)	131.75
wheel pants 500 x 5 set (used with cert.500 x 5 tires)	155.25
NG30 cover (optional)	19.95
bulkhead kit (optional)	655.00
pre-cut foam cores (canard) (optional)	**99.50**
fuel strake leading edges w/bulkheads (optional)	499.00
strut cover - SC	17.85
nose wheel cover - NG	17.85
sump blister - SB (2 required) each	17.85
Defiant main gear strut	756.00
Kevlar engine cowl set - front & rear	1488.00
Glass engine cowl set - front & rear	986.00
glass 600 x 6 wheel pants set (Kevlar on request)	175.00

Larry and Michael are both ex-RAF employees and were heavily involved in the Rutan Ams/Oil Racer, the RAF grizzly, and the RAF Solitaire. Larry built (and still owns and flys) his own VariEze, one of the real early ones and one of the highest time VariEzes. Michael is in the process of building his own Long-EZ. Both are very knowledgeable to the extreme on the EZs and glass work in general. Michael and Larry will be Oshkosh 1987. They will be sharing the RAF booth with us, same as last year.
Contact: Michael or Larry at: FeatherLite, Inc., P.O. Box 781, Boonville, CA 95415, (707)895-2718

Miscellaneous

From CP55-5 (CH12,CH19,CH20,CH31,CH33,CH37)
HIGH ANGLE OF ATTACK DEPARTURE TESTING
Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. **Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable.** Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

From CP59-5&6 (CH11,CH12,CH17,CH19,CH31,CH33)
THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.
This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. **First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.**

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is normal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

****From CP63-13,14&15 (CH10,CH31,CH37)****

ACROSS AUSTRALIA, NONSTOP - TWICE!

The trip from Brisbane to Perth nonstop and return three days later, is a crossing of 1948 nm Great Circle Route across Australia. This was a planned, nonstop trip to see our buddy homebuilders in Western Australia for the weekend function. The trip didn't take long but the drama of preparing paper work to satisfy the bureaucrats was something else. To get a permit for a homebuilt 39% overweight, for a 16 hour flight sounded easy. The reply was, "We have never done this before." Nothing is impossible; the Civil Aviation Authority chaps are great guys but are bound by structured rules that are out of date. With a so-called modern aircraft, Long-EZ or, for that matter, anything different - with no engineering justifications; the EZ Flight Manual so conservatively written - things looked bad for any approval.

The only way to get anything through is to sit back and wait until you US EZ guys do your thing and get approval on History of Performance, but this is where it starts for us down under.

I must thank Rutan Builder Support for all their time and nonprofit effort to justify overweight Long-EZs that have flown in record breaking attempts with success. After this effort, all this evidence had to be set up properly by an aeronautical engineer and his Statement of Approval was necessary. The tank and fuel system had to be designed; the tank, 9G forward load with 7-1/2 psi pressure test, weighed only 9 lbs. Fibreglass/foam panel is amazingly strong. The tank, 49 US gallons, was built in a big hurry. Some glass/foam panel was left over for an oil tank made with 5 minute flox joints.

Nothing was built until approval for safety and airworthiness came through the system. The Engineer had to have all the Special Flight Manual Inserts with CAA signatures all over them, and a one square meter drawing of tank and fuel system. It all looked good in the end for a late getaway. As usual. Jean, my son, Glen, and friend crawling all over the Long-EZ for the final inspection/completion.

In the rush, a last minute decision to try the Vortex Generators - this time without approval, fitted on the canard. On the way to the Brisbane Airport, 75nm, I found a cloud to try them in. Believe me, it really worked. No down pitch. I knew then that I might stand a chance for a successful trip.

Next morning, raining, of course. After the rush of preparing for this flight, the three hours sleep were welcome. There was no point in expecting a VFR departure 2 hours before light so I waited till first light and saw a couple of holes in the sky - really only good for F18-type aircraft. The rain had eased with low clouds, 1/8-1800 ft. Out came the TV cameras. Two national channels had been waiting in rain 2 hours but they weren't disappointed. The aircraft, at 1850 lbs. approved maximum take-off weight, flew normally and climbed 500 ft./min. under this cloud cover. Testing the canard and climbing into this spitting heavy cloud for 15 minutes. was fine, "the bloody thing worked, no trim change."

Departed on radial, clocked on departure by the Tower, and I disappeared into a white, precipitating cloud and never saw the ground for 30 mins.. while climbing a coastal range. The stick pressure did get heavier as it rained, but climbing with this weight, normally my canard would have given up long ago.

Now settled in at 10,000 feet in between stratiform layered clouds, I knew this was about as bad as it would get for this trip. Bearing west for 945 nm, intercepting a couple of NDB stations, went smoothly. The fuel burn was established on the Alcor Fuel Meter and full throttle was acceptable with maximum fuel flow of 22.5 liters/hour (5.9 gal.). The 0-235-L2C maintained 2700 rpm with all engine gauges showing normal and the TAS averaging 150 kts., over and back.

Very soon the tree line disappeared, leaving red sand and only an occasional salt lake for direction. At the 945 nm mark, the NDB was working. The average ground speed was now 145 kts. for the 945 nm. The next 757 nm was strictly dead reckoning, 5 hrs. on the new RMI compass, resulting in a track error of 3^{0} or 40 nm off track, acceptable for a homebuilt, plastic aircraft.

The next, and last, 300 nm flight was over a civilized part of the country with a few trees visible and signs of cattle tracks leading to water holes and, soon after, the fields were ploughed.

The sun was still high in the sky giving a beautiful reflection in the Indian Ocean. This was one of the highlights of the trip - to experience seeing the Pacific Ocean on departure and then, the Indian Ocean on arrival. This puts it together in a nutshell: it's a long way across this 2000 nm wide, barren continent in a light aircraft, nonstop.

The reception was overwhelming with meeting old friends again. The TV didn't miss the landing either. So now the Long-EZ, "Winglettes" stands taller in the misnamed category "Ultralite".

The trip from Perth to Brisbane was much easier to handle and it helps if you go to sleep sometimes. The return flight from Perth started 2 hours before first light and I must say, in Australian terms, "as black as a sheep's gut". When dawn broke, I was 10,000 ft., in stratiform layer clouds with the outline of the coast to the south; a beautiful sunrise mixed with Swan Lake stereo music tickling my excitement made it one of my life's most precious starts for the day.

I flew over the South Australian coastline with 700 miles of the whitest and purest beaches fading from green to the deepest blue ocean you'd find anywhere. I have flown this area with Jean at water level; it's beautiful, pure, clean and undisturbed. This trip was a mixed bag of air with little, if any, tail wind. Density altitude for most of the trip over and back was around 12,500 ft. I used only .5 liters. of oxygen and I'm sure this kept me on the ball.

Long range flying is another dimension of flying, if you can lie back as you do in the Long-EZ, you don't get muscle fatigue from sitting, I was amazed. The fourteen hours soon went in excitement.

Eventually, the coast came up - Brisbane at 10,000 ft. for a Tower clock timing a final decent to Oakey, 75nm west again, landing in the night.

What a private welcome! Jean had the hangar doors open and we had lots to talk about.

FILED RECORD

BN - PTH - 1948 nm (Great Circle) clocked 13 hrs., 41 mins.., (heading west) 145.57 kts. av., 24.12 L/hr (6.35 US gal.) - 380 litres fuel useable - 330 litres used - 50 liters remaining.

FILED RECORD

PTH - BN - 1948 nm (Great Circle clocked 13 hrs.., 55 mins.., (heading east) 140.88 kts. av., 24.43 L/hr. (6.45 US gal.) - 380 liters fuel useable - 340 litres used - 40 liters remaining.

FILED RECORD

Longest distance-2037 nm nonstop for C1B Class, Australia."
Magna Liset

HotWiring

****NOTE: Refer to Elevator Section (later in this chapter) before hotwiring elevator cores!****
****Also see LPC #124 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP46-8&9 in the "Prefabricated Parts" section of this chapter.****
****Also see CP51-8 in the "Prefabricated Parts" section of this chapter.****
****Also see CP47-8 in the "Elevators" section of this chapter.****
****Also see CP48-3 in the "Elevators" section of this chapter.****

****From CP24-4 (CH3,CH10,CH11,CH19,CH20,CH31)****
Hotwire Templates-
An excellent way to make hot wire templates, is to glue the paper template to a clean piece of 1/16" thick aircraft plywood, available from Spruce or Wicks or hobby stores, using RAE or Safe-T-Poxy. Squeegee the paper onto the plywood and allow to cure overnight. Band saw or saber saw as close to the line as you can, finish to the line with a smooth metal file and/or sanding block. Lubricate the edge with pencil lead. This makes a really fine template with zero shrink. Do not use water base glue, it will shrink the paper.

****From CP25-5 (CH3,CH10,CH11,CH19,CH20,CH31)**
HOT WIRING
Important - do not substitute lighter tube than the 1/2" dia. steel tubes for the hot wire saw. The wall should be at least .049. The hot wire must be tight to operate without wire lag. Tighten till the stainless wire starts to yield (tone no longer increases when "strummed", as you tighten).

****From CP25-5 (CH3,CH4,CH10,CH11,CH13,CH19,CH20,CH31)****
BUILDER HINTS
You can avoid cutting the bulkhead patterns from the plans if you over-lay the foam with normal typing carbon-paper then trace the patterns through the plans. **This works great for hotwire templates too.**

****From CP30-7 (CH3,CH10,CH11,CH31)****
Hotwire Templates
When making identical templates, (canard, elevators, etc.) clamp them together, and use your Disston abrader to sand them to exactly the same shape. This is also valid for canard jigs.

****From CP34-8 (CH10,CH31)****
Brent Parsons suggests taking a coat hanger wire, bend it to form a 1" wide 'u' shape about 5" long and install it into a 250 w soldering gun. This can be used to rapidly and cleanly remove the blue foam in the canard for installation of the high density foam blocks. **SKETCH OMITTED**

****From CP36-6 (CH3,CH10,CH11,CH19,CH20,CH31)****
V/E & L/E: Straight edges for hotwire cutting foam blocks to the correct planform. Buy an aluminum 36" yard stick from any hardware store. Drill a #30 hole (or to fit your nails) at each inch in the center of the yard stick. Cut it into two 18" lengths and you have the very best pair of hot wire cutting straight edges.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
HOTWIRE TEMPLATES - VariEze and Long-EZ - We have found that the best material to make hotwire templates is from 1/16" thick phenolic. This is readily available from Aircraft Spruce or Wicks. The next best material is formica, then 1/16" or 1/8" aircraft birch plywood, then possibly 1/32" aluminum.

Glueing the paper template to the phenolic, formica or whatever you use, should be done with Safe-T-Poxy or a quality glue that does not shrink or distort the paper. A better method is to use carbon paper over the phenolic, and trace the airfoil through the carbon onto the phenolic. Using a french curve and a sharp, hard pencil, you can produce a very accurate template, with no distortion and still have the original paper template for reference. Just be sure that the phenolic and the paper template can not slip relative to each other. Masking tape will position them securely.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Glueing hotwire template paper material. Punch a few holes through the paper along and on the waterline. Draw a line with a straight edge on your phenolic, formica or plywood template material. Now it is easy to line up the water lines since you can see through the paper. This also helps prevent warping or distortion of the glue soaked paper.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Trimming and squaring foam blocks can be done quickly and accurately if you take a couple of carpenter squares and drill nail holes every inch or so. Nail the squares to the foam and use the square as the hotwire guide. This works great, especially if your work table is flat.

From CP43-5 (CH3,CH10,CH11,CH19,CH20,CH31)
VariEze, Long-EZ and Defiant - Drill a couple of tiny holes through your hot wire templates right on the W.L. and put a couple of small brads part way through the templates. This allows you to rest your level on the brads, assures that the level and the W.L. are correct to each other, and the short point of the brad sticking through the template helps hold the template temporarily in position on the foam block without slipping until you can nail it in place.

From CP46-7 (CH31)
The New Roncz 1145MS Canard - Hotwire templates A and B are supposed to be identical. A few builders have reported that Template B is slightly larger than Template A. We have checked a bunch of plans here at RAF and have found this to be true in a few cases. We believe this must be due to paper shrinkage or offset printing variation. In our checking we have found Template A to be more consistently correct and we advise you to use A as the master, clamp A and B together and file them both as a pair down to be identical to Template A.

Lift Tabs

Also see LPC #53 in the "Long-EZ Plans Changes" section of this chapter.

From CP27-6 (CH10,CH31)
The canard inserts (page 10-2) should be drilled to match the hole pattern of CLT (page 10-3). These inserts (CLI) are available from Brock. Brock is also stocking the NG5 plate (page 13-3).
Note: The raw materials list does not include the 1/8" aluminum for these parts.

From CP47-8 (CH31)
LONG-EZ R1145MS CANARD UPDATE
IMPORTANT for all builders of the R1145MS canard: If you bought NC-CLT aluminum lift tabs from Ken Brock. These are the "retrofit" lift tabs and should have been used only by builders planning on replacing an existing, already mounted canard. For some unknown reason, a few builders building this canard as new construction have managed to use this lift tab. It is best recognized by the fact that it was blank at the attach point. It did have 3 holes at the top, exactly as the original CLT lift tab did, but it does not have a hole at the lower, rounded end. If you have used the CLT original lift tab which did have a pilot hole drilled in the rounded end, you are OK. If you have used the blank lift tab from Brock, Part #NCCLT, it must be replaced. DO NOT FLY WITH THIS LIFT TAB. This tab was incorrectly manufactured from 2024-0 aluminum which is dead soft. The correct material is 2024-T3 aluminum which is heat treated and much harder, with a much higher bearing load capability.

Ken Brock has mailed out registered letters to all known purchasers of part #NC-CLT warning of the incorrect material and offering to replace them with the correct material. Do not ignore this situation, even if you have installed them and are ready to fly, ground the airplane until they have been removed and replaced.

This is really not such a traumatic job as it appears! We have done it ourselves several times. Using a Dremel saw, carefully cut through the bottom skin in front of each lift tab (don't try to cut through the spar cap!!). Remove a skin patch approximately 2" wide by 1 3/4" forward of and centered about each lift tab. (See sketch). **SKETCH OMITTED**

Now dig out enough foam to be able to see the heads of the three AN-4 bolts that anchor the NC-CLT lift tabs to the shear web. Using a dull chisel or even a screw driver and a small hammer, chip away enough micro so that you can fit a 7/16" box-end wrench on each bolt head. Remove these bolts and give the lift tabs a sharp tap forward and they will pop off. Send them back to Brock in exchange for the "real" ones. Sand the aft face of the new lift tabs with 320 grit and sand the face of the shear web. Smear a thin layer of flox onto the shear web and re-install the three AN-4 bolts. Carve a block of blue foam to fit as closely as possible into each of the holes and micro them into place. (Pour-in-place X-40 can also be used). Sand the foam to match the bottom contour, and carefully sand the bottom skin completely dull a minimum of 3" each side of each hole and about 1" forward of each hole. Layup 3 plies of UND spanwise. Across the repair area, the largest ply goes on first. Since most, if not all of this repair is inside the fuselage very little fairing is necessary. Do not be intimidated by this repair, it is quite easy and can be done in a surprisingly short time.

We have received several more reports from builders who have completed and flown the R1145MS canard and without exception, all have reported no rain trim change. One builder, though, has reported a "flat spot" or area of low response when he pushes the nose down (elevator trailing edge up). He has adequate nose down authority, but has to push forward more than what he feels is normal for good nose down response. We have looked at his canard quite carefully and have not found any obvious difference.

We have noticed a slightly "softer" nose down response when compared directly with the original GU canard, but no "flat spot" or area of almost no response. We would appreciate hearing from all builders who are flying the new canard. Please report your opinion of the flying qualities, control authority, and rotation speed differences, any stall speed difference, and of course behaviour in the rain. Comparisons with your original canard would be useful, too.

When you build your R1145MS canard, areas to be as accurate as possible with that are sometimes ignored, are the shape of the canard "cove" or trailing edge and the elevator leading edge. These two define the "slot" shape, which is quite critical and should be given your best attention. The lower half of the leading edge of the elevator should be a section of a circle, and smooth. There should be no spanwise bumps or ridges. (See sketch). **SKETCH OMITTED**

Spar Caps

From CP26-7 (CH10,CH19,CH31)

Wing Spar Caps - We have found a good way to clamp the spar caps during cure to get minimal waviness and to force them down level with the wing cores. See the accompanying sketch. Select some hot wire cuts of styrofoam (left over from wing core cutting) about 1" to 1 1/2" thick and cut them 4" wide. These should be covered on one side with grey duct tape for a release, and you should cut and fit them end to end to go the length of the spar cap. Get these prepared before doing the cap layup. Now layup the cap normally, squeegee it out properly, then carefully place the foam pieces (with duct tape down) on top of the wet cap. Weight the foam down evenly with lead shot bags, milk jugs full of sand, salt bags or whatever. This will pack the cap layup down evenly and result in less sanding before the skin layup.

From CP27-6 (CH3,CH14,CH19,CH31)

Long-EZ builder hints.

Heavy Unidirectional Fiberglass Tape - The 3" wide roll of unidirectional glass is used only for the spar caps of the wing and centersection spar. "BID tapes" called out are cut from BID cloth (generally 45 degree orientation). Other UND pieces or strips are cut from UND cloth. Be sure fiber orientation is correct.

From CP34-8 (CH10,CH14,CH19,CH31)

Spar caps - wings, canard and centersection - Be sure to peel ply these spar caps, or you will wear yourself out sanding prior to installing the skins.

Trailing Edge Close Outs

From CP32-6 (CH10,CH11,CH19,CH20,CH31)

CAUTION - TRAILING EDGE CLOSE OUTS

It is very important for structural integrity, that you ensure that your trailing edges of the canard, elevators, wings, ailerons, winglets and rudders meet the prescribed minimums in the plans. Do not accept delaminations in the trailing edge glass to glass area. Even the smallest delam can get moisture in it which will freeze and expand when you climb through the freezing level, and thus delaminate further and further with each occurrence until it could weaken the overall integrity. About the quality of your trailing edge glass to glass close outs - accept nothing less that perfection in this area. Always sand smooth every lap after cure - do not leave them joggled as shown. **SKETCHES OMITTED**

LAP DIMENSION Ignoring the proper procedure here could result in serious consequences, even structural failures! Here is a list of these areas. The minimum dimension should be considered an absolute minimum. If you don't meet this criterion it requires repair before you fly.

	Glass Lap Dimension Shown	Minimum Acceptable Lap
Canard	**0.45"**	**0.3"**
Elevators	**0.25"**	**0.2"**
Wings	0.6"	0.5"
Aileron cut outs	1.0" (top) 0.75" (bottom)	0.75" (top) 0.52" (bottom)
Ailerons	0.5"	0.3"
Wing Root Rib	0.6"	0.4"
Winglets	0.6"	0.4"

SKETCHES OMITTED

Elevators

Also see LPC #122 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #123 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #125 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #129 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP46-3 in the "New Canard - History" section of this chapter.

From CP24-4 (CH11,CH31)
NOTE: MAY NOT BE APPLICABLE TO THE NEW CANARD!!
Elevator Positioning
VariEze Section I, page 5-5 (or Long-EZ page 11-5) shows a smooth transition from the trailing edge of the canard onto the top of the elevator. This is not easy to attain, and still get full and easy elevator travel. It is acceptable to have up to 0.1" of "step-down" as shown below. However, be sure the slot shape and elevator shape are precise. **SKETCH OMITTED**

From CP30-7 (CH11,CH31)
NOTE: MAY NOT BE APPLICABLE TO NEW CANARD!!
Long-EZ Elevator Templates
Ref: Section I Page 11-1, step I.
A few builders have reported that they have cut the templates accurately, and still ended up with oversize foam cores after hotwiring the elevators. It appears that perhaps we allowed a little too much allowance for the hot wire burn-down. So when you make your elevator templates, go ahead and clamp them together, and sand down not just to the line, but you should sand virtually all of the line off. Check your templates carefully against the full size drawing on page 11-5. Remember that 2 plies of UND (the skin) will add only .018" to the size of the foam core. Be absolutely certain your foam cores are perfect before you glass the skins.

From CP47-8 (CH11,CH31)
ELEVATOR SHAPE
We have had this in many CPs in the past, but surprisingly, we still find builders out there with the bottoms of their elevators convex or curved. No matter which canard you have, you must have perfectly flat bottoms on your elevators. Lay a machinists 6" scale or other known straight edge chordwise across the elevator bottom. There should be contact from the tangent point of the elevator torque tube to the trailing edge as shown in the correct example below. **SKETCH OMITTED**

If your elevators are not flat or look like the INCORRECT example, you elevator will try to float trailing edge down in flight. As a result you will find yourself pushing forward on the stick at cruise speed, and probably will not have enough trim authority to trim off this force. This is normal at very high speeds, but should not be true at cruise speeds.

From CP47-8&9 (CH31)
R1145MS CANARD
Several builders have reported not being able to get the full 15 degrees of elevator trailing edge up travel. This is very important to assure adequate nose down authority at aft limit CG. The best way to assure that this does not happen to you is to follow the plans as far as jigging the elevators into position with the NC-3 hinges inserted into the slots in the canard. Do not pour in the wet flox yet! Using scraps of wood stirring sticks (tongue depressors) and Hot Stuff glue, temporarily tack each NC-3 to the canard bottom skin as shown. **SKETCH OMITTED**

Use Hot Shot to kick the Hot Stuff off. (If you don't have a bottle of the thick Hot Stuff and Hot Shot, you really are missing a very handy jigging tool). You should now have the NC-3 elevator hinges temporarily bonded into position, with the elevators mounted to them. Carefully break off the elevator jigs "L". This should let you swing the elevators on their pivot pins. Using an angle finder (Sears or Pro-line) check the full available elevator travel. If you find you are unable to get the full 15 degrees of elevator trailing edge up-travel, break the Hot Stuff glue joints, and repeat the procedure, this time shimming the "L" jigs off the canard bottom skin with pieces of tongue depressors. This will move the elevators down relative to the canard, allowing more travel in the trailing edge up direction (nose down command). Once you have a full 15 degrees or even 16 degrees to allow for finish, re-bondo the "L" jigs to the canard and elevators. Break off the Hot Stuff-ed scraps and pour in the wet flox to lock the

NC-3s in place. Do not pour in flox into these slots until you are absolutely confident that you have the full 15 degrees of travel. Removing these NC-3s after the flox cures is virtually impossible.

From CP47-9 (CH31)
WELDMENTS FOR THE R1145MS CANARD
Paul Green from Ken Brock Mfg. would like all builders of the new R1145MS canard to know that when Brock made the first run of NC-12A weldments (pitch control belhorn in elevators), the #12 drilled hole called out in the plans, was inadvertently drilled as a #2 hole (almost 1/4" instead of 3/16"). Brock has available a small steel bushing, part #NC12B which can be pressed into this oversize hole and will then give you the correct size #12 hole.

The NC-13 bushing called out on page C-2 is now available from Ken Brock Mfg. Due to a mixup when Paul Green talked to Mike Melvill, Brock has been shipping CS-13 bushings, which are not quite long enough. Several builders have run into this problem, it causes the pivot point at the NC-12A weldments to be too tight. Contact Brock (Paul) for the correct length part #NC-13.

From CP48-3 (CH31)
Elevator trailing edge up travel (nose down command) on the new Roncz 1145MS canard continues to cause some builders' problems. Jigging the elevators per CP47 which enables the builder to look at the actual travel BEFORE he floxs hinges into the canard has certainly helped to avoid getting things permanently assembled with not enough clearance. However, the cause of the problem has not been clearly determined.

Looking closely at several homebuilt examples. we have noticed in almost all cases, a tendency to build the elevators too thick. This extra thickness is always all on top of the elevators and that seems to be why the elevator nose down travel becomes a problem.

Why are elevators being built too thick? One reason might be that the elevator templates in the plans, particularly the holes running the length of each elevator for the torque tubes, may be letting you hot wire cut an undersized hole. The 1" diameter torque tube, when forced into this, perhaps undersized hole, swells the top shape of the elevator.

When you make your elevator hot wire templates, sand halfway through the line, or possibly even a little more than that. When sanding in the area of the 1" diameter hole, sand the line off entirely. The hot wire temperature can also make a big difference, especially on such a small part as an elevator. Too hot of a wire will cut an undersized elevator with an oversized hole, while too cool of a wire will cut an oversized elevator with an undersized hole!! Complicated, huh? Anyway, after you have cut your elevator cores, stand then on end atop the full size drawing on page C-1 and compare them. If they are oversize, a little careful sanding can bring them into perfect size. If the 1" diameter torque tubes do no want to go into the elevator cores easily, sand them until they do. After these torque tubes are micro-ed in and cured, carefully sand the excess "ears" of foam off and again check them by standing them up on top of the full size elevator drawing. If necessary, sand them until they fit. Elevator shape and size is very important, and a little extra time spent now will pay off handsomely when you go to hinge your elevators to the canard.

Control Surface Balancing

From CP51-4 (CH11,CH19,CH20,CH31,CH32)
CONTROL SURFACE BALANCING
We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so that the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50 percent of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and ,more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons and elevators without any additional lead. At least, this has been our experience.

Canard Installation (Retro-fit)

From CP47-9 (CH31)
Judge King, Long-EZ N350JK has just completed his new R1145MS canard, which he retro-fitted to his Long-EZ. He has an easy way to transfer the existing 1/4" diameter holes in the F-22 bulkhead to the aft face of the new undrilled NC-CLT aluminum lift tabs.

1. Fit your new canard per plans, be sure the water line is level with the top longeron level (correct incidence).
2. Remove the canard and paint a thin film of oil around the hole in the F-22 bulkhead. Spray a coat of any color paint on top of this oil film about 2" diameter around the 1/4" holes.
3. Obtain some foam tape with stick on both sides (1/8" thick 3M double stick foam tape works great). Stick this on the aft face of the NC-CLT lift tab centered roughly over the area where the hole will be.
4. Install the canard and clamp the NC-CLT lift tabs firmly against the F-22. Remove the canard. The paint will now be on the sticky surface of the foam tape and a perfect impression of the 1/4" diameter hole will be clearly visible.
5. Now make a drill guide out of 1 1/2" x 1 1/2" piece of 1/8" aluminum scrap. Drill a 1/4" diameter hole through it. Lay it on the foam tape, exactly centering the guide hole over the paint impression location of the hole. Clamp this drill guide to the NC-CLT using two small 'C' clamps.
6. Drill through the drill guide, through the foam tape and through the NC-CLT, both left and right and presto! You have a perfectly matched canard to F-22 bulkhead.

Vortilons

From CP44-3&4 (CH19,CH31)
VORTILONS
We noticed that almost all of the VariEzes at Sun 'n' Fun had vortilons installed on their wing leading edges, some even installed them over the cuffs! During some of the bull sessions, we talked to the builder/pilots and all agreed that the vortilons are well worth having. Slow speed stability, visibility over the nose for take off and landing were greatly improved. If you have not already installed them on your VariEze, do it, you will like 'em. We believe it is better to remove any existing wing cuffs before you install the vortilons, and the vortilons are definitely superior to the cuffs and are lower drag. We are even starting to notice a few Long-EZs with vortilons. Yes, they will improve visibility over the nose and lateral stability a little (with the standard canard) but we did not feel they were warranted until we flew the new R1145MS canard. **As we mentioned, if you install the new canard on a Long-EZ, the vortilons are mandatory.** They are not an option. The new canard with no vortilons can drive the main wing to such a high angle of attack that the main wing can stall before the canard does.

Vortilons are impressive little devices, but keep in mind that they only work on a swept wing. It would not help to put them on your canard for example. Any straight wing with no sweep will not benefit from vortilons.

Static Loading

From CP29-9 (CH10,CH31)(Photo Caption)
VariEze canard in a specially designed load testing device at the University of Texas, in Arlington. Prof. Jack Fairchild conducted the test to destruction on two canards.

From CP33-9 (CH10,CH31)(Photo Caption)
An informal static load test of a reject canard loaded at the Miami seminar. Sixteen men wrestle for room while Mike measures the buttline of everyone's feet! A non-catastrophic failure occurred near a hinge fitting at about 11.5-g.

From CP40-3 (CH3,CH10,CH19,CH31)
TO STATIC LOAD OR NOT TO STATIC LOAD
RAF has been receiving more and more requests from builders who would like to static load their newly constructed VariEze or Long-EZ. We are concerned that many of these builders may not fully understand what a static load entails and what the consequences of an incorrectly done static load can be.

Anyone who absolutely insists on doing a static load, can obtain a copy of the load schedule from RAF. We strongly recommend that you have a qualified structural engineer present during the load tests. Perfectly good parts can easily be failed by poorly or incorrectly done static load tests. This has occurred to some of the builders from overseas. Unfortunately, for some of the countries, their equivalent to our FAA has a requirement for a static load to be done. We know of two builders who have had their wings (on completed aircraft) destroyed. Do not allow some government official to decide on a load schedule for your airplane. Write to RAF and get a copy of the correct load schedule.

Before you rush off and static load your brand new EZ, consider this. When you purchased your plans from RAF, you paid for the benefit of all the aerodynamic and structural design capability that Burt and RAF has. RAF does an extremely thorough job of structural analysis, as well as conducting any static load test deemed necessary by Burt. Once the airplane is flying and the flying qualities are to Burt's liking, the airplane is put through an extremely thorough flight test program. Prior to the prototype being built, the amount of testing of various materials to be used in the aircraft is unsurpassed.

We believe that if you build your aircraft structurally and aerodynamically in accordance with the plans, and you layup the correct number of plies of the appropriate glass, (no less, and certainly no more), in the correct orientation, and you do a reasonable job of wetting out the glass with the appropriate epoxy, you will have an airplane that is more than adequately strong enough.

****From CP45-3 (CH48,CH10,CH31)****

RAF FLYIN - JUNE 8 1985 - MOJAVE

What a day! The morning dawned bright and clear with little wind (we had all been praying to the Mojave wind gods and they were kind!!) About 7:30 a.m. a bunch of volunteers from the Long-EZ Squadrons I and II showed up and started getting ready for the spot landing contest which they had kindly offered to organize. They barely had their white line painted on the runway, when the first airplane, Bruce and Bonnie Tifft overflew the airfield and announced they were on downwind for the landing. Bruce touched down less than 20 feet beyond the white line and we all began to think that this was too easy! HA!! Not at all, in fact Bruce was the leader for most of the day until finally Bill Oertel of Norco, California landed a scant 8 feet short of the line. The flyin did not really start until 9:00 a.m. but by that time there were 25 EZs tied down on the ramp! After it was all over it turned out that 39 VariEzes and 37 Long-EZs flew in. In addition to this of course there were present on the ramp the 85 percent scale Starship, the Voyager, the Grizzly, the Solitaire and the Defiant. The Gemini, Dave and Kathy Ganzer's unique push pull twin two place was also on the line. The total count of airplanes was 83! This is the largest number of RAF designs ever assembled on one airport at one time, including Oshkosh!!!

A busy schedule, starting with the spot landing contest, then going into a hands on demonstration of composite construction methods, and the finishing of the composites, **followed by lunch and the highlight of the day for most people, when we static loaded three different VariEze/Long-EZ canards.** A raffle was held for a brand new multilaminate Great American prop, a number of door prizes were given away and the party started breaking up around 4 p.m.

We did not get an absolute head count but we believe we had over 400 people. The hands on seminar was a standing room only situation. Even more people were jammed into the hangar for the static load testing. The first canard was one that was built by a homebuilder and was rejected due to an extremely dry layup. This canard was mounted in a frame (upside down) in exactly the same manner as it would have been in the aircraft.

Thus the static load test was a valid test of the aluminum attach points as well as the composite structure. With Burt directing proceedings, 25 lb lead shot bags were carefully loaded onto the bottom surface of the canard in the proper order and spacing to simulate airloads. Burt called out the load factor at each 2 g increment. At 10 g there was a loud crack as the top skin, forward of the spar cap failed in compression. The spar cap was still in good shape, so we continued to load shot bags until we were one bag short of a 14 g load on each side, when with a mighty crack, the canard failed catastrophically. All failures were in compression, there was not one tension failure. The attach points (lift tabs) did not fail. At the time of failure, there were 69 bags, each weighing 25 lb loaded on each side of this canard! The tips were deflected an average of about 11 inches. This was 1725 lbs. on each side, for a total load of 3450 lbs hanging on those little lift tabs!!

A dramatic demonstration that surely made every builder feel good about his or her airplane.

We attempted to fail two more canards, but due to the fact that these had been painted white and were shiny and slick (each was airworthy and had over 800 hours of flying time each), we had difficulty keeping the lead shot bags from slipping off. Both went to 12 g with no sign of failure before the load of lead slipped. Interestingly, one side of one of these canards had been deliberately damaged by Burt using a special damage tolerance testing device. The damage was quite severe, enough to have punched deep dents all over an aluminum wing, but in spite of this, there was no difference in deflection from the damaged side to the good side, even at 12 g!!

We at RAF had a really great day and we hope everyone who attended our flyin enjoyed it as much as we did. There were many beautiful examples of EZs on the ramp, presenting a golden opportunity to EZ builders and potential builders to look at and talk to the owners.

We would like to thank all the people who made this flyin such an enormous success, in particular Squadron I and II members. Dick Kreidel, David Orr, Lynn Burks, Joe Orrico and especially Joan Richey. There were many others who also helped. Thank you all, shall we do it every year!?!

****From CP45-8 (CH10,CH31)(Photo Caption)****

About 3.7 g so far. Burt is standing by to make sure we place the bags correctly.

****From CP45-8 (CH10,CH31)(Photo Caption)****

Right at 12 g. At this point there is 3000 lbs of lead shot on the canard - all suspended from the "little aluminum" lift tabs! Deflection at the tip is around 10" on each side - scary!

From CP45-10 (CH10,CH31)(Photo Caption)
Careful now! Going for about 13 'g'. This rejected homebuilt canard failed at 13.8 'g'.

Control System Friction

Also see CP33-4 in the "Long-EZ Plans Changes" section of this chapter.

From CP33-5 (CH11,CH16,CH31,CH38)
CAUTION! CONTROL SYSTEM FRICTION
The presence of friction in the pitch controls of an EZ will result in serious degradation in flying qualities. Mike recently installed a different shape canard tip and when reinstalling the elevators one of the pivot bolts was adjusted to bind an elevator. Sally and Mike both flew the aircraft with friction and reported PIO tendencies and over-control difficulty. Adjusting out the bind immediately returned the excellent pitch control and smooth flying qualities.

From CP47-12 (CH11,CH16,CH19,CH31,CH38)
CAUTION: CONTROL SYSTEM STIFFNESS
We have previously warned builders to ensure absolute freedom from stiffness in the pitch control system. This is very important and must be corrected if it exists in your EZ. We never have particularly addressed lateral (roll) control system stiffness. While not quite as important as pitch, tight bearings in the aileron control system really spoils the nice flying qualities inherent in an EZ. Conscientious attention to detail here will pay dividends. Long-EZs and VariEzes have similar lateral control systems, the main difference being that the CS-132L belhorn in a Long-EZ is mounted inside of the wing root, and the same part (CS-132) in a VariEze hangs out in the breeze, inboard of the wing root, close to the bottom cowling.

Both of these areas can be troublesome. In the Long-EZ, you must assure that the end of CS-132L cannot contact the bottom of the wing. Even if you have to dish the skin locally, you cannot accept any rubbing here. In fact, it would be best to have at least 1/4" of clearance. The VariEze though, needs even more clearance between the lower end of CS-132 belhorn and the bottom cowling, because the cowling will tend to flex up in flight and could cause a rubbing interference, or even worse. For example, if your CS-132 belhorn just barely clears the bottom cowl while at rest on the ground, it is possible that in flight the cowl could move up enough to seriously interfere with lateral control of the aircraft! The answer is a streamlined blister on the bottom cowl which will give the required clearance and will stiffen the bottom cowl.

Lubricate all bushings and bearings in the control system and do not fly until you have the control system working nice and free with no tight spots or stiffness anywhere within the full range of control stick movement.

From CP55-6 (CH11,CH16,CH31,CH38)
CAUTION
Friction in the pitch control system of an EZ can make it very difficult to fly. In fact, it can flat-out make it so uncomfortable to fly that you won't enjoy it at all!

Friction in an EZ's pitch control system is easy to avoid and must be avoided. There are so few parts involved that it is simple to check. Disconnect the pitch trim springs, push the stick forward and aft, or grab the trailing edge of the elevator and move it full travel up and down. There should be no perceptible friction. It should not hang up anywhere, it should easily flop all the way up and all the way down. If it feels stiff or tight anywhere in the full arc of travel, find out where it is binding and fix it before you attempt to fly. Check the rod ends at the stick and at the inboard ends of the elevators. Check the stick's pivot points. Check every one of the elevator hinges. On the original GU canard, it is easy to get one or more hinge points too tight. The washers at the hinge points should easily spin. The bronze bushing should be lubricated and should be a nice easy slip fit on the AN525 screws which are the hinges. Check that the mass balance weights are not rubbing or chafing inside the slot in the canard on each elevator.

Lastly, put a saw horse or chair under each canard tip (well padded, of course) and have someone push down on the nose or center of the canard. Apply enough weight to bend the canard at least 3 or 4 inches up at the tips, then check all of the above for friction or binding or chafing under load. There should be no perceptible drag in the pitch control system (with no pitch trim springs installed) in any of the RAF designs, VariEzes, Long-EZs. Defiants or Solitaires.

New Canard - History

From CP39-2 (CH31)
NEW DEVELOPMENTS
Since January 1982, RAF has been working on a new canard airfoil for the Long-EZ. The design goal was higher performance, lower takeoff speed, lower landing speed, and no rain trim change. Quite an order. John Roncz, (designer of the Solitaire airfoils) said he could do it, so we asked him to have a shot at it.

The canard was built and test flown in early 1982, and even flown in the CAFE 400. It had some problems and needed more refinement. We have been working on it and flying it on and off since then, with mixed results. Some aspects are excellent, others are not good. We are actively pursuing this test and if we get it to where it meets our requirements, we will publish the results and put out plans for the canard as an optional performance change.

Please do not call us for information on this canard. We cannot release any data on it until it meets the standards we require. The only reason we are reporting on it at this time, it that so many builders have seen it on the Long-EZ here at RAF, that rumors are flying around. RAF's policy is that we will not put out any information on any design modifications until we are completely satisfied with the results of flight testing. At this point, we are not satisfied, but are continuing with flight tests. Stay tuned.

****From CP41-1 (CH31)****

RAF ACTIVITY

RAF has been heavily involved in getting the Voyager ready for its first flight and the followup test flights. We have also been working on the Solitaire engine installation and of course the "big one", the Defiant plans. **In our 'spare' time we have been testing the John Roncz designed canard for the Long-EZ.** This canard has been installed on Mike's and Sally's Long-EZ and has been flown in seven different configurations. It shows a lot of promise, particularly when it comes to rain trim change. We will have more information at Oshkosh, since we are currently in flight test.

****From CP42-1 (CH31)****

RAF ACTIVITY

We have been working hard on the new Long-EZ canard and have almost 200 hours of test flying on four different versions of the new canard. This week we are flying the final version in its final configuration on the prototype N79RA. RAF has also provided test pilot support to Scaled Composites for Burt's latest airplane, the Predator. Predator is a new generation of agricultural aircraft (crop duster) and is a canard type airplane with a small horizontal tail, actually a three surface airplane. Look for information in the upcoming aviation magazines.

We have built an engine mount for the plans built Solitaire and actually installed it into a homebuilders fuselage. Since the plans built version of the Solitaire is a little different than the prototype, it was a big help in getting the engine installation plans done.

Defiant builder support is picking up and several builders are really going fast on their projects. Right now it looks quite possible that one or more homebuilt Defiants may be at Oshkosh 1985!

RAF travelled to the Brown Field flyin at San Diego, California with Burt's Defiant and Mike's VariViggen. VariEzes and Long-EZs as usual were far and away the most numerous types at the flyin (38). We flew to the Copperstate flyin in Eloy, Arizona. This is really a fun flyin, with lots of EZs and with lots of flybys flown by more different types than you see at most flyins. Dick Kreidel won the Best Composite award for his beautiful Long-EZ.

****From CP42-2 (CH31)****

NEW AIRFOIL FOR LONG-EZ CANARD?

As many of you know, Mike and Sally had a different airfoil canard on their Long-EZ at Oshkosh. The purpose of this airfoil was to try to lower rotation speed, to try for a little higher performance (lower drag) and to try to eliminate the small nose down trim change that occurred at cruise power in the rain. The new airfoil in fact achieved all three objectives. However it had a glitch at 70 to 80 knots, in other words right in the approach to landing mode. We have made several changes since Oshkosh in an attempt to cure this small corner of the envelope. Unfortunately, when we fix this, we lose it somewhere else. We have recently built an entirely new canard, new airfoil and new plan form that is currently being flown on the Long-EZ prototype. We do not have sufficient data to release any information in this newsletter, but we will continue to work on it. When we have it refined to our satisfaction, we will make an optional set of plans available for it. It is difficult to predict when this will be, due to our work load here at RAF.

Please don't call us on this, as there is nothing we can release at this time. When we are ready, we will publish it in the CP. If you are ready to build your canard, go ahead. If you can delay it for 3 or 4 months by building winglets, wings or whatever, it may be a good idea to do that.

****From CP43-1 (CH31)****

RAF ACTIVITY

Last CP we announced that we would be testing the "new canard" in its "final configuration". Guess what? It did not do the job and we were ready to call it quits. John Roncz meanwhile was still working on the problem. He came up with a new airfoil that he felt would do all we wanted. We looked at his data and decided to give it one more try. We built the new canard and elevators, and flew it on N79RA, the prototype Long-EZ on January 16, '85. This fifth attempt was the charm. The new Roncz canard flies essentially identically in the dry and in the rain. RAF will be making a set of drawings available as an option to the original GU canard. We have not started the drawings as yet as we need to do more evaluating of the new canard. Don't call us for information. We will have plans available by April 1, 1985.

We have been busy modifying a second Long-EZ for the Army, and the engine installation plans for the Defiant.

We are currently planning to fly Burt's Defiant to the Sun' 'n Fun flyin at Lakeland, Florida. Mike and Sally will be there from March 19 through March 23.

From CP43-1&2 (CH31)
LONG-EZ CANARD UPDATE
The standard Long-EZ canard if built according to the plans, is identical to the VariEze plans-built canard. On the Long-EZ however, there has been a history of what has become known as the "rain trim change". This trim change is usually a nose down trim change when flying into rain requiring a small aft force on the stick to maintain altitude, which is easily trimmed out, using the bungee trim system. According to feedback we have received from builder/flyers, this is what most pilots notice. For the average Long-EZ pilot, this is of course no problem, rather more of a minor annoyance and once you have experienced it a few times, you simply trim for the condition and press on. A few builder/pilots however, report that their Long-EZs exhibit a more pronounced nose down trim change, requiring most of the available bungee trim force to fly hands off and in a couple of cases, pilots report not having enough trim authority to trim "hands off". During the last two years we have spent a lot of time and effort to try to understand what causes this trim change.

Thanks to John Roncz (airfoil designer par excellence) we now do understand it and have the analytical tools to predict and to overcome this phenomenon. We have built and tested five completely different canards with different airfoils. Many flight hours have been flown and a considerable data base has been generated. Also, a video camera was used to document tuft behavior on each airfoil. The lift and hinge moments with and without rain were documented. A method to simulate the rain effect was developed. Surprisingly one airfoil had no rain trim change at approach or cruise speed but has a considerable reduction in max lift, resulting in a nose drop if rain were encountered in the flare. The result of this extensive testing was the data John needed to model the rain trim change in his computer program. Soon he was able to duplicate the flight test results on the computer and from there was able to produce a brand new airfoil, the Roncz 1145MS, which we have recently tested on the prototype Long-EZ, N79RA.

This completely new and never flown before airfoil is by far the best we have seen. It has a negligible rain trim and the rain only adds 2 knots to stall speed. Of course some more flight testing remains to be done, however, we are confident that we do indeed have what we have been looking for. The R1145MS produces considerably more lift than the original GU-5(11)8 airfoil, and in fact more than any we have tested so far. This enables us to reduce the span, reducing whetted area, and thus drag. The basic airfoil is also very low drag. Its trailing edge shape provides the correct stick forces <u>without</u> external devices.

At this time, the span from the outboard tip of the left elevator to the outboard tip of the right elevator is 130". This compares to 140" on the original GU canard. We have incorporated the John Roncz designed curled-up wing tips first seen on Mike and Sally's N26MS. These tips are specifically optimized to enhance the vortex coming off the tip of the canard and position this vortex in the "sweet spot" over each main wing. The remaining test and preparation/printing of the plans should be completed by April 1.

The new Roncz 1145MS canard will <u>not</u> be recommended for the VariEze. The airfoil used on the VariEze main wing, is working very hard to maintain attached flow even with the GU canard. This new canard may ruin the stall characteristics of a VariEze. Feed back from VariEze flyers indicates that while most VariEzes do have a small rain trim change, it is just that, a small trim change that in most cases is not significant enough to warrant the flight test program that would be required to qualify a new canard for the VariEze.

From CP44-1 (CH31)
RAF ACTIVITY
Much work has been done on building and testing the new Roncz canard for the Long-EZ and getting the plans ready to go to the printer. We are pleased to tell you that they are at the printer and should be available in four weeks.

Mike and Sally flew the Defiant to Sun n' Fun in Florida. A complete annual inspection was required before leaving on this over 5000 mile round trip.

We have checked out a couple of pilots in the Solitaire, and we have had old Grizzly out several times in the last few weeks.

From CP44-2 (CH31)
LONG-EZ CANARD UPDATE
Since the last newsletter, we have built yet another canard! This one was built to proof the plans and to test the final hinge pivot location called out by John Roncz. This canard was mounted on N26MS and flight tested throughout the Long-EZ envelope, including flight in varying degrees of rain at speeds from 60 knots to 150 knots in 10 knot increments. The trim change at any speed is negligible, although the "stall" speed, or more correctly the minimum speed or full aft stick speed is higher in rain than in dry air by anywhere from 2 to 10 knots, depending on rain intensity.

This new canard is the final plans built configuration and uses a completely new method of hinging the elevators to the canard. All new hinges and Brock parts will be required. Ken Brock will have these parts available by June 8, 1985 (the RAF EZ Flyin, Mojave). There are a few parts that can be used from the original plans built GU canard, but most of the metal parts are new and different. There are only two hinges on each side of the canard that are visible outside the fuselage and these hinges are essentially flush with the bottom of the canard.

The new canard's primary design goal was to have no trim change when flying into or out of rain. We are satisfied that we have accomplished that. The trim change is essentially non existent at least on the two Long-EZs we have tested here at RAF. In addition we have measured a small increase in top speed and a small decrease in minimum speed, on the order of 1 1/2 to 2 knots depending on the individual airplane.

With the installation of this new canard airfoil, we have found that vortilons are mandatory on the leading edges of the main wings. With higher lift performance on the canard, we are driving the main wing to and even beyond it's critical angle safely. All of this information is covered very thoroughly in the plans, and there are also lots of photos of the canard under construction. The plans should be back to us by the first week in June and we are currently planning on introducing them at the RAF EZ Flyin on June 8th. Price will be $42.50 per set. Ken Brock has promised to have several sets of prefab metal parts available here at the RAF EZ Flyin. We do not have prices on the metal parts as yet.

We are very pleased with this new airfoil, and it accomplishes our goal but we do not consider it to be a mandatory change or addition to a Long-EZ. If you are happy with your present canard or if you have built and installed the original canard on your as yet untested Long-EZ, you do not have to build the new canard. It is an option, and can be retrofitted at any time. If you are uncomfortable with your present rain trim change, or if you like the idea of the latest airfoil with flush hinges and curled up wing tips, by all means build one and install it. If you do, please let us know how it performs on your Long-EZ compared to the original.

Once again, this new R1145MS airfoil is too powerful for the VariEze and is not recommended.

From CP45-3&4 (CH31)

LONG-EZ CANARD - RONCZ 1145MS

We are pleased to announce the availability of the plans for the new canard. We have these plans in stock, available for immediate shipment. We are also pleased to announce that Ken Brock Mfg. has all the machined parts and weldments necessary to complete the new canard including the two elevator torque tubes, ready to install available for immediate shipment. Contact Brock for prices. The canard plans sell for $42.50. This new canard design is an option for Long-EZ only, it is not recommended for the VariEze. The installation of this airfoil on a Long-EZ requires the installation of the vortilons on the leading edges of the main wings. DO NOT try to fly your Long-EZ without first installing the vortilons. The canard plans of course include instructions for the manufacture and installation of vortilons.

From CP46-3 (CH19,CH31)

NEW RONCZ 1145MS CANARD UPDATE

Quite a number of these plans have been sold now and we have been receiving lots of feed back. There are several small errors in the plans, (see this issue, Long-EZ plans changes) but generally most builders have been doing real well building the canard.

There are at least three flying now, the first homebuilder to notify us that he was flying his new canard was Harold Martindale of Anchorage, Alaska. Harold called after his first flight during which he had flown in and out of several rain showers and was delighted with the lack of trim change.

One of the errors in the plans has caused a few people to build a shorter canard by 2". This is not good. The elevators are shown the correct length, the elevator torque tubes as provided by Ken Brock are the correct length. Do not cut your elevators down. If you have built your canard too short (Page C1, 64" dimension should be 65", 10" dimension should be 11"), you will need to glue a 1" piece of foam to each end of the canard, carefully sand it to match the airfoil shape.

Mount the elevators, then proceed according to the plans, with the shaped wingtips. Now, when you glass these wingtips, simply run the two ply layup on the tip over the 1" foam addition onto the canard. Do this top, bottom and trailing edge and your canard will be the proper length.

Do not cut down the length of this canard. There is apparently a rumor being put out by someone in the Florida area, that you can vary the length of the canard depending on your weight. This is absolutely not true. We have tested this airfoil section at various lengths and the length called out in the plans is the optimum length and should not be changed.

Do not neglect to install the vortilons on your main wings - vortilons on the main wings are MANDATORY when using the R1145MS canard. They are optional when using the original GU section and we have had reports varying from no change to "really makes a big difference" with the original canard. Try them and see.

From CP50-1 (CH10,CH31)

OSHKOSH '86

Burt flew his Defiant, N78RA, and Mike and Sally flew their Long-EZ, N26MS, into Oshkosh again this year and this year saw more Rutan Designs on the flight line than ever before.

Irene "Mom" Rutan did her usual sterling job of checking everyone in and chasing down all elusive ones parked in camping areas, etc.. Once again, not everyone registered, so her count does not jive with the number published in the Sport Aviation. It really is hard to understand why you guys and gals don't register, a few minutes of your time, and that is all - maybe next year? According to Irene, there were 54 VariEze's, 67 Long-EZ's, 3 Defiants and 3 VariViggens that were parked on the ground at Oshkosh in 1986. That is a grand total of 127! A list of all "N" numbers recorded by Irene and seen by her on the field is published in this CP.

The RAF booth was shared this year by Feather Lite Products (Larry Lombard and Michael Dilley) and the IVHC. This made for a much more interesting booth with all kinds of hospitality club members helping out, the booth was always crowded, friendly and happy. Larry and Michael had several of their products there for builders to inspect and it was really neat having them there to help answer questions.

We are very proud of "our" EZ builder/flyers who keep showing the way with some truly outstanding workmanship, and who continue to blow away the rest of the field with the kinds of incredible trips routinely flown all over these United States as well as many, many parts of the world. A recent example is two Long-EZ's which flew from Spokane, Washington to Australia, crossing the Atlantic via the Azores, (not to be confused with the more normal island hopping route via Greenland, Iceland and Scotland which can easily be accomplished even in a Cessna 172).

Pretty incredible, really. As we said, we are proud to be associated with these kinds of people.

Some highlights for us at this year's Oshkosh were the obvious effort that EAA had made on the flight line, the Homebuilders Corner, a neat little building on the flightline used one morning by the EZ group, good coffee, good company and lots of "hanger flying". The Italians were sensational! The Goodyear blimp was ponderous, but interesting. The Pitcairn Autogiro was quaint! The little Stratos from Australia was cute. Best of all, the Hospitality Club dinner, as always was really the highlight of the week. Thanks to Bernadette and Doc Shupe.

A poll was taken at the Bull Sessions of rain trim changes in VariEze's, Long-EZ's and Defiants. The VariEze's had 9 examples that trimmed nose up and 12 that trimmed nose down in rain. The Long-EZ contingent had 16 that trimmed nose down and 1 with no trim change, all standard canards. **Three examples of the Roncz canard were there and all 3 had no trim change.** All three Defiants reported no trim change. The trim change in the EZ's range from very slight to slight (90 percent), or moderate (5 percent), heavy (5 percent). It was very difficult to see or feel any difference between these canards.

If you did not make it this year, too bad, how about next year? Don't forget to register!

Table of Contents for Supplemental Chapter 32, Optional High Performance Rudders

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Update Number 66 to Supplemental Chapter 32, Optional High Performance Rudders

****From CP66-8 (CH19,CH20,CH32)****
CHECK YOUR BELHORN PLANS
Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error. (Joan did it).

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Update Number 67 to Supplemental Chapter 32, Optional High Performance Rudders

****From CP67-5&6 (CH11,CH16,CH19,CH20,CH31,CH32)****

CONTROLS - RIGGING

Both control sticks should be rigged approximately 10 degrees left of being vertical. A side stick should not be rigged vertical with ailerons at neutral. The 10 degree, however, is not critical. You should sit in your airplane and place your hand on the stick in a relaxed condition, such as you might experience while on a long cross country. You will find that the most comfortable position for you hand is a little left of the vertical. Clamp your stick in this position and check that the CS-124 belhorn is now vertical or exactly as shown on page 16-5 of the plans.

Now, rig your ailerons to fair with the wings (neutral roll). Adjust the CS-126 and CS-129 push rods to position the ailerons at neutral with the angle between the CS-128 belcrank and the CS-129 push rod at 90 degrees (see pages 19-5 and 19-6 of the plans). This is very important, do not omit this step.

Now, install the stop bolt shown on pages 19-5 and 19-6 of the plans to allow approximately 20 degrees of rotation of the CS-128 belcrank but, more importantly, to move each aileron up 2.1" as measured at the inboard trailing edge of each aileron relative to the wing trailing edge. Theoretically, the aileron should travel up and down equally but may not due to individual tolerances. Do your best to set each aileron travel equal at 2.1" in the aileron trailing edge up position and accept whatever you get in the down position. (Note: More than 2.1" travel will not give more roll authority due to flow separation on the ailerons (aileron stall)).

The stop bolt on the right side of the airplane (through the CS-127 brackets) should stop the right aileron at 2.1" trailing edge up. The stop bolt on the left side of the airplane should stop the left aileron at 2.1" trailing edge up. The sticks, however, should be able to travel further left and right than just to the point where the CS-128 belcranks strike against the stop bolts. It is very important that you can move the stick approximately 10 degrees more in each direction than what it takes to strike the aileron stop bolts. This is because the air loads on the ailerons will cause some "wind up" of the roll control torque tube.

In order to have the maximum available roll authority, you must be able to displace the ailerons to their maximum deflections (i.e. 2.1" of travel) at speeds up to the maneuvering speed, Va-120kts. Check to see that your hand wrapped around the stick does not strike the side of the fuselage when rolling right, and that the AN4-15A bolt and washer through the bottom of the front control stick does not strike the side of the fuselage when rolling left. See page 16-6, top left, of the plans and, if necessary, grind through the inside skin of the right side of the fuselage to allow over-travel of the stick (left roll) with full forward (as well as neutral and full aft) pitch control. If you are already flying your Long-EZ and do not have as good a roll rate as your buddy does, check the aileron throw and the ability of the forward stick to over-travel both left and right to assure that you can deflect the ailerons to their stops at up to 120 knots.

Carefully check that you have the correct elevator travel and that the stick does not limit your ability to reach the elevator deflections by prematurely striking the console or any cover you may have over or around the control sticks. If you have the original GU canard, you should have approximately 22 degrees of nose up (elevator trailing edge down) and 18 to 20 degrees nose down elevator travel. If you have the Roncz 1145MS canard, you should have 30 degrees nose up and 12 to 15 degrees nose down. It is very important that you have pitch control stops set correctly to obtain maximum lift, and no more. (More travel gives less lift.)

Rudder travel is not as critical but, due to dihedral effect, the rudders on a Long-EZ add considerably to rate-of-roll. In order to obtain the maximum benefit from the rudders, do be sure that your rudder travel is set to the maximum recommended. (6" measured at the top of the rudder for the original plans-built rudders and for the new high performance rudders, 4-1/2" measured at the bottom of the rudder relative to the lower winglet trailing edge.)

Do not accept any friction in the pitch control system. If you have friction, do not fly until you have corrected this condition. Friction in the pitch control system of a canard-type such as a Long-EZ can make the airplane critically sensitive to fly. Friction in the roll control system greatly reduces the enjoyment of flying your Long-EZ and should be corrected. Work on ever pivot and hinge point until the aileron control system is nice and free, with the minimum possible friction.

Your flight control system is absolutely critical to safe, controlled flight and, in this area more that any other, accepting less than perfection could be very hazardous to your health! Do not go flying until you are completely satisfied that you have done your very best to reach the above goals in the control system of your Long-EZ.

****From CP67-7 (CH19,CH20,CH32)****
SPRINGS FOR FLUSH BELHORNS
NOTE NEW ADDRESS AND PHONE
Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact:
John York
921 College Rd.
Lebanon, IL 62254
618-537-2142

****From CP67-10 (CH19,CH20,CH32)****
CHECK YOUR BELHORN PLANS
Some of the flush rudder belhorn plans shipped from RAF did not contain page A5. Please check your set of plans and notify us so we may send you the required page of drawings. We apologize for this error.

Update Number 68 to Supplemental Chapter 32, Optional High Performance Rudders

****From CP68-5 (CH19,CH20,CH32)****
NOTE: NEW ADDRESS FOR ORDERING FLUSH RUDDER BELHORN SPRINGS.
John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049

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Update Number 70 to Supplemental Chapter 32, Optional High Performance Rudders

****From CP70-7 (CH19,CH20,CH32)****
FLUSH RUDDER BELHORN SPRINGS.
Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
903 W. 24th Street
Lawrence, KS 66046
913-832-2049
NOTE: NEW ADDRESS FOR ORDERING

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Update Number 82 to Supplemental Chapter 32, Optional High Performance Rudders

Information derived from CP82 published by RAF Oct 1995

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****

Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00
Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00
Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	**18.50**
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	**10.00**
Moldless Composites manual	14.50

Postage & handling included in price.

Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

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Supplemental Chapter 32, Optional High Performance Rudders

Long-EZ Plans Changes

****From CP41-4 (CH32)****
LPC #118, High performance rudder plans, page R-2. Top left hand corner. The sketch shows the hinge attach screws and nutplates to be on the rudder and the rivets to be on the winglet. This is in fact reversed as can be seen in Photos #23 and #24. The hinge should be permanently mounted into the rudder with rivets and the attach screws and nutplates should be in the winglet.

****From CP45-4 (CH19,CH32)****
LPC #121, Long-EZ High Performance Rudder Plans.
For new construction only - install the rudder cable conduit in the wing so that the conduit is 1.5" aft of where it is shown on the full sized pattern on Page A-12 of the large 'A' drawings supplied with Section I of the plans.

Miscellaneous

****From CP40-2 (CH20,CH22,CH32)****
NEW RUDDERS FOR THE LONG-EZ
The plans for the new rudders for the Long-EZs have been very popular although there has been some confusion. We will try to clear up a few points.

First of all, these plans are strictly for Long-EZ. They absolutely do not apply to the VariEze or any other type aircraft. VariEze builder/flyers should be able to recall a mandatory change in CP 22, Page 8, that reduced the allowable rudder travel from the original plans call out of 3.5" to 2". This was because the rudder authority of a VariEze was powerful enough in some cases to depart the airplane. The VariEze is the last airplane that needs stronger rudders!

If you have not installed your comm antenna(s) in your winglet(s) on your Long-EZ and you would like to have the high performance rudders, do not install any antenna in the winglets until you have the plans for the new rudders in hand. If you are wanting to retrofit the new rudders to a Long-EZ that is already flying, or one that has the antenna already installed per CP 26, you will have to cut through the original antenna and install a new one forward of the new rudder hinge line. This is covered in the new rudder plans. We have made this modification now to 3 Long-EZs and in all 3 cases the old antenna is still under the glass skin, (cut through and disconnected) and the new antenna works very well. We have not been able to perceive any degradation in radio performance. In fact on two of the three, we seem to have improved range both transmitting and receiving!

The new rudders on the Long-EZ give at least twice the yaw authority of the original rudders and allow you to steer while taxiing at speeds as low as 25 to 30 knots without using the brakes. The main advantage of course is in a crosswind take off from a narrow runway. With the new rudders minimal braking is required for steering, so you can accelerate to rotation speed more rapidly. You can rotate at your normal rotation speed of 50 to 60 knots (depending on cg) in any amount of crosswind up to 20 knots at 90 degrees and lift off in essentially the same distance as you would with no crosswind. Quite a few homebuilt Long-EZs have flown into RAF with the new rudders and every one so far has been pleased with them.

****From CP41-4 (CH32)****
Clarification
High performance rudder plans. The dimensions shown are what we used to mount these rudders in 3 different Long-EZs and are correct. The 39" dimension from the top of the rudder down to the "kink" in the rudder trailing edge is a reference dimension. The "kink" in the rudder varies from plane to plane. To lay out the rudders on your winglet, follow the instructions exactly as called out on Page R-1.

****From CP59-6&7 (CH19,CH20,CH32)****
FLUSH RUDDER BELHORNS FOR A LONG-EZ.
A few enterprising builders have designed their own method of hiding the external rudder belhorn and when Mike and Sally converted their Long-EZ, N26MS, about a year ago, we started getting enquiries from Long-EZ builders who wanted to do the same. Now that we have a years experience on the system used by Mike and Sally, we feel we can share it with Long-EZ builders who may wish to remove the external belhorns. RAF will be making a simple set of instructions, drawings, sketches and photos available within the next 6 to 8 weeks. These will sell for around $10.00.

The first "flush belhorns" Long-EZ we ever saw was Ben Ellison's Long-EZ (of Ellison Throttle Body fame). A beautiful Long, the simple elegance of the smooth outboard faces of the winglets made it even cleaner. Then we saw Joe LaCour's Long-EZ at Oshkosh and he had done something similar to Ben's and made some sketches as to how he had done it. Mike and Sally decided to use Joe's basic method and it has worked flawlessly for just over a year now. Ben Ellison, Joe LaCour and Mike and Sally's Long-EZs have one thing in common, all have forwarded mounted brake master cylinders. The hidden rudder belhorns method used by all three of these Long-EZs has the rudder striking a hard mechanical "stop" at full throw. This means that it is mandatory to have a strong spring in the rudder cable to allow normal use of the brakes.

While we have not tried this method on a Long-EZ with the brake master cylinder mounted on the firewall, per plans, we believe that with the springs installed correctly, this method should work well. This is only for Long-EZs with the tall, high performance rudders and would not work well at all on the small, original rudders.

First of all, why do it? Mike did it because it looked better and he tells people he gained 10 kts! (which, of course, is nonsense). Obviously, it is lower drag but probably so little as to be impossible to measure. Not having the steel belhorns protruding out of each winglet saves you from catching your clothes on them, it also saves you from bending them on the side of the hangar and cracking the paint but, best of all, from a safety standpoint, it eliminates the possibility of someone flipping the rudder cable end thimble over the back of the belhorn. This can make for quite an exciting take-off if you don't catch it in your preflight!
The external steel belhorns are removed and discarded, new belhorns are fabricated (from full size patterns) and installed into the rudders. A new rudder cable conduit must be installed in a different location in the wing. (Much easier to do in original construction but certainly possible as a retrofit). A strong compression spring, rigged like tail wheel springs, must be installed into each rudder cable to allow you to use the brakes after the rudders strike their stops at the end of their travel.

With forward mounted brake master cylinders, the CS-15 belcranks can be removed and discarded and pulleys can be installed in their place between the CS-71 belcrank brackets. The rudder cables can then be routed through the firewall through a short length of nylon conduit, thus eliminating the large slot required when using firewall mounted brake master cylinders. Also, when using forward mounted brake master cylinders, the rudder cables can be small, 1/16" diameter, all the way from the rudder pedals to the rudders.

The simple plans will consist of full size patterns for all parts required, and will cover building from scratch, new construction, as well as how to retrofit to an existing Long-EZ, however, it will be a simple set of instructions and will not cover every tiny detail, rather, it will assume that since you built the airplane, you can surely figure out this simple thing! Mike did take a series of photos of his retrofit, so these will be included plus a brief outline of procedures.

If you would like a set of these "plans", send a check for $10.00 to Rutan Aircraft, Bldg 13 - Airport, Mojave, CA 93501 and Joan will mail them to you.

****From CP62-5 (CH19,CH20,CH32)****

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 93501
805-824-2645 (Tues. & Fri. only)

****From CP63-9 (CH19,CH20,CH32)****

FOR SALE

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

****From CP64-5&6 (CH19,CH20,CH32)****

****Note: If you plan on installing the flush rudder belhorns, buy the plans before you build wings or rudders!****

Plans for flush rudder belhorns for Long-EZ (sorry, not applicable to VariEze). As seen on Mike and Sally's N26MS - has been flying for 3 years trouble-free. Clean up the only thing on your Long that just does not look right and enjoy stronger rudder authority for taxiing with no compromise to flight safety. $10.00 per set

Contact: Joan Richey
Rutan Aircraft Factory
Building 13-Airport
Mojave, CA 9350
805-824-2645 (Tues. only)

From CP65-10 (CH20,CH32)

FOR SALE

Many builders have had difficulty locating the correct springs called out to be installed in the rudder cables when installing the flush rudder belhorn modification. The springs called out in the plans are available from Century Spring Corp. but this company has a $25.00 minimum charge! Fortunately, John York, a Long-EZ builder who experienced the same problem, has informed us that he has a supply of these springs and is willing to keep them in stock for a year or two. He will sell the springs for $1.50 each plus $1.00 shipping. So send John a check or money order for $4.00 and he will send you a pair of springs!

Contact: John York
230 Coachman Way
O'Fallon, MO 63366
314-281-5851

Thanks for your generosity, John. We realize this is essentially a non-profit operation but it is a much needed service.

Control Surface Balancing

From CP51-4 (CH11,CH19,CH20,CH31,CH32)

CONTROL SURFACE BALANCING

We have published this before but since it's one of the most common problems we get calls and letters about, here it is again!

First of all, your ailerons, elevators and rudders can be very thoroughly sanded, far more so that the rest of the aircraft. Use a blue foam (Styrofoam) block, sized to fit your hand, and a half sheet of 40-grit sandpaper. Sand vigorously the top and bottom skins of the control surfaces, particularly toward the trailing edges. You can safely sand off up to 50 percent of the top ply of UND - this leaves one and a half plies of UND - more than adequate for control surfaces. What it does is reduce the weight of these parts considerably, especially aft of the hinge, which makes it much easier to balance and ,more important, since it is now very smooth it takes much less fill and paint to finish the part, making it easier to balance. Using this method, and assuming reasonably good workmanship, it should be easy to balance your elevators. Elevators absolutely must be balanced per the plans criteria or they will flutter! This means they must balance after finish.

Ailerons are not as critical due to the much stiffer wing they are hinged to, but even though we have not had a single case of aileron flutter reported, you should still be sure to balance them within the plans criteria. If after sanding them thoroughly as called out here and checking to be certain that the mass balance is correctly positioned relative to the hinge, they still don't balance, the best method of adding mass balance weight is to go to your nearest golf pro shop and purchase a roll or two of soft lead ribbon used by pros to weight the heads of their clubs. This is a 3M product and consists of a roll about 1/2" wide of lead ribbon with a sticky back. Stick it on top of your existing steel rod mass balance, as far forward as possible without increasing the chord of the ailerons. Stick it on the full span. Use as many layers as it takes to balance within the criteria, then lay up one ply of BID over the lead to permanently attach it to the aileron.

EZ type rudders do not require balancing, however they can benefit from a thorough sanding because it will take less fill and paint to finish and therefore, they will be lighter. As far aft on the aircraft as the rudders are, excess weight here is hard to take care of.

This is the method we have used for many years here at RAF and it works well. In about every case, the sanding alone will balance the ailerons and elevators without any additional lead. At least, this has been our experience.

High Performance Rudders - History

From CP39-1 (CH32)

RAF ACTIVITY

We have been kept quite busy supporting VariEze, Long-EZ and Solitaire builders. In addition work continues on Voyager project. Although this airplane is being built in RAF's skunk works, information on it is very limited as the program is proprietary to Dick and Jeana. **We have also developed, installed and flight tested, larger more powerful rudders on the prototype Long-EZ, N79RA as well as on Mike's N26MS.**

From CP39-1 (CH32)

NEW RUDDERS FOR LONG-EZ

For almost two years we have worked hard on nosewheel steering for the Long-EZ. The reason we did was the Long-EZ's one weakness, a take-off on a narrow or icy runway with a strong cross wind. Due to the requirement to brake for steering on the ground, the take-off roll with a stiff cross wind is extended. We wanted to eliminate this problem, and some form of nose wheel steering seemed like the logical way to do it. We spent many frustrating hours, and actually installed several different types of nosewheel steering mechanisms. None of them proved to be effective enough and it soon became clear that the only way to achieve this was to completely redesign the nose gear. This got away from our goal of a simple, retrofittable system.

Some time ago Charlie Gray of Lantana, Florida had asked our advice on larger rudders for his modified Long-EZ. We saw his airplane at Oshkosh with Mike and Dick both having the opportunity to fly it. Both were quite impressed with the effectiveness of the larger rudders, particularly the way they "steered" on the ground, even down to quite low airspeeds. Dick installed his own version of the larger rudders on his and Jeana's Long and Mike had the opportunity to evaluate their effectiveness in a 20 knot plus cross wind, on a narrow runway.

Now all we had to do was convince Burt to let us try it on N79RA. He gave us his blessing and the two Michaels and Sally cut out the old rudders, foamed and glassed the winglets, cut out the new ones, glassed them, hinged them and had them ready to fly (minus finish paint) in only 3 days. (These were not 8 hour days!!!). They also photo documented the whole procedure.

Mike put on the trusty parachute and climbed to 12,000 feet where he put old 79RA through a vigorous test program to determine departure susceptibility similar to the one that Phil Brown of NASA did several years ago. The result was very satisfying. The prototype N79RA, even at the aft limit of the cg envelope (103") will not depart or do anything unusual, even using aggravated control inputs at all attitudes and airspeeds from full aft stick (52 KIAS) to the maneuvering speed (120 KIAS) including full pro-spin controls in both directions. Mike has demonstrated crosswind take offs and landings in direct crosswinds of over 20 knots. We are very pleased with the performance of the new rudders and feel that they are a very real and desirable improvement to the Long-EZ. We do not intend to make their installation a mandatory one. However we believe that the original rudders, while not super, are adequate, and any Long-EZ flyer who is satisfied with his or her yaw control does not need to install the new rudders.

For those builders wishing to have more yaw authority, better crosswind take off and landing capability and less braking required for steering on the ground (at least while taxiing into the wind!). We have a set of plans available for $18.50. These plans consist of 4 pages 18" x 24" with a detailed description as well as many cross section drawings and sketches. Two of the pages have a total of 28 photos of a step by step sequence of how to retrofit these rudders to your already completed Long. The plans also cover installation on a new construction Long-EZ. The plans are available off the shelf as of now.

We sincerely hope that the builders and flyers out there in the field appreciate the amount of time, effort and not a little risk that RAF puts out for continued support and improvement where possible for the RAF airplanes. You can demonstrate your support by paying for one set of plans for each airplane you build. Those builders out there that are building more than one airplane from one set of plans, are not just cheating RAF, they are actually cheating themselves and may eventually end up cheating all of our builders RAF has the finest builder support program in the industry and we are very proud of that. We intend to continue with the same quality program for the foreseeable future. However, we do need your support to do so. A very high percentage of our builders do support us and have rigidly stuck to the license agreement of one plane per set of plans. We sincerely appreciate your honesty and your support. Those who have not supported us, stop for a moment and consider what a small percentage of your airplane's total cost your plans are. Consider also what you get for that cost. Not only an excellent flying machine, but the designing, structural testing, flight testing and development of that flying machine. Add to that the fact that we are here 6 days a week, ready to help you on the phone or by mail, any time you don't understand something, or have got yourself into a jam. Actually the plans are quite a bargain if you think about it. Enough said!

From CP40-1 (CH32,CH37)

RAF ACTIVITY

RAF has been involved in some work for the Army on an Army Long-EZ. We installed a Texas Instrument T.I.9100 Loran C, a King HSI and some special-mission sensors in a large external pod. We also converted their standard rudders to the new high performance rudders. **This large rudder installation was very thoroughly tested not only by RAF, but by two Army test pilots.** All agreed that they were an enormous improvement and no sign of any tendency to depart was observed by any of the three test pilots. We also made other changes and installations that are proprietary. It was a most interesting project to work on. Maybe if it shows up at Oshkosh it can park among the warbirds and get free gas!

Table of Contents for Supplemental Chapter 33, Long-EZ Owner's Manual

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Update Number 66 to Supplemental Chapter 33 Long-EZ Owner's Manual

From CP66-4 (CH33)

CONTROLS CHECK BEFORE TAKE-OFF

An EZ pilot here at Mojave recently had an experience well worth relating and bears serious thinking about. He had had his canard off for routine inspection and maintenance and when he replaced it, he inadvertently bolted the pitch control pushrod to the VECS12 arms incorrectly (due to a builder modification). This limited the nose down pitch authority but this fact was not discovered in preflight. In flight, this pilot discovered that at full forward stick, his elevator was essentially even with the canard tip! Reducing power enabled him to descend and he was able to land without incident. What this tells us is to not only feel the forward, aft and left/right stops when checking controls prior to take-off, but to look at the control surface you are moving and verify that it is, indeed, traveling to what you know is the correct direction as well as limit. There is no substitute for a complete, full travel check of flight controls before take-off.

From CP66-4 (CH33)

CAUTION

"Be careful about flying your EZ in a relaxed manner with your feet forward of the rudder pedals. On one flight, my shoe lace loop got caught over one rudder pedal and it took me 90 miles to work it loose. I now have on my checklist to stuff the loops in my shoes before I get into my seat.

Ray Mucha"

From CP66-5&6 (CH33)

ED: BURT WANTED TO SHARE THIS LETTER WITH ALL EZ OPERATORS.

To: James Vliet
From: Burt Rutan
Subject: Your request for my comment re: Suitability of the Long-EZ for pylon racing.

First of all, please understand that I do not build Long-EZs. Each one is manufactured by a separate individual or group and he is responsible for determining what are the safe uses for his product. Each Long-EZ is different since there are no conformal drawing requirements and no FAA conformal checks. I do have extensive experience in testing and operating my own Long-EZ. I do report the results of these tests, and operational experiences of others, via the owners manual and newsletters. This information is helpful to Long-EZ builders in deciding how to limit his operation, however, each builder/flyer has a different experience base and capability, thus each must decide for himself how to operate his own machine.

The information I provide shows operational limitations I have found to be safe for the Long-EZ using the Lycoming 0-235 or Continental 0-200 engines for gross weights up to 1425 lbs., speeds to 190 knots calibrated, and maneuver G's to 5.0. I have not operated the Long-EZ in pylon racing and thus, cannot recommend it per se. I do have a few reservations though, as listed in the following:

1. The forward-downward visibility and sideward-downward visibility is somewhat limited which could result in a mid-air collision when turning inside another pylon racer from behind or from one side. If I had designed the aircraft for pylon racing, I would have provided a more extended field of view.

2. Racing, by its nature, results in propulsion operation at the limits of capability, resulting in a significantly higher failure rate. This occurs when close to the ground. Thus, it is anticipated that engine-out landings will frequently occur. While the Long-EZ is a relatively good glider, its stall speed (56 to 65 knots depending on homebuilder variances) is relatively fast and thus, engine-out landings, particularly off-runway, will be hazardous.

3. Those who normally operate their Long-EZs as intended, ie, non-aerobatic, cross-country, efficient transportation, may be encouraged to operate beyond their capabilities after viewing a Long-EZ pylon race.

I am sure that with due consideration of all safety issues, the Long-EZ could be raced with a safety level similar to Formula One, however, that operation is considerably more hazardous than cross-country transportation and all involved must consider the hazards and requirements to fly with professional skills and attitudes.

Best wishes, Burt Rutan

****From CP66-7 (CH33)****

Center of gravity computer program.

Works on any IBM compatible - a neat, simple, "VariEze"-to-use program which instantly calculates your CG on a VariEze or Long-EZ and gives you a printout of the data. Jim has recently improved the program making it more user friendly. Send $5.00 and specify 5-1/4" floppy or 3-1/2" disc.

Contact: James H. Langley
245 E. Kimberly Street
Republic, MO 65738
417-732-1143

Update Number 67 to Supplemental Chapter 33 Long-EZ Owner's Manual

From CP67-6 (CH30,CH33)
CAUTION
HAND PROPPING
"If your magnetos are not both impulse mags, be certain that you have the non-impulse mag turned off during hand propping. Lycomings usually have an impulse mag on the left and a non-impulse on the right. Small Continentals usually have two impulse mags. Check yours to be sure.

If you leave a non-impulse mag on while hand propping, it can result in a kick back with fingers in the way. I have personal experience with this. I had trouble starting one day so decided to use both mags. The resulting kickback caused a broken thumb and badly bruised fingers! Be careful."
Chuck McCleod

ED - We know of at least three EZ flyers who broke their hands the same way. One spent over $5000.00 in doctor bills getting his hand repaired! As Chuck says - be careful.

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Update Number 68 to Supplemental Chapter 33 Long-EZ Owner's Manual

****From CP68-7 (CH9,CH33)****

ACCIDENTS AND INCIDENTS

FAILED MAIN LANDING GEAR DUE TO HOT BRAKES.

This is a subject that has been addressed before but we continue to hear from builders who are having problems in this area. We are revisiting this problem because recently we have received two reports from builder/flyers who have had this problem on airplanes with 300 to 500 flying hours on them.. These were not new airplanes. Originally the problems were associated with new airplanes doing taxi tests with wheel pants on. All the braking used while learning to drive a different airplane like an EZ, simply overheats the brake discs. This heat radiates into the strut and literally boils the epoxy out of the strut locally opposite the brake disc. Well, we are now finding out that this scenario also holds true on older airplanes. At one time, we had figured that the strut, over a period of time, gets postcured by repeated heat cycles due to braking and, thus, the heat distortion temperature goes up and makes the strut less prone to this type of problem. We still believe this to be true but only to a point. **If you, for example, go to check out a new EZ pilot and have him or her conduct high speed taxi runs and stops on a runway, be certain that you will have this failure occur if you do not remove the wheel pants.** There simply is not enough cooling available with wheel pants on to allow for this kind of operation. Normal take-off, go somewhere, then land operations do not put the thermal load into the discs that high speed taxi and runway flight tests do.

For additional protection from this radiating heat damage, install a 1/8" thick aluminum plate between the axle flange and the gear strut such that is extends up an inch or two above the brake disc and is somewhat wider than the strut. This will act as a heat reflector to reflect radiating heat from a red hot brake disc. You will still need to wrap the strut with fiberfrax and aluminum foil tape to insulate the glass strut.

****From CP68-7,8&9 (CH4,CH19,CH26,CH29,CH33,CH39)****

A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not positive of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. Do not fly a Long-EZ or VariEze without vortilons. In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on your particular aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. **If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power.** Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the forward face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around. **SKETCH OMITTED**

This change is mandatory and should be completed before next flight. Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats. Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall crash that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

THE FOLLOWING IS AN ANALYSIS OF THE UTAH ACCIDENT

The Utah accident involved a deep stall, flat descent (angle of attack of about 80 degrees). The fact that the pilot survived and that a slower-than-expected sink rate occurred (confirmed by video tape evidence of the last 2.3 seconds of descent) presents somewhat of a dilemma. We are baffled as to why this can occur. A similar phenomena has been experienced during several deep stall accidents with the Velocity aircraft. All were survivable and one went into water with the pilot experiencing no injury at all! (See article in July '91 *Sport Aviation.*)

The Utah Long-EZ had a wing-loading of about 12.2 lbs./sq. ft. and, considering all its area, including the wings, strakes, cowl and fuselage, a "flat-plat loading" of about 9.2 lbs./sq. ft. (1150 lbs. divided by 125 sq. ft.). A basic calculation of the predicted rate-of-sink in a flat descent would use a flat-plate drag coefficient of about 1.2 and would predict a sink of about 4820 ft. per minute or 80 ft./sec. This would definitely not be survivable.

Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

1) Analysis of the video tape shows a sink rate of about 48 ft./sec. (2900 ft./min.). This required measuring the size of the airplane image and may be off as much as 30 percent. The post-crash video data show the rate of drift of dust from impact. Comparing this rate of drift of dust (wind was about 20 knots) to the rate of sink of the airplane (on video) confirms the approximate 48 ft./sec. estimate.

2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

Update Number 70 to Supplemental Chapter 33 Long-EZ Owner's Manual

From CP70-9&10 (CH33,CH39)
A French VariEze was ditched off the coast of France when the engine quit while on short final to the Montpellier airport. Fortunately, neither the pilot nor the passenger were injured and, amazingly, the aircraft suffered relatively minor damage. This is the first known ditching of an EZ so we at RAF were most interested to read the report submitted to us by the pilot. We reprint the relevant information contained in his letter with the pilots permission and for the education of those readers who may fly this type of aircraft over water.

Pilot took off using the fuselage reserve fuel tank. Failed to notice the fuel valve position due to epoxy covered sleeve of coveralls. (VariEze fuel valve handle protrudes vertically into forearm when set to emergency reserve fuel tank). After 35 minutes of flight over beaches, the engine starved of fuel when the reserve tank ran dry. Pilot attempted to glide to runway, could not make it, so elected to land in the water due to bushes on approach end of runway. Pilot executed a normal landing on the surface of the water. **He did extend the nose gear (but did not say if he extended the landing brake - RAF recommends both.)** He touched down on the main gear at near minimum flying speed. The main gear instantly folded aft as the wheels penetrated the surface of the water. (This VariEze was equipped with a Long-EZ main gear strut and mounted similarly to a Long-EZ main gear mount). The nose gear did not collapse, but rather acted as a water "ski", preventing the nose from diving into the water. All of this happened very quickly according to the pilot, and although the stop was abrupt (he estimated less than 100 feet from point of touchdown 'til stopped), it was also gentle enough that he and his passenger did not even suffer any bruising from the seat belt/shoulder harnesses!

The fuselage filled rapidly with water and the pilot and passenger evacuated the aircraft after opening the canopy. The VariEze floated high enough in the water that the magnetos were above the water line and the instrument panel did not get submerged. The aircraft was pushed to the beach, the nose wheel was retracted and it was lifted up onto the beach with minimal damage.

The lower cowl was extensively damaged. The upper cowl, less so. Both ailerons were damaged and, of course, the main gear was torn completely out of the fuselage. The small plastic window used to check nosegear-down, was blown out by water pressure in the nose wheelwell. The ailerons have been rebuilt, both cowlings were replaced. The same main gear strut has been reinstalled and the aircraft is once again in flying condition.

So, how could this have happened? In the pilot's own words: he was in too much of a hurry. He had not expected to go flying, he was wearing his epoxy-covered shop coveralls and did not take the time to change. He raced through his checklist and missed a few important items. He did not climb to the standard pattern altitude, and flew relatively low over the beach. He recommends always taking enough time to do all the things that must be done to accomplish a safe flight. If, in spite of all your best efforts, something goes wrong, keep you head, think about what you are doing, fly the airplane and control it all the way to touchdown, maintaining flying speed without fail. After his experience, he believes the VariEze to be an excellent choice for long, over-water flights! He says that if something goes wrong, simply land in the water, stay with the plane, it will provide you with protection and flotation while you wait to be rescued!

We certainly appreciate this pilot's candor, and we take our hat off to him for keeping his cool and making a safe landing into the water.

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Update Number 71
to
Supplemental Chapter 33
Long-EZ Owner's Manual

****From CP71-1 (CH2,CH3,CH25,CH33,CH38)****
WARNING - STRUCTURAL DEGRADATION OF FOAM CORES
We have noted that many of you have not been adequately inspecting your structure and may not be aware of how seriously the structure can be affected by a degradation or defect in the underlying foam core. For example, a 3-inch diameter depression or bulge in the skin due to damage in the foam (void, crush or de-lam) can weaken a winglet or wing (particularly a VariEze outboard wing that has no discrete spar) by as much as 50% or more! A skin dis-bond on an elevator or aileron can result in flutter failure even within the allowable flight envelope.

We have recently found foam damage to several of our own aircraft structures. One was due to the inadvertent intrusion of an agent used to clean a wing before it was primed and painted. Another was traced to a stress crack that was in the foam block, a flotation billet, not the proper fabrication billet. Never substitute a different material even if it seems to work okay. We have also had dis-bonds in control surfaces. These can grow rapidly when exposed to high altitude flight. (The void is trapped and expands at altitude).

The solvent-susceptible and easily-damaged cores we use need constant attention to maintain safety. We know of no accidents due to this problem, however, the potential is high if you are careless with the maintenance of your airplane. Please let us know what you find on your inspections so we can pass this on to everyone. Since these types of structures are used on non-RAF types, we are asking Sport Aviation to also publish this caution.

****From CP71-5 (CH3,CH25,CH33,CH38)****
MAN-GND
ADD THE FOLLOWING TO THE MAINTENANCE/INSPECTION SECTION OF VARI-VIGGEN, VARIEZE, LONG-EZ, DEFIANT AND SOLITAIRE OWNERS MANUALS.

PREFLIGHT CHECKLIST

Check all skin surfaces of wings, canard, winglets and control surfaces for cracks, dents, or bulges and for evidence of interior foam damage (skin moves when you push on it or has a dull thud if tapped with a coin). Do not fly if structure is damaged beyond the limits noted in the 25-hour inspection (page 46).

COMPOSITE STRUCTURE

WARNING - The foam core in composite control surfaces, wings, canard and winglets is easily damaged by solvents, including solvents found in paint primer, most cleaning products and, of course, oils and fuel. Never wash the structure with anything but soap and water. The smallest invisible pinhole through the epoxy surface structure can allow intrusion of liquids or vapors that will attack the styrofoam core. A void or dis-bond (separation from the skin) will weaken the structure and can result in a fatal accident. The foam core can also be damaged by local concentrated loads such as a dropped tool or by using your shoulder to set the gear. Never use a wing as a workbench or to stack luggage. Treat all composite skins like eggshells.

EACH 25 HOURS Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or if it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re-painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping with a 25-cent coin. Good core is indicated by a sharp "tap" or "knock" noise. Bad core is indicated by a "dull thud". Listen carefully as you tap and mark with a grease pen directly on the skin the boundary of any suspected dis-bond area. Ground the aircraft if any core damage area is larger than the following:
Fuselage, wing/canard - 3" diameter.
Winglet, control surface or VariEze outboard wing - 2" diameter.
Repair per instructions in the annual/100 hour below.

ANNUAL/100 HOUR Conduct a very careful 100% skin surface coin tap, surface stiffness and contour smoothness inspection. Include interior areas in fuselage, cowl and wing with wings removed. Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge (any

divergence from the intended smooth contour) must also be repaired and reinforced per the standard repair methods in the plans.

From CP71-6 (CH33)
IMPORTANT REMINDER
Do not omit the required placard for minimum pilot weight. Keep in mind that someone other than you may someday fly your airplane. If that someone is not as heavy as you are, he or she may take-off with an out of CG, aft condition that could cause an accident.

From CP71-6 (CH33,CH39)
DEEP STALL TEST PROGRAM
Some work has been done on how to conduct this test but because we do not have an aircraft (Long-EZ), we have not built any hardware. We have so far received offers of two Long-EZ airframes, one structurally complete with no finish, no engine or cowling. The other has been modified and is not a stock Long-EZ shape.

RAF desperately needs a plans-built Long-EZ, complete, including cowling (engine not required). What we really need is a Long-EZ that has flown (is contoured and is complete) but is not currently being flown for some reason. We will have to cut holes in the bottom of each baggage-strake area and mount a pivot on the vertical and longitudinal CG. The airplane will then be mounted on a custom built trailer using these two pivot mounts and will be ballasted using lead shot bags to the various CGs we want to look at. This "damage" (holes in strakes) will be repaired by RAF prior to returning the airplane.

If you know of a Long-EZ such as this that may be available, please let us know. Possibly someone has one they are no longer flying but they don't get this newsletter. PleasE contact the owner or let us know who and where he or she is.

Update Number 72 to Supplemental Chapter 33 Long-EZ Owner's Manual

****From CP72-2&3 (CH2,CH3,CH25,CH33,CH38))****
FOLLOW-UP ON CP71 DISBOND/DELAM CAUTION
So far, we have received only one letter from a builder with a problem in this area. This aircraft is a Q-2 and, normally, we would not presume to comment on someone else's design but this particular problem could so easily have resulted in an in-flight structural failure that we felt morally obligated to say something about it.

During a landing that the pilot said was not any harder than other landings he had made, the canard (also the landing gear since the main wheels are mounted on the tips of the canard) failed. The top skin just inboard of the fuselage side, buckled and the canard folded. Subsequent sectioning of this area showed a large percentage of the foam had "melted". This builder/pilot suspected that this melting damage was caused by excessive heat from the sun while tied down outside in Florida. He included three photographs of the section of damaged canard.

We at RAF have not seen this canard, only the photos, but we have a different opinion. We believe this damage may have been caused by fuel leaking out of the fuel tank (above the canard) and seeping through tiny pinholes in the top skin and melting the foam. Styrofoam, be it blue or orange, fabrication billets or floatation billets, will melt when it comes in contact with any fuel, solvent, etc. Put a scrap of foam in a container of fuel and, in a short period of time, the foam will disappear. Pour a little fuel, avgas or mo-gas onto a block of foam and you will be amazed at the damage. The three photos supplied to us by this Q-2 builder/pilot, in our opinion, show classic fuel or solvent damage. One of Scaled's employees who has built a Quickie and a Q-2 informed us that the fuel tank is, in fact, mounted directly over the canard and that he had heard of this type of foam damage before.

All of the RAF designs have a fuel-proof barrier between fuel and Styrofoam. This barrier can be a sandwich panel of glass/PVC foam/glass, or glass/urethane foam/glass, but RAF feels it is absolutely essential to completely protect any Styrofoam core structure from exposure to fuel or any kind of solvent. In some cases, even the fumes of fuel or a solvent such as MEK or acetone can degrade a foam core to the point of causing a possible structural failure.

We have written a letter to this particular Q-2 owner and will be passing this information on to Jack Cox, editor of *Sport Aviation*. We are not criticizing anyone, it's just that this kind of damage is many times invisible and may not easily be spotted in a normal preflight. Any foam core, glass structure, while perfectly safe with an undamaged core, can become prone to catastrophic failure if the foam core is damaged. This kind of hidden damage could cause a serious accident. This is our only reason to bring this to everyone's attention.

To protect yourself from this kind of failure, it is critically important to prevent fuel from coming into contact with a glass structure that has a Styrofoam core. The same goes for any form of solvent, be it MEK, acetone, Prep-Sol, Acrylikleen, or whatever.

To check your structure for possible delamination or dis-bonds, move the airplane into the sun or, at least, to where it is warm. This will cause any disbonded areas to bubble up due to the air or gas in the void heating up and expanding. Carefully tap the entire area using a quarter (25-cent piece). Listen carefully for the telltale "hollow" sound when you tap an area that is disbonded or delaminated as opposed to the solid "click" sound of normal structure. By carefully tapping and using a felt tip pen to mark the perimeter of the damaged area, you can outline any areas that need repair then you can repair these areas, in most cases, simply by injecting a mixture of epoxy and micro-balloons, using a syringe. You will have to drill a number of small holes (to closely fit the needle) and inject the epoxy mix into one hole until it comes out of adjacent holes. Keep moving the syringe around until forcing it into any hole will make it come out of the holes closest to that one. Now, move the airplane out of the sun into a cooler area. Place some plastic (Visqueen) over the area, cover that with a piece of flexible material (.032 aluminum) and place a lead shot bag on top of that. As soon as the epoxy in the cup has kicked off, remove the lead shot bag, the aluminum and the plastic. Carefully scrape the excess epoxy off the paint using a plastic putty knife. After a full cure, you can carefully polish this area and repaint. Sometimes the visual damage is so little it does not require repainting. Recheck the area by tapping with a quarter to assure that you completely filled all void areas.

****From CP72-7 (CH25,CH33)****
IMPORTANT REMINDER

Do not omit the required placard for minimum pilot weight. Keep in mind that someone other than you may someday fly your airplane. If that someone is not as heavy as you are, he or she may take-off with an out of CG, aft condition that could cause an accident.

Update Number 76 to Supplemental Chapter 33 Long-EZ Owner's Manual

****From CP76-2&3 (CH13,CH21,CH33,CH36,CH39)****

TRUCK-EZ TESTS - THE LATEST ON DEEP STALL

For several years, we have been trying to obtain information and data on the characteristics of various canard-types at deep stall conditions. Data for the VariEze has been available since the late 70's when NASA conducted rotary-balance wind tunnel tests and concluded that the VariEze has no stable spin modes, i.e., that if forced to any angle of attack and spin rate, it will recover by itself. Also, the small model tests showed normal flat-plate drag at high angles of attack. These data and extensive stall-departure flight tests with N4EZ formed the basis for our confidence in the deep-stall safety of these general aircraft types.

Then, about 5 years ago, several accidents occurred with the Velocity aircraft. We think the problem could have been determined if extensive aft-CG departure testing had been done during development, like we did with the Long-EZ and Defiant. Two very noteworthy results from these Velocity accidents were 1). The descent was a stable, non-rotating condition about 50 to 80 degrees AOA, not recoverable with forward stick or by rocking the wings. 2). The descent was slow enough to allow impact in water without pilot injury.

Rumors were abound about this slow, 1000 ft./min. "parachute-like" descent probably induced by a violent, trapped vortex above the wing. Researching this, we found the rumors were just speculation, that there was no hard data on the descent rate. Even the test pilot who stayed with a Velocity to the ocean instead of using his parachute admitted he had not timed the altimeter nor remembered the rate-of-climb indicator's data. He merely climbed partially out, but feeling the "light breeze" of the descent, elected to ride it down. We have been extremely skeptical that an airplane can descend at this low rate, even with the best possible vortex. To put things in perspective, consider what would be required. The EZs and the Velocity have a "loading" of about 10 lb. per square foot of total planform area (including wings, canard, fuselage strakes and cowl). If all this area acts like a "flat plate" in the descent, the airplane would sink at 50 knots or 5000 ft./min. (flat plate Cd=1.24). The very highest Cd we have seen in aerodynamic research papers on trapped vortex is about 10. Using a Cd of 10 for the entire airplane (very unlikely, of course), the sink rate would be 17 knots or 1800 ft./min. If the airplane could descend flat at 1000 ft./min. (only 9.9 knots), it would have a Cd over 30!!

Our interest in this phenomena certainly was increased after the deep stall accident of a Long-EZ at Kanab (CP 68). Now we had some data, but very poor data. Only a tiny image of the airplane during the last 2.8 seconds on a video tape. This airplane hit the dirt without killing the pilot so we believed it could not have been descending at 5000 ft./min. An attempt to analyze the video resulted in a very rough approximation of 2900 ft./min. which results in a Cd of 3.7. Our surprise, of course, was that forward stick did not recover from the deep stall. The surprise subsided when we later learned that the airplane was being flown with the CG well aft of the FS 103 aft limit.

While the 2900 ft./min. sink estimate seemed to make sense, it was not considered accurate due to the problem of measuring a fuzzy blip on the video. We then made a decision to try to gather full scale data on the Long-EZ. The previous full scale tests done in Florida on the Velocity did not measure drag and lift, only the more important data of recoverability with various airplane modifications.

Then, another Velocity deep stall accident occurred. This one descended inverted, hit land, not water, and killed the pilot. In this accident data <u>was</u> available - good, accurate radar and transponder data. Obtaining this data from the FAA is a story in itself.. Finally, after threatening a media expose about government cover-up, we received the data. This Velocity entered a deep stall at about 7000 ft. and descended at a nearly constant 4400 ft./min. (44 knots) for the entire 90 seconds to impact. Of course, this inverted descent data may not apply to an <u>upright</u> Velocity but, at least, for the first time it represented good data during a deep stall accident.

We proceeded to develop the rig to allow us to measure the Long-EZ. This turned out to be a much more difficult and expensive job than originally thought. It was made possible by the loan from Donald Douglas of Sherman Oaks, CA of his Long-EZ that is accurately built to the plans, without modifications. A 3-axis electronic balance was built to measure lift, drag and pitching moment and an accurate speed indicator was installed in front of an Isuzu truck. These "Truck-EZ" tests can only be done in dead calm winds, so after many delays, we were able to obtain data at 40, 50, 60, 71 & 80 degrees angle of attack.

The data are presented in this newsletter. Note that these are full-scale tests at near the same Reynolds number as flight, so they are much more accurate than the small scale model tests done by NASA in the 70's.

First, let's discuss the lift and drag data. The data show substantial scatter due to the truck riding over bumps in the runway. A line faired through the average of scatter is considered reliable. If we combine the lift and drag resolved to a total reaction that would support the airplane during a stable deep stall descent, we can calculate the sink rate. This data, sink rate vs. angle of attack, is shown. Note that this prediction is very close to the radar data of the Velocity (4400 fpm).

Now, how slow does a Velocity descend upright in the deep stall attitude? We don't know, but we now tend to suspect that it is relatively high, 3500 to 4500 ft./min. We reason that the low damage and pilot survival is related to the fact that the water impact is nose down and the bottom fuselage is curved, this allows a few feet of deceleration at impact which can explain the lack of pilot injury.

How slow does a Long-EZ descend in a deep stall attitude? First of all, our pitching moment data show that it cannot descend at the extremely flat attitude of 70 to 90 degrees angle of attack. The pitch data indicated that if the CG is aft of limit, say F.S. 106, the aircraft may hang up at about 40 to 50 degrees angle of attack. It would then descent at about 5000 feet per minute. Why did the Kanab pilot survive? Possibly the nose-low attitude allowed a couple of feet of "crush and rotate" deceleration that provided adequate protection.

Our concern now is that there are many Long-EZs with extensive modifications that can affect deep stall recovery (long noses, bigger strakes, baggage pods, etc.). While we do not approve these modifications and can't be expected to analyze or test each one, we do feel obliged to encourage everyone to conduct adequate testing to determine the safety of their own modified airplane. **Conduct stall tests at the CGs you fly, with adequate altitude for a parachute jump (egress above 8000 ft. AGL). Do not ride it down, even over water.**

Another concern is that many of you do not accurately know your CG position. Calculating weight and balance is a pilot's responsibility (FAR 21) for each flight. Be sure you fly within limits (your <u>own</u> test-verified limits for modified airplanes) and check CG when any changes are made.

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF LIFT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF SINK RATE, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF DRAG COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-13 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF MOMENT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

See pages 2 and 3 in this CP for article "Truck-EZ Test.

****From CP76-14 (CH13,CH21,CH33,CH36,CH39)****
Donald Douglas lent us his beautiful plans-built Long-EZ so that we could generate the full scale, angle-of-attack data using this "Truck-EZ" rig. Many thanks, Don. **PHOTOGRAPH OMITTED**

****From CP76-3 (CH33,CH35,CH38)****
<u>CP ADVISORIES AND RECOMMENDATIONS</u>
These are for <u>your</u> protection. All that RAF can do is tell you. It is up to you to comply for your safety, as well as any passengers you may take up. Keep your aircraft <u>TOTALLY</u> up to date on <u>all</u> CP advisories and recommendation.

Not everyone who is flying a RAF design receives the CP. If you know of anyone who may not read the CP, make it your business to get involved, lend him (or her) your CPs (or copies of the CPs - we encourage copying the CP). The whole purpose of the CP is to help <u>you</u> fly as safely as possible.

If anyone knows of a condition that may have developed over the years or of any unsafe situation, <u>PLEASE</u> send us a letter detailing the problem. Help us to get the word out.

****From CP76-5 (CH33,CH39)****
A California Long-EZ struck a pine tree on short final. The airplane pitched down and crashed. The pilot was killed and the passenger was seriously injured. It was late in the evening and the runway lights were on. The pilot had not flown this airplane at night although he had night experience in certified aircraft.

The NTSB has not yet completed their investigation, but we feel compelled to point out that a night approach over trees to a fairly short runway (3600 ft.) can be very tricky. The "black hole" effect on short final can be very deceptive with little or no visual cues as to altitude. Practice night landings (if you must fly at night!) at airports with clear approaches and long, well lighted runways. Always aim to touchdown about 1/3 of the way down the runway. Do <u>not</u> try to hit the numbers at night.

****From CP76-5&6 (CH21,CH33,CH38,CH39)****
A VariEze crashed on departure from the Kansas City GIG on June 13, 1993. Since there were a lot of EZ builders and flyers on the field at the time, a rather extensive investigation was conducted on the spot, not only by FAA/NTSB personnel, but also by several EAA members, all of whom are very familiar with EZs. Tragically, two people died in this accident.

By all accounts, the airplane was refueled some time prior to take-off. The fuel caps on this particular VariEze were not the plans-recommended Brock-type fuel caps. They were the "Thermos" expanding 'O' ring-type. This type of fuel cap requires regular lubrication of the 'O' rings at 25 hour intervals. If this is not done, the 'O' rings will crush and crack and, even though you may have the locking tab down and "locked", the cap in fact will not be locked!

Shortly after take-off, the engine was heard to surge and loose power. The airplane began a 45 degree bank turn to the left. After completing 90 degree of the left turn, the nose began to drop and the aircraft impacted in a ploughed field, 30 degree nose low in a 45 degree left bank.

The investigators located all airframe parts except for the tip of one blade of the prop and the right fuel cap. The next day, parts of the fuel cap and pieces of the wood prop blade were found near the center line of the runway on the airport. This verified the theory postulated by the investigators that a fuel cap had come off and gone into the prop disc, breaking the prop. The resulting heavy vibration probably caused the pilot to pull the power back. For some reason, he elected to try to turn back to the runway. With little or no thrust, a heavy airplane in a steep bank (which causes high inducted drag) simply got too slow to fly and descended to the ground at a high sink rate.

It is too late for the couple in this VariEze but it is not too late for all of us who fly to learn from this tragedy. If you are flying a RAF design and have not complied with the CP advisories recommending you chain your fuel caps to the filler neck - do not fly again until you have corrected this omission. If the fuel cap on this VariEze had a chain to retain it, <u>this accident would not have occurred.</u> Please check your back issues of the CP for more information about chaining the fuel caps to the filler neck. See CP28, pg. 7&9; CP 31, pg. 5; and CP50, pg. 5&7.

Another lesson we should all learn from this accident is the problem of trying to make a 180 degree turn back to the runway while low and slow. A landing straight ahead into the wind (which was 15-20 knots that day) even if near the end of the runway, is much more likely to be survivable than a landing with a 15-20 knot tailwind. Think about it. Assume 100 knots airspeed. With 20 knots of headwind, your <u>ground</u> speed would be 80 knots. Downwind, it would be 120 knots! The kinetic energy in a downwind landing, in this case, is 2.25 times as high as it would be in a upwind landing. This could turn a survivable 15 "G" impact into an unlikely-to-survive 34 "G" impact! This assumes that you have not caused a higher sink rate due to the extra drag in the steep turn!

Please read this accident report and never forget the lessons learned. It is much, much better to land long, into the wind, and roll off the end of a runway at slow speed, even if you have to negotiate obstacles, than to land off field, downwind, at high speed.

****From CP76-6 (CH21,CH33,CH39)****
An Indiana VariEze departed after refueling. The control tower operator noticed a fire on the wing trailing edge and notified the pilot, suggesting an immediate return for landing. The pilot put the airplane into a high speed dive while returning to the airport to land - and succeeded in putting out the fire. The left aileron, wing trailing edge and engine cowling were slightly damaged by the fire. **The fire was caused by the fuel cap being left off during refueling and fuel syphoning out of the fuel tank onto the hot exhaust system.**

****From CP76-7 (CH33,CH39)****
A California Long-EZ descended into the ocean at cruise speed without any apparent effort to slow down or flare for a minimum speed touch down. The pilot, the sole occupant, was killed. It is uncertain at this time what caused this tragic accident.

Remember, if a water landing is imminent, put down the nose gear <u>and</u> the landing brake. Touch down under control, wings level, at minimum flying speed. Do not attempt to "stall" it in or to touch down on water at high speed. At least one VariEze has conducted a safe, successful water landing with no injuries and only minor damage to wheelpants and lower cowling.

We will report further on this accident as more information becomes available to us.

****From CP76-7 (CH33)****
<u>FUEL PRICES</u>
Have you noticed the incredible disparity in the price of 100 low lead avgas around the country? Right here in southern California, we have 100LL selling for as little as $1.64 (at California City) up to $1.92 (at Mojave) and for $2.50 (at San Diego Lindburgh). At Pittsfield, IL it is $1.50 per gallon!

Before you make your annual trip across the country to Oshkosh this year, you might want to call *Fillup Flyer Fuel Finder* who will sell you a list of fuel prices nation wide for a very modest cost. This really is a good idea for those of us who fly across the country a lot. Also, perhaps, it will send a message to those FBOs that charge ridiculous prices. Hopefully, the budget priced FBOs will reap the rewards of a capitalistic, free enterprise system.

If you have access to a PC, call the computer line at 1-800-955-7900, 3/12/24/9600 baud 8-N-1. If you do not have a computer, call the voice line at 1-800-333-7900.

Update Number 77
to
Supplemental Chapter 33
Long-EZ Owner's Manual

Information derived from CP77 published by RAF Jan 1994

From CP77-6,7&8 (CH33)

FROM CHARLIE PRECOURT, VARIEZE BUILDER/FLYER, ASTRONAUT.

"Dear RAF,

I've sent along some info I hope will make good inputs for the upcoming newsletter. You'll find a photo of my launch on the Columbia in April and a couple of other shots we took from orbit. The launch is an impressive ride to say the least! In the photo, the tail of the orbiter has just cleared the tower level (couple hundred feet) and our speed is already over 100 mph vertical. There are 7 million pounds of thrust and our liftoff weight is just under 5 million pounds! First stage is quite a rumble - about like a freight train - and the thrust gives you a relentless, increasingly hard push into the back of your seat - to just under three g's at booster burnout. That's not a lot of g but it's a long duration at that g level so you really get a strong sense of the rapid acceleration. After booster separation, the ride smooths out and the g level drops off until the fuel weight starts to decrease as the tank empties. We hit 3 g's again at about the 7 minute point in ascent and stay there until main engine cutoff at 8 1/2 minutes where we hit orbit at a speed of 17,500 mph (Mach 25). Zero g is immediate after the engines cutoff. Some folks may recall that our initial attempt at the launch resulted in a pad abort as our right main engine failed the start sequence due to a purge valve that failed to close. There were some tense moments sorting out the problem, but the safety system worked as designed and stopped a potential engine burn-through... Once on orbit though, the delays become insignificant. In the grand scheme of things a month delay for the engine changeout and retest was a small price to pay to ensure a safe and very productive mission.

We were a spacelab mission that conducted over 90 different experiments in medicine, biology, robotics, materials sciences, (crystal growth and metallurgy - using furnaces to melt and resolidify a variety of materials in the absence of gravity which enhances their properties -- I'd like to try a fiberglass layup in zero g sometime!!). We had a laboratory setup that included some 8 furnaces, over a dozen laser devices, a medical diagnostic rack that had ultrasound, EKG and EEG devices - you name it. One experiment in fluid physics actually verified a process empirically that up 'til now had only been a theory in the textbooks. So all in all, we had a great flight in terms of scientific return. In the medical research area, a very promising research in cell fusion (genetic engineering) was also completed. In the absence of gravity, cells of different types can be fused using electric fields without damaging the cells (without gravity you have no perturbing forces that damage the cells during fusion like you have on earth). The result is the ability to produce hybrid cells with very high quality characteristics. One day this technique may allow us to design cancer killing cells or cures for other diseases.

The most rewarding aspect of space flight personally, though, was viewing the earth. It is nothing short of incredible. Those are some of the most precious moments of a lifetime and I wish I could have somehow had my family there with me to share it. When we travel to talk about our spaceflight experiences, we're often asked if the experience changed us in any way. Some have even called it a religious experience but I like to describe it more in terms of gaining a new perspective on our place in the universe. You witness first hand and on a grand scale the awesome power of nature. At any one moment you can view an area that is approximately 1000 miles across the face of the earth - further than that you lose detail at the horizon - and the speed of the orbiter is such that you see an entirely new 1000 mile area every three minutes and twenty seconds! When you take in the view of a sandstorm blowing out of Africa across the Atlantic that covers over a thousand miles across or watch lightning continually going off under you on the night side of the earth, you really get a new perspective of how powerful nature is. I used to think our machines were pretty powerful - I've flown my VariEze coast to coast several times and I've flown F-15's across the Atlantic on deployments and now I have ridden several million pounds of thrust to orbit. We speak in terms of big numbers when we talk about the power of our machines, but when you see how little you are from the perspective of viewing the earth from orbit, you realize how insignificant you are as an individual against the power of nature. You also realize that your seven million pound thrust machine is nothing more than a speck of dust revolving around a planet that itself is just a speck of dust in the universe. So when you combine that with the view of an earth without visible borders or political boundaries, you see that it is only the teamwork of thousands of people that allows us to harness our little piece of nature! If only we could take the people fighting in Bosnia, Haiti or Somalia to orbit to see where they come from - I don't think there would be nearly as much conflict on earth.

Speaking of Somalia, I've also put in a photo of that country that shows the horn of Africa, the Gulf of Aden and off on the horizon Saudi Arabia. The colors are incredible and in person the view in 3D is mind boggling. You can't float by a window on orbit without being distracted by the view! Finally, I've included a slide showing yours truly floating in the lab module while I was working on an air sampling experiment (sorry I've run out of prints of interior shots for the moment). Nothing beats being able to float, although it makes working with multiple free pieces of equipment or parts kind of tough as they all want to float away. I remember at one point having a couple of items in each hand, something else between my knees and a pencil between my teeth while I was trying to record some data - and then Houston decided to call and I needed to key the mic to answer!

Reentry was a treat as well - we entered on the night side of the earth for an early morning landing at Edwards. As we hit the atmosphere at about 400,000 feet, the heat of reentry (about 2500 deg.) started an ionization of the atmosphere that we saw as an orange-pink glow out all the windows. We're at an angle of attack of about 40 degrees during the hot phase of entry and so out the overhead window you can see down the core of the vortex and plasma trailing behind us which appears as a brightly pulsating, red-orange tail. At about Mach 19, we came into sunrise on the eastern horizon in front of us so through the forward widows we began to see sunlight which was bright enough to overpower the red glow, while out the overhead and side windows we continued to see the glow until we fully slowed below the high heat velocities (down below about Mach 8). We hit the California coast doing Mach 5 and were finally starting to fly a little more like an airplane. In five more minutes we were on final at 300 knots with a 19 degree dive for Rwy 22 breaking through a thin overcast at about 16,000 feet. It was like a homecoming to see the lakebed again, as I had spent 5 years there before joining the space program.

I'm looking forward now to my next flight opportunity as the pilot. This first mission, I was designated mission specialist number 2 (MS-2) who performs duties somewhat analogous to a flight engineer in an airline crew on ascent and entry but who also acts as pilot and shift commander on orbit. I was on opposite shifts from the mission commander on orbit and therefore flew all the orbital maneuvers required during my awake hours to point the science instruments in the payload bay at their intended targets (earth observation cameras, ultraviolet cameras for the study of the Milky Way and our communication antennas that needed to be pointed at satellites). I also had command of the overall operation while the mission commander's shift slept. With a crew arrangement like this, we can operate the experiments 24 hours a day and maximize the science return of the flight... In any event, I hope to fly again towards the end of '94 or early '95 as the pilot for my next crew. Until then, I'm supporting upcoming missions as CAPCOM - the person who communicates with the crew from the control center.

Our future with the shuttle program is now expanding to include the Russians. We have two cosmonauts here in Houston now training for a shuttle flight in January. We are also planning up to 10 MIR (Russian space station) rendezvous flights where we will use the shuttle to change out crewmembers on MIR. Some of our astronauts will begin training in Moscow to fly on MIR and we plan to conduct further research, expanding on what was done on my lab flight, aboard MIR. This is all leading up to our planned joint space station development with the Russians and our European, Japanese and Canadian partners. So, many of us are now also beginning Russian language training. Things have really changed for a guy who used to fly F-15's on the German border - now I walk down the hall in my office and hear Russian being spoken by visiting cadre from the Russian space agency! Let's hope it works!

Mike, I've also enclosed the info about deep stall that we discussed at Oshkosh. I have received permission for public release of the video tape of an F-16 deep stall incident which gives a pilot's -eye view of a deep stall which almost doesn't recover. I've also attached a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall. I've made arrangements with a local video service here to duplicate the tape for those who want a copy. I'll be happy to provide a copy of the tape along with a transcript of the audio portion (for clarity) and my writeup about the learning points to look for on the tape to anyone out there who'd like one. I'm able to do this at cost for $13 a copy which includes the tape, the duping, printing and mailing. Folks can just mail me a note at my address: 7015 Little Redwood Dr., Pasadena, TX 77505 to get a copy.

Y'all take care, and fly safe!

Charlie Precourt"

ED NOTE: Many thanks, Charlie, for the fabulous description of what most of us can only imagine - what a trip! Also: See ad for tape in the FOR SALE section of this newsletter.

****From CP77-11 (CH33)****

F-16 DEEP STALL INCIDENT VIDEO

Gives a pilot's-eye view of a deep stall which almost doesn't recover. Includes a letter describing what the important learning points are from the video, especially as they apply to EZ pilots who are unfamiliar with deep stall, as well as a transcript of the audio portion (for clarity).

Price - $13.00.

Contact: Charlie Precourt
7015 Little Redwood Dr.
Pasadena, TX 77505-4433

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Update Number 78
to
Supplemental Chapter 33
Long-EZ Owner's Manual

Information derived from CP78 published by RAF for April & July 1994

****From CP78-2&3 (CH21,CH30,CH33,CH38,CH39)****

WATER IN FUEL

A recent off-field landing in a Long-EZ, fortunately with no injuries, forcibly brought to mind the ritual of checking for water at all the drains. A standard Long-EZ has a gascolator drain on the firewall which should be easily accessible through the cowling inlet. This should be drained before each flight, once the airplane is in the level position (on all three wheels). There is a water drain at the forward end of each main fuel tank and these must be drained before each flight but before the airplane is moved. That is to say, while it is parked in the normal nose down position. Do not lift the plane up to the 3-point position until after you have checked these two water drains. If you are in the habit of normally parking your EZ in the level, 3-point position (tying the nose down), you should consider installing low point water drains in each sump blister and then check them religiously before every flight.

Where does the water come from? Sometimes, but rarely, from the gas pump (or gas truck), very rarely, if ever in a composite EZ-type, from condensation in a less than full fuel tank. This is common in metal airplanes. That is why it is normal to top off the tanks in any Spam Can after a flight. Because the fuel tanks in any RAF design are insulated sandwich construction, they are similar to a thermos bottle and condensation does not normally form on the inside of our fuel tanks. The most likely way for water to get into your fuel tanks is a leaking fuel cap on an airplane left out in the rain. The "O" rings on any of the commonly used fuel caps do not last forever. Far from it, in fact. Ozone, ultra violet light and many airborne pollutants attack these rubber "O" rings. Check them frequently and replace them as soon as you see small cracks in the outer edges of these "O" rings.

Be especially diligent about checking your water drains if you have left your airplane out in the rain. Also, if you fly into an airport on one fuel tank with no problems, consider taking off and climbing to a safe altitude on that same, known to be free of water, fuel tank. Switch to the other (unknown) tank only after you have plenty of altitude to allow a safe return to the airport in the event water may be in this fuel tank. This philosophy is an old one but a good one. For the same reason, if anything untoward happens when you switch tanks, always switch back to the first tank before you try anything else.

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Update Number 79
to
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Long-EZ Owner's Manual

Information derived from CP79 published by RAF Oct 1994

****From CP79-7(CH33,CH39)****
A VariEze got away from its owner recently while hand propping. A friend, a non-pilot, was asked to monitor the throttle while the owner propped it. It started, unfortunately the throttle was full forward, and the non-pilot did not retard it but did hang on for the ride of his life as it scooted across the ramp on its nose. It finally struck a steel fence post which cut a 3" wide slice from just left of the pitot tube in the nose, all the way aft to the shearweb/spar cap of the canard! An expensive lesson. Fortunately, no one was hurt but the damage was extensive.

Always have a pilot who understands the EZ throttle and mag switches monitor your controls while you prop it - or better yet, get a B&C light weight starter!

****From CP79-7&8(CH33,CH39)****
Charlie Mottier sent this letter to RAF regarding his ditching in the ocean off the Berry Islands in the Bahamas. Unfortunately, the airplane was a total loss but the good news is that Charlie and his wife, Phyl, survived with only minor cuts and bruises. His letter is printed in its entirety in the hope that this information may help someone someday.

"Following Sun-N-Fun '94, nineteen canard-type aircraft flew to Great Harbor Cay in the Berry Islands (67nm south of Freeport, Grand Bahamas) for some well deserved R&R.

On the flight home our Long-EZ experienced a loss in engine power about 15 minutes into the flight and we subsequently ditched the plane in Big Sturrup Bay off the Berry Islands.

When the problem developed, we immediately advised our flying partner and then changed frequency to call in a Mayday which was acknowledged by Customs at the airport. We advised that we were attempting to return to the airstrip and requested landing priority. On that frequency, all inbound and departing aircraft were advised of the emergency.

When it became apparent that we would not make the field, the decision was made to ditch rather than to put the plane in the trees on the adjacent island as I felt there would be less chance of fire in a water landing. Our landing speed into the wind and with calm seas was about as low as possible to keep the sink rate to a minimum. The main gear hit first and pitched the plane forward. The canard was sliced off cleanly at the fuselage on both sides. The plane dove under water and the canopy was lifted right out of its frame. We came to rest dead in the water and perfectly level. With the canopy gone, I simply stood up and turned to check up on my wife who was in the back seat. Boats to help arrived within 3 minutes and, after sending Phyl to the local dispensary, we towed the plane to the shore.

I suffered no injuries other than some minor cuts and bruises and required no medical attention. Phyl suffered some sore ribs on her left side and some minor cuts, but on complete examination in Ft. Lauderdale, was pronounced fit and was released from Browder Memorial hospital.

There are at least two important points for EZ drivers from this experience: 1) A water landing is survivable although it is hard on the plane. My plane floated, it was heavily loaded and it floated entirely level. We walked on the wings as did others and it was very stable. **In attempting to stretch the glide to reach the airport, the nose gear <u>was not</u> extended. If I had to do it over again, I would put the nose gear down. That might help soften the forward pitch when the main gear digs into the water. (Also, the landing brake should be deployed - ED.).** 2) Most of our problems have developed from dealing with our own FAA. They advised immediately and strongly that we were in violation of the law by being in Bahamas air space without receiving prior written approval from the Bahamas government. That restriction is shown on the back of your pink

Experimental Airworthiness Certificate. It is item D and among other things, restricts experimental aircraft from flying over any foreign country without the special permission of that country. That means "in writing and in advance".

In summary, we do not know what happened to our factory-new, 250-hour, Lycoming 0-320, 150hp engine. The plane took all of the licks and we elected to total it. The passengers suffered almost not at all. Not a pretty story but we think one with a happy ending.

We want to thank our Canard friends who agonized with us as we splashed down and for their continued support through phone calls and cards.

Charlie and Phyl Mottier"

****From CP79-8&9(CH21,CH33,CH38)****

STATIC FUEL FLOW CHARACTERISTICS

We often receive inquiries as to what the acceptable static fuel flow is on an EZ or Defiant. While draining all of the fuel prior to installing new fuel caps into his Long-EZ recently, Mike took the opportunity to carefully measure the fuel flow. Here are the results: The fuel line was removed at the carburetor and run into a container. The fuel was allowed to flow for 6 minutes, exactly, then the container was weighed and the fuel flow was calculated. This was done with the in-line boost pump off, and with the boost pump on.

With 12 gallons in one of the tanks, the free flow with the in-line boost pump turned off, was 7.1gph. With the pump turned on, this increased to 21.1gph. With only 2 gallons of fuel in a fuel tank, the free flow, boost pump off, was 5.3gph, with the boost pump on, it increased to 19.8gph.

This airplane has a Lycoming 0-360 engine and the fuel supply to this engine has been very adequate over the past 1400 hours without the boost pump running, and at altitudes from sea level to 27000 feet. If your fuel flows are at least this good, you have nothing to worry about.

This test should be carried out by anyone who is preparing to fly a new airplane. Check the flow with 10 to 12 gallons in either fuel tank, boost pump on and off. Then repeat the test with a minimum fuel, such as 2 to 3 gallons. If you do not have flows similar to the above, you probably have a blockage in the fuel lines somewhere and this should be corrected before you attempt your first flight.

Mike ballasted the airplane so it was level on all 3 gear (not parked nose down). His fuel valve is between the pilot's legs, exactly per the plans. His boost pump is in line (all the fuel must go through the Facet fuel pump) per the plans. The only addition is the presence of a flow-scan fuel flow transducer between the engine-driven, mechanical fuel pump and the carburetor. This transducer was left in place for this test.

****From CP79-9(CH30,CH33,CH38)****

WHAT CAN I DO TO COMBAT THE HAZARDS OF 100LL FUEL IN MY 80 OCTANE CONTINENTAL 0-200 OR LYCOMING 0-235?

We have been asked this question a number of times and, over the years, we have accumulated a few answers for those whose engines simply were not designed to live on low lead fuel.

Use TCP as recommended on the can. Pure TCP can possibly harm glass/epoxy fuel tanks but we used TCP on the RAF Long-EZ prototype, N79RA, all of its life with no measurable problems and the TCP will definitely help your engine digest the modern low lead fuel.

Lean your mixture, even while taxiing. Richen it for take-off and then lean in flight using a good quality EGT gauge. A good rule of thumb is that you can lean aggressively above 8000 feet (below 75% power) or if you have a manifold pressure gauge, when you are below 22"MAP.

The bad news is that, in spite of these precautions, you should expect to have to remove your valves and ream the carbon build-up out of the guides every 300 to 400 hours. If you don't, you will experience sticking valves. If you can get 80 octane avgas, by all means, use it. Your engine was designed to run on leaded fuel and that is why you may be having these problems.

****From CP79-9&10(CH33,CH39)****

LIGHTNING STRIKE!

Long-EZ builder/flyer, Dan Worley, sent in a couple of photos and a report of a lightning strike. **PHOTOGRAPHS OMITTED** His Long-EZ, N63EZ, was parked, nose down, at his local airport within 50 feet of other airplanes and a metal hangar during a storm. As you can see from the photograph, the lightning vaporized the copper tape comm antenna under the skin of the left winglet and, in doing so, melted the blue foam core fully 2" wide and through to the outboard skin. The pressure of expanding gasses literally blew the inboard skin off the foam core and split the skin for almost 30". The rudder itself was undamaged and the structural attachment of the winglet to the wing was intact.

In addition to the above damage, his nav/comm was burned out, a handheld wired into the airplane was destroyed, the voltage regulator, intercom and strobe power supply were burned up, a digital CHT monitor, a digital fuel flow meter and bus voltmeter were destroyed. One co-ax antenna cable was burned. No other wiring was damaged. The lightning entered at the NG-3/NG-4 nose gear brackets, burning a 2" hole in the nose gear fairing, then ran around burning out the various electronic items and, finally, traveling outboard along the antenna co-ax and exiting from the tip of the left winglet. This is what we are told probably happened. Andy Plumber is a lightning expert and Burt has talked to him about this incident.

It is Andy's opinion that this was a very tiny lightning strike! He also informed us that had this strike occurred in flight that damage most probably would have been less, not more! He is absolutely adamant that no unprotected composite aircraft should fly within 50 miles of a thunderstorm!

We have a friend who works on a fleet of 4 C-130 aircraft and he tells us that at least one of these airplanes experiences a lightning strike on an average of once a month! Damage is usually small but occasionally results in an antenna being blown off the aircraft! There is even a report circulating that the recent loss of a similar C-130 (not one of his) was caused by a lightning strike which hit a fuel tank blowing the wing in half!

Lightning is not to be taken lightly, but for those who can afford it, there is a full, anti-lightning treatment available as written up in *Sport Aviation* on a Glasair III. A metal screen was bonded to every square inch of the airplane then it was struck by an artificial lightning bolt. There was some damage but mostly cosmetic. I cannot find the article right now but it is an expensive procedure and not something the average homebuilder would normally opt for.

This article is reproduced here simply to let all composite flyers know that flying close to thunderstorms could, quite literally, ruin your day! Stay clear of them, fly well around them, heck, that's the advantage of our canard pushers, we can fly around this kind of hazard with the excellent range we have. Fly safe and report any incidents to RAF so we can keep everyone informed.

****From CP79-13(CH33,CH39)(PHOTO CAPTION)****

Dan Worley's Long-EZ winglet after suffering a lightning strike while parked nose down on the ramp during a storm.

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Update Number 80
to
Supplemental Chapter 33
Long-EZ Owner's Manual

Information derived from CP80 published by RAF Jan 1995

****From CP80-5 (CH21,CH30,CH33,CH38)****

STATIC FUEL FLOW TESTING

In CP79, we reported the results of a thorough static fuel flow test conducted on Mike and Sally's Long-EZ, N26MS. This test was conducted at two fuel levels, tanks with half fuel and tanks almost empty. This was checked with the boost pump running as well as with the boost pump turned off.

The results have been questioned by several builders who generally agreed on the flow with the electric boost pump running but who could not achieve any flow at all with the pump turned off, even with a full tank of fuel!

Well, it turns out that there may be a plausible explanation. We have published static fuel flow results over the years from the prototype Long-EZ, N79RA; from Burt's Defiant, N78RA and from Mike's, N26MS. All of these aircraft had used engines in them which also had used, and probably quite old, mechanical fuel pumps installed on them. All of these pumps were manufactured before 1988. In 1988, Lycoming began manufacturing the AC mechanical fuel pump themselves. All of these pumps have 4 ounce springs installed at both the inlet and outlet of each pump. It takes about 1 psi to open one of these spring-loaded valves. In order to accomplish this, the fuel head would have to be at least two feet above the mechanical fuel pump. Actually, even with full tanks, we only have a little more than one foot of head on a Long-EZ.

AC mechanical fuel pumps manufactured prior to 1988 had only 1 ounce springs installed at the inlet and outlet valves. One ounce springs at the valves will allow about 5 gallons per hour of static flow. We believe this solves the mystery of why some builders have easily achieved the fuel flows called out in the CP and others could not achieve any flow (pump off).

Mike is close to a major overhaul on his engine and will conduct these tests, once again, with 4 ounce springs in the mechanical fuel pump and we will report the results here in the CP. With your boost pump turned on, you should have at least 20 gallons per hour of flow, even if you have the new mechanical fuel pump.

The electric boost pump (Facet Square pump) allows fuel to flow through it even when it is not running, the problem is in the newer AC mechanical fuel pumps. It may be possible to design a fuel system that by-passes the mechanical fuel pump, but keep in mind, that a system like this requires a check valve in the system and check valves, themselves, have spring-loaded valves that require some pressure to open so you may not gain any redundancy. You can take some solace from the fact that every low wing aircraft (Cherokee, Grumman Tigers, Cheetah, Mooney, etc.) suffer from the same situation and we are not aware of any of these aircraft having engine failures due to a double failure (both fuel pumps fail at the same time). We welcome any feedback on this subject. As long as one, or both, fuel pumps are functioning, the engine will run to its maximum power capacity.

****From CP80-4&5 (CH30,CH33,CH41)****

SKY RANCH ENGINEERING MANUAL

(SECOND EDITION) BY JOHN SCHWANER

This is quite simply the best book on the subject of air cooled aircraft engines that we have ever read. Covering a variety of subjects including engine inspection, engine performance, cylinder repairs, lubricants and wear, hose assemblies, trouble shooting, performance limits, vibration and balance, and an excellent section on fatigue analysis, this book is easy to read and understand. It contains valuable "gems" of information derived from a lifetime of overhauling engines and a hobby of studying failures. **It is an absolute must for anyone interested in operating and maintaining a Lycoming aircraft engine.** There is a complete list of all Lycoming engines in the Lycoming engine specification chapter.

There are many operational techniques described from how to start the engine through proper leaning, to taxiing and shutdown techniques, oil and grease specification and uses, etc., etc. We highly recommend John's book.

Call: Sacramento Sky Ranch
916-421-7672

Update Number 81
to
Supplemental Chapter 33
Long-EZ Owner's Manual

Information derived from CP81 published by RAF July 1995

****From CP81-3&4 (CH30,CH33,CH41)****

"Dear RAF,

Greetings from Houston... I had come across some information recently that would probably be of interest to EZ drivers and builders for your next CP.

I noticed in CP 79 your comments about using TCP to counter the effects of lead in the fuel. I had been suffering from sticking exhaust valves over the years in my 0-200 and finally had decided best to do a complete overhauls and install new (millennium) cylinders. The engine work was done by Dick Demars Aero in Fort Collins, CO. - they do excellent work and I highly recommend them to anyone contemplating an overhaul. At their suggestion, I've started using "Av-Blend" an oil additive that is supposed to be a big help in preventing exhaust valve sticking. Although it is too soon to tell (I've only 100 hrs. SMOH), I have been using it at each oil change and subjectively, (sound, smoothness) it seems to be helping. I'm told that TCP will help in the lead fouling area, but ultimately won't solve the "caking" of oil that occurs on the valve stems. The Av-Blend folks sent me some technical data on their product which I'm forwarding to you. I get mine from Engine Additives, Inc. in Humble, TX (800-672-7262), but it is produced by TechniFlyte Corp. in Chicago (800-209-0083). They've got some fairly impressive test results to back up their claims.

There are two very interesting NASA reports available to the public that were written in '85 and '86 on the results of the wind tunnel tests they did on the full scale VariEze and the 2/3 scale VariEze. **One is about 80 pages, the other 60, and they are full of interesting data on the basic aerodynamic characteristics as well as the aircraft's stability and control parameters.** I'm sure you at RAF have seen them - but it is not generally known that copies can be obtained by anyone wanting to add to their "canard-pusher library". They are excellent reference material for anyone flying an EZ. They are available through the National Technical Information Service by calling 1-800-553-6847. The first report is entitled "Wind Tunnel Investigation of the Flight Characteristics of a Canard General Aviation Airplane Configuration". The document number is NTIS No. N-87-10039. (NASA Technical Paper 2623). The second is entitled "Wind Tunnel Investigation of a Full Scale Canard Configured General Aviation Airplane (NASA TP 2382). The document number is NTIS No. N-85-19935. The only hitch is they aren't free - they are about $19.50 each, but they will take your order by phone at the NTIS 800 number if you use a credit card.

Deep Stall info update: I was perusing these wind tunnel reports recently when I noticed an interesting piece of data about high angle of attack characteristics of the EZ. I remember a couple of years back when we had our discussions about the Long-EZ deep stall incident that someone had asked about the possibility that engine power could aid recovery. At the time, I think we concluded it would not since the thrust line was basically through the cg. **However, the wind tunnel data does show a fairly significant restoring moment is added in the pitch axis by going from idle to full power - about as much nose-down moment as the elevator provides, at the high angle of attach of a deep stall.** A good piece of data to keep in your hip pocket should you ever encounter a deep stall inadvertently. Applying full power could aid in recovering an EZ - this is a characteristic of pusher prop configuration.

Well that's about all for now in the airplane department - I'm fully engaged in training for my next shuttle fight scheduled for this June. I've been assigned as pilot on the Atlantis crew with a mission to take two Russians up to the Russian MIR Space Station. We'll be making the first ever docking of a space shuttle with another space shuttle. Two 250,000 lb. vehicles will come together at little over 1/10th of one foot per second relative velocity. It's an interesting (and fun) flying task. This is also the first time we've docked with the Russians since Apollo-Soyez in 1975. We'll remain docked for 5 days and will leave the 2 Russian cosmonauts on board their MIR station and will bring home the 3 crew members who are up there now (2 Russians and an American - our first to fly on a Russian craft). They will have been there 90 days when we arrive so will probably be ready to come home. If all goes on time, I'll look forward to seeing you again at Oshkosh

Fly Safe,
Charlie Precourt"

Ed. Note

We concur with Charlie on the use of engine power to aid in recovery from a deep stall in a canard pusher-type. In fact, we used this successfully on several occasions during high angle of attack testing of the Mercury aircraft, a development of the Microlite which was designed and built for Colin Chapman, Lotus Cars of England.

ACCIDENTS AND INCIDENTS

As always, the following reports are published for the sole purpose of helping others to avoid the same problems that caused the accidents.

Update Number 82
to
Supplemental Chapter 33
Long-EZ Owner's Manual

Information derived from CP82 published by RAF Oct 1995

****From CP82-8 (CH33,CH39)****
A VARIEZE crashed in Illinois recently, and unfortunately the pilot was killed. The passenger survived with severe burns.

After this VariEze landed on the 2,300-foot paved landing strip, the two occupants complained that they smelled fuel fumes in the cockpit. They spent considerable effort trying to locate a fuel leak. No leak was found, so they purchased fuel and took off.

At least four eyewitnesses saw the crash. The VariEze reportedly used nearly the entire 2,300-foot runway before breaking ground. It did not climb out of ground effect, and struck the corn in a field off the end of the runway before crashing on the runway centerline a quarter of a mile from where they broke ground.

Witnesses reported that the engine sounded normal, and there was no sign of an in-flight fire.

The VariEze was destroyed, and a fire broke out shortly after impact. The passenger was able to evacuate the aircraft, but received severe burns trying to get the pilot out.

This VariEze was known locally as a "heavy" aircraft, and routinely used lots of runway to take-off. The pilot did not build this aircraft, but purchased it three years previously. He was a proficient pilot, and flew his VariEze often. The pilot was a large man, weighing between 270 and 280 pounds. The weather was clear with temperatures in the high 80's. The pilot's home base runway was 4,000 feet long.

CONCLUSION
This was a heavy example of a VariEze, and had a reputation of needing a long take-off roll. The day was hot (upper 80's) and the pilot was a heavy man. With a load of fuel and a passenger, this aircraft was undoubtedly over gross. Even a lightweight VariEze (630 lbs) would be at the maximum allowable gross weight just with this pilot (270 lbs) and full fuel, not including a passenger! An over gross weight take-off from a 2,300-foot strip on a hot day is simply a recipe for disaster.

****From CP82-8 (CH33,CH39)****
A LONG-EZ crashed on take-off in Arizona. The pilot was killed but the passenger survived with serious head injuries.

The aircraft was attempting to take off on a 7,000-foot-long runway with an 1 percent uphill grade. The long-EZ was loaded to more than 150 pounds over the maximum allowable gross weight. The temperature was 85 degrees F, and density altitude was over 8,000 feet.

It was almost dark, 8:30 pm in August 1995, and the tower operator reported that the aircraft initially broke ground at the 4,800-foot mark, but settled back onto the runway. The pilot continued the take-off attempt, lifting off briefly twice more before finally chopping the power and steering around the approach light system.

Unfortunately there was a six-foot chain link fence around the airport perimeter. The Long-EZ crashed into this fence, striking two fence posts, and breaking through the chain link. It crossed a road. broke through a wood-pole fence and came to rest upright on a golf course.

There was no fire, but the chain link fence and/or fence posts severely injured the passenger and fatally injured the pilot.

CONCLUSION

This was yet another example of an attempted take-off at over gross weight! Add to that, a hot, high density evening, plus an uphill runway! This pilot might have been successful with any one of these problems individually, but was unable to overcome them all.

****From CP82-8&9 (CH33,CH39)****

A LONG-EZ crashed near an interstate highway in New Mexico. Weather at the time was bad with low ceilings, poor visibility in rain.

The aircraft struck a tree (a very low tree) and was totally destroyed. Both occupants were killed. Several eyewitnesses reported seeing this aircraft flying very low near the highway.

There was no evidence of any kind of mechanical problem, and it is believed that this accident was caused simply by the pilot attempting to fly VFR in IMC conditions.

CONCLUSION

This particular case is even more difficult to understand since this pilot was very experienced and IFR capable. Was this another case of "get home itis"? Certainly, a 180-degree turn before the weather degraded would have been prudent, and they both may have lived to fly home the next day.

In a tragic accident like this one, it is of course impossible to know what the pilot was thinking, or why he continued in such poor conditions, but having done our share of skud-running, we have had to make many 180-degree turns due to bad weather. So far, we have been lucky, and have made the correct choice. But it is not always easy and many things can cloud your judgment - having to be at work the next day; make a doctor's appointment; deal with a family emergency, etc., - please friends, know your and your aircraft's limitations, and fly within that envelope.

****From CP82-9 (CH33,CH39)****

<u>*EDITORS COMMENT*</u>

The above accidents were preventable and unnecessary. The pilot-in-command is responsible to check the gross weight and to make a "go" or "no go" decision based on the available runway and density altitude. An uphill runway, even an 1 percent grade, is a lot. A 7,000-foot-long runway. with an 1 percent grade is 70 feet higher at one end than the other.

Think of this as a seven-story building being at the end of the runway. It is hot, it is dark, you are over gross with a high-time Lycoming 0-235 engine. The wind is calm, so no help from the wind (although a downhill take-off should have been an option with no wind). Would you attempt a take-off in these conditions, particularly if you think of the uphill grade as a seven-story building you would have to clear!?

Hopefully not. For most pilots this situation would be unacceptable.

Recently we read in the Cozy newsletter of an attempted over gross weight take-off from a short runway. The take-off attempt was aborted, but the brakes failed to stop the aircraft and it broke through a fence and hit a berm, failing the canard, both wings and the landing gear. Fortunately both occupants survived with minor injuries.

How can accidents such as this be prevented? Know your aircraft's limitations, and know your own limitations. <u>Never</u> try to operate outside of this envelope. Use your common sense. if you don't like the look of a situation, *STOP and RE-EVALUATE* what you are trying to do. *NEVER* allow yourself to be driven by schedule - much better late in this world that early in the next!

To report accidents and incidents

Write: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

or Fax: (805) 824-4174
Attention RAF

From CP82-10 (CH33)

High Density Altitude Takeoffs

Be Aware of Density Altitude

Takeoff in any aircraft on a hot day from an airport located at a high elevation, is not to be taken lightly. You, as Pilot-in-Command, should always check the density altitude, and most control towers at airports where high density altitude is prevalent will remind you to check "density altitude." This should trigger a mental alarm and you should calculate the density altitude and look up your flight manual takeoff performance estimate. You need this information before you decide to take off.

Flight manual performance data, if accurate, should predict the takeoff capability of a properly flown aircraft. "Properly-flown" is very important as it is possible to greatly extend a takeoff if the pilot does not smoothly fly the correct speeds.

Density altitude is a function of pressure altitude (altimeter set at 29.92) and outside air temperature. For example, at Flagstaff, Arizona (elevation 7,000 feet) on a hot summer day, 100 degree F, the density altitude is over 11,000 feet. This means that your airplane performs just as it would for standard temperature at 11,000 feet!

High altitudes require that you accelerate to higher true speed to attain adequate wing lift. High altitude also reduces the power output of your engine and prop. Also, when your performance is low, a modest uphill runway slope will greatly extend take-off roll. Add all of these factors together and you have an airplane that may roll two or three times as far down the runway before reaching lift-off speed. If you try to rotate early (maybe at about the normal distance down the runway) you will extend the take-off roll even further, due to the drag of the airplane at a high angle of attack, at too low an airspeed. Thus, you will find yourself in a classic "behind the power curve" situation. If you have tried to lift-off at too-low speed you have greatly extended your distance required to clear an obstacle. Your only option is to chop the power and land. Do not wait too late to be able to safely exercise this last option.

As pilots we are all trained about the dangers of heavy, hot, and/or high conditions for takeoff, and how to avoid the "backside" performance problem. Also, your pilot's handbook instructs you to fly faster when heavy or at high density altitude. In general, the EZ pilot community is very familiar with the limitations of their airplanes. However, since these recent accidents occurred, we are compelled to add further emphasis to the pilot's handbooks.

Do not fly until you comply with the plans change section on page 14 of this newsletter.

From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)

Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00
Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00

Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	**9.00**
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	10.00
Moldless Composites manual	14.50

Postage & handling included in price.
Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

****From CP82-14 (CH33)****
Plans Changes

Do not fly until you comply with the following plans change.

MANDATORY GROUND for All RAF DESIGNS until adding the following information to the takeoff performance section of your pilot's handbook:

High Density Altitude Takeoffs
The combination of high aircraft gross weight and high density altitude represent significant dangers for takeoff obstacle clearance. Special care is required to avoid premature rotation, ie, if liftoff is too slow, the aircraft will be on the back side of the power curve and may not climb.

When operating heavy and high (say, within 100 lbs of gross weight and above 5,000 ft density altitude) do not fully rotate to liftoff attitude until your airspeed is within 5 knots of the best rate of climb speed, for your specific weight and altitude (see climb charts). This will require more runway than a slower liftoff, but will assure the best capability to clear obstacles and continue a safe climb. Never attempt takeoff under conditions in which you cannot achieve best rate of climb speed while still on the available runway. If this ability is not clear at any point during takeoff - abort. Off-load weight or wait for a cooler time of day.

Lift-off is possible as slow as the "minimum lift-off speed," and can be successfully used at light weights and/or low altitudes to achieve a short ground roll. However, that technique will usually result in inadequate initial climb if used when heavy or high.

Runway slope effects are minor when light or at low altitudes, but they become very significant when heavy/high. For example, a 1 percent uphill runway slope may add well over 1000 feet to the distance required to clear an obstacle. Never takeoff uphill when your takeoff roll performance is marginal. Never continue a takeoff if crosswinds require you to brake so much that a safe liftoff is in doubt. Always use "best power mixture" for high attitude takeoff conditions. An over-gross weight takeoff that seems like an acceptable operation near sea level can be a real killer when hot and high. Never attempt a takeoff when over approved gross weight.

There may be considerable variance in takeoff capabilities from one homebuilt aircraft to another of the same type. Engine installed power and propeller efficiency at low speeds may be less than that for the prototype that provided the basis for the takeoff distance charts. Find a long runway and measure your takeoff capability at the weights you intend to fly. If your actual performance is less than the charts, correct the charts or improve your prop and/or engine.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may discover as you go through the building process.

Supplemental Chapter 33, Long-EZ Owner's Manual

Long-EZ Plans Changes

From CP26-6 (CH9,CH33)
LPC #41, MAN GRD, page 33, Owners Manual.
After "70 to 80 psi" add "75 to 85 psi for 6-ply tires".

From CP28-9 (CH33)
LPC #62, MEO.
Long-EZ Owners Manual Page 24. Add maximum landing brake extension speed - 95 kts.

From CP29-7 (CH33)
LPC #73, DES
Owners Manual checklist page 66. After "canopy-locked" add "visually confirm proper canopy latch engagement and proper safety catch engagement".

From CP29-7 (CH33,CH38)
LPC #74, DES
Owners Manual Page 47, add, CAUTION prop bolts - recheck torque (180 in.-lbs.) before next flight when a transition is made from a wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in flight loss of the entire propeller.

From CP31-5 (CH33)
VariEze and Long-EZ
Owners Manual
Under engine failure, add "CAUTION, in weather conditions where carb ice is likely, descents should be made with as high a power setting as possible in order to keep the maximum available carb heat. Descent at idle power will allow carb heater (exhaust system) to cool down such that inadequate heat will be available should the carb ice up. This is particularly true when using any of the Continental engines".

From CP33-4 (CH11,CH16,CH31,CH33)
VariEze and Long-EZ MEO
Owners Manual appendix three add "CAUTION friction in the pitch system can seriously degrade flying qualities". Also add ditching procedure shown on next page.

From CP34-7 (CH33)
LPC #103 DES
Long-EZ Owner's Manual page 21, first paragraph, "carbon dioxide-type" should be "dry type fire extinguisher".

From CP35-9 (CH33)
LPC #110
Add the following to the Owners Manual, page 22 under "Engine Out" "A windmill start uses less altitude if you initially dive steeply to rapidly attain 135 knots"

From CP36-6 (CH33)
LPC #113, MEO, Long-EZ Owners Manual, page 32
Aileron mass balance - it reads "level to 10 degrees nose down", should read per Section I page 19-9 bottom left - "The aileron must hang between the angle that makes the bottom surface level and the angle that makes the top surface level after painting".

From CP36-6 (CH33)
LPC #115, MAN-GRD, Long-EZ Owners Manual, page 20, Bottom of the page add - "Builder experience has indicated that it may be possible to spin a Long-EZ when at or aft of the aft CG limit. Analysis indicates that the spin mode or recovery would not be effected by power. Recovery should be forward stick, rudder against rotation and ailerons neutral or with the spin rotation".

From CP37-4 (CH33)
LPC #116 Owners Manual, Page 30, Change aft limit from 104 to 103.

From CP39-6 (CH33)
NOTE: Plans change LPC #116, CP 37, this is a mandatory change.

From CP49-6 (CH33)
LPC #130 MAN-GRD Add to owners manual page 16. "Clear" idling engine every 15 seconds or so on the approach. Also, always fly final with the speed brake and at an altitude to allow reaching the runway without the engine after retracting the speed brake. Accounting for deceleration to the stall speed, this can be done from a 3 degree flight path at 1/2 mile final.

From CP54-9 (CH21,CH33,CH38)
LPC #133 DES Check the static flow, as well as the flow with the boost pump running per the method shown in this CP.

From CP55-8 (CH21,CH33)
DES Static ground for potential fire problems. See this CP for details.

From CP57-7&8 (CH25,CH33)
VARIEZE, LONG-EZ, VARIVIGGEN, SOLITAIRE, DEFIANT - ALL AIRCRAFT. Insert the following plans change.

MAN GRD; Photocopy, clip out, or otherwise clone the placard below and install one each in your appropriate owner's manuals and easily viewed location in each cockpit, visible to each pilot and passenger seat. Also, assure that the other placards in the owners manual (Pg. 22-VariEze; Pg 24-Long-EZ, Pg. 24-Defiant and Pg. 14-Solitaire) are installed.

As we have discussed previously in the Canard Pusher and as has been reported by Aviation Consumer magazine, the experimental homebuilt airplanes have an accident record that is worse than that experienced with certificated, factory-built aircraft. This is due to a number of factors. There are more chances for non-conformality to occur, thus each airplane built is actually a new, experimental, research, high-risk article. This new research aircraft is often tested by pilots who have very little time in type and who often do not follow careful flight safety procedures in their testing. Also, because these aircraft are more fun to fly and have higher performance, many accidents are the result of improper aerobatics or other high-risk flying.
For example, as we reported in CP47, seven of the eleven Long-EZ accidents occurred during low altitude buzzing or aerobatic maneuvers. Because many individuals, including those who may purchase one of these aircraft or may ride in one as a passenger may not be aware of the risks involved, we are including a plans change in this newsletter requiring placarding the aircraft and the owner's manual.

WARNING!
STATISTICS INDICATE THAT AMATEUR BUILT AIRCRAFT ARE MORE LIKELY TO HAVE AN ACCIDENT, INCLUDING A FATAL ACCIDENT, THAN FAA CERTIFICATED, MANUFACTURED TYPES. WHILE STRICT ADHERENCE TO OPERATING PROCEDURES CAN REDUCE THIS RISK, THE HAZARDS ARE SIGNIFICANT, PARTICULARLY DURING INITIAL FLIGHT TESTING OR WHEN OPERATED IN A NON CONSERVATIVE MANNER.

From CP63-10&11 (CH33,CH39)
VARIVIGGEN MAN/GND
VARIEZE MAN/GND
LONG-EZ MAN/GND
DEFIANT MAN/GND

The cause of the VariEze accident that was reported in CP 62 that occurred at Aspen, Colorado has been determined by the FAA to have probably been fuel starvation resulting in engine stoppage. Since this EZ was definitely fueled while parked in the nose down position, the FAA has asked RAF to remind our VariEze, as well as Long-EZ, builders/flyers that if you are planning a long cross country and expect to have full fuel tanks, it is mandatory that you fuel the aircraft while it is sitting level on all three wheels. This is the only way you can actually fill the fuel tanks to their maximum capacity. Obviously, if parked nose down (nose wheel retracted), you will not be able to completely fill the fuel tanks and depending on where you installed your fuel caps, you may, in fact, be several gallons short. We would also recommend that you fill the tanks yourself rather than have the line boy do it. Depending on how large the vent holes are in your fuel tank baffles, to someone not familiar with your airplane, your tanks may appear to be full when, in fact, they are not. Above all, remember you, the pilot, are responsible to see to it that you have sufficient fuel for the proposed trip.

Owners Manual, General

Also see LPC #130 in the "Long-EZ Plans Changes" section of this chapter.

From CP25-1 (CH33)
LONG-EZ OWNER'S MANUAL
The Owner's Manual is now available from RAF, and is an excellent place to go for Long-EZ performance, range, etc. Note: unless otherwise specified all speeds shown in the manual are in KNOTS.

From CP28-7 (CH33)
CAUTION
Never rotate the nose beyond the angle that places the canard on the horizon. **SKETCH OMITTED**

From CP29-6 (CH33)

ADDED CRUISE EFFICIENCY CHART

The Long-EZ Owners Manual cruise fuel flow chart plots fuel flow vs. indicated speed (in knots) with lines of altitude. The chart below may be more handy in flight planning and can be added to your Owners Manual. **CHARTS OMITTED**

From CP32-8 (CH33)

Bob Hansen, Long-EZ builder/flyer (N7LZ) has developed a neat program for use on a hand held TRS-80, pocket computer. Bob's goal was to replace the Owners Manual with the computer. The pilot has only to answer the questions posed to him by the computer to get all the significant performance answers. Bob admits that there may still be a few bugs in the program, but feels that it is a big jump over starting from scratch. Bob will sell any builder/flyer a commented program listing and a magnetic tape cartridge for $5.00.

Bob Hansen
22319 Marilla Street
Chatsworth, CA 91311

From CP57-12&13 (CH30,CH33,CH38)

MAGNETO WIRING CHECK PRIOR TO SHUT DOWN.

The other day, Burt came in from a flight in his Defiant and reported a broken wire on the right rear magneto. He discovered this condition because, it has always been his habit, he conducted a magneto wiring check just before he shut the engine down.

How many of us do this with any regularity? How many do it at all? If you have never done this check, you may possibly have a "hot" magneto, even though you have both mag switches turned off. This is a potentially dangerous situation. Anyone who moves the prop may suffer a prop strike. Many people during the history of aviation have been seriously hurt, even killed, by a "hot" magneto.

The procedure to check if both of your magnetos are correctly grounded, is as follows: Just before you pull the mixture to shut down your engine after a flight (be sure the avionics master switch is off), momentarily flip both mag switches off and then back on. This only needs to take a second or so. The engine should instantly quit. If it continues to run, you have one or both magnetos "hot" or not grounded. Remember, a magneto is always hot unless it is connected to ground. Your mag switches should connect each magneto to ground when they are in the off position. Check the wiring at the magnetos or between the firewall and the magnetos. This is the most likely place for the wiring to fail due to the movement of the engine during start-up and shut down. Be sure to have adequate strain relief for the wires, and don't have the wires from the firewall to the engine too tight - you need adequate length to allow for the considerable movement of the engine relative to the airframe.

Try to develop the habit of conducting this test each time you shut down; power to idle, avionics off, both mags off for a second, engine should abruptly quit, mags back on, engine should catch and run, then mixture to idle cut off as normal. Knowing, for a fact that your magnetos are indeed grounded and that anyone, including yourself, is not likely to get surprised by the engine suddenly firing when the prop is moved is very comforting.

From CP61-7,8&9 (CH26,CH33,CH39)

"Dear Burt,

I regret to inform you that VariEze Serial No. 235, N13EG, "Old Dog's New Trick", was destroyed in a landing accident at Blackhawk Airport, Cottage Grove, WI on Saturday, July 29, 1989.

After planning to fly to Oshkosh on Thursday, the weather wasn't reported as good until Saturday when the Washington FSS allowed as how it was good weather all the way to Oshkosh so I took off and flew to Findlay, Ohio, planning a fuel stop there. When I got to Findlay, they were giving Special VFR clearances from the FSS there. I called the FSS and when they answered my transmitter went out so I could not reply to them. So I flew on to Putnam County Airport about 30 miles west of Findlay, landed and called the FSS on the phone and explained the situation. As Oshkosh did not want you to talk to them, I decided to press on as I could receive very well. I then flew to Porter County Airport at Valparaiso, IN. Findlay FSS also gave me a good forecast for my route. After refueling at Porter County, I proceeded to the Peoria VOR and took up a 337 degree heading to miss the Chicago TCA. When I reached the town of Marengo, IL, I was due south of Oshkosh so took up a 360 degree heading. I had not been able to go higher than 3500 MSL after leaving Putnam County and the ceiling now started dropping. Soon it started to rain and I did a 180 and ran out of it again. Deciding that sitting it out on the ground would be the best idea, I started to look for airports on my chart and spotted Blackhawk about ten miles east of Madison. I was tuned to the Madison VOR and was on the 90 degree radial. According to my chart, there was a super highway running near Blackhawk so I flew until I spotted the highway and turned west, as I got onto base leg the rain started again. I could see alright out of my canopy except for the critical lower front area where I needed to see the runway. On my first pass, I could see that I was too low so I released the landing brake, added power and started a go-around. Just then I heard and felt a thump but the airplane kept on flying and climbed out. I checked what I could from the cockpit and discovered that the front of my left winglet had a crushed area about the size of my hand just above opposite the top of the rudder.

The only thing I can figure was that I had hit a big bird as I was flying over a cornfield and there were no trees or poles in the field. I climbed out and then tried to land the other way. This time I was all set up but had closed the air vent to keep the rain out of my face and just as I came down final the canopy steamed up so it was another go-around. On my final pass I tried Runway 27 again. I was set up well and as the runway was 2600 feet I was trying for the numbers. I could see that I was to the left of the runway so I banked right to line up, just as I banked left again, I felt it hit.

What I hadn't seen in the rain was that Runway 27 had a 275' displaced threshold because of a mound with a cornfield and a road that was about two feet higher than the end of the runway. The main gear and the left wingtip hit the edge of the road and separated from the airplane. The fuselage then skidded across the grass and up the runway, stopping just on the right edge of the runway just before the displaced threshold markings. I was completely unhurt so unbuckled my harness, opened the canopy and stepped out into the rain. The ELT worked because even though the radio was tuned to 119.3 the sound of the ELT signal could be heard.

The destruction was almost total, the only thing that could have been salvaged was the canard and that had some tip damage. The left wing had been torn from the center section spar. The left side of the center section spar outboard of the fuselage had been torn off separately,. The center section spar with the engine mount, engine, and fuselage tank had ripped loose from the fuselage and the fuel strakes, the only thing keeping it with the fuselage was the aileron torque tube. The right wing attach fitting was wrenched both at the wing and the center section spar. The fuselage lower aft cover was ripped off when the gear separated. It had the all glass gear tabs according to CP 14 and the tabs stayed in the airplane, although the gear legs did delaminate between the tabs. The nose gear failed to the right and crushed a small section of the lower nose. The belly of the airplane was surprisingly unscathed, just some paint scratches, at no point was the fiberglass abraded through. The engine sustained some damage, the main thing was the air intake pulled the carburetor with the intake spider attached loose from the case, breaking one bolt and cracking the boss where the other bolt was attached. The carburetor and intake spider stayed with the carcass held on with the fuel line. When the left wing separated, it swung in and dented the valve covers on cylinders 1 & 3. The propeller was shattered and the spinner had a few dents. I was lucky that it was raining as the center section spar coming loose dumped all the fuel into the engine compartment. The lower cowling and wheel pants disintegrated.

What hould I have done? The first two things were lapses of memory. When I was getting the airplane ready for the trip I had planned to put RAIN-X on the canopy after polishing it but I left the RAIN-X home. The second item was that I forgot my handheld radio when I started on the trip. I'm sure that the canopy would have been easier to see through with RAIN-X and the handheld radio would have allowed me to go into a controlled field with long, wide runways. Next when I ran into rain again I should have headed south again until I was well in the clear, there was plenty of fuel on board, having flown less that 2 hours on full tanks. Also I could have dialed up 7700 on my transponder and gone on ten miles to Truax Field which has an ARSA, I was definitely in an emergency situation.

To what do I attribute my luck in being unscathed? First of all to a great design, the one witness to the accident stated that the airplane came apart just as it was supposed to,. The fuselage cocoon ended up intact. The seat belt and shoulder harness helped. Also had TEMPER FOAM cushions, even though the airplane hit with such force that it broke the bracket on the back of the radio stack the cushions absorbed the impact so that I could not feel it. I'm sure that the TEMPER FOAM saved me from serious back injury.

Such is my sad tale and is the reason that I did not see you at Oshkosh this year.

Sincerely
James O. Eggleston"

Many thanks, Jim, for this accurate and honest accident report. We can all learn from an accident like this. **Rain-X is a great idea when flying into rain, and carrying a hand held radio for emergency use is another.** ED.

****From CP62-10&11 (CH33)****
CAN I SLIP MY EZ?
This is question we get here at RAF from time to time and it is a subject that has been discussed at Oshkosh during the "bull sessions".

The reason for the question stems probably from the fact that a lot of you have flown C120's, Luscombes, Champs and the other taildraggers with no flaps. As you know, the best way to lose altitude in one of these airplanes is a forward slip. In a Champ, as an example, a forward slip will cause the airplane to lose altitude dramatically, yet not gain any airspeed. Many taildragger advocates will tell you that a slip in a flapless taildragger is more effective when trying to lose altitude than flaps are on a Cessna or Piper.

What about in an EZ, though? Well, a VariEze slips quite well, that is, it will lose altitude readily in a forward slip. Not anywhere near as much altitude as a Champ or a Pitts. However, the VariEze has been shown to occasionally depart in a sideslip departure. In fact, RAF put out a mandatory change to the rudder travel on all VariEze's for this reason. For this reason, RAF HAS NOT AND DOES NOT RECOMMEND slipping a VariEze. Actually, a VariEze and a Long-EZ, for that matter, will lose as much altitude as rapidly by deploying the landing brake and stepping on both rudder pedals (deploying both rudders) and slowing to around 75 knots and flying wings level.

We have done considerable testing of this fact, and a Long-EZ with landing brakes and both rudders out, flying wings level, at 75 knots will lose 1100 feet per minute. The same Long-EZ, clean (landing brake closed) in a full rudder forward slip will lose also about 1100 feet per minute. A full rudder forward slip with the brake down will generate about 1250 feet per minute rate of sink. All tests were done at 75 knots indicated, with power at hard idle.

We can therefore conclude that although EZ's can and do slip OK, there is no point in slipping them because you can do essentially as well with the landing brake, both rudders and the proper airspeed - and it is much safer since there is much less chance of a departure from controlled flight.

****From CP65-5,6&7 (CH21,CH22,CH33)****

LANDING LIGHTS AND COCKPIT NIGHT LIGHTING.

Why does the Long-EZ have its landing light where it is? Initially, the prototype Long-EZ had no landing light. It also had no navigation or strobe lights. When Dick Rutan wanted to try for the Closed Course Distance Record in the C1B class, it was obvious that night lighting would be required. Dick and Mike hurriedly designed, built and installed a "fold out" type landing light under the right thigh support which was somewhat similar to the present plans call-out for a Long-EZ.

The light worked quite well, but due to its design, it was difficult to extend and it took up storage space under the thigh support. This led directly to the present landing light design. While there are probably a lot of EZ drivers who have landed their EZ's at night, there are probably a lot more who have not.

There are several requirements for an effective landing light on an EZ. One of the most important is that it have the capability to be correctly pointed for landing and then re-positioned for taxiing. An EZ approaches to land, nose high. The Cessnas and Pipers that many of us learned to fly in, do not. Due to their flaps, they normally approach nose down. This means that a landing light on an EZ must point down to a much greater degree than the light in a Cessna. Once this angle is determined (by trial and error), it will be immediately obvious that this light is now essentially unusable for taxiing since it points at the ground directly in front of the nose of the aircraft and the pilot can only see forward for about 6 to 8 feet. If this light is adjusted to make taxiing possible, it becomes useless for a landing light. That is why it is adjustable and must be adjustable at least to these two positions.

This pretty well eliminated using the nose mounted landing light that Burt had called out for the VariViggen back in the early '70's. Some VariEze builders did use this type of light but not many used it to actually land at night. Those who use it regularly found they needed to have a two position adjustment, usually a cable driven, difficult-to-design and-build device.

A number of EZ's have the landing/taxi light mounted in the leading edge of the outboard fuel strakes. We rejected this idea very early on because we were concerned about these lights reflecting on the canard, lighting up the canard and blinding, or at least hurting, the pilots night vision. This editor would welcome constructive comments based on actual experience using this type of landing/taxi lights. One definite advantage would be to make it easier to flash a landing light while flying at cruise speed.

Using the Long-EZ plans landing light requires some practice and a couple of little tricks only learned by experience. If you have never used your landing light at night, you are in for a surprise! The first time you turn it on and extend it, it will probably light up the interior of the front cockpit! It will tend to blind you by glaring off the nose gear strut into the little plexiglas window between your legs. Here are a few ideas to help you with these problems.

First of all, you should paint the inside of the nose wheel well flat black. Also, the inside of the trough where the nose gear strut fits while the gear is retracted should be painted flat black. The aft face and both sides of the nose gear strut itself, including any nose gear doors or covers should be flat black. Make a small cover (a piece of engine baffle rubber works quite well) that can quickly and easily be installed over the plexiglas window through the lower instrument panel. Velcro works really well here. Do not permanently cover this window. For daytime and night flying, this window can save your butt by allowing the pilot to verify that the gear is indeed down. Extend the nose gear, extend the landing light, verify that the gear is down, then install the window cover to completely block any light. With the landing light on, you should get no reflected light through the plexiglas window or through the fiberglass wheel well. If you do, take whatever steps it requires to correct this.

The above evaluation should be conducted on the ground, at night. Before you go flying at night, you should address all of the above suggestions and satisfy yourself that you are comfortable with the landing light's effectiveness. Focus the light to an optimum taxi position and practice taxiing at night. Keep in mind that you will have to depress the light considerably from the optimum taxi position to the optimum approach-to-land position.

This editor has logged over 300 hours of night flight, many of those hours in a Long-EZ. The way I use the landing light is as follows: I slow to about 100kts on base and extend the landing light to what I feel is about the correct position. Once established on final, I fine-tune the landing light until I can plainly see the runway numbers illuminated by the landing light. (Mine is a 250 watt light and, as such, easily lights up the approach end of the runway). I continue to slow to reach touchdown speed just above the runway. I use a small amount of power right to touch down and I drive it on, rather than, flare for a "greaser" type landing. This avoids the problem of dropping it in and it also helps keep the landing light focused on the runway and not up in the sky (as it might be with a very nose high, fully flared touchdown). Once the nose wheel is rolling on the ground, I readjust the landing light to clearly illuminate the runway/taxiway in the 3 point position. So much for the landing light - if you have only a 100 watt light and you do actually fly at night, you should replace the 100 watt with a 250 watt. 14v 250w #4313, 28v 250w #4587.

Now to address the instrument panel lighting. An airplane with a canopy rather than a windshield presents a rather more difficult cockpit lighting problem due to the "fish bowl" affect. This is the result of all the panel light being reflected in the bowl shaped canopy and making it difficult to see outside. In this editor's opinion, the very best form of instrument lighting (to help cut down the fish bowl affect) is internal lighting in each instrument. Unfortunately, this is not available on most aircraft instruments but you should use it where possible such as VOR heads, engine instruments, etc.

The next best lights, I feel, are post lights. The least desirable form of lighting would be a flood light. A good dimmer switch is important, particularly when you are taking off or landing and need to maximize your ability to see outside. Dim the instrument panel lights down as much as possible while still being able to read the critical instruments. With post lights, there should be two to each critical flight instrument - airspeed, attitude, altimeter and rate of climb. These post lights can be turned to focus their small red glow to best illuminate each instrument.

Now, sit in your airplane at night with the canopy closed. You may be surprised to see just how much reflection you have in the canopy. You should obtain a piece of cardboard or fairly stiff paper, painted flat black, and cut it to closely fit into the forward end of the plexiglas canopy at the bottom edge of the plexiglas (where the plexiglas is retained in the canopy frame by fiberglass). You should ideally be able to secure this stiff paper in place with velcro or something similar. While seated in the normal position in the seat with the canopy closed, your eye should see only the aft edge of this cardboard or paper. It must not restrict your view of the instrument panel or your view outside through the canopy. You should now have zero glare or "fish bowl" affect on the canopy. Cut the aft edge of the flat black cardboard away as much as you can to give you more physical room but not so much that you get the glare on the canopy. This must be done at night with the cockpit lights on. You should experiment, by trial and error, until you get it right.

All this may seem like a lot of trouble to go to but, believe me, if you plan on flying your creation at night, you will be very glad you took the time. Just be sure that this paper glareshield does not restrict your visibility of the instruments or of the outside. It should be soft enough to collapse out of the way in the unfortunate event of an abrupt stop or accident.

One other point. Flying at night can be a beautiful experience. It can also become a terrifying and dangerous experience if anything at all goes wrong. Flying a single engine at night is considered by many to be an unacceptable risk. Away from an airport, an engine or prop failure at night will almost certainly result in an accident and the chances of surviving an off-field landing at night are so small as to be essentially non-existent. This is a decision you, the pilot, must make. The information in this article is to assist you should you decide to fly at night. It is absolutely not intended to encourage you to do so.

Preparation for First Flight

****Also see LPC #113 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #133 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP24-6 (CH33)****
FOCAL POINT - FIRST FLIGHT ASSISTANCE
The following VariEze builder/pilots have volunteered to give first flight assistance to any VariEze builder in their respective local areas. Many others have also done several first-flights on EZ's in their areas.

Steve Stuff 517 Roberts Street Monroe, WA 98272	Ray Cullen, 1116 6th Street T lamook, OR 97141
John Steicher, 960 86th Street, Downers Grove, IL (312)985-6671	Bob Woodall 8302 26th Ave, Adelphi, MD 20783 (301)422-6027

Thanks very much for offering your help, this is a much needed service and anyone else wanting to offer this kind of help should let us know, and we can publish names and addresses. With well over 200 VariEzes flying now, there is really no valid reason why a builder with no VariEze experience should have to make his first flight. We strongly recommend that any first flight of any new airplane be made by a pilot with at least 10 hours in type. Do take advantage of this from the many pilots who offer their skills and experience. A back-seat ride is not adequate checkout. Get the 10 hour front seat time or locate someone who has this experience.

****From CP24-7 (CH33,CH39)****
Reference the Australian fatal VariEze accident reported in CP #23 page 7. **We have learned that the pilot's total flight experience in the last 2 years had consisted of 1 hour solo and about 3 to 4 hours dual.** He grossly over-controlled the aircraft in pitch on his first take off, flying at a relatively heavy weight at a relatively aft cg. Based on this and analysis of a previous accident with similar statistics, we are recommending additional limitations for the VariEze operators manual. These are listed in the VariEze plans changes section of this newsletter (page 6).

****From CP30-1 (CH3,CH33)****
Video Tapes available from RAF
We are pleased to announce the addition of a new video tape. This tape was premiered at Oshkosh '81 and was made by Ferde Grofe. It is called "Go-a-Long-EZ" and we sell it here at RAF (VHS or BETA) for $49.95 plus $4.00 handling and postage. **Go-a-Long-EZ is an audio-visual presentation of the subjects covered in Appendix I and Appendix II of the VariEze and Long-EZ Owners Manual: Preparation for initial testing, including weight and balance and initial flight testing.** We also have the building seminar tape called, "Building the Rutan Composite". This tape sells for $59.95 plus $4.00 for handling and postage. Both of these tapes were shown daily at Oshkosh and proved to be very popular.

****From CP31-1 (CH3,CH33)****
Video Tapes - Building the Rutan Composites.
This tape shows you the "how to" with composites. It is a great help for first timers as well as experienced builders. When ordering your tape, please specify whether it is VHS or Beta II. $59.95 plus $4.00 for postage.

Go-A-Long-EZ is a tape that covers the checkout, weight and balance of your aircraft, how to conduct the taxi tests and first flight. $49.95 plus $4.00 for postage.

Orders for the Construction tape from overseas customers should be sent directly to the address below. Ferde will convert the VHS or BETA to the PAL system for you. At present he is only doing the construction tape.
Ferde Grofe Films,
702 Washington St.,
Suite 168,
Marina Del Rey, CA 90291

****From CP32-8 (CH3,CH33)****
VIDEO TAPES
RAF now has available a two cassette volume that contains the original "Building The Rutan Composites" as well as "Flying Is VariEze", "Defiant" and "Go-A-Long-EZ". All four programs run for a total time of 2:41. All of the above for $99.95.

We still have the single cassette of "Building The Rutan Composites", running time is 1:36 for $59.95.

California residents should add 6% sales tax and shipping to anywhere in the U.S. and Canada is $4.00, all foreign orders, add $8.00. Both of the above are available in the European PAL system.

****From CP34-4 (CH33)****
Long-EZ N81KP - First Flight Report
"July 5, 1982 marked the date for the first flight of Long-EZ N81KP. WOW! What a fantastic feeling to finally rotate, lift-off and fly after 23 months of construction. It is indeed rewarding to have a safe and uneventful first flight. Thank you Mike for flying chase! It was reassuring to have you at our first flight.

Mike you mentioned that it is unusual to see a first flight in which some small problem did not arise. We feel the way to avoid these problems is to find and resolve all squawks prior to that first flight. This attitude, of course, should carry right on through the life of the airplane for every flight. It is just too late to worry about problems when you're in the air.

N81KP now has 50 hours and has been flying flawlessly. The performance of N81KP meets or exceeds all the data in the Pilot's Handbook (based on the use of wheel fairings) and as yet we have not installed our wheel fairings. We are using a Lycoming 0-235 L2C (118 hp) with a B & T, 62 x 66 prop. The basic empty weight is 811 lbs. and this includes the standard alternator, vacuum system with D.G. and A.H. and "extra-cushy" upholstery.

Regarding the high speed taxi testing in preparation for our first flight: Our tests were conducted at Chino Airport using runway 21/3 which is 6,200 feet long. This was about the right length needed to achieve canard flying speed (50 kts), rotate, hold attitude and lift-off (60-65 kts.) to 5-10 feet altitude, then touch back down and stop. This enabled us to get a good feel for the landing flare and develop roll control (which is substantially quicker than most general aviation aircraft).

We are certainly grateful to all those people at RAF who so patiently and courteously answered so many questions. Truly this kind of builder support helps dreams come true!

Sincerely,
Paul and Kim Prout". (Father and Son)

****From CP35-9 (CH33)****
Avoid First Flight with 'Zero-time-type'.
When your EZ is ready for first flight, relax, take stock, be honest with yourself. In this day and age there is no reason for a person to have to do a first flight "cold turkey". There are enough of these aircraft around now that there is little excuse not to at least get a back seat ride. If you do not feel confident, get an experienced VariEze or Long-EZ pilot to do your first flight. Do not let pride get in your way. Having an experienced EZ pilot do your first flight is very often the smartest move you can make.

****From CP37-2&3 (CH33)****

The 'Real' George Scott reports over 80 hours on his Long-EZ and he is very happy with it. George is willing to help local builders with a back seat check out before they fly their Longs. Contact George at 14102 Susan Crest, San Antonio, TX 78232.

****From CP47-6&7 (CH33,CH39)****

This letter from Rob Cook, VariEze builder, is printed in its entirety. Hopefully, it will prevent anyone else from making the same mistake. Rob was doing a high speed taxi run with the canard installed, but with his main wings still in his garage! NEVER attempt a high speed taxi run unless you are mentally and physically and mechanically prepared to fly.

"Dear Mike,
First, thank you for your help and understanding. Feel free to publish the following account of my accident any way you see fit.

If you don't believe that the little canard on the front end of your VariEze produces all that much lift, listen to this! I've been taxi testing my VariEze for about two months. At the Concord, California airport it's easier to taxi to the other side to see friends, get advise, etc. than it is to drive around on the surface streets. I've taxied at indicated speeds up to 60 mph and found the airplane easy to handle throughout the speed range. These tests were done with and without the canard installed. The main wings are in the final finishing stage and the airplane has only been taxied once with them on.

On August 16, at 6:30 pm I lined up on 19 right and pushed the throttle to the firewall. The acceleration was brisk to say the least! I was indicating 60 mph in about three hundred feet. I pulled the throttle back half way and made sure I wasn't still accelerating. Everything was stable. I eased back on the stick and the nose came up slowly. The airplane was rolling straight but the nose kept coming higher. Pushing the stick forward resulted in no gain except in angle of attack. The throttle was off by now.

I remember thinking "Why am I going through this? I'm going to end up in the grass and be really embarrassed!" I was pressing full force on the brakes but to no avail. At 15 degrees angle of attack the prop started to contact the ground. I could hear it. The resulting torque transfer to the ground caused the airplane to start turning sharply to the left. I saw the tower and at the same time heard them dispatch the fire truck.

By now I was just along for the ride. The tires couldn't resist the turn and the airplane flipped. I remember seeing the tower roll inverted. The first thing to hit was the left wheel. The gear had enough spring to throw me into one more roll, this time landing inverted. The canopy shattered, the headrest collapsed forward, and the slide began. Thank God I didn't have my seatbelt on! I was conscious for the whole hundred foot ride. When everything stopped, I turned off the master and mag switches and started talking to myself. Just wanted to be sure that I stayed awake!

I was laying upside down on the back of my neck and bleeding pretty good. The fire truck was there immediately and I was pulled out and taken to the hospital. Three hours of surgery and six days in the hospital is mighty expensive learning. It took two more hours and two more days to have me back to being pretty again!!

Well, it has been three months and I'm back full time on the airplane again. It's in much better shape than I was. It's going to need a new canopy, right upper wing attach fitting, prop (the old one will make a nice sixteen inch clock), and what the hell, I knew I'd end up with the Long-EZ gear in the long run anyway. Oh, I almost forgot, the canard snapped five inches outboard of the spar on the under surface. It's already repaired and looks as good as new.

The FAA, bless their hearts, didn't call it an accident ... no intent to fly. Even though this has been written in a light vein, I think the message is pretty loud and clear. THINK, and after you've given an idea a thorough brainstorming, try it out on someone whose judgement you trust. And then .... be careful. The only reason I can give for still being alive is that it just wasn't my turn.
Sincerely,
Rob Cook"

****From CP47-13 (CH3,CH33,CH41)****

SHOPPING AT RAF

The following items are available from RAF. Of course, all the additional plans (meaning engine installation, owner's manuals, speed brake etc) are also available.

Moldless Composite Construction Book	14.50
VHS and Beta Tapes	
Moldless Construction	59.95*
Weight and Balance	59.95*
Both tapes bought as set	99.95*
*Plus $4.00 postage	
Gold and Silver VariEze and Long-EZ tie tacs	6.50
Books:	
The Complete Guide to Rutan Aircraft by Don & Julia Downie	13.95
Canard - a Revolution in Flight by Andy Lennon	17.95

T-Shirts:

Blue - Long-EZ logo with "Laughter silvered wings" - small, medium, large, Xlarge	8.00
White Polo shirts - Long-EZ logo with "RAF"	14.00
Caps - blue with white front and any aircraft patch of your choice	7.00
Patches- VariEze, Long-EZ, Defiant, Solitaire	3.00
Rutan Aircraft patch	3.00
Aircraft name patches	1.50
Some assorted belt buckles, mainly VariEze and Defiant and Solitaire	25.00
Posters:	
Long-EZ two ship	2.00
Defiant on Water	8.00
3-ship Defiant, VariEze and VariViggen	2.75
8 x 10 color Long-EZ	1.25
8 x 10 color Defiant	1.25

From CP49-5 (CH33,CH39)

A Northern Nevada VariViggen was involved in a first flight, take-off accident. The airplane was demolished but the pilot suffered only minor cuts and bruises. Unfortunately, this accident could easily have been avoided. The pilot had no current medical or biennal, nor had he flown at all in the past 3 years. He did not inform the FAA of his intention to fly and he attempted to take-off on an uphill runway with a tail wind.

From CP51-3 (CH33)

FIRST FLIGHTS

Congratulations to all of you who have reached the major milestone of first flight. Although we no longer hear from everyone who get this far, we hear from enough of you to know that there are a lot of new VariEzes, Long-EZs and even a few VariViggens, a couple of new Defiants and even a Solitaire.

It sure is great to hear that so many of you have achieved what must be one of the notable achievements of one's life, the building and flying of a machine that one has crafted with one's own hands. The first flight is the culmination of this experience and, for all of us, is a tremendously exciting and sometimes nervous time. When this time arrives for you, how can you be sure you really are ready? How can you be sure your flying machine is ready? We have always believed that the pilot must be current, must be proficient in at least two different airplanes, preferably three, and must be rested, relaxed and feeling good before he or she ever attempts a first flight on a brand new airplane.

Current means just that. You are presently flying something, be it a Cessna 150 or a Beech Bonanza, it does not matter just as long as you are, or have been recently, flying something. If at all possible, fly another example of the type to be tested. It is dangerous to combine a first flight in a new airplane with a pilot who has zero time in type. If something is unusual, he doesn't know if it's an airplane problem or his proficiency. If you have not flown for a year or more, do not even consider doing your first flight until you have taken a check ride in several types with a good instructor.

Tell him what you are about to try to do and have him really put you through a thorough proficiency check. Have him particularly concentrate on landings, balked landings, approach too slow. approach too fast - how do you handle it? Be as conscientious as you can, ask a lot of questions, be very sure you are feeling good, feeling confident in your abilities.

Now go out and check out in a Grumman TR-2, two place trainer or a Cheetah or a Tiger. When you feel good in this, then try to get a check out in some kind of a taildragger. A Champ or Citabria, or even a J-3 Cub would be good. It's not that you need taildragger skills to fly an EZ, but being proficient in a taildragger simply makes you that much more proficient overall.

Now you are ready, but is your newly completed airplane? The more pairs of eyes that look at it, the more likely you are to get everything the way it should be. Remove the cowlings, canard and nose cover. Invite the local EAA chapter to have their meeting at your home and have them all look at it. At least, try to recruit a couple of EZ builders to look at it. Concentrate on the control system. It is simple, functional and trouble free, but all the bolts must be tight, safetied, and have two threads beyond the lock nuts. Does the stick move freely to all limits without any friction? Friction in the pitch control will make the airplane very twitchy and difficult to fly. Friction in the ailerons (lateral control) will make the airplane unpleasant to fly because you will not know if you are pushing or pulling against control system friction or against aerodynamic loads. This makes it awkward and not much fun to fly. It really is a truly delightful airplane to fly if it has a nice friction free, precise control system. Of course, the rudder should snap back into the faired position after rudder pedals are depressed then released (they should also do this in flight! If they don't, this condition must be corrected). Also, be sure the elevator shape and canard slot shape is exactly the same as the check templates in the plans. If in doubt, take a "splash" of the surfaces, send a drawing of the splashed shape to us for comment before attempting to fly. Small differences in slot and elevator shape can have large effects on the safety of your airplane at low and high speeds.

The next point to concentrate on is the fuel system. Fuel lines should be fireproof and there should be no leaks of any kind, even with the boost pump running. Flush the whole system several times with gasoline. Clean all screens/filters. Check that all nuts and bolts on the engine, baffling, and exhaust system are tight and safetied. Be sure the prop bolts have been torqued correctly, and re-torqued at the specified intervals.

The engine controls are a critical area. You will need help to check these out, and they must be right! Check the throttle, mixture and carb heat for full and complete travel. The throttle and mixture must travel stop-to-stop smoothly with no tendency to hang up.

If anyone looking at your project spots a discrepancy, write it down. Make a list of these discrepancies no matter how small they might be. Do not fly unless all items that could compromise flight safety have been taken care of. This applies throughout the flight test period and indeed, the life of the airplane, but is particularly important for first flight. You will be nervous, you will be excited. This is normal. If you have taken care of your proficiency and your airplane's readiness, your first flight will be uneventful, safe and a memory that will last forever.

From CP52-7&8 (CH33)

FIRST FLIGHT PREPARATIONS

Tom Jewett of Littleton, CO sent us the following essay concerning preparation for your first flight. We enjoyed it and we agree with him 100%. We have printed it here so that all potential flyers can benefit from his perceptive point of view.

"March 22, 1986 7:35am Long-EZ, N35TM, takes off for its very first flight. After 2700 hours of work, it was time for some fun! That's right, fun! I believe that if all preparations are properly made, first flights of homebuilt aircraft should be fun. I would like to pass along my thoughts about the first flight of my Long-EZ, hoping that it will help others to have fun on their first flights.

A successful first flight depends upon four things being 100 percent ready. This simple checklist of four items includes: 1) The airplane, 2) The pilot, 3) The weather, 4) The circumstances. Great discipline is required to assure yourself that all four items on the checklist are 100 percent ready before attempting your first flight. Pressure to fly your new airplane will come from the most unlikely sources.

Obviously, the airplane must be ready, but what is less obvious is making sure that you have 100 percent confidence in your airplane. Prove to yourself that everything is in proper working order. If there is the slightest doubt about anything, fix it! The last thing you need on your first flight is doubt. I found that the best way to inspect your airplane is to have someone else double check your inspection. I was lucky enough to have other EZ builders and flyers who were willing to look over my work during construction and prior to the first flight. I was always amazed at the number of seemingly minor items to be corrected or adjusted that a different set of eyes would find. Even if you do not have other EZ builders or flyers in your area, enlist someone else to inspect your work. Do whatever it takes to develop 100 percent confidence in your airplane.

Pilot preparation for the first flight is very important because of all the "unknowns" that will be thrust upon the test pilot. Basic pilot proficiency must be very high so that the pilot can concentrate on how the airplane performs, not on basic pilot skills.

In my opinion, the best pilot proficiency preparation is recency of experience. During the four years of construction of my Long-EZ, I flew one airplane a total of 47 hours (less than one hour per month!) Needless to say, I was extremely rusty. To prepare myself, I flew the following aircraft: CE 150, CE 152, CE 172, American Yankee. All flights were made from the right seat to practice flying with my right hand and doing other chores with my left hand. I felt that flying the Yankee was the most beneficial because it is very similar to the Long-EZ, both in ground handling and flight characteristics. The major differences are: 1) The Yankee requires a higher power setting to maintain a comfortable decent rate during landing approach, 2) The climb rate of the Yankee is much lower than that of the Long-EZ. After I felt proficient in all these airplanes, I was lucky enough to get a one hour flight in the back seat of a VariEze. The resulting critique of my pilot skills from an experienced EZ pilot was invaluable. In summary, I flew 13.8 hours in five different aircraft in the two months prior to flying my Long-EZ.

The other pilot preparation which I would highly recommend is to make a definite flight plan for your first flight. Use your owner's manual for procedures and target airspeeds, but do not forget that your airplane may behave differently from the airplane upon which the owner's manual is based. Discuss your flight plan with as many experienced pilots as you can. You will get good and bad suggestions, but overall, it will help. I wrote my plan out in the form of a checklist and practiced flying through it in familiar airplanes. You will be a test pilot on your first flight (and many flights thereafter) so practice being one!

The weather is a simple checklist item, but it should not be overlooked or neglected. Proper weather conditions are at least as important as any other item on the first flight check list. If, for any reason, you are uncomfortable about the weather, wait. Don't make yourself fight adverse weather conditions on your first flight. Make sure you have plenty of ceiling so you can fly at a safe altitude, and try to make your first flight on a cool day. All airplanes perform better at cooler temperatures.

Last, but not least, on the first flight checklist is the "catch-all" that I call circumstances. In includes many intangible things, the most important of which is the condition of the pilot. If you are tired from a full day of preparing yourself and your airplane, it is probably best to wait a day until you are fresh and your mind is clear.

Another circumstance to consider is traffic. Try to make your first flight at a time of low traffic. You will have your hands full with your new airplane, and heavy traffic will be an unnecessary distraction. Also, consider the number of spectators/assistants on hand to witness the big event. As you build your airplane everyone says, "Call me when you get ready to fly that thing." I, personally, think that having many spectators around provides more distractions than benefits. I chose to have only my wife and a fellow Long-EZ builder present at my first flight, and this worked quite well. The "ground crew" used a hand held radio and a copy of my flight plan so they could follow the progress of the flight and make notes as I transmitted them down. Having a support crew member who is familiar with your type of airplane and its systems is very helpful (especially in the event of any malfunction). However you decide to make your first flight, make sure that all the circumstances are correct and that your support crew is the one that you have chosen.

As you approach your first flight, you will be anxious to fly, and many opportunities to do so will present themselves, as they did for me. I mentally went through the checklist: 1) Airplane, 2) Pilot, 3) Weather, 4) Circumstances. At least twice I had three of the four items ready so I decided to wait. When I had four of four ready, I went flying, and I had fun! I was well prepared, the airplane performed beautifully, the weather was great, and the circumstances were perfect. Be careful, and have fun!

From CP53-7 (CH9,CH33,CH38)

CAUTION: BINDING BRAKES

Dave O'Neill, Long-EZ builder from Johannesburg, South Africa, writes of his first flight. Empty weight was 849 lbs. with starter and alternator and 500 x 5 wheels. The only problem Dave had was one that could effect all of us and this is binding brakes. Even a fairly light binding of the brakes can increase rotation speed significantly. Dave had to accelerate to more than 15 kts. above normal rotation speed in order to get the nose wheel off. This is potentially quite hazardous since you are taxiing at above flying speed and things could get out of hand quite rapidly in the event of some small problem. Check your brakes before you go out to do your high speed taxi runs and be sure that the brake discs turn freely between the brake pads when the brakes are not applied. Thank you for this important point, Dave, and congratulations on your first flight.

From CP53-7 (CH22,CH33,CH38)

CAUTION: AIRSPEED INDICATOR INACCURACIES COULD CAUSE PROBLEMS ON A FIRST FLIGHT.

Fred Mahan, Long-EZ builder/flyer reports that on his first flight he was uncomfortable on final, felt too slow, decided to check his airspeed indicator. Using a water manometer, Fred discovered that his airspeed indicator read 200 kts. when the manometer said 200 MPH. This continued all the way down to 40 kts, so his airspeed had been mis-graduated by somebody. This meant that when he was indicating 75 kts., he was, in reality, only doing 65 kts.! This could have been a "gotcha"! Of course, it was great at the high end. Fred thought he was going really fast! Check your airspeed indicator before first flight. See the neat water manometer suggestion in this CP.

From CP53-7 (CH22,CH33,CH38)

HOW TO TEST YOUR AIRSPEED INDICATOR by Verne Vawter

This neat water manometer article is taken from the Long-EZ Squadron 1 newsletter.

One instrument in my airplane that has been a source of constant irritation is the airspeed indicator. For some reason mine always reads too low and my friends' airplanes, at least during hangar flying sessions, say they are always faster than mine.

On the verge of an inferiority complex. I decided to do some investigation which revealed that the airspeed indicators are based on a well known physical law and that it is feasible for owners to check and calibrate their own aircraft's speedometer.

Before I relate the principles of airspeed theory, based on Bernoulli's Law, let's get right into how simple it is to make an instrument called a manometer, which is easily put together of a little of this and that found at most hardware stores.

EQUIPMENT REQUIREMENTS:

1. Approximately 10 feet of clear plastic tubing preferably 1/8 inch to 1/3 inch inside diameter (it should cost between $1.00 and $1.25).
2. A board 30 inches in length suitable for mounting the plastic tubing in a "U" shape.
3. Some type of "T" fitting. This can be made by soldering small pieces of copper tubing together.
4. A yardstick.
5. A few ounces of water with a little bit of food coloring to aid visibility and a small quantity of detergent as a wetting agent.

TESTING PROCEDURES:

1. Examine the pitot tube carefully and if there is a small drain hole, cover it with tape.
2. Stretch the one end of the plastic tubing over the nose of the pitot tube (see Fig. 1).
3. Blow the manometer until the water level between the two sides of the tube has approximately 20 inches difference in heights. Pinch off the air supply tube and check for leaks. If the manometer and the static system are free of leaks the water level will remain constant.
4. With one person in the cockpit viewing airspeed indicator, bleed off the air by releasing the pinch referring to the chart (see Fig. 2) for proper water level differences. Start with a water level that is appropriate for the speed of your aircraft. For example, if your plane is capable of 180 mph, there should be 16.16" difference between the levels of water in the "U" shaped tube. If your airspeed indicator is reading 183 at the 16.16 inch differential level, you know it's 3 mph fast. Repeat the procedure at 160 mph, 140 mph, 120 mph and so on. Most airspeed indicators are usually two to three mph off somewhat in their range. Naturally if there is a leak in your airspeed system this is indicated by an inability to hold the water level. It is sometimes difficult to bleed the correct amount of air to reach the exact inch difference that you want. Often several attempts are required. The yardstick is moved up and down so as to measure the different levels that the water will reach.

DRAWINGS OMITTED

Bernoulli's Law: The controlling physical law of a manometer

$$hw = \frac{Pair}{Pw} \cdot \frac{V\text{-squared}}{2g}$$

hw = height of water inches
Pair = density air
Pw = density water
V = velocity air miles per hour
g = gravity

V (mph)	Hw (differential height of water in inches)
60	1.77
80	3.16
100	4.95
120	7.14
140	9.73
160	12.7
180	16.16
200	20.0
250	31.6

From CP57-9 (CH33,CH39)

A TEXAS HOMEBUILDER took eight years to complete his VariEze. His total experience consisted of about 150 hours in Cessna 150's and 172's. He had not flown solo for some time. He called RAF and explained what had happened. He successfully made his first flight, although it was very short and he had a lot of trouble with pitch control. On the second flight, during the take-off and climb, he again had difficulty with overcontrolling in pitch. At higher speeds, it flew great, but when he slowed down to land, he got into a PIO (pilot induces porpoising), got slow while trying to get it under control, the EZ pitched up then pitch down, crashing hard on the runway. The nose gear and left main gear were torn off; the prop and lower winglets were broken.

By his own admission, this pilot said he was anxious to fly, but he overstepped his ability and his experience. He says, "Don't lie to yourself, don't fool yourself. If you are not ready, get someone else to fly it and check you out, or get the necessary training".

We appreciate this pilot's honesty and his guts in calling us with this accident report. Don't kid yourself into believing you can do it if you know in your heart that you are not ready - profit by this pilot's experience - it cost him his airplane and eight years of hard work. Don't let it happen to you.

From CP62-8&9 (CH33,CH39)

A Louisiana Long-EZ crash-landed on its first flight. The pilot was not injured. Although we have very sketchy data on this incident, as is our policy, we are publishing all we do know as we do on all accidents and incidents we hear of.

Apparently the pilot got behind the airplane on final, got too slow and developed a high rate of sink. The airplane hit hard failing the gear, slid along leaving the runway and flipping over. The winglets were broken, one wing was ripped off and the canopy was smashed. The head rest broke off, but incredibly, when the airplane was lifted, the pilot had only minor cuts and bruises.

As with all accidents and incidents reported in the CP, the only reason we print them is to hopefully help someone else and maybe prevent a similar situation by being forewarned. There is no intention of judging a pilot or his or her actions.

What can we learn from the above accident? Although our own records do not show it, the FAA says that a high percentage of accidents in homebuilts occur on the first flight. This is one that did. There is no question that the sight picture out of the front seat of an EZ on final, is not like anything the average low time private pilot may have seen. It is unlikely that he has ever sat on the aircraft centerline before. The EZ must be set up to land a little differently than the "standard" Cessna, Piper, etc. In fact, it is much closer to a modern jet fighter in some respects. There is no prop in front of the pilot, the airplane does not pitch nose down as a Cessna or other single engine certified airplanes do when flaps are lowered, and it does not have to be rounded out or flared when close to the ground as a Cessna does. Rather, the landing attitude is set on 1/2 mile final by simply slowing to 80 or 90 knots. The landing brake creates no lift, no pitching moment as flaps do, all it does is provide drag to steepen the glide slope a little. The nose high attitude necessary to land is strictly a function of airspeed. Slow to approach speed and the airplane will automatically set itself to the correct touchdown attitude. Now, simply fly it onto the runway. When you have 20 to 50 landings in your log book, you can finesse the touchdown with a tiny flare, but for the new EZ pilot, this is not necessary or desirable.

Because of this "difference" in an EZ, whenever it is possible, always try to get at least a back seat ride in an EZ before you attempt your first flight, particularly if you don't have much flying experience. This can easily make the difference between a successful and unsuccessful first flight.

Just as you carefully, even meticulously, prepare your airplane for first flight, so must you prepare yourself if you are to be the pilot. Get yourself current and proficient in at least two different aircraft: A Grumman TR-2 and a Cessna 150 would be excellent, or a Champ or Luscombe and a Piper would be fine. The point is to be as sharp as you can be. Then find someone who will give you a ride in their EZ. A VariEze or a Long-EZ, it does not matter. Get a little stick time, maybe even fly an approach, it will make an enormous difference if you have at least flown in an EZ.

That is not to say they are difficult to fly - they are not, they are just a little different. Another thing to keep in mind is this - ANY aircraft will develop a high sink rate if you get it too slow, including canard types. Don't be lulled into a false sense of security by thinking you can pull the stick all the way back on short final and the airplane, because it is a canard, will look after you! A canard airplane is just like a conventional airplane, it must be at or above flying speed to fly. Get it too slow and a canard airplane will sink just as a Cessna or Piper will.

Flight Test/Envelope Expansion

****From CP30-4 (CH33)****

Trimming the Aerodynamics of your EZ

Like any other aircraft, the trim and stability of a VariEze or Long-EZ depends on correct cg position and proper contour and incidences of all flying surfaces. There is an easy way to verify that your aircraft is rigged properly with the incidences correct. This involves flying at several airspeeds while monitoring the elevator position, then comparing your data with the design information. Measuring elevator position in flight is simple since the pilot can easily see an indicator attached directly on the elevator surface. If your EZ does not handle, perform and stall exactly as described in the Owners Manual it could be due to an improper incidence or contour of the wing, canard or elevator, and you should conduct the test below to see if your elevator is at the correct position. If the elevator position is not correct, your airplane may also have a large trim change when flying into rain.

Fabricate the plate and needle from .016 2024 aluminum. Paint the plate white and the needle black. Mount the plate to your outboard elevator fairing and the needle to the elevator (use 5 minute epoxy it will later peel off without damaging your paint job). Calibrate your elevator position (plus is trailing-edge-down) using your elevator position template from Chapter 11, page 6, making a mark on the white plate every 2 degrees.

Now, load your aircraft to the mid-cg position (99 for VariEze and 101 for Long-EZ). Fly in stabilized conditions, smooth air in level flight at 70, 80, 90, 100, 120, and 140 knots indicated. Plot your elevator VS speed data on the graph shown below. Your data should fall within the limits shown. RAF is interested to see the variations of this data occurring due to tolerances from one airplane to another. If you do this test, please send us your data whether or not it is within the limits shown. **SKETCHES AND GRAPHS OMITTED**

****From CP30-12 (CH33)****

Performance Flight Testing Lecture

This year at Oshkosh, Burt presented a lecture on basic methods to conduct performance flight tests and on data corrections and standardization methods. Many in the audience asked for a list of the equations used, so he promised to print them in CP #30. Room here does not allow a presentation of the total lecture with pilot techniques, but those who were in attendance will be able to use the information below: **EQUATIONS OMITTED**

****From CP31-4 (CH9,CH33)****

Caution - Damage From Brake Heat

Do not conduct your taxi tests, high speed taxi and first flights with wheel pants installed. You will be using far more brake during this period than is normal. See Long-EZ Owners Manual, page 41, under low speed taxi.

If you do have wheel pants installed, it is possible to generate enough heat buildup to soften the main gear strut and cause it to sag/fail.

Long-EZ and VariEze - Glue a piece of fiberfrax on to the outboard face of the main gear strut to protect the strut from local heat radiation from the brake disc.

****From CP48-4 (CH11,CH33)****

CAUTION

ELEVATOR CONTROL STOP POSITION. This applies to VariEzes as well as Long-EZs using the original GU canard (Roncz 1145MS not affected). The design philosophy of the EZ canard type airplane calls for the canard airfoil to develop maximum lift coefficient (CLmax) at full aft stick. Thus the elevator trailing edge down (nose up command) stop must be set correctly. On an accurately built GU canard/elevator, this will usually be at approximately 22 degrees (trailing edge down).

Recently, we have heard from a few builders, both VariEze and Long-EZ, who have noticed stall characteristics that were not "per the handbook". In all cases, the cause was the elevator nose up stop set to allow too much elevator travel. If you have noticed any of the following symptoms, check that you have no more than 22 degrees to 22-1/2 degrees trailing edge down travel on your elevator.

1) Perform a 1-'g', wings level, straight ahead stall with sufficient power to maintain level flight. Slowly pull the control stick back to full aft stick. This should result in a nose high attitude with a "pitch bucking" that can vary from hardly noticeable to quite vigorous, perhaps "one buck" per second, with a deck angle change of several degrees per "buck". This is normal and will vary depending on the cg. If, however, you notice a strong stall break (canard stalls) and the nose comes down through the

horizon until you are in a stable shallow dive, even though you are still holding full aft stick, the speed may build up to over 100 KIAS before the EZ begins to climb again. This very long period pitch "bucking" can be as long as 30 seconds per cycle and is indicative of too much elevator trailing edge down travel. You can verify this by releasing back pressure on the stick during the nose down phase of the cycle and gently raising the elevator trailing edge perhaps 1/8" at a time.

This should allow the canard to develop more lift and pitch the nose up. Try to determine by experimenting with elevator position, where CLmax is, then set your elevator stop at that position.

2) Another classic symptom may be noticed during a take off. At full aft stick, it may take a longer take-off roll to lift off that it does at, say, slightly forward with the stick. If you have ever noticed this, it should be corrected. Under certain circumstances, this could become a serious problem. A Long-EZ builder/flyer in Alaska, attempting to take off on a rather short runway, discovered that he was rapidly approaching the end of the runway and, even though he was holding the stick all the way back, was not rotating. Realizing he was not going to make it, he backed off from the full aft stick stop and, to his surprise, the airplane literally jumped into the air! Again, his trailing edge down elevator stop was set for too much travel. This same scenario has also been reported to us by a San Diego VariEze pilot.

What causes this? If the elevator stop is set so that at full aft stick your canard can develop its maximum possible lift, this will result in the lowest possible rotation speed for take-off and a good, clean canard stall (limiting the main wing angle of attack) or classic "per the book" stall at full aft stick in flight. If, however, you have set your elevator stop for too much travel (perhaps you thought you could lower your rotation speed?!!) what happens is that you are now on the "back side" of the lift curve, lift is less than maximum, <u>and</u> the elevator is creating lots of drag. The result may be running off the end of the runway. Keep in mind that this condition could be aggravated even further if it were raining.

From CP50-7&8 (CH30,CH33,CH38)
"Dear Folks at R.A.F.
I am very pleased to announce that N721EZ made it's first flight earlier in September and as with many of the other builders the initial flight went off perfectly. Performance has been without exception, right out of the owners manual.. Basic empty weight is 853 lbs., with starter, wheel pants, and a 25 amp/hr gell cell up front. 125kts IAS @ 2500 rpm fits very well within the 65% power range. I now have over 22 hours of very enjoyable time and look forward to completing the required time.

Although I'm happy to report the excellence of this design, I actually wrote to describe a problem I had after the fourth hour. Having made the modifications to the flight controls in the last CP (LPC 131) and coating the firewall with the intumescent paint, I had the crankshaft seal split and lost two quarts of oil over a one hour period. Fortunately, I kept my first 10 hours down to one hour segments. On removal of the cowling, I decided to run a short inspection and discovered very small fuel stains running down the firewall from the Facet fuel pump. Had I not had the new firewall paint on, I might not have noticed the stain. The stain was reddish and did not coincide with the 100LL fuel which confused me at first. The stains were not very much at all and I was almost going to dismiss them but I elected to turn on the fuel pump and watch it for awhile. After 5 minutes, a single drop of fuel dripped out from the back case of the pump.

A few drops of fuel over a 5 minute period does not seem like much but it was enough for me and off came the pump. Close inspection did not show any fuel coming from either of the fittings so I pried open the back of the pump and there found a surprise. The central core of the pump was wrapped with coils of enamel coated wire (red) and then finished wrapped with cloth. The cloth was soaked with fuel and stained red I presume from the fuel acting on the enamel wire insulation. It's anybody's guess what further progress this may have taken. I am in the process of returning the pump for inspection.

Since the last newsletter had important information the fire hazards, I thought I would pass this information along to you.

If I may make any suggestions to builders on their initial flight test program, keep the first few flights short and near airports in the restricted areas. Also, even though the cowlings may be a small inconvenience to take off, during these first few hours remove them and check things over.
Once again many thanks,
Rick Glos"

From CP59-5&6 (CH11,CH12,CH17,CH19,CH31,CH33)
<u>THE BUNGEE ELEVATOR TRIM SYSTEM ON AN EZ.</u>
This is an area that has generated a lot of questions and this will be an attempt to help answer many of those questions and, hopefully, give everyone a better insight into the EZ bungee pitch trim. First of all, all that follows here assumes you have built your airplane reasonably accurately - that canard incidence is correct and that wing incidence and relative wing incidence is correct. These items can greatly influence elevator's position and will effect the bungee trim system's ability to trim.

The elevator shape is critical to the success of this bungee spring-operated pitch trim system. If the elevator is the "perfect" shape, it will float in a faired position relative to the canard at approximately 120 to 130 KIAS, without the springs. This means that at this speed, the aircraft will fly hands off and maintain level flight, even if the springs are disconnected and removed. This is about optimum and not everyone will have this situation. If you do, it will then be possible to pick a pair of springs that will provide you with enough spring power to trim the plane hands off down to the approach speed (approx. 65 KIAS), as well as to trim hands off up to the maximum level flight speed. This is normal and perfectly acceptable. Now, if you go faster (by descending, for example, you may run out of forward trim and may have to provide this force by maintaining forward pressure on the stick. Again, for an EZ, this is normal and nothing to be worried about. At the same time, you will probably have to "help" the trim system by maintaining back pressure on the stick as you approach a stall or reach full aft stick. This, also, is normal for an EZ and many other planes.

The problem is when your elevator shape causes your elevator to float, no springs, at, say, 80 KIAS or at, say, 160 KIAS. Obviously, if either of these cases applies to your aircraft, your elevator shape is not correct and you will probably not be able to come up with a pair of springs that can provide enough range to cope with as low as 65 KIAS or as high as, say 170 KIAS (max. level speed). This is because the elevator is trying to fly to a different position than the one you need it to be in for the speed you are indicating. If you put a strong enough spring into the system, you may be able to overcome the elevator's lift and force it to a position it does not want to be, however, this is a losing proposition for two reasons. You almost certainly will not be able to trim hands off at the other end of the speed range, and more importantly, your speed stability will be compromised. All EZ's (Vari and Long) have excellent speed stability (as do all Defiants). That is to say, if you set the power for a given speed and trim for level flight, the airplane will maintain this speed even if you displace the airplane by pushing or pulling the stick. When you release the stick, the plane will quickly return to level flight and be on speed as before provided you did not change power or trim. If you install overly powerful bungee springs in the trim system, to overpower an incorrectly shaped elevator, your airplane will not return to the trim speed. In fact, it will be difficult, maybe impossible, to trim it to fly level at any speed.

We have tested this by simply removing the trim springs and flying the airplane. We attempt to fly level at various speeds, increasing speed perhaps 5 Kts at a time, until we find the trim speed at which the EZ flys level, hands off without diving or climbing. This speed should be close to 130 KIAS. 120 KIAS is OK, 135 is OK but much more or much less will require a fixed trim tab on each elevator or a new elevator with the correct shape. A small aluminum tab pop riveted to the bottom trailing edge of each elevator and bent up per sketch (See page 12) can be adjusted to cause the elevator to float exactly at 130 KIAS with no springs. This will allow you to use the weakest possible pair of springs that can provide enough force to hold the plane hands off from approximately 65 KIAS to approximately 170 KIAS.

We are not necessarily recommending that everyone go out and fly with no trim springs! On the contrary, while it is not difficult to fly without any springs in the pitch trim system, it is extremely aggravating and tiring because you have to hold the trim force required all the time. You can never relax or let go of the stick. So keep the flight short (or fly at the elevator's natural trim speed, once you have determined it). Do not attempt to conduct a test flight such as this unless you have plenty of experience in the airplane. We have done this many times and it is not that big a deal. It is just not a good idea for a low "time in type" pilot.

With the correct shaped elevator, your bungee trim system should provide you with the capability to trim hands off from around 65 KIAS to around 170 KIAS, no more and probably no less. If you have to push to fly level at 150 or 160 KIAS, your elevator shape is wrong and its lift is stronger than your springs. The only way to fix it is to install the fixed trim tabs (one each side) or to build a new, correctly shaped elevator.

****From CP60-11,12&13 (CH19,CH20,CH25,CH33)****

HOW TO CHECK IF YOUR AIRPLANE IS STRAIGHT.

So you have a few hours on your new EZ/Long/Defiant/etc., and you are buzzing around within your limited 25 mile radius of home base - why not spend the required hours you have left to take a close look at your airplane. Specifically, checking the rigging, the "straightness", if you will, of your brand new creation.

Assume you have built a "perfect" airplane, both wings are mounted to the fuselage at the correct incidence with zero relative difference, the canard is straight and at the correct incidence, and the two winglets are correct and exactly symmetrical relative to each other. This airplane should fly at cruise power, level flight, with the ball centered and both ailerons even and faired with the wing trailing edges. Depending on the CG and the speed, the elevator may also be perfectly faired with the canard tips. Since elevator position is a function of speed and, to a lesser degree, to CG position, I will limit this discussion primarily to rudder and ailerons.

How many of you have reached this goal? Not many I would bet. I know my own Long-EZ certainly is short of this state of perfection. How important is it to have a perfectly straight airplane? Difficult to say. Obviously, the straighter it is, the less control surface deflection there will be in high speed flight and the lower the drag and the greater the efficiency will be.

How do you check for a straight airplane? First of all, you will have to have a slip indicator, accurately installed. This can be a short length of yarn stuck to the canopy on the aircraft centerline with a small piece of masking tape (this will only work on gliders and pushers!). Place it about 12" up from the leading edge of the plexiglass canopy. If you have a needle and ball, a turn coordinator and ball, or just a ball, it must be mounted in the panel, ball centered with the wings exactly level. Be sure this is correct before attempting to evaluate the airplane.

Now, before you conduct the following flight test, check to see that the two elevators are rigged perfectly, relative to each other. You will have to remove the canard to check this out. Simply eyeball along the elevator trailing edges. They should be in a straight line. If they are not, you must correct this before doing the flight testing. Elevators rigged incorrectly will roll the airplane.

Also, stand behind your airplane looking at the center of the spinner. Raise or lower your head until your eyes can see along the top skin forward of the trailing edges of the wings. You don't want to be looking down on top of the wings or up at the bottom skins. You must be able to see the trailing edges and the top skins as a line. Now, without tilting your head, look from the right wing to the left. Any differences? Shouldn't be. If you can see more of the top of one wing, you have a relative incidence problem. Make a note as to which way it should roll and verify this in flight.

Take off and establish a high cruise in level flight, feet off the rudder pedals and ailerons perfectly centered (if you can't see your ailerons, take a passenger along to help you get them centered. Remember, your limitations allow you to carry a passenger if they are essential to the mission)! Now, look at the ball. Is it centered? Are the wings level? Probably not! Bummer, oh well, take comfort in knowing that almost everyone else is in the same boat! Keep the ailerons centered (visually verify this), and "step on the ball", that is, step on the rudder to center the ball. Step on the rudder opposite the direction of the yarn slip indicator. Lock your feet, ball centered (yarn centered), keep ailerons centered, and carefully observe the horizon and your DG (if you have one) to see if the airplane is flying a straight course over the ground or if it is slowly turning. If you have no turning rate and your wings are level with the horizon, you have one or both winglets attached to the wings slightly crooked. Even though you have a small error in your airplane, at least you know what is wrong and it can be corrected.

What if you are turning? Carefully null out the turn. Use just enough aileron in the proper direction to zero the turn. Verify this by watching for zero heading change on your DG or by observing a distant peak or other prominent object on the ground at the horizon. This takes a little time and patience but you can get it perfect if you try. With zero turn rate and the ball centered, check how much aileron and rudder deflection you have and in which direction. An assistant can be a great help here. Have them write down, for example, "right aileron up 3/16", left aileron down 3/16" and left rudder outboard 1/4", right rudder at zero." These dimensions can be quite accurately "eyeballed" with a little practice. If you doubt your passenger's ability to judge this, before you fly, have him or her sit in the passenger seat and you move the ailerons and rudders, using a scale and have them call out what they see. Now you know you have a relative wing incidence problem, as well as a relative winglet incidence problem.

Block the rudder out to whatever the eyeball estimate was by taping a small wood block to the inboard trailing edge of the winglet. When the rudder is released, it should close on this block and remain deflected outboard the estimated amount. Repeat the flight test and verify that the ball is centered with zero turn rate.

Now, in the case of a Long-EZ or Defiant, you will have to install shim washers on one of the outboard wing attach bolts such that the wing incidence is altered in the proper direction, i.e., in the example above of the right aileron trailing edge up, this wing would need to be shimmed by perhaps one thin washer (AN960-816L) on the bottom outboard bolt. The left wing probably should be left alone until you look at the results of this change in flight.

Fly it and see if this was enough and if it was in the correct direction. Remember, do this kind of adjusting only in small increments. Use thin washers or thin shim stock, one piece at a time, starting with the wing that appeared to be off when you eyeballed the airplane from behind, whichever wing needs to be shimmed to raise the trailing edge. If one washer on one wing does not do it, add one on the other bolt on the opposite wing. Keep both wings even by eyeballing from behind - do not get one wing much different than the other. Continue using small increments until the airplane flys wings level, ball centered with zero turn rate.

You now have a straight but ugly airplane! Unfortunately, if you have already painted it, you will have some work to do. If it is still in primer, fair the fuel strakes to match the wing roots with dry micro (West System). To fair the rudder with the upper and lower winglet (on a Long-EZ), use a hacksaw blade to cut through the outboard skin along the rudder hinge line to the top and bottom of the winglet. If necessary, widen this saw cut as required and cut through the foam core to the inside of the inboard skins above the rudder and below the rudder. Check that you can now flex the trailing edges of the top and bottom of the winglet til it lines up with the rudder (still in its blocked outboard position). Now, reduce the amount the rudder is blocked out by approximately 10 percent, fill the saw cuts with micro and force the top and bottom outboard to exactly match to the rudder. Clamp them in this position and allow to cure. Layup a 2-ply BID repair over the saw cuts and fill, sand and finish. Install a permanent block, full span along the inboard trailing edge of the winglet to block the rudder in its proper faired position. You can use wood or a piece of pre-cured glass here.

Your airplane should now fly straight and the winglet repair will not be detectable.

This works great on a Long-EZ, but what about a VariEze? Since it is not possible to adjust the incidence of the wings of a completed VariEze, you will have to do surgery to the TOP of whichever wing it takes to correct the tendency to roll. If it rolls left (ailerons centered), you will have to slit the top skin of the right wing, outboard of the aileron along the aileron hinge line and bend this trailing edge up as described for Long-EZ winglets/rudders. If you have to do this to your VariEze, call me at RAF and let's discuss it before you do it.

Well, I hope this is helpful and not too confusing. I'd be happy to discuss this with any builders or flyers who may find themselves having to make this kind of correction.

Mike Melvill

****Also see LPC #115 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see LPC #116 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP30-1 in the "Preparation for First Flight" section of this chapter.****
****Also see CP31-1 in the "Preparation for First Flight" section of this chapter.****
****Also see CP32-8 in the "Preparation for First Flight" section of this chapter.****
****Also see CP47-13 in the "Preparation for First Flight" section of this chapter.****

****From CP36-4 (CH33,CH37,CH39)****
Unintentional Spin in Homebuilt - Long-EZ N711OA
As you know, our Long-EZs have undergone extensive high angle-of-attack testing at all cgs and configurations and the results have shown them to be immune to stall, departure or spins. Vigorous and sustained combinations of all flight controls were input, by us and by a NASA pilot with the same results. The Owners Manual does caution, though that experience has indicated not all examples fly the same and that the builder should be aware of differences. We have recently heard from a Long-EZ owner who has experienced a spin and his report is published below. It is possible that he was operating aft of the aft limit cg. His impression of the effects of power for recovery are probably due to the oscillatory effects of the incipient spin since it lasted only two and a half turns. Conclusive data on power effects can only be made after a stable (developed) spin rate is achieved (over 2 or 3 turns) and by study of flight test instrumentation-obtained data. See also our LPC #115 on page 6.

Pilot Info: Age 63, 30,000 plus hours, flew Aeroncas, Cubs, Monocoupes, Cessnas, Stinsons, Wacos, Fairchilds, Douglas DC 3-4-6-7-8, Boeing 747 etc. Currently own half interest in a Pitts S-1, Long-EZ and a 1927 Monocoupe".

"Conditions - Gross weight 1070, Fuel 84 lbs left tank and 42 lbs. right tank, CG - maximum aft, altitude 3000 ft, SL - 2200 ft above ground, WX - CAVU.

While approaching a stalled condition with the nose about 15 degrees up, air speed 62-65 mph, the left wing went down about 60 degrees followed by the nose dropping and the airplane entering a left spin. The nose was at least 60 degrees down. After the spin had started, an attempt to recover was made by using forward stick and opposite rudder. There was no response. Opposite aileron was also used which may have aggravated the situation. The aircraft had a rather rapid rate of rotation - faster than a Citabria type but less than a Pitts S-1. Also there was pressure to the right - being pushed against the right side of the cockpit. With no response from basic control inputs the throttle was "jabbed" which resulted in a momentary slower rotation rate. When the engine idled back, the rotation returned to its original quite rapid rate. The throttle was then opened (1/8 - 1/4) and left there. The spin rate decreased and a recovery was effected. The pull out from the dive did not result in high air speed. The actual speed was not observed: however, the G load was not excessive - less than the bottom side of a loop with the airplane.

The number of rotations was about 2 and a half and 800 to 1000 feet of altitude lost. After climbing a few thousand feet a half hearted attempt was made to duplicate the situation, but it was unsuccessful.

With the many times that the almost identical flight conditions have been explored that is the only time this condition ever surfaced or gave any indication that it might surface. The airplane has about 180 hours on it and flys and performs beautifully.

Approaches to stalls have been very normal and docile. Usually a wing will drop (30 degrees at the most) followed by the nose dropping, and then wings can be leveled with either rudder or aileron. During this incident no attempt was made to level the airplane until the resulting spin was entered.

That the gyration was a tight spiral does not seem logical for a couple of reasons. From past experience with spins and spirals, had the airplane been spiraling considerable speed would have built up and basic control would have been regained. Also the pull out would have had much more speed.

As to the effect that the engine had on recovery, one wonders whether it was the thrust that aided recovery or the resulting torque, or both.

The only change to the aircraft since the original flight test is the addition of wheel fairings. It would not appear that they would cause appreciable change in flight characteristics particularly at such low air speeds.

Sincerely, Paul Wallace.

Paul reports that he installed 10 lbs of lead in the nose and his Long-EZ now flies at full aft stick per the book.

NOTE: When doing the original envelope expansion on your new Long-EZ, wear a parachute and have at least 7000 feet of altitude. If you find yourself routinely operating at aft CG, ballast to around mid CG. Any aircraft flies better at mid CG, a little lead up in the nose does not hurt a thing.

****From CP37-5 (CH33,CH39)****
Shortly before this newsletter went to press, we began investigation a fatal accident in which a Long-EZ apparently struck the ground in a flat attitude, possibly from a flat spin or deep stall. Of course, the results of all testing shows that a Long-EZ is not capable of a flat spin or deep stall, when flown within the allowed limits. Preliminary information shows that the cg may have been behind the aft limit. Even though this aircraft was highly modified, we are concerned that it is possible that others operating near the aft limit and with contour tolerances that degrade flying qualities from the intended and tested configuration, may also be susceptible to spins. At least until this accident is totally investigated and understood we are recommending the Long-EZ aft cg limit be moved forward one inch. **Also be sure you follow to the word all information on Pages 44 and 45 of the Owners Manual.**

****From CP39-3 (CH33)****
WEIGHT AND BALANCE
Recently here at RAF we have been conducting several weighings of the two Long-EZs. For test flight purposes, we needed actual center of gravity information for a certain condition. During these exercises, we were sharply reminded just how careful you have to be. Remember, accurate weight and balance data on a new airplane is critical to flight safety.

We have a librated certified balance beam scale. We decided it would be easier if we used 3 scales, so we borrowed two balance beam type scales. We assumed these scales were accurate and we conducted a whole series of weighings in order to establish actual pilot position (with parachute), actual fuel load position, and actual position of required ballast. It took the best part of a working day to get all of this information logged for two airplanes and then to drop reactions and measure the actual location of wheel centerlines, canard leading edges etc, etc.

At the end of all of this very careful, painstaking work, we reduced all of the data and came up with some pretty significant errors! The errors were small regarding the actual aircraft cg, but quite large when we tried to pin point the pilot's position or the position of required ballast or fuel. After much head scratching and figuring, we found that two things had "bitten" us. 1. One of the borrowed scales was inaccurate to the tune of about 15 lbs. in 400 lbs. 2. The nose gear shock spring when loaded with pilot, parachute and ballast collapsed slightly, allowing the nose wheel centerline to move aft on the scale. If this is not noticed and taken into account, your results can be very misleading.

The lesson to learn there, is that we have conducted dozens of weight and balances over the years, and should know better. We ended up with some erroneous figures that could have conceivably resulted in someone getting hurt. Do not take your scale accuracy for granted. Check it with a known weight close to the weight you expect to weigh. Be sure that the axle center line fuselage stations, as measured on the floor by dropping reactions using a level or plumb bob, are the same when the airplane is up on the scales and loaded as required.

****From CP39-5 (CH21,CH33,CH39)****
A modified Long-EZ crashed on the Southern California coast. (This accident was mentioned briefly in CP37). We have actively been trying to determine a possible cause on this one but so far have been frustrated. Although there were a few eye-witnesses, their information is sketchy and contradictory. Several witnesses reported seeing the aircraft flying low along the beach and pulling up into steeply banked turns. No one we have talked to saw the actual impact. We have carefully examined the wreckage and it appears that the airplane struck the beach with very little forward speed in a flat attitude. There was no evidence of rotation. This aircraft has a non standard fuel system. A header tank containing 5 gallons was built into the space over the centersection spar, aft of the passenger's head. This tank was kept full with a fuel pump at all times, and the engine was gravity fed from this header tank.

The aft cg, and the vertical cg of this fuel possibly contributed to an unacceptably aft cg condition for the airplane, particularly at higher deck angles, when the vertical cg would cause a worse aft cg condition. We know this aircraft made its first flight with 30 lbs of ballast in the nose. There was no evidence of any ballast in the wreckage.

NOTE: We would like to reiterate what we said in CP 37. Due to individual builder tolerance build-ups, and contour variances, you cannot assume that your airplane will behave exactly like the original prototype, N79RA. Because of possible variances, **we are now making the aft cg limit of F.S. 103 (recommended in CP 37), a mandatory permanent change.**

****From CP44-3 (CH30,CH33,CH36)****
WARNING
We have recently learned that some Long-EZ operators have been attempting to overextend the intended capability of the aircraft by installing larger engines than the O-235 and/or by attempting overweight operation. These practices are hazardous and cannot safety be conducted on the aircraft. A re-design to allow this operation would not be just a simple replacement or beefup of a few components.

A major development for adequate airframe/propulsion mounting/landing gear/brakes would be required, as well as wing area increase to meet reasonable energy limits for forced landing. In short, you would be talking about a new aircraft and a new test program.

Overweight operation will definitely result in structural problems with landing gear, brakes and possibly airframe.

From CP46-2&3 (CH13,CH19,CH30,CH33,CH36)

HOMEBUILDER MODIFICATIONS

Recently we have noticed a trend towards homebuilder modified Long-EZs, particularly the long nose and heavier engines. These are not RAF approved modifications and we are concerned that most pilots may not be aware of what they could possibly be getting into. First of all, the longer nose IS destabilizing in pitch as well as directionally (yaw). How much of it may influence your particular airplane is not known. We believe you as the pilot should know just how stable your own airplane is. We strongly recommend to anyone who has modified their own aircraft in this way, that first of all you should install vortilons on the main wings. The vortilons allow a little more stall margin. Secondly, you should put on a parachute, and climb to at least 10,000 feet above the ground and at that altitude, you should fully explore the stall/full aft stick characteristics of your airplane. Do it first at a mid cg position, then ballast to the aft limit, (103") and do it again. In this way at least you will be aware of any possible unpleasant stall behavior or unstable tendency, and you would be a lot less likely to later discover any nasty trait at low altitude with no margin for a safe recovery.

We are really concerned when we hear that a particular builder has done a major modification to his airplane. For example, a larger, heavier engine and a longer nose. Then he goes out and flies it for a few hours and then tells all the builders in his area what a neat thing he has done. Now some of these builders decide, based on his results to do the same thing. Meanwhile, the original experimentor never did test his airplane at aft limit cg, at full aft stick, with aggravated control inputs, or at the red line or at limit g so he never knew for a fact that his airplane was safe. Another builder, influenced by the first experimentor makes similar changes, goes out and while demonstrating the much touted stall characteristics to a passenger, enters a deep stall condition at low altitude, does not have enough room to recover, and so he and his airplane become another statistic and make not only the Long-EZ look bad, but also puts a blot on the accident record of all homebuilts.

To sum up: If you must make changes to your aircraft, keep in mind that you now have a different airplane than the original plans built Long-EZ prototype. Your new design may have perfectly safe aft cg, high angle of attack flying characteristics, but it may also have unsafe, nasty characteristics, just waiting to bite you at an inopportune time. To protect yourself, and any future passenger you may take for a ride, 1) you should install the vortilons, 2) you should thoroughly test your airplane at aft cg, high angle of attack (full aft stick) with aggravated control inputs. **If your airplane does not handle well, limit your aft cg. You do not have to go back to the published limit.** If you are not comfortable at 103, try 102 or 102.5. If it is good there, limit it there, note it in your log book, placard the airplane, and don't ever exceed this (or any other) limitation. Remember, each Long-EZ, or any other homebuilt design, is different. Don't assume because Joe Blow did it and was safe, that you will be. You may not be and that really can take the fun out of the whole project. Don't ever lose sight of the fact that, that is what this whole thing is about - having fun!! FLY SAFE AND ENJOY.

From CP55-5 (CH12,CH19,CH20,CH31,CH33,CH37)

HIGH ANGLE OF ATTACK DEPARTURE TESTING

Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable. Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

From CP55-6 (CH33)

WEIGHT AND BALANCE

We recently heard of a serious deep stall accident in a homebuilt plane (not a RAF design) in which the builder pilot had not conducted a weight and balance! To quote Burt in CP12, April 1977 - "Now hear this, all of you homebuilders, an inadequate or inaccurate weight and balance could kill you! The final weight and balance you do on your plane before flight testing begins is just as important as installing the wing attachment bolt!" DO NOT NEGLECT THIS CRITICAL FLIGHT SAFETY ITEM.

From CP63-9 (CH33)

Computer program to calculate Center of Gravity on a Long-EZ or VariEze. Will work on any IBM or IBM-compatible computer. A simple program, EZ to use and it gives you a printout of your weight and balance to keep in your aircraft. A really simple and neat idea. Send $5.00 to cover the cost of the 5" floppy disc and postage.

James H. Langley
245 E Kimberly Street
Republic, MO 65738
417-732-1143

Emergency Procedures

Also see CP33-4 in the "Long-EZ Plans Changes" section of this chapter.
Also see LPC #110 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP40-4 in the "Fuel Management" section of this chapter.
Also see CP38-10 in the "Refueling" section of this chapter.

From CP24-7 (CH21,CH33,CH38,CH39)

ACCIDENTS

Since CP #23 there have been two off-field forced landings in VariEzes due to engine failure. No injuries, but both aircraft received major damage. The one in Southern California landed in the desert after the engine failed (reason yet unknown) taking the gears off and buckling the forward fuselage. The other in central California - engine failed just after take off when the pilot selected a tank with water in the fuel. (non-standard fuel system). The field was undulating soft grass. When the aircraft touched down it took the main gear off and damaged the under fuselage and wings. The nose gear was not extended. Rain water got into the tank due to a very badly deteriorated "O" ring in the fuel cap. The aircraft had no gascolator or tank drains.

What is learned from the above? **First, we don't recommend the nose be retracted for any landing no matter what the terrain is, even water.** The nose gear provides extra cushion and keeps the nose from slapping down and digging in after the mains hit. The one possible exception could be brake failure after landing to retract the nose to keep from running off into unfavorable terrain or obstacles.

Water in the fuel system - - be sure the cap "O" rings are in good shape. Be sure all three drains are installed and used. If you suspect water, drain at least two quarts. Drain first while the nose is down from the wing tanks then from the gascolator with nose up. Some times it takes a lot of doing to get to the water. Run your engine at high power for awhile before take-off (nose up) to purge the water. Better to have it quit on the ground than just after take-off.

Don't be in a big rush to switch tanks. Have a safe landing area in sight before switching tanks if you can. Especially the first time you take fuel from the tank. In the case of water, even if you switch back to the "good" tank, you may not get it going in time. It takes a long time to purge water out of the carb. Also don't take short cuts on your systems, it takes a lot less time to do it right the first time than rebuild it.

From CP28-3 (CH13,CH33)

A note from EZ Ed - owner of one of the highest time VariEzes.

Burt asked me to jot a note for the newsletter since at this writing (4/22/81) I have 680 hours on 777EJ. It first flew in March of '78 and since that time we have really flown it quite regularly. In '78 we went to Oshkosh plus explored all of California twice. In '79 we made a trip through Canada, we were going to Alaska but "someone" got carb ice and Joanne had a tooth go bad in Calagary. In 1980 we went to Montana (home again) and toured some in that area. We also made the Bahamas trip in '80-81 to cap off '80 and start '81. At Easter we went to Loreto Baja Sur, Mexico. Had a really great time.

The reason that the hours build up on 777EJ so fast is that I also use the airplane in my work. I work for Placers Savings and we have 22 branches. I visit each branch at least once a month and often more frequently. I average flying to a branch once or twice a week, (the boss buys the gas) so we really get to keep the cobwebs off Echo Juliet.

As far as maintenance goes I really haven't had any major problems. The engine has run great but I did a top at 400 hours and had one wierdo, a warped intake valve seat. Those two problems though didn't stop the flying for long.

I have used a lot of brake pads as the airplane is an all brake situation after it's on the ground. I can touch down say at 75 mph on a 5200 ft runway, (I did it at Mendocino, with a passenger) and probably would go off the other end. That's with speed brake down and rudders extended. **If I ever suspected I didn't have brakes I would land nose gear up.** A 2" x 3" x 1/4" steel pad is good for at least 3 nose gear up landings!

When we get 1000 hours we will write another article.

Ed Hamlin.

****From CP33-5 (CH33)****
EMERGENCY PROCEDURES
Ditching in water
Actual ditching has not been experienced to test the following procedure. However, this should provide the best chance for success. Wear your life jacket for overwater flying. On descent, bend safety catch away but do not open canopy. Extend the nose gear. Touchdown should be planned at minimum speed, landing into the wind. Land on the back side of a swell, or parallel to the swells. The aircraft or major components of the airframe should float and support occupants and equipment due to the large amounts of structural closed cell foam.

****From CP35-9 (CH33)****
Prop Windmill and Forced Landings
An EZ's prop will windmill at flight speeds above 65 to 70 knots. However, while practicing slow-flight or stalls at 60 knots or less, if your engine's idle is set too low, or you run out of fuel on one tank, the engine may not only quit running, but the prop may stop. Should this happen, and you do not have a starter, keep calm, switch tanks, verify mags on and mixture rich. Push the nose down and build up at least 135 knots (155 mph). The prop will begin to windmill at 125 to 135 knots and the engine should start. A windmill start uses less altitude if you initially dive steeply to rapidly attain the 135 knots. If you are faced with a forced landing for any reason, pick out a smooth spot and execute a NORMAL landing. Extend the nose gear and speed brake and land as if you were on your home field, DO NOT try anything fancy. Make a normal landing. If there are obstacles in the field, guide the fuselage/cockpit between them.

****From CP40-4 (CH18,CH33,CH39)****
Canopy Opening In Flight In An EZ
Ralph Gaither, an experienced naval pilot with over 26 years of experience in airplanes and a VariEze pilot/owner called the other day to let us know of a canopy opening that he had. First of all his canopy warning system was out of order, a micro switch had failed. (Don't laugh, this can happen to you!) Secondly it was a hot day in Arizona. The canopy was kept open while taxiing out to the runway. The canopy was locked, then the wind shifted necessitating a long taxi to another runway. The canopy was opened for better ventilation (you can see it coming, right?) To make a long story short, he had to quickly fit in between traffic for take off, his safety catch had somehow gotten bent and did not catch, so the canopy opened fully at between 200/300 feet AGL during the climb out. Ralph, kept his cool, he flew the airplane, maintaining the climb, left the throttle full up, reached with his left hand and grabbed the canopy rail. He pulled the canopy down and closed it on his wrist (not fully closed). He climbed out in this configuration until at 1000 feet AGL. He trimmed the airplane as best he could, and throttled back to fly level at a reasonably slow speed (100 to 110 knots would be best). Then he took his right hand off he stick and calmly locked the canopy and continued on his way. Ralph's canopy does not have the throw over stay that was shown in CP 30, page 8. Rather he has a simple retaining cable. He expressed the concern to us that he felt that the over-center type throw stay may have made it much more difficult to close the canopy in flight. We have given this some thought and we agree. It would be more difficult to close the canopy, but certainly not impossible. Anyone who flies an EZ with this type of stay, will know that it takes both hands for about a second to flick it over center and close it.

It is food for thought and we wanted to give the builder and flyers the benefit of Ralph's experience. We believe the throw over stays advantages out weigh its disadvantages. It is very light, it will hold your canopy open in a wind without allowing it to crash closed or open against the fuel tank. It does not impose the tremendous torsional loads through the canopy frame that the gas spring type canopy restrainers do.

Consider also that there has to be literally a triple failure before this would become a factor in flight.
1. The canopy warning system must have failed.
2. The safety catch has to fail.
3. The pilot must have a brain failure, or fails to comply with his or her checklist.
All three of the above have to occur before the throw over stay becomes a factor. We at RAF have elected to keep our throw over stays but we feel that each individual builder should make his or her own decision.

Incidentally, Ralph reported that **the airplane was not at all difficult to fly,** he easily maintained heading and continued his climb. The biggest thing to remember is to FLY THE AIRPLANE.

****From CP52-6 (CH13,CH33,CH39)****
The following two incident reports were sent in by Long-EZ builder/flyer, Jimmie Hays.

"I had a totally unnecessary off-airport landing the other day. I pulled the airplane into an exceptionally nose high attitude while bleeding off speed from cruise to do some stall tests. **As I pushed over to recover, the carburetor became unported and the engine quit.** This wasn't altogether a surprise, but when the engine would not start right away after speed and "G" forces were returned, it was a definite surprise!

I went through all the emergency procedures (several times!), switched tanks, boost pump on, pumped the throttle, tried carb heat, talked to ATC, all to no avail! I was over distinctly unhealthy terrain but, fortunately, there were a couple of fields in gliding distance. I made the decision to lower the nose gear on short final, to absorb some of the landing shock and minimize nose-over possibilities. At about 25 feet, I noticed, for the first time, the tach was resting on zero! Too late to hit the starter, I went ahead with the landing. A very short landing roll in very sandy, loose soil. I am sure happy I decided to put down the nose gear. The only damage was some paint damage and the loss of one vortilon while loading it onto the wrecking truck which got stuck 4 times getting out of the field!

Obviously, checking the tach has now become VERY MUCH a part of my personal engine-out procedures. The prop had stopped in the horizontal position and may not have been noticed, even if I had looked back."

Canopy/Nose Gear Experience
"Less than 6 hours into my test flight period, I failed to lock the canopy before take-off. Everything went perfectly normally through rotation and until the mains came off the runway. Suddenly, the canopy slammed open against the safety catch. The noise level immediately went up from wind and engine noises. I, also immediately, thought of all the stories I'd read about control problems with the canopy open. I reached to grab the canopy with my left hand and my right hand subconsciously followed, driving the nose gear smartly back into the runway. I reacted almost as quickly, raising the nose again, but, alas, the nose wheel was no longer there. What a strange looking thing that nose gear strut is in the bare state when you look at it through the little plexiglass window.

Naturally, the nose wheel assembly had found the prop, so now I also had a lopsided prop to add to my problems. The nose wheel and fork assembly came through the whole affair quite nicely (and is still doing well with 200-plus hours). The only damage was the four bolts having failed as described in CP51. I retracted the nose gear strut and landed with minimal skin damage in the nose area. LESSONS LEARNED: 1) Fly the airplane! 2) the airplane would have flown quite nicely with the canopy open against the safety catch. 3) the airplane is distractingly noisy with the canopy partly open. 4) the canopy won't lift against the safety catch until just at take-off speed and attitude. 5) wooden props will keep going with quite a lot of damage. 6) FLY THE AIRPLANE, STUPID!"

****From CP55-5&6 (CH19,CH33)****
CAUTION - AILERONS FREEZING
Jerry Nibler, an Alaskan Long-EZ builder/pilot tells us of an experience he had near an area known as "the trench". He encountered heavy rain and low visibility while trying to fly north so he did a 180 degree turn to where there were breaks in the cloud cover and climbed up on top. Climbing through the freezing level at 8,000 feet, he noticed the ailerons getting stiffer and stiffer until he could hardly bank the plane at all.

This scared him rather, so say the least, so he did another 180 degrees and descended below the freezing level where the ailerons returned to normal, much to his relief. Jerry thinks the rain water got into the hinges, did not have time to dry out completely before he climbed to the freezing level where, or course, the moisture froze. He advises to stay below the freezing level after flying in rain or taking off covered in dew until the airplane has a chance to completely dry out.

This is a good point, one we have mentioned in the CP before but one that should be repeated because it can really scare you if it happens to you. We have had it happen to us in a Long-EZ as well as Burt's Defiant. We found we could control the bank angle well enough to continue by using the rudders and, eventually, the ice sublimated away and we were able to break the ailerons free. We suspect that water runs across the bottom of the wing, bridges the gap between the bottom wing skin and the leading edge of the ailerons, then freezes there. You can help this a little if you keep the ailerons moving left and right as you climb through the freezing level.

Thanks for this report, Jerry. This is the kind of thing that can really help out a fellow EZ pilot. By the way, Jerry ended his letter by saying that his Long-EZ is the most valued of all his material possessions and has provided him with more shear pleasure that anything else he can think of (yes, even more than that! he says).

****From CP56-6,7,&8 (CH33,CH39)****
ACCIDENTS AND INCIDENTS
Bob Yarmey, a professional pilot and Long-EZ builder, was involved in a serious accident in his Long-EZ. Recently he offered to share his thoughts with all of us and he wrote this accident report and comments. It is not often that any of us who fly get to hear the thoughts and opinions of a pilot involved in a serious crash for obvious reasons. Bob is a very experienced pilot and a very observant person whose views may be very important to all who fly. We found his comments on how to touch down in a short field in a emergency such as he had, most instructive and very perceptive. **The average homebuilder/pilot is so concerned with damaging his creation that in a bad situation, instead of trying to preserve the safety of the people aboard, he or she is likely to try to preserve the airplane at all costs.** As Bob has pointed out, this is not the way to go. We can appreciate this point, particularly, having been there a time or two ourselves. Every EZ builder should read this accident report several times. The time may come when knowledge such as this could save your life. We are most grateful to Bob Yarmey for taking the time and having the courage to write this report so that others may benefit.

REQUIEM? FOR A LONG-EZ
With much excitement, I awoke on the morning of June 14, 1986. The previous night, I had been up late - washing and waxing my Long-EZ, N23RY. I wanted her to look her very best while on display at the big Texas Sesquicentennial Airshow in Waco,

Texas. With my wife, Margi, settled in the back, we enjoyed a comfortable 45 minute flight from our home base at the Addison Airport in North Dallas.

It grew to be an oppressively hot day - right at 100 degrees. We enjoyed a great airshow, yet after having answered hundreds of spectator questions, we were anxious to get airborne once the field reopened. A little over half way back to Dallas at approximately 2500 feet AGL, we experienced a sudden complete loss of power. Searching around, I spotted a field about a mile off the right wing. As I swung into a wide right-hand turn to land into the wind, I turned on the boost pump, switched fuel tanks and checked the mixture and mags - all to no avail. Established on a base leg, I can recall observing a line of trees at the roll-out end of the field and utility lines at the approach end. Given what I estimated to be about 2,500 feed of field in between, I decided that my approach path should be planned to just clear the wires. I felt well prepared for this situation since I had performed a good number of practice forced landings and actual engine shut-downs both during my thorough flight test phase and subsequently. My 170 hours in this Long-EZ had been accumulated since her maiden flight four months previously. My overall experience includes 9,300 logged hours as a professional pilot in a wide variety of aircraft.

Once on final, Margi recalled me saying that I needed to go a little bit lower. I remember feeling confident on a short final that everything was going to turn out OK. Tragically, this was not the case as I was to realize while slowly emerging from heavy morphine sedation a week or so later.

I was disappointed with the FAA's investigation of the accident. Once the badly damaged forward fuel lines were by-passed and the prop replaced, the engine started up and ran satisfactorily. Despite the extensive damage at the fuel selector location, the FAA said the AN 818 aluminum coupling nuts were found to be finger tight and listed this as the probable cause. This was hard for me to accept as I had recently applied fuel lube to help unstick the fuel selector valve and had checked that these fittings were plenty snug. **I personally suspect that given the hot conditions and my use of mogas that the occurrence of vapor lock was a possibility.**

The accident investigation revealed that after impact with some smaller gage wires near the top of the cluster, the aircraft impacted the ground 70 degrees nose down at approximately 70 kts wings level. The fuselage shattered with severe damage extending to and including the front seat bulkhead. I was ejected at the impact point as the aircraft flipped over and came to rest 27 feet further on. Margi was terrified as she remained secured in the inverted aircraft with fuel coming out of the broken vent lines. Other damage included: a clean shearing off of the right winglet at the attach juncture, one-third of the top left winglet crushed (with no apparent damage at the juncture), the left-hand baggage pod sheared off in the wing saddle area although the right-hand pod remained attached intact, the canopy and aft turtle-deck were flattened to within approximately 4 inches of the longerons, the head rest sheared off along with a good portion of the front seat bulkhead, the canard remained surprisingly intact except for major crushing damage to the center section area.

We thank God that given the severity of the forward fuselage and canopy damage, that both Margi and myself came out of it alive and reasonably well. She suffered a concussion and a cracked rib. We were very fortunate that bystanders were immediately available to re-right the aircraft and extricate Margi. Also, a veterinarian was right on hand and administered three tourniquets to me. A Care-Flight helicopter delivered me to the emergency room in quick order. I don't know how, but I appeared to have maintained consciousness during the whole ordeal. Unfortunately, both my legs were eventually amputated just above the knees. I am thoroughly convinced that my decision to employ approximately 15 pounds of extra thickness thermo-foam absorbed a great deal of the impact forces and prevented both of us from receiving any internal or spinal injuries. **In reflecting on how this tragedy might have been avoided, I would advise against the use of any automotive fuel.** Although I had no problems in using it up to that day, operating temperatures had never exceed about 80 degrees. In all honesty, I cannot rule out that human factors may have played a part. The long hot day standing on the concrete ramp left me feeling irritable and not too perky. It is possible that my judgement could have been impaired.

The point at which my landing gear snagged the thin wires indicated that just another two feet of altitude would probably have put me in the clear. In evaluating the position of the canard relative to a line extending from my eye level to the aircraft flight path it appears to be within the realm of possibilities that the highest thin gage wire that I struck could have been hidden from my view by the canard. **With this in mind, I would caution anyone flying a canard aircraft to closely eyeball the approach area well prior to getting set up on final approach.**

Besides being concerned with the utility lines at the approach end, I was equally preoccupied with the consequences of not stopping before reaching the trees at the end of the field. I suppose its a natural feeling for a pilot - especially a homebuilder to avoid anything that could inflict even the slightest damage to his creation. **Had I been willing to just get it down and accept the possibility of minor airframe damage, I could have avoided all personal injury.**

No other aircraft has ever come close to providing me with the great satisfaction and sheer flying excitement as N23RY did. Given the nature of my disability (specifically, loss of ankle articulation), the rudder/brake combination of an unmodified Long-EZ represents a viable and realistic opportunity for me to get back flying again. I am contemplating a static load analysis of my aircraft which has been stored in my garage. Amazingly, close visual inspection of the wings, spar, strakes and rear half of the fuselage reveals no apparent damage. Any builder/flyer of a properly constructed Long-EZ is entitled to utmost confidence in its structural integrity, energy absorbent characteristics and resultant crash worthiness.

My twin brother, Al, and his wife, Cathi, are heading towards completion of their beautiful Cozy later on this year. I'm really excited and will not hesitate to go up and fly that Rutan derivative.
(Signed)
Bob Yarmey

From CP58-4&5 (CH18,CH33,CH39)

BIRDSTRIKE! BIRDSTRIKE!

"On the Sunday after Thanksgiving, my wife and I departed Inyokern airport (Mojave desert) for a casual Sunday morning flight in our Long-EZ. I climbed out to 5500 feet MSL (approx. 2500 feet AGL), leveled off and throttled back to approximately 150 mph TAS. I looked up just in time to see a bird about 50 feet above my flight path and several hundred feet ahead. I didn't have time to determine its direction of flight or which way I could turn to avoid it. I had probably less than 2 seconds between first sight and impact. Just before impact, the bird winged over and dove down, striking the canopy head on .....instant explosion/implosion? The canopy was shattered and completely missing from my head forward. From my head back, the canopy stayed intact.

The bird and/or plexiglass struck me, knocking my headset off and giving me a fat lip. The bird ended up in the back seat. My glasses were undisturbed.

I immediately throttled back and nosed up slightly to reduce airspeed to keep the debris from flying around and anything else from ripping out. I was in control of the airplane at all times and slowly turned for the airport 8 miles away. I reached for my headset microphone, cupped my hand around it and declared an emergency. I was later able to put my headset on while my wife took the stick.

We proceeded to motor back to the airport at about 100 mph. The direct wind in the face was no worse than riding a motorcycle at 80 mph. My glasses stayed put with no problem. The plane flew fine and a normal landing was made.

The prop was totaled. There was a chunk missing from each blade (approximately 1" x 1/2" x 1/2") and one blade had a split from the tip toward the center about 10" long. I experienced no noticeable vibration on the flight back or in taxiing. The bird's head was missing and probably went through the prop. The leading edges of the prop were severely chewed up by the canopy fragments. The webfooted bird (Duck??) weighed in at 1-1/2 pounds. My wife was bloodstained but unhurt with a duck in her lap.

My canopy was formed from 1/8" thick plexiglass. The manufacturer increased the thickness for Long-EZ canopies to 3/16" a few years ago.

Prop and canopy: On order!

Gary Spencer"

EDITOR'S COMMENT

Char and Gary Spencer's experience with a birdstrike that broke the canopy is the first reported EZ incident of its kind. Gary remained cool and FLEW THE AIRPLANE and with no further problems, made a safe landing at his home airport. Congratulations, Gary!

We have had several reports of birdstrikes on the canopy, as well as other parts of the airframe, but none resulting in a broken canopy. Now we hear from a Texas Long-EZ builder/flyer who inadvertently took off without latching his canopy. His safety catch had been bent so it did not catch as it should have and the canopy opened rapidly, and with enough force to fail the "throw over" canopy stay bracket on the canopy frame. This allowed the canopy to open beyond its normal position and smash into the right fuel strake, breaking the plexiglass canopy into small pieces. This occurred right after lift off and, to make matters worse, it was raining! Well, our intrepid pilot remembered to FLY THE AIRPLANE. He ignored the canopy problem, slowed down to cut down some of the stinging effect of the rain and flew a normal pattern back to a safe landing on the same runway he had so recently departed from. Apart from the stinging raindrops, he suffered more form hurt pride than anything else. His canopy frame was in perfect shape, all the plexiglass was gone, but incredibly, there was no damage to his prop! Presumably, the pieces departed toward the right winglet with enough velocity to completely miss the prop. He reports that the Long-EZ flew OK, he had no trouble maintaining control or in making a normal landing. Now he is faced with the unenviable job of replacing the plexiglass canopy.

All of this goes to show that as long as you continue to think and continue to FLY THE AIRPLANE, you can fly away from even this kind of a serious emergency problem. Replacing the plexiglass is tedious, hard work but it can be done, and it's a lot easier than trying to repair a badly damaged airplane - or worse.

1) NEVER fly with your canopy warning system inoperative - NEVER EVER.
2) CHECK YOUR SAFETY CATCH FOR CORRECT FUNCTION BEFORE EVERY FLIGHT, it could save your canopy or even your life. - NEVER FORGET that there have been several fatal accidents because the canopy opened on take-off or in flight.
3) IF you are unfortunate enough to have an emergency situation such as an open canopy in flight, if you do nothing else, FLY THE AIRPLANE, then, and only when you have the airplane under reasonable control, you might consider what else you could do.
4) When pilots are faced with an emergency, frequently their first problem is realizing (or admitting) that it is an EMERGENCY. That is the first switch that must be thrown. After the pilot accepts that he or she has an emergency, and is FLYING THE AIRPLANE, and has reasonable control, obviously the flight may have become non-standard to some degree or other, depending on conditions, careful evaluation of the situation must then determine the extent of deviation from normal procedures. You must get back on the ground as quickly and as safely as possible, but NEVER exceed your own capabilities. If necessary, declare an emergency, but get an immediate clearance for any runway (if at an airport). You may have to land

downwind, or crosswind, whatever. Keep your cool, watch your speed and make as normal a landing as possible, depending on the circumstances.

From CP58-13&14 (CH30,CH33,CH39)
A California VariEze suffered an engine failure over the airport and crash landed short of the runway in two to three feet of water. The airplane flipped over and the pilot did not survive. The FAA has stated that their initial findings are that carb ice was probably the cause.

This was carefully looked into by people much more expert in these matters than we here at RAF, and their report to us was that, yes, they would have to agree with the FAA. The weather was conducive to induction icing with light rain, fog and high humidity. This pilot was in the process of fine-tuning his EZ with the intention of entering it in the CAFE 400 efficiency race. With this in mind, he was after fuel efficiency at medium power setting. He made a number of improvements to his Continental 0-200 engine but one of these changes was probably very significant in light of the accident. He altered the intake manifold to include an expansion chamber, or plenum, downstream of the carburetor or, in this case, a throttle body. While throttle body types, in general, are highly resistant to carb ice, it is strongly suspected that the induction ice in this case probably formed in the plenum downstream of the throttle body. Tests have shown that allowing the fuel/air mixture to rapidly expand after it comes out of a venturi, or throttle body, can cause immediate and severe induction icing in the plenum and intake tubes, yet not form any ice in the carburetor or throttle body.

In view of the situation, this is very likely what happened. The builder/pilot had been experiencing power related problems since installing the new plenum -type intake manifold and had, in fact, been working on a carb heat system. He arrived over head the destination airport and reported having lost power. Visibility was poor, but he was seen on short final, gliding toward the runway threshold. Tragically, he was about 50 yards short and touched down in 2 to 3 feet of water on the extended runway centerline. The EZ pitched nose down and flipped on its back where it remained until rescuers lifted it out of the water. The plexiglass canopy was broken, the canopy frame was undamaged as were the latches and hinges. The canard failed aft on both sides, leaving a short center section of the canard still attached to the fuselage. Left and right pieces of the canard from the fuselage sides out were torn off. The fuselage was damaged below and aft of the canard. The wings and winglets were not damaged. After drying out the engine, it started and ran OK although a magneto was replaced due to waterlogging.

What can we learn from this tragedy? The pilot was unable to exit the airplane, either because it was inverted with its nose and canopy imbedded in the mud on the bottom of the shallow bay, or because he may have been incapacitated by the impact, or both. Obviously, this situation was very bad and the chances of surviving a crash landing in shallow water are very slim. Since this accident, RAF has received a number of calls and letters wanting to know how to ditch an EZ. **We honestly do not know of a safe way to ditch any fixed gear airplane. The possibility of nosing over is very high with fixed gear since the gear dragging in the water produces a powerful nose down pitching moment.**

If we were faced with an unavoidable water landing, we would put the nose gear and landing brake down and we would fly into the water as slowly as possible while still maintaining control. We would not unlock the canopy because when the nose dives under water, a 60 mph jet of water entering under the canopy and striking the pilot in the face, would almost certainly be incapacitating. We would recommend carrying a canopy breaking tool such as a heavy, short bladed knife, kept where the pilot could easily reach it. After the airplane has come to rest, be it upright or inverted, if the canopy was intact, the canopy breaking tool should be used to break the plexiglass, making a large enough hole to exit through. Since an EZ will almost certainly float, particularly if it remains mostly intact, the surface would not be far away.

Prior to touch down, declare an emergency and, if possible, give an accurate position report. (A Loran would sure be handy here, since you could broadcast your latitude and longitude position.) Tighten your seat belt and shoulder harness as tight as you can bear it and brace yourself as best you can. Try for the slowest controlled touch down, no fancy stalling maneuvers, these will usually only compound the problem. Since the EZ-types will almost certainly nose over, be prepared for this. Remain calm, release your seatbelt, break out and swim to the surface.

Better yet, since a successful water landing is so uncertain, perhaps we should all seriously consider remaining within gliding distance of land at all times. EZ's were never designed with landing in water as one of the goals, and they are almost certainly not at all suited for this activity.

One other VariEze crash landed in water. The cockpit area broke up and the pilot found himself swimming. He made it to the beach but had a fractured back and wound up in a body cast for two months. His EZ was severely damaged and he never did rebuild it.

Surprisingly, or perhaps not surprisingly, one of the phone calls we got suggested we, or someone, should conduct a test by deliberately crash landing an EZ, preferably by remote control, in water!

From CP60-10&11 (CH33)
SAFE FLYING IS AN ATTITUDE
This safety suggestion was sent in by former Navy Safety Officer and VariEze pilot, Ralph Gaither.

"I am one of those guys who does more flying than writing, with little input for your newsletter. I modify as recommended and have little trouble with my VariEze. I use my aircraft to support my business as a professional speaker. With reasonable weather - any city within a thousand miles is fair game. My EZ is like many of those heavy ones with full gages, nav package plus loran. I have made my share of mistakes (as noted in my previous comments to you) but have always flown the aircraft first and came out ahead. One suggestion for consideration. I have a few hours around gliders and one thing these birds teach you is to always have a place to land... I believe we should all keep that in the back of our minds as we travel. I find myself constantly on the lookout for the nearest airport, major highway or just a good looking farmer's field to put down in case of an emergency. It becomes a part of my flying and keeps me alert too. Nice to have when that surprise comes along. Make it a part of your flying too.

Hope to see you all at Oshkosh."
Ralph Gaither

Editor's comment. An excellent suggestion. Thanks, Ralph. We have practiced Ralph's system for many years now and can attest to its success from a couple of actual forced landings.

From CP64-3&4 (CH33,CH39)
A Long-EZ based in Oregon crashed on take-off and the pilot was fatally injured. The cause is not known at this time but, as always, RAF publishes all accident reports we know of in the hope that these reports and analyses may help others to avoid the same problems.

The Oregon EZ had been flying for just over a year. It was reported to be a "work of art", a potential show winner. The pilot was in the habit of flying locally at least once or twice a week so he was very current. He was known for his steep climb-outs after take-off, so it was no surprise to the eye witnesses on the day of the accident when he climbed very steeply. However, at about 300 feet above the ground, the engine quit and the Long-EZ nosed over and crashed. There was no attempt to flare or land, it simply flew a parabolic arc and crashed nose first. The forward fuselage was heavily damaged but the wings, fuel tanks and centersection were essentially undamaged.

We may never know exactly what happened here, but the lesson that comes to mind is, as always, "Fly The Airplane". If you are still physically able to, you must maintain flying speed and you must contact the ground wings level, nose high at, or slightly above, minimum flying speed. Try to aim between any obstacles to minimize damage to the fuselage/cockpit area. You have an excellent chance of surviving any landing if the aircraft is under control when it touches down. Above all, never give up! Continue to fly the airplane right to the ground and then brake as required to guide the plane to a stop.

Hot Dogging

From CP34-6 (CH33,CH39)
Don't allow yourself to be deluded into thinking that you cannot get into trouble in your VariEze or Long-EZ. These aircraft are tremendous confidence builders, but they are still aircraft and unless treated with respect, will bite. A VariEze pilot, trying to fly through a canyon near the Snake River, encountered such a severe down draft, that he only just managed to execute a 180 degree turn. He lost 2000 feet and recovered less than 300 feet from the ground. He had previously believed that no matter what, his VariEze would get him out of trouble. Don't push your luck. We recently checked what would happen to a Long-EZ, with full aft stick, both rudders all the way out, nose gear extended and engine at hard idle. The airplane developed a sink rate that varied between 950 fpm and 1250 fpm. This was also tried with the prop stopped. You cannot expect to walk away from this kind of impact. 1250 fpm is 21 feet per second or 14.5 mph. You must get the nose down and build enough airspeed to have sufficient energy to arrest your descent with a flare.

From CP44-8 (CH33,CH39)
HOT DOGGING EZs - Is The Thrill Worth It?
We have received comments and complaints about pilots flying their EZs at low altitude, over beaches, over ski slopes etc. LISTEN UP GUYS!! It may be fun to buzz when you are in your EZ. You really do feel like you have the world by the tail and nothing can happen to you. No denying it, any airplane that is this small, maneuverable and responsive, will tend to build your confidence. The Long-EZ's flying qualities give the pilot the sense that he is "a part of the airplane" and that he can make the combination fit into the smallest areas with ease. The thrill of this capability has made many of us do dangerous flying.

This must stop. The majority of EZ builder/flyers fly by the rules but some of you are putting us all in jeopardy.

We recently reviewed the data and have found that in seven of the eleven Long-EZ accidents, buzzing was either the primary cause, (like the Florida one discussed in this CP) or a contributing cause. In general, the offender is the one with the loss, but if an EZ is involved in an accident on a crowded beach or ski slope, we are all out of business, no more experimental aircraft flying.

From CP47-2&3 (CH30,CH33,CH39)
ARE HOMEBUILTS SAFE?
FAA accident statistics show that per hour flown, a homebuilt is at least three times more dangerous than its general aviation store bought certificated counterpart. We have studied the accident records of these aircraft and have found some specific information that highlights the reasons for this large difference. The reasons are these general categories.

1. Low Flying/Buzzing/Aerobatics
This cause results in a relatively small percentage of accidents for the Cessna, Cherokees etc. We are astounded to see that the vast majority of serious homebuilt accidents fall into this category (3 out of 4 Long-EZ fatal accidents, 7 out of 11 total accidents/ incidents). It seems that the homebuilts are such fun to fly that the pilots take risks that they generally do not take when flying their Cess 172.

2. Engine/Prop Failure
Engine failures on homebuilts occur much more often than factory-builts, basically because many homebuilders do not apply adequate workmanship in the engine installation. A homebuilder who is not an A and P should get one to inspect his work and better yet, have an FAA desig ted IA approve the installation as would be required for a certified aircraft.

Note that the 2 categories described are items that you as a homebuilder pilot have complete control of if you fly your aircraft as you would your Cessna and inspect and maintain your power plant as you would your Cessna. Your exposure to the risks of an accident should be as good or probably better than that for the general aviation average. It is a shame that while we see many cases of a homebuilder being spared because he was in a homebuilt (safer stall characteristics and longer glide after engine failure), we still, due to things under his control, find him in a much riskier environment.

Fuel Flow Tests

****From CP50-4&5 (CH21,CH30,CH33,CH38,CH39,CH41)****
A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally fuel associated. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating from the plans is probably the most common reason. Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. Tony Bengelis' book Firewall Forward is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

****From CP54-3 (CH21,CH33,CH38)****
"The airplane will always try to tell you before it lets you down."
This is a well remembered statement Dick Rutan always preached at RAF when he worked here. Many, many times we have found it to be so very true. The problem is to recognize and act on the information.

A classic case in point occurred a few months ago with Burt's Defiant. N78RA had always had lower fuel pressure on the front engine than on the back, at least as long ago as any of us could remember, even after we installed the 180 hp engines and constant speed props. Lately though, it seemed the pressure was even lower. On the way to Oshkosh 1987, Burt said he had only 2 psi on the front and 6 psi on the rear. Must be the gauge, right? Wrong! On the approach into Oshkosh, the pressure dropped to 1 psi. Mike and Sally moved into very close formation, looking for any sign of a fuel leak - nothing.

On the trip back from Oshkosh, the fuel pressure hung between 1 & 2 psi. The engine seemed okay though, so Burt pressed on. A few weeks after the return from Oshkosh, Burt and Tonya decided to take two friends to Big Bear for lunch. The take off and climb to 300 feet were normal. Then, suddenly, the front engine began to die. Burt was frozen for a second trying to determine if he should turn back and land - should he shut it down and feather it? What?

He happened to glance at the two fuel pressure gauges - the rear was at 6 psi, the front was showing ZERO! He reached down and cross fed the front engine to the rear engine fuel tank - instantly, the front engine recovered and returned to full power! This airplane had been trying to tell us for a couple of years that something was wrong, but no one was listening.

We knew now that it was in the left (front) fuel system. We checked all the screens and filters - nothing. Finally we pulled out the fuel lines themselves and there we found a blockage of foam chips, small pieces of fiberglass and tiny fragments of micro and epoxy. This blockage was fully 4 inches long in the fuel line from the left tank to the fuel valve, right at the fuel valve. We replaced all the fuel line in the airplane and now we have 6 psi, front and rear, at all times.

The moral of the story is this: If you notice anything unusual, pay attention, the airplane may be trying to tell you something. A new noise, a "different" vibration, any change in fuel or oil pressure, don't ignore these things - remember Dick's teachings, "The airplane will always try to tell you, before it zaps you!"

P.S. The accumulation of debris was caused when we had to replace two low-level light switches in the aft sump tank in Burt's Defiant. Apparently, we were not careful enough when cleaning out the tank before closing it. Burt's sump tanks do not have screens in them, the assumption being that the screen in the main tank should do the job.

****From CP54-3 (CH21,CH33,CH38)****
Similar Problems in a Long-EZ
Marc Borom, N966EZ, writes that he had had many engine hesitations, slight rough running periods, some requiring the use of the boost pump to make it run smooth. All of this was during Marc's first 25 hours in his test area. Needless to say, Marc was rapidly loosing confidence in his new Long-EZ. How would he ever be able to fly cross country in this thing?

He called us here at RAF several times and we had long discussions about his problem. Finally, one day he decided to make a short cross country to visit a fellow Long-EZ builder.

During this flight, the engine literally quit each time he shut off the boost pump. He asked himself, "Am I having fun yet?" The answer was an obvious - NO!

Safely back on the ground, he once more broke down the fuel lines aft of the firewall. Same results, no problems downstream of the gascolator. Then he remembered that when he had done his fuel flow checks, the fuel flow was sluggish at the gascolator (the airplane was trying to tell him!). He mentioned this fact to other pilots who persuaded him that it was due to low fuel "head" pressure with the nose down. He put that important data point aside as probably not being pertinent.

With no other clues, it was time to check the fuel lines forward of the firewall and back to the sumps. He disassembled the gascolator and found he could blow through both lines from the valve to each sump with very little effort. While he had the system apart, he decided to check the line from the fuel valve to the gascolator. To his amazement and horror, he could not blow through this section of fuel line. He had, at last, found the source of his problems.

He called RAF to discuss this problem and we suggested he use shop air to blow the line clear. The blockage cleared itself with a loud "POP". What he found was a 1" long plug of foam and fiberglass chips that had backed up behind a needle of epoxy coated fiberglass that had lodged in the first sharp bend in the aluminum tube.

This problem was very similar to Burt's problem in the Defiant, and it re-enforces the necessity to "listen" to your airplane. When she tries to tell you something, don't ignore her, check it out and you will become more confident in this machine you have built. In time, you will come to trust her and, therefore, enjoy her and to get more utility out of her. Remember, she will always try to tell you.....

****From CP54-3 (CH21,CH33,CH38)****
Suggested Method of Checking Static Fuel Flow
VariEze, Long-EZ and Defiant - Before first flight, and if you are now flying but have never done this check, we strongly recommend a fuel flow check. Disconnect the fuel line at the carburetor and hold the airplane in the normal level flight attitude of approximately 1-1/2 degrees nose up (a 24" level with a 5/8" block under the rear end of the level on the top longeron will give you this attitude). Now, using a stop watch and a bucket, turn the fuel valve on for two minutes. Weigh the bucket of fuel, then weigh the bucket empty. The result is the weight of fuel that flowed in two minutes. Since a minimum of 10 gph for a VariEze is required, you should have at least 1/3 gallons (2 lbs.) of fuel in the bucket after a 2 minute run.

For a Long-EZ, you need a minimum of 12 gph, so you should have .4 of a gallon or 2.4 lbs. (without the electric boost pump running). This should increase to a minimum of 16 gph with the boost pump running, or 1/2 of a gallon (3.2 lbs.) in the bucket after 2 minutes. Remember to check both tanks in a Long-EZ, left and right.

For a Defiant you need a minimum of 14 gph (NO boost pump), 0.46 gallons or 2.8 lbs. in 2 minutes. With the boost pump running, you should see a minimum flow of 18 gph, or 0.6 gallons or 3.6 lbs. in two minutes. Don't forget to test both tanks as well as cross feed on both tanks.

These flows are fairly arbitrary, but are flows we have tested for and measured on each of the above aircraft. You should get at least, and probably better than, these numbers when you test your own airplane. If you are way down on these numbers, you should disassemble the fuel lines and blow through them to check for a blockage. Use caution blowing through lines that go into fuel tanks. High pressure shop air might rupture a fuel tank even with the fuel cap removed.

This fuel flow test should be conducted on any new airplane and it would not hurt at all to retest at each annual. Keep in mind that foam chips tend to float on the surface of the fuel and may not get into the fuel lines for a long time or, at least, until you run that tank very low or all the way empty.

****From CP58-7 (CH21,CH33,CH38)****

FUEL FLOW CHECKS

As called out in CP 53 have caused a number of builders some confusion. We even re-checked our numbers to be sure we had not made a mistake! Mike and Sally's Long-EZ and Burt's Defiant are both relatively old (8 years and 11 years) and the electric fuel boost pumps were also this old at the time of the tests, as were the mechanical fuel pumps.

Since we have installed new Facet electric boost pumps on both of the above aircraft, we also cannot get the fuel flows called out in CP 53. We believe that the foot valve springs in the new pumps must be creating enough restriction to fuel flowing by gravity, that it is impossible to obtain the flow rates called out in CP 53. Of course, the "fuel pump on" tests are still relevant and nothing has changed in this test. We believe, now, that the gravity flow check must be conducted by removing the gascolator bowl or breaking the fuel line at the gascolator. You should be able to achieve the flows shown in CP 53 using this method for the gravity flow check. You should re-connect the fuel line at the gascolator for the "fuel pump on" test and break the fuel line at the carburetor. Again, you should be able to achieve the flows shown in CP 53. If you cannot get at least the correct flows shown, you may have a restriction in the fuel lines or fuel valve. This restriction must be cleared before flight.

****From CP62-2 (CH21,CH33,CH38)****

FUEL LINE BLOCKAGE

This has been a CP subject before, but we continue to receive reports of fuel line contamination. Listen up, People! A fuel line blockage may, at the least, cause a forced landing and at the worst, kill you. Foam chips, fiberglass shards, pieces of micro falling into your fuel tanks when you install the fuel caps, can work their way into the fuel lines and we have even heard of them getting all the way to the fuel valve and jamming the valve! How about that for a problem! Check your fuel lines for obstructions before first flight. Check them again after 50 hours and thereafter at each annual inspection. A fuel line or valve blockage is a very serious problem.

Fuel Management

****Also see CP24-7 in the "Emergency Procedures" section of this chapter.****
****Also see CP52-6 in the "Emergency Procedures" section of this chapter.****

****From CP40-4 (CH33,CH39)****

"Dear RAF,

The weather here in the northwest has been terrible, so I have not been flying much. The aircraft is a super flying machine and a compliment to Burt's designing and engineering skills. The only incident to report is an engine failure. Airplane fault? NO. Pilot stupidity? Yes. I was flying up the Columbia river gorge towards the Dalles at about 3,000 feet when I suddenly heard the ominous sound of nothing but air, and sudden deceleration,. You always think the worst in these kinds of situations, but since there were no loud noises, I figured that fuel starvation must be the problem. I checked the boost pump, it was on. Mixture was rich, throttle was full open. All the time I was looking for a spot on the freeway below, thinking, 6 o'clock news, here I come. (I really did not want to break into show business in this manner) I then reached for the fuel valve (had to loosen my shoulder harness first) and switched tanks. As I was reaching for the starter, the engine roared into life. Music to my ears!! I added full power and climbed to 5,000 feet so that if it dare happen again, I would have a shot at the airport. All of this happened in a matter of seconds but, with absolute fear coursing through every cell of my body, it seemed like an eternity.

On the ground I checked the drain on the suspect tank and only a few drops dribbled out. Before take off I had assumed I had about 3 gallons in that tank. I had 5 gallons added to it. I took off on this tank and flew for about an hour at high power settings when the failure occurred.

Evidently there was little more than the 5 gallons when I took off. I am only thankful that it occurred with enough altitude to handle the situation, and that it ended up a learning experience and not a tragic one. Additionally thank goodness for the other tank!

Sincerely,
Dave Perrosino"

Editors note: **If you do hear the sudden silence, always assume it is fuel related** and switch tanks immediately., Check mixture rich, throttle open. The prop will continue to windmill if you were cruising along, so you do not need a starter. It will windmill down to 65 knots in fact.

****From CP51-6&7 (CH13,CH33,CH39)****

Long-EZ N218EZ: Incident Report

Scenario: I was the pilot in command of Long-EZ N218EZ at Scottsdale Municipal Airport when it crashed into a Cessna 152 after hand propping the engine. The situation occurred as follows: I had just fueled up for a local flight and was preparing the aircraft for engine start. I placed the wheel chock under the port tire and set the magnetos for ignition. I set the throttle position incorrectly although I did not realize this until it was too late. I then hand propped the engine and she started on the first pull but the RPMs were too high and the Long-EZ jumped the chock. I ran around the port wing but then my last failsafe malfunctioned. The rubber stopper under the nose, which was made out of a hockey puck, sheared off and the Long-EZ raced away toward the active runway. A previous gear up landing prompted the installment of a stainless steel plate under the nose in the event that a gear up landing occur again. The steel plate offered little friction to the asphalt and she accelerated away from me (I am slow of mind not of foot). I was only able to get alongside the wing at full sprint and the plane was still accelerating toward the active runway. I decided to try to alter the plane's course and at my last chance grabbed the port winglet and pulled myself up off the ground. Off balance, the Long-EZ did veer away from the runway but my troubles were just beginning. Now a less than willing passenger on the wing of a pilotless plane going approximately 25 mph, I helplessly watched as the Long settled on a course directly at a parked Cessna 152. I had no choice but to release and watch the planes collide.

Damage: The Cessna suffered a collapsed wing and sustained propeller, nose gear, and engine cowl damage. The Long lost the canard and punctured the port wing strake on the Cessna's propeller.

Recommendations: This situation arose primarily because the throttle was set at too high a power setting thus initiating the runaway condition. Second, the rubber stopper was made out of the wrong material (hockey pucks are designed to slide) and it was not secured to the fuselage properly. For those who hand prop their planes, I would recommend installing a parking brake and/or some remote cutoff switch for the engine. **A simple procedural solution would be to set the fuel valve to off so that if the plane runs away, it won't get too far. Always be certain of your throttle setting.** By Michael Best

Leaning

****From CP28-5 (CH33)****

Leaning for Cruise.

Few pilots realize the extent of fuel economy benefits available when an engine is leaned to proper "best economy" (BE) settings. Due to cooling requirements, BE setting (50 degrees F on lean side of peak EGT) is allowed only below 65 percent power. Lycoming-supplied data shows that a BE, specific fuel consumption is 14 percent lower that at "Best Power" leaning (approximately 90 degrees F on rich side of peak EGT). A pilot that cruises at full-rich is not only damaging his engine and fouling plugs, but is burning up to 55 percent more fuel than at the BE setting! Always lean at least to peak EGT when cruising with less than 65 percent power.

Carburetor Ice

****Also see CP31-5 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP42-4&5 (CH9,CH13,CH25,CH30,CH33,CH38)****

LONG TERM MAINTENANCE ITEMS ON EZs

Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto worm gear teeth. Of course this strips off about half the teeth on the worm gear.
Solution - Rotate worm gear 180 degrees and you back in business. Worm and worm gear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. **When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming.** The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

****From CP58-5&6 (CH30,CH33)****
PREVENTING CARB ICE using a Teflon coated throttle plate, shaft and screws plus a gasoline icing inhibitor.

Long-EZ builder/flyer Ken Clunis sent us a copy of *Mechanical Engineering Report LR-536* from the National Research Council of Canada titled "Aircraft Carburetor Icing Studies" by L. Gardner and G. Moon. This report is quite extensive and obviously very carefully researched. The summary of the test results states: "A study has been made of the effects of gasoline icing inhibitors on aircraft carburetor icing. An engine test was developed and used to evaluate various types of icing inhibitors. The results obtained showed that aircraft carburetor icing can be prevented by the inclusion of additives in the gasoline.

The use of a Teflon-coated throttle plate to prevent ice adhesion was studied and found to virtually eliminate any ice formation on the plate. **The use of ethylene glycol monomethyl ether (EMGE) at 0.10 to 0.15% by volume in the** gasoline and the Teflon-coated plate was shown to prevent both carburetor and fuel system icing".

Ken has followed up on this report and has had his shaft, screws and throttle plate Teflon-coated. He is currently running his Long-EZ with these parts installed and is using Prist "Hy-Flow" (not "Lo-Flow" which is alcohol based and may be hard on your epoxy in the fuel tanks), which he says is the best source of EMGE. He has installed a carburetor temperature gauge and is very pleased with his results so far.

Ken says that he had his carburetor shaft, screws and throttle plate Teflon-coated (black) at:

Durable Release Coaters, Ltd.
4 Finley Road
Bramalea, Ont., L6T 1A9
Canada
416-457-2000

His contact there was Dave Lund, himself a well informed expert on carb icing. There is a $75.00 minimum charge. If enough people wanted to get it done, the price would run about $15.00 for shaft, screws and plate in quantities of 10. We sure appreciate the effort Ken put out to obtain this information. It sounds like an excellent preventive measure that EZ/Defiant pilots may wish to try.

From CP60-3&4 (CH33,CH39)
LOSS OF POWER ON TAKE-OFF. (PIREP from Bill Perry).
"I am sorry to have to report an off airport landing with my Long-EZ due to loss of power on take off. The result was damage to the landing gear, canard and left wing.

The Long-EZ, serial no. 132, is powered with a Continental 0-200 and has been a joy to fly for the past two years and 200 hours flight time. Recently, I flew the Long-EZ to a nearby airport in Alabama for an "Aviation Day" event. About an hour after landing, I was to participate in a flyby. It was about 12 minutes after I started the engine, with outside temperatures near 90 degrees, before getting into takeoff position. The oil temperature was up to 200 degrees and I was considering cancelling the flight when we were cleared to go. Even though the engine was very warm, the temps were in the green and a crowd was watching, so I decided to takeoff. The takeoff roll was normal although an observer later told me that he saw what appeared to be smoke coming from the engine. The climb seemed a little sluggish and, at approximately 60 feet, the engine lost power.

I verified that the booster pump was on and, pumping the throttle, got a couple of very brief surges of power. The flight was so short and I was so busy looking for a place to land that I did not look at the fuel pressure and did not attempt to switch fuel tanks. The aircraft was put down in virtually the only field available. It was about 1000 feet long with the always present powerline on the approach end and was ringed with trees. Touch down was 1800 feet beyond the end of the 4300 foot runway and was 300 feet into the field beyond the powerline. The aircraft slid 240 feet in a straight line. It remained upright with the engine still running at a rough idle. The ELT was activated. The engine was shut off with the mixture control. I was not bruised or scratched. The aircraft touched down nose low because the canard was stalled and apparently the left wing was slightly low. The nose gear shock strut broke and the lower NG-15A casting cracked and came off the gear strut. The gear strut appears to be undamaged. The left main gear leg twisted with some damage to the gear attach point. The prop did not make contact. The left tip of the canard touched, breaking the canard with some damage to the F-22 bulkhead. The left wing made contact with slight damage to the lower winglet and buckling the skin aft of the outboard attach fitting.

I fully expected to go through the trees at the end of the the field and was surprised that the aircraft stopped just beyond midfield. If the plane had not been stalled in, it would have touched down much further down field and would surely have gone into the trees with probable injuries to me and major damage to the aircraft. I feel very fortunate to have avoided injury and to be left with a repairable aircraft. I am impressed that the Long-EZ could be put down in so small a field with so little damage.

I have not been able to identify a probable cause for the power loss. The engine was restarted about an hour after the landing. It ran and accelerated smoothly and both mags checked ok. There was an unusual sooty deposit in both exhaust pipes. After the aircraft was brought home, the engine was run and checked again. The throttle, mixture and carb heat controls have been checked. The fuel tank vents (two per tank) are clear. The fuel flow rate with booster pump on is 25.8 gal./hr. for both tanks. The booster pump was replaced in Nov. 1988 as recommended by newsletter CP 57, pg 7. The engine driven fuel pump has a cooling shroud as per CP 48, pg 4.

It seems likely that there was a partial vapor lock due to the heat soak from the warm engine and minimal cooling air flow. It is also possible that the engine driven pump over heated and caused a loss of pressure. When I look at the carburetor mounted behind, and very close to, the oil tank on the Continental, I suspect the possibility of fuel boiling in the carburetor. This however will not be easy to prove since I don't plan to try another takeoff with an overly warm engine."
William R. Perry

Editors comment: **We have talked at length with Bill Perry about what may have caused his loss of power and we suggested carb ice as a possibility.** Certainly, as a student pilot flying a C-150 (Cont. 0-200) in the humidity of the midwest, we saw carb ice on take-off at least once when it required full application of carb heat just to make it back to the runway. This would also explain why the engine ran fine an hour later - the ice melted. Whatever it may have been, we have asked Bill to keep us apprised of anything he may come up with during his rebuild and, of course, we will pass it on via the CP.

Refueling

Also see CP55-8 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP56-6,7,&8 in the "Emergency Procedures" section of this chapter.
Also see CP63-10&11 in the "Long-EZ Plans Changes" section of this chapter.

From CP34-4 (CH21,CH33)
AUTO FUEL IN COMPOSITE FUEL TANKS
RAF has recently received many requests to use auto fuel in VariEzes and Long-EZs. RAF cannot approve or disapprove the use of auto fuel. We can advise though, and we do not recommend using any auto fuel in a composite fuel tank. This is because of possible toluene content and its effect on the epoxy matrix. There is no way to be positive that the auto fuel you buy does not contain toluene (or possibly other potentially damaging aromatics). This is especially true of the unleaded or low lead auto fuels, which can leach the uncured epoxy residues out of the inside laminates of your fuel tanks, including the aft wall of the tank, which is your center section spar. The damage may be very insidious and may take years to become obvious. Safe-T-Poxy is much more resistant to aromatics than the previous RAE epoxy, but may still be effected in the long term.

From CP38-10 (CH33,CH39)
The following is a letter from Ken Swain on his incident at Oshkosh, 1983. We have printed the letter in its entirety as maybe it will help someone in a similar situation one day.

"On August 2, 1983 my VariEze N4ZZ suffered a total power loss over Lake Winnebago and was substantially damaged in the ensuing off airport landing. Since it happened at the EAA Convention, there were a lot of stories that were semi-correct floating about. I would like to give the complete one to C.P. for dissemination along with my personal analysis of the apparent causes. Also, while I in no way consider myself the world's most experienced pilot, I do believe that my recurrent emergency training as an active duty, current Air Force pilot gives me a perspective on emergencies not held by the average private sportsman pilot. Hopefully some of the low time EZ drivers can get some food for thought from my actions.

THE FACTS: The flight before the ill fated one was the Oshkosh 500. During the race I noticed that the fuel flow would occasionally drift up from the set 6.4 gph to 9.5 gph. Since additional leaning had no effect I concluded that my Compucruise had swallowed a few bad electrons and would have to be looked at after the Convention. Each drift up episode lasted only 15-20 seconds. I completed the race, bought 9.5 gallons of gas, and 2 hours later took off in a flight of 10 race aircraft to return to the Convention as the beginning of the pre-airshow. We were on downwind, over land, within landing distance of the field when we were sent to a VFR holding pattern over Lake Winnebago. five to ten minutes later we were cleared for approach and we headed for the field. I soon reduced power to idle to slow to gear lowering speed, got the gear down, then left power back until I hit pattern speed. When I advanced the throttle there was no response. Tach showed windmilling RPM and all temperatures and pressures were in the green. My position was approximately 1 1/2 to 2 miles from shore over the lake at 100 ft agl at 100 mph. I immediately initiated a turn towards the closest land while switching to the header tank. I then raised the gear and slowed to best glide for my aircraft. While cycling mags, mixture, and throttle I made my first of two terse unanswered radio calls: "4ZZ has lost power over the lake and is attempting to reach the shoreline just south of Oshkosh". By this time I was 1 mile from shore and the prop had stopped. A cornfield was the only area that wasn't wet, hard (trees, houses, wires) or full of people that was clearly within my small energy envelope. I kept my eyes on it while I made my last airborne call: "Hey people, listen up. 4ZZ has lost power over the lake and is headed for the shoreline just south of Oshkosh". There was a strip of grass running through the field so I decided to try for it. I cleared the 75 ft. tall trees at the shoreline by about 20 feet, lowered my gear again and made a left turn to line up with the length of the cornfield. Just prior to touchdown I slowed to between 50 and 55 mph indicated, a speed I have often flown during flight tests. As I touched down it turned out the ground beneath the grass was not level and the grass to my left was taller. The left main then failed torsionally, pulling the nose left, causing the aircraft to enter the corn. The nose was now pointing 45 degrees to the left of the motion vector. The aircraft wound up on the nose and right main gear. The momentum continued the rollover on the right canard tip and wing tip. The canopy shattered as I hit the ground inverted. The aircraft came to rest on the rollover structure and the remains of the rudder tips. The nose of the aircraft was pointing 90 degrees to the left of the direction of landing. I was about 100-150 yards from the lake, hanging in the straps, trapped in the wreck. I dug my head set out of the dirt where the front of the cockpit used to be and got off one call to Johnny Murphy who was circling overhead, to let him know I was ok. Then I smelled gas so I shut off the master.

AIRCRAFT DAMAGE: Besides the rudders and canopy, the main gear strut is failed torsionally on the left and right sides. The right gear attach is 100 percent intact. The left tabs and attach are intact but the pad layup has separated from the strut on the front half. The motor mount failed in tension at the first welds at each bottom corner; the aluminum extrusions are intact. Wings are intact. The right strake tank is separated from the spar all the way around and leaking freely. The left tank appears to have held, with minor fill cracks. Compression damage done to the inboard rib of the right aileron by the cowling are intact. Seat belts and attach are 100 percent intact. The forward fuselage sides and top will have to be completely rebuilt from just in front of the instrument panel forward. Nose gear, strut and box are intact. F28 is broken in two places. F22 broke in 6 places. The top right longeron is crushed. The canard lift tabs are twisted and the outer left of the right tip will have to be replaced. The possibility of damage exists in the canard center spar but I have yet to strip the cover off the canard center to inspect it.

POST CRASH INVESTIGATION: When the wreck was pulled off the trailer used to get it back from the cornfield, the engine started on the forth blade and ran strong. After shutdown a small but steady stream of fuel ran from the carburetor. Tapping on the bowl eventually made it stop. Later, with representatives of both the FAA and NTSB present, the fuel system and carburetor were disassembled and inspected. There was some sand in the VA-6 fuel filter. There were a few infinitesimal slivers of teflon tape and a small amount of fine sand in the carburetor bowl. Less than 200 gallons of gas had been run through the system since cleaning at annual on June 30. The needle valve was clean and free and the float was undamaged. There was extensive fuel staining of my brand new ram air elbow.

MY ANALYSIS OF THE CAUSE: First, I totally rule out carb ice. I have 800 hours experience with my Lycoming and have only had it ice a couple of times in the most severe carb ice conditions. **What I believe happened was this: One of the four FBO's that I bought fuel from after my annual passed some sand along with the fuel.** Some of that sand eventually made it through the filter and was intermittently preventing my needle valve from closing completely. The teflon tape shreds could also have done it but there were only 3 of them and there were lots of grains of sand, 300 to 400 grains. Under pressure from the fuel pump the bowl would then overflow out the atmospheric vent, into the elbow. I believe the high fuel flows I noted during the race were grains of sand in the process of passing the needle valve. Since the power setting was high, the engine just ran a bit rich for a short while. The worst case would be to experience a needle valve clog at the moment of quickly reducing power to idle. The engine would then flood since fuel pump out put is proportional to prop rpm, not power demand. It would be so loaded up that it could take quite a while to clear, certainly more than the 15-20 seconds of windmilling prop time that I had.

Other support for this view: The stream of gas from the carb after shutdown and the fuel stains on the elbow where 2 hours earlier there were none. Also, at the completion of the Oshkosh 500, Gene Sheehan looked at my exhaust stacks and commented on how lean I must have been running the race since they were almost white on the inside. After the crash and at most 10 to 15 minutes of flight, they were heavily caked with black soot.

MY ANALYSIS OF MY INFLIGHT ACTIONS: In retrospect, I feel I did a few things wrong and a bunch of things right handling the inflight portion of my emergency. My biggest mistake was not turning off the master before impact. I should have. My biggest correct action was not even a conscience one. Both the military and FAA part 121 operations require seat belts and shoulder harness to be worn by flight crew for all takeoffs and landings. My habit is to always keep them both on. I loosen, but never remove, the harness only once in a great while at high altitude cruise. Had I not had a tight seat belt and shoulder harness, I would be dead! Instead I walked away from a pretty spectacular crash literally without a scratch.

Other "right actions": My immediate turn towards shore at the first hint of trouble. 2. My immediate raising of the gear. 3. My immediate switch to the header tank which, 4. allowed the rapid, and correct, decision that the engine wasn't coming back; this prevented me from wasting precious energy/altitude on keeping the prop windmilling. 5. My rapid attaining of best glide speed for my airplane as determined by flight test. 6. I picked out the only field that I was certain I could make and never let it out of my sight. Remember, I cleared the trees by only 20 feet from almost 2 miles away. Had I omitted any one of the above actions, I probably would have hit the trees or lake. Cornfields are rough on airplanes, but not nearly as rough as trees or water at high speed.

Some additional right actions: I devoted my full attention toward stabilizing the situation before giving any thought to a radio call. I also got the aircraft as slow as I had been able to demonstrate good control in flight test before touchdown. Another very important action was the relowering of the nose gear before touch down. Judging from the damage to the gear doors and paint abrasion on the strut, grass drag (=slow down help) on the strut was significant. Had it not been down, I probably would have gone over at 50 mph vs. 20 mph.

My last correct decision was to leave my seat belt buckled when the 160 lb. fireman said "OK, unbuckle the belt". About 15 people had lifted the airplane, still inverted, about 5 feet off the ground. I said to him, "Are you ready to have 215 lb. come tumbling down on your head as soon as I open it?" He said, "Wait a minute", and got another fireman to help. I could just see me surviving the crash unscathed only to break my neck in the rescue!

SOME FINAL THOUGHTS: Thanks Burt, for designing a super strong airframe and especially a super strong rollover structure. Without it I would have been severely injured or worse. The TV newsman asked if I was scared. I told him that I was too busy doing my job, flying the airplane, to be scared. Every military flight manual I've ever used has virtually the same basic instructions for handling any emergency:

1. Maintain aircraft control
2. Analyze the situation
3. Take corrective action.

Nowhere does it say to wring your hands, go berserk yelling for help in the radio, or to contemplate your navel. The only person who can help you out of your hard spot is you, and you won't be any good whatsoever to you if you don't keep a calm, clear mind and concentrate on the business at hand.

Ken Swain"

****From CP43-6 (CH21,CH33)****

CAUTION

Paul Prout's fuel sight gauge as advertised in previous CPs should not be used with auto gas. Av gas is no problem at all and the pair installed in N26MS over a year ago have worked perfectly using only av gas. Paul is working on a auto gas option, but until then no auto fuel in Paul's sight guages.

****From CP49-5 (CH30,CH33,CH38,CH39)****

A Long-EZ on its first flight after installing a newly overhauled engine suffered an inflight engine fire and was unable to make it back to the runway. The engine quit on approach and the pilot attempted to land in a housing tract. There was not enough room and he rolled into a car which also burst into flames. He landed under control, thus, inflight structural failure or control failure are not suspect. Sadly, the pilot was killed by fire. The fire was so intense in the engine/cowling area the the FAA accident investigator was unable to determine what could have started the fire. The fuel pumps, carburetor, etc., were consumed. The airplane had been airborne for only a few minutes. Reportedly, the engine was an 0-320 and he was using auto fuel. We may never know what caused the fire, but it is easy to overlook a loose fitting - we have done it ourselves. **A fuel leak, particularly auto fuel, could be ignited by hot exhaust or any number of things.** Always try to have at least one other person go over your work, especially engine related work like plumbing or control systems. The more pairs of eyes that look at your engine installation, the better chance that you will catch some overlooked items. This is specifically important if you are developing new, unapproved installations.

Never, ever, cowl an engine that has been worked on without a brief engine run to check for leaks. We, here at RAF, have more that once found fairly drastic leaks during the leak-check engine run.

From CP49-7 (CH30,CH33,CH38)

FUEL LEAKS IN THE ENGINE COMPARTMENT

We recently heard from a Long-EZ pilot who had just installed new fuel lines in his airplane. While on a cross country flight, he noticed that his cylinder head temperatures were way down from where they normally ran, and they continued to run cool for the duration of the flight. Upon landing, he removed the bottom cowling and found that the engine looked as though it has been steam cleaned! He turned on the boost pump and a fine mist of fuel sprayed out of one of the new fuel lines. These were stainless braided fuel lines, supposedly aircraft quality, and yet, one of them had several tiny pinhole leaks that had allowed a fine spray of AV gas to drench the engine. Apparently, the high speed cooling air, mixed with fuel, had literally scoured the engine clean as a whistle! Why no fire? **Perhaps it is the relatively high flash point of AV gas which is much higher than auto gas. According to Popular Science, March 1986, it is becoming increasingly commonplace to boost octane ratings by dissolving cheap "light ends" such as butane into auto fuel.** This increases vapor pressure and volatility and lowers the flash point. If this Long-EZ pilot had been using auto fuel, he may not have been so lucky. See "Accidents" in this issue.

Fuel leaks aft of the firewall are potential killers. If you have recently broken your fuel lines, or if you are in a new, untried installation, it is mandatory that you conduct a short engine run with the cowling removed.

Carefully inspect all the lines and fittings for leaks (including oil leaks) while the engine is running (watch out for the prop!) and fuel and oil is under pressure. It is common to find one or more fitting loose and you would be surprised how much oil you can lose through a finger tight (but not correctly tightened with a wrench) oil line nut.

Some years ago, Dick Rutan had a fuel line fitting break in flight during a speed record attempt. He lost most of his fuel over board before he became aware of the problem. When he landed, the entire aft end of the cowling and wings were stained with 100LL blue stain. This was the result of mounting an electric fuel pressure sender directly to the carburetor. The vibration failed the aluminum fitting. It is very important that fuel pressure and oil pressure senders be remotely mounted with flexible, aircraft quality hoses connecting them to the engine.

Use only steel elbows, nuts and nipples aft of the firewall in the fuel system. In certified aircraft, only steel or stainless steel fittings and tubes are used between the firewall and the engine, and all fuel and all oil flexible hoses have fire sleeves covering them. The reason is that in the event of an engine fire, the fuel and oil system will not burn through, thus allowing the pilot enough time to execute an emergency landing. Other than an inflight structural failure, an inflight fire would have to be the scariest thing that could happen to a pilot. As the builder of your own airplane, you owe it to yourself to do the best possible job you can on your engine/fuel/oil system. If in doubt, have an A&P or AI mechanic look it over. At least, have other EZ builders look at your engine installation. Many times, in spite of our best efforts, we miss something important which may be easily spotted by someone not so close to the project.

From CP52-6 (CH21,CH33,CH39)

REFUELING FIRE

We received this information third hand. We have not had any contact with the Long-EZ pilot. Apparently, after a flight in his Long-EZ, a Norwegian builder/pilot landed at an airport in Norway and requested fuel. As the attendant started to fill one of his tanks, a static spark jumped and ignited the fumes around the fuel cap area. Fortunately, a fire extinguisher was available and the fire was extinguished.

The above is all the information we have. We are endeavoring to find out more about this incident and we would appreciate any information anyone may have about this or any other similar incident.

This is the first time we have had a report of a fire while fueling an EZ. We have, of course, fueled many composite airplanes here at Mojave, literally hundreds of times, and we have never even seen a static spark. That is not to say it could not happen but of all the places it should happen, Mojave, with its extremely dry climate, would seem to be a likely candidate.

What can be done to prevent such an incident? If you built a ground strap into the tank connecting the fuel cap ring to the aircraft ground, and you grounded the aircraft during a refueling operation, this should not be able to occur. However, if your airplane was ever struck by lighting, the ground strap would conduct the charge. It would become red hot and melt which may cause an explosion/fire! Not a good alternative.

The most practical thing to do would be to always touch the fuel truck's ground cable to each fuel cap BEFORE you open these caps. This would discharge any static build-up on the aircraft skin/strake area. Another suggestion was made in EAA's Sport Aviation magazine and that is to make up a length of brass bathroom chain with a small clip on one end. Clip it to the fuel nozzle and drop the chain into your fuel BEFORE pumping fuel into the tank. The idea is to discharge any static that may build up due to the friction of the fuel running out of the nozzle into the tank. This would be in addition to the first suggestion.

We are not experts in this field at all. During fueling we, ourselves, have never taken any special precautions other than the normal grounding of the exhaust pipe (which may or may not do anything at all!) We have been fueling composite airplanes here at Mojave and, indeed, all over the United States for more than ten years without any evidence of a problem. We simply present the report of this incident as food for thought. If anyone has any suggestion as to what could be done to prevent such a thing, we would be pleased to hear from you.

From CP53-3 (CH21,CH33,CH39)

REFUELING FIRE IN A LONG-EZ

"To Ground Or Not To Ground?" By Alfred K. Tiefenthal

"I had intended to carry out an exact calibration of the fuel sight gauges of my Long-EZ. While in my hangar, and using a metal funnel and "Jerry" cans, I began pouring Avgas 100LL into the right tank. The metal funnel had three legs, but due to the cross wi e in the Brock fuel tank opening, they were too short. I supported the funnel with pieces of wood and foam. With that arranged, the funnel did not touch the metal tank opening or cross wire but was a few millimeters away from it. I suppose it was at this gap that a spark jumped over and ignited the fuel.

This happened when I was pouring in the third can. The tank was about half full. Fortunately, there was no explosion, the fuel just started to burn. I must have bumped the funnel when the ignition happened because there was splashed, burning fuel all around the tank opening and dripping down the leading edge. The can I was pouring from was on fire and I, myself, got burned on my right hand, fortunately, not seriously.

I will never forget the nasty sight of my beautiful and beloved Long-EZ, after four years of hard work, burning all over the wing strake with the flames reaching almost to the roof! A few seconds later, I managed to extinguish the fire with a single blow from a powder-type fire extinguisher I found in the hangar, and it was all over.

The e was very little damage, some discolored spots on the strakes and a few paint blisters along the leading edge. These were quickly repaired and, surprisingly, I actually flew the plane the next day!

There is no doubt in my mind that the source of the fire was a spark caused by static electricity. It was my fault, of course, that I did not ground the airc aft. Nor had I any grounding connection between can, funnel, and aircraft. I will never pour any amount of fuel into any aircraft without ground, and if I have to fill from "Jerry" cans, I will also make a ground connection between the can, funnel, and grounded aircraft.

It is illegal to refuel an aircraft in a hangar and without grounding and I was fined 500$ (Norway money!), but what is that?! I could have lost my ai plane, or even my life, if the ignition had occurred earlier while there was a combustible mixture in the fuel tank- or it could have exploded.

My hope is that this sto y will prevent other builder/flyers from having a refueling fire."

The above letter was received from Alfred Tiefenthal who lives in Norway and it is the same incident as was described in CP 52. We made a couple of suggestions then and have received several comments concerning this incident.

A fueling fire is a very, very serious situation and anything that can be done to prevent it should be done. Also, be sure to have a suitable fire extinguisher at hand whenever you are doing anything with fuel.

Haley Haynes wrote to us concerning our suggestion of a brass chain and he is concerned that the chain should not be grounded to the fuel nozzle until after it has been dropped into the fuel. The connection to the fuel nozzle should be made as far away as possible and upwind from the fuel tank opening.

He says that at the present level of understanding, a static charge can and does build up on the surface of the fuel, probably due to molecular friction between two dissimilar materials, like cat hair and plastic.

The obvious solution would seem to be to install some form of uninsulated metal ground into the tanks during construction, and securely connect these to the aircraft ground and engine. Thus, the gas truck operator grounding your exhaust system would be grounding the fuel. Unfortunately, the problem is not that simple. This solution, in event of an airborne lightning strike, could result in the inside-the-tank ground strap becoming red hot and causing an explosion! Also, the fuel acts as a dielectric between the metal fuel lines and the static charge on the surface of the fuel. Therefore, a very large area ground is needed in the fuel tank. The aluminum mesh called "Explosafe" and advertised in Sport Aviation, if properly grounded to the engine during construction, may be a good way to go.

We would welcome suggestions and comments on this problem. The other side of the coin is, of course, the fact that many hundreds of EZ's have been fueled many thousands of times all over the world without any reported problem until we heard from Alfred Tiefenthal. Is the problem really as big as it seems? We wish we knew, but unfortunately, we are not experts in this field and we would truly welcome the view of any experts.

Our biggest concern, now, is that someone may actually cause a fire trying to avoid the problem by grounding his fuel incorrectly or in the wrong sequence. We are certainly going to have a nice big Halon fire extinguisher at hand for all fueling operations here at Mojave, but what to do on a cross-country?

From CP55-3&4 (CH21,CH33,CH39)

REFUELING FIRE

"I knew it was possible, but surely it wouldn't happen to me. How many thousands of times have EZ's been refueled without any incidents of fire? One reported in Norway (see CP 52 and 53) and now me. Why does it happen? It is carelessness, or is it preventable?

After a 40 minute flight in my LEZ N8HA, I called for the fuel truck and parked on the ramp with the nose headed into an 8 knot breeze. The fuel truck drove up and was parked about 8 feet behind the plane - downwind. Gary, the driver, unreeled the ground cable and clipped it to the exhaust stack, just the same as we had done about 30 times before. Gary then brought the fueling hose around the left wing and I removed the left tank fuel cap. Eleven gallons of (100 LL) fuel was pumped into the tank and it was about an inch and one-half from being full. He then shut the nozzle down to slow the flow and with both of us looking directly at the fuel tank opening, the fumes from the tank started burning. No explosion. The flame above the tank was a couple of feet high and was being blown across the wing aftward about 4 to 6 feet. I remember seeing the end of the fuel nozzle positioned even with the fuel tank opening and in the center of the 3 inch flush filler ring when the fire started. We don't know if the nozzle had touched the ring or not. The nozzle was also on fire.

By very fast reaction and a dry powder extinguisher from the rear of the fuel truck, we had the flame out in about 12 seconds from the time it started. Gary had one hand singed and I was spitting dry powder. I had just turned around from getting a small Halon unit in my cockpit when he shot across the wing with the powder. Damage to my LEZ was mostly cosmetic, but with a couple of heat wrinkles in the skin just aft of the filler ring, and some places in the centersection and wing spar area where the finish paint was blistered up from the primer coat. A large area was smoke blackened from the filler ring to the trailing edge. If we had been standing on the downwind side of this operation it may have been a tragedy for both of us.

The main thing I will do for sure is to install a grounding lug onto the metal fuel filler ring and use it instead of the engine exhaust. Also, a jumper groundwire will be clipped to that lug and to the fuel nozzle BEFORE removing the jumper wire or ground cable. The fuel truck should be parked crosswind from the plane and <u>not</u> downwind of it, and should be grounded into earth rods. The fuel handler should not be wearing any nylon clothing. A two pound Halon unit will be mounted in my EZ and it will be "IN HAND" or "WITHIN ARMS' REACH" each time the plane is fueled. If this fire had burned another few seconds the top of the tank may have melted away and then it might have been uncontrollable.

Alfred Tiefenthal of Norway and I have learned from a first-hand experience. I hope it will not happen again, anywhere, but I am sure that it will - Maybe to YOU, so please be prepared.

Herb Anderson
Montrose, Colorado"

<u>EDITOR'S COMMENT</u>

The above letter was sent in by Long-EZ builder/flyer, Herb Anderson of Montrose, Colorado after he had experienced a refueling fire. The only other case ever reported to us was written up in CP52 and CP53. We have refueled EZ's literally hundreds of times ourselves here at Mojave where it is very dry and static electricity is quite prevalent. You can get a nasty jolt just getting out of you car. For some reason we have never had a fire. Now that we know of two instances, it is obvious that we cannot go on without doing the best job we can to prevent such a disaster.

Refueling fires, surprisingly, are not all that uncommon, even in metal airplanes. In the military, for example, the gas truck is grounded, the nozzle has a ground strap that is connected to the fuel tank near the gas cap <u>before</u> opening the gas cap.

We can learn from this. We are equipping our Long-EZ's with a ground lug which is connected to the gas cap ring. This is where the gas truck will connect his groundstrap instead of onto the exhaust as he usually does. We believe that a ground wire should go <u>into</u> the tank from this ground lug or the gas cap ring such that it is immersed in fuel even when the airplane is parked nose down with minimum fuel in the tank. When we get ready to take on fuel, the procedure will be this: a short cable with alligator clips will be kept in the EZ and will be connected to the ground lug and to the gas truck's fuel nozzle <u>BEFORE</u> opening the gas cap. The gas truck's grounding cable will also be connected to this ground lug <u>BEFORE</u> the gas cap is removed. This will drain any static off the airframe, out of the inside of the fuel tank and also off the surface of the fuel in the tank where static can build up. <u>Then</u> we will open the cap and pump in fuel.

The friction of fuel through the nozzle and pouring from the nozzle to the inside of the fuel tank creates static electricity but this charge will drain away from the nozzle, the tank, and the surface of the fuel through our internal cable and ground lug, as well as through the truck's ground lines.

We are not experts in this area, however, we believe what we have outlined is a good common sense approach to eliminating the threat of a fire caused by static electricity arcing from the fuel nozzle. We are open to suggestions on this potentially serious problem, but what we have outlined above is what we are doing to our airplanes, and we believe every builder/pilot should do to his or her airplane before the next time you refuel it. In addition, as Herb Anderson has recommended, we will carry a good quality Halon fire extinguisher which will be available to the pilot or person refueling the airplane. Once the refueling operation is complete, the gas cap should be closed and locked <u>before</u> any ground strap is removed.

We would like to thank Herb Anderson for writing his report for the CP. Taking these actions now, before it happens to you, may save you from a potentially very, very <u>serious</u> <u>problem</u>.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON "STANDARD" AIRCRAFT 2" DIAMETER OR 3" DIAMETER GAS CAP ASSEMBLY (MIL-C-7244B)

SKETCH OMITTED

Top skin is spot faced through the ring. A reverse spot face is required to remove foam and glass from under the ring, as shown, to allow the steel tube spacers to clamp up tightly onto the ring for a good electrical contact. Care must be used to avoid contaminating the inside of the fuel tank.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON BROCK FUEL CAP ASSEMBLY

SKETCH OMITTED

Use a Dremel to cut a 3/8" diameter hole through the top skin of each fuel tank adjacent to the Brock fuel cap, as shown. Remove all foam and micro down to the inside skin, but do not penetrate inside skin. Fill this hole with flox - allow to cure. Drill a number 12 hole through the cured flox into the tank close to the edge of the Brock fuel cap ring, as shown. Care must be used to avoid contaminating the interior of the fuel tank.

****From CP62-5 (CH21,CH33,CH38)****

High Performance Antistatic Wax.

Appropriately named Zerostatic, this new product was developed by EZ builders for EZ's and it is excellent. You can wax your entire aircraft, including the canopy, and it will greatly reduce dust build up while parked in the hangar. It is a gel that is easily applied and, best of all, it reduces electrostatic buildup - meets mil-B-8170C specifications for static decay. As an example, a Long-EZ fuel strake, treated with Zerostatic gel and polished with a high speed orbital power buffer, will have essentially no static buildup. Try it, then place your forearm in close proximity to the strake. The hairs on your arm will not react with Zerostatic, but will stand up and tingle with any other wax. **Should help reduce the risk of static discharge while refueling.** Wicks & Spruce have this new product in stock. Give it a try.

****From CP62-7&8 (CH33,CH39)****

ACCIDENTS AND INCIDENTS

A VariEze crashed soon after takeoff in Aspen, Colorado. The pilot and passenger were both killed. Engine failure is suspected. The damage to the prop is such that the engine was not running when it crashed. The FAA has not officially come up with a probable cause for this accident, but their investigation is looking seriously at fuel exhaustion or, at least, a fuel stoppage as being the likely cause. This VariEze had been flown for at least 3-1/2 hours since the last time it was known to be refueled. Depending on the power setting and fuel tank capacity, this is very close to enough to have used a full tank of gas.

At the last known refueling, this VariEze was refueled while parked nose down. Also, the pilot did not supervise the refueling, rather, the line boy was told to fill it up.

First of all, it is not possible to completely fill the fuel tanks of an EZ while parked nose down. If for some reason you require all the fuel you can get, top if off in the 3-point position. Second, we have had it happen to us, that a line boy failed to top off an EZ fuel tank when using a very high rate of fuel flow due to the baffles in the tank causing the tank to momentarily appear full. Some refueling trucks and pumps have more flow capacity than the baffles in the fuel tank can allow the fuel to drain to all corners of the fuel tank. Don't forget this fact if you absolutely need to have the maximum fuel for a long trip. Most important of all, remember it is the pilots responsibility to check how much fuel he or she has onboard, not the line boy's. On a VariEze, built per plans, you have a 2 gallon-plus emergency reserve fuel tank in the area above the centersection spar forward of the firewall. Don't forget to check the level in this tank and to fill it if necessary. This is a get-you-home fuel supply, but it will do you no good at all if it has been used or has drained through a leaky fuel valve into the main fuel tanks. Keep this tank full, always - it could save your bacon.

Braking

****From CP26-10 (CH9,CH24,CH33,CH39)****

5) A Nebraska VariEze equipped with the original 2-ply tires, was making a gross weight takeoff. The pilot began rotation at 85 or 90 mph, (above the normal lift off speed of 75 mph), when the right tire blew. He aborted the takeoff, using left brake all the way to stop to maintain directional control. He reported it was not hard to control even though the right brake bleed failed and the right wheel pant and brake rotor was destroyed. His gear strut was the original configuration, not reinforced. He placed the right wheel up on a dolly tilting the aircraft with most of the weight on the left wheel, then pushed it half mile to a hangar. On arriving, the left gear strut buckled a few inches above the axle, inside the tightly-sealed, non-vented wheel pant. The cause of the strut failure was heat. The long, continuous high speed braking resulted in a very hot brake. This heat, sealed in by the wheel pant, slowly permeated the fiberglass strut allowing it to soften and buckle under load. Lessons learned: Do not use the two-ply tires. Ventilate the top of your wheel pants. **If unusually heavy braking is done, 'set' the gear to relieve load or jack the airplane to relieve stress while the strut cools.** Glue a piece of your fiberfrax fire wall insulation material to the strut (use silicone rubber adhesive) adjacent to the brake disc. Your VariEze and Long-EZ should lift off and land at under 65 kts and 60 kts respectively, unless you have an airspeed instrument error or airspeed position error. **Leaving the airplane on the ground above this speed increases tire stresses and reduces tire life.**

****From CP40-7 (CH9,CH33,CH38)****

VariEze and Long-EZ - If you ever experience what appears to be a brake failure, that is to say you hit the brake and it goes all the way down, don't just sit there!! Hit it again and if necessary several times and it will almost certainly be as good as ever. This had been a fairly common problem, and can be caused by several things. The first place to check is the clearance between the brake caliper and the wheel pant and/or the main gear strut. If the strut or wheel pant touches the caliper, this will cause the piston in the caliper to back away from the brake disk, and this will then necessitate several quick pumps on the brake to bring the piston back. Similarly, a disc that does run true can do the same thing. Do not just assume that your master cylinder is shot, do check it for signs of hydraulic fluid leaks, also check the elbow and fitting in the caliper for leaks. Don't forget to check fluid level in the master reservoir. Do not fly if you suspect a bad brake.

Another potential place to keep an eye on is the hole in the firewall where the rudder/brake cable goes through and connects to the CS15 bellcrank. Check and be sure that it is not possible for the nicopress sleeve on this cable to go into the hole and jam. If necessary enlarge these holes a little, or adjust the brake cable length to limit the travel so the nicopress sleeve does not get into the firewall.

Dick Kreidel has been using a new brake lining, a Cleveland part #66-56, which is a semi metallic material with good success. He reports equal brake effectiveness, but about three times the brake lining life. RAF is currently testing these linings and so far have not managed to wear them out, so cannot comment on the brake life.

Rough Fields

****From CP42-5 (CH33,CH39)****

A South African Long-EZ crashed off the end of a 1700 feet rough field when the pilot attempted to take off with a quartering tailwind. The airplane accelerated slowly on the very rough strip and failed to lift off before running off the end of the strip into a marsh. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger were both injured and airplane badly damaged.

This accident was one that need not have occurred. **The Long-EZ is <u>not</u> suitable for short rough fields.** You can land a Long-EZ on a rough strip that you may not be able to fly out of. Remember, with a canard pusher configuration, such as the Long-EZ, you have no prop blast over the elevator, and therefore you can not force the airplane to rotate early and start the wings carrying load. You have to accelerate to flying speed, 50 to 60 knots depending on the cg and a rough field or even a grass field with long grass (anything over 2" long) will <u>greatly</u> add to the rolling drag and slow down your ability to accelerate to the point that you may need more runway than you have available. As long as you fly your Long-EZ from a hard surface or a smooth grass field at least 2500 feet long, you should have no problems. All aircraft are compromises, you cannot have a Lear jet and a J-3 cut in one aircraft. The Long-EZ is no exception. It does what it was designed to do very well. High speed, economical transportation is the Long-EZs forte.

Parking

****From CP31-3 (CH33)****

<u>PARKING YOUR EZ</u>

It does not seem possible, but there are still VariEze and Long-EZ builders out there who apparently are not aware of the fact that this configuration of aircraft <u>will</u> fall over on its tail if it is left unattended while the nose gear is extended. The pilot is <u>required</u> in the front seat to balance the airplane to the correct cg. Should the pilot climb out and let go of the airplane, it <u>will</u> fall over on its tail, and this can result in a broken prop or at least damaged winglets. This condition is unavoidable. The main gear position is a direct function of rotation speed. Ballasting the nose to overcome this will result in unacceptably long take-off rolls, and a very difficult airplane to handle on the ground. This is the main reason that the nose gear retracts. This allows you to park the airplane nose down, which is a very stable way to park and avoids the requirement for a wheel chock when untied in winds up to 35 knots.

****From CP48-3 (CH13,CH33)****

<u>NOSE GEAR MISTREATMENT</u>

We have noticed a growing tendency among EZ owners to set the nose gear at one-half to two-thirds down and then leave the airplane sitting on its 3 wheels. This is asking for a stripped worm gear in the retract mechanism. Take a look at the drawings. It should be obvious that the worm/worm gear never sees the load. With the gear down and locked, the pushrod is in an overcenter position and takes all the load in compression. The worm/worm gear mechanism only takes the weight of the gear driving the retract/extend cycle and that is all it is ever designed to do. It cannot carry the weight of the airplane and will strip instantly if you ever allow it to "see" the weight of the nose plus a pilot. Park it nose down, or tie it down with the nose gear extended.

****From CP53-2&3 (CH21,CH33)****

<u>STOLEN LONG-EZ</u>

During the last week of June 1987, N83RT, a really beautiful Long-EZ IFR equipped with King avionics, was stolen from its tiedown on the ramp at Montgomery Field in San Diego, California.

The owner knew there was only 200 miles of fuel in the tanks, so he flew to every airport in a 200 mile radius and left a reward poster with two color photos of the plane and instrument panel giving all details such as equipment, serial numbers and identifying features. In addition, these posters were mailed to every tower-controlled airport and all flight service stations in California.

By great luck, and due entirely to the keen memory of a fellow San Diego VariEze driver, the above aircraft has been returned to its owner. The thief had previously tried to steal a different Long-EZ from a hangar on the field. He failed for some reason, but did take the owner's manual which was later recovered from his home. When he flew away in 83RT, the tower operator, who knew the owner/pilot, exchanged pleasantries with the thief but did not realize it was not the owner. He flew only 30 miles to Ramona where is was hangared for two weeks while it was dismantled. Then it was removed to the thief's home where he seriously damaged the airplane, cutting out the wiring, instrument panel and sanding all identifying colors and numbers off the airframe.

By pure good luck, a VariEze owner/flyer landed at Ramona right behind the thief. He did not recognize the stolen Long-EZ as a local airplane and maybe that is why when, several weeks later, he returned to the airport and saw the reward notice, he called the owner. The San Diego police followed up and got the name and address of the thief and literally caught him about to repaint the aircraft.

What can we all learn from this incident? First of all, notify the local police and work closely with them. Give them all possible information (do you have all serial numbers, engine, avionics, etc. recorded?). Second, fly to <u>all</u> landing strips within a reasonable radius and <u>talk to as many pilots as possible</u>. Near the Mexican border, you might notify the Drug Enforcement Agency (DEA), also the FBI since stealing an airplane is a federal offense.

Most importantly, we should all give serious thought to coming up with some method to prevent the plane from being flown. A plastic coated, heat treated chain wrapped around the prop and secured with a quality lock is good. Perhaps a fuel shut-off valve located, where only you know, in addition to the normal fuel valve. This could be shut off after you park it. Be <u>very careful</u> that this, or anything else you do to disable your aircraft, does not bite <u>you</u> in some way!! If you park it outside on an airport ramp for any length of time, notify the focal FBO, tower, mechanics, etc. that it will be there and ask them to keep an eye on it.

The owners of N83RT were extremely lucky. Imagine if you will, that this thief had managed to get the new panel installed and get the airplane repainted. He could have showed up at Montgomery Field with his "new" Long-EZ on a trailer, announced the rollout of his "new" Long-EZ, even had a little celebration to celebrate its "first flight" - may even been able to join the local San Diego EZ group, and probably no one would have been the wiser! Keep your EZ locked up if at all possible. The heartbreak of having it stolen must be experienced to be appreciated.

Propellers

****Also see LPC #74 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP29-2 (CH30,CH33,CH38)****
<u>Warning - Loss of Prop!</u>
Dick recently had an experience with his Long-EZ that would raise the hair of the most experienced pilot. He lost the entire prop and spinner while cruising at 10,000 ft. over a solid cloud deck. After watching the prop cascade away he received radar vectors from center to allow a successful approach to an airport, under weather conditions of 1/4 mile visibility in fog. Investigation revealed that the all-important bolt tension (required to transmit torque through faceplate friction) had been lost when the prop dried out in desert conditions after exposure to the humid-wet Caribbean climate at his world-record arrival location. Note the added caution in the plans-change section of the newsletter. **Also, do not, <u>do not</u> exceed the recommended interval on prop bolt torque check. (Owners Manual, Appendix III).**

****From CP41-5&6 (CH30,CH33,CH38)****
<u>PROPELLER TALES!</u>
Propellers are very important. Check them carefully every flight, and handle them with great caution, they can bite. Check your prop bolt torque regularly. The first check should be done after the first flight on a new prop, then at 10 hours then at 25 hours and thereafter every 25 hours. The recommended torque is between 18 ft./lbs. (216 inch pounds) and 22 ft./lbs. (264 inch pounds). The proper torque on your prop bolts is very important, if the torque gets much below 12 to 15 ft./lbs. it is possible to loose your prop! Recently we were getting the original VariEze prototype out for a flight. It had not been flown or had the prop torqued in almost one year. All six prop bolts were literally finger tight! There was no measurable torque on any of the bolts.

Once the prop has been in operation for a hundred hours or so, you will seldom find the bolt torque low, except when you have flown from a wet or humid area into a dry climate. Check your prop bolts regularly and save yourself from what could be an embarrassing situation to say the least!

There have been one or two EZ pilots recently who have had their hands or fingers bit by the prop. Hand propping an aircraft engine particularly on an EZ is not difficult, but there is not room for carelessness or lack of concentration. The prop should always be treated like a loaded gun. Be especially careful when "backing up" the prop, such as is commonly done to clear a flooded engine. This problem appears to be associated with the larger engines (0-320) more than with the standard 0-235 engines. However, it can happen and if it does it can cause painful cuts and abrasions and even broken bones and will also result in a broken prop. Be careful. Use good safety procedures and never move an aircraft propeller unless you are ready and in position for it to fire.

****From CP44-3 (CH33)****
LIGHTNING STRIKES ON FIBERGLASS AIRCRAFT
We recently received information from NASA and from Andy Plummer of Lightning Technologies Inc, a recognized expert in this field, regarding lightning strikes on fiberglass aircraft. At this point in time there is not one single documented case of a fiberglass sailplane being struck by lightning. This is surprising, especially in Europe, where sailplanes do fly in the clouds. There is no documented evidence of any EZ or composite type having been struck and damaged. There is however, one documented case of an all wood sailplane which was struck, with catastrophic results. There are many cases of radones, glass tail fins, etc. on airlines being struck with damage from insignificant to quite considerable.

The expert opinion from both NASA and Mr. Plummer, is that it could happen and if it did, it may be possible to suffer catastrophic damage. Mr. Plummer states, "I am firmly convinced that fiberglass aircraft are just as likely to receive a lightning strike as a metal aircraft of the same size". **The consensus of opinion is to stay well away from thunderstorms or cloud formations that may generate lightning.**

****From CP53-9&10 (CH33,CH39)****
The following three letters are concerning a lightning strike on a Long-EZ flown by Dick Kreidel. We certainly thank Dick for taking the time to write the account which Burt sent to Andy Plummer for his comments. Mr. Plummer is one of this countries leading authorities on lightning strikes and his letter is, also, reproduced here for all of us to read and inwardly digest. Pay attention, guys, our EZs are not indestructible, although many of us fly them as though they were.

"I deliberated for a long time whether to publish this account of poor judgement and foolish mistakes. When I read it now, on the ground, three months later, the faulty reasoning is easy to see. But I assure you, that the decisions and events on May 23rd were made to the best of my ability and skills. My hope is that someone will benefit from my errors. It is a fine line between being around to tell a story and not being around.

This account was originally sent to RAF for their comments. Burt passed it on to Andy Plummer of Lightning Technologies who is reputed to be the foremost lightning expert. Mr.Plummer's comments follows my tale......

I departed New Orleans Lakefront Airport IFR to El Paso at approximately 9:30 a.m. local on Sunday, May 23rd. I had received a thorough weather briefing from Flight Service only 20 minutes earlier and they indicated that westbound I shouldn't have much problems; rain showers and multiple cloud layers with tops at 14,000' to 16,000' MSL with a thin cirrus layer at 25,000'. Live Radar and FSS painted a line of thunderstorms about 20 miles south but it probably wouldn't arrive at Lakefront for at least an hour. I was cleared to 16,000' and had gone through multiple layers of cloud and picked up some light clear ice after a climb through 12,000'. I requested from ATC to hold at 14,000' for a while since I was between layers and the next ceiling didn't look as thin as advertised. The OAT at 14,000' was +1 degree C. I flew through some heavy rain and more ice accumulated on the plane, especially the canard, elevators and vortilons. The wing did not appear to have much ice on it and I could not see any on the winglets or the intersection between the wing and winglets. Indicated airspeed at 2400 RPM was 122 KIAS. The ice on the canard covered about 20-25 percent of the chord with some "streamers" that went back to perhaps to 50 percent chord line. Ice formed below the trailing edge of the elevator about 1/8" thick with a uniform spanwise distribution. The ice on the canard was definitely clear ice but what was below the trailing edge of the elevator looked more like mixed or rime ice. The elevator position was about 5/16"-3/8" T.E. down. The airplane was very controllable with good elevator responsiveness. I could have easily climbed if I had wanted to so I was not overly concerned.

ATC was giving me radar vectors to stay clear of any CB's but indicated that contrary to my preflight weather briefing, the "weather west of New Orleans is really wicked with the big boys having trouble going through!" Center advised that the only way they felt would be O.K. would be to deviate approximately 60 nm due North - obviously I followed their recommendation. After a few minutes I was again in cloud and it became increasingly difficult to hear radio transmissions - static was all that came through the headset.

I started receiving small electrical shocks from the roll trim lever through my jeans and shocks from the microphone to my lips. I became aware of the transparent blue glow that was on the nose and canard. I say blue but somehow it seemed blue with a pink tinge. The color was similar to the bright blue from a gas welders flame. This halo was about one chord width above the canard and seemed to "move" - it is very difficult to describe in words. I was now getting shocked through the speed brake handle and from the rudder pedals to my ankles (my feet were in the relaxed position forward of the pedals). The B&D tachometer was bouncing erratically from 500 RPM to full scale and both Nav CDI displays were swinging from stop to stop. The electric engine instruments were also useless - I didn't notice what the wet compass was doing. Here I was: IFR conditions, icing, no communication or navigation, thunderstorms and weird light. So far the ride was smooth with no rain or hail in the cloud - the cloud was not a dark, heavy one. The blue (pink) glow increased in intensity and its movement was more rapid. I am not sure but I believe that the blue glow was now inside the cockpit between my face and the instrument panel, but I could still easily read the gages; it was right out of the Twilight Zone.

I saw a bright flash way ahead of me that seemed to go from left to right that really lit up the cloud I was in; I assumed that it was cloud to cloud lightning and that I was definitely in deep grease! The com was still all static and calls to center were unanswered (or perhaps unheard). I was so scared that I was sure that this would be the way it would all end and Kay (my wife) would really be pissed! I smelled a thick sweet odor, got one good shock from the microphone and then there was a tremendous flash of light and an incredibly loud "crack" - I felt it in my bones and chest as opposed to hearing it.

I had been looking out at the right wing trying to figure out why the blue halo was not on the wings, only the canard, when the flash occurred. I was temporarily blinded so I removed my hand from the stick hoping I wouldn't enter a spiral dive. When I could see again (10-15 seconds), to my amazement 1) I was still alive and 2) the plane was still level at 14,000' on my last assigned heading of 060 degrees. The blue halo was gone and I heard a transmission on the com for a Delta jet. I called center to see if my radio was blown and they immediately answered my call! Apparently they had been trying to reach me to give me a new vector and immediately turned me to 330 degrees. The airplane was again between layers and the visibility was good, I could even see patches below. Everything appeared to be working O.K. but the plane still had a lot of ice on it and I didn't think I was in any mental state to fly an approach. The airspeed now read less the 50 knots so I knew that the pitot tube had iced over. The weather seemed to be improving rapidly with a broken layer above and below with some beautiful blue sky far in the distance. Since the plane would easily climb with full power and the remaining aft stick I saw no reason to descend and kill myself making a lousy IFR approach after all of this! I then saw several dark patches on the wing and winglet leading edges that upon later inspection were areas where only the glass skin remained. In about 20 minutes all of the ice melted and the elevator position returned to 1/16" T.E. up and the airspeed increased to 140 KIAS at the same power setting of 2400 RPM. The flight continued normally in IFR and I landed at El Paso International four hours later.

So what is there to learn from this unwanted experience? Probably several things. First, that the invincibility I felt in B888EZ contributed to my cavalier attitude in flying in bad weather - this certainly was not the "California IFR" that I was used to. After nearly 1100 hours of flying in a plastic cocoon, I had developed a false sense of immortality - after all, the EZ had gotten me through some tough situations before. Also, I learned to never, ever trust ATC and/or FSS - the pilot must make his own decisions and evaluations on when to commence or terminate a flight.

Another significant revelation is that although the Long-EZ is a great plane and can leap tall buildings with a single bound, it is <u>not suited</u> for <u>hard IFR</u> flights with <u>embedded thunderstorms</u>. I consider myself <u>extremely lucky</u> to have survived this flight - my skill and judgment (or more correctly - lack of both) hopefully will serve me better in the future.
Dick Kreidel"

SKETCHES OMITTED

FIG. I Ice distribution on canard and elevators.
FIG. II Ice on vortilons.

SCALED COMPOSITES INC.

0554/87
3 June 1987

Andy Plummer
Lightning Technologies
10 Downing Parkway
Pittsfield, MA 01201

Dear Andy,

As you may recall when you visited about 10 years ago, we, as well as hundreds of other homebuilders have been flying without lightning protection and with apprehension as to what would occur in a lightning strike. The enclosed account is from Dick Kreidel of Yorba Linda, California who was flying his Long-EZ when it was struck by lightning.

I would appreciate any comments you could pass on to us or any recommendations of analyses which should be done. I am wondering if any data is available on laboratory strikes on fiberglass skins with foam cores. If so, I would like to look at that information to get some idea of the intensity of Mr. Kreidel's strike.

Best regards,

Burt Rutan

ELR/kl

cc: Mike Melvill
Dick Kreidel
Jim Terry

LIGHTNING TECHNOLOGIES, INC.,
10 Downing Parkway,
Pittsfield, Massachusetts 01201
(413)499-2135

22 July 1987

Subject: Long-EZ Lightning Strike

Reference: Your Letter of 3 June 1987, Same Subject, with
Dick Kriedel's Letter Attached

Burt Rutan
Scaled Composites, Inc.
Hangar 78,
Mojave Airport
Mojave, CA 93501

Dear Burt:

I have studied the interesting account of a lightning strike to a Long-EZ by Pilot Dick Kreidel, accompanying your letter of 3 June, and have the following comments:

1. After beginning the deviation North, the aircraft entered an electrically charged region, as indicated by the static in the communications system, "small electrical shocks" and "blue glow" (corona) on aircraft extremities. The electric shocks were due to electric field penetration of the non-conductive fiberglass airframe. The erratic behavior of the instruments was also due to electric field interaction with the interconnecting wiring. It is very likely the the corona was indeed occurring inside the cockpit as Mr. Kreidel suspected.

2. The synoptic weather conditions reported by the pilot are very characteristic of those reported by other operators when lightning strikes have occurred (~14,000 ft; icing, precipitation, within a cloud, OAT +/- 5 degrees of freezing). Apparently the aircraft was near embedded thunderstorm cells, though lightning strikes have been known to originate in "layered" clouds as well as CB clouds.

3. The "flash of light" and "loud crack" indicate a lightning strike, although evidently one of mild intensity as indicated by the comparatively minor effects on the aircraft. At 14,000 ft. it is likely that the aircraft encountered a branch of a flash, rather than the main channel of a cloud-to-earth flash; as illustrated in the following sketch. **SKETCH OMITTED**

4. The electric currents in a branch (of which there are a lot in a typical flash structure) are usually much less than that in the main channel. Even so, the flash and noise can be frightening if experienced close at hand.

5. Apparently the lightning current entered one wing tip (take your pick) and exited from the other, being conducted by internal metal conductors between. The amount of damage to the fiberglass and foam structures indicates a very mild strike - perhaps 5 kiloamperes or less (Part 23 rules require an airframe to tolerate 200 kiloamperes).

Comments

1. Pilot Kreidel was lucky! A more severe strike may well have caused major structural damage and lethal voltage difference among metal objects in the cockpit (column, pedals, headphones, etc.) as well as severe damage to internal electrical conductors such as control cables, hinges, bearings, rods, electrical wiring, etc. These voltages and currents can be far in excess of fatal levels. Electric fields and lightning strikes themselves will directly penetrate unprotected fiberglass structures, attracted by metal objects within - not matter how small.

2. This is another example of the fact that ATC cannot be relied upon to vector an aircraft safely around- and clear of - hazardous thunderstorms. Controllers are not provided with sufficient (and timely) information for this purpose. Even though avoiding areas of heavy precipitation the aircraft ran into an electrically active region.

3. This incident is not a good example of what would occur to a Long-EZ in a lightning strike. A "full threat" stroke would likely have ripped a hole a foot in diameter through the composite and vaporized small diameter control cables and interconnecting wiring. The accompanying shock waves would have caused extensive internal damage, delamination, etc. I doubt very much whether the aircraft or pilot could have survived such a strike.

Recommendation

1. Continue to warn pilots of this class of aircraft to stay VFR and avoid "weather" clouds, precipitation and icing within 5 degrees of the freezing level should especially be avoided.

2. This Long-EZ should be thoroughly inspected to be sure that there has not been damage to any internal metal parts. All internal parts should be inspected. It is quite probable, for example, that this strike burned some strands of control cables, electrical wires, etc.

Thank you for sharing this interesting account with me. Please give me a call if you have any further questions.

Yours truly,
J.A. Plumer, President
Lightning Technologies, Inc.

Fire Extinguishers

****Also see LPC #103 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP47-6 (CH33)****
FIRE EXTINGUISHERS IN THE COCKPIT
There are now many small Halon fire extinguishers available at very reasonable prices. Halon is the only fire extinguisher that can be used in the case of a fire in the small confines of a cockpit. While electrical fires are not all that common, they do occasionally occur and if one ever happens to you, particularly in flight, without a means to extinguish the fire, you have little chance. A classic example of how a small fire extinguisher can save the day occurred to us here at RAF. We were taxi testing an airplane when a brake line failed and the brake fluid ignited. It was a small fire, but it quite rapidly began to burn the paint on the wheel pant and the paint on the gear leg. If we had not had one of these small fire extinguishers available, we would probably have had to sit by and watch it burn. We were over a mile from the nearest building at the other end of the airport!

Small, easy to mount Halon fire extinguishers are available from many aircraft supply companies including Sporty's Pilot Shop in Cincinnati, Ohio. Don't let it happen to you, order one now and mount it in your cockpit where you can easily reach for it anytime. It is very cheap insurance.

****From CP50-8 (CH33)****
FIRE EXTINGUISHERS IN THE COCKPIT
With our recent experience of a brake fire while taxiing the Defiant, the value of an on-board fire extinguisher became painfully evident. If we had not had an extinguisher, we would have lost the Defiant!

We have done a little research into the subject of fire extinguishers and the consensus is the "Halon" extinguishers are the only ones to consider. There are two types of Halon, 1211 and 1301. FAA says that Halon 1301 is best. However, the much more readily available Halon 1211 is still an excellent choice and is available in a small size well suited to our EZ cockpit. A lot of mail order catalog houses, such as Sporty's Pilot Shop, sell these fire extinguishers. A 2-1/2 lb. Halon bottle is well suited to a Defiant size airplane, but is really bigger than necessary in an EZ cockpit, while the tiny, aerosol size 12 oz. Halon bottles are probably marginally too small although they may well be a life saver if used soon enough on a small fire. They certainly are easy to mount in our small cockpits. Be sure you place the fire extinguisher where you can easily reach it in flight.

Do not use a dry chemical or a CO2 fire extinguisher in any aircraft for any reason.

Oxygen

****From CP47-6 (CH33)****
OXYGEN AND COLD FEET
Mike and Sally have been doing quite a lot of high altitude, cross country flying in the last 6 months and they have purchased a portable oxygen system. It is an "Aerox" high duration system that uses "oxysaver" (TM) nasal cannulas instead of the usual face mask. They are very pleased with this system. It is comfortable to wear, allows normal conversation and, best of all, the 22 cu.ft. aluminum oxygen bottle (4 1/2" diameter x 29" long) will allow two people to remain at 17,500' for up to 11 1/2 hours!! The bottle fits into the left strake baggage area where it is convenient for the pilot to observe the pressure gauge. The nasal cannulas are so comfortable that after a few minutes, you forget you have them on! You can also eat or drink with no problem. Try that with a face mask!

Using oxygen allows an EZ pilot to take more advantage of tailwinds at altitude, which can result in very cold feet! Outside air temperatures of -10 degrees C are quite common, even in the summer. Mike and Sally recently tried wearing "moon" boots, the common "after-ski" boots available at most K-Marts, etc. for $15.00-$20.00. A pair of wool socks inside a pair of moon boots will allow you to cruise at OATs of -10 degrees C for 2 or 3 hours, without heat, and without any discomfort. TRY 'EM. you'll like 'em!

Contact: Ken Johnson
Aerox Aviation Oxygen Systems, Inc.
P.O. Box 5343
Hilton Head, SC 29928
1-800-237-6702

****From CP49-4 (CH33)****
CORRECTION TO CP48
Aerox Oxygen Systems phone number was incorrectly printed. It should be 800-237-6902 not 6702 as printed in CP48.

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Supplemental Chapter 34, Weight Control

****FROM CP24-4 (CH22,CH25,CH30,CH34,CH36)****
WEIGHT CONTROL - Too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap -- if you address each item as, "Oh, that's only one/half pound, it's a small percent of the empty weight", you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?". Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program -- the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transit it will put a lot less stress on your landing gear. Then if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modifications.

****From CP25-4 (CH3,CH34)****
PV FOAM AND WEIGHT CONTROL
The original PV core foam, type R45 dark blue, that we tested here at RAF, layed up absolutely perfectly without using slurry. Based on this series of tests, we called out no slurry on type R45 PV foam in Long-EZ plans. The production type R45 PV foam in most cases is representative of our test samples, however in a few cases larger cell foam is being delivered in the kits. This large cell foam is structurally excellent, and can be layed up without slurry with real acceptable physicals, however it is a lot easier to accomplish the layup if you slurry the type R45 PV foam. The glass wets out quicker and you get less air or dry looking areas. There is little or no difference structurally, but our test have shown a slightly lighter part if you use slurry. The best thing to do is conduct your own test as you build and decide for yourself which way works best for you.

In all cases your glassing time should not exceed 2 minutes per square foot per ply, i.e., front side of front seat bulkhead, is two plies, and should take no more than half hour. If you are working slower than this you are doing something wrong, and you will end up with poor work, heavy parts etc., due to epoxy gel. Above all, don't leave excess epoxy in a layup. If a squeegee can remove epoxy, do remove it. Use numerous squeegee passes to wet out as well as to remove excess. Remove the grams of excess epoxy from every layup, and your airplane will be many pounds lighter and stronger.

Do not add extra glass anywhere. One VariEze builder wanted his airplane "extra strong" so he added a ply here and there. His airplane is over 100 lb. overweight and his strength for flight and landing loads is less.

Chase after grams, and the pounds will take care of themselves. Bill Lear once said he would kill his grandmother for a pound. While this measure is not recommended, it is possible if you are not diligent on weight control throughout your project you will be building a sluggish, single-place airplane.

****From CP26-3 (CH34,CH37)****
MIKE AND DICK'S LONG-EZ's By Mike Melvill
Progress has been good since CP #25. All major structural parts are complete, wings, winglets (upper and lower), centersections, fuselages, canards, elevators, mains and nose gears. Dick plans on completing his in the same building we rented and I have transported mine to our home in Tehachapi, where Sally and I have been working like mad in our two car garage.

At this point our Long-EZ (N26MS November two six, Mike Sally) is on its gear, the canopy is complete and mounted, the engine is mounted. The canard is mounted, without the fairing block. The wings have been mounted and drilled into the centersection, which is hard mounted into the fuselage. The speed brake is installed and operational, pitch trim, roll trim and control sticks are installed. Upper and lower winglets are mounted on the wings, as are the ailerons.

Still left to do, mount the wing strakes (fuel/baggage areas) which will be the prefab parts (see page 1). Fit and install the cowling, install and hook up all instruments, throttle quadrant, and complete all plumbing and wiring. Then of course it is finishing time, lots of dry micro, featherfill, primer and paint.

Sally and I have been trying very hard to get our Long-EZ ready for the Hospitality Club Bahama's trip this Christmas. At this time I am not certain we will make it. To a large extent it now depends on being able to get all the little parts it will take to finalize the whole thing, we will keep on going as hard as we can and it will not be for lack of trying if we don't make it.

During the course of our building we have weighed virtually all the parts and kept an accurate record of man-hours we have spent building. Here is a list of weights and hours spent on the parts. Use this as a guide to judge if you are too heavy, too light or spending far too much time on a part:

Front seat bulkhead	2 lbs. 14 ozs.
Back seat bulkhead	1 lb. 7 ozs.
F28 bulkhead	3 ozs.
F22 bulkhead	1 lb. 7 ozs.
Instrument panel	2 lbs. 2 ozs.
Fuselage sides (with gear attach layup and angles and bolts)	10 lbs. per side
Fuselage, assembled with bottom on and carved outside, but not skinned	41 lbs.
Skinned fuselage, with roll over structure and speed brake (from F22 to firewall)	59 lbs.
Speed brake	2 lbs. 2 ozs.
Main gear strut with 8 ply UND torsional layup	24 lbs. 14 ozs.
Main gear with attach tabs complete	27 lbs.
Centersection spar	29 lbs. 5 ozs.
Wing, skinned top and bottom, no root ribs, ailerons cut out	46 lbs.
Wing, with root rib layups, and aileron trailing edge spar complete (no aileron)	46 lbs. 8 ozs.
Aileron with mass balance, hinges, torque tube and universal	5 lbs. 2 ozs.
Wing, complete to end of Chapter 19, with level reference board bondo'd on, ailerons, hinges, controls, etc.	51 lbs. 8 ozs.
Upper winglet with R.S.T. antenna, coaxial cable and BNC connector, ready to install on wing	6 lbs.
Lower winglet	1 lb. 3 ozs.
Canard no hardware, no elevators	17 lbs.
Left elevator, no hinges, no counter-weights	2 lbs. 2 ozs.
Right elevator, no hinges, no counter-weights	1 lb. 13 ozs.
Left elevator, ready to finish	3 lbs. 8 ozs.
Right elevator, ready to finish	3 lbs. 4 ozs.
Canopy complete ready to finish	16 lbs.
Fuselage, complete with centersection (includes side consoles) brake cylinders, main and nose gear (and fore and aft canopy frame) (500x5 tires on main gear) no wingstrakes, no canard, no canopy, no engine mount	183 lbs.
Wing, complete with upper and lower winglet, rudder mounted and hinged, ready to finish and bolt to mounted centersection spar	64 lbs.
Dynafocal engine mount	5 lbs. 3 ozs.

BUILDING TIMES IN MAN HOURS (MH)
Note: These are not just layup times. These are total hours worked for all people, including shop cleanup.

Fuselage, assembled with nose, nose gear, main gear, and roll over structure	86 mh
Main Gear (complete, no axles)	9 mh
Canard	38 mh
Elevators	8 mh (2 pcs)
Centersection	62 mh
Both Wings	97 mh (2 pcs)
Upper winglets	11 mh (2 pcs)
Lower winglets	6 mh (2 pcs)
Wing root layups, aileron cut out and trailing edge spar layups (2 wings)	15 mh
Ailerons, complete, hinged and operational in the wings with controls (2 wings)	32 mh

Canopy complete	36 mh
Wings, jigged to centersection and drilled in	6 mh
Upper winglet, jigged to wing, and all layups complete plus lower winglet, jigged and layed up	23 mh (per wing)
Rudder layout, cutout, layup, mount hinge and bracket, string cable	7 1/2 mh
Total Man Hours to date	**458 mh**

This is where I am at this time and we will continue to report progress, weights and times in future CPs.

****From CP27-1 (CH34,CH37)****

Mike and Sally's Long-EZ by Mike.

In CP 26 Sally and I were going at it as hard as we could to try to finish N26MS before the Bahamas Trip. Due to several circumstances, some beyond our control, we were unable to fly our Long to the Bahamas, although we did manage to get a few flights on it prior to leaving on the trip.

We really burned the midnight oil the last few weeks and without help from Burt, Pat, Bruce and Giles, we would not have got it flying before leaving. We filled and primed all the parts and then transported it down to Mojave Airport, where we finished up engine baffling and wiring. On Sunday, 21 December we finally had it all done. We put 10 gallons in each fuel tank, flushed the fuel system thoroughly and started the engine. Since Sally and I overhauled the engine, it was a great relief to have it start and run so smoothly! We ran the engine for half an hour, then after conducting a careful weight and balance, determining that the cg was in the center of the first flight box for me, I taxied out for the first runway flights. I made 3 runs down the runway, checked brakes, rudder effectiveness, rotation speed and on the 3rd run lifted off a foot or two. It felt absolutely great, it was straight, no trim required, so I landed, taxied to the end of runway 12, and with Dick and Sally in Burt's Long-EZ on my right wing, I took off.

It felt absolutely right. It is a difficult moment to describe on paper, when you depart the runway environment completely, and commit yourself and your new airplane to the air, it is an incredible feeling. All engine instruments were in the "green", so I climbed on up to 5,000 feet and carefully explored various control inputs and power settings. I am delighted to report that it required no trim to fly straight and true. I flew about 40 minutes, landed and Sally made the next flight. She is also delighted with the handling qualities. Just before dusk Burt took it up and was pleased with it.

Since getting back from our Bahamas trip we have been putting hours on our Long. I have opened the envelope up to 185 knots indicated at 9,000 feet and she loops and rolls beautifully. The roll response is even better than the prototype N79RA. With no wheel pants, the large 500 x 5 tires and no spinner, speeds are not very meaningful, but at 7,500 feet she trues out at 151 knots (173mph), so I believe that with wheel pants, a spinner and a magneto that sparks on all 4 cylinders our Long-EZ will be at least equal to the owners manual, possibly a little better.

Evaluation of N26MS by Burt

Sally and Mike built this one with alot of attention to accuracy. The reward is an airplane that flys ball-centered at neutral roll trim, hands-off. Its roll qualities are crisp with minimal adverse yaw. Pitch handling is solid with firm speed stability. Stalls are optimum - a very mild pitch bobble at full aft stick. Roll reversals and sideslips performed at full aft stick are smooth and do not produce wing rocking. Engine noise and vibration are lower than the prototype due to the dynafocal mount. A superb flying airplane, the best of any type I've flown.

Back to Mike. - We will continue to report on how it goes, as we accumulate time and data.

Before final assembly we got a few more relevant weights:

Wings with ailerons and rudders complete (before finish)	64 lbs. each
Rudders (filled and painted	1.2 lbs. each
Left elevator (filled and painted)	3.5 lbs.
Right elevator (filled and painted)	3.0 lbs.
Ailerons, with hinges, universal and torque tube, (filled and painted)	5.4 lbs. each
Canard with fairing cover (filled and painted)	18.5 lbs.
Canopy, with hinges (filled and painted)	17 lbs.
Wings with winglets, no rudders, no ailerons (filled and painted)	60 lbs. each

We ended up with a total of 1,200 hours. This included all man hours put in by everyone who worked on the airplane. This also includes overhauling the engine, developing the new engine mount and baffling, installation of such things as tape deck, intercom and what Burt calls "fru-fru" (non-essentials). See page 4 of this newsletter for Burt's comments.

From CP27-4 (CH22,CH30,CH34)

IMPORTANT WEIGHT INFORMATION - LONG-EZ

The most disappointing thing about the VariEze experience has been the general lack of adequate weight control by most builders. It is necessary to use diligence in controlling and eliminating each gram in order to avoid an undetected growth of many pounds. It is a reliable prediction the many Long-EZs will be built over-weight and be limited to short range or single-place operation. An equally reliable prediction is that many Long-EZs will be built with little equipment, careful weight control, and will be considerably lighter than those now flying. They will enjoy a high useful load, great takeoff and climb performance and unexcelled range.

The following information is a complete analysis of the actual weight of Mike and Sally's Long, N26MS. If you are building a Long, it is very important that you study all this information before you plan your equipment installation that you be aware of the weight impact of any additional equipment. N26MS has excellent structural workmanship, thus, most airplanes with less attention to good layups will probably be heavier than the data shown below. Study the table below. Note particularly the magnitude of the additional equipment.

N26MS was built with two conflicting requirements that added considerably to its empty weight: (a) full electric start with large alternator, and (b) pilot weight of only 108 lbs. using no temporary ballast. While the heavy electric (number 4) and ballast provisions (number 7) had the major impact on their heavy final empty weight of 883 lbs., their utility has not suffered as much as one might think. The reason is the total weight of Mike and Sally is only 263 lbs.. Thus, using the 1425 gross (owners manual page 30) their allowable fuel load is 46.5 gallons giving 1,000 mile range at 75% or 1,550 miles at 40% power, with reserves. Their allowable fuel load at normal gross is 29.8 gallons. Consider this same airplane with two 190 lb. adults as crew and without the then unrequired number 7 ballast provisions. That situation leaves only 207 lbs. (34.5 gallons) fuel for a range at 75% of only 700 miles, with reserves, or 350 miles with a 1325 lb. take off. Obviously, with that 360 lb. crew weight strong consideration should be given to using the electrical system in number 2 and eliminating as many items as possible in number 6, and 8, to provide the high utility and long range available with the Long-EZ.

We encourage everyone to use the light electrical system as in number 2. This is the one installed in the RAF prototype N79RA. Then, add only the equipment you absolutely need and diligently refrain from seemingly - "small" additions.

Note that it is possible and advisable to have the Nav, Com and transponder with the small alternator and have an empty weight of less than 720 lb. However, if your front-seat pilot weight is less than 170 lb., you should use the 25 AH battery in the nose and accept the 19 lb. increase. This will be needed anyway to balance the aircraft. Also, if you are a very light pilot (less than 150 lb), be prepared to suffer a large penalty in empty weight if you want to install an electric starter. The starter, ring gear, alternator, brackets etc. mount way back at station 150+ and will require nose ballast for light pilots.

If you are successful in obtaining an empty weight of less than 730 lb you can fly two 180 lb people with the full 52 gallons of fuel and attain over 1800 nautical miles (2070 sm) range at economy cruise - a feat considerably in excess of any other light aircraft.

LONG-EZ EMPTY WEIGHTS BASED ON N26MS

1. BASIC EMPTY WEIGHT (BEW) VFR instruments plus g meter and turn/bank gyro. No starter and alternator, graphite cowling. All equipment and components per plans. Conical engine mount and ram inlet. No avionics, cabin heat or lights. Small motorcycle battery to power warning system and fuel pump.	693.4	lbs.
2. BEW plus the small alternator (see CP 26), including wiring and regulator (4.9 lbs.).	698.3	lbs.
3. Number 2 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	713.7	lbs.
4. BEW plus standard 60-amp alternator, starter, ring gear, belt, brackets, mounting hardware, regulator, wiring, relays and 25 AH battery (68.5 lbs.).	761.9	lbs.
5. Number 4 plus Com, Nav, Transponder and all installation misc. (15.4 lbs.).	777.3	lbs.

6. Number 5 plus additional equipment on N26MS including: 500 x 5 tires, dynafocal mount, NACA inlet, landing light, Nav lights, strobe lights, cabin heat, relief tubes, primer, intercom and stereo tape player (38.1 lbs.). 815.4 lbs.

7. Number 6 plus provisions to allow Sally (108 lb. pilot) to fly at cg=102.2 (1.8" fwd of aft limit). Includes a second 25 AH battery, wiring and switches to use the second battery, and 15 lbs. of lead permanently installed in front of NG 31 Bulkhead (44.8 lbs.). 860.2 lbs.

8. Number 7 plus some extras added because they were nice and "didn't hardly weigh anything". Misc. ranging from small covers and aluminum knobs, to heavier upholstery and different fuel caps (12 "small" items 22.8 lbs.). 883 lbs.

From CP27-5 (CH3,CH34)
FIBERGLASS LAYUPS
We have recently inspected some layups with unacceptable epoxy-to-glass ratios and improper fiber orientation. Aircraft structure, whether its fiberglass, aluminum, or welded steel must be built properly or must be rejected. It is not satisfactory to accept any critical part that has excess epoxy. On every part, be sure to do the squeegee test for a "ridge" - see page 3-11 step 7. Pull the squeegee along, stop and remove it and see if you have piled the excess epoxy up into a ridge. You must spend time with the squeegee pulling all excess off the sides if the test reveals a ridge. Do not attempt any layup (except small corner tapes) unless you have a clean, flexible, smooth squeegee to use. It is not possible to smoothly remove excess or determine correct ratio with a brush. When building any type of aircraft structure, your very best workmanship is just barely adequate. Do not accept anything less. Practice on your Chapter 3 flat layups until it is perfect before building aircraft parts. If in doubt on how a given layup should look, duplicate it on a small piece and send it to RAF for our comment. It is difficult to access the acceptability or dry or wet layups on the phone.

From CP27-9 (CH34)
Comments from Jud Bock - "I have installed the Long-EZ nose and main gear on my VariEze so I am sure I will have a lot better landing gear system, but it is making me even more overweight than I already was. I decided the best thing to do about it was to lose 30 excess pounds off of my 230 lb body, which I have almost accomplished. Also my wife has lost nearly 20 lbs, so the 17 or 18 extra lbs I picked up on the bird is more than compensated for by the 50 lb weight loss of my wife and myself. I attend Weight Watchers and you can rest assured I am the only one in the class who isn't losing weight because of a woman or a man. My white, red and blue mistress has put on weight, so in order to be compatible with her, I had to lose or else become a single place pilot".

From CP28-6 (CH34)
Weight Control.
CAUTION - Weight growth generally occurs late in the building project. The following scenario occurs during most homebuilt aircraft projects: Careful weight control is exhibited in the fabrication of the various bulkheads, wings etc., in building the basic structure. The builder is optimistic about the prospect of having a light weight aircraft, because all his components meet or beat the various weight goals. Then, when he begins the final stages of outfitting and finishing he relaxes his concern for weight control. He says "oh, this is only a few ounces, a small percentage of the total weight". Forgetting that the addition of many seemingly insignificant items results in a large total weight, he proceeds, expecting to attain a light empty weight. Another factor is present that he is not aware of. This is the existence of the Phantom Weight Law (PWL). The Universal PWL states that "additional weight of 3 to 10 percent of the empty weight will sneak into an aircraft (usually at midnight when the lights are out) between the time the weight engineer is confident he has accounted for everything and the time the aircraft is rolled onto the scales. This Phantom weight will remain in the aircraft and grow, but will never be accounted for nor rationalized"

The biggest trap is the non-concern for each gram of additional weight. Example: a two-inch BID tape installed at two and a half inches wide - seems insignificant? Yes, but that part is 25 percent overweight. Using the next size electrical wire - seems insignificant? Yes, but that part is 25 percent overweight. A small knob that is 25 percent heavier than another, a 5 lb rather than a 4 lb seat cushion, etc. Note that acceptance of these kind of items throughout the building and outfitting can result in an aircraft more than 100 lb overweight!!

From CP48-2&3 (CH30,CH34)
LECTURE TIME! EXCESS WEIGHT/WORKMANSHIP
We have not had a weight lecture in a long time, so please bear with us! We have seen quite a number of airplanes and parts of airplanes recently, and there are a couple of things that are showing up. The good news is that the average workmanship (glass work) is good, much better than it was a few years ago. We still see an occasional example that makes us wince, but generally, the quality of glass layups is very good.

The bad news is that most builders, VariEze and Long-EZ, seem to have lost the incentive to build light airplanes. We see heavier and heavier examples. 700 lbs. VariEzes and 950 to 1000 lb. Long-EZs!! This is very bad, guys. Perhaps this is in part due to the tendency to put bigger and bigger engines in these airplanes? Whatever it is, keep in mind it is a snowball, the heavier you build, the more it takes to make it go and the heavier that makes it! There is no way to get ahead taking that route. The solution is to be very conscientious about weight all the time while building.. Resist the temptation to add "fru-fru", unnecessary items that just add weight.

We have flown dozens and dozens of examples of both VariEzes and Long-EZs. Without exception, regardless of engine/HP installed, the lightest examples are always the best flying, most fun to fly.

Keep in mind that the prototype VariEze N4EZ weighed 594 lbs. and the prototype Long-EZ weighed 790 lbs. (and this airplane had a 50 lb. center-section spar due to the "plug-in" wings it had when first flown!). There are a number of EZs flying that beat these numbers easily. A 1,000 lb. Long-EZ is like flying the prototype all the time with a 200 lb. passenger on board! Regardless of the engine/power installed, it is still more fun to fly the prototype and much, much more economical!

Update Number 66 to Supplemental Chapter 35, Builder Support

****From CP66-1 (CH35)****

THE AVIATION COMPOSITES VERSUS RAF/SCALED LAWSUIT.

It has been almost two years since we were sued by Aviation Composites (a British company). We have had many letters of support and concern from you, the builders and flyers of RAF designed planes. We appreciate your support and are pleased to announce that on January 28, 1991 a jury in federal court in Fresno, CA returned a unanimous verdict in favor of RAF and Scaled on all counts. The federal judge absolved Burt and Dick of any blame and disallowed Aviation Composites claim for punitive damages before he ever gave the case to the jury! The judge also directed Aviation Composites to pay Scaled the unpaid balance of their account amounting to over $60,000.00.

All in all, from our standpoint, a satisfactory result. Unfortunately, an unbelievable amount of Burt's time, and several others at Scaled, was spent preparing for and during this trial.

RAF has felt from the beginning that this lawsuit was improper and without justification. Evidence presented at the trial clearly demonstrated that flight testing conducted by the law firm of Ervin, Cohen and Jessup of Beverly Hills, CA, under the technical direction of Ivan Shaw for Aviation Composites, produced results that confirmed RAF's innocence. These test results showed that RAF had performed the requirements of its contract with Group Lotus and had accurately presented the test results in the formal test report.

This lawsuit should never have been filed. RAF is investigating the potential for recovering defense attorney fees from Aviation Composites and the law firm.

Again, thank you, all of those who wrote and called during this tough and worrisome time.

****From CP66-2&3 (CH35)****

REVALIDATE YOUR LICENSE TO BUILD

As you know, in CP65, page 2, RAF requested all builders and flyers who were licensed by RAF to fill in a form and send it to us. This process is to revalidate your license to build. New builder fabrication starts were not allowed after 1 Jan. 1991. Please understand that RAF has extended builder support to those who purchased plans for a period far in excess of what any other company in this business has ever done.

We have received a total of 446 responses, 333 from Long-EZ, 79 from VariEze, 27 Defiant, 4 Solitaire and 3 VariViggen builders. This response is less that what we expected, ie, we believe there are more of you out there who desire to be properly licensed. Thus, we are extending the registration deadline to 3 months, to give those of you who failed to respond more time to do so.

Important - Register your building project and show proof that construction is underway by April 1, 1991 (see CP65). If you do not do this by April 1, you are not licensed to build a RAF design.

RAF cannot promise builder support for any project started after April. We do not consider it safe for anyone to build and fly any homebuilt without adequate support. Your are not protected by the AD (airworthiness directives) system like you are on a certificated, manufactured aircraft. We cannot validate licenses for any unsafe practice. Since we will have to drop support sometime over the next few years, the April '91 cutoff for builder starts is critical. While we can't predict the future extent of builder support, plan to complete your project by April '93. Those who respond by filling in the form and returning it to RAF will be considered by RAF to be legitimate and will be assigned new serial numbers. This will allow RAF to continue to provide quality support to those who deserve it.

****From CP66-8 (CH35)****

Canard Pusher Digest - Stet Elliott's *Canard Pusher Digest for the Long-EZ* is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP65 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Note that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

CP Digest for the Long-EZ. Overseas orders add $20.00 for airmail, otherwise, it will be sent via surface vessel.	$67.00
Annual Update subscription (4 updates)	$25.00

Overseas orders add $5.00 for postage

Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

Update Number 67 to Supplemental Chapter 35, Builder Support

****From CP67-1 (CH35)****
LICENSE AGREEMENTS
Many of you have called RAF in the past month regarding your new license agreement number.. We ask your patience since the cut-off date has just recently been reached. After "digesting" the hundreds of forms that were returned, we will, indeed, issue new numbers to those of you who qualify for continuing builder support. It may take us a little time, but it will be done as soon as possible.

****From CP67-2 (CH35)****
A LETTER FROM BURT
We print this letter in CP67 because it is a typical reply to many we receive and in the hope that it will clarify the situation.

"Dear Craig;

We confirm that our records do not show you as authorized to build a Long-EZ as you do not have a license from RAF.

No new licenses were issued after July 1985.

The person who sold you plans may or may not hold a license. If he does, he could contract with you, as he is an authorized manufacturer of a Long-EZ. If he, as the manufacturer, is willing to accept the responsibility of this aircraft and thus, in effect, sub-contract its fabrication to you, he may do so. However, be sure before you start, that he is willing a accept responsibility as the authorized manufacturer and is committed to providing support to you during your fabrication, and while you fly your aircraft. We, RAF, will support him (the authorized manufacturer) as long as we are able to do so.

We strongly recommend that you obtain a written contract with him to guarantee that you will be provided with support. It is not advisable, and may be extremely dangerous, to build an airplane referring only to plans and without the benefit of a safety information system. In effect, you would be doing a true prototype without benefit of experience of others.

Also, please see *Canard Pusher* #46, pages 9 and 10, and *Canard Pusher* #54, page 1 for further explanations.
Burt Rutan"

****From CP67-9&10 (CH35)****
CANARD PUSHER DIGEST
Stet Elliott's *Canard Pusher Digest for the Long-EZ* is still available. He has just published the 2nd edition which includes all pertinent information for CPs 24-65. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ Overseas orders add $20.00 for airmail, otherwise, it will be sent via surface vessel.	$67.00
Annual Update subscription. (4 updates)	$25.00

Overseas orders add $5.00 for postage
Send payment to Stet's new address below:
Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

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Update Number 68 to Supplemental Chapter 35, Builder Support

****From CP68-4 (CH35)****
SHOPPING
CANARD PUSHER DIGEST
Stet Elliott's *Canard Pusher Digest for the Long-EZ* is still available. (For a complete description of the Digest, see CP57). He has just published the 2nd edition which includes all pertinent information from CP's 24-67. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.
Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.
Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

CP Digest for the Long-EZ.(2nd edition) Overseas orders add $20.00 for airmail, otherwise, it will be sent via surface vessel.	$67.00
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Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

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Update Number 69 to Supplemental Chapter 35, Builder Support

****From CP69-1 (CH35)****
NEW SERIAL NUMBERS
At last, we are able to tell you that new serial numbers have been assigned. If both the name and number on your mail label have an asterisk by them, then that number is your new serial number. If you receive CP information from someone else's subscription but you are the original purchaser of RAF plans and responded to the survey, please contact our office and we will give you the number assigned to you. If you responded to the survey and believe you should have received a new number but didn't, please call RAF.

****From CP69-1&2 (CH35,CH41)****
ATTENTION BUILDERS
If you are currently building a Long-EZ, you are missing a bet if you do not subscribe to the Central States newsletter. Editor Terry Schubert is doing a tremendous job of writing and publishing really helpful builder hints.
Contact: Terry Schubert
9283 Lindbergh Blvd.
Olmsted Falls, OH
44138-2407

If you are currently building a Defiant, you should subscribe to the Defiant Flyer. Defiant builder/flyer John P. Steichen is the editor of this excellent newsletter which is full of information on building and flying the Defiant.
Contact: John Steichen
960 86th Street
Downers Grove, IL 60516

****From CP69-2 (CH35)****
SHOPPING
CANARD PUSHER DIGEST, 2ND EDITION
Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now in its 2nd edition. (For a complete description of the Digest, see CP57). Includes all builder related information from CPs 24-68. The 2nd edition has now grown to 654 pages and is professionally printed on double sided paper from a laser printed master.

Note that the Digest is for builders and flyers of the Long-EZ only. It does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current . The updates are compatible with either Digest edition.

CP Digest for the Long-EZ (2nd Edition) $75.00.
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be sent via surface vessel
Annual Update Subscription $25.00.
(4 updates)
Overseas orders add $5.00 for airmail.
Contact: Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

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Update Number 71 to Supplemental Chapter 35, Builder Support

****From CP71-6 (CH35)****

LICENSE AGREEMENTS

RAF continues to receive requests for new license agreements on Long-EZs, Defiants, Etc. This is particularly true from foreign countries. Pleas understand. RAF cannot issue any new license agreements to anyone for any reason. This is final, official and irrevocable.

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Update Number 72 to Supplemental Chapter 35, Builder Support

****From CP72-1&2 (CH35)****
BURT/RAF WIN LAWSUIT
A VariEze accident reported in CP61 in which two people were fatally injured resulted in a lawsuit being brought against Burt Rutan, Rutan Aircraft Factory and Scaled Composites. Very early in the case, there was a ruling that Scaled Composites, Inc. has no connection with the VariEze design.

Testimony which came out during the trial indicated that the builder had constructed his own wing attach mechanisms, including the four taper pins that hold the wing in place...and that the workmanship was not to a high standard. On the morning of the accident, the builder had the wings off his VariEze and in the course of reinstalling them, left out two of the four taper pins. During the ensuing fatal flight, the aircraft was observed doing aerobatics, and subsequently crashed, killing both occupants. Post crash tests revealed that the pilot was intoxicated (by FAR 91 definition). During the course of the trial, RAF presented evidence showing that testing it had done on a stock VariEze...to destruction...proved that the type of failure that had occurred could not have happened even with the two taper pins omitted as long as the aircraft had been operated within its design envelope. Only loads far in excess of the VariEze's design limits could have caused such a failure, Burt and RAF testified...and, in the end, the jury agreed. The cause of the accident, the jury decided, was negligence on the part of the builder/pilot.

This lawsuit may well turn out to be a legal landmark...one that changes the way suits against homebuilt plans/kit business are defended. Burt Rutan has put the litigious society on notice that if he is sued, there will be no out-of-court, pre-trial settlements; the case will be aggressively defended; and that when he wins, he will go after the costs he has incurred in defending himself.

Burt feels there were many aspects of the trial that will be of interest to EAAers, so he will devote a portion of one of this Oshkosh '92 forums to it. His forum entitled "Mojave Update", set for 10:00am on Monday, August 3, is being changed to "Mojave Update and Liability Issues" and may include Burt's attorney, Lee Horton, if his schedule permits. Burt's forums are always standing room only, so it will be advisable to come early for this one.

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Update Number 73 to Supplemental Chapter 35, Builder Support

****From CP73-12 (CH35)****
CANARD PUSHER DIGEST, 2ND EDITION
Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-72. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail
Annual Update Subscription (4 updates) $25.00
Overseas orders add $5.00 for airmail

CANARD PUSHER NEWSLETTERS "ON DISK"
Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CP's is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CP's on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-4156

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Update Number 74 to Supplemental Chapter 35, Builder Support

From CP74-1 (CH35)

RUTAN AIRCRAFT FACTORY, INC.
Building 13 - Airport
1654 Flight Line
Mojave, CA 93501
805-824-2645

U.S. & Canadian subscriptions	$14.00
Back issues	$ 3.50
Overseas (Airmail)	$16.00
Back issues	$ 4.00

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Edition), newsletters 1 to 74.
VariViggen (2nd Edition), newsletters 18 to 74.
VariEze (1st Edition), newsletters 10 thru 74.
VariEze (2nd Edition), newsletters 16 thru 74.
Long-EZ, newsletters 24 through 74
Solitaire, newsletters 37 through 74.
Defiant, newsletters 41 through 74.

A current subscription for future issues is mandatory for builders -- as this is the only formal means to distribute mandatory changes. Reproduction and redistribution of this newsletter is approved and encouraged.

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem. If you are not in an emergency situation, we ask that you write to Mike. However, if you require immediate assistance, Mike will make every effort to return your call between 2:30pm and 4:00pm (our time).

When writing to RAF, send along a stamped, self addressed envelope if you have builder's questions to be answered. Please put your name and address on the back of any photos you send.

From CP74-1 (CH35)

SOMETHING NEW HAS BEEN ADDED

The post office has decreed that a change be made to our address. The flight line number must appear above the city name or they will not deliver our mail beginning March 1, 1993.
Please read and heed.

From CP74-8&9 (CH35)

CANARD PUSHER DIGEST, 2ND EDITION

Stet Elliott's "Canard Pusher Digest for the Long-EZ" is now it its 2nd Edition. (For a complete description, see CP57). Includes all builder related information from CPs 24-74. The 2nd edition of the Digest has now grown to over 700 pages, and is professionally printed on double sided 8 1/2 x 11" paper from a laser printed master.

Quarterly updates to the Digest are also available. The updates provide additional information from newly published CPs to bring the Digest current. The updates are compatible with either Digest edition.

Note that the Digest is builders and flyers of the Long-EZ only. It does not support other RAF designs.

CP Digest for the Long-EZ (2nd Edition) $75.00
(Overseas orders add $20.00 for airmail
Annual Update Subscription (4 updates) $25.00
Overseas orders add $5.00 for airmail

CANARD PUSHER NEWSLETTERS "ON DISK"
Stet Elliott has also compiled the text of all the Canard Pusher newsletters in electronic format. The set includes all of the Canard Pusher Newsletters, from the very first one published in May of 1974, to the present. The set of CPs is provided in a text only format which should be 100% compatible with any computer word processor you presently use. It is available for either the IBM or Macintosh platforms. A hard disk is strongly recommended since the set contains over five megabytes of textual information!

This product is ideal for anyone interested in reading about the evolutionary development of RAF's canard designs through the years, or for those builders still plagued with the "I know I read it here somewhere!!" syndrome. With one of the inexpensive text search and retrieval programs, text string searches across the entire set of files are a snap.

CPs on disk costs $65.00. Specify disk size, (3 1/2" or 5 1/4"), platform (IBM or Mac), and disk capacity.

For either the CP Digest for the Long-EZ, or the CPs on disk, contact:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
(714) 839-4156

Update Number 76 to Supplemental Chapter 35, Builder Support

****From CP76-3 (CH33,CH35,CH38)****

CP ADVISORIES AND RECOMMENDATIONS

These are for your protection. All that RAF can do is tell you. It is up to you to comply for your safety, as well as any passengers you may take up. **Keep your aircraft TOTALLY up to date on all CP advisories and recommendations.**

Not everyone who is flying a RAF design receives the CP. If you know of anyone who may not read the CP, make it your business to get involved, lend him (or her) your CPs (or copies of the CPs - we encourage copying the CP). The whole purpose of the CP is to help you fly as safely as possible.

If anyone knows of a condition that may have developed over the years or of any unsafe situation, PLEASE send us a letter detailing the problem. Help us to get the word out.

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Update Number 77
to
Supplemental Chapter 35,
Builder Support

Information derived from CP77 published by RAF Jan 1994

****From CP77-1 (CH35)****

WHAT EVER HAPPENED TO OCT. CP?

The October 1993 edition of the Canard Pusher did not make it to the printer. There were two reasons for this: We were very busy with a flight test program at Edwards Airforce Base and, we had very little material for CP 77 (Oct.). All subscribers will have their subscriptions extended so you will still receive the same number of CPs.

If you have any subject you feel would be of interest to other builders/flyers of RAF designs, or one of a safety nature, please send them in. This newsletter is your newsletter. In order to keep it alive, we need feedback!

****From CP77-10&11 (CH35)****

RAF "GOODIES" AVAILABLE

NEW ITEM

VIDEOS AS MENTIONED IN CP76.

We now have available VHS tapes of two of Burt's talks at Oshkosh '93.

Tape #1 - Design College - Cockpit of the Future.
Tape #2 - RAF Builder's Support Forum.

Please send $20.00 per tape to RAF at 1654 Flight Line, Mojave, CA 93501. We will pay the postage.

Charms-Long-EZ/VariEze (gold or silver)	6.50
Name patch	1.50
Silhouette patch (no Defiant or Long-EZ)	3.50
3-ship poster (17"x22")	3.75
2 Long-EZs in trail (11"x17")	3.00
Defiant on water (11"x17")	8.00
RAF Chronological poster	15.00
Long-EZ lithograph 10.00	
Color photos (EZs, Solitaire, Defiant)	1.25
Night photo by Jim Sugar	5.00
Videos - Building the Rutan Composite	39.00
Go-A-Long-EZ	39.00

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Update Number 80
to
Supplemental Chapter 35,
Builder Support

Information derived from CP80 published by RAF Jan 1995

From CP80-3&4 (CH35)

<u>LETTERS</u>

Dear RAF,

I am the Vice President of EAA Chapter 238 here in New Jersey and have served as Technical Counselor for almost 20 years. Over the last few years, I have become increasingly preoccupied with finding a better way of providing builders with faster and broader access to technical support. With that purpose in mind, eighteen months ago, I started an Electronic Bulletin Board specifically for sport aviation enthusiast across the United States.

Without having spoken to you previously about this technology, I am uncertain as to how much depth I should go in describing it to you. Stated simply, the *North American Sport Aircraft BBS* provides builders and Technical Counselors with a 24 hour on-line service. It is a dedicated interactive computer environment within which to communicate questions or problems related to building an aircraft and get them answered from a national pool of experienced people, not just local ones. There are no subscription fees or access charges. The service is free. To date, the board has attracted calls from every major country in Western Europe including Scandinavia as well as from North American builders. It was this broad acceptance that prompted the recent improvements in software. It is becoming increasingly likely that the BBS will become a node on at least one international message network by January of '95.

Presently, there are 19 special conferences on this BBS:

1. Safety: Items of urgency
2. General Purpose
3. Composite Construction
4. Monocoque Construction
5. Tube & Fabric Construction
6. Ultralight Aircraft
7. Help! (Requests for support)
8. Swap-N-Sell
9. Education: Books. Forums. seminars
10. Fuel Systems
11. Engines
12. Ignition Systems
13. Paint & Upholstery
14. Landing Gear: (Incl. floats & skis)
15. Avionics: (Incl. instruments & wiring
16. Resources: (alternate suppliers)
17. EAA Technical Counselor (private)
18. Government Activity: Fed, State, Muni.
19. Calendar of Events

Others will be added as demand warrants it. In addition, there are 7 file areas which contain files that can be down-loaded to the caller's computer and which will also accept uploaded files.

1. Flight Planning & Pilot Proficiency
2. Building Tips & Techniques
3. Aeronautical Design & Analysis
4. Newsletters

5. Disk Utilities
6. Manufacturers
7. Special Interest Groups

Recently, the system underwent a major change in software so as to make the environment easier for me to manage and to provide a greater scope of services for builders and pilots. I have also gone to great lengths to maintain an environment that is free of computer jargon and user friendly so that those not yet comfortable with this technology will find it easy and beneficial to use. *An invitation is being extended to all known manufacturers and designers of sport aircraft to use the board as a fast means of contacting their building groups and end users, something obviously not possible with the typical monthly or quarterly newsletter.*

I would appreciate your extending my invitation to EAA chapters and urge them to call the BBS and leave information regarding their chapter activities. Ben Owen is aware of the BBS as is Jack Cox. There is hope that a complete national listing of Technical Counselors will be made available on disk media for posting so that builders will make better use of the TC programs.

I invite you to log on as well to see how it might support the EAA Chapter Office. The *North American Sport Aircraft BBS* can be reached by dialing 908-755-5371 any time, day or night with whatever personal computer you may wish. The BBS currently supports any modem from 1200 baud and up and uses an ANSI screen environment.

If you wish to explore other applications, please call me by voice line (908-755-9573). I'll try to give you whatever assistance I can that will further the support of homebuilders and their projects.

Sincerely,
Art Bianconi

This is a great idea and should be extremely helpful for builders. Many thanks for all the hard work, Art. ED.

Update Number 82
to
Supplemental Chapter 35,
Builder Support

Information derived from CP82 published by RAF Oct 1995

****From CP82-2 (CH35)****

The Canard Pusher is published quarterly (January, April, July, October) by Rutan Aircraft Factory, Inc.
1654 Flightline,
Mojave, CA 93501
Editor: Mike Melvill
Publisher: Tonya Rutan
(805)824-2645

U.S. & Canadian subscriptions $14; Back issues $3.50
Overseas (Airmail) subscriptions $16; Back issues $4

RAF is no longer accepting multi-year subscriptions. Please renew only after your current subscription has expired.

If you are building a RAF design, you must have the following newsletters:
VariViggen (1st Ed) CP 1 to current
VariViggen (2nd Ed) CP 18 to current
VariEze (1st Ed) CP 10 to current
VariEze (2nd Ed) CP 16 to current
Long-EZ CP 24 to current
Solitaire CP 37 to current
Defiant CP 41 to current

A current subscription of the Canard Pusher is mandatory for builders, as it is the only formal means to distribute mandatory changes. Reproduction and distribution of the Canard Pusher is approved and encouraged.

****From CP82-5 (CH35,CH36)****

Surfing the Net

Internet has some EZ info. Burt recently posted the following letter on America Online Clubs - Interests - Aviation - Forum - General Aviation - Homebuilts, Long-EZ & VariEze Message Boards. **SKETCH OMITTED**

While I am far too busy to keep up a continuous dialog on this news group I do think I should respond to some of the info out there!

I've been surfing the postings and see a lot of wrong stuff (abet mixed with some very good info). I offer the following to update those EZ guys that somehow don't get the quarterly CanardPusher newsletter.

Yes, we still support EZ licensed builders and flyers. even now, 10 years after we sold the last set of plans. If you are licensed by RAF to build an EZ (several thousand people) we still here to help in any way we can to assure that you have the best chance to fly safely. We do not support second-party plans owners or bogus (Xeroxed) plans owners, so if you buy a set of plans from a licensed builder, be sure to get his agreement to support you. Remember he is still authorized to build ONE aircraft, and we will support him. He, if he wants, can sell ANYTHING to you, If you buy a used set of plans we suggest that, along with the plans, you get his agreement to license you and to support your project, since he is the only RAF licensed manufacturer.

The CP is still in publication, written chiefly by Mike Melvill, the primary builder support guru since 1978. It still is my official means to pass on plans changes and important safety info. CP #82 (Oct 95) is a bit late, because it is being revamped to an all-new format (my wife Tonya is the new editor). It's 16 pages are packed with interesting stuff including several MAND-GROUND changes that Mike Melvill and I think everyone should have. A CP subscription is available to anyone, not just licensed builders.

Also strongly recommended are the Oshkosh talks.

In general, RAF only supports the basic, unmodified versions of the aircraft, since that is all we have flight-tested. Many mods have been done by builders (bigger engines baggage pods etc, etc, etc). Many of these MAY be OK, but to find out for sure, contact those who developed them, NOT RAF.

We are painfully aware of how difficult it is for everyone to keep up with every single improvement and revision. The words of the newsletters alone comprise about 4 megabytes. That is why we are in the process of putting together a CD-ROM. This will be a special product since it will include not only the newsletters but also pilot's handbooks, tech reports, and even the plans of all the RAF homebuilts since 1972! (No, it will not include new licenses to build - the postings here accurately explain why we stopped that).

The CD-ROM will have thousands of illustrations, photos and a great search engine. If You are a CD-ROM developer/producer, contact us for an RFP, by faxing your address to (805)-824-4174.

RAF is open on Tuesdays ph (805) 824-2645 addr 1654 Flightline, Mojave CA 93501

Onward & Upward, Burt Rutan

PS: No, the Boomerang is not yet flying, I hope to finish it this spring. I WILL post the first flight report here on America Online. PPS: Check out the postings on the BD 12/14, shades of 1971!!

Supplemental Chapter 35, Builder Support

From CP24-7 (CH35)
OVERSEAS FOCAL POINTS
The purpose of this section is to list anyone willing to help other builders in their areas overseas.

Builders in France, contact -
Jaques Lesschaeve.
218 rue de la Rianderie,
59700 Marcq en Bardoeul
FRANCE

Builders in Switzerland, contact -
Rudi Kurth.
Langgasse 51,
CH-3292 Busswil
Switzerland

From CP25-3 (CH35)
BUILDER ASSISTANCE
More names to contact for builder assistance:

Al Coha,
5173 Leo Street,
San Diego, CA Phone: 582-2137

Nat Puffer,
???? N Payne Ave,
St. Paul, MN 55117

Nat is also willing to check new EZ pilots out in his VariEze, and to do first flights in new EZ's, limited runway flights, but not including envelope expansion.

From CP27-2 (CH35)
Tom Garrison - Route "S" Box 80, Tulia, Texas, 79088 is trying to get a Long-EZ/VariEze group together in the Texas panhandle area. Any builders interested please contact Tom at the above address.

From CP30-1 (CH35)
EZ Clubs
Charlie Gray of Miami Lakes, Florida, has formed a group of VariEze/Long-EZ builders in the South Florida area. This is a very active group and have had several meetings already. Next meeting is at Charlie's house on Saturday, October the 24th. This is a "minimeet" and the next major meeting is December the 5th, time and place to be announced. There were 52 people present at the last get together, so you can get some idea of the size of the operation. Charlie has been out to RAF several times in the past six months and is doing a tremendous job, not only organizing this South Florida group, but helping builders with construction problems. He is building 2 Long-EZs and is quite far along with both of them. Charlie has put out a newsletter, Eze Builders of Florida, that contains some useful builder hints and also covers the meetings. Write to Charlie Gray, 6893 Seagrape Terrace, Miami Lakes, FL 33014.

From CP30-1 (CH35)
Art and Bonnie Lazzarini, P.O. Box 1691, Hailey, ID 83333, phone (208)788-3453, requested us to publish their names and address in the CP in hopes that other EZ builders in Idaho might make contact, perhaps share a beer and some moral support.

From CP30-5 (CH35)
From the Builders and Flyers
Eze builders if Florida.
Charlie Gray hosted a dinner for EZ builders on Saturday the 18 of July '81 at 7:00pm. Dinner was at "Beefsteak Charlies". We adjourned to Charlie's large home and six car garage in Miami Lakes. Betty Gray had coffee, sodas, and cookies for us. (Maybe Charlie figured out that if everyone got heavier, his two Long-EZs will be the fastest). Charlie led the group in a discussion of current Rutan developments, then discussed the formation of a club. He felt the purposes of such a club should be things like dissemination of builder's hints, where to buy tools and supplies, a flying group, and encouragement to those starting or completing their project. Mr. Gray's ideas were well received by the group and it appears we will organize during our next meeting.

The 35 of us broke up into three groups. Some people watched the RAF composite education tape in the living room. The rest of the group then either formed small bull sessions or went through Charlie's shop to look at his two projects and tools, supplies, etc.. Many good questions came up in the shop so the flow of information was both diverse and extensive. The best part of the discussion was that there were pilots there who had finished their EZs, some close to finish, and many just starting along with a few just making up their minds. This led to more and better information coming out from diverse points of view.

The builders who were unable to attend missed a very fine evening. We started with Charlie G. giving each plans holder a folder with note pad and a large print of a delightful sunset taken by Charlie from aloft, we then ate a leisurely meal spiced with hanger flying and building. Finally we went and seriously talked about the costs, problems, and joys of EZ building. I hope those who did miss it are looking forward to the next meeting half as much as those of us who participated in the first meeting.

Robert Dunham
Florida

From CP30-11 (CH35)

Note that Ray and Nova Cullen have moved, but are still available for anyone who needs assistance with Eze construction problems. Ray and Nova still continue to supply plans for seat cushions and survival kits for $8.00. Mike and Sally's N26MS seat cushions are done from a set of Ray and Nova's plans.
Ray and Nova Cullen
1607 First Street
La Grand, OR 97850

From CP30-16 (CH35)(Photo Caption)

The mostly-alert group of EZ builders, watching the construction video tape at Charlie and Betty Gray's meeting in Florida.

From CP31-1 (CH35,CH36)

RAF BUILDER SUPPORT

It has become necessary to further clarify Rutan Aircraft's position in relation to the homebuilder and the support we give. Rutan Aircraft can only offer the assistance that helps them interpret the plans when they desire to build their aircraft like the prototype we have tested. We cannot assist in the design and construction of modifications. We cannot comment on the advisability of modifications. Many of the developments we design and test do not work as predicted. Thus, without testing your idea we cannot reliably predict its success. A similar situation exists for substitutions of materials. We will not be able to advise you on any material we have not tested ourselves.

From CP31-2 (CH35)

VARIEZE/LONG-EZ CLUBS

Jerry Gruber, who recently flew his beautiful Long-EZ, has offered builder assistance to anyone in his area. Contact Jerry at 401 Aspin Dr., Elkhart, Indiana 46514

John Steichen of Downers Grove, Illinois would like to hear from builders/flyers who would be interested in some form of Great Lakes or Midwest hospitality activities. John is willing to organize a winter or spring flyin/drive in. Contact

John Steichen (N27EZ),
Brookeridge Air Park,
960 86th Street,
Downers Grove, Illinois 60516

From CP31-9 (CH35)

A Chino Valley area Long-EZ club for beginners, those in the middle and those finished. Let's get together and share some of our ideas and helpful ideas and helpful hints.
For more information please contact:
Kim Prout, 3801 Carlos Court, Chino, CA 91710 (714)628-1403
or Paul Prout (714)621-0060
Everyone welcome.

From CP32-1 (CH25,CH35)

SEMINAR IN FLORIDA

In February Burt and I flew to Miami, Florida (in a Lockheed L-1011) where Burt was the speaker at EAA Chapter 37's annual banquet. I was lucky enough to tag along, and I must say I really enjoyed the banquet. The food was good, Burt's talk and slide show, as always, was great and being in the company of so many VariEze and Long-EZ builders and flyers was neat. Charlie Gray, a Long-EZ builder organized the whole affair, and did a super job. A really nice touch was that each person at the banquet received a water glass, with a Long-EZ printed on one side and the Chapter logo and date printed on the other.

The next morning Saturday, Charlie drove us to the Fort Lauderdale Executive Airport, where Burt and I gave a composite seminar to about 300 people. At least two Long-EZs and two VariEzes flew in and I was pleased to be invited to fly Jack Fehlings gorgeous VariEze "Yellowbird". Burt and I spent a couple of hours talking to builders, before the seminar, and several things were noted on both Long-EZs that were there. Smooth contour on wings, canards and winglets is really important if you are to get the performance you expect. Paint stripes along the leading edges of wings and canards are only acceptable if there is no masking tape joggle. A joggle like this can trip the boundary layer and transition good, low drag, laminar flow into high drag, turbulent flow. NASA tests on our Long-EZ has shown that destroying all the laminar flow can cost you up to 11 knots!

Prior to the seminar, Charlie Gray had got hold of a reject canard that we looked at and Burt agreed that it should not be installed on an airplane. We decided to do an informal static load test to destruction. So we called for people weighing about 175 lb. With Burt positioning each person for correct load distribution, we proceeded to try to fail the canard. We got 18 people (not an easy task, very little room!) on it before we finally got a few minor cracks. At this point, Burt calculated we had 11.54 g's on it, and it still would have got the airplane home. It did not fail catastrophically. Someone must have photos of the 18 people on it. We didn't get one, unfortunately.

The seminar went well, we both enjoyed the opportunity to answer questions, look at parts, and do some hands on, hot wire cutting, layups etc. When we went back to Charlie Gray's home, both of us were a little "hoarse" but it was fun. Sunday, on the way to the airport, we visited a couple of Long-EZ projects, wish we could have seen more of them. There are a lot of Long-EZs under construction in the south of Florida. Thanks to Charlie and his wife Betty for showing us such fine hospitality. Charlie should be flying his Long before to long.

****From CP32-3 (CH35)****
CLUBS
A Long-EZ club has been formed in the Chino, CA area. With 26 members already, this is a fast growing club. For more information contact:
Dick Kreidel
4422 Acorn Street
Yorba Linda, CA 92686

****From CP33-4 (CH35)****
VariEze Help
William Rice is willing to show his VariEze and even give a back seat ride to any EZ builders in the northern California area. Bill has over 300 hours on N103B. Contact: Bill Rice, 1156 Ridgewood Drive, Eureka, CA 95501

****From CP34-2 (CH35)****
Long-EZ Squadron I
This is a Long-EZ builder/flyer club. Anyone with Long-EZ plans or building a Long-EZ in the Los Angeles basin area is welcome to write to the address below for information on the club and its purposes. This club is not for people with a general interest, but is for serious builders and only Long-EZ builders. The club is very well run and has meetings once a month. They put out a monthly newsletter to the 48 paid up members. There are organized committees to assist builders in various areas such as electrical, engine installation, structure and even plan interpretation. The club tries to have interesting speakers at their meetings and members are encouraged to bring parts to the meetings for constructive criticism. There are two Long-EZ's completed and flying and two others that are close. This group is builder support oriented. There is little or no social aspect.
Contact: Long-EZ Squadron I
7000 Merrel,
Chino Airport, CA 91710

****From CP36-5 (CH35)****
EZ CLUBS
Dayton area (Ohio) VariEze and Long-EZ builders have formed a Hospitality and Co-op support organization called "DUCK". This stands for "Dayton United Canard Klub". Local area builders should contact: Michael Zimmerman,
7313 Dabel Ct.
Dayton, OH 45459
(513)435-0882
"DUCK" will be organizing a flyin in connection with the Dayton Air Fair in July 1983 and will hold monthly meetings.

Long-EZ Squadron #1.
This is a club for Long-EZ builders only.
Contact: Long-EZ Squadron #1
Chino Airport,
7000 Merrill Ave,
Chino, CA 91710

Long-EZ Squadron #2
A second Long-EZ builder/flyer club is starting up at Santa Monica airport with aims similar to those of Squadron #1. A builder's support club to provide assistance by builders to builders. Those who have Rutan registration numbers are welcome to join. The club plans to develop assistance committees, a newsletter and lectures. If interested, please contact:
Long-EZ Squadron #2
3021 Airport Ave.
Santa Monica, CA 90405
(213)398-5652
(213)454-9877

EZ Builders of Florida
This club was run by Charlie Gray, now organized by Jim Carlin. For more information, contact:

Jim Carlin
5359 Lantana Road,
Lake North, FL 33463
(305)964-3805

Claude Beaudet, a French Long-EZ builder would like to contact other French builders. Please contact:

Beaudet J. Claude,
33 Boulevard de Charonne
75011 Paris, France

The Educational Resources and Planetarium in Lumberton North Carolina has asked us to announce that they will show, upon request, the Rutan video tapes. That is the Construction tape, Flying is VariEze, Defiant and First Flight tape. For more information, contact: James Hooks at (919)739-3302.

From CP37-2 (CH35)
CLUBS
Dayton 'Ducks' (Dayton United Canard Klub) held is first organizational meeting and workshop. 18 members were present, most of whom are building VariEzes and Long-EZs. The 'Ducks' would like to extend an invitation to all EZ types to contact them for meeting dates and times to share knowledge, special skills and above all, have a lot of fun the 'EZ' way.
Contact: Mike Zimmerman, 7313 Dabel Court,Dayton, OH 45499. (513)434-6800 or (513)435-0882.

From CP38-5 (CH35)
BUILDER SUPPORT
Builder support at RAF lately has been handled by Michael Dilley, since Mike Melvill had been involved in the very busy flight testing of Burt's new design, the Beech Starship I. Michael came to RAF over two hears ago and has been involved in the finishing stages of the Grizzly, all phases of construction of the Solitaire, including the writing of the plans and of course he flies Solitaire. A few months ago, he started building his own Long-EZ at home, and of course he regularly demonstrates the prototype Long-EZ and gives the builder rides on Saturdays. In addition Michael was a primary builder of the Amsoil Racer. He has previously owned a Taylorcraft and a BD-4. Michael is doing sterling work handling almost all builder support including VariEze, Long-EZ and Solitaire. Thanks Michael, we could not do it without you!

From CP38-7 (CH35)
LONG-EZ CLUBS
Arnie Ash, RR #5, Davenport, IO, 52806, would like to form a Long-EZ group interested in construction etc. Anyone in Quad Cities area of Iowa/Illinois, contact Arnie.

Sunbelt Long-EZ Club.
Contact: Pete Petrie or Jim Hooks,
(919)739-3302

LONG-EZ Squadron 2
Squadron 2, the Long-EZ builders/flyers club, is going strong at Santa Monica Airport and now has 30 builder members. They meet at Santa Monica Airport at Claire Walter's Flight Academy on the 2nd Wednesday of every month at 7:30 pm. Squadron 2 has aims similar to those of Squadron 1. It is a builder's support club to provide assistance by builders to builders. Those who have a Rutan registration number are welcome to join. Anyone considering a Long-EZ project is welcome to come visit as a guest.

Long-EZ Squadron 2
3021 Airport Avenue
Santa Monica, CA 90405
(213)398-5652 or 454-9877

From CP39-3 (CH35)
EZ CLUBS
Gianni Zulani, via Procaccini 68, 20154 Milano, Italy, would like to make contact with more European EZ pilots and builders. Gianni reports that his beautiful Long-EZ now has over 60 hours on it. Besides his Long-EZ, he knows of two Italian VariEzes flying and three more nearing completion.

An EZ-Association has been formed by the French VariEze and Long-EZ builders. Over 40 members, including 20 Long-EZ builders have joined already. All EZ builders in French as well as other European countries are invited to join. Contact: Jean Louis Beret, 2 rue d'Anjou, 57157 Marly, France.

The Long-EZ Squadron I and Squadron II, from the Los Angeles basin area, are planning a joint fly out/drive to RAF in Mojave. This is planned for May, probably Saturday the 19th. We at RAF welcome this idea and encourage other groups to do it. Let us know a few weeks in advance and it should make for an interesting day for all.

From CP40-5 (CH35)
EZ CLUBS
EZ Builders Of Florida - A very active group of builders put out an excellent newsletter that is published on a flexible bi-monthly basis. The main purpose is to aid in the construction and assimilation of information on all Rutan designed aircraft, as well as other aircraft using the same type materials. A fee of $6.00 annually is requested to help cover mailing and printing costs. Anyone is welcome to subscribe, whether or not you are building an airplane. For more information, contact:

Contact: Jim Carlin
7282 Skyline Drive
Delray Beach, FL 33446
(305)498-8006 - nights
(305)585-1756 - days

Long-EZ Squadron I - Chino, California. This is an active Long-EZ builders only club. They put out a bi-monthly newsletter and have meetings once a month usually with a guest speaker. The purpose is to help each other during the building stages and to encourage as many as possible to complete their airplanes. They have a respectable record so far. Club membership is limited to 100. To qualify for membership you must have a set of Long-EZ plans and have a RAF issued serial number.

Contact: Robert Maetzold
2814 Associated Road #7
Fullerton, CA 92631

Long-EZ Squadron II - Santa Monica, California. This club is an offshoot of the Squadron I and has generally the same goals and requirements. Mike and Sally were the guests at last months meeting and thoroughly enjoyed the camaraderie of a group so dedicated to producing safe, high quality Long-EZs. In a hangar on the field, there are two flying Long-EZ's, while upstairs in the attic there are four more under construction. One of these is very nearly done, and should be an outstanding example. This group of four are called the "hole in the wall gang" and with good reason. They will have to cut a hole in the wall to remove their airplanes from this second story workshop!

Contact: David Orr,
2523 S. Bundy Drive,
Los Angeles, CA 90064

D.U.C.K.(S) - (Dayton United Canard Klub!) This club now has 43 members and are continuing to grow. They are presently assembling a photo roster to include a photo of each member and his or her project. This will be updated each six months. This club is not exclusive to a particular type, rather it caters to all canard, composite types.

Contact: Michael Zimmerman,
7313 Dabel Court
Dayton, OH 4549
(513)435-0882 - home
(513)434-6800 - work

From CP40-5 (CH35)
SOLITAIRE CLUB
If you are building a Solitaire and are interested in forming a club, Bob Matheny from San Diego would like to hear from you. Bob is probably as far along as any Solitaire builder and would like to exchange information and share ideas.

Contact: Bob Matheny,
4452 Brindisi Street,
San Diego, CA 92107
(619)223-3745

From CP42-2 (CH35)
CLUB NEWS
Long-EZ builders in the Chicago area, interested in getting together and exchanging information and experiences, contact:

Roger Shem,
14540 Oakley,
Orland Park, IL 60462
312-349-0510

Defiant builders in the Chicago area, VariEze builder John Steichen, is working on his Defiant and would like to share information, skills, possibly even jigs and fixtures with other area builders.

Contact: John Steichen,
960 86th St,
Downers Grove, IL 60516
312-985-6671

From CP43-2 (CH35)
DEFIANT NEWS
Fred Keller has been at it again, working hard on the engine installation plans and as we go to press, we are expecting to receive his drawings. We will correlate the drawings, add baffling templates as required and prepare the words, music and drawings for the printer. Usually it takes 3 to 4 weeks to get the prints back. So realistically we should have the engine section available for sale around the end of March.

We continue to hear from Defiant builders who are progressing at almost unbelievable speed. Dr. Yost, from Sheffield, Alabama has his fuselage on the gear, nose gear retract mechanism is installed and operating, wings are complete and mounted, the canard is complete, canopy and turtle deck and is building dynafocal engine mounts to mount his IO-320, 160 hp engines. We have been giving him information over the phone as he needs it to build the mounts. We would never have thought anyone would be this far along so soon!

Johnny Murphy is also working on engine mounts and has all of the major parts built. Hopefully we will see at least two new Defiants at Oshkosh, 1985.

A group of Defiant builders have gotten together in the general vicinity of Houston, Texas. They are comprised of 12 plans owners, with at least 3 of them going great on their projects. A group of builders like this really speeds things up, one jig works for everyone and shared knowledge of short cuts, sources for parts and even potential pit falls are all among the advantages of forming and maintaining a group.

****From CP43-2 (CH3,CH30,CH35,CH41)****

HOMEBUILDER RESPONSIBILITY

Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you the homebuilder should be aware of what you are taking on when you build your own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft, is in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues a airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meetings, talk with other EZ builders. Many good books are available from EAA. Supplement your plans with a few, such as Tony Bingalis' "Firewall Forward". After you have got something built, get as many people as you can, to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them only from the recommended suppliers.

The same philosophy is also true for engines. Almost daily we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ we recommend any model of the Lycoming 0-235. If you wish to install some other engine, please do not call us. We can not help you. As an experimenter, you can of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You the builder have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what material, power plants, etc. go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials and therefore cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer, is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

****From CP44-9 (CH35)****

CLUBS

Lew Nixon is building a Solitaire and he would like to hear from other Solitaire builders, particularly from the Dallas area.

Contact: Lew Nixon
7746 Alto Karo Drive
Dallas, TX 75248
(214)239-6323

****From CP44-9 (CH35)****

Ken Cooley is interested in getting together all Long-EZ builders in north Florida and south Georgia to exchange information and experiences. His hangar is located on the south end of the runway on Hallars Airpark, Green Cove Springs, Florida (Jacksonville sectional). Contact Ken if you are interested. Groups of builders, like Ken is trying to do, have sprung up all over the place, and are really working out well. The moral support as well as the experience available from other builders who may have already done what you are trying to do, is invaluable.

Contact: Ken Cooley
P.O.Box 1346
Orange Park, FL 32067
(904)282-1920

From CP45-6 (CH35)

Squadron I, the original Long-EZ builders group in the Los Angeles basin has a new address and meeting place. They meet once a month on a weekend, usually a Sunday morning on the Bracket Field airport in La Verne. The new address is: P.O. Box 396, Yorba Linda, CA 92668.

From CP46-1 (CH35)

PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY AND FRIDAY FROM 8:00 am TO 5:00 pm ONLY. If you have parts that you would like us to see and or would like to drop in, please make it Tuesdays and Fridays if you can. If you need to come up other than those days, please call so that we can be sure to be here.

From CP46-2 (CH35)

CLUBS

Arnie Ash reported an excellent turnout for EZ types in the central part of the country. The flyin/drive in was organized and hosted by Arnie who says that 17 EZ types flew and over 70 people enjoyed the kind of a weekend only EZ people can. Arnie **is trying to organize a builder/flyer group in the area and is planning on holding another flyin next spring.** Anyone interested in joining this group and receiving their newsletter, contact: Arnie Ash, Route 5, Davenport, IA 52806. To join the group is a cost of $10.00 per year.

From CP46-2 (CH2,CH35)

RAF BUILDER SUPPORT

The most asked question these days is how long will RAF remain in existence to support the homebuilder? The answer to that question depends largely on you the homebuilders. We will be here as long as you support RAF, that is to say, you send in information on your project, photos, builder hints, safety/maintenance related information on your aircraft and you continue to subscribe to the Canard Pusher newsletter. Now that RAF has zero income from plan sales, its important that you support RAF by buying your raw materials, prefabricated metal parts, or prefab glass parts from RAF approved suppliers, such as Aircraft Spruce, Wicks Aircraft, Ken Brock, Lombard's and Dayton Airplane Factory. This will go a long way to making sure RAF is around for many years since RAF gets a small percentage of your cost from each of these suppliers. If you elect to buy your part or supplies from one of the "bootleggers", you are contributing to the demise of RAF and we will not be here to support you should you have a problem while building or flying your RAF design.

If you buy from non-recommended suppliers, you are not only not supporting RAF financially, but you also do not know if you are getting correct materials or safe parts. When you buy from RAF recommended suppliers, you are absolutely getting RAF recommended materials and parts we have tested and are happy with.

It is up to you the licensed homebuilder. If you want RAF to be around to publish the Canard Pusher, to help when you have a problem, support RAF. Send in your builder hints, your photos and flight reports. We will be here as long as we possibly can to assimilate and disseminate safety information and to try to promote the safe building and flying of our various RAF designed airplanes.

From CP46-10 (CH35)

Join EAA

Membership in the Experimental Aircraft Association Inc. is $30.00 for one year, $54.00 for 2 years and $84.00 for 3 years. All include 12 issues of Sport Aviation per year. Junior Membership (under 19 years of age) is available at $18.00 annually. Family Membership is available for an additional $10.00 annually.

Make checks payable to EAA. Address all letters to EAA.
WITTMAN AIRFIELD
OSHKOSH, WI 54903-2591
PHONE (414)426-4800
OFFICE HOURS: 8:30-5:00 MON - FRI

From CP47-7 (CH35)

RAF DESIGN CLUBS AND GROUPS

International VariEze Hospitality Club
Don and Bernadette Shupe
2531 College Lane
La Verna, CA 91750
714-593-1197

This one is a must for all EZ pilots/builders and their spouses. A super newsletter four times a year and super flyins and flyouts several times a year - only $10.00 for US and Canada and $12.00 for overseas.

Long-EZ Squadron I
Russell Harris
13211 Chestnut Street,
Westminster, CA 92683

Strictly for Long-EZ builders, you must own plans and possess a RAF serial number. Excellent newsletter 4 times a year, $12.00 a year.

Long-EZ Squadron II
David Orr
1451 Berwick St.
Los Angeles, CA 90049

Similar to Squadron I, in fact a spin-off as a result of too many members. Both of these groups have a very high rate of completed airplanes.

Dayton DUCKS - (Dayton United Canard Klub!)
7313 Dabel Court
Dayton, OH 45490
513-435-0882

The "DUCKS" have been in operation for several years and have a substantial list of members building and flying EZs.

EZ Builders of Florida
Charlie Gray
2314 St Croix
Kissimmee, FL 32741
305-847-7070

Open to EZs, Defiants and most other composite designs. Good newsletter and flyins.

Central States Association,
Arnie Ash
Rural Route #5,
Davenport, IO 52806
319-386-5245

Open to all RAF designs. A new organization - good newsletter.

Atlantic Coast EZ Squadron (ACES)
O.N. Pete Petree,
RT 6 Box 99-B
Laurinburg, NC 28352
919-276-7186

A new organization to exchange ideas, for all EZ types.

From CP48-1 (CH35)
RAF ACTIVITY
RAF is open Tuesdays and Fridays only. This also means we are only available to answer phone call questions on Tuesdays and Fridays. Do NOT call for builder support on Mondays, Wednesdays or Thursdays, you will get a recorded message.

We still talk to lot of builders as well as flyers of RAF airplanes and we do enjoy keeping in touch. If you have any construction problems or flying qualities questions, don't hesitate to drop us a line or give us a call.

If you come up with a good idea, an easier or better way to do something, or you just took a neat trip in your airplane that you would like to share with other flyers, let us know. In order to keep the CP newsletter going and to provide useful information for builders and flyers, please keep those letters coming.

Mike was extremely fortunate a few weeks ago when Dick Rutan offered him a ride in the Voyager! Jeana was not in town, she was back in the Midwest adding a couple of ratings to her pilot's certificate. A test flight had to be flown, and since there was so much to do during a test flight that a co-pilot is a necessity, Dick invited Mike to go along.

Mike reports that it was a tremendous experience and that he is really impressed with the airplane and the team which is now rapidly moving toward the goal of world flight. The date has been set, Sept. 14, 1986 (weather, or course, permitting). It is not too late to help them along. Send a few dollars to: Voyager, Hangar 77, Airport, Mojave, CA 93501.

Look for an article in an upcoming Sport Aviation which details Mike's experience in this incredible flying machine.

From CP48-9 (CH35)(Photo Caption)

SUPPORT THE CANARD PUSHER!

If you enjoy the Canard Pusher, and would like to see it continue in its present form, we need your help! Please send in photos of your projects, or your flying airplanes. We need builder hints, better or easier ways to do things, suggestions, corrections to the plans etc.

We enjoy putting out the CP, it really has become a way of life, almost an institution here at RAF but lately we have received very little feed back from builder/flyers. We need your support and you may be able to save another builder from making the same mistake you did or even prevent a possible accident. If you have information that may be helpful to other EZ builders and/or flyers or if you have had an interesting or unusual experience in your EZ, sent it in. This is really what the CP is made up of, the builders and flyers input.

From CP52-6 (CH35)

PLANS CHANGES

There are no plans changes for this newsletter. Not for any of the RAF airplanes including VariEze, Long-EZ, Solitaire, or Defiant.

Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need help from you, the builder. If you come across an obvious error or omission in the RAF plans you are working from, please send us the information so that we can print it here to help other builders.

For the same reasons, we request any information about building, flying or maintaining any of the RAF airplanes so that we can publish this information in the CP newsletter. This newsletter is for your benefit so if you want it to continue and be helpful and interesting to builders and flyers of RAF-types, send in your hints and suggestions!

From CP53-3 (CH35)

(The one and only, first annual membership drive)

(PLEASE PASS THIS ALONG TO ANY EZ BUILDER/PILOT WHOM YOU FEEL WOULD HAVE AN INTEREST IN AND BENEFIT FROM CENTRAL STATES. THANKS FOR YOUR ASSISTANCE.)

Starting its 3rd year, Central States is an association of builders/pilots of Rutan designed and marketed aircraft.

Central States members have the opportunity to attend Spring and Fall Fly-ins and also receive quarterly newsletters containing valuable information supplied by the membership pertaining to the construction, maintenance and operation of RAF-type aircraft.

Central States has in place a membership "hotline" if it ever becomes necessary to get critical information to all members in a hurry. Although it has never been utilized, the system is in place should ever a critical development require its usage.

The cost to join Central States is $12.00 annually and covers newsletters for the period of December, March, June and September. (Upcoming issues #9-#10-#11-#12.)

If you are interested in joining Central States, send a check for $12.00 payable to:

Central States
c/o Arnie Ash
Rural Route #5
Davenport, Iowa 52806

From CP53-7 (CH30,CH35)

USERS OF ROTORWAY RW-100 ENGINES - John S. Derr is forming an association for those EZ flyers who are using the above engine. Please send your name, address, daytime and evening phone numbers, serial number of engine, type of plane and status of project, any photos or written material you would like to share. If John gets enough response, he will underwrite the first issue of a newsletter. John is a professional scientist and is used to gathering data and presenting it in a reasoned way.

If you have a Rotorway engine and are interested in such a newsletter, contact: John S. Derr
706 Partridge Circle
Golden, CO 80403

From CP54-1 (CH35,CH40)

WHAT HAPPENS IF YOU SELL YOUR PROJECT OR YOUR PLANS?

ILLUSTRATION OMITTED

Note: The licensee, not RAF, is responsible to the new manufacturer. If you sell a completed aircraft, you may be liable for any manufacturing flaws. If you sell a partially completed aircraft, you may be liable for any flaws in your work. If you sell your project, or even just your plans, you are ethically responsible to provide builder support and to pass on safety information.

LICENSE TO BUILD RAF AIRCRAFT

Those of you who are active builders know that your purchase of plans from RAF, entitles the holder to apply for a license to allow him to construct one aircraft from the purchased set of plans. Plans sold without the license indicate that the purchaser has obtained to plans for the purposes of using as a book or educational material to learn fabrication or design processes but not to build an airplane of this specific design.

When RAF had been selling plans, RAF had accepted transfer of the license from the original purchaser to a second party, when that transfer was requested. However since mid 1985 when rights to the RAF designs were sold agreements specify that RAF support only those who are previously licensed to build the RAF designs and we cannot issue further licenses for any further production of the designs. In order to provide the best possible service to those licensed to build the aircraft with the remaining funds available for support we must insist that the support be limited to only those who are legally building the aircraft ie; those who have obtained a license to build one of the designs from RAF.

We are aware that there are instances where people are fabricating an EZ without a license from RAF. If those people have gotten information or authorization to do so from one of the licensees it must be made clear as to what the licensees' responsibilities are. Keep in mind that the individual that has obtained a license to build a Long-EZ for example, has the permission of RAF to copy the RAF prototype Long-EZ for one airframe. He is the aircraft manufacturer and he is using certain design information purchased from RAF as well as other design information that he has generated himself or obtained elsewhere. There is no such thing as a conformal amateur built aircraft since there are no official conformality drawings accepted by the FAA or anyone. The FAA thus assumes that each aircraft is indeed a new type and does not have to conform to specific drawings or manufacturing processes. The drawings and manufacturing processes to be used on each airplane are totally the decision and right of the homebuilding manufacturer.

Now if you as a licensee wish to discontinue your project and sell it to someone, the new buyer is dealing with you the licensed manufacturer, not with RAF. RAF's responsibility is to support the individual that has the license, not a third party. Thus keep in mind that if you are selling a project, don't expect that RAF can or will provide builder support to the person buying your project. That responsibility rests with you the manufacturer. You are then effectively licensing the third party to produce an airplane of which you own all manufacturing rights. It is strongly suggested that if you do sell a project, either a completed airplane or a partially built airplane or a set of plans, that you contact an attorney and have him draw up an agreement between yourself as manufacturer and the new party whom you are authorizing to build an airplane and be certain that the agreement provides you with some release or indemnification from liability should that aircraft ever be completed and flown. Keep in mind that you are ethically obligated and responsible to the person who has trusted you for that information and that he may need continuing support to allow him to operate the aircraft safely. If you own a license from RAF, RAF will provide the support to you, however, it is your responsibility to pass that on to the individual that you have your own agreement with.

From CP54-2 (CH35)

Joan Richey

Who answers the phone here at RAF on Tuesdays and Fridays? Some of you probably think it is still Sally or Trish. No so, they both work for Burt over at Scaled. It is Joan Richey, VariEze pilot and wife of Chuck Richey. Between them, they built one of the early VariEzes at their home in Las Cruces, New Mexico.

Just over five years ago, they quit their jobs and moved to Mojave where Chuck went to work for Burt at Scaled Composites.

Joan co-owned and operated an FBO on the airport at Las Cruces before coming to Mojave and has flown a number of different general aviation airplanes as well as their EZ. We were fortunate to have Joan write us an article on an incident she had when the canopy opened in flight on her EZ while she was flying solo, (See CP30).

Joan is a storyteller and, when she is scheduled to tell stories at the Mojave library, you better get there early if you want a seat - she is great!

With her knowledge of EZ's and her business background, we are lucky, indeed, to have her working here at RAF. She types the newsletter, handles all the mail as well as answers the phone - so next time you call, say hello to a fellow EZ pilot, Joan Richey.

From CP55-1 (CH35)

RAF - BACK IN BUSINESS?

In the February issue of Sport Aviation there was an article quoting me as saying that RAF was being "re-activated". This has caused quite a bit of confusion in that many have inferred that it means we were again planning to market plans for homebuilt aircraft construction. Actually, the comment was referring to statements I made at the Voyager reunion party in Washington in which I mentioned that the Catbird had once again become a RAF project and that RAF may do some projects in the future such as a man-powered helicopter or man-carrying ornithopter.

I am still very busily and happily employed at Scaled Composites in Mojave, California next door to the old RAF building and together with a bunch of engineers and builders (a staff that includes many of our old homebuilt aircraft buddies) working heartily away at some very interesting airplane development projects. I have every intent to continue to pursue that job for the foreseeable future as it is one that is being done in a very creative environment and involves some very interesting projects such as the design and fabrication of the wing for the wing-masted catamaran for the America's Cup challenge race this fall.

You can find out about some of the other Scaled projects in the Aviation Week magazine. RAF projects are primarily in the category of things we like to do as hobbies. However, RAF does have one full time employee, Jim Shultzman, who's been preparing the Catbird for its test program and will be preparing it for the CAFE race this year. Most of you know that Jim is the builder of a Grand Champion quality J-3 Cub restoration as well as a Champion quality Long-EZ.

The RAF projects are not funded by plans sales or by any commercial customer. All the funding for the recent years and next years activities have come from income that I have received recently by making an occasional lecture to engineering groups and aviation industry groups concerning the developmental aspects of the Voyager.

Back in mid 1985, we announced that instead of cashing in the RAF bank account when we decided to no longer market plans, we would use that money to provide builder support as long as we felt it either necessary for the continued safety benefits of assisting current builders, or until the money ran out, which ever cane first. I am very happy to report that the cash health of RAF has remained approximately the same throughout this nearly 3 year time period even though no plans sales have been made since July of 1985. The major reasons for this are that RAF moved out of the shop and into a small room, has for the most part only part time employees, has not had any liability expense, and we have been able to continue the sale of items other than plans. The poster sales alone (the eighteen Rutan-designed airplanes) paid for our Oshkosh trip last year. Joan Richey, our two-day-a-week RAF manager, is currently looking for another product we could sell at Oshkosh '88 to allow us to continue to support the Oshkosh show. This important forum allows us to communicate with so many builders and flyers regarding all the support requirements. The pilot's bull sessions at Oshkosh on the flight line continue to be attended just as well as they were when they were first introduced at Oshkosh in 1978.

My specific activity in the homebuilding arena is very limited cause I have to do it essentially on hobby time. I plan to continue to attend the Oshkosh convention indefinitely and have given up golf so I can have the most time available to enjoy my favorite hobby.

I would like to say that I will some day re-enter the homebuilt aircraft marketplace with a new design. However, while the demands of Scaled Composites development projects exist, I an unable to predict that for the foreseeable future. We had predicted that RAF would last only two or three years as far as its ability to provide builder support to past customers. Now, however, nearly three years into our post-business time period, we still are not aiming at a particular time in which we must stop builder support. I think that it is important to remind you that your support of RAF and your purchasing the things that we can sell is the reason we're still around. I'm certainly hoping for your continuing support so that we can continue to provide the best homebuilder service available for as long as we can. Thanks again, and we'll see you at CAFE, Jackpot and Oshkosh.
Burt Rutan

From CP55-2 (CH35)

LONG-EZ SQUADRON II HOLDS AN ENGINE SEMINAR

This enthusiastic group of Long-EZ builders and flyers organized a really great weekend of seminars on the engine, its installation, instrumentation, etc. We would like to compliment Squadron II for their initiative in setting up such a project.

Several experts we on hand to lecture on the various subjects covered and Burt Rutan was the guest speaker at the end of the very full weekend of lectures and talks. From feedback we have received, this was a very popular program and was extremely informative, educational, and practically helpful to all those who are building, and even those flying. We would heartily recommend this idea as an excellent one for any of the EZ clubs or groups to organize for the benefit of their members.

The aircraft engine, its installation, and its operational requirements are all subjects that are not often talked about in any set of plans in any great detail, and many homebuilders get into this area of their project with great temerity and very little knowledge of what they are about to attempt.

Great idea - Congratulations, all at Squadron II for a great job well done.

From CP57-2&3 (CH35)

CANARD PUSHER DIGEST FOR THE LONG-EZ

Stet and Kim Elliott of Governors Island, NY have come up with the ultimate tool to help Long-EZ builders find pertinent information in the CP newsletters. Using a computer, they have created what they call the "Canard Pusher Digest". They have taken the complete text of all CP articles that pertain to building, inspecting and safely flying the Long-EZ and rearranged them in plans chapter order. If a particular CP article affected more than one plans chapter, then the complete text of that article was duplicated for each chapter affected. The resulting document (over 500 pages long!) has been professionally printed on double sided paper using a computer laser printer. The Digest, which includes information from CP24 through CP56, is organized into 41 chapters. Chapters 1-26 of the Digest correspond directly to the 26 chapters of the basic Long-EZ plans. Chapter 27-41 are "Supplemental Chapters" to group CP information pertaining to

Changes to the back cover of the plans,
The Appendix Drawings,
Long-EZ Section VI, Landing Brake Plans,
Section IIL, Lycoming O-235 Engine Installation,
Optional Special Performance Canard Plans,
Optional High Performance Rudders,
Long-EZ Owner's Manual.
Weight Control
Builder Support
Builder Modifications
Long-EZ General
Maintenance and Inspections

Accidents/Incidents
Liability and Insurance
Additional Reading

Each chapter of the Digest is further broken down by sections that correspond to particular areas of interest. The first section in each chapter gives plans changes that affect that chapter. The Digest includes a master table of contents, as well as a separate chapter table of contents at the beginning of each major chapter. The Digest is extremely comprehensive, as evidenced by the chapter on the Lycoming O-235 installation, which alone is 72 pages long and includes 20 separate sections!

Stet originally envisioned the Digest to include every article in the CP's. Once it was was completed, however, Stet says it was over 700 pages long! To save printing and shipping costs, the Digest has been pared down by omitting articles that don't specifically pertain to building, inspecting or safely flying the Long-EZ. The following types of information have been omitted:

Advertisements for "one each" items that individuals (not suppliers) offered for sale. One exception is O-235 engines offered for sale. Stet felt that this information, while obviously dated, would still be of sufficient interest to builders who might want to review the price history of the O-235.

Articles and Plans Changes pertaining to designs other than the Long-EZ, and that have no relevance to building, inspecting or flying the Long-EZ. However, all of these articles were examined to see if they contained any information that could be of use to Long-EZ builders. Any articles that were found to have merit were included in the Digest.

Articles pertaining to social gatherings (i.e. flyin's), and that have no relevance to building, inspecting or safely flying the Long-EZ.

Since drawings, sketches, graphs and some tabular information could not be readily duplicated in text form, they were also omitted. A notation in the Digest, such as "**SKETCH OMITTED**" will key the user to look in the CP's to see the relevant drawing, sketch, etc.

Obviously, photographs have been omitted from the Digest. Photo captions, however, have been included for all relevant photos. The notation "(Photo Caption)" appears in the annotated heading for each photo caption to key the user to look in the CP's to see the relevant photo.

The Digest would be of enormous benefit to those who are still building their Longs. There have been cases where builders have missed important information in the CPs, and have built portions of their aircraft incorrectly. We also continue to receive builder questions about subjects that have already been covered in the CPs. Use of the Digest could solve most of these problems once and for all.

Those of you who have already completed construction of your Long-EZ's could also benefit from the Digest, especially from those chapters dealing with the Owner's Manual, Maintenance and Inspections, Accidents/Incidents, Liability and Insurance, etc. The Maintenance and Inspections chapter is an excellent reference source (along with the Owners Manual) for compiling a Maintenance and Inspection program for newly completed Long-EZs.

The Digest is truly a magnificent piece of work. Stet and Kim have put an awful lot of effort into this excellent product and it is well worth your consideration, especially the next time you can't find what you are looking for in the newsletters!

Cost of the Digest is $45.50, plus $4.00 shipping. New York state residents add 8 1/4 percent sales tax.

Stet is also considering providing quarterly updates to the Digest which would be mailed to subscribers within a few weeks after each CP is published. The update material would be compiled such that it could be inserted at the back of each Digest chapter. When you place your order for the Digest, please indicate whether you might be interested in updates as well. If there is sufficient interest, Stet may make updates available.

Stet and Kim Elliott
Bldg 12-1-2
Governors Island, NY 10004
(212) 825-0011 (after 5:00 pm)

From CP58-11 (CH35)
CANARD PUSHER INDEX
"Response to Canard Pusher Index that was discussed in CP57 was much greater than I had expected! All orders have now been shipped and I have a good number of Digest copies ready for immediate delivery.

After a long period of deliberation, I've decided to publish quarterly updates to the Canard Pusher Digest. Compiling the Digest set me nearly a year and a half behind on my own Long-EZ project, and I was initially hesitant in taking on the task of compiling updates - a task which will no doubt put me even further behind. However, nearly all of you who ordered the Digest expressed a desire for the updates, so I feel somewhat obligated to make them available. Updates will be compiled so that the new information can be inserted at the front of each affected Digest chapter.

Effective 15 February, all new orders for the Canard Pusher Digest will include Update number 57. Update 57 contains information from CP57 necessary to update the basic Digest package. Also effective 15 February, the cost of the Digest will be $53.00, plus $4.00 shipping. This cost increase is necessary to cover the additional cost of the update.

Yearly subscriptions for the Digest Updates will be $30.00. Updates will be mailed to subscribers 4 times per year, each within a month of receipt of the respective CP newsletter. I apologize for the high cost, but copy costs these days are unbelievably high, and I'm unable to get volume discounts due to the relatively low number of copies required. In addition, there usually will be many more pages in the update than the CP from which the information was obtained. This is because many CP articles affect more than one Digest chapter and have to be duplicated for each chapter affected. As an example, Update 57 contains 44 pages, more than double that of CP57.

Stet Elliott
Building 12-1-2
Governors Island, NY 10004
212-825-0011"

EDITOR'S COMMENT
If you have not seen the Canard Pusher Index, you are missing a bet. It is great. We use ours almost every day and we have heard from a number of builders who feel the same way. Give Stet a call.

From CP59-1 (CH35)
RAF ACTIVITIES
As many of you know, Rutan Aircraft has been sued by an English Company, Aviation Composites.

In 1982, RAF was contracted by Colin Chapman of Lotus Cars, Ltd. to design and build a microlite aircraft. A proof of concept aircraft was built and a basic flight test program was conducted. No problems were found with regard to its stall characteristics.

Aviation Composites employed VariEze builder, Ivan Shaw, and built a similar but much heavier version and had several problems with it. Aviation Composites approached Scaled Composites requesting developmental help. While we were assisting Shaw with flight testing, we discovered a poor spin recovery characteristic. (See CP55, pg 5).

Aviation Composites next step, of course, should have been to equip the aircraft with a spin recovery parachute and to develop an appropriate aerodynamic fix for the problem. Instead, they discontinued support of the flight testing and sued RAF for all of their expenses to date, allegedly amounting to several million dollars.

This situation, win or lose, of course, poses a serious threat to RAF's financial ability to continue to provide builder support. We will keep you informed of developments in future CP's.

From CP59-10&11 (CH35)
CANARD PUSHER DIGEST
The Canard Pusher Digest for the Long-EZ is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP56 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, see CP57). Note that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

I've recently managed to get a very good deal on duplication of the updates, and I'm passing on the savings!. Effective immediately, the cost of an annual update subscription drops from $30.00 to $20.00. For those of you who ordered the update service at the higher price, I have already credited your account with an additional 2 updates for each year you ordered, free of additional charge!

CP Digest for the Long-EZ (Includes Updates 57 & 58)	$57.00
Annual Update subscription (4 Updates)	$20.00

Send payment to:

Stet Elliott
Building 12-I-2
Governors Island, NY 10004
(212) 825-0011

We cannot say enough for this publication. It has been an immense help to Mike Melvill in his assisting builders when they call for support. Every builder would find it just as helpful since there are now so many CP's to search through when you need some specific piece of information. Here it is, all nicely indexed and researched for you. Stet and Kim Elliott have done a tremendous job and we appreciate the fact that they are publishing quarterly updates. What a job! ED

From CP62-1 (CH35,CH41)
CENTRAL STATES ASSOCIATION
Please note that the Central States Newsletter/editor has a new address. Arnie Ash has retired and passed on the editorial responsibilities to Terry Schubert.

New members are encouraged to join Central States and receive a quarterly newsletter and attend the annual flyin. Membership is $15.00 -

Contact: Terry Schubert
9283 Linbergh Blvd.
Olmsted Falls, Ohio 44138

From CP62-5 (CH35)
Canard Pusher Digest - Stet Elliott's *Canard Pusher Digest for the Long-EZ* is still available. The Canard Pusher Digest is basically a recompilation of information from CP24 - CP61 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Note that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

CP Digest for the Long-EZ Overseas orders add $20.00 for airmail, otherwise, it will be sent via surface vessel.	$67.00
Annual Update subscription (4 updates) Overseas orders add $5.00 for postage.	$25.00

Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

From CP63-1 (CH35)
REDUCED OPERATING HOURS AT RAF
As of May 1, 1990, RAF will be manned on Tuesdays only.

It has been five years since RAF discontinued selling plans and licensing builders to fabricate Burt's designs. That's a long time to support builders. RAF's bookkeeping procedures has always logged deferred income for 5 years after plans sales on the assumption that any serious builder would complete his project within that time. However, we do plan to continue, on a limited time basis, builder support. Mike's duties have become quite varied and, more and more, he is required to be at his desk at Scaled Composites. We hope we have hit upon an acceptable solution for you people who purchased plans from RAF prior to 1985 and are still busily building the flying machine of your dreams.

Each Tuesday, there will builder support of an abbreviated nature. We ask that if you have a question or problem that can be sent in, please do so. (See page 1 of this CP). If you have epoxy dripping from your elbows, or if you have an urgent problem that requires attention within the next week or so, then Mike will attempt to return your call. This, of course, requires not only your name and serial number when calling, but also a brief description of your problem (in laymen terms, so Joan can understand and forward the information to Mike) and your agreement to accept a collect call.

Hopefully, this will still accommodate those of you who might encounter serious building problems while allowing Mike to fulfill his duties at Scaled Composites

We certainly appreciate your co-operation.

From CP63-9 (CH35)
Canard Pusher Digest - Stet Elliott's *Canard Pusher Digest for the Long-EZ* is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP61 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Not that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

Quarterly updates to the Digest are also available. These updates provide additional information from newly published CPs to bring the Digest current.

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postage.
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

From CP64-6 (CH35)
Canard Pusher Digest - Stet Elliott's *Canard Pusher Digest for the Long-EZ* is still available. The Canard Pusher Digest is basically a recompilation of information from CP24-CP61 into chapters that correspond to chapters of the Long-EZ plans. (For a complete description of the Digest, See CP57). Not that the Digest is for builders and flyers of the Long-EZ only! The Digest does not support other RAF designs.

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Overseas orders add $5.00 for postage
Send payment to Stet's new address below:

Stet Elliott
5322 W. Melric Dr.
Santa Ana, CA 92704
714-839-4156

From CP65-1 (CH35)
PLEASE NOTE: BUILDER SUPPORT IS ON TUESDAY ONLY FROM 8:00 TO 12:00 AND 1:00 TO 5:00. When you call on Tuesdays for builder assistance, please give your name, serial number, and nature of the problem along with a number where you can be reached, collect, between 3:30 and 5:00. Mike will try to return your call the same day. However, we ask that calls be limited to emergency-type situations and other questions be mailed in. When writing to RAF, send along a stamped, self addressed envelope.

From CP65-1&2 (CH3,CH35)
TOUGH SLEDDING AHEAD FOR RAF
In general, I have been very pleased with the business performance of RAF since we discontinued the sale of plans and the licensing of individuals to build aircraft based on RAF design information. RAF made these moves in mid-1985 partially because of severe conflicts with other aircraft development projects at Scaled Composites which were taking all of my time and because of the expanding threat of lawsuits which often occur after an accident, regardless of the cause of the accident.

In 1985, I decided to keep RAF's doors open in spite of the fact that we had lost our primary source of income. The remaining assets of RAF would be used to continue to provide technical and safety support to those licensed individuals still building and flying their RAF designs. In order to provide the best service to those customers who were licensed by RAF, we discontinued the policy of allowing transfer of license and, in effect, promised support only to our direct customers. Those who bought a project or completed aircraft from "Joe Smith" must be supported by "Joe Smith". We would maintain, to the best of our ability, our support of Joe, as our licensee.

In 1985, we believed that we would be able to continue support for 2 to 3 years in this way and thus, not strand any builder who had recently begun his project. Little did we know that 5-1/2 years later RAF would still be alive and well, providing support, continuing newsletters, continuing our talks and booth at Oshkosh, even helping new starts for those licensed in the early 80's and only now laying up the front seat fuselage bulkhead! Our survival has had a lot to do with a few key items:

1. Great support from our family of builders who helped police the cheaters (those who sought RAF support even though working without a RAF license). Understanding from builders when we raised our newsletter price from $7 to $14 and cut down on our hours of direct builder support. Support from those who still stop by our Oshkosh booth and load up on goodies.

2. Patience, dedication and sacrifice from people like Mike and Sally Melvill and Joan Richey who hung in there even though it was obvious that the ship was beginning to sink. Their continuing dedication was because they love working with this wonderful group of EAAers who truly enjoy our hobby.

3. The donation to RAF of the income from paid lectures that I gave from '87 to '89 telling the exciting story of Voyager, RAF's most famous design (developed at RAF from 1982 to 1984).

The good news is that RAF still has potential to provide a few years more of support to builders - to maximize their chances of building a safe airplane and operating it safely.

The bad news is that RAF now is plagued by two lawsuits, both of which seem ridiculous, and both of which are proving to be very expensive distractions.

1. RAF contracted with Colin Chapman, the Lotus car founder, in 1982 to develop a proof-of-concept prototype to assess the feasibility of an ultralite-category light plane. The result (RAF model 97 Microlite) completed its contracted initial test program in 1983. The program was shelved by Lotus, primarily due to the death of Mr. Chapman. Rights to the concept were later sold to another English Company, Aviation Composites, which used the design's features as a basis for a different aircraft, the Mercury. The Mercury's development program suffered a number of developmental problems, among them, the failure to obtain an acceptable engine (the Lotus engine was dropped and others were too heavy for the configuration), and the discovery that changes would be necessary to obtain adequate spin recovery characteristics. Aviation Composites then discontinued further development and sued RAF claiming that we should have more thoroughly tested the model 97 in 1983 to find a possible flaw in spin recovery. This case is scheduled for trial in federal court during January '91. Of course there seems to be no basis, however, these exercises have an enormous effect on our time and distract from our ability to concentrate on things more productive and enjoyable.

2. The latest lawsuit to be brought against RAF concerns the VariEze accident described in CP61 page 9. We did a thorough investigation of that accident and came to the conclusion that the wing attach taper pins, which were home-made, were a poor fit. The bolts that secure these taper pins were too long and all had had a threading die run onto them to increase the length of threads on each bolt! Aircraft bolts are roll threaded and heat treated. Under no circumstances should an aircraft bolt have threads extended or cut using a die! One of these bolts was missing as were the two taper pins. The three remaining bolts had been over-torqued allowing a wing to swing aft. The VariEze was seen to be doing aerobatic maneuvers by at least one eyewitness just prior to crashing. The pilot was found to have alcohol in his bloodstream. In spite of these facts, RAF and the builders estate are being sued by the relatives of the passenger.
It seems unreasonable that these suits are allowed to threaten the viability of RAF and, thus, its ability to continue to provide support to EZ builders/flyers. We, of course, do not plan to accept any settlement offers on these suits since bowing to extortion in order to avoid the hassle only attracts other frivolous suits.

From CP65-2&3 (CH35)

YOU MUST REGISTER YOUR PROJECT.

YOUR LICENSE TO BUILD WILL EXPIRE 1 JANUARY 1991.

RAF ceased licensing builders in July '85. Our decision to remain open to support builders was based on our desire to not strand those who had been recently licensed. We did not foresee that now, more that 5 years after the last license, new building starts would still be occurring. In order to continue to be able to provide support for those who obtained a license with an honest intention of building, we must now place a limitation on the exercise of your license to build. Of course, it is not reasonable for any contract, especially one in which support is expected, to be good forever.
We must, therefore, cancel your license to build a RAF design unless you show that your building project is started by Jan. 1, 1991 and completed by Jan. 1, 1993.

We think you will agree that RAF has extended free support far beyond that expected of a company departing from the business. Between now and Jan. 1, 1991, RAF will compile a list of active projects with proper licenses to build so we can define those projects who are authorized and who deserve our support. By 1 January '91, you must fill out the form below and mail it to RAF along with proof that your building project is underway - a receipt for purchase of materials will do.

NAME________________TYPE A/C________

ADDRESS__________________________________

DATE LICENSE AGREEMENT WAS SIGNED_____

SERIAL NUMBER ASSIGNED________________

DATE CONSTRUCTION STARTED____________

DATE OF FIRST FLIGHT
(OR PLANNED DATE)_____________________

N-NUMBER_______________________________

THIS SURVEY IS IMPORTANT as it will allow us to determine what projects are being conducted by legitimate, licensed manufacturers and which projects have been dropped. This will allow us to continue to provide quality support to those who deserve it.

Please fill out the form even if your aircraft is flying (no materials purchase receipt required). In this way, we can define our support requirements for the future. If RAF does not receive the form, we will assume your project is dropped, your license expired, and you no longer require support. RAF may assign new serial numbers based on the active list as of 1 Jan. '91. Our main concern is the safety of those who fly RAF designs and we will continue to disseminate information pertinent to the safe operation of all RAF designs until we run out of resources to provide this support.

We believe RAF has provided the best support in the industry and we will continue to do so for as long as we can. As far as we know, no other homebuilt plans or kit manufacturer has provided any support after they stopped marketing their product. We are proud of our record and are proud of the thousands of builders who have completed their projects and who now fly them safely, efficiently and enjoy the full potential of the various RAF designs. BURT RUTAN

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NO CHAPTER 36

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Update Number 68 to Supplemental Chapter 37, Long-EZ General

From CP68-2 (CH37,CH39)

NEW WORLD RECORD

Magna Liset has been at it again. Magna and fellow Australian Long-EZ flyer, Lindsay Danes, took off from Sydney, Australia and landed in Mangere, New Zealand 7 hours and 25 minutes later. This broke Don Taylor's previous world record for this crossing in his famous T-18 by some 35 minutes. Congratulations to Lindsay and Magna.

After arriving in New Zealand, these two intrepid Long-EZ pilots entered The First International Around New Zealand Air Race sponsored by Air BP. Lindsay finished the race in the money but Magna was not so lucky. Shortly after taking off from Wigram, New Zealand, the crankshaft oil seal popped out and Magna lost all his oil. Zero oil pressure caused the engine to seize and he was faced with an emergency dead stick landing. He picked out a road and landed without incident. Even though he was heavily loaded with full fuel tanks, he did no damage to his airplane. Considering the many miles of Tasman Sea, he had so recently crossed, he was extremely fortunate that the seal chose this moment to pop out! Thanks to some members of the Royal New Zealand Air Force who pitched in, obtained another engine and helped install it, Magna was able to fly to the final banquet after the air race!

Long-EZ enthusiasts are apparently the same the world over. Wonderful effort - neat people.

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****From CP31-1 (CH35,CH36)****
RAF BUILDER SUPPORT
It has become necessary to further clarify Rutan Aircraft's position in relation to the homebuilder and the support we give. Rutan Aircraft can only offer the assistance that helps them interpret the plans when they desire to build their aircraft like the prototype we have tested. We cannot assist in the design and construction of modifications. We cannot comment on the advisability of modifications. Many of the developments we design and test do not work as predicted. Thus, without testing your idea we cannot reliably predict its success. A similar situation exists for substitutions of materials. We will not be able to advise you on any material we have not tested ourselves.

****From CP31-3 (CH36,CH40)****
BUILDER-INITIATED CHANGES
This is an item that needs to be put into perspective, since we often answer questions and often observe activity that we consider questionable. First, we do recognize that you are the manufacturer of your aircraft and that if you do not agree with us on specific details you have every right to modify, redesign, substitute etc., on your aircraft and to then take the risks of trying something new and untested. We do recommend only that which we have tested, since it is the only configuration we know is adequate and, by our own experience we can report on and support.

Any builder (at least U.S. builder) has the freedom to build his own aircraft exactly as he sees fit. Changes he makes will be opening up new areas not substantiated by test. We have no argument with this. However, if he makes recommendations to other builders on a change that he likes, but has not verified by test, he should realize that he may be liable for loss or injury caused by that change.

If, for example, you recommend a larger engine or a substitute of an inferior foam core to someone else, without fully qualifying and testing the many design changes that may be required, you must remember that those builders are now counting on you to be right and that your responsibility is then extended beyond your own risk with your own airplane.

****From CP44-3 (CH30,CH33,CH36)****
WARNING
We have recently learned that some Long-EZ operators have been attempting to overextend the intended capability of the aircraft by installing larger engines than the O-235 and/or by attempting overweight operation. These practices are hazardous and cannot safety be conducted on the aircraft. A re-design to allow this operation would not be just a simple replacement or beefup of a few components.

A major development for adequate airframe/propulsion mounting/landing gear/brakes would be required, as well as wing area increase to meet reasonable energy limits for forced landing. In short, you would be talking about a new aircraft and a new test program.

Overweight operation will definitely result in structural problems with landing gear, brakes and possibly airframe.

****From CP46-2&3 (CH13,CH19,CH30,CH33,CH36)****
HOMEBUILDER MODIFICATIONS
Recently we have noticed a trend towards homebuilder modified Long-EZs, particularly the long nose and heavier engines. These are not RAF approved modifications and we are concerned that most pilots may not be aware of what they could possibly be getting into. First of all, the longer nose IS destabilizing in pitch as well as directionally (yaw). How much of it may influence your particular airplane is not known. We believe you as the pilot should know just how stable your own airplane is. We strongly recommend to anyone who has modified their own aircraft in this way, that first of all you should install vortilons on the main wings. The vortilons allow a little more stall margin. Secondly, you should put on a parachute, and climb to at least 10,000 feet above the ground and at that altitude, you should fully explore the stall/full aft stick characteristics of your airplane. Do it first at a mid cg position, then ballast to the aft limit, (103") and do it again. In this way at least you will be aware of any possible unpleasant stall behavior or unstable tendency, and you would be a lot less likely to later discover any nasty trait at low altitude with no margin for a safe recovery.

We are really concerned when we hear that a particular builder has done a major modification to his airplane. For example, a larger, heavier engine and a longer nose. Then he goes out and flies it for a few hours and then tells all the builders in his area what a neat thing he has done. Now some of these builders decide, based on his results to do the same thing. Meanwhile, the original experimentor never did test his airplane at aft limit cg, at full aft stick, with aggravated control inputs, or at the red line or at limit g so he never knew for a fact that his airplane was safe. Another builder, influenced by the first experimentor makes similar changes, goes out and while demonstrating the much touted stall characteristics to a passenger, enters a deep stall condition at low altitude, does not have enough room to recover, and so he and his airplane become another statistic and make not only the Long-EZ look bad, but also puts a blot on the accident record of all homebuilts.

To sum up: If you must make changes to your aircraft, keep in mind that you now have a different airplane than the original plans built Long-EZ prototype. Your new design may have perfectly safe aft cg, high angle of attack flying characteristics, but it may also have unsafe, nasty characteristics, just waiting to bite you at an inopportune time. To protect yourself, and any future passenger you may take for a ride, 1) you should install the vortilons, 2) you should thoroughly test your airplane at aft cg, high angle of attack (full aft stick) with aggravated control inputs. If your airplane does not handle well, limit your aft cg. You do not have to go back to the published limit. If you are not comfortable at 103, try 102 or 102.5. If it is good there, limit it there, note it in your log book, placard the airplane, and don't ever exceed this (or any other) limitation. Remember, each Long-

EZ, or any other homebuilt design, is different. Don't assume because Joe Blow did it and was safe, that you will be. You may not be and that really can take the fun out of the whole project. Don't ever lose sight of the fact that, that is what this whole thing is about - having fun!! FLY SAFE AND ENJOY.

Supplemental Chapter 36, Builder Modifications

****FROM CP24-4 (CH22,CH25,CH30,CH34,CH36)****

WEIGHT CONTROL - Too many builders are loading their airplanes down with extra equipment and heavy finish jobs. They are going to miss the real thrill of flying their EZ at a light weight, and they will find their useful load disappearing. Here is the trap -- if you address each item as, "Oh, that's only one/half pound, it's a small percent of the empty weight", you will find that the sum of all the extras will add up, and when you weigh your ready-to-fly airplane you will be scratching your head and saying, "where is it all?". Believe me, it happens every time.

We have a strong recommendation for all of you, and that is to delay installation of any equipment not absolutely required for flight, until after you have flown your airplane a few hours. Then, you will have a much better chance of a successful flight test program -- the airplane is easier to fly light and uses less runway. Also, if you make a real bad landing during your transit it will put a lot less stress on your landing gear. Then if you must, load on the equipment, at least you will get to see first-hand the effect it has on performance and runway requirements.

This philosophy also goes for modifications, too. Don't try something new on your unflown new airplane. Build to the plans first, where you know from our experience that it will work. Fly it that way, then try your modifications.

****From CP25-3 (CH36,CH39)****

CAUTION - AMATEUR DESIGN

In 1977 an amateur designer/builder highly modified a VariEze with all-flying canard and other modifications. It crashed on its first tests, injuring its designer test pilot. Recently a new design, with the outward appearance of a VariEze, crashed on its first flight attempt, killing the pilot (a professional Cessna test pilot).

If you are contemplating a new design or modifications to an existing design be sure you understand that aerodynamic design, particularly for tandem wing configurations, is an engineering discipline that requires the appropriate analysis and test before risking ones life.

****From CP26-2 (CH30,CH36)****

LARGER ENGINES FOR LONG-EZ?

A number of builders have asked if it is feasible to install the 160hp Lycoming O-320 engine in a Long-EZ. At this time we must respond that this installation is definitely not approved. In order to approve this we would have to do a new structural analysis and possible beef up of a large portion of the airframe, install the engine, then conduct new tests to confirm structural adequacy and to develop the cooling, induction, vibration, exhaust, propeller matching, expansion of aerodynamic envelope, etc. Unless these tests and development are done it would not be known if it were feasible, much less recommended.

A larger engine will make the airplane tail heavy and lower the useful load. Higher horsepower would result in a small increase in speed and a large increase in climb. However, the Long-EZ's ceiling of over 19000 ft at gross and demonstrated 27000 ft at light weights, makes it the last light plane that needs better climb! Lycoming engines have their best fuel efficiency at about 70% power. If an O-320 were throttled down to 51% power, to cruise at the same cruise speed as the O-235, it would burn more fuel than the O-235. The calculated comparison below shows that the O-320 saves only 18 minutes on a 500-nm trip, but costs $9.11 more in fuel. This is over $30 cost per hour of saved trip time.

	115hp O-235	160hp O-320
75% power cruise	161 kt	179 kt
75% power fuel flow	6.7 gph	9.32 gph
Nautical mi/gal @75%	24	19.2
Nautical mi/gal @127kt	37.3	36
Range @ 75% power (45 min reserve)	1150 nm	920 nm
Flight time-500nm trip	3 hr 6min	2 hr 48 min
Fuel cost-500nm trip	$36.46	$45.57

****From CP28-1 (CH36)****

It has become necessary to further clarify Rutan Aircraft's position in relation to the homebuilder and the support we give. Rutan Aircraft can only offer the assistance that helps them interpret the plans when they desire to build their aircraft like the prototype we have tested. We cannot assist in the design and construction of modifications. We cannot comment on the advisability of modifications. Many of the developments we design and test do not work as predicted. Thus, without testing your idea we cannot reliably predict its success. A similar situation exists for substitutions of materials. We will not be able to advise you on any material we have not tested ourselves.

From CP28-2 (CH22,CH30,CH36)

26MS - Mike and Sally's Long.

Currently we have 85 hours on our Long and it is literally running like a Swiss Watch. We are truly delighted with it in every possible way. We have been using it to commute to work every day for the past couple of months. From Techachapi to Mojave by road is 26 miles, about a 30 minute drive. It takes between 8 and 12 minutes in the Long, depending on the winds. We use two to two and a half gallons for the round trip. This is almost exactly what we use in our Honda Civic car. Besides the time saved the biggest thing is the 'fun' factor. There is a lot of enjoyment in flying across the desert in the early morning with glass smooth air, no traffic and the stereo tape deck playing in the head phones. Coming down-hill in the morning, we usually fly at very low power settings. The quiet, smooth exhilaration really makes it enjoyable to come to work.

All flight tests, engine break in etc., have now been completed. All systems work perfectly. The Radair comm, nav, and transponder work very satisfactorily. The Sigtronics intercom and audio switcher work excellently in conjunction with our stereo tape deck. This also gives us the capability to transmit from either cockpit. The newest piece of equipment recently installed is a Silver Fuelgard. This small instrument accurately reads out fuel flow in gallons per hour and you can look at fuel used with a momentary switch. This fuel flow meter is a TSO'd instrument and uses a flow-scan transducer. We installed it in the fuel line so that all fuel on board runs through it. It is accurate within +- 2 percent. So far it has verified the Owners Manual fuel flow information very closely. N26MS will burn 1.9 gallons per hour at minimum power required for level flight at 8000 ft (max endurance) and at 75 percent at 7/8000 ft it reads 6.7 gph. Take off, full rich at sea level is a shock, 11.7 gph!! On a recent cross-country, we went to Northern California, a straight line distance of 404 nm (471 sm). On the trip up north we had a ferocious head wind of 29 kt (33 mph) so we ran at approximately 70 percent power at 8500 ft for a fuel flow of 6.4 gph. This gave us a ground speed of 130 kts (150 mph) with a true airspeed of 159 kts (183 mph). Our time enroute was 3.1 hours and we used right at 20 gallons of gas. By contrast on the return trip we had a tail wind!! We climbed to 11,500 ft, where the tail wind component was 35 kts (40 mph). It took some will power, but we pulled the power back to approximately 48 percent which gave us a fuel flow of 4.4 gph, and a true airspeed of 133 kts (153 mph) which, with the tail wind, had us crossing the ground at 168 kts (193 mph). The time enroute was 2.4 hours and we burned a total of 10.6 gallons of gas! I honestly believe that a Long-EZ built to the plans will consistently give these kind of results. The airplane is incredibly comfortable, reasonably quiet, particularly with David Clark headsets, and is an honest to goodness, economical, high speed touring machine, with good baggage capacity, excellent high altitude capability and unbelievable range. All in all, looking back at the intensive effort required to build it, it was well worth it!! The Long continues to delight us, Sally takes it to her 99's meetings, I have been into terminal control areas, we have flown it quite extensively at night. We have flown over mountains, over ocean (to Santa Catalina) and it is just super. The Lycoming O-235-L2C has continued to run like a dream and to be honest, I have no regrets. **If I had to do it again, I would build it exactly as we did, using the same engine.** The only thing I would not recommend is the electrical system we have. The engine came with a 28 volt starter and alternator, and all the electrics on the airplane are 12 volt. We have got it working, but it was simply too much hassle for the average builder to have to put up with, when you don't have to. N26MS will be here at RAF on a daily basis, and we plan on attending most of the flyins, including Watsonville and Oshkosh.

From CP28-2 (CH36)

Long-EZ #4 by Dick Rutan.

Last summer Mike Melvill and myself decided to build ourselves one-each Long-EZ. We agreed to work together on the basic structure then split off and finish individually. On 15 June 1980 we started and with a lot of help from Mike's wife Sally and my friend Jeana Yeager both aircraft are now flying. Mike's (N26MS) late December 1980 and mine (N169SH) in early April 1981.

Mine took longer to build for two reasons. First, Mike worked harder, but the biggest reason is all the changes I made to mine. I thought I wanted more power, more roll rate, more negative g and IFR equipment. I installed a bigger engine, longer ailerons, different canard airfoil and several other changes. All these mods took more time to build, cost more and after first flight, I found they didn't work. When I should have been very happy after it flew I was not. Instead of having an aircraft I could use I found I had a "prototype" that needed work. The big engine over-heated, the revised canard airfoil resulted in loss of speed-stability at high speed, and very poor stall characteristics (a nose drop). The standard Long-EZ rolls about as fast as mine and because of a poor prop match, Burt's Long even out-ran me on the first flight! I was then faced with finding fixes for all the problems.

I'll fix the problems but it will take some time and effort. But in retrospect, I wish I had stayed more standard. My airplane now is a compromise, a whole bunch more effort that I feel is not worth it.

If you see my light-blue modified Long-EZ (N169SH) at flyins and airshows, remember the mods were not approved by Burt or RAF. In fact Burt was not aware of most of them. Please don't bother RAF about my mods. They have enough to do just to support those building from the basic plans. I do not intend to do as complete a test program on my airplane as RAF did on N79RA. Thus, they are in no position to verify or recommend my modifications.

I am now deeply involved in the Voyager round-the-world program and will not be able to get involved in any way assisting builders.

I don't recommend any of the changes I've made and wish I had not. The best advice I can give is to keep it stock, build it light, and resist the temptation to change, especially anything structurally.

From CP29-3 (CH30,CH36,CH39)

ACCIDENTS

Power Loss - A south eastern VariEze crashed into trees after power loss on its first flight. The power plant was a conversion of a Chevy Corvair automobile engine. The aircraft was destroyed. The pilot was not injured.

Update Number 76 to Supplemental Chapter 36, Builder Modifications

****From CP76-2&3 (CH13,CH21,CH33,CH36,CH39)****

TRUCK-EZ TESTS - THE LATEST ON DEEP STALL

For several years, we have been trying to obtain information and data on the characteristics of various canard-types at deep stall conditions. Data for the VariEze has been available since the late 70's when NASA conducted rotary-balance wind tunnel tests and concluded that the VariEze has no stable spin modes, i.e., that if forced to any angle of attack and spin rate, it will recover by itself. Also, the small model tests showed normal flat-plate drag at high angles of attack. These data and extensive stall-departure flight tests with N4EZ formed the basis for our confidence in the deep-stall safety of these general aircraft types.

Then, about 5 years ago, several accidents occurred with the Velocity aircraft. We think the problem could have been determined if extensive aft-CG departure testing had been done during development, like we did with the Long-EZ and Defiant. Two very noteworthy results from these Velocity accidents were 1). The descent was a stable, non-rotating condition about 50 to 80 degrees AOA, not recoverable with forward stick or by rocking the wings. 2). The descent was slow enough to allow impact in water without pilot injury.

Rumors were abound about this slow, 1000 ft./min. "parachute-like" descent probably induced by a violent, trapped vortex above the wing. Researching this, we found the rumors were just speculation, that there was no hard data on the descent rate. Even the test pilot who stayed with a Velocity to the ocean instead of using his parachute admitted he had not timed the altimeter nor remembered the rate-of-climb indicator's data. He merely climbed partially out, but feeling the "light breeze" of the descent, elected to ride it down. We have been extremely skeptical that an airplane can descend at this low rate, even with the best possible vortex. To put things in perspective, consider what would be required. The EZs and the Velocity have a "loading" of about 10 lb. per square foot of total planform area (including wings, canard, fuselage strakes and cowl). If all this area acts like a "flat plate" in the descent, the airplane would sink at 50 knots or 5000 ft./min. (flat plate Cd=1.24). The very highest Cd we have seen in aerodynamic research papers on trapped vortex is about 10. Using a Cd of 10 for the entire airplane (very unlikely, of course), the sink rate would be 17 knots or 1800 ft./min. If the airplane could descend flat at 1000 ft./min. (only 9.9 knots), it would have a Cd over 30!!

Our interest in this phenomena certainly was increased after the deep stall accident of a Long-EZ at Kanab (CP 68). Now we had some data, but very poor data. Only a tiny image of the airplane during the last 2.8 seconds on a video tape. This airplane hit the dirt without killing the pilot so we believed it could not have been descending at 5000 ft./min. An attempt to analyze the video resulted in a very rough approximation of 2900 ft./min. which results in a Cd of 3.7. Our surprise, of course, was that forward stick did not recover from the deep stall. The surprise subsided when we later learned that the airplane was being flown with the CG well aft of the FS 103 aft limit.

While the 2900 ft./min. sink estimate seemed to make sense, it was not considered accurate due to the problem of measuring a fuzzy blip on the video. We then made a decision to try to gather full scale data on the Long-EZ. The previous full scale tests done in Florida on the Velocity did not measure drag and lift, only the more important data of recoverability with various airplane modifications.

Then, another Velocity deep stall accident occurred. This one descended inverted, hit land, not water, and killed the pilot. In this accident data was available - good, accurate radar and transponder data. Obtaining this data from the FAA is a story in itself.. Finally, after threatening a media expose about government cover-up, we received the data. This Velocity entered a deep stall at about 7000 ft. and descended at a nearly constant 4400 ft./min. (44 knots) for the entire 90 seconds to impact. Of course, this inverted descent data may not apply to an upright Velocity but, at least, for the first time it represented good data during a deep stall accident.

We proceeded to develop the rig to allow us to measure the Long-EZ. This turned out to be a much more difficult and expensive job than originally thought. It was made possible by the loan from Donald Douglas of Sherman Oaks, CA of his Long-EZ that is accurately built to the plans, without modifications. A 3-axis electronic balance was built to measure lift, drag and pitching moment and an accurate speed indicator was installed in front of an Isuzu truck. These "Truck-EZ" tests can only be done in dead calm winds, so after many delays, we were able to obtain data at 40, 50, 60, 71 & 80 degrees angle of attack.

The data are presented in this newsletter. Note that these are full-scale tests at near the same Reynolds number as flight, so they are much more accurate than the small scale model tests done by NASA in the 70's.

First, let's discuss the lift and drag data. The data show substantial scatter due to the truck riding over bumps in the runway. A line faired through the average of scatter is considered reliable. If we combine the lift and drag resolved to a total reaction that would support the airplane during a stable deep stall descent, we can calculate the sink rate. This data, sink rate vs. angle of attack, is shown. Note that this prediction is very close to the radar data of the Velocity (4400 fpm).

Now, how slow does a Velocity descend upright in the deep stall attitude? We don't know, but we now tend to suspect that it is relatively high, 3500 to 4500 ft./min. We reason that the low damage and pilot survival is related to the fact that the water impact is nose down and the bottom fuselage is curved, this allows a few feet of deceleration at impact which can explain the lack of pilot injury.

How slow does a Long-EZ descend in a deep stall attitude? First of all, our pitching moment data show that it cannot descend at the extremely flat attitude of 70 to 90 degrees angle of attack. The pitch data indicated that if the CG is aft of limit, say F.S. 106, the aircraft may hang up at about 40 to 50 degrees angle of attack. It would then descent at about 5000 feet per minute. Why did the Kanab pilot survive? Possibly the nose-low attitude allowed a couple of feet of "crush and rotate" deceleration that provided adequate protection.

Our concern now is that there are many Long-EZs with extensive modifications that can affect deep stall recovery (long noses, bigger strakes, baggage pods, etc.). While we do not approve these modifications and can't be expected to analyze or test each one, we do feel obliged to encourage everyone to conduct adequate testing to determine the safety of their own modified airplane. Conduct stall tests at the CGs you fly, with adequate altitude for a parachute jump (egress above 8000 ft. AGL). Do not ride it down, even over water.

Another concern is that many of you do not accurately know your CG position. Calculating weight and balance is a pilot's responsibility (FAR 21) for each flight. Be sure you fly within limits (your <u>own</u> test-verified limits for modified airplanes) and check CG when any changes are made.

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF LIFT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF SINK RATE, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-12 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF DRAG COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

****From CP76-13 (CH13,CH21,CH33,CH36,CH39)****
GRAPH OF MOMENT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

See pages 2 and 3 in this CP for article "Truck-EZ Test.

****From CP76-14 (CH13,CH21,CH33,CH36,CH39)****
Donald Douglas lent us his beautiful plans-built Long-EZ so that we could generate the full scale, angle-of-attack data using this "Truck-EZ" rig. Many thanks, Don. **PHOTOGRAPH OMITTED**

Update Number 82
to
Supplemental Chapter 36,
Builder Modifications

Information derived from CP82 published by RAF Oct 1995

****From CP82-5 (CH35,CH36)****
Surfing the Net
Internet has some EZ info. Burt recently posted the following letter on America Online Clubs - Interests - Aviation - Forum - General Aviation - Homebuilts, Long-EZ & Vari Eze Message Boards. **SKETCH OMITTED**

While I am far too busy to keep up a continuous dialog on this news group I do think I should respond to some of the info out there!

I've been surfing the postings and see a lot of wrong stuff (abet mixed with some very good info). I offer the following to update those EZ guys that somehow don't get the quarterly Canard Pusher newsletter.

Yes, we still support EZ licensed builders and flyers. even now, 10 years after we sold the last set of plans. If you are licensed by RAF to build an EZ (several thousand people) we still here to help in any way we can to assure that you have the best chance to fly safely. We do not support second-party plans owners or bogus (Xeroxed) plans owners, so if you buy a set of plans from a licensed builder, be sure to get his agreement to support you. Remember he is still authorized to build ONE aircraft, and we will support him. He, if he wants, can sell ANYTHING to you, If you buy a used set of plans we suggest that, along with the plans, you get his agreement to license you and to support your project, since he is the only RAF licensed manufacturer.

The CP is still in publication, written chiefly by Mike Melvill, the primary builder support guru since 1978. It still is my official means to pass on plans changes and important safety info. CP #82 (Oct 95) is a bit late, because it is being revamped to an all-new format (my wife Tonya is the new editor). It's 16 pages are packed with interesting stuff including several MAND-GROUND changes that Mike Melvill and I think everyone should have. A CP subscription is available to anyone, not just licensed builders.

Also strongly recommended are the Oshkosh talks.

In general, RAF only supports the basic, unmodified versions of the aircraft, since that is all we have flight-tested. Many mods have been done by builders (bigger engines baggage pods etc, etc, etc). Many of these MAY be OK, but to find out for sure, contact those who developed them, NOT RAF.

We are painfully aware of how difficult it is for everyone to keep up with every single improvement and revision. The words of the newsletters alone comprise about 4 megabytes. That is why we are in the process of putting together a CD-ROM. This will be a special product since it will include not only the newsletters but also pilot's handbooks, tech reports, and even the plans of all the RAF homebuilts since 1972! (No, it will not include new licenses to build - the postings here accurately explain why we stopped that).

The CD-ROM will have thousands of illustrations, photos and a great search engine. If You are a CD-ROM developer/producer, contact us for an RFP, by faxing your address to (805)-824-4174.

RAF is open on Tuesdays ph (805) 824-2645 addr 1654 Flightline, Mojave CA 93501

Onward & Upward, Burt Rutan

PS: No, the Boomerang is not yet flying, I hope to finish it this spring. I WILL post the first flight report here on America Online. PPS: Check out the postings on the BD 12/14, shades of 1971!!

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Update Number 74 to Supplemental Chapter 37, Long-EZ General

From CP74-1&2 (CH30,CH37)
"Dear RAF;

Thought that you might be interested in knowing some of the details of another world record set by a Long-EZ during my flight to 30,500 ft. in N121DT. The flight has yet to be certified by FAI and NAA, however I see no problems at this time. After altimeter errors are computed in, expect to be certified to 30,370. (Editor's note: Verification from NAA has been received since this letter arrived at RAF).

My Long-EZ, fully equipped including oil, weighs 889 lbs. having no starter. Class C.1.a. has a max take off weight of 1102 lbs. including instrumentation to certify the flight. Needless to say, with fuel, added instrumentation and me at 175 lbs the aircraft would be about 50 lbs. over weight.

To make the flight, I removed the back seat upholstery, navigational lighting, wing-leveller autopilot, fire extinguisher, ELT, alternator, all radios, prop spinner, oil cooler, carb heat muff and 15 lbs. of body weight. Had to eat a lot of popcorn without beer to wash it down to bring my body weight down to 160 lbs. On a previous test flight I discovered that the vacuum pump still pulled almost 3 inches at 25,000 ft. so I elected to keep my vacuum pump and gyro instruments in case the inside of my canopy frosted over, which it did partly.

I added an electronic ignition made by Electroair and removed the right mag to give me advanced timing and performance at altitude which worked flawlessly. I also had a climb prop (70Dx46P) made by Performance Propellers for my Lycoming 0-290. The prop turned 2800 RPM on climb out and 2600 RPM at 30,000 ft. For communications with ATC and the ground during the flight, I fabricated a microphone into my oxygen mask and carried a hand held radio.

Weigh-in was 1099 lbs with 10.5 gallons of fuel, 8 gallons in the right tank for climb and 2.5 in the left for return flight. I also carried a video camera mounted over my right shoulder and a recording barograph in place of the back seat.

Take off from Camarillo airport was at 08:15 Dec. 5, 1992 with an initial climb rate of 2300 ft./min. ATC had been FAXed of my intentions for airspace more than 12 miles off the coast of California. So when I was handed off to LA Center they were expecting me and cooperated to keep me out of the Continental Control Area before climbing above FL180 VFR, as well as recording my mode C replies for the record. Interestingly, at 29,000, ATC asked if I was turbo charged!

Passing through 20,000 ft. I was climbing at 700 ft./min. However, it took me a couple of minutes to make the last 100 ft. to 30,500 indicated. I had reached my goal of breaking 30,000 so at 1 hour and 4 minutes into the flight, I leveled off and held that altitude for another three minutes The engine was turning 2600 RPM at approximately 8.5 inches of manifold pressure and I figured that I was developing about 30% power. Outside air temp. was -40C and my hands and feet were getting cold through my gloves, layers of clothes and snow boots.

Descent and return to CMA was uneventful. I found a warm reception waiting for me with Dick Freeborg, the National Aeronautic Association and FAI representative, the first one to shake my hand.

Note worthy is that this altitude record breaks the previous of record of 27,040 ft. set two years ago by Hoot Gibson, astronaut and space shuttle commander, in a modified Cassutt.

Dave Timms"

Ed. note: Hoot Gibson took his record away from Norm Howell, Quickie and Long-EZ builder, flying Terry Schubert's Long-EZ.

From CP74-14 (CH37)(Photo caption)
Dave Timms in his Long-EZ N121DT, on December 5, 1992 prior to altitude flight after canopy has been sealed by NAA representative, Dick Freeborg.

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Update Number 76 to Supplemental Chapter 37, Long-EZ General

From CP76-4&5 (CH22,CH37)

A CROSS COUNTRY TRIP WITH GPS

I recently installed a King KLN-90 GPS in our Long-EZ, N26MS. The installation was simple and, the best news of all, the antenna installation is a piece of cake! (Compared to a Loran antenna.)

The King GPS is, of course, pretty much the top of the line, state-of-the-art with all the bells and whistles, and it really makes navigating, VFR or IFR, easy. The amount of information available at your finger tips is simply mind boggling.

Our first cross country with the GPS was a couple of weeks ago when we flew back to Anderson, Indiana to attend a wedding of one of Sally's nephews. We departed Mojave early in the morning and climbed directly to 17,500 feet. Breathing oxygen through our cannula AEROX system, we flew to Pittsfield, Ill, non-stop, 1333 nautical miles (1533 statute miles) in 7 hours and 6 minutes at an average speed of 188 knots (215 mph). We burned exactly 48 gallons of gas for an average of 27.7 nmpg (32mpg). Try that in your foreign car - 215mph at 32mpg! Wow, the old Long-EZ is still awful hard to beat. N26MS has over 2030 hours total time and she is nearly 13 years old. Total flight time to Anderson was 8-1/2 hours. Total flight time back to Mojave from Anderson was 10 hours. We flew back at low altitude against a headwind and used 80 gallons coming west compared to 60 gallons going east. What a difference a tailwind can make!

The GPS performed flawlessly, the accuracy was amazing and rain, thunderstorms, lightening and low altitude scud-running (all the while running a CD player) had no effect whatever on its operation. (Our Loran used to drop off the line due to static build-up in bad weather, just when you needed it most!). The King even has a simple moving map mode that is really the way to go when running under the scud in low ceiling and low visibility conditions.

In spite of the military deliberately "dithering" the satellite signals, the GPS works much better than Loran. (We had a King KLN 88 Loran.) It is much more stable, ground speed readout is close to DME for stability, whereas Loran ground speed varies constantly. I believe the military will eventually be forced to quit the "dither" which will give incredible accuracy. I also believe that GPS will be ultimately the primary enroute navigation system. Already GPS is approved for some IFR operations, so if you are in the market for a navigation system, consider GPS over Loran for potentially greater accuracy, much better weather capability, easier installation and better reception in a fiberglass airplane.

If you do decide on a GPS (or Loran), consider this: Pick one with knobs, not buttons! Buttons are very difficult to use in turbulence, whereas your fingers can grasp and support themselves while turning a knob. For use in an aircraft, a database is a must. I believe a GPS or Loran without an aircraft-type database is of rather limited usefulness.

The GPS antenna works fine <u>inside</u> the fuselage which is a big plus. It does not have to be installed on the outside like a Loran antenna must be. Also, the ground plane is not critical at all. I mounted mine, a small, flat antenna about 2"x3"x5/8", on a bracket mounted on the foreword face of the F22 bulkhead, under the canard. It works great. The GPS reported accuracy of 0.02nm essentially all the way to Indiana and back. The worst accuracy I saw was 0.04nm! See me at Oshkosh '93 for more information.

Mike Melvill

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Update Number 82 to Supplemental Chapter 37, Long-EZ General

Information derived from CP82 published by RAF Oct 1995

****From CP82-1 (CH30,CH37)****

Oshkosh or bust by gosh

One of our South American friends reproduced the flight of an aviation hero, set four new records and entertained air show tourists in the U.S. with Long-EZ antics all within four months.

Brazilian pilot, Andre J, Deberdt, began the adventure in his hometown, Sao Paulo on April 21, '95. After landing his 1989 Long-EZ in Natal, Brazil, the native Frenchman. who has lived in Brazil for forty years, took off for a long-distance flight across the Atlantic Ocean to Dakar, Senegal on the African coast. Flying at an average speed of 130 Kts, Andre covered 1627 NM in little over twelve hours. That was the first leg of a four month odyssey that swept him across the Atlantic four times, through Africa and parts of Europe, over Iceland, Canada, and eventually landed him in Oshkosh, Wisconsin for the annual fly-in.

PPZAD, or "01 'ZAD" as the airship is affectionately called, is the first Brazilian experimental homebuilt to fly from Brazil to Africa non-stop and to tie South America to Europe with only one fuel stop.

Joao Ribeiro DeBarros, a famous Brazilian pilot who made the Atlantic crossing in a twin-engine Amphibian Savoria Marchetti on April 28, 1927, served as prototype-pilot for the early part of Andre's voyage. "What is little known is that DeBarros made the crossing 22 days before Lindbergh," Andre explained. "But the difference was that Lindbergh was flying (between) two important cities, New York and Paris, and also he had the American media, which was very good. This poor guy had little media. At the time he was famous, but the Brazilian don't seem to have memory for their hero. I am trying to change that."

Andre waited two days on Isl de Sal in the Cape Verde Islands just to cross on the same date as DeBaffos - April 28th. "Looking at the weather, of course," he added.

Andre chose to cross the ocean by night. "As Dick (Rutan) told in his forum, what you do not see, you do not fear," he explained with a hearty laugh, "it's psychology." The shorter nights while traveling east and the ability to spot far-off lightening and heavily traveled traffic patterns also played a role in his decision. "By night it is cooler, and the engine works better," he said. "You can fly at higher altitude, and the sight is just beautiful."

An intelligent, gregarious guy, Andre had no problems making friends and influencing people even while crossing the wild blue yonder at an average of 12,000 feet. "Anytime I could not contact the controls by HF radio, I called on International Emergency Frequency and asked the big boys over there to help me, and use their radar," he said. "There are many airplanes crossing at the same time. You get many, many answers every time you call. One of them, from Swiss Air, had a Long-EZ so we were discussing the virtues of each EZ for an hour or so."

Foreign flying permits were relatively easy to come by, according to Andre, who serves as a judge for a Brazilian Rally team as well as an International judge for the FAI. "In South America (it is) completely free, as easy as here in the United States," he said. "The difference being that taxes are high and fuel more expensive, but it's a simple matter of filing an international flight plan."

Andre said there are four Long-EZs, two Cozys and one VariEze flying in Brazil. Two Velocitys are currently under construction.

He was only questioned once during his sojourn, while trying to fly over Morocco. "Three hours into the flight after leaving Tenerife, Canary Control called me and told me, 'Casa Blanca wants to know if you have permission to overfly their country.' And then I answer with another question, 'Ask them if they know that it's the new regulation of International Organization for Civil Aviation (IOAC)?'

"But there was no way. They wouldn't let me overfly the country, So I had to discuss with Spanish Authority (a way to) vector me direct to Spain."

Andre said the airplane never failed, but he lost his ADF and Altitude Encoder at one point, landing by GPS and the feel of the airplane. It was repaired by RMI as soon as he arrived in the States. "The NARCO ADF was also repaired there," he said, "and I had to transfer the NDB data's for the IFR landing procedure in Iceland into the data base of the GPS, and I then completed the instrument landing there with no problems."

As for the 118 hp Lycoming 0235-L2C engine, "it works like a fine Swiss watch," he said. "I have the Klaus ignition, of course, and that is a big factor in the fuel efficiency."

A surprise encounter with ice south of Greenland was a new experience for Andre. Flying at 12,000 feet with a headwind, Andre said he felt that the airplane was a handling nose-high. While he noticed a little rime ice on the leading edge of the wing and the winglets, he did not consider it a significant problem. However, a short flight-test soon shattered his calm. The airplane shuddered, forcing Andre to cut power and descend to 8,000 feet. "Then suddenly I heard two big, loud bangs," he said. "After a while I figured out I had much more ice on the canard that I couldn't see, of course. It melted and (left) the wings. I had an aft CG, and I almost entered a deep stall because of that. This was quite an experience."

"I once had an experience of icing of gasoline over Chile in 1993. I lost my engine. Mike Melvill had the same problem over Alaska. He told me "Well, you are from the tropics. You do not know this phenomenon. At the high latitude it happens frequently." Since then I was careful to add some additive to each leg over Iceland just to avoid icing."

After the Iceland episode, Andre made a stop in Gander, Newfoundland before heading to Oshkosh.

"I was not going to come to Oshkosh '95," he said. "But Terry Schubert (President & Editor, Central; States Association) told me you cannot do that, you have to be part of our team for the Glass Overcast."

Indeed, he did. Andre and ZAD flew as part of the Lone Eagle Flight Team's display during Saturday's air show.

Andre, who is married with two daughters and two granddaughters age 13 and age 6, said he claimed four more distance records, which are about to be confirmed. by the FAI, as he headed home from Oshkosh to Sao Paulo. The return home was uneventful, he reported, and "very enjoyable if not a bit tiring."

For now ZAD is temporarily grounded "by popular demand - my wife," he said, for a much deserved rest. But in 1997 Andre plans to fly the long-distance courses again, this time to close the loop through Australia.

Good luck Andre, we will listen for you on the airwaves.

**From CP82-4 (CH37)

PP ZAD's Journey to Europe and Oshkosh '95.

LEG	*DATE*	*ROUTE*	*NM*	*SPEED*	*EET*
1	Jul 2	Marte SP Brazil - Natal RN Brazil	1283	135	09:30
2	Jul 4	Natal RN Brazil - Tenerife Canary Islands	2342	130	17:57
3	Jul 7	Tenerife Canary Islands - Castellet France	1489	142	10:30
4	Jul 13	Castellet France - Strasbourg France	430	139	03:06
5	Jul 15	Strasbourg France - Lelystad Holland	292	146	02:12
6	Jul 16	Lelystad Holland - Lille France	181	136	01:30
7	Jul 18	Lille France -Valence France	360	135	02:54
8	Jul 18	Valence France- Castellet France	160	137	02:24
9	Jul 22	Castellet France - Moulins France	229	134	01:41
10	Jul 23	Moulins France - Herning Denmark	642	121	05.10
11	Jul 25	Billund Denmark - Reyjkavik Iceland	1047	125	08:24
12	Jul 26	Reyjkavik Iceland - Gander Canada	1385	121	11:28
13	Jul 27	Gander Canada - Oshkosh USA	1494	126	11:47
14	Aug 3	Oshkosh USA - Ft. Lauderdale USA	1200	107	11:08
15	Aug 6	Ft. Lauderdale USA - St.Martin Carribean	1114	134	08:18
16	Aug 9	St.Martin Carribean - Belem PA Brazil	1470	122	11:55
17	Aug 12	Belem PA Brazil - Marte SP Brazil	1356	131	10:20

Total IFR Enroute 16.474 NM (30.510 KM) - 130:14 HOURS - 126.5 KT AVG (234.4 KM/H)

From CP82-3 (CH37)

Glass Overcast
blast from the past

PHOTOGRAPH OMITTED

The old trusty Defiant N78RA ferried Burt, Tonya, Mike and John Campbell (Scaled engineer) safely to and from Oshkosh '95.

For the first time in 15 years, Mike and Sally's N26MS Long-EZ did not make it to Oshkosh. Built in 1980, N26MS has been to Oshkosh every year since 1981. This year it was not to be.

Mike and John Campbell worked very hard installing the newly over-hauled engine, and were putting as many hours on it as possible prior to departing for Oshkosh, when, just the day before leaving, the oil pressure abruptly went away! Immediately all energy was transferred to preparing Burt's Defiant for four passengers instead of two, and early the next morning we departed Mojave via the Trona Gap, a small passage-way between the restricted areas of the Navy's China Lake and Edwards Air Force Base.

The GPS driven moving map on the laptop computer (Mentor Plus) made this task easy, and from there the route was GPS direct, over Las Vegas towards Oshkosh. The only stop was at the tiny town of Cambridge, Nebraska, where the FBO lent us his wife's car. Tonya drove us into town where we had excellent country style food at the only restaurant.

Cambridge is a neat little town, and the people are friendly. It's an excellent place to stop for gas if you are in the area.

After lunch we flew GPS direct to Racine, Wisconsin where we spent the night. We enjoyed a fun evening and supper with the 60 or so other canard owners courtesy of EAA Chapter 838 in Racine. Great pizza, great company.

Early the next morning more than 60 composite canard aircraft took-off from the John H. Batten (RAC) runway, after a pilot's briefing held by Maj. Norm Howell, for a 90-nm in-trail mass arrival at Oshkosh led by Burt flying "Mother Ship," Defiant N78RA. Anyone with a Rutan or similar design was allowed to participate, as long as they had a cruise speed of 120 KIAS or better at 3000 feet MSL.

After being announced to the Oshkosh audience (according to EAA estimates, 830,000 people and more than 12,000 airplanes showed up for Oshkosh '95), the canard flock taxied to a specially designated area north of the Theater in the Woods.

In addition, to help celebrate the 20th anniversary of the proof-of-concept VariEze N7EZ, 28 composite aircraft swept the field in professional formation at Saturday's air show while five pilots gave the audience a taste of the canard right stuff for the first time in 10 years with a five-plane flying show - Ron Smith in his Variviggen; Andre Deberdt in his Long-EZ; Marty Pavlovich in his VariEze; Terry Krouch in his Quickie; and Mike in the Defiant.

Glass Overcast 1995 was a great effort organized by Steve Sorenson, Glass Overcast Coordinator; Terry Schubert, President & Editor, Central States Association; Norm Howell, Glass Overcast Western Region Coordinator; Gene and Ann Zabler, Wisconsin State Rep, Central States Association; and Tim Bass, President EAA Chapter 838, Racine WI.

RAF thanks them and all the pilots who spent hours of practice preparing to put on the "greatest show on earth" at the greatest air show on earth."

From CP82-6&7 (CH37)

Canards take Oshkosh by storm

This year Rutan canards filled the skies over Wisconsin like a flock of regal birds heading Midwest for the summer. They flew to Oshkosh to celebrate the 20th anniversary of the 7-EZ. the "Ass Backwards" prototype that wowed that aviation-loving crowd for the first time in 1975.

We here at RAF applaud two people for their devoted efforts to count the flock. It was a big job, as you can see from the following list compiled by Irene Rutan and David Orr - 161 Rutan canards in all.

Thank goodness for friends and mothers.

*Participants in Glass Overcast.
Variviggen N31AN (Adam Wehr III) FL
Variviggen N212RS (Ron Smith) IN
Variviggen N77AX
Defiant N219DF (Lonnie Weitzel) TX
Defiant N711JS (Bill Sattler) TN
Defiant N143PS (Bill Sattler) TN
Defiant N78RA (Burt Rutan) CA*
Defiant N431RA (Bayard Dupont) DF LA
Defiant N3XK (Tom Kuffel) MT
VariEze N7AH (Larry Hoepfinger) TN
VariEze N115AM (Bob Campbell) IN
VariEze N13OBE (Bob Eckes) AZ
VariEze N12BN (Bernard Nitz) IL
VariEze N300DJ (Don Jones) TN
VariEze N862DP (Dan Patch) CA
VariEze N50EP (Edra Parker) IN
VariEze N7EZ (EAA) WI
VariEze N17EZ (Dick Harkey) OK
VariEze N83EZ (Terry Sweat) TN
VariEze N216EZ (Wm Morgan) OR
VariEze N392EZ (William Freeman) KS
VariEze N500EZ (Victor Mondary) IN
VariEze N9FJ (Jon Gabrick) MN
VariEze C-GMEZ (Nigel Field) Canada
VariEze N341HA (EAA) WI
VariEze N64HL (Howard Stern) CA
VariEze N83HR (Harry Robbins) MO
VanEze N60HZ (Bruce Leonard) OH
VariEze N91JC (James Carraway) CA
VariEze N844JF (JD Hostutler) TX
VariEze N26JW (Gary Holt) OK
VariEze N47LG (Dave Kilbourne) CA*
VariEze N6LK (Rob Martinson) CO
VariEze N40LR (Leon Rausch) TX

VariEze N79RA (Burt Rutan) CA
VariEze N56RH (Bob Head) CA
VariEze N301RW (Bob Woodall) MD*
VariEze N118SJ (Steve Sorensen) CA
VariEze N301SR (Stan Rawlings) WA
VariEze N810TC (Martin Pavlovich) WI
VariEze N12VE (Joe Bennight) TX
VariEze N44VE (Joe Rosa) MO
VariEze N829WJ (Dave Nelson) MN*
VariEze N75WR (William Ingram) CA
VariEze N2XB (Kurt Kuhlmann) CA
VariEze N4ZX (John Cannon) TX
VariEze N4ZZ (Ken Swain) IL*
VariEze N9091A (Gary Mowad) CO
VariEze N9113A (Wm Brin) CA
VariEze N3260K (Doug Kouri) MI*
VariEze N5080K (Chuck Airesman) MD
VariEze N930L (Richard Zadow) TX*
VariEze N1158M (Maxey Hester) IA
VariEze N8037T (Jim Willer) CO
VariEze N183W (Bill Oertel) CA*
VariEze N303Y (Joe Krueger) WI
VariEze N9664 (Burt Carmenzino) CA
Long EZ N60AK (Gerald Nibler) AK
Long EZ N57AM (Alex Becker) MI*
Long EZ N775AM (Sam Chambers) KY
Long EZ N41AN (Ian Ayton) CA
Long EZ N454BC (Brad Carter) KS
Long EZ N89BE (Robert Englert) CT
Long EZ N82BJ (Bob Wilson) CO
Long EZ N73BR (Brent Bristow) AK
Long EZ N199BW (Barry Weber) CA*
Long EZ N52CA (Chuck Allison) MN*
Long EZ N18CC (Larry Laughlin) CA
Long EZ N143CL (Chuck Busch) CA
Long EZ N8CP (H.E. Crocker & Paul Jones) TX
Long EZ N91CX (Ray McCrea) CA*
Long EZ N129DD (Don Druckenbrodt) TX
Long EZ N1114 (Darryl Hensingfeld) TX
Long EZ 1N412DM (David Haggard) KS
Long EZ N83DT (David Adams) MO
Long EZ N86DT
Long EZ N49DW (Dan Wicklund) FL
Long EZ N22EM (Ed Madona) OK
Long EZ N27EZ (Jahn Steichen) IL
Long EZ N63EZ (Dan Worley) AR
Long EZ N90EZ (Tim Binder) IA
Long EZ N165EZ (Tom Kranzusch) WI
Long EZ N282EZ (Dan Mislik) MI
Long EZ N321EZ (David Orr) CA*
Long EZ N433EZ (Richard Reuland) AZ
Long EZ N45FC (Ron Cothern) CO
Long EZ C-FRMZ (Roland Moreau) Canada
Long EZ N81LP
Long EZ N6KO
Long EZ N21EM
Long EZ N312SS
Long EZ N81HM

Long EZ N99FW (Fred Wimberly) VA*
Long EZ C-GBVC (S.C. Audet) Canada
Long EZ N197GC (Sam Shelton) GA
Long EZ C-GDOW (Lucas Wagenaar) Canada
Long EZ N20GJ (Gus Sabo) NV*
Long EZ N99HM (Herb Sanders) TN
Long EZ N38JD (Jim Doan) OH
Long EZ N83JM (James Madsen) MN
Long EZ N57JP (James Price) MI*
Long EZ N731JS (James Napier) CA
Long EZ N818KD (Steve Drybread) CA
Long EZ N28KM (Erik Stolle) NM
Long EZ N58LD (Dave Jones) CA*
Long EZ N776LE (Lew Miller) CA
Long EZ N954LE (Sid Stiber) NY
Long EZ N223MM (Carl Stevens) CA*
Long EZ N407MN (McCumber Nickman Corp.) MN
Long EZ N24ND (Norm Dodge) AZ
Long EZ N510PG (Darryl Nelson) MI
Long EZ N616PH (Pat Halverson) CA
Long EZ N86PT (Gordon Jones) CA
Long EZ N126PW (Harold Peterson) OR
Long EZ N729RA (Rolland Sturtevant) NE
Long EZ N86RG (Ron Gowan) TX
Long EZ N312RH (Stan Sussman) CA*
Long EZ N35RS (Bob Sudderth) WA
Long EZ N424RW (R.G.Westphal) WI
Long EZ N169SH (Dick Rutan) CA
Long EZ N309SH (David Knox) SC
Long EZ N24SK (.Scott Carter) TX
Long EZ N600TD (Dave Dent) CA*
Long EZ N112TG (Buzz Talbot & Robert Gooch) IL
Long EZ NI58TG (Tom Garrison) TX
Long EZ N9TS (Terry Schubert) OH
Long EZ N83TS (Scott Talmadge) FL
Long EZ N200TY (Terry Yake) KS
Long EZ N87WH (George Walters) SC
Long EZ N58WL (Wayne Litherland) MO
Long EZ N30WP (James Jansa) FL
Long EZ N262E (Ralph Galetti) CA*
Long EZ N339E (Jim Evans) VA
Long EZ N4706G (Jim Peck) NM
Long EZ PP-ZAD (Andre Deberdt) BRAZIL*
Long EZ N676H (Maring Fagot) MO
Long EZ N163J (Harry Jenkins) CA
Long EZ N271J (Norm Howell/Jay Greene) CA/AK*
Long EZ N8248L (Steve McCaskie) MO
Long EZ N4372Q (John Stuart) MD*
Long EZ N369R (Bob La Bonte) NH*
Long EZ N715R (Roger Crupper) OH
Long EZ N2398T (Ron Verderame) CA*
Long EZ N3260T (Klaus Savier) CA
Long EZ N7128U (Bob Lemmon) CA
Long EZ N378X (Tom Ridyard) AZ
Long EZ N1378X (David & Robert Iuliano) NY*

****From CP82-13 (CH3,CH20,CH29,CH30,CH31,CH32,CH33,CH37)****
Christmas Shopping

Posters	
Chronological lith poster (see cover CP64)	$10.00
Jim Sugar night poster(Voyager & Friend)	4.00
Defiant on water.	4.00
EZ 3-ship 17x22(see cover CP 62)	4.00
Long-EZs in trail (llxl7)	4.00
Color photos (8x 10)	2.00
Stocking stuffers	
Long EZ ball caps (only 23 left)	$5.00
Solitaire ball caps (only 4 left)	5.00
Long EZ charms / tie tacks (silver/gold tone)	6.00
VariEze charms / tie tacks (silver/gold tone)	6.00
Name patches (except for VariViggen)	1.00
Silhouette patches (VariEze, Solitaire only)	3.00
Video	
Building the Rutan Composites.	$24.95
Go-A-Long-EZ	24.95
On Wings of Glass	20.00
Sensible stuff	
VariEze and Solitaire owner's manuals	$8.00
Long-EZ owner's manual	9.00
Defiant owner's manual	15.00
Large rudder plans	18.50
Speed brake	10.00
0-235 engine installation	21.50
Roncz Canard	42.50
Flush belhorns	10.00
Moldless Composites manual	14.50

Postage & handling included in price.
Make check to: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

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Supplemental Chapter 37, Long-EZ, General

****From CP24-3 (CH1,CH37)****

LONG-EZ UPDATE

(See also Long-EZ flyer, "Which one?" and "Sun-'n-Fun" in this issue, and CP #23).
Long-EZ plans are now available!!
The major benefits of the Long-EZ over the VariEze are listed below:

(1) Lower (65 kts) landing approach speed, can touch down at 50 kts with full aft stick.
(2) Better visibility for takeoff, approach and landing.
(3) Higher roll rate, lighter and more responsive ailerons.
(4) Stiffer elevator forces, more solid feel in pitch.
(5) Increased useful load, cabin size and instrument panel space.
(6) More baggage area. Cabin-accessible area in wing strakes.
(7) 60% more range and less runway required.
(8) Better high-altitude performance.
(9) Better maneuverability, yet more docile for low proficiency pilots.
(10) Greater stall margin.
(11) Ability to use 100 to 118 hp engines without nose ballast.
(12) Ability to use lighting, alternator and starter.
(13) Ability to use 500 x 5 tires.
(14) Improved structural materials.
(15) Improved structural methods and easier jigging.
(16) Overlap, incidence - adjustable wing attach (no wing fittings).
(17) Improved trim, electrical, and fuel systems.

The major benefits of the VariEze over the Long-EZ are listed below:

(1) Lower cost - materials are approximately $500 less due to smaller size and cheaper type foam.
(2) Ability to use the A75, A80 and C85 engines.
(3) Easier to trailer (Long-EZ must be tilted to meet the 8 ft width requirement).
(4) Faster to build (Long-EZ requires about 15% more work).

Note that there is only a minor difference in speed. Our Long-EZ outran half the VariEzes in the Sun-'n-Fun race.

The adjacent photos show Johnny Murphy of Cape Canaveral with his Long-EZ. This is the #2 ship, started last year. Johnny's project was built from the plans before they went to the printer, thus he provided assistance in debugging the plans. The Long-EZ plans are layed-out and detailed very clearly and completely. They are drawn based on our experience providing support for over 2000 VariEze builders. Thus, we expect far fewer changes and building problems than with the VariEze.

The Long-EZ design has taken advantage of the numerous improvements noted based on over 250 EZ first flights. Testing has been more extensive. When the VariEze plans first went to print in 1976 the prototype had 100 hours flying in 4 months and had been flown by about 6 pilots. Long-EZ prototype has over 250 hours flying in 10 months and has been flown by 25 pilots (front seat).

Our original plan of a addendum rather than a new set of plans was foolish, since even the unchanged canard and elevators were redrawn to improve their clarity and to eliminate common builder errors. The Long-EZ plans Section I include finishing instructions and complete electrical system drawings. Section IV is required and IIA or IIC are needed for engine installation. The Long-EZ Section I includes all updates for these Sections. Thus, Long-EZ builders do not need newsletters previous to CP #24.

The fact that the Long-EZ plans are completely new rather than an addendum eliminates the confusion of plans editing. However, some of you have purchased VariEze plans with the intent to build a Long-EZ when the addendum was published. Thus, we are providing a plans trade-in program so those people can get credit toward the Long-EZ plans. If you bought a VariEze Section I from RAF after July 15, 1979 with the intent to build a Long-EZ, contact RAF for terms for trading them for the Long-EZ plans.

We are just now finishing the Long-EZ Owners Manual. It should be printed and available by the end of May.

****From CP24-12 (CH1,CH37)****

WHICH ONE?

Rutan Aircraft Factory Inc., markets homebuilt plans for three different aircraft - The VariViggen, VariEze and Long-EZ. All three are two-place. The following information is intended to help you decide which is best for you.

PERFORMANCE AND UTILITY

The Long-EZ is the best in this category with range, altitude capability and performance way above the other two. Operation from high density-altitude airports at heavy weights is also best with the Long. The Long-EZ has the highest ceiling - a demonstrated 26,900 at light weights! Takeoff and landing distance of the Long is better than the VariEze and roughly similar to the VariViggen. Neither of the three are suited to unprepared fields, soft surfaces, gravel or small airports (less than 2000 ft, or 2400 ft with obstacles). Only the Long and Viggen are capable of night or IFR flying and only when properly equipped and flown by pilots with appropriate competence.

EFFICIENCY

The VariEze has the best miles per gallon, the Long coming in a close second and the VariViggen last. MPG at 75% power for the three are 35, 29, and 16 respectively.

CABIN/BAGGAGE

All three airplanes are soloed from front seat only. The VariViggen has two, similar, large, spacious cockpits with relatively upright seating. Large enough for 6 ft-5 in pilots. Two or three average-size normal suitcases fit the large baggage area aft of the rear seat. The cabin size and baggage room is much larger than the VariEze or the Long.

The VariEze and Long have two cockpits that are not similar. The front seat allows stretch-out comfort for pilots up to 6 ft-5 in, with carefully engineered thigh, lumbar, armrest and head support. The VariEze and the Long-EZ front seats are better suited to long-range comfort than the VariViggen seats. However, the VariEze and Long-EZ rear seats are smaller and less comfortable than the VariViggen. They can fit a 6 ft-4 in person, but comfort is compromised above 5 ft-10 in.

The Long-EZ baggage areas include two special suitcases, two cabin-accessible wing strake areas and additional room over the rear seat and in the wing spar. Total volume is nearly 10 cubic feet, however soft-type luggage must be used. Normal, hard suitcases do not fit. The VariEze has baggage room limited to the two special suitcases, approximately 3 cubic feet.

The VariViggen has center control sticks, rudder pedals and throttle in both cockpits, arranged much like a modern fighter. Conventional toe brakes are used. The VariEze and Long-EZ have side-stick controllers in both cockpits, but rudder pedals and engine controls only in front. Their rudder pedals work the two rudders independently and actuate the wheel brakes after full rudder is reached, i.e., one simple pedal for rudder and wheel brake.

CONSTRUCTION

None of the three require special skills or elaborate tools, since prefab parts are available for complex components. The VariViggen is by far the most demanding to build for several reasons: retractable landing gear, electric aileron reflex controls, full dual cockpit controls add a considerable number of parts to build. The mix of wood and composite structure requires different skills and tools. Control system includes many parts. Total building time can run from 3000 to 4000 hours, approximately 3 to 5 years of spare time effort.

The VariEze has been built by homebuilders in as little as 550 man hours and 4 months. However, projects on the average run closer to 900 to 1200 man-hours and 1 to 1.5 years spare time. The Long-EZ requires about 10 to 20 percent more work than a VariEze.

Any of the composite work (complete Long-EZ, VariEze and VariViggen outer wings) requires a clean shop that is controlled to a temperature range of 70 to 90 degrees and that allows work without direct sunlight on the part being built. Minimum shop size for Viggen, Long and VariEze is 400, 300, and 250 sq. ft. respectively.

ENGINE SIZE

The VariViggen, designed for the 273 lb 150 hp Lycoming is limited to the 150, 160, and 180 hp Lycoming engines. The lightweight, fatigue-free fixed pitch wooden props must be used. Heavy metal props make it (and the VariEze and Long) tailheavy, and increase risk of prop failure. Use of the 180 hp or injected 160 hp Lycomings on a VariViggen will result in a requirement to carry nose-ballast.

The Long-EZ is limited to the Lycoming O-235 (108 to 125 hp) and Continental O-200 (100 hp) with any accessories. The Lycoming is preferred, since it has a fuel pump and longer overhaul life.

The VariEze is intended for the lightweight Continental A75 and A80 engines. The C-85, C-90 and O-200 can be adapted, but they must be stripped of accessories to avoid an overweight, tailheavy airplane.

STALL CHARACTERISTICS

All three aircraft are designed to be "stall proof", i.e., they can safety maneuver up to, and including, full-aft-stick without experiencing a stall break, departure, or loss of altitude. They can all climb at the full-aft-stick speed, Long-EZ being the best (900 ft/mn at gross), Viggen the least at about 400 ft/mn. Homebuilder experience has shown that most VariEzes have excellent stall characteristics but a few experience wing rocking and roll-off at the stall. This is not expected with any of the Long-EZs, since they were designed with a greater margin of stall for the rear wing. Our prototype Long has proved to have exceptionally docile high angle attack characteristics, resisting departure for any maneuvers including tailslide stall entries, and application of all combinations of rudder and aileron. The VariViggen also has a good stall margin, with its standard wing configuration, however, with its special performance-wing its stall margin is low, resulting in more conventional characteristics, i.e., at minimum speed the S.P. wing will drop if the pilot sideslips.

MANEUVERABILITY
The VariViggen excels here, with its high roll rate and tight turning capability. However, due to its low aspect ratio, the Viggen looses speed in maneuvering. Thus, for sustained maneuvering, the Long is the best - it can climb over 400 ft per minute while maintaining 2-g at gross weight! The VariEze has the lowest roll rate. All three types are noted for their good maneuverability, as compared to conventional aircraft.

PILOT SKILL REQUIRED
The VariEze's high approach and landing speeds and responsive controls put more demands on pilot proficiency than the Viggen or Long-EZ. The Viggen has a relatively large trim change with power application. (nose up when power is reduced), requiring pilots attention. The VariEze and Long-EZ have very small trim changes for power, gear extension and landing brake extension. A VariEze or Long-EZ can fly for extended periods with "hands-off" controls. A Viggen must be continually flown. For those reasons the Long is the most docile, easiest for fly, and safest for the low-proficiency pilot.

Crosswinds - due to its responsive roll rate, high available sideslip and wide landing gear, the Viggen can handle the most crosswind. Takeoff and landing in wind components well above the capabilities of conventional airplanes are relatively easy. The Long-EZ is next, capable of handling a 20-knot component. Due to lower roll rate and lower wing tip clearance, the VariEze is last for crosswinds.

VISIBILITY
In order of preference - Viggen, Long and VariEze.

COST
Refer to the respective sheets for a breakdown of costs to build each airplane.

From CP24-19 (CH37)(Photo Caption)
Dick in Long-EZ doing his thing.

From CP24-19 (CH37)(Photo Caption)
Sally Melvill - First solo - Long-EZ.

From CP24-19 (CH37)(Photo Caption)
Dick checking out Don Downie.

From CP24-19 (CH37)(Photo Caption)
Les Faus - Long-EZ check-out.

From CP24-19 (CH37)(Photo Caption)
Barry and Mary Schiff, after first Long-EZ flight.

From CP25-1 (CH30,CH37)
DICK AND MIKE'S LONG-EZ's By Mike Melvill
We like the Long-EZ so much that Dick and I decided to get together and build two of them. We rented a building, fabricated a couple of tables, the wing jigs and centersection spar jig and ordered complete raw material kits from Aircraft Spruce and complete prefab parts from Ken Brock. We picked up the parts and materials on June 14th. Since this is our own project and we are doing it as a recreation and hobby type thing, we only work on them during our spare time, after work and weekends. Today, 12 days after receipt of kits, we have two fuselages assembled and glassed on the outside with speedbrakes and are laying out centersection spar parts. We are building them as quickly as possible, as we both want them for economical transportation machines, and we would like to have them flying as soon as possible. Neither of them will be "Grand Champion Quality" by any stretch of the imagination, rather they will be "plain vanilla" Long-EZ's built as light as possible to be flying as soon as possible. I have obtained an engine already, a Lycoming O-235 L2C, 118 hp at 2800 rpm out of a wrecked Cessna 152. Unfortunately this engine is not ideal for a Long-EZ in that it does not have a fuel pump, and does have a full-flow spin-on oil filter. The filter projects 1" into the centersection spar, and a fuel pump is mandatory on a Long-EZ. I am currently looking for an O-235-C accessory case! The O-235 L2C come as above only from Cessna 152's. The same engine from a Piper Tomahawk or Grumman trainer is fine and does have the fuel pump. Dick is still looking for an engine for his Long-EZ. We will continue to report progress on our two Long's in future Cps.

From CP25-3 (CH37)
CHECK OUT EXPERIENCE IN THE LONG-EZ
To date 30 pilots have been checked out in the Long-EZ. Pilot experience ranges from student, private, military, aviation writers, VariEze and even the odd airline captain. No problems were encountered by anyone and all made the transition easily.

Pilots current in a VariEze were given ground systems briefing and turned loose. The more experienced pilots without VariEze time were given one turn around the pattern (instructor in the back) then turned loose. Since the Long-EZ has a more solid pitch response and a lower deck angle on landing than the VariEze there was much less pitch bobble and no high round out landings as in some VariEze check outs. There was still some tendency to push both rudders out, especially on the first take off, but since you don't couple to roll as much as the VariEze this never created a problem. The most common comment was how long it took to slow down to pattern airspeed and how much it would float on landing especially if you were fast.

We check out and soloed two of our RAF low time pilots, Sally Melvill Mike's wife) 150hr private pilot and Pat Storch (Burt's girlfriend), a 24 hour student pilot. At no time did the instructor need to take control to save/recover the aircraft. Both were soloed after 1.5 hours dual in the front seat (6 to 8 landings). Neither had any formal backseat dual. Since the instructor had no throttle or brakes in the back, enough time was spent on the ground making low/high speed taxi runs to be sure this area was mastered. Neither required more than 10 minutes in this area.

Sally is current in a Champ, Grumman Tiger and VariViggen. Pat had only flown the Tiger. Both girls are exceptional pilots, better capable than average for their flight time. The following is Pat's personal perception of her flight:

"Incredulous - that was my first feeling when they told me they wanted me to solo the Long-EZ. Tiny insecurities worked their way out in the form of protests. "But I'm only a student! I've only soloed one other airplane! I have less than 25 hours!" It seemed that I was the only one lacking in confidence, because they would not be dissuaded.

The day came when it was time to give it a try from the front seat. The cockpit looked foreign, almost hostile. Instruments were not where my eyes wanted them to be. Throttle and stick were in the wrong hands. With my heart in my mouth, we started the pattern work. Soon I was thankfully too busy to be nervous, but I still felt I was reaching for an unattainable goal. Control of the Long felt so different, and the full-stall landings I had practiced so diligently in the Tiger were to be forgotten.

Then, amazingly, little pieces started falling together. Each landing felt better, the cockpit looked more familiar and a tiny seed of confidence started to bloom. Could it be? Would it really happen? Down to refuel and then came the words I wanted to hear - "you're ready to go!". My heart was racing once again but this time it was from anticipation and excitement. Lined up on the runway, I took a deep breath and was rolling. The take-off was smooth and felt good. The plane felt fantastic. I played in the sky. Up, down, around, turns and steep turns to 2 g's. I never expected any experience to equal my first solo, but this surely surpassed it. Flying never felt so good! Then came the final test, the landing. A little long, but a good one.

A Long-EZ pilot! I flew the Long! I wanted the world to celebrate with me. Flying had taken on a new dimension. I may have landed, but I was still in the air, and haven't come down yet. What a satisfying, exhilarating experience".

****From CP25-12 (CH37)(Photo caption)****
The RAF crew with the Long prototype. Left to right: Pat Storch, Burt Rutan, Dick Rutan, Sally and Mike Melvill, and Roger Houghton.

****From CP25-12 (CH37)(Photo caption)****
The Long-EZ prototype on grass. 500 x 5 tires are mounted, as well as the spring strut. The ride and handling is similar to most light-planes - very pleasant.

****From CP25-12 (CH7,CH37)(Photo caption)****
It seems the fastest Long-EZ builders are those that have built VariEzes. The adjacent fuselage is the first 1 1/2 weeks work by Herb Sanders. Other EZ-types of note are Ed Hamlin and Don Shupe. Ed and Don have a total of just under 1000 hours on their EZ's. Ed, Joanne, Don and Bernadette plan a round-the-world trip for a summer vacation when they get their Longs finished.

****From CP25-12 (CH37)(Photo caption)****
Pat and Sally after Pat's Long-EZ solo.

****From CP25-13 (CH37)(Photo caption)****
Sally with RAF's Long-EZ. She soloed N79RA last year. Sally and Mike are now working about 30 hours per week building their own Long. They plan to fly the new one to the Bahamas this Christmas for the Hospitality Club Fly-in.

****From CP26-3 (CH34,CH37)****
MIKE AND DICK'S LONG-EZ's By Mike Melvill
Progress has been good since CP #25. All major structural parts are complete, wings, winglets (upper and lower), centersections, fuselages, canards, elevators, mains and nose gears. Dick plans on completing his in the same building we rented and I have transported mine to our home in Tehachapi, where Sally and I have been working like mad in our two car garage.

At this point our Long-EZ N26MS November two six, Mike Sally) is on its gear, the canopy is complete and mounted, the engine is mounted. The canard is mounted, without the fairing block. The wings have been mounted and drilled into the centersection, which is hard mounted into the fuselage. The speed brake is installed and operational, pitch trim, roll trim and control sticks are installed. Upper and lower winglets are mounted on the wings, as are the ailerons.

Still left to do, mount the wing strakes (fuel/baggage areas) which will be the prefab parts (see page 1). Fit and install the cowling, install and hook up all instruments, throttle quadrant, and complete all plumbing and wiring. Then of course it is finishing time, lots of dry micro, featherfill, primer and paint.

Sally and I have been trying very hard to get our Long-EZ ready for the Hospitality Club Bahama's trip this Christmas. At this time I am not certain we will make it. To a large extent it now depends on being able to get all the little parts it will take to finalize the whole thing, we will keep on going as hard as we can and it will not be for lack of trying if we don't make it.

During the course of our building we have weighed virtually all the parts and kept an accurate record of man-hours we have spent building. Here is a list of weights and hours spent on the parts. Use this as a guide to judge if you are too heavy, too light or spending far too much time on a part:

Front seat bulkhead	2 lbs.	14 ozs.
Back seat bulkhead	1 lb.	7 ozs.
F28 bulkhead		3 ozs.
F22 bulkhead	1 lb.	7 ozs.
Instrument panel	2 lbs.	2 ozs.
Fuselage sides (with gear attach layup and angles and bolts)	10 lbs. per side	
Fuselage, assembled with bottom on and carved outside, but not skinned	41 lbs.	
Skinned fuselage, with roll over structure and speed brake (from F22 to firewall)	59 lbs.	
Speed brake	2 lbs.	2 ozs.
Main gear strut with 8 ply UND torsional layup	24 lbs.	14 ozs.
Main gear with attach tabs complete	27 lbs.	
Centersection spar	29 lbs.	5 ozs.
Wing, skinned top and bottom, no root ribs, ailerons cut out	46 lbs.	
Wing, with root rib layups, and aileron trailing edge spar complete (no aileron)	46 lbs.	8 ozs.
Aileron with mass balance, hinges, torque tube and universal	5 lbs.	2 ozs.
Wing, complete to end of Chapter 19, with level reference board bondo'd on, ailerons, hinges, controls, etc.	51 lbs.	8 ozs.
Upper winglet with R.S.T. antenna, coaxial cable and BNC connector, ready to install on wing	6 lbs.	
Lower winglet	1 lb.	3 ozs.
Canard no hardware, no elevators	17 lbs.	
Left elevator, no hinges, no counter-weights	2 lbs.	2 ozs.
Right elevator, no hinges, no counter-weights	1 lb.	13 ozs.
Left elevator, ready to finish	3 lbs.	8 ozs.
Right elevator, ready to finish	3 lbs.	4 ozs.
Canopy complete ready to finish	16 lbs.	
Fuselage, complete with centersection (includes side consoles) brake cylinders, main and nose gear (and fore and aft canopy frame) (500x5 tires on main gear) no wingstrakes, no canard, no canopy, no engine mount	183 lbs.	
Wing, complete with upper and lower winglet, rudder mounted and hinged, ready to finish and bolt to mounted centersection spar	64 lbs.	
Dynafocal engine mount	5 lbs.	3 ozs.

BUILDING TIMES IN MAN HOURS (MH)
Note: These are <u>not</u> just layup times. These are <u>total</u> hours worked for <u>all</u> people, including shop cleanup.

Fuselage, assembled with nose, nose gear, main gear, and roll over structure	86 mh
Main Gear (complete, no axles)	9 mh
Canard	38 mh
Elevators	8 mh (2 pcs)
Centersection	62 mh
Both Wings	97 mh (2 pcs)
Upper winglets	11 mh (2 pcs)
Lower winglets	6 mh (2 pcs)

Wing root layups, aileron cut out and trailing edge spar layups (2 wings)	15 mh
Ailerons, complete, hinged and operational in the wings with controls (2 wings)	32 mh
Canopy complete	36 mh
Wings, jigged to centersection and drilled in	6 mh
Upper winglet, jigged to wing, and all layups complete plus lower winglet, jigged and layed up	23 mh (per wing)
Rudder layout, cutout, layup, mount hinge and bracket, string cable	7 1/2 mh
Total Man Hours to date	458 mh

This is where I am at this time and we will continue to report progress, weights and times in future CPs.

From CP26-4 (CH37)
TULLAHOMA 80 by Dick Rutan
This was our first time we had been to this event and thoroughly enjoyed it. Good weather, nice crowds and a lot of fun flying. The side trips to the "Grand-Ole-Opera" and the Jack Daniels distillery were interesting. I flew the Long-EZ each day in the airshow demonstrating it's maneuverability by doing some very basic aerobatics both with and without power.

The event was well attended by VariEzes and all the Long-EZs in the world were in attendance. Johnny Murphy flew his Long-EZ non-stop from Florida. Friday night the EZ crowd got together at the VFW club for dinner. I took the opportunity to give special recognition to some very nice flying machines. I selected John Benjamin N40JB VariEze as the overall winner with Steve Darlington N36SD and Robert Vaughan N66EZ so close behind they also received awards. "Good job guys, it makes us proud to see such fine machines".

The significant part of my trip was the demonstration of the Long-EZ, long range cruise efficiency by flying from Mojave, CA to Tullahoma TN non-stop arriving with fuel to hold almost two hours. Myself and my friend Jeana Farrar with baggage for two weeks flew the 1600 nm (1860 statute miles) in 10 hours 46 minutes non-stop, for an average speed 148.7kt (171 mph). This included a detour to see the Grand Canyon at dawn. The total flying time was 11 hours 6 minutes including holding an arrival airshow demonstration. Total fuel burn was 55 gallons for 4.74 gph. Fuel burn for the leg not counting holding was 53 gallons for 34.7 sm per gallon. Not bad for two people at over 175 mph true airspeed. In August, the non-stop flight to Oshkosh from San Francisco was virtually the same distance and speed as this one. We are very pleased with the data on both of these long flights because it was just slightly better than what is stated in the Owners Manual. Both flights were blessed with good smooth weather and a 3-4 kt average tail wind. At over 12000 ft cruise altitude, we were using only about 58% power. The Lycoming O-235 (at 1500 hours total time) ran smooth with very low oil burn.

On our return trip we stopped off at Ray Field, a little 2000' grass strip just south of Mobile Alabama, to attend a local EAA chapter meeting. Even with trees at both ends the Long-EZ operated out of the grass strip with no problem. I want to thank Rick and Kully Thompson and all the chapter members for replacing our burned-out landing light, and bedding us and the Long-EZ down for the night.

It is very interesting to note that Mojave to Tullahoma via jet airliner requires a 2 hour drive to Los Angeles, a 7.1 hour airline flight (including one stop) to Nashville Tennessee, a half hour baggage pick up and another one and a half hour drive.

MOJAVE TO TULLAHOMA - TWO PEOPLE, ONE WAY

	AIRLINES & CAR	LONG-EZ
TOTAL TIME	11.1 hours	10.8 hours
COST-AIRLINES	$580.00	-
COST-CAR	40.00	-
COST-FUEL AND OIL	-	$88.00
COST-DEPR. HANGER, OVERHAUL, INS	-	$90.00
TOTAL COST	$620.0	$178.00

It may surprise many to find that you can go 3/4 the way across the country faster than airlines and at less than 30% of the cost!

From CP26-13 (CH37)(Photo caption)
Darrol Stinton, of British CAA after his flight evaluation of the Long-EZ.

From CP26-16 (CH37)(Photo caption)
Long-EZ shortly after Dick and Jeanna arrived non-stop from San Francisco.

From CP27-1 (CH34,CH37)

Mike and Sally's Long-EZ by Mike.

In CP 26 Sally and I were going at it as hard as we could to try to finish N26MS before the Bahamas Trip. Due to several circumstances, some beyond our control, we were unable to fly our Long to the Bahamas, although we did manage to get a few flights on it prior to leaving on the trip.

We really burned the midnight oil the last few weeks and without help from Burt, Pat, Bruce and Giles, we would not have got it flying before leaving. We filled and primed all the parts and then transported it down to Mojave Airport, where we finished up engine baffling and wiring. On Sunday, 21 December we finally had it all done. We put 10 gallons in each fuel tank, flushed the fuel system thoroughly and started the engine. Since Sally and I overhauled the engine, it was a great relief to have it start and run so smoothly! We ran the engine for half an hour, then after conducting a careful weight and balance, determining that the cg was in the center of the first flight box for me, I taxied out for the first runway flights. I made 3 runs down the runway, checked brakes, rudder effectiveness, rotation speed and on the 3rd run lifted off a foot or two. It felt absolutely great, it was straight, no trim required, so I landed, taxied to the end of runway 12, and with Dick and Sally in Burt's Long-EZ on my right wing, I took off.

It felt absolutely right. It is a difficult moment to describe on paper, when you depart the runway environment completely, and commit yourself and your new airplane to the air, it is an incredible feeling. All engine instruments were in the "green", so I climbed on up to 5,000 feet and carefully explored various control inputs and power settings. I am delighted to report that it required no trim to fly straight and true. I flew about 40 minutes, landed and Sally made the next flight. She is also delighted with the handling qualities. Just before dusk Burt took it up and was pleased with it.

Since getting back from our Bahamas trip we have been putting hours on our Long. I have opened the envelope up to 185 knots indicated at 9,000 feet and she loops and rolls beautifully. The roll response is even better than the prototype N79RA. With no wheel pants, the large 500 x 5 tires and no spinner, speeds are not very meaningful, but at 7,500 feet she trues out at 151 knots (173mph), so I believe that with wheel pants, a spinner and a magneto that sparks on all 4 cylinders our Long-EZ will be at least equal to the owners manual, possibly a little better.

Evaluation of N26MS by Burt

Sally and Mike built this one with alot of attention to accuracy. The reward is an airplane that flys ball- ntered at neutral roll trim, hands-off. Its roll qualities are crisp with minimal adverse yaw. Pitch handling is solid with firm speed stability. Stalls are optimum - a very mild pitch bobble at full aft stick. Roll reversals and sideslips performed at full aft stick are smooth and do not produce wing rocking. Engine noise and vibration are lower than the prototype due to the dynafocal mount. A superb flying airplane, the best of any type I've flown.

Back to Mike. - We will continue to report on how it goes, as we accumulate time and data.

Before final assembly we got a few more relevant weights:

Wings with ailerons and rudders complete (before finish)	64 lbs. each
Rudders (filled and painted	1.2 lbs. each
Left elevator (filled and painted)	3.5 lbs.
Right elevator (filled and painted)	3.0 lbs.
Ailerons, with hinges, universal and torque tube, (filled and painted)	5.4 lbs. each
Canard with fairing cover (filled and painted)	18.5 lbs.
Canopy, with hinges (filled and painted)	17 lbs.
Wings with winglets, no rudders, no ailerons (filled and painted)	60 lbs. each

We ended up with a total of 1,200 hours. This included all man hours put in by everyone who worked on the airplane. This also includes overhauling the engine, developing the new engine mount and baffling, installation of such things as tape deck, intercom and what Burt calls "fru-fru" (non-essentials). See page 4 of this newsletter for Burt's comments.

From CP27-11 (CH37)(Photo Caption)

Well folks, its done! **MIKE AND SALLY'S LONG-EZ**

From CP27-1&2 (CH37)

CROSS COUNTRY IN A LONG-EZ by Mike Melvill

Due to our Long-EZ not having all the hours flown off in time for the Hospitality Club fly out to the Bahamas, Burt very kindly let Sally and I use N79RA. While I have quite a bit of flying time in Burt's Long, it has all been around the airport, this was my first long cross country in a Long-EZ.

To say that I was impressed would be putting it mildly., This is absolutely the nicest cross country flying machine I have ever flown. At 9,500 feet we trued out at 158 knots (183 mph) at approximately 72% power. At sea level, full throttle we trued out at 169 knots (194 mph).

We flew 3 legs of 5 hours and one of just over 6 hours. We were extremely comfortable at all times. Cabin noise level is a little high and a good noise-attenuating headset really is a must. The tremendous range is something I have not experienced before and there is a lot of comfort in knowing that you can fly for 7 or 8 hours if you have to, particularly in a bad weather situation. We generally had great flying weather, but on the way back Sally and I ran into about four hours of marginal VFR, low ceilings and occasional low visibility in rain. It was great to know that we could turn around or fly around virtually any sized weather system, without having a fuel problem. We flew in loose formation with Burt and Pat in the Defiant on part of the trip, and on one occasion we had to stop because the Defiant was getting low on fuel! Sally and I shared the flying almost equally and I was pleased to find how comfortable I was even in the back seat. I spent 17 1/2 hours there! On one leg, from Las Cruces, New Mexico to New Orleans, Louisiana, a distance 1016 sm, the Defiant and Long-EZ went together non-stop at 9,500' and covered the distance in 5.1 hours, a ground speed of 199 mph! During this flight in smooth air several times, I did not touch the controls for an hour at a time, a super airplane. Total trip distance, including sight-seeing and demos was 6440 statute miles. All we did was add fuel and oil, no maintenance of any kind was required. N79RA how has 493 hours, averaging nearly 1 hour per day since first flight in June 1979.

From CP28-2 (CH22,CH30,CH36,CH37)

26MS - Mike and Sally's Long.

Currently we have 85 hours on our Long and it is literally running like a Swiss Watch. We are truly delighted with it in every possible way. We have been using it to commute to work every day for the past couple of months. From Techachapi to Mojave by road is 26 miles, about a 30 minute drive. It takes between 8 and 12 minutes in the Long, depending on the winds. We use two to two and a half gallons for the round trip. This is almost exactly what we use in our Honda Civic car. Besides the time saved the biggest thing is the 'fun' factor. There is a lot of enjoyment in flying across the desert in the early morning with glass smooth air, no traffic and the stereo tape deck playing in the head phones. Coming down-hill in the morning, we usually fly at very low power settings. The quiet, smooth exhilaration really makes it enjoyable to come to work.

All flight tests, engine break in etc., have now been completed. All systems work perfectly. The Radair comm, nav, and transponder work very satisfactorily. The Sigtronics intercom and audio switcher work excellently in conjunction with our stereo tape deck. This also gives us the capability to transmit from either cockpit. The newest piece of equipment recently installed is a Silver Fuelgard. This small instrument accurately reads out fuel flow in gallons per hour and you can look at fuel used with a momentary switch. This fuel flow meter is a TSO'd instrument and uses a flow-scan transducer. We installed it in the fuel line so that all fuel on board runs through it. It is accurate within +- 2 percent. So far it has verified the Owners Manual fuel flow information very closely. N26MS will burn 1.9 gallons per hour at minimum power required for level flight at 8000 ft (max endurance) and at 75 percent at 7/8000 ft it reads 6.7 gph. Take off, full rich at sea level is a shock, 11.7 gph!! On a recent cross-country, we went to Northern California, a straight line distance of 404 nm (471 sm). On the trip up north we had a ferocious head wind of 29 kt (33 mph) so we ran at approximately 70 percent power at 8500 ft for a fuel flow of 6.4 gph. This gave us a ground speed of 130 kts (150 mph) with a true airspeed of 159 kts (183 mph). Our time enroute was 3.1 hours and we used right at 20 gallons of gas. By contrast on the return trip we had a tail wind!! We climbed to 11,500 ft, where the tail wind component was 35 kts (40 mph). It took some will power, but we pulled the power back to approximately 48 percent which gave us a fuel flow of 4.4 gph, and a true airspeed of 133 kts (153 mph) which, with the tail wind, had us crossing the ground at 168 kts (193 mph). The time enroute was 2.4 hours and we burned a total of 10.6 gallons of gas! I honestly believe that a Long-EZ built to the plans will consistently give these kind of results. The airplane is incredibly comfortable, reasonably quiet, particularly with David Clark headsets, and is an honest to goodness, economical, high speed touring machine, with good baggage capacity, excellent high altitude capability and unbelievable range. All in all, looking back at the intensive effort required to build it, it was well worth it!! The Long continues to delight us, Sally takes it to her 99's meetings, I have been into terminal control areas, we have flown it quite extensively at night. We have flown over mountains, over ocean (to Santa Catalina) and it is just super. The Lycoming O-235-L2C has continued to run like a dream and to be honest, I have no regrets. If I had to do it again, I would build it exactly as we did, using the same engine. The only thing I would not recommend is the electrical system we have. The engine came with a 28 volt starter and alternator, and all the electrics on the airplane are 12 volt. We have got it working, but it was simply too much hassle for the average builder to have to put up with, when you don't have to. N26MS will be here at RAF on a daily basis, and we plan on attending most of the flyins, including Watsonville and Oshkosh.

From CP28-2 (CH36,CH37)

Long-EZ #4 by Dick Rutan.

Last summer Mike Melvill and myself decided to build ourselves one-each Long-EZ. We agreed to work together on the basic structure then split off and finish individually. On 15 June 1980 we started and with a lot of help from Mike's wife Sally and my friend Jeana Yeager both aircraft are now flying. Mike's (N26MS) late December 1980 and mine (N169SH) in early April 1981.

Mine took longer to build for two reasons. First, Mike worked harder, but the biggest reason is all the changes I made to mine. I thought I wanted more power, more roll rate, more negative g and IFR equipment. I installed a bigger engine, longer ailerons, different canard airfoil and several other changes. All these mods took more time to build, cost more and after first flight, I found they didn't work. When I should have been very happy after it flew I was not. Instead of having an aircraft I could use I found I had a "prototype" that needed work. The big engine over-heated, the revised canard airfoil resulted in loss of speed-stability at high speed, and very poor stall characteristics (a nose drop). The standard Long-EZ rolls about as fast as mine and because of a poor prop match, Burt's Long even out-ran me on the first flight! I was then faced with finding fixes for all the problems.

I'll fix the problems but it will take some time and effort. But in retrospect, I wish I had stayed more standard. My airplane now is a compromise, a whole bunch more effort that I feel is not worth it.

If you see my light-blue modified Long-EZ (N169SH) at flyins and airshows, remember the mods were not approved by Burt or RAF. In fact Burt was not aware of most of them. Please don't bother RAF about my mods. They have enough to do just to support those building from the basic plans. I do not intend to do as complete a test program on my airplane as RAF did on N79RA. Thus, they are in no position to verify or recommend my modifications.

I am now deeply involved in the Voyager round-the-world program and will not be able to get involved in any way assisting builders.

I don't recommend any of the changes I've made and wish I had not. The best advice I can give is to keep it stock, build it light, and resist the temptation to change, especially anything structurally.

****From CP28-5&6 (CH30,CH37)****

How much Power?

One of the basic functions of the aircraft designer is the sizing of the aircraft such that the selected powerplant is correct. An engine too-small for the aircraft results in inadequate climb in high-altitude summer conditions or an unacceptably long takeoff roll. Too large an engine is wasteful of fuel because either the high cruise speed is at an inefficient flight condition for the airframe (low cruise lift-to-drag ratio), or the engine itself is inefficient when throttled back to obtain the speed for a good lift-to-drag ratio.

If a designer attempts to select an engine for optimum cruise efficiency, i.e. at a flight condition for maximum miles-per-gallon he finds the engine inadequate for climb. This situation is not unlike that of the automobile designer who finds his vehicle is cruised at a speed far in excess of that for the best mpg. However, the designer knows that the airplane should not operate at best L/D (or best mpg) anyway, since this is not practical unless you are setting a distance record. Increases in speed above but near the best mpg speed result in only small losses of mpg. But, as the speed increases considerably above the best mpg condition, the mpg drops drastically. The big question, then, is how fast should you really fly? If this question can be answered, then the designer can size the engine for this practical speed.

Aerodyanmicist, Dr. B. H. Carson of the U.S. Naval Academy has published an excellent analysis of the fuel efficiency of light planes (AIAA publication 80-1847) and has presented theoretical rationale for practical cruise efficiency. His interesting technical treatise is beyond the scope of this article, but the summary of findings is of interest to pilots. Rather than focusing on the cost per distance (mpg), he finds the speed that gives the minimum cost per speed. This "cruise optimum" speed corresponds to minimum outlay in extra fuel (over best mpg) per increment in additional speed. This speed corresponds to the closest approach of the airplane to a "technology barrier" of efficiency proposed by Gabrielli and Von Karman in an article "What price speed?" published in Mechanical Engineering Vol. 72 October 1950.

This "cruise optimum" speed, at 32 percent over the speed for best mpg, results in a 16 percent increase of total fuel used, requiring a 52 percent increase of power and saving 24 percent of flight time. This speed is regarded as the most productive use of excess fuel for cruising. The pilot should consider it his best "economy" cruise speed.

Accepting this theory, lets see what the resultant engine size is for the Long-EZ. At 8000 ft. altitude and 1325lb. weight the "cruise optimum" speed is 139 kt. (160 mph) and required 47 thrust horsepower (55 brake horsepower). This is a power setting of less than 48 percent power when using the 118 hp O-235 Lycoming. This suggests that, for 65 percent power cruise (to allow operation at lean side of peak EGT), the ideal engine for a Long-EZ should have 86 BHP. However, here is where the theory breaks down. The "Long" is a fast aircraft for a fixed-pitch prop application. Thus, with the low prop efficiency at slow speeds, it requires a 100 BHP engine for satisfactory take off performance.

The larger engines, 160 BHP for example, are wasteful of fuel at any speed. This is because specific fuel consumption (SFC) increases as the engine's power is reduced below 75 percent. The accompanying graph obtained last month shows this trend. Data are for best economy setting, about 50 degrees F on lean side of peak EGT.

If a Long-EZ is cruised at "cruise optimum" speed, its O-235-L2C engine will burn 8 percent less fuel than would an O-320-B at the same speed. (48 percent power for the O-235 and 36 percent for the O-320). If both engines were run at 65 percent power the O-320 would burn 22 percent more fuel than the O-235 for a given trip.

The following table shows data from a computer printout using the performance parameters for the Long-EZ, and assuming sfc equal 0.5.

Long-EZ weight equal 1325 lb.
Sea Level, * denotes 8000 ft.

Data for sfc equal 0.50

True Speed Knots	Indic Speed Knots	Req'd THP HP	Induc THP HP	Prop eff Percent	Req'd BHP HP	Fuel Flow GPH	Naut Miles/ Gallon	L/D Ratio
90	90	21.8	7.7	65.7	33.2	2.76	32.58	16.8
100	100	26.2	7.0	70.7	37.1	3.09	32.34	15.5
110	110	32.0	6.3	74.9	42.7	3.55	30.96	14.0
120	120	39.1	5.8	78.5	49.8	4.15	28.94	12.5
130	130	47.7	5.4	81.3	58.6	4.88	26.62	11.1
140	140	57.8	5.0	83.4	69.4	5.78	24.23	9.9
150	150	69.6	4.6	84.6	82.3	6.86	21.87	8.8
160	160	83.2	4.4	85.0	97.9	8.16	19.61	7.8
170	170	98.7	4.1	84.6	116.7	9.72	17.49	7.0
180	180	116.2	3.9	83.4	139.3	11.61	15.51	6.3
*90	79.8	20.9	9.9	65.7	31.8	2.65	33.97	17.5
*100	88.7	24	8.9	70.7	34	2.83	35.33	16.9
*110	97.5	28.2	8.1	74.9	37.6	3.14	35.08	15.9
*120	106.4	33.5	7.4	78.5	42.7	3.56	33.71	14.6
*130	115.3	40.1	6.8	81.3	49.3	4.11	31.67	13.2
*140	124.1	47.9	6.3	83.4	57.4	4.78	29.26	11.9
*150	133	57	5.9	84.6	67.4	5.61	26.72	10.7
*160	141.9	67.5	5.5	85	79.5	6.62	24.17	9.6
*170	150.7	79.6	5.2	84.6	94.1	7.84	21.69	8.7
*180	159.6	93.2	4.9	83.4	111.8	9.31	19.33	7.9
*190	168.4	108.5	4.7	81.4	133.3	11.11	17.11	7.1

GRAPH "FUEL SPECIFIC AT BEST-ECONOMY MIXTURE" OMITTED

From CP28-10 (CH37)

Q. How noisy is it in a Long-EZ?

A. We ran a comparison with a Cessna 150 and a Long-EZ.

	Long-EZ	C-150
Taxi	82 dba	78 dba
Takeoff and climb	96 dba	92 dba
High Cruise	98 dba	91 dba
Low Cruise	94 dba	88 dba

From CP28-12 (CH37)(Photo Caption)

N79RA and N26MS. Two 'Longs' out on a rare day that clouds visit our Desert.

From CP29-1&2 (CH37)

WORLD DISTANCE RECORD - Dick Rutan

Another World Class distance record now belongs to the Long-EZ. 4563.35 miles straight line distance in C1B (1000kg) is the new record subject to ratification by the FAI. That is the great circle distance between Anchorage, Alaska and Grand Turk Island in the British West Indies near Puerto Rico. The flight time was 30.08. The total fuel burn was 142 gallons, that works out to 151.4 average ground speed and 4.71 gph. We used only 1.8 qts. of oil.

We found the logistics of getting the aircraft (N169SH) to Alaska and recovering it back home was quite an undertaking. We departed for Alaska on May 22 and got back to Mojave on June 13. Most of the time was spent waiting for favorable winds at Anchorage. For a while it looked like we should have started in Puerto Rico and flown to Alaska. But after waiting 14 days the Weather God pushed a high pressure ridge out of the Gulf of Alaska that gave us some tail wind over Southern Canada and the Northern mid U.S.A. But the rest of the route was a no-help cross wind to a light head wind in Alaska and over the Atlantic. The over all wind factor was only +6 knots.

I flew at between 12 - 13 thousand feet and averaged 153 mph true airspeed. The reason that does not compute is because the actual airway distance was 4690 sm and the route time was 29.5 hours. When I got to Grand Turk I was feeling good and had plenty of fuel so just flew around long enough to log over 30 hours! I landed with 6 gallons fuel, enough for another 200 miles but the next over-water leg was 363 miles so Grand Turk was where it had to be.

Luckily for me I had none of the fatigue problems I had on the 33.6 hour closed-course record flight. I was in better physical shape and was well rested before take-off. Also one big factor was all the adrenaline pumped into my system during the night-long weather system I flew through on only a turn and bank gyro after my vacuum pump failed. It did get a little uncomfortable during the last part of the flight because I had on a lot of arctic clothing. It was quite a difference from my 4 a.m. Alaska take-off to the mid-afternoon Caribbean tropical hot-humid weather! Latitude change for the flight was 40 degrees, longitude changed 79 degrees.

We are a little disappointed that we did not make 5000 miles. We were short because we just could not find any more room for fuel inside the aircraft, the lack of good tail winds and the time spent at low altitude punching through the weather. Also, the bigger 0-320 engine used more fuel than Burt's 0-235 Long-EZ. The weight limit in the class was 2204 lbs and my gross weight at take-off was only 2033 lbs. I could have handled the 2200 lbs. easily. The take off roll was only 2800 ft. and at a stabilized climb speed of 140 mph indicated I had an initial climb of 600 fpm.

When I did the closed-course record in the prototype Long, I had used a cable between the main gear axles to prevent excessive gear spread because the prototype had an early, more flexible gear. My Long has the standard main gear like all the homebuilt Longs, and it did not need any additional support. The wheel camber was only slightly outward at my take off weight of 2033 lbs.

All in all we are happy with what we got. Next is the world altitude record and some of the long-distance speed records. Most are within EZ reach of the Long. I would like to see more homebuilders involved in breaking some of the records. It is not that complicated and the challenge is a lot of fun.

From CP29-6 (CH33,CH37)
ADDED CRUISE EFFICIENCY CHART
The Long-EZ Owners Manual cruise fuel flow chart plots fuel flow vs. indicated speed (in knots) with lines of altitude. The chart below may be more handy in flight planning and can be added to your Owners Manual. **CHARTS OMITTED**

From CP30-1 (CH37)
RAF Aircraft on the tube
Some very spectacular footage of Long-EZs, VariViggen and Defiant has been shot this summer and fall for several scheduled TV programs to be aired this fall probably during November.

1. OMNI Science Series - network depends on area, generally at 7:30 P.M. Saturdays - 10 minute segment of spectacular formations, aerobatics and remote mounted cameras.

2. Whats up America - scheduled on Cable TV - segment on Homebuilts - much of it Long-EZs at RAF.

3. Guinness Book of Records - segment of Dick and Jeana's Long-EZ shot flying up the face of Angel Falls in Venezuela, South America.

From CP30-1 (CH37)
Long-EZs are flown extensively
While the average homebuilt airplane is flown less than five hours per month, the high-utility Long-EZs are proving to be quite an exception. Based on reports from the Long-EZs now flying they are logging an average of 30 hours a month. The first five Long-EZs to fly logged a total of over 900 hours flying in their first six months of operation!

From CP30-2 (CH19,CH37)
NASA Tests Long-EZ
Researcher Bruce Holmes and Research test pilot Phil Brown of NASA's Langley Center recently visited RAF to study the Long-EZ. Of particular interest was the measurement of the extent of natural laminar flow on the flying surfaces. Also, the stall characteristics and departure susceptibility. They had previously measured extensive laminar flow on their full scale VariEze in the Langley 30 x 60 wind tunnel. This was verified by flight tests at Langley of Bob Woodalls VariEze. They found essentially textbook predicted boundary layer transition locations are being achieved with the airfoils on the EZ despite the presence of wing sweep and canard impingement. This is due to the stable contour that is achieved with our full core composite construction.

The Long-EZ main wing airfoil was designed by Richard Eppler. It has a steep initial pressure gradient intended to provide a reasonable probability of laminar flow despite minor leading edge contamination. The Eppler computer code predicts 32% chord laminar flow on the upper surface for a perfectly smooth surface. As the photos elsewhere in this newsletter show, the sublimating chemical tests on Long-EZs N26MS and N79RA verify that the wings are achieving the full 32% chord laminar flow. Small insect remains on the leading edge forward of about 4% chord will not trip the boundary layer. Bugs aft of 5% chord will destroy laminar flow, as will the small bump of a paint stripe. We now have documentation of the boundary layer characteristics on all surfaces and intersections of the Long-EZ.

Also of interest to NASA was the departure immune stall characteristic we have noted during our tests. NASA wanted to test the spin susceptibility to supplement the extensive data they have gathered on all types of general aviation aircraft. Phil put the Long-EZ through all types of extreme stall entry conditions: accelerated entries, vertical entries, etc. with all combinations of control inputs. He also alternated left and right rudder inputs at the dutch roll natural frequency, combining opposite aileron to add adverse yaw effects, at the maximum attainable angle of attack. Despite all combinations of gross misuse of flight controls, and attaining over 45 degrees sideslip, he was unable to obtain a departure from controlled flight. Phil left with the comment that he could find no way of inducing loss of control in the Long-EZ.

This is a stark contrast to the general aviation aircraft configurations he has testing at Langley, all of them being relatively susceptible to loss of control or spin entry from any aggravated stall entry. Many of them have unrecoverable spin modes that require wingtip rockets or anti-spin parachutes to effect recovery.

From CP30-3 (CH9,CH37)
Mike and Sally's Long-EZ N26MS
Sally flew our Long to Oshkosh and back, put 37 hours on it and used only 1 quart of oil. We have 260 hours total time now, with virtually zero maintenance. We could not be more pleased with the airplane. It does everything as advertised and more.

Most of our flying is to and from work, which includes a lot of take-offs and landings. When commuting we only fly 0.3 hours between landings. I estimate we have well over 500 landings at this time, and the tires look as though they are good for that many again. I am very pleased with the 500 x 5 tires, we get excellent tire wear and a super comfortable taxi ride. With a decent wheel pant the performance is still excellent.

Sally and I recently made a cross country trip to Fort Collins-Loveland for the Rocky Mountain Regional Fly In. This trip was 720 nm (828 sm). We flew from Tehachapi to Loveland direct, non stop. This took us over Las Vegas, Grand Junction and Long Peak (14,300 ft.). Time was 4.9 hours, we burned 27 gallons of 100 oct. We indicated 120 knots at 13,500 ft. (temp. 1 degree C) for a true airspeed of 150.3 knots (173 mph). Our ground speed, block to block was 147 knots (169 mph).

Our figures for the return trip were virtually identical, I flew out there and Sally flew back. Weather was perfect with virtually no wind. The route took us over some spectacular country, with the highlight being perhaps flying over the top of Long Peak, which is on the Continental Divide west of Loveland. The Long-EZ performed flawlessly, and handled this kind of flying with absolutely no problems. It was comfortable, both in the front seat and the back seat. Our relief tubes worked well, and I am very "relieved" we put them in! Noise level, with headsets, was very acceptable and I must say it was nice to listen to taped music to pass the time. Here is a break down of the trip.

Climb segment:	4,000 ft. (Tehachapi) to 13,500 ft.
Fuel Used:	2.4 Gallons
Time:	0.3 Hours
Distance:	40 nm (46 sm)

Cruise segment:	
Distance	= 720 -40 = 680 nm (782 sm)
Time	= 4.9 -0.3 = 4.6 hours
Ground Speed	= 680 = 148 knots (170 mph)
	4.6
Fuel used 24.6 gal	Fuel flow 5.35 gph
Economy 27.64 nm/gal	(31.8 sm/gal)

The Long-EZ Owners Manual shows 4.8 gal/hr at 120 kt indicated at 14,000 ft. (148 kt. true) at a gross weight of 1100 lbs. Correcting this to 1350 lbs. results in 5.4 gal/hr and 27.4 nm/gal.

Thus, on this trip our Long-EZ did slightly better that the Owners Manual, and certainly more than satisfied Sally and I. We won best composite at the airshow, and really had a great time.

From CP30-15 (CH37)(Photo Caption)
Three Long-EZs in the flyby pattern at Oshkosh.

From CP30-18 (CH19,CH37)(Photo Caption)
Sublimating chemicals applied to the Long-EZ wing and vertical fins show the extent of laminar flow. Note that turbulent flow is induced when the paint trim strip is located aft of 5 percent chord on vertical fin.

From CP31-2 (CH37)
LONG-EZ ACCEPTED
For amateur construction in Canada. Thanks to much hard work by the EAA Canada, in particular Edward Slack, the Long-EZ is now accepted by the Canadian DOT for amateur construction. Maximum take off weight allowed is 1325 lbs.

From CP31-10 (CH37)(Photo Caption)
OK, which way to a runway! Roger Johnson's Long nearly complete.

From CP32-2 (CH22,CH37)
MIKE & SALLY'S LONG-EZ
N26MS has been spending more time in the hanger than usual due to bad weather, while the weather in Mojave is almost always acceptable it certainly is not in Tehachapi, so during the two to three months of winter type weather, we have been driving, and what a pain that is! On top of that it actually takes more fuel to drive our Honda Accord to work and back, than it does to fly the Long!

Even so we have managed to put some time on her, she is just over one year old and has 320 hours total time. I did an annual inspection last month and found very little, I adjusted the rudder travel, relined the brake shoes, changed the oil, topped off the batteries, checked brake fluid level and that was about it. Engine health is excellent with compression like new on all four cylinders.

The airplane has proved to be exactly what I had hoped, a low maintenance, high utility, high speed, economical cross country airplane. I have been testing a small electric cabin heater for the past month or so. This heater is STC'd for any aircraft, and came to me from Steve Franseen, 1245 S. Tennyson, Denver, CO 80219. Steve is a Long-EZ builder and is the distributor for the heater. Contact Steve if you are interested.

The heater I have is a 12v 16 amp heater, with an advertised capability of heating a 50 cubic foot area. On the ground, static it is much more that you need. In the air at a normal cruise speed around 160 knots true, in my Long-EZ, it is marginal with an outside temperature of -14 C. This is primarily due to the many air leaks that I have, around the elevator tubes, the nose access hatch, etc. I am sure that with close attention to sealing the nose of your Long-EZ from all leaks, this little heater will do an adequate job. I am going to be testing a 24v 16 amp heater, which has an advertised capacity of 80 cubic feet, in the next few weeks and will report on the performance in the next CP. The heater is well made, has a built in fan and safety cut out. It is also internally fused. It completely eliminates the problem of carbon monoxide contamination, and is easy to hook up. I installed mine in less than an hour.

I have also recently installed a Compucruise and flo-scan fuel flow transducer. I elected to use a flow-scan series 100-A, which has a range from 1.5 gph to 15 gph. It is a real kick to fly with this gadget on board, as you can really keep track of your fuel management. Once calibrated, it is accurate, and measures fuel burn in 1/100ths of a gallon. The only apparent drawback I have found is that the Compucruise, even with the display turned off, will drain a 12 volt 25 amp hour battery in less than two weeks. This is no problem as long as you use the airplane at least once a week. But I would recommend a master switch to shut the Compucruise down completely if you don't intend flying for extended periods. This of course drops out the memory and your fuel flow calibration, but it is not difficult to reenter.

We have entered our Long-EZ in the Cafe 400 race, and are looking forward to it. We expect to be quite competitive, with the race being extended to about 400 miles from 240, and a requirement to climb from sea level to 10,400 feet and back. What with the Long-EZ's high aspect ratio and low induced drag, we should make a good showing.

Sally recently had a "#99's" meeting at the Bullhead City Airport, on the banks of the Colorado. This is a nice little cross country of about 190 nautical miles each way. We gassed up both the Long-EZ and the VariViggen. Son Keith went in the back of the Long with Sally and I flew solo in the Viggen. A beautiful day, with a 26 knot tail wind took us there at 7,500 feet indicating 120 knots with an average ground speed of 162 knots (187 mph). The return trip against a 26 knot head wind found us flying low, from 100 feet to 500 feet AGL. Crossing the desert at low altitude at 140 knots indicated is really fun, but in the Viggen it really burns up a lot of fuel. Which meant we had to land at Barstow-Dagget for gas. A quick low altitude dash from Barstow to Mojave and I tallied up the fuel burned in each airplane for comparison. While the Viggen with its 180 hp Lycoming, used 24.7 gallons, the Long with its 118 Lycoming, used exactly 12 gallons and carried two people. This is a good comparison showing the difference between a low aspect ratio (requiring lots of horsepower) VariViggen and a high aspect ratio, low induced drag (requiring very little horsepower) Long-EZ, both flying at the same speed and altitude, the Viggen averaged 8.8 gph, while the Long averaged 4.4 gph.

From CP32-8 (CH37)
<u>SOARING IN A LONG-EZ?</u>
A month ago, on a Sunday, Mike was up over the Mojave Airport in N26MS. He was doing a fuel flow evaluation. It was a very windy day (50 knots at the airport) but clear. During the course of the test the right tank was deliberately run out of fuel, to the point that the engine quit completely prop stopped, at which point he found himself climbing at 800 fpm! He started his elapsed timer and 42 minutes later, having gained 3,100 feet of altitude he gave up and returned to the airport. The strong lift over Mojave airport was apparently a wave condition, and had he been dressed better (warmer) he could have stayed up for much longer. He had to come down due to being very cold, not because he ran out of lift. Someday, dressed more suitably, he intends to try again.

Mike and Sally's son Keith, was involved in an accident about a year ago, which left him without the use of his legs. Keith had always wanted to fly the Long-EZ, and toward that end, Mike recently installed a temporary rudder/brake system in the rear cockpit. Keith has now flown a total of 5 hours in the front seat and is doing very well. He is hoping to go all the way through his private pilot's license in the Long-EZ. As far as we know Keith is the first paraplegic to fly a Long. Mike and Keith are working on a rudder brake system that will be hand controlled from the front seat. The Long-EZ has worked out amazingly well in this application. Keith's only prior experience was about 2 hours in a glider. He has not made a bad landing so far.

From CP33-12 (CH37)(Photo Caption)
RAF has recently had noted artist Jim Newman draw a complete illustrated cutaway of the Long-EZ. The result is not only a fine frameable work of art, but is also a technically accurate reference. Lithographs of this drawing in 20" x 30" size may be available at Oshkosh. Price is $10.00 which includes postage.
DRAWING OMITTED

From CP34-11 (CH37)(Photo Caption)
J. Civetta's Long-EZ, the first to be completed in Europe, on the ramp with three French VariEzes at La Grande Motte, France.

From CP34-11 (CH37)(Photo Caption)
"Charlie's Outdoor Factory". The advantages of Miami's climate are obvious in this shot of Charlie's Long-EZ in the final stages.

From CP35-12 (CH37)
Bull Durland and Gordon Boyer, all major structure completed.

From CP36-1 (CH37)
<u>LONG-EZ COMPLETES TESTS AT EDWARDS AIR FORCE BASE, CA</u>
We are pleased to announce that the United States Army has built 2 Long-EZs at Fort Lewis, Washington. One of these Longs has recently completed a comprehensive static load, ground vibration test and flight test program at Edwards Air Force Base. The Army is studying the Long-EZ with its all composite construction to see of the design can be applied to future Army aircraft. Test pilots, Major Don Underwood and Major Robert Ward both agreed that the handling characteristics of the Long-EZ were very good.

Both Long-EZs will be involved in an evaluation program starting in May of 1983 and lasting approximately 6 months. This is to determine the feasibility of using the latest civilian technology in a military environment.

(Does this mean that we can park our "replicas" with the War Birds at Oshkosh ????).

From CP36-4 (CH33,CH37,CH39)
<u>Unintentional Spin in Homebuilt - Long-EZ N711OA</u>
As you know, our Long-EZs have undergone extensive high angle-of-attack testing at all cgs and configurations nd the results have shown them to be immune to stall, departure or spins. Vigorous and sustained combinations of all flight controls were input, by us and by a NASA pilot with the same results. The Owners Manual does caution, though that experience has indicated not all examples fly the same and that the builder should be aware of differences. We have recently heard from a Long-EZ owner who has experienced a spin and his report is published below. It is possible that he was operating aft of the aft limit cg. His impression of the effects of power for recovery are probably due to the oscillatory effects of the incipient spin since it lasted only two and a half turns. Conclusive data on power effects can only be made after a stable (developed) spin rate is achieved (over 2 or 3 turns) and by study of flight test instrumentation-obtained data. See also our LPC #115 on page 6.

Pilot Info: Age 63, 30,000 plus hours, flew Aeroncas, Cubs, Monocoupes, Cessnas, Stinsons, Wacos, Fairchilds, Douglas DC 3-4-6-7-8, Boeing 747 etc. Currently own half interest in a Pitts S-1, Long-EZ and a 1927 Monocoupe".

"Conditions - Gross weight 1070, Fuel 84 lbs left tank and 42 lbs. right tank, CG - maximum aft, altitude 3000 ft, SL - 2200 ft above ground, WX - CAVU.

While approaching a stalled condition with the nose about 15 degrees up, air speed 62-65 mph, the left wing went down about 60 degrees followed by the nose dropping and the airplane entering a left spin. The nose was at least 60 degrees down. After the spin had started, n attempt to recover was made by using forward stick and opposite rudder. There was no response. Opposite aileron was also used which may have aggravated the situation. The aircraft had a rather rapid rate of rotation - faster than a Citabria type but less than a Pitts S-1. Also there was pressure to the right - being pushed against the right side of the cockpit. With no response from basic control inputs the throttle was "jabbed" which resulted in a momentary slower rotation rate. When the engine idled back, the rotation returned to its original quite rapid rate. The throttle was then opened (1/8 - 1/4) and left there. The spin rate decreased and a recovery was effected. The pull out from the dive did not result in high air speed. The actual speed was not observed: however, the G load was not excessive - less than the bottom side of a loop with the airplane.

The number of rotations was about 2 and a half and 800 to 1000 feet of altitude lost. After climbing a few thousand feet a half hearted attempt was made to duplicate the situation, but it was unsuccessful.

With the many times that the almost identical flight conditions have been explored that is the only time this condition ever surfaced or gave any indication that it might surface. The irplane has about 180 hours on it and flys and performs beautifully.

Approaches to stalls have been very normal and docile. Usually a wing will drop (30 degrees at the most) followed by the nose dropping, and then wings can be leveled with either rudder or aileron. During this incident no attempt was made to level the airplane until the resulting spin was entered.

That the gyration was a tight spiral does not seem logical for a couple of reasons. From past experience with spins and spirals, had the airplane been spiraling considerable speed would have built up and basic control would have been regained. Also the pull out would have had much more speed.

As to the effect that the engine had on recovery, one wonders whether it was the thrust that aided recovery or the resulting torque, or both.

The only change to the aircraft since the original flight test is the addition of wheel fairings. It would not appear that they would cause appreciable change in flight characteristics particularly at such low air speeds.

Sincerely, Paul Wallace.

Paul reports that he installed 10 lbs of lead in the nose and his Long-EZ now flies at full aft stick per the book.

<u>NOTE</u>: When doing the original envelope expansion on your new Long-EZ, wear a parachute and have at least 7000 feet of altitude. If you find yourself routinely operating at aft CG, ballast to around mid CG. Any aircraft flies better at mid CG, a little lead up in the nose does not hurt a thing.

From CP36-4 (CH18,CH21,CH22,CH30,CH37)

N26MS - Mike and Sally's Long

With 521 hours on the Hobbs, 26MS is running like a dream and continues to prove what a reliable high speed transportation machine a Long-EZ is. I recently got tired of my combination 12V/24V system which never did work correctly. I cut the front cover over the instrument panel off and rewired the airplane to be a 100 percent 24 volt electrical system. It was intimidating thinking about how I was going to do this, but once started it was actually quite simple to do. I have also installed Wes Gardner's fuel sight gauges (see CP 35 page 10) and must say I am pleased with the result. Also installed Wes's oil separator breather and it has worked great! No more cleaning cowling after landing.

A few weeks ago a photographer from "Technology Illustrated" took a bunch of slides of my Long-EZ for the cover of the May edition. He wanted to light up the inside of the cockpit. He handed me a remote controlled flash unit with quite a heavy power pack. Like a dummy, I laid it on my lap, not tied down. In the middle of the photo session, I hit a strong bump, the flash unit sailed off my lap and crashed into the canopy cracking it badly just in front of my head. It cracked almost clear across with a hole a couple of inches square. It scared me but once I slowed down and pulled the cracked pieces back into place, I found it to be no immediate problem and was able to complete the mission.

Sally temporarily repaired it by laying up a huge fiberglass patch both inside and out. At least we could fly until the new canopy came in. Actually went to the IVHC Agua Caliente flyin this way! I talked to Dan Patch and Phil Cornelius, both of whom had been through repairing a broken canopy.

First we cut the plexiglass canopy about 1 inch above the rail all the way around (son Keith did the work, I supervised!). This removed the broken canopy. We turned the frame over and cut through the fiberglass just inside the edge of the plexiglass lip. This allowed us to peel out the fiberglass piece that fitted the original plexiglass bubble exactly. This thin glass "frame" was carefully layed into the new "bubble" and was used to layout where it should be trimmed in order to fit. While I cut the new bubble, Keith broke out the remaining plexiglass with a vice grip, a hammer and wood chisel and a dremel grinder. The plexiglass does not come out easily. After the frame was cleaned up, the new bubble fitted almost perfectly. We floxed it into the frame and let it cure over night. Next morning, I trimmed and sanded. I microed in all the voids and the layed up two plies of BID over the plexiglass up onto the inside of the frame. I let this gel up for a few hours, then reinstalled the whole canopy/frame onto the airplane. I locked it down and let it cure for two days. This assured that it would fit the fuselage. Later I removed it, cleaned it up and sprayed the charcoal Zolatone inside the canopy frame. I did not have to repair the outside frame. The new canopy gives me a little more head room (not all canopies are alike!) and the visibility without the fiberglass patch is superb!!

From CP36-9 (CH37)(Photo Caption)

80 years young, Charlie Auton built and flies this Long-EZ. Alright Charlie!!!

From CP38-11 (CH37)(Photo Caption)

Stig Sall, proud owner/builder of the first Long-EZ to fly in Sweden.

From CP38-11 (CH30,CH37)(Photo Caption)

Don Foreman's beautiful Long-EZ ready to go to the airport. This is the first Long to fly in England and it has a Rolls Royce O-240, 130 hp engine!

From CP38-11 (CH37)(Photo Caption)

Now this is going too far! Steve Palun, Amherst, OH. Wonder what he is building?

From CP39-2 (CH37)

1/5 SCALE LONG-EZ R/C MODEL

In December, 1983 RAF granted St. Croix of Park Falls, Ltd. the exclusive rights to develop and market a radio controlled scale model of the Long-EZ. On December 13, Jim Schmidt, Manager of St. Croix's Model Aircraft Division, flew prototype demonstration flights at the Mojave airport for Mike Melvill who agreed that the model looks and performs much like the real thing.

The kit, which will build up to a 1/5 scale replica of Mike and Sally's Long-EZ will be available in the spring and should retail for under $100.00

To receive information about this product as it becomes available, you may contact Jim at the following address:

Jim Schmidt,
St. Croix of Park Falls Ltd.
P.O. Box 279E,
Park Falls, WI 54552

The 1/5 stand off scale model Long-EZ was painted to look exactly like N79RA and when it was in the air, it looked for all the world like the real thing. It flew very well, Jim really knows how to fly R/C models. Mike had not flown an R/C model in two years but Jim allowed him a few minutes of "stick time" and Mike said it was a 'blast'!! It flew just like the real one, right down to the full aft stick, no stall condition, it even rolls much like a real Long. To watch it come in and land was quite a treat. Mike was able to take Jim for a ride in his Long-EZ and although Jim had never flown a light plane before, he was quite at home in it and commented that it was just a big model!!

As soon as St. Croix has the kit available, RAF plans to keep some in stock.

From CP39-8 (CH37)(Photo Caption)
Jim Schimidt of St. Croix of Park Falls, WI with the proof of concept prototype 1/5 scale Long-EZ model. This stand off scale model will soon be available as a kit. It not only looks like a "Long", it flies like a "Long".

From CP39-9 (CH37)(Photo Caption)
Gene Scott and Jerry Hansen's immaculate Long-EZ. This one is a real beauty.

From CP39-9 (CH37)(Photo Caption)
Bill Rice has over 300 hours on his VariEze N103B and now he has flown his Long-EZ N9JB, which he built with friend Jim Hopelain.

From CP40-1 (CH32,CH37)
RAF ACTIVITY
RAF has been involved in some work for the Army on an Army Long-EZ. We installed a Texas Instrument T.I.9100 Loran C, a King HSI and some special-mission sensors in a large external pod. We also converted their standard rudders to the new high performance rudders. This large rudder installation was very thoroughly tested not only by RAF, but by two Army test pilots. All agreed that they were an enormous improvement and no sign of any tendency to depart was observed by any of the three test pilots. We also made other changes and installations that are proprietary. It was a most interesting project to work on. Maybe if it shows up at Oshkosh it can park among the warbirds and get free gas!

From CP40-11 (CH37)(Photo Caption)
The first Long-EZ to fly in Germany belongs to Roland Heier. What beautiful countryside to fly over.

From CP41-7 (CH37)
We recently received a letter from a Long-EZ builder, Patrick Colin. Patrick built his Long-EZ, believe it or not on the former US atomic testing ground, ENEWETAK ATOLL in the south western Pacific, Marshall Islands. Construction time was 14 months, and Patrick had to have everything shipped in from 4,500 miles away. He says he received excellent service from the approved materials distributors and never made one call or wrote one letter for builder support!!

Soon after completing and test flying N83PC, Patrick was informed that funds for his project on Enewetak had been cut and he had to vacate the atoll. He decided to fly the Long-EZ out and headed for the island of Kwajalein, over 360 nautical miles away over open water. From there he flew via Ponape in the Caroline Islands to Rabual on New Brittain, then finally to Port Monesy in Papua, New Guinea where he landed a new job and is now based. This is about 2,500 miles across the water. Quite a trip to break in a new Long-EZ.

Patrick tells us his Long-EZ caused quite a sensation when he arrived from where no airplanes arrive from, the open Pacific. It took four months and the paper work is almost equal in weight to the airplane, but he got his Long-EZ, the first composite aircraft in Papua, New Guinea licensed and has a PNG airworthiness certificate. As soon as Patrick gets his HG radio installed (required) he and his wife Lori, intend to travel extensively in PNG and over into Australia.

They would enjoy hearing from other builders, particularly those in Australia or anywhere in the Western Pacific. Contact Patrick and Lori at:

Motupore Island Research Station
P.O. Box 320
University of PNG
Papau, New Guinea

From CP41-8 (CH37)(Photo Caption)
Patrick Colin's beautiful Long-EZ built on the former US atomic proving ground, Enewetak Atoll in the Marshall Islands, South Pacific.

From CP41-8 (CH37)(Photo Caption)
Ferde Grofe being checked out in his brand new Long-EZ by Neil Hunter. It looks great Ferde!

From CP41-8 (CH37)(Photo Caption)
Ray Poynor in his clean, stock Long-EZ. Ray is from Sun City, Arizona.

From CP42-10 (CH37)(Photo Caption)
Jacques Causse' beautiful new Long-EZ. Jacques is from Toulouse, France.

From CP42-10 (CH37)(Photo Caption)
Anthony Gittes has his Long-EZ flying in Equador! He had to move it in a C-130 Hercules due to extremely high density altitude. Most of us have adventures getting to the airport, but this takes the cake!!

From CP42-10 (CH37)(Photo Caption)
Bernard Verdon's newly completed Long-EZ was the second Long-EZ to fly in Canada.

From CP43-2 (CH37,CH41)

1/5 SCALED LONG-EZ MODEL UPDATE

Four different model airplane magazines are doing "in-depth' reviews of the 1/5th Scale Long-EZ. Look for them on the newsstands. We read an article in March 1985, "Flying Models" by Nick Nicholson, who built and flies one, and for anyone interested in the model, this is an outstanding article. The kit is really top class and easy to build. RAF has kits in stock for pick up or you can write to St. Croix Models, P.O.Box 279, Park Falls, WI 54552. (715)762-3226. Talk to Jim Schmidt.

From CP43-3 (CH30,CH37)

Learn to Fly in a Long-EZ?

Dick Prentice built his Long-EZ as a non-pilot with the intention of using it to obtain his pilots license. Dick built his Long in the San Diego area, a hot bed of EZ activity. When it was complete, he trucked it to Brown Field, where VariEze builder/pilot, Al Coha did the first flight in May 1984.

Dick installed a throttle, mixture and push-to-talk transmitter switch in the back cockpit. He found an excellent instructor who was very interested in the Long-EZ who gave him dual, soloed him and signed him off for his cross countrys and night flying. Ultimately Dick was signed off for his private check ride, when a possible stumbling block was thrown at him. The FAA could not decide if Dick should be issued a restricted license, since he had not done any stalls! After some hassling around, Dick decided to end the problem by renting a Cessna 152 for 1 1/2 hours. During this time his instructor put him through all the required stalls and finished up his night flying requirements. He took his private check ride in his Long-EZ and received a normal private pilot certificate.

This is the first case we know of, of a builder obtaining his pilots license in his own Long-EZ. Congratulations Dick! Dick would like to give credit to his wife, Joy, who was the driving force behind getting the Long-EZ built and who is now taking flying lessons in their Long. He also wants to thank the EZ Squadron in San Diego for all their help and encouragement.

From CP43-7 (CH37)(Photo Caption)

Dick and Joy Prentice with the Long-EZ they built and learned to fly in, N93DJ.

From CP43-7 (CH22,CH37)(Photo Caption)

Buzz Talbot and Mr. Gooch, partners on their Long-EZ, N112TG. Note the 720 channel "Becker" comm radio on the right. It fits into a 2 1/4" hole!

From CP43-7 (CH37)(Photo Caption)

Captain Peter Magnusun flying his Long-EZ. When he is not flying the Long, he flies an Electric Jet, (F-16).

From CP44-10 (CH37)(Photo Caption)

Dr. Julio Moron, of Caracas, Venezuela has completed and flown the first homebuilt of any kind ever in Venezuela. Note how carefully the precious parts are wrapped and loaded on the flat bed truck for the two hour trek to the airport. YV-08X is an absolutely stock Long-EZ and flies straight, true and fast. Congratulations, Dr. Moron!

From CP44-11 (CH37)(Photo Caption)

Ron Southern of Glen Ellen, California, recently completed this example of St. Croix's 1/5 scale model of a Long-EZ. Beautiful!

From CP44-11 (CH37)(Photo Caption)

Jim Glendermann of Frankston, Australia has got his Long-EZ close to completion in spite of an allergic reaction to the epoxy!

From CP44-11 (CH37)(Photo Caption)

Marty Martindale of Anchorage, Alaska recently completed his Long-EZ. Marty was one of the group of EZ folks who helped Mike and Sally when they had engine problems in Alaska. Thanks Marty.

From CP45-9 (CH37)(Photo Caption)

Chris de Brichambant of Ramonville, France (holding under left canard) with his team of young people (average age 23 years) who built this beautiful Long-EZ. This airplane will fly from France, over Spain and West Africa, across the Atlantic to South America and then to Miami, Florida with a possible stop at Oshkosh during the convention. Good Luck Chris.

From CP45-9 (CH37)(Photo Caption)

Beau Wold's outstanding Long-EZ in formation with his St. Croix model Long-EZ - neat!

From CP45-9 (CH37)(Photo Caption)

Roland Othin-Girard, Sevres, France, with four helpers, getting an idea of what their Long-EZ will look like.

From CP46-13 (CH37)

David Haygard of Wichita, Kansas recently completed this excellent example. He calls it the "Wichita Express".

From CP48-8 (CH37)(Photo Caption)

Aub Liebig taxies out for take off in his recently completed Long-EZ at Waikerie Aerodrome in Australia.

From CP48-8 (CH37)(Photo Caption)
Graham Singleton and friend Joan preparing for a flight in Graham's Long-EZ in England.

From CP48-8 (CH37)(Photo Caption)
Peter Van Rensberg of Pretoria, Republic of South Africa, built this Long-EZ shown in his yard just prior to going to the airport. Peter reports that she flies beautifully, "stable as a rock".

From CP48-8 (CH37)(Photo Caption)
Marcus Borom from Schenetady, New York shows off his Long-EZ in his front yard.

From CP50-9 (CH37)(Photo Caption)
"The finishing touch" goes on the side of Bill Hemmel's Long-EZ prior to first flight - what an appropriate name for a Long!

From CP50-9 (CH37)(Photo Caption)
Joe and Della La Coure, New Orleans, Louisiana with their new Long-EZ. This striking looking EZ was on the flight line at Oshkosh where is was much admired.

From CP50-10 (CH37)(Photo Caption)
Don Druckenbrodt, Garland, Texas - won't be too long now, Don! Looking good, hold tight, Son.

From CP51-11 (CH37)(Photo Caption)
Sid Busby of Marlow, Buckinghamshire, England has 14 hours on his Long-EZ.

From CP51-11 (CH37)(Photo Caption)
John Sabadian and Susan McQuillan with their newly completed Long-EZ at the Cairns International Airport in Australia

From CP51-12 (CH37)(Photo Caption)
FIRST LONG-EZ IN INDIA
The first ever canard type, first composite type and first Long-EZ ever to be built and flown in India was completed and successfully test flown on February 26, 1987 in Bangalore, India, by builder R. B. Damania. Congratulations, a really fine looking Long-EZ judging from the photos he sent us. When you consider some of the bureaucratic problems some of our builders have to contend with, we have nothing but the strongest admiration for their tenacity and skill. It really makes us realize just how fortunate we who live in these United States are!

From CP52-9 (CH37)(Photo Caption)
Peter Froidevaux's beautiful newly completed Long-EZ in Switzerland.

From CP53-2&3 (CH21,CH33,CH37)
STOLEN LONG-EZ
During the last week of June 1987, N83RT, a really beautiful Long-EZ IFR equipped with King avionics, was stolen from its tiedown on the ramp at Montgomery Field in San Diego, California.

The owner knew there was only 200 miles of fuel in the tanks, so he flew to every airport in a 200 mile radius and left a reward poster with two color photos of the plane and instrument panel giving all details such as equipment, serial numbers and identifying features. In addition, these posters were mailed to every tower-controlled airport and all flight service stations in California.

By great luck, and due entirely to the keen memory of a fellow San Diego VariEze driver, the above aircraft has been returned to its owner. The thief had previously tried to steal a different Long-EZ from a hangar on the field. He failed for some reason, but did take the owner's manual which was later recovered from his home. When he flew away in 83RT, the tower operator, who knew the owner/pilot, exchanged pleasantries with the thief but did not realize it was not the owner. He flew only 30 miles to Ramona where is was hangared for two weeks while it was dismantled. Then it was removed to the thief's home where he seriously damaged the airplane, cutting out the wiring, instrument panel and sanding all identifying colors and numbers off the airframe.

By pure good luck, a VariEze owner/flyer landed at Ramona right behind the thief. He did not recognize the stolen Long-EZ as a local airplane and maybe that is why when, several weeks later, he returned to the airport and saw the reward notice, he called the owner. The San Diego police followed up and got the name and address of the thief and literally caught him about to repaint the aircraft.

What can we all learn from this incident? First of all, notify the local police and work closely with them. Give them all possible information (do you have all serial numbers, engine, avionics, etc. recorded?). Second, fly to all landing strips within a reasonable radius and talk to as many pilots as possible. Near the Mexican border, you might notify the Drug Enforcement Agency (DEA), also the FBI since stealing an airplane is a federal offense.

Most importantly, we should all give serious thought to coming up with some method to prevent the plane from being flown. A plastic coated, heat treated chain wrapped around the prop and secured with a quality lock is good. Perhaps a fuel shut-off valve located, where only you know, in addition to the normal fuel valve. This could be shut off after you park it. Be very careful that this, or anything else you do to disable your aircraft, does not bite you in some way!! If you park it outside on an airport ramp for any length of time, notify the focal FBO, tower, mechanics, etc. that it will be there and ask them to keep an eye on it.

The owners of N83RT were extremely lucky. Imagine if you will, that this thief had managed to get the new panel installed and get the airplane repainted. He could have showed up at Montgomery Field with his "new" Long-EZ on a trailer, announced the rollout of his "new" Long-EZ, even had a little celebration to celebrate its "first flight" - may even been able to join the local San Diego EZ group, and probably no one would have been the wiser! Keep your EZ locked up if at all possible. The heartbreak of having it stolen must be experienced to be appreciated.

****From CP53-12 (CH37)(Photo Caption)****
Donald Douglas' Long-EZ ready for final contour and paint.

****From CP55-5 (CH12,CH19,CH20,CH31,CH33,CH37)****
HIGH ANGLE OF ATTACK DEPARTURE TESTING
Our own flight test experience plus NASA spin tunnel evaluations plus a NASA test pilot's actual attempts to spin a Long-EZ have lead us at RAF to believe that it was virtually impossible to get our airplanes (VariEze and Long-EZ) to depart from controlled flight and enter a classic spin. Recent flight testing conducted here at Mojave by three different test pilots on a research airframe similar in configuration to a Long-EZ, have resulted in the classic spin modes.

While opening the high angle of attack envelope, we discovered that this particular airplane would, indeed, depart and would enter steep upright spins from which it would readily recover, at least in spins of less than 2-1/2 turns. As we cautiously pushed into the unknown, we suddenly found that this plane could also go flat! That is to say, it would transition from a steep spin into a very high angle of attack flat spin, uncommanded.

Recovery was very difficult but a combination of full recovery controls plus power was successful, at least twice. However, in one case, the engine quit due to high centrifugal forces and, although full recovery controls were put in after two turns and held in for eight more turns, this had no perceptible effect. The pilot then initiated full throw pitch control inputs, attempting to get the nose down. Control input was in phase with a slight pitch oscillation he noticed during the previous 10 turns. The oscillating inputs were successful and after 7 more turns, the airplane was recovered and landed dead stick on the Mojave runway.

This experience was quite a shock to the pilot who did not think a canard configured airplane could enter a flat spin. The chances of recovering from such a spin are usually remote. The pilot experienced some disorientation, the spin rate was as high as one turn each two seconds, or 180 degrees of rotation per second.

What was learned from these experiences? First of all, it may be possible to depart and spin any canard configured airplane, even a plane such as a VariEze or a Long-EZ, particularly if these airplanes were not carefully and accurately built. Do not deviate from the plans. Use care to not accept any modification or variation from that configuration that has been thoroughly tested here at RAF, subtle modification of the wing and winglet may make your aircraft dangerous. Use your absolute best effort to set canard, wing and winglet incidence correctly. Level all waterlines as closely as you can read a level. In other words, build your EZ as accurately as you are capable. Conduct a careful, accurate weight and balance, including measuring the airplane. Do not assume you airplane will be the same as the prototype. Also, your test program must include stall/departure tests of your airplane, flown with a parachute and with plenty of altitude.

Fly your airplane sanely and well within your own piloting skills and ability, and remember that flying is not necessarily a dangerous activity, but it can be terribly unforgiving of any carelessness or foolish judgement.

****From CP55-3 (CH9,CH30,CH37)****
Excerpt from Ivan's letter to Mike Melvill

"Dear Mike,
Please find enclosed a photograph of my latest project, the Shaw "TwinEze", thought you may be interested.

G-Ivan started life as a VariEze that I built in 1980-81. After 350 happy hours flying, I decided to convert it to a Long-EZ then, inspired by Starship, got carried away with twin engines and retractable gear.

The engines are British fully certified units - three cylinder, inline, water cooled, two strokes giving 77 bhp at the prop. They were designed and built my Mike Hewland for the ARV Super Two aircraft. Both engines have completely separate systems, batteries, etc. and left fuel tank feeds left engine, right feeds right.

To date, I have completed approximately 10 hours flying with the only problems being getting the cooling air to go where I wanted it to go and some fuel vapour (sic) locking that has only been completely cured by running on 100LL instead of MOgas. The good news is that it flys superbly, just like the Long-EZ, the noise level and vibration is less. Control on a single engine could not be easier, 350 fpm climb and a VMCA wings level of 56 knots on the critical engine. I have not opened up the envelope speed-wise yet but one thing I am sure of and that is it's going to be fast. The main gear is a retractable unit of my own design that tucks the wheels aft through 115 degrees to where the engine used to be, it is powered by hand hydraulic.

The technical challenge has been everything and more that I expected. The bureaucratic hassle has been something you have to live through to believe. After static load testing the aircraft to 5 g's, gear drop tests to beyond FAR part 23 requirements, engine mount static load test, 25 hours of ground running, taxi, runway hops, my approved inspector clearing it as airworthy, after all this, it took a further six months to get permission to commence a test flight program. I was actually told that I could not do this because, "it has not been done before". What a sorry state of affairs for a country that once led the world in innovation.

My flight testing continues. I will keep you updated on my progress.

Thanks, Burt, for the inspiration,
Ivan Shaw"

From CP55-11 (CH9,CH30,CH37)(Photo Caption)
Ivan Shaw's Twin-Eze, a modified VariEze/Long-EZ retractable twin.

From CP59-1&2 (CH37)
NORM HOWELL DOES IT AGAIN!
A new world record - this time in a very light Long-EZ, N9TS, borrowed from his friend, Terry Schubert, of Cleveland, Ohio.

The C1-A (altitude record), (1102 lbs. max. take-off weight) now belongs to Norm. He took-off at 1101 lbs.!, climbed to 25,000 feet, establishing a new altitude record for this weight class. The entire flight lasted only 55 minutes. Norm has put together a really neat oxygen system using a full face military mask and says it worked great for this flight.

Congratulations, Norm. What will be next? Norm already owns several speed/distance records in his Quickie, the "Ugly Quickling".

From CP63-12&13 (CH37)
VFR-MOJAVE TO LONG ISLAND, NEW YORK IN A LONG-EZ
I have almost 1600 hours in our Long-EZ, N26MS, which is equipped for light IFR (or California IFR) including a full gyro panel, localizer, glide slope, Northstar loran, transponder and encoder, oxygen and a big engine. The airplane I was about to ferry across the USA was equipped with an 0-235-C2C, 108 horsepower engine, a one-and-a-half nav/comm (so called because you can comm or you can nav but you cannot do both), and a recently installed Micrologic ML6500 loran completed the avionics package. It was to be a real back-to-basics experience for me.

I went over the airplane very thoroughly prior to departing and felt good about its ability to make the trip. The weather in March across the nation is not always great, but I was hoping for good VFR.

I took off from Mojave just as the edge of the sun showed on the horizon. I had some baggage and full fuel tanks so with just me in the front seat, take off weight was at 1380 lbs. She used up only 1500 feet of runway to break ground and climbed well at 800 feet per minute. I climbed to 11,500 feet and set sail for Santa Fe, New Mexico, direct. This is a very rugged route, but is quite spectacular and beautiful. I passed by the San Francisco peaks at Flagstaff, Arizona in 2-1/4 hours. These mountains are very scenic, reaching to almost 13,000 feet and covered with snow. I flew over the Navajo and Hopi reservations to Santa Fe, all the way with beautiful clear blue skies and unlimited visibility - and a 10 knot tail wind!

The weather man had told me of a huge, fast moving, cold front coming down from Canada into the nation's midsection but I was hoping to beat it. Alas, no such luck! As I peeked over the Rockies at Santa Fe, there was a solid undercast as far as I could see. The bad news was it was all the way to the ground. Tucumcari, NM, was zero/zero in blowing snow, as were most of the other towns along my intended route of flight.

I changed my route to follow the edge of this cloud mass and found myself going almost south to Roswell, NM, then southeast to Midland, TX. From there I flew south of Dallas-Fort Worth and on over to Pine Bluff, AR, where I landed and spent the night. This was a flight of 9 hours and I used 46 gallons of fuel for an average fuel burn of 5.1 GPH. There was a flight service station at Pine Bluff but it turned out they did not open on weekends! The outlook for the morning was pretty dismal but I got a good night's rest at the local Holiday Inn.

I departed Pine Bluff at dawn in a fine drizzle with visibility down to 3 or 4 miles. I headed southeast toward Florida to get out from under the front which had overtaken me during the night. I crossed Mississippi, Alabama and Georgia in light rain, poor visibility and low ceilings. Quite a change from typical Southern California weather! I crossed South Carolina and North Carolina into Virginia. I crossed the coast at Norfolk, VA, 15 hours and 41 minutes after departing Mojave. I had failed to beat the front to the coast however, and although I tried to fly up the east coast along the beach, I only made it as far as Accomack County Airport on the Delmarva peninsular (Delaware, Maryland and Virginia). It was raining very hard as I flew up the coast and I actually picked up a pretty good load of ice trying to make it to Salisbury, before turning back to land at Accomack Co. I spent the night in a delightful motel called The Captains Quarters - good food and real friendly people.

In the morning it was snowing! Ceilings were quite low but visibility was acceptable so I flew up the beach across the mouth of the Delaware, past Atlantic City where the ground was white with snow all the way to the beach! The weather improved dramatically as I flew north and was clear as I worked my way around the New York TCA. I crossed the Long Island Sound and landed at Mattituck airport, my destination. A short airport with an approach over some 30 foot trees. A very tough proposition in a Long-EZ. I was thankful to get it down in one piece.

My trip had covered some 3000 statute miles in 18-1/2 hours using 99 gallons of gas for an average fuel burn of 5.3 GPH and an average ground speed of 162 MPH. Not bad economy - over 30 miles per gallon.

The 1-1/2 nav/comm was a pain in the neck and I really missed my KX-155 with flip-flop frequencies. The Micrologic loran was amazingly accurate and performed very well but it, too, is a high workload since it has no database and every waypoint must be entered as you go. This was tough at times, especially when the weather was bad, which it was for more than half the trip. I must say, I did enjoy the trip overall. It is quite remarkable that a simple, built-exactly-to-the-plans Long-EZ can be such an efficient, comfortable flying machine.

Sally and I will be essentially repeating this trip in June in our own Long-EZ. It will be interesting to compare the two airplanes.

Mike Melvill

****From CP63-13,14&15 (CH10,CH31,CH37)****

ACROSS AUSTRALIA, NONSTOP - TWICE!

The trip from Brisbane to Perth nonstop and return three days later, is a crossing of 1948 nm Great Circle Route across Australia. This was a planned, nonstop trip to see our buddy homebuilders in Western Australia for the weekend function. The trip didn't take long but the drama of preparing paper work to satisfy the bureaucrats was something else. To get a permit for a homebuilt 39% overweight, for a 16 hour flight sounded easy. The reply was, "We have never done this before." Nothing is impossible; the Civil Aviation Authority chaps are great guys but are bound by structured rules that are out of date. With a so-called modern aircraft, Long-EZ or, for that matter, anything different - with no engineering justifications; the EZ Flight Manual so conservatively written - things looked bad for any approval.

The only way to get anything through is to sit back and wait until you US EZ guys do your thing and get approval on History of Performance, but this is where it starts for us down under.

I must thank Rutan Builder Support for all their time and nonprofit effort to justify overweight Long-EZs that have flown in record breaking attempts with success. After this effort, all this evidence had to be set up properly by an aeronautical engineer and his Statement of Approval was necessary. The tank and fuel system had to be designed; the tank, 9G forward load with 7-1/2 psi pressure test, weighed only 9 lbs. Fibreglass/foam panel is amazingly strong. The tank, 49 US gallons, was built in a big hurry. Some glass/foam panel was left over for an oil tank made with 5 minute flox joints.

Nothing was built until approval for safety and airworthiness came through the system. The Engineer had to have all the Special Flight Manual Inserts with CAA signatures all over them, and a one square meter drawing of tank and fuel system. It all looked good in the end for a late getaway. As usual. Jean, my son, Glen, and friend crawling all over the Long-EZ for the final inspection/completion.

In the rush, a last minute decision to try the Vortex Generators - this time without approval, fitted on the canard. On the way to the Brisbane Airport, 75nm, I found a cloud to try them in. Believe me, it really worked. No down pitch. I knew then that I might stand a chance for a successful trip.

Next morning, raining, of course. After the rush of preparing for this flight, the three hours sleep were welcome. There was no point in expecting a VFR departure 2 hours before light so I waited till first light and saw a couple of holes in the sky - really only good for F18-type aircraft. The rain had eased with low clouds, 1/8-1800 ft. Out came the TV cameras. Two national channels had been waiting in rain 2 hours but they weren't disappointed. The aircraft, at 1850 lbs. approved maximum take-off weight, flew normally and climbed 500 ft./min. under this cloud cover. Testing the canard and climbing into this spitting heavy cloud for 15 minutes. was fine, "the bloody thing worked, no trim change."

Departed on radial, clocked on departure by the Tower, and I disappeared into a white, precipitating cloud and never saw the ground for 30 mins.. while climbing a coastal range. The stick pressure did get heavier as it rained, but climbing with this weight, normally my canard would have given up long ago.

Now settled in at 10,000 feet in between stratiform layered clouds, I knew this was about as bad as it would get for this trip. Bearing west for 945 nm, intercepting a couple of NDB stations, went smoothly. The fuel burn was established on the Alcor Fuel Meter and full throttle was acceptable with maximum fuel flow of 22.5 liters/hour (5.9 gal.). The 0-235-L2C maintained 2700 rpm with all engine gauges showing normal and the TAS averaging 150 kts., over and back.

Very soon the tree line disappeared, leaving red sand and only an occasional salt lake for direction. At the 945 nm mark, the NDB was working. The average ground speed was now 145 kts. for the 945 nm. The next 757 nm was strictly dead reckoning, 5 hrs. on the new RMI compass, resulting in a track error of 3^{o} or 40 nm off track, acceptable for a homebuilt, plastic aircraft.

The next, and last, 300 nm flight was over a civilized part of the country with a few trees visible and signs of cattle tracks leading to water holes and, soon after, the fields were ploughed.

The sun was still high in the sky giving a beautiful reflection in the Indian Ocean. This was one of the highlights of the trip - to experience seeing the Pacific Ocean on departure and then, the Indian Ocean on arrival. This puts it together in a nutshell: it's a long way across this 2000 nm wide, barren continent in a light aircraft, nonstop.

The reception was overwhelming with meeting old friends again. The TV didn't miss the landing either. So now the Long-EZ, "Winglettes" stands taller in the misnamed category "Ultralite".

The trip from Perth to Brisbane was much easier to handle and it helps if you go to sleep sometimes. The return flight from Perth started 2 hours before first light and I must say, in Australian terms, "as black as a sheep's gut". When dawn broke, I was 10,000 ft., in stratiform layer clouds with the outline of the coast to the south; a beautiful sunrise mixed with Swan Lake stereo music tickling my excitement made it one of my life's most precious starts for the day.

I flew over the South Australian coastline with 700 miles of the whitest and purest beaches fading from green to the deepest blue ocean you'd find anywhere. I have flown this area with Jean at water level; it's beautiful, pure, clean and undisturbed. This trip was a mixed bag of air with little, if any, tail wind. Density altitude for most of the trip over and back was around 12,500 ft. I used only .5 liters. of oxygen and I'm sure this kept me on the ball.

Long range flying is another dimension of flying, if you can lie back as you do in the Long-EZ, you don't get muscle fatigue from sitting, I was amazed. The fourteen hours soon went in excitement.

Eventually, the coast came up - Brisbane at 10,000 ft. for a Tower clock timing a final decent to Oakey, 75nm west again, landing in the night.

What a private welcome! Jean had the hangar doors open and we had lots to talk about.

FILED RECORD

BN - PTH - 1948 nm (Great Circle) clocked 13 hrs., 41 mins.., (heading west) 145.57 kts. av., 24.12 L/hr (6.35 US gal.) - 380 litres fuel useable - 330 litres used - 50 liters remaining.

FILED RECORD

PTH - BN - 1948 nm (Great Circle clocked 13 hrs.., 55 mins.., (heading east) 140.88 kts. av., 24.43 L/hr. (6.45 US gal.) - 380 liters fuel useable - 340 litres used - 40 liters remaining.

FILED RECORD

Longest distance-2037 nm nonstop for C1B Class, Australia."
Magna Liset

From CP63-15 (CH37)(Photo Caption)
Magna Liset (Rt) & his navigator for the Around Australia Race, Wayne Johnson (See CP59). VH-MJL is of course, Magna's Long-EZ which he used to fly twice across the width of Australia.

From CP64-2 (CH37)
LONG-EZ'S - TRAVELLING MACHINES
During one 3 week period a month or so ago, we noticed the following: Two friends flew their Long-EZ's from the LA basin to the southern Bahamas islands. Another friend flew to and from Kansas City for a weekend visit. A week later, Mike and Sally flew to New York and back.

These were only the people we knew of personally. There were probably others! Talk about a travelling machine - the Long-EZ, designed by Burt in 1979, was named for its long range and long endurance. It has really lived up to its name and its design goals

From CP64-4&5 (CH22,CH37)
MOJAVE-WILKESBORO, NC-LONG ISLAND, NY-MOJAVE IN LONG-EZ N26MS
Sally and I had planned this vacation for months. We were ready and so was our Long-EZ.

We lifted off runway 7 at Mojave at 5:55AM and headed East. I climbed at 140 kts. indicated which, at our weight, yielded a 600 FPM climb. The Northstar showed a ground speed of 185 kts! Great tailwind even during the climb. We donned our oxygen cannulas (AEROX - simply the best - 11-1/2 hours duration with two people at 18000') and climbed to 17500 feet. Once we were level and trimmed out, we were looking at a true speed of 173 knots. while burning 6.4 GPH. The winds were pretty much on the tail giving us a ground speed that never fell below 200 knots for the first 1000 NM. At times, we saw 220 knot ground speeds on the loran.

Unlike the terrible weather I had experienced flying the 0-235 powered Long-EZ over approximately the same route (See CP63), we had glorious blue skies essentially all the way from Mojave to New York.

We stopped for gas in Rogers, Ark. then pressed on to Wilksboro, NC. Flying time was 9-1/2 hours. We used 63 gallons for an average fuel burn of 6.7 GPH. Not bad when you consider two climbs to 17500'! We averaged right at 30 NMPG (34 MPG) on the trip from Mojave to Wilksboro mostly due to strong tailwinds.

We had a marvelous 3-day weekend at a hot air balloon festival run by our old friend and VariEze builder/flyer, "Mule" Ferguson. We flew in hot air balloons, we chased hot air balloons all over the countryside and we had a ball. Thanks a million, Mule and beautiful wife, Debbie.

The trip from Wilksboro to East Hampton, Long Island, NY at 11500' took only 2.7 hours. Again, we got lucky and had a huge tailwind. We flew under the NY TCA at 500 feet, just off the beach. Quite an experience. You fly so close to Kennedy you can almost look into the windows of the airliners waiting to take off!

Although the route flown was not exactly the same, it was close. The 0-235 powered Long-EZ used 99 gallons and the trip took 18-1/2 hours. This time, our 0-360 powered Long-EZ used 83 gallons and the trip took 12.2 hours. The tailwinds had a lot to do with it, though - it took 16:10 to fly back to Mojave, bucking strong head winds and awful weather, at least to Ohio. Average fuel burn on the trip home was 8.8 GPH - the price you pay for the big engine if you can't go up high enough.

We stayed with a friend on Long Island and he and his wife saw to it that we had a splendoriforous time. We flew to Boston, then to Newport, RI. (Saw a completed Rutan Solitaire on the Newport airport.) We flew into New York City, flying down the Hudson river at, or below, 600 feet to stay below the TCA. We flew by the Statue of Liberty and landed at Linden, NJ. We spent 3 days in New York City and loved every minute of it.

We departed from Linden on a cloudy, low ceiling day and "scud ran" in driving rain for almost 4 hours! We landed for fuel in Burlington, IA and discovered that our voltage regulator had died. Sally called Bill Bainbridge of B&C Specialty in Newton, KS and he invited us to drop in. He also offered to trouble-shoot the problem, fix it or replace the B&C linear voltage regulator. He was as good as his word and, when he could not find the problem, he replaced the regulator. As we lifted the broken one out of the nose, it was dripping water! Bill took the lid off and, low and behold, it was full of water! Stupidly, I had installed it directly under the access door in the nose and my door does not have a good seal. Flying for hours in pouring rain had somehow caused water to get into the regulator and shorted it out! A valuable lesson - do not mount your voltage regulator where rain can get to it!

While I am on the subject of Bill Bainbridge and his B&C Specialty Company, I would like to thank Bill and his delightful wife, Celeste, for their hospitality and kindness. Bill really does have a neat little company in Newton. I got a tour of the facility and was tremendously impressed. The lightweight starters, the linear voltage regulators, the various alternators, etc., all are built with incredible attention to detail. You have to see these accessories going together to appreciate just how much superior they are to anything else out there. By the way, you can order a brand new Lycoming 0-235, 0-320, or 0-360 from the factory equipped with one of Bill's beautiful starters! Bill really cares about us homebuilders and he strives to provide us with excellent parts designed to not only provide excellent service but also to give us the best possible performance and long life. The linear voltage regulator also provides <u>absolute</u> protection from an over-voltage spike thus keeping your expensive avionics safe. Before buying less expensive starters, alternators and voltage regulators, take a hard, critical look at what you get - believe me, I speak from experience!

We flew out of Newton during a summer thundershower and ended up fighting thunderstorms and rain all the way to Gallup, NM. From Gallup to Mojave the weather was perfect except for a 30 knot headwind.

N26MS now has 1630 hours on her. She first flew in 1980 which makes her almost 10 years old.

We have been all over the lower 48 states as well as Alaska and our Long-EZ has served us well. No question, our lives would not be the same without her. She has been ready to fly us anywhere, virtually anytime we wanted to go. Airframe maintenance has been essentially zero. Engine maintenance with the 0-235 was more than it should have been. We topped it twice in 907 hours. This was probably due to my running it too hard! The 0-360 has required no maintenance during the last 720 or so hours. We have had to have both magnetos worked on and we had an alternator failure once. We are extremely satisfied with our Long-EZ and would not trade it for anything.

Mike and Sally Melvill

From CP64-7,8&9 (CH37)

ATTENTION: ANYONE WHO EVER WANTED TO CROSS THE ATLANTIC . . .

"Planning my North Atlantic crossing began in May, 1989 when my wife, an Air Force physician, received word that her next assignment was to Hahn Air Base in central West Germany. I borrowed an old copy of IFR magazine (Jan. 1989) which had an article about such crossings written by an experienced ferry pilot. First, I contacted Canada Air Transport (Bob Lavers at 506-857-7131) in Moncton, New Brunswick, Canada. They sent a complete packet detailing the requirements for single engine North Atlantic crossings.

In short, they require a full gyro panel, two long range navigation radios, and a high frequency communications radio. I found a marine hand-held radio direction-finder that worked very well. The other long range nav radio I had was a loran. Loran coverage is normally good all the way to Scotland using the Goose Bay-Narsarsuaq-Keflavik route but the Labrador Bay chain was down for maintenance during my trip. I found out after buying it that my Northstar loran is not able to receive the loran chains in Europe or the North Atlantic past the Labrador Bay chain so I had to rely on my other nav radios. I was able to get a heading for the Simiutaq (SI) NDB on the coast of Greenland using both my Northstar and King Marine lorans before the Labrador Bay chain went down. I was able to use the East Canada chain all the way to the coast of Greenland, but the Northstar kept asking to change chains and warning about repeatability. The King loran worked great in the states but not at all in Europe.

For the crossing, a full immersion suit, life raft, and sea survival pack are also required. The spares that I carried were a set of plugs and oil. I used 100 weight oil but would recommend a lighter weight as it felt pretty stiff trying to hand-start in Greenland. Also, the oil temp never got over 120o between Greenland and Iceland.

Navaid Devices sold me an auto pilot and it worked well and let me relax a bit during the long legs over water.

Since the Long-EZ is classified as experimental, technically, we must contact any country in which we want to operate and request validation of our airworthiness certificates. Canada and Iceland were aware of this rule, written in small print on the back of our certificates. Others were not. Eventually, all countries responded; Denmark said that they wouldn't validate my certificate since my aircraft was not "certified", and I was in and out of Greenland before I even got their reply (which ultimately was "no"). The people at the airport in Narsarsuaq didn't care about this rule. They even let me park overnight in the hangar with the Ice Patrol planes.

For maps, I relied on Jeppesen. They sold me a North Atlantic set of charts, A VFR radio navigation chart for Germany, and an expensive set of books called a Bottlang Airfield Manual. The Bottlang books were very handy, with all the required details I needed for international travel.

I didn't install any extra tanks since I planned legs of only about 700 or 750 nautical miles. This left plenty of fuel to meet the three hour reserve fuel requirements of Canada Air Transport.

The trip itself started from Dunnellon, FL. I headed up the east coast to Barnes Airport in MA. On subsequent days, it was on to Caribou, ME and then across to Moncton, New Brunswick for the required inspection. Don't try to skip the inspection; security checked paperwork in Goose Bay and the officials in Iceland also checked the "ship's papers". After a low pass which the Moncton tower requested, I was off to Goose Bay about four hours north. Telephone ahead for a prior permission number that you will need for the approach controller (Goose Bay Operation at 709-896-7331). Outside the U.S., our airplanes get lots of attention, most controllers asked lots of questions if they had the time and always gave very good service. Goose Bay was my first landing at a primarily military airport, so phrases like "check gear down" and "arresting cable up" made the approach a little out of the ordinary.

Before I left, people I talked to about the trip said that the weather briefing that you get at Goose Bay is really something special and they were right. After having made an appointment the night before, the weather service had a folder ready for me covering the flight and a weather man met with me to go over it. I was following a high pressure system out to the U.S. and the weather couldn't have been much better.

After I was out of VHF range, I started using airline traffic passing overhead to relay my position reports. Over the North Atlantic, air traffic is required to monitor 121.5 and it is normal practice to call and ask for help with a position relay. My calls always got an instant response and we arranged to meet on 131.8, the air-to-air frequency assigned to the North Atlantic. Again, there were always lots of questions about my aircraft and the trip.

About seven hours out of Goose Bay, the coast of Greenland and the fjords that lead to Nararsuaq airport come into sight. Simiutaq NDB is on the coast and there are three choices for someone flying too low to pick up Narsarsuaq NDB. If you fly up the right-hand fjord, as I did, you are on a long right base for the runway. For the center fjord, you jump over a hill and are on final. The third fjord does not lead to the runway. You shouldn't fly up the fjords if the clouds are below the tops of the ridges at 3600 feet but should use the Narsarsuaq NDB/DME approach. The charts show an instrument approach using the NDB and DME but the controller said that the airport is normally only open for VFR. I stayed at the Artic Hotel in Narsarsuaq; the only choice except in mid-summer. The room was warm and clean and reasonably priced at about $60.00 per night.

Overnight, Greenland had snow so I had to wait until noon before the low clouds and fog went out to sea. Just before I left, the weekly airliner arrived and said that they had a lot of turbulence over the ice cap on their way in from Iceland. So, I had to skip flying over part of the ice cap and head out to sea and around the southern tip of Greenland before heading for Iceland. Again, I got excellent weather service with hourly satellite pictures. The personal service might have been because the airliner and I were the only traffic for the day. My only alternate was Kulusuk, about 400 miles north on the east coast. Kulusuk was reporting a snow storm but I went ahead because the satellite pictures showed a clear path to Iceland.

The trip to Iceland was uneventful although very cold. I wore the immersion suit, pulling off the top half after climbing in. Wool pants and a down coat under the immersion suit were not quite enough. I was afraid to run the electric cabin heat since I could not tell if the legs of the suit were touching the heating elements. I was very cold by the time I reached Iceland, especially since it was in the 90's when I left Florida.

Iceland is supposed to be a North Atlantic radar outpost but they didn't see me until I was over land despite operating my transponder and giving them my flight level and inbound VOR radial.

If you can afford $150 a night for a hotel, the Lofleder Hotel at the Reykjavik airport is an excellent choice. It offers pilots a discount, has a heated pool and seafood lunch buffet that you shouldn't miss. I could only allow myself one night of luxury and then had to catch a shuttle bus over to Keflavik and stay at the Navy base (military only). I spent three days in Iceland waiting out both a wind and rainstorm with steady 35 to 40 knot winds and some military maneuvers that restricted low level flight between Iceland and Scotland.

The wind was not as strong as forecasted on the trip between Iceland and Scotland and I purposely over-corrected for the forecasted wind in a southerly direction so that if I was off course, I wouldn't pass north of Scotland. All this put me about twenty miles south of Stornoway when Benbecula VOR came into range. A call to Scottish information and I was on my way down the coast to Glasgow. Communications and radio navigation were weak down at lower levels in northern Scotland but improved after I cleared the hills and entered the valley leading to Glasgow.

Strong winds and rain delayed my departure from Glasgow the next day until nearly noon again and after flying southeast into England, I began to run out of daylight and the weather, while reported as clear in Germany, was turning into a sold deck below me. So, it was time to change plans and land at Teeside airport on the central coast of England after only a couple hours of flying. The next day was sunny and very windy but I was off to Germany. I had radar service all the way across the north sea. VFR traffic is required to descend to one thousand feet around Amsterdam and, again, I caught up with the rain and a forecasted ceiling. I passed a small airport just inside the German border and I called Dusseldorf radar to let them know that I was heading back there to land because of the weather.

My wife, Peggy, drove the two hundred kilometers north to pick me up. I had to wait out a week of clear skies until the next weekend when she could take me back up for the short flight down to Koblenz. The airport there has a 3000 foot paved runway and overlooks the Moselle river. This is homebase for my airplane for the next four years.

All in all, I had a pretty smooth trip. The only problem was the loran chain being down for maintenance and this shouldn't be a problem for future flights. For the flight back, I'm planning to build a back-seat tank and take the Shannon-Gander route or go through the Azores.

Juan Rivera"

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Update Number 66 to Supplemental Chapter 38 Maintenance and Inspections

****From CP66-3 (CH3,CH11,CH31,CH38)****

ALERT! POSSIBLE CORROSION IN ELEVATOR TORQUE TUBES IN EZS.

We have one report from a VariEze builder/flyer who lives and hangars his EZ in Ohio. He noticed small bumps rising up on the top of each elevator along the aluminum torque tube. He could depress these bumps a little with his finger. He has removed each elevator and cut the glass and foam away along the top of each elevator, exposing the aluminum torque tubes. He reports that he has found "severe corrosion pits where each bump was located." We have not seen this corrosion yet - he is sending us a sample of the affected tube. We will report further in the next CP. He says that this corrosion occurs only under the foam and glass. These is no corrosion at all on the exposed ends of the elevator torque tubes.

Pitch control is absolutely critical to safe flight. For this reason, any report such as this must be taken seriously. All EZ, Defiant and Solitaire flyers should inspect the leading edges, the tops and the bottoms of both elevators for bumps such as we have described here, before next flight. If any evidence of bumps or corrosion is found, ground the airplane and remove foam and glass locally. Inspect the aluminium tubing under a bright light. Please report any problems found to RAF as soon as possible.

Any builders who have not yet built the elevators should treat the aluminum tubing with Alodine before starting on the foam and glass elevators. Do not omit this step! Remember, the corrosion, if it exists, is not visible on the exposed part of the tubing. It is under the foam and glass and cannot be seen without removing the foam and glass. Do not remove foam and glass without evidence of bumps or swellings that may or may not be soft. Do let RAF know of any evidence of corrosion.

The above report came out of Ohio where it is hot and humid in summer and cold and damp in winter. Anyone who lives where there is much humidity and/or near the coast should be especially concerned and should check the area called out before each flight.

We have checked all of the EZs at Mojave with no sign of any problems but that probably was to be expected, this being a desert with only a few inches of rainfall in a good year.

****From CP66-3&4 (CH2,CH21,CH30,CH38)****

CAUTION

Check that what you order is what you get! Plastic fuel lines must be checked - often.

"Just re-read an article in the *Canard Pusher* about fuel lines in VariEzes. These "original call-out" urethane, flexible fuel lines have been reported to deteriorate over time and should be carefully inspected and replaced periodically. Unless the material for these fuel lines is the correct material, deterioration can be very rapid. Visually examining plastic tubing when it arrives from the supplier may not tell the builder/flyer that it is, in fact, the correct material. Even when the correct material is used, deterioration can occur and be invisible to all but an extremely thorough examination. Here is my experience:

Recently, I brought my VariEze home on a trailer and had it in the carport, nose down. It had been sitting there for quite some time awaiting my attention. When I finally got around to it and opened the canopy, I smelled fuel but could find no sign of liquid fuel. Later, I was checking fuel lines under the rear seat by squeezing them with my fingers to determine hardness or brittleness when the header tank fuel line fell off in my hand! This was the source of the fuel smell. With the nose down, fuel had slowly leaked behind the rear seat bulkhead and into the rear cockpit. All of the other fuel lines were discolored to a dark brown but still felt pliable. In removing them from the fitting, to my horror, they easily split and crumbled.

I had always assumed that deterioration would occur in low spots in the fuel lines where water may collect. These failures, however, were up high at the aluminum fittings. They had been installed in July of 1983 and flown for a total of 750 hours, so they were seven year old. I have used auto fuel, regular, when at home and 100LL Avgas when traveling. Lately, regular auto fuel is no longer available locally so I have been using auto unleaded (no alcohol). I have, on occasions, used Marvel Mystery oil as a fuel additive and, many years ago, I used TCP.

I believe that VariEze fuel lines should be changed at least every three years and great care should be taken to order the correct material. Also, make sure you receive the correct material. As a further safeguard, cut a few small pieces of the new fuel line and submerge some in a bottle of gasoline and some in a bottle of acetone. I check these samples from time to time for any obvious signs of deterioration.

Byron McKean"

Editors comment: Thanks for your report, Byron. We agree wholeheartedly with the suggestion to change plastic fuel lines at least every three years. Also, we have found that buying polyurethane-type tubing from a supplier like McMaster Carr (locations in Chicago, Los Angeles and New Brunswick, NJ) will get you a receipt that spells out part numbers. For example, according to McMaster Carr's catalog, Tygon tubing comes in at least two material types, one called out for fuel and lubricants, another for food and beverage! Each material has its own part number. Tygothane, the material originally called out in the VariEze plans, is recommended for fuels and lubricants. Using McMaster Carr, at least you have the verification of the part number on the receipt. We highly recommend this company as a source of an unbelievable variety of materials, tools, etc. Their catalog is an awesome tome!

From CP66-6 (CH30,CH38)

ROCKER COVER OIL LEAKS?

Burt's Catbird, N187RA, had moderate oil leaks at all four rocker covers. This is an TIO-360, 210 hp, angle valve Lycoming. We removed the rocker covers and the standard cork gaskets had flattened down to nothing at each attach screw and all were leaking badly.

A call to Doug Price of REAL GASKETS initially caused a bit of confusion as to exactly what gaskets were required. Apparently this engine is an oddball, updraft cooled with inlets on the bottom and exhausts on top. Turned out Doug had the gaskets in stock. He shipped them out UPS Red Label and we had them the next morning here in Mojave, in time to install them during lunch hour.

The rocker covers, themselves, were carefully scraped clean then polished with a Scotch Brite. The cork gaskets were peeled and scraped off the tops of each cylinder using a worn out wood chisel. This surface was then also polished with a Scotch Brite.

Now, and this is the critical part, we cleaned both surfaces with paper towel saturated in Acetone. (MEK would also be good). It is extremely important that all traces of oil are removed from the surfaces that these silicone gaskets will seat on, otherwise the silicone will extrude out from between the rocker cover and cylinder head. We used several fresh pieces of paper towel until there was no trace of oil. The screws were also cleaned in Acetone then each screw was treated with one drop of removable Locktite (Blue). The gaskets and rocker covers were installed and the screws were tightened with a large screw driver and a firm hand. (Don't know the exact torque, but the screws were tight). There should be no reason to have to keep tightening these screws each time you check in your cowl. If there are no oil leaks, leave these screws alone! Voila! No more leaks. Burt's Defiant has "Real" rocker cover gaskets, as does Mike and Sally's Long-EZ, and there has never been a drop of oil leaking from these rocker covers in over four years.

From CP66-9&10 (CH30,CH38)

THROTTLE/CARB PROBLEMS ON A VARIEZE

"Dear RAF,

Enclosed is requested survey information on our VariEze, N222HK, SN 222. We are the original builders and continue to maintain and fly this thoroughly enjoyable aircraft. During our eight years of such, 222HK has proved to be remarkably free of serious problems. It has flown five times Utica, NY to Oshkosh. There are a couple of things I would like to relate, however.

The most sever problem which I can recall was with the throttle carburetor control. Very small diameter portals built into the carb (Marvel Schebler mounted on a Continental 0-200) became clogged to such an extent that they created hydraulic back pressure on the primer piston. The result was very sluggish response of the actuator arm on the carburetor with the following consequences: Failure to provide adequate prime on opening the throttle, this made for hard starting. Failure of the two springs to quickly move the throttle arm to full open on demand, - a serious problem in the event of a go around. Failure of the cable to push the throttle arm to full open.

During servicing the aircraft, I noticed when opening the throttle using the control handle the cable actually buckled up and the arm did not move. Probably with the engine running vibration caused the arm to move slowly and would only be noticed in the event a sudden surge of power was demanded. I believe the change was a slow process and very subtle indeed.

Disassembly of the carburetor revealed the clogged portal and the fact that the fuel injection piston could not force a stream of fuel into the carburetor during prime. I do not know what material caused the clogging, perhaps a small residue of epoxy.

Whenever the cowl is removed, a simple check can be made to insure that the carburetor arm responds quickly when the throttle handle is advanced. It may take two people to do this.

A second issue involves small particle fuel contamination which has been virtually eliminated in 222HK by installation of an in-line auto fuel filter. We didn't like the heavy gascolator so installed three low point quick drains and the filter. The filter is a glass enclosed cylinder about 1 inch dia. x 4 inches long and easy to service. The clear glass allows visual inspection whenever the cowl is removed. We have found particulates such as Teflon, fiberglass and other unknowns in spite of thoroughly cleaning all tanks before placing in service.

As original builders, we greatly appreciate the tremendous job you have undertaken in keeping us informed. We have built two more aircraft, a Kitfox Model I and a Zenair STOL 701. Neither of these can compare with the service we have received from you. Please accept our heartfelt thanks and keep it going as long as possible.

Sincerely,

Charles M. Hewison"

EDITOR"S NOTE: We certainly appreciate Charles' experiences, but instead of the in-line auto fuel filter we would recommend a Kinsler in-line fuel filter. These are available from:

Kinsler Fuel Injection
313-362-1145

The filter assembly, part #9020, costs $85.00 and extra filters, part #9023, costs $8.00 each.

These are quality parts, machined from solid aluminum and have Dash 6 (3/8") AN flared fittings machined on to each end. The internal paper filter is replaceable (Kinsler part #9023) and can be cut apart to look for particulates at each annual. These filters are made for fuel injected engines and work very well. Mike and Sally, Doug Shane and Dick Rutan are all currently using this in-line fuel filter.

****From CP66-10&11 (CH30,CH38,CH39)****

P-LEAD TO MAGNETO INCIDENT

"Dear RAF,

I took a trip last August in Norse Nomad, my Long-EZ, which has over 400 hours to date.

I had an uneventful flight to McKinney, TX from my home in Carbondale, IL to visit with my son's family. On the way home via Texarkana and Little Rock, I suddenly experienced a noticeable drop in rpm. Since I had put in 20 gallons of 100LL before departing, I suspected water in the fuel. I did a 180 degree turn and made it to an airport with the engine running rough and surging between 2400 and 2600 rpm's.

I removed the gascolator and found a half teaspoon of sand and sediment but no water. A quick test flight revealed that I had not found the problem. I decided to leave the Long-EZ, fly home commercially and return with a trailer. To make a long story short, when I got my Norse Nomad home, I started the engine and got a bad mag check on the right mag. The mags had checked perfectly on the previous two flights, but not now.

The culprit was a break in the shielded P-lead from the mag to the starter switch. where the wire made a 90 degree turn close to the switch. A single strand had cut the insulation and grounded the center electrode!

Knowing what I know now, I would have simply removed the P-lead from the mag and flown home. This would have left me with a "hot" mag but it would have been much better than the 650 mile trailer trip! Also, I did not check the mags in the air when I had the problem. That check probably would have revealed the problem. A sudden loss of about 10% of your rpm is, in most instances, a magneto problem. Another clue was that the cylinder head temperature on my number 4 cylinder was unusually low. This plug runs off my right mag.

Hopefully, this experience may help other EZ flyers who may run into similar problems. Remember, any sudden drop in rpm, check the mags, if possible, check individual cylinder head temperatures, land and disconnect the P-leads. Watch out no one touches the prop with the mags hot. This may get you home where you can affect proper repairs. Keep in mind that P-leads can shut you down if grounded! These wires should be shielded and installed very carefully to minimize any chance of accidental grounding.

Greeting to all at RAF,
Jake Bach"

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Update Number 67
to
Supplemental Chapter 38
Maintenance and Inspections

****From CP67-6 (CH13,CH38)****
NOSE GEAR EXTENSION PROBLEM
"On my first flight, I left the nose gear down for the entire flight. When I attempted to retract the nose gear to park nose down, it retracted until the nose tire contacted the aft edge of the nose wheelwell then stopped moving! Turning the crank handle either way had no effect. On examination, I found that the AN-4 70AD4-10 rivets attaching NG60 to NG65 (worm gear to shaft) had sheared off! I am so happy I did not retract my nose gear on that first flight".

Jack Bennett
DeKalb, IL

Jack sent this note in because he was worried that the suggestion from Ken Clunis in CP66, Page 9, may cause more failures like he experienced. We print this information, like we do all of our hints and problems, in case they may help others. Let this serve as a warning to carefully check your rivets before next flight.

On the bright side, this is the first failure of this kind we have had reported. I checked on just our local fleet of EZs on the Mojave airport (at least 7 EZs as of April 1991!) with a collective total flight hours of 7668 hours! None of these have had this problem. Maybe Jack had some sharp edged holes or something - hopefully it won't become a common problem. Jack solved his problem by simply installing an AN-3 bolt in place of the rivets. An excellent fix if you find yours is loose.

Please report any failures like this to RAF so we can disseminate the information to the several thousand builders and flyers around the world.

****From CP67-7 (CH30,CH38)****
EXHAUST SYSTEM CRACKS
We seem to be experiencing a rash of exhaust system cracks. After years of essentially no cracked weld or cracked pipes, suddenly, over the last year or so, we have received perhaps a half dozen reports - a couple in the last few weeks. A few have been Brock exhausts for Long-EZs, but most have been Sport Flight (Herb Sanders) VariEze as well as Long-EZ exhausts. Steve Franseen, VariEze builder/flyer in Denver had what he termed a Big Time Emergency when the outboard section of a Sport Flight VariEze exhaust system came off in flight and split the prop to the hub. He would like to warn builder/flyers to check exhaust systems very carefully around the welds. This is a real important preflight check item. With a pusher, a broken exhaust will almost always result in a forced landing.

Steve has requested information from anyone who is operating Sheehan Engineering piston and rings in an 0-200. His VariEze, N86EZ, has run without problems using these parts for over 2 years. He is interested in comparing information on higher time engines using this set up. Steve is also interested in sources for more of these high quality components. Anyone who would like to contact Steve can reach him at:

Steve Franseen
10196 W Keene Ct
Denver, CO 80235
303-987-1880 (H)

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Update Number 68 to Supplemental Chapter 38 Maintenance and Inspections

****From CP68-2&3 (CH38)****
NEW FAA SERVICE
AMATEUR-BUILT/ULTRA-LIGHT AIRCRAFT SAFETY DATA EXCHANGE BULLETIN BOARD SYSTEM

There is now a new service through the Federal Aviation Administration for the use of those involved with Amateur-Built and Ultra-Light Aircraft. This new service consists of a Bulletin Board for those who wish to participate in the Service Difficulty Reporting System and Safety Information of said type aircraft.

By establishing the Bulletin Board, interested users can obtain service and safety information from 1530 to 0700 central time (Monday through Friday) and 24 hours on weekends and holidays. Reports which are entered on-line into the system by members of the aviation public will be available to everyone within 12 to 24 hours.

Any PC with a modem or any terminal equipped with a modem can be used. The same equipment used for connection with DUATS can be used with this system. Normal parameters are 1200-N-8-1, but any baud rate from 1200 through 2400 is usable, and the system is entirely menu driven for ease of use. The telephone number of the system will be 1-800-426-3814, and the password is SAFETY. Also, this system is programmed to use UPPER CASE letters only.

Users of this system will be pleased to know that it is designed to protect the anonymity of the submitter. No identifying information such as registration number, serial number, city, etc., can be entered into the data base. The only identifying element will be a model name such as "VariEze". Even in the unlikely event that someone should wish to use the information in the data base for an enforcement action, it would be impossible.

Accident and incident reports will not be made available in this system in the traditional accident report format. A major complaint from users has been that accident reports were detrimental in many ways to the pilot or owner of an aircraft. Since the Safety Data Exchange Bulletin Board is interested in the rapid exchange of safety information, the service or safety problems contained in an accident report will be extracted and entered into the data base in the same format as any other safety report. (No identification).

The type of information that will be in this system will be that pertaining strictly to safety and service problems in amateur-built and ultra-light aircraft. As a general guideline, anything that happens with your aircraft which may happen to another person's aircraft, should be reported. The exchange of safety information will improve safe flying for everyone. The type of information that would be helpful is as follows:

- Model of aircraft (must be entered)
- Engine make and model (particularly if an engine problem)
- Propeller make and model (particularly if a prop problem)
- Component make and model (particularly if a component problem)
- Part name and part number
- Location and condition of the part of problem
- Remarks, in sufficient detail to help others identify the same problem

In other words, enter the information that you would like to see if you were reading the report.

It should be stressed here again that this system is just for amateur-built and ultra-light aircraft and not type certificated aircraft. There are many regulations and statutes which cover the service difficulty system as it pertains to type certificated aircraft. The reporting of safety problems for these aircraft is strongly encouraged through the traditional system.

Please be patient with any problems you may experience since the system is still in the development stage. Your questions, suggestions, or comments are welcome. The only way this system will grow and accomplish its purpose of improving the exchange of safety information is with your support.

Bob Morrow, SDR Coordinator
FAA, ACE-103
601 E. 12th Street
Kansas City, MO 64106
816-426-3580

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Update Number 70 to Supplemental Chapter 38 Maintenance and Inspections

****From CP70-3&4 (CH30,CH38)****
"This is a report of a stuck throttle "near-miss" incident. In hindsight, it is quite similar to the Don Patch report in CP 65 and the Charles Hewison report in CP 66. I consider I was lucky to not have pranged the airplane.

I have just converted my Long-EZ from an MA-3A (non-accelerator pump carb) to an MA-4SPA (accelerator pump carb) as part of a change from an 0-235 C2C to an 0-320 E2G. After about seven hours of uneventful flying, I sent the MA-4SPA away for an overhaul, including a new throttle shaft and a rebuilt accelerator pump. This greatly improved the smoothness and mixture control of the engine but the rebuilt carburetor requires about two pound of force to operate, when applied to the throttle bellcrank arm at the inner most hole, using the plans carburetor cable bracket. The force to operate the throttle bellcrank is about the same whether or not the engine is running (two pounds). The MA-3A carburetor springs itself to full throttle, since it had no accelerator pump; the non-rebuilt MA4SPA was much looser than the rebuilt one. The problem is that the throttle quadrant is not able to supply this much force at idle without help from a spring. With a spring, the throttle sticking problem never occurred with the engine shutdown, only with the engine running after the throttle had been pulled to hard idle, and then slowly advanced.

I found this out over several days of trouble-shooting when I noticed the throttle response of the engine was occasionally delayed when coming off a slow idle. I investigated by cycling the throttle and visually inspecting the system, but could not reproduce the problem or find a cause for it on the ground. Being foolish and thinking the problem had fixed itself, I went flying, landed, and when I tried to apply some power to taxi, I could not get any power response, only a very spongy throttle movement to about half throttle position (2 inches of throttle knob motion). My first stealth forced landing! After engine shutdown, throttle response was normal!
(Good thing he did not have to go around! -ED)
I then verified visually (top cowl removed) that engine movement was not binding the cable somehow. I increased the throttle spring tension, and slightly relocated the throttle cable clamp to perfectly position the cable at the throttle cable end bushing. These changes appeared to eliminate the slow response. I flew again, and on landing, still had some reduced amount of sluggish response off of idle. Suspecting a damaged cable, I made the force measurements on the carburetor and the cable using some string, a volunteer to make the measurements with the engine running, and a 1-10 pound fish scale. These measurements confirmed that the system could not operate the carburetor without a spring assist. Suspecting damage to the cable, I then removed the cable from the airplane for inspection (yes, it was floxed in every foot or so: no, my consoles were not removable: yes, hell of a mess and lots of swearing). The cable was not damaged, nor was the cable sheath. Interestingly, however, if you pull on the cable shroud from opposite ends, even as little as 2 pounds of force will stretch it some.

I really didn't want to put a spam can-sort of throttle system in, but it appears that something with greater push authority than the original design is needed. I don't want to just increase the throttle spring force since spring failure will mean possible throttle failure. Do you have any thoughts or suggestions?

Lew Miller"

Five years ago, Mike Melvill went to an aircraft push-pull throttle cable and has been pleased with the result. -ED

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Update Number 71 to Supplemental Chapter 38 Maintenance and Inspections

****From CP71-1 (CH2,CH3,CH25,CH33,CH38)****
WARNING - STRUCTURAL DEGRADATION OF FOAM CORES
We have noted that many of you have not been adequately inspecting your structure and may not be aware of how seriously the structure can be affected by a degradation or defect in the underlying foam core. For example, a 3-inch diameter depression or bulge in the skin due to damage in the foam (void, crush or de-lam) can weaken a winglet or wing (particularly a VariEze outboard wing that has no discrete spar) by as much as 50% or more! A skin dis-bond on an elevator or aileron can result in flutter failure even within the allowable flight envelope.

We have recently found foam damage to several of our own aircraft structures. One was due to the inadvertent intrusion of an agent used to clean a wing before it was primed and painted. Another was traced to a stress crack that was in the foam block, a flotation billet, not the proper fabrication billet. Never substitute a different material even if it seems to work okay. We have also had dis-bonds in control surfaces. These can grow rapidly when exposed to high altitude flight. (The void is trapped and expands at altitude).

The solvent-susceptible and easily-damaged cores we use need constant attention to maintain safety. We know of no accidents due to this problem, however, the potential is high if you are careless with the maintenance of your airplane. Please let us know what you find on your inspections so we can pass this on to everyone. Since these types of structures are used on non-RAF types, we are asking Sport Aviation to also publish this caution.

****From CP71-5 (CH3,CH25,CH33,CH38)****
MAN-GND
ADD THE FOLLOWING TO THE MAINTENANCE/INSPECTION SECTION OF VARI-VIGGEN, VARIEZE, LONG-EZ, DEFIANT AND SOLITAIRE OWNERS MANUALS.

PREFLIGHT CHECKLIST

Check all skin surfaces of wings, canard, winglets and control surfaces for cracks, dents, or bulges and for evidence of interior foam damage (skin moves when you push on it or has a dull thud if tapped with a coin). Do not fly if structure is damaged beyond the limits noted in the 25-hour inspection (page 46).

COMPOSITE STRUCTURE

WARNING - The foam core in composite control surfaces, wings, canard and winglets is easily damaged by solvents, including solvents found in paint primer, most cleaning products and, of course, oils and fuel. Never wash the structure with anything but soap and water. The smallest invisible pinhole through the epoxy surface structure can allow intrusion of liquids or vapors that will attack the styrofoam core. A void or dis-bond (separation from the skin) will weaken the structure and can result in a fatal accident. The foam core can also be damaged by local concentrated loads such as a dropped tool or by using your shoulder to set the gear. Never use a wing as a workbench or to stack luggage. Treat all composite skins like eggshells.

EACH 25 HOURS Conduct a general inspection of all composite structure. Any visible crack must be investigated to determine if it is only paint and filler damage or if it extends into the fiberglass structure. All paint and filler cracks should be repaired or sealed to prevent water intrusion. All fiberglass damage must be re-painted before flight. Check skin surfaces for evidence of depressions or bulges that indicate a failure of the underlying foam core. Note the integrity of the underlying core by pushing on the skin and tapping with a 25-cent coin. Good core is indicated by a sharp "tap" or "knock" noise. Bad core is indicated by a "dull thud". Listen carefully as you tap and mark with a grease pen directly on the skin the boundary of any suspected dis-bond area. Ground the aircraft if any core damage area is larger than the following:
Fuselage, wing/canard - 3" diameter.
Winglet, control surface or VariEze outboard wing - 2" diameter.
Repair per instructions in the annual/100 hour below.

ANNUAL/100 HOUR Conduct a very careful 100% skin surface coin tap, surface stiffness and contour smoothness inspection. Include interior areas in fuselage, cowl and wing with wings removed. Repair all suspect areas (even 1" diameter ones) by drilling #50 holes and injecting epoxy in one side of the void/bulge/dent area until the epoxy vents out the bulge (any

divergence from the intended smooth contour) must also be repaired and reinforced per the standard repair methods in the plans.

From CP71-7 (CH3,CH10,CH19,CH20,CH25,CH31,CH38)

SHOP AIR AND FOAM CORE WINGS

High pressure shop air can cause serious dis-bonds between skins and foam cores. Be extremely careful using shop air to blow off a wing, winglet, canard, etc. If there is a small hole such as a drilled hole for wiring, antennas, etc. and the high pressure air gets into this hole, it will literally blow the skins off the surface. We have had it happen to us and we have had several reports from homebuilders who have had this problem. Sometimes it can be repaired fairly simply - other times, it can be a really tough repair. The answer is not to get into this situation. The greatest danger would be if it occurred and went undetected. This could lead to a structural failure and a serious accident. See "Warning" in this newsletter for information on "tap" testing for dis-bonds.

Update Number 72 to Supplemental Chapter 38 Maintenance and Inspections

****From CP72-2&3 (CH2,CH3,CH25,CH33,CH38))****

FOLLOW-UP ON CP71 DISBOND/DELAM CAUTION

So far, we have received only one letter from a builder with a problem in this area. This aircraft is a Q-2 and, normally, we would not presume to comment on someone else's design but this particular problem could so easily have resulted in an in-flight structural failure that we felt morally obligated to say something about it.

During a landing that the pilot said was not any harder than other landings he had made, the canard (also the landing gear since the main wheels are mounted on the tips of the canard) failed. The top skin just inboard of the fuselage side, buckled and the canard folded. Subsequent sectioning of this area showed a large percentage of the foam had "melted". This builder/pilot suspected that this melting damage was caused by excessive heat from the sun while tied down outside in Florida. He included three photographs of the section of damaged canard.

We at RAF have not seen this canard, only the photos, but we have a different opinion. We believe this damage may have been caused by fuel leaking out of the fuel tank (above the canard) and seeping through tiny pinholes in the top skin and melting the foam. Styrofoam, be it blue or orange, fabrication billets or floatation billets, will melt when it comes in contact with any fuel, solvent, etc. Put a scrap of foam in a container of fuel and, in a short period of time, the foam will disappear. Pour a little fuel, avgas or mo-gas onto a block of foam and you will be amazed at the damage. The three photos supplied to us by this Q-2 builder/pilot, in our opinion, show classic fuel or solvent damage. One of Scaled's employees who has built a Quickie and a Q-2 informed us that the fuel tank is, in fact, mounted directly over the canard and that he had heard of this type of foam damage before.

All of the RAF designs have a fuel-proof barrier between fuel and Styrofoam. This barrier can be a sandwich panel of glass/PVC foam/glass, or glass/urethane foam/glass, but RAF feels it is absolutely essential to completely protect any Styrofoam core structure from exposure to fuel or any kind of solvent. In some cases, even the fumes of fuel or a solvent such as MEK or acetone can degrade a foam core to the point of causing a possible structural failure.

We have written a letter to this particular Q-2 owner and will be passing this information on to Jack Cox, editor of *Sport Aviation.* We are not criticizing anyone, it's just that this kind of damage is many times invisible and may not easily be spotted in a normal preflight. Any foam core, glass structure, while perfectly safe with an undamaged core, can become prone to catastrophic failure if the foam core is damaged. This kind of hidden damage could cause a serious accident. This is our only reason to bring this to everyone's attention.

To protect yourself from this kind of failure, it is critically important to prevent fuel from coming into contact with a glass structure that has a Styrofoam core. The same goes for any form of solvent, be it MEK, acetone, Prep-Sol, Acrylikleen, or whatever.

To check your structure for possible delamination or dis-bonds, move the airplane into the sun or, at least, to where it is warm. This will cause any disbonded areas to bubble up due to the air or gas in the void heating up and expanding. Carefully tap the entire area using a quarter (25-cent piece). Listen carefully for the telltale "hollow" sound when you tap an area that is disbonded or delaminated as opposed to the solid "click" sound of normal structure. By carefully tapping and using a felt tip pen to mark the perimeter of the damaged area, you can outline any areas that need repair then you can repair these areas, in most cases, simply by injecting a mixture of epoxy and micro-balloons, using a syringe. You will have to drill a number of small holes (to closely fit the needle) and inject the epoxy mix into one hole until it comes out of adjacent holes. Keep moving the syringe around until forcing it into any hole will make it come out of the holes closest to that one. Now, move the airplane out of the sun into a cooler area. Place some plastic (Visqueen) over the area, cover that with a piece of flexible material (.032 aluminum) and place a lead shot bag on top of that. As soon as the epoxy in the cup has kicked off, remove the lead shot bag, the aluminum and the plastic. Carefully scrape the excess epoxy off the paint using a plastic putty knife. After a full cure, you can carefully polish this area and repaint. Sometimes the visual damage is so little it does not require repainting. Recheck the area by tapping with a quarter to assure that you completely filled all void areas.

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Update Number 73 to Supplemental Chapter 38 Maintenance and Inspections

****From CP73-5 (CH30,CH38,CH39)****
"Dear RAF:
This letter finds my aircraft N84GR VariEze up and ready to go anywhere. My years of enjoyment with this fine design are pleasant memories which nothing can replace.

I use my aircraft mostly for cross country flights. I rarely get into weather, but have the quals and gages if necessary. I find that 11,500 ft. is max when wet. Rain during takeoff always means an extra 500' roll before lift off. My stall when wet is 10 knots faster than dry....so I advise everyone to watch the wet stuff. Here in Florida we get our share of liquid sunshine. Always watch out for puddles on the runway....can pull you off runway and ruin your whole day (like my friend Byron McKean's previous report).

My only hangertale concerns a flight I took this last summer. I normally fly from Pensacola to Stuart, Florida to visit my family several times per year. It is such a routine flight now, I know the route by memory. I usually fly the VFR corridor just south of Eglin AFB along the beautiful white beaches to Panama City then direct to an intersection just west of Cross City and direct to Orlando...direct Stuart. The flight normally takes 3+00. I was at 9,500' just south of Orlando and waiting for a few more miles closer before beginning my enroute descent (35km) into Stuart when my trusty 0-200 seemed to change pitch and lose some power. I began checking into things not worried too much since I had over 750 hours on that engine and had only 100 plus hours before done a cermichrome overhaul on the top end. Mags checked okay....tank change did not help....(I have the Long-EZ fuel system with separate main tanks plus the emergency)....the emergency tank did not help....(I knew of one guy that had a clogging fuel filter and the higher point of the emergency tank gave more head pressure through the filter....plus RAF reports say the same)....boost pump was okay....oil pressure fine....so I backed the throttle a bit....then she began getting rougher....NO GOOD! I hit emergency search on the loran....(A nice feature to have even if you know your way) figured I best be getting on the ground asap....(I really wanted to go that next 80 miles to Stuart, but knew better....ole Navy flight training and common sense said..."Get it on the ground while she is still running") so....I landed at Sebastian (home of Danny Mayer and Velocity). A nice twin allowed me to have his place in the pattern after I said I had a rough runner. I landed a bit hot (lots of runway) with plenty of altitude in case of failure, but she was running fine at idle...no oil to be seen, so I taxied in to give her a good look-see. After a lot of looking and plenty of advice from Danny and other local folks the problem could not be immediately found. New fuel, plugs, etc...did not help. **The next day with the help of my cousin Tim and friend George of Aviation Propellers, Miami we found a *loose exhaust valve guide* on number two cylinder.** The keepers were still in and springs working fine. This allowed the engine to run fairly well at idle, but at high rpm the valve was floating some and causing loss of power. (2200 rpm static) Lucky for me the keepers stayed in and no significant damage was done. A new cylinder was shipped out (complete warranty replacement by cermichrome folks and my mechanic Don Freeman, Aviation Engines of Hueytown, Ala..thanks!). My cousin and friend drove up from Miami again and helped me put her together...I mostly watched...then after a short test flight returned to Pensacola....nonstop. This once again reminds us to believe what we have and don't push it. With only one engine back there and God only issuing each one of us one sweet life it is the prudent man/lady who is careful while hurling themselves through the air at tremendous velocities.

That's about it for now. Ken Forrest's old VariEze N84ST is well over 1000 hours now and still flying fine in the hands of my hangermate. Just a thought. I and many others are still awaiting a new 3-4 place bird from Burt which will run the pants off the competition....please.

Together for a GREAT AMERICA
Ralph Gaither"

****From CP73-5&6 (CH30,CH38,CH39)****
"Dear RAF,
I'm writing this letter in the interest of safety for all canard-pusher type designs. Please feel free to edit or paraphrase it at will; I just want to help others avoid the scare that I had. As a little background, I bought my Long-EZ about two and a half years ago with 400 hours on the airframe. Since then, I have put almost 300 more hours on it, including a trip around the borders of the US last summer. I love my plane, but my only regret is that I did not have the honor of building her myself.

Last week, after doing an oil change, I took off into a quiet Friday evening sky at my home field for a test flight. I climbed to 8,000 feet, where I spent about 15 minutes watching the sun set, after which I started my descent.

Suddenly, there was a loud bang, followed by violent vibrations. I immediately pulled the throttle to idle and shut off the mags as I pulled the nose up. The prop stopped quickly, and I was able to see in my rear-view mirror (a small convex mirror inside the canopy for looking at my passenger) that something had hit my B&T prop and that it was badly broken.

I decided to keep the engine off and glide back to my home field. Fortunately, I was at about 5,000 feet and only 10 miles from my airstrip, a mile-long asphalt runway. This would have been possible in any plane, but was an easy task in the Long-EZ with its great engine-out performance. I announced my problem on unicom and the FBO operator monitored my descent.

As I touched down on the runway, I was amazed as to how dark it was, for I'd forgotten that sunset at 8,000 feet occurs quite a while after it had on the ground at sea level. I rolled out without any problems and got out to inspect the damage and determine the cause.

It was immediately obvious that my right exhaust stack had broken inside the heat muff box and that was what had damaged my propeller. The damage to the prop consisted of complete loss of the plastic rain edge, a gouge out of the leading edge of the blade measuring about 1 inch by six long, and a 5 inch longitudinal crack propagating from the impact point towards the hub.

After pulling the cowlings and exhaust stack, I was able to determine that the cause of the problem had been entirely the result of the builder NOT FOLLOWING THE PLANS and my A&P mechanic and I missing a problem in the recent annual inspection (5.5 flight hours prior). The heat muff and been built as per the plans except that it had not been welded directly to the exhaust stack. Instead, it had been built to be a snug fit. The problem with this was that this design allowed it to vibrate, albeit in very small movements, and this slowly ground away at the wall of the exhaust stack. The groove was deepest on the inside wall of the muff. After almost 700 hours of use, the walls of the stack were paper thin and finally gave way, allowing a half-foot long section of the exhaust stack to separate and hit my prop.

Believe it nor not, this failure may have saved me from an even greater danger - that posed by carbon monoxide poisoning from exhaust gases leaking into my cabin air system.

Lessons learned:

1. With the engine off, I'm glad I have a Long-EZ, as she has a great glide ratio and handles like a dream.
2. I was glad that I had practiced simulated engine failures just the flight before; the practice really helps out.
3. Build your planes as per the plans. If you do buy a used RAF design, go over each and every step in the plans (which should be included as a condition of sale) to find where an error or oversight might have occurred.
4. Pay special attention to the dangers of very small vibrations; small movements over long periods of time can grind through very strong metals.

I hope that this information is of help. If there are any of you out there thinking of buying a used EZ, please call me. The designs are great, but, as experience has taught me, used homebuilts have an unusual number and kinds of pitfalls.

Have a great day flying, and thanks to the folks at RAF for their continuing support.

Sincerely,
Tom Staggs"

****From CP73-6&7 (CH9,CH38,CH39)****

"Dear Mike:
Several weeks ago, I had a right brake failure on landing. Please re-alert others as to the serious nature of a brake failure, and suggest they frequently inspect their brakes. Finally, I suggest there may be a problem with Silicone brake fluid (DOT 5 motor vehicle standard #116).

In the last 2 months, I have flown around 200 hours, and the brakes had been working fine. (Yes, the brakes were inspected twice during this period). The takeoff at MEI, prior to the problem landing, the right brake was nearly gone. Previous flight, only 1 hour before, indicated no problem. I aborted the takeoff to bleed the brake. This seemed to fix the problem and I left with excellent brakes. However, two hours later I landed at RKW with NO right brake.

Assuming I might still have a problem, I landed with the wind on the right side. This worked great down to about 30 knots when it was obvious the nose had to be lowered to stop (I should have cut the engine on landing!). The damage was minor (retract gear and a few scratches) but could have been very serious. For example, had I landed the other direction, I would have left the runway at a much higher speed and went into the trees. The pilot has little control of a Long-EZ without brakes. It's a very sobering, dangerous situation -- best avoided!

I inspected the brakes after the accident, and found three confusing things. The calipers and pads had retracted about 1/4" from the disk. Why? The pads, disk and wheel pant were covered with silicone brake fluid. A leak (but small??) was found in the tube where it connected to the caliper. **I believe the leak was initiated by 7 years of age and a "hot" landing several weeks before at a high altitude airport.** Finally, there was a "gummy" gray deposit on the O-rings within the tubing and elsewhere.

This indicates stability/compatibility/moisture problem with Silicone Fluid. I have changed back to standard good old red aviation fluid. Its thicker, lubricates better, works and leaks are apparent! I had changed to silicon fluid about three years ago after reading about it in a CP.

Mike, I have over 1300 hours in Long-EZ's and I have never had as serious a problem as this. I spend more time inspecting/working on my airplane than flying it! For example, in the last 7 years, I have replaced both master cylinders, upgraded to 50-106 disks and completely dissembled, cleaned and inspected the brake system 3 times. Yet, it got me! I will be even more attentive to the brake system!
Tim Crawford"

Editor's note: We have used silicon brake fluid (Dot 5) in all RAF airplanes for many years, the main reason was aircraft red brake fluid is highly flammable, Dot 5 is not. This is the first problem we have had reported. Mike did replace the o-rings in his master cylinders about 6 months ago and found a "grey" deposit in each cylinder. This was cleaned out and the brakes have functioned perfectly ever since. Has anyone else seen any problems using Dot 5 silicone brake fluid?

Keep those letters coming! Remember, anything that was a problem, or of interest to you, will also be appreciated by other EZ people.

From CP73-8 (CH30, CH38)
CAUTION
Corrosion in the gascolator sediment bowl and even in the aluminum fuel lines is not only possible but has occurred more than once. Check you gascolator bowl often and, if ever you smell gasoline in the cockpit, do a thorough inspection of all aluminum fuel lines for leaks at the "B" nut fittings as well as leaks in the lines themselves due to corrosion.

From CP73-9 (CH30,CH38,CH39)
"Dear Mike,
On May 20, while doing touch-and-go's at Clark Co. airport in southern Indiana, my VariEze (N64SJ) was extensively damaged. I had elected to go around because of a slower aircraft ahead (C-150). While traveling along the right side of the active about half throttle in a very shallow climb, just past the take-off end of the runway, I moved the throttle to full power. The engine (0-200) started to respond then tailed off to nothing. I turned back toward the airport but came up about 50 yards short of the intersecting runway. It had rained quite heavily for several days previously and the sod was very soft.

The aircraft rolled several yards before the nose gear failed causing the plane to flip forward landing inverted and traveling another few yards before finally coming to rest, tail first, upside down.

Damage included -- Right wing broken just o/b of the wing attach fitting, left wing broken at mid span, Canard separated from aircraft taking a small part of F-22 bulkhead, the elevator control pushrod did considerable damage to the right side of forward fuselage before it finally broke, the canard has a small tension tear in the top skin at mid span, the main gear has some torsional damage, both winglets were broken near mid span, the taper pin holes in the top sides of both inboard sections of the wing attach fitting were slightly elongated from tension, other damage to canopy and cowling that I won't go into here.

After removing the cowling, the cause of the engine stoppage was obvious. **The aeroduct between the carb heat valve and the carb had collapsed.** A further check confirmed that both ends of the coiled wire were held tightly under the worm clamps. The wire coil had become completely disorganized and, in fact, parts of it looked somewhat like a Slinky that had been mistreated.

On a subsequent engine run, the engine repeated the in-flight shutdown. After removing the aeroduct, the engine ran normally.

I feel the shoulder harness and seatbelt and rollover structure worked very well as I was uninjured.

I can't say how much I enjoyed and miss my EZ. I would appreciate any advice you might have about possibly rebuilding.

Please pass on my experience with the aeroduct.

Best regards,
James Bierly"

From CP73-10 (CH30,CH38)
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

MANDATORY GROUND
VARIEZE AND LONG-EZ
Engine mount weldment inspection before next flight is required. Using a bright light, carefully examine the tubing close to each weld in the entire weldment. Look for hairline fractures or cracks. See page 1, this CP. Please report any cracking or failures found to RAF. If at any time during flight you should feel any unusual vibration, land and check the engine mount for cracks.

****From CP73-10 (CH30,CH38)****
ALL RAF DESIGNS - See Accidents and Incidents this CP, page 9 - aeroduct collapse.

Carefully check any aeroduct hose in inlet systems for security and condition. Suspect hose must be replaced before next flight

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Since RAF is no longer active in the development of homebuilts, we are not likely to discover many new errors or omissions in the plans. For this reason, we need your help. Please submit any significant plans changes that you may come across as you go through the building process.

****From CP73-10 (CH9,CH38)****
The "Bead Buster" TM - $75.00.

If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe.

Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

Update Number 74
to
Supplemental Chapter 38
Maintenance and Inspections

****From CP74-5 (CH30,CH38)****
MARVEL METAL FLOATS
Terry Schubert reports difficulty getting a new metal float to work correctly. It turns out that the tooling to manufacture these carburetor float bowls is very old and no two bowls are, in fact, identical, therefore, no one float will fit all bowls! Terry got a lot of help from Bill Smith of Consolidated Fuel Systems and highly recommends talking to Bill if you are having trouble in this area. Phone: 205-286-8551

****From CP74-5 (CH30,CH38)****
ENGINE MOUNT CRACKING (UPDATE)
Only one report has come in regarding a cracked engine mount. This one was a conical Lycoming mount. After 530 hours, the tube from the lower right engine mount bolt hole was found cracked completely through about 1" above the bolt. This was repaired by welding a sleeve around this fracture. The prop was dynamically balanced and there has been no further sign of a problem with 807 hours now. The vibration is noticeably less and an exhaust flange cracking problem has also been solved.

We have been talking to anyone we can regarding this engine mount cracking problem. We spoke with one very experienced builder/flyer who had a tube crack through on a Dynafocal engine mount. The fracture occurred about 1/4" from the weld between the tube and the right upper Lord mount cup. This kind of crack is usually caused by improper normalizing of a TIG welded 4130 weldment. There is simply not enough evidence at this time to point at whether this may be a design problem or a heat-treat problem.

Anyone who finds a crack or fracture in an engine mount, please report it to us here at RAF. In the meantime, a close inspection of you engine mount, using a strong light, every 25 hours is recommended. Any unusual vibration felt in flight is cause to land and check the mount. On the bright side, there are now dozens of VariEzes and Long-Ezs with accumulated flight times of more than 2000 hours with no engine mount problems whatever. Please do contact RAF if you hear of, or experience a problem like these.

****From CP74-5&6 (CH30,CH38)****
AEROQUIP SERVICE BULLETIN
TO OWNERS/OPERATORS OF ALL GENERAL AVIATION AIRCRAFT USING AVIATION GASOLINES (E.G., INCLUDING, BUT NOT LIMITED TO, 100 OCTANE LOW LEAD, HIGH OCTANE AUTOMOTIVE UNLEADED, ETC., HEREINAFTER REFERRED TO AS "AVIATION GASOLINE").

Aeroquip Corporation's Aerospace Group has recorded several failures of its 601-type hose over the past 12-month period. *The subject hose meets all required specifications,* however, based upon data accumulated to date, it appears that the use of this hose in fuel systems which carry AVIATION GASOLINE is adversely affecting the life expectancy and performance which Aeroquip has historically experienced with this type of hose. Aeroquip has seen degradation of the elastomeric inner tube which has resulted in the tube cracking which, in turn, has caused leaking of the 601 hose in these limited types of applications. Based on data which Aeroquip has accumulated to date, it appears that this phenomenon is occurring after approximately two (2) years installation time (independent of actual service hours on the subject hose). *To the extent your aircraft may be affected by this phenomenon, Aeroquip recommends that you inspect your aircraft to determine:* (a) if your aircraft has 601-type hose fuel lines; and (b) the age and condition of said hoses. Aeroquip strongly recommends that any 601 hose, which is approaching, or has more than, two (2) years in an AVIATION GASOLINE application, be replaced in accordance with the recommended action outlined in this Service Bulletin.
Note: This Service Bulletin does not apply to applications using Jet A, JP4, JP8 grades of fuel commonly used for turbine/jet engines. It also does not apply to other fluids such as lubricating oils, REF. MIL-L-7808 or MIL-L-23699.

Editor's Note: It is interesting to note that this exact type of failure was reported as early as 1986 in the CP and several times since then. Do not use Aeroquip 601 series hoses for fuel lines. Use only Stratoflex Teflon lined, stainless, braided or equivalent MIL-H-8794 Hose, TSO'd to MIL spec. C53A.

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Update Number 75 to Supplemental Chapter 38 Maintenance and Inspections

****From CP75-2&3 (CH30,CH38)****

FROZEN CRANKCASE BREATHER

The following experience is reiterated in the hope that reading about it may prevent a similar problem, or at least allow someone unfortunate enough to run into this, to come through it undamaged.

Sally and I flew our Long-EZ to Telluride, Colorado this past February. We had planned five days of skiing in the San Juan mountains. We landed at Telluride airport which is at 9100 feet elevation. There was lots of snow and it was cold, especially at night. There was no hangar or tiedown available so we parked nose down, into the wind.

While we were there, it snowed four to six inches each night. The last night, we had 27 inches of snow. We had to dig the Long-EZ out of the snow before we could leave.

A careful preflight was conducted, followed by pulling the prop through enough times to show oil pressure on our mechanical gauge. The engine started easily and I warmed it up at low power. I did not taxi out for take-off until I had 120 degrees F oil temperature. We took off and headed directly toward Page, Arizona at 14500 feet.

One hour out of Telluride, I suddenly noticed the oil pressure gauge fluctuating. The oil pressure slowly fell from 85 to 60psi. At this point, I hit the Loran "nearest airport" button and headed for the brand new Black Memorial airport near the northeast end of Lake Powell.

We removed the cowl and found that the engine had only 1-1/2 quarts of oil left in the sump. We had left Telluride an hour earlier with 7-1/2 quarts! There was evidence of oil near the push rod tube seals, the rocker cover oil drains, but no oil in the vicinity of the main bearing/prop seal. The prop had some oil on it, but not nearly as much as I would have expected considering we had lost 6 quarts of oil!

We topped off the oil, ran the engine for 10 minutes with no sign of an oil leak. We replaced the cowling and headed toward Mojave. One hour later, we had an exact repeat of the problem! This time, we landed at Boulder City, Nevada. It was much warmer there. We went through essentially the same steps again; filled up the oil, replaced the cowl and headed for home. One hour and 10 minutes later, we landed at Mojave and found that we had not used a perceptible amount of oil!!!

Here is my theory but, I hasten to add that I have no conclusive proof of anything at all. We have one of Wes Gardner's breather systems installed and we have run this system for more than 1500 hours without a problem. For those who may not be familiar with this system, it consists of a 5/8" I.D. hose that runs from the crankcase breather elbow to an anti-backfire valve welded into the exhaust system. There is a "T" fitting in this hose from which a 3/8" I.D. hose runs to an automotive PCV valve, and then to the intake manifold (in my case, a fitting is screwed into the Ellison throttle body in the venturi). At low power, the anti-backfire valve does not open and the crankcase breathes through the PCV valve and into the carburetor, then into the cylinders where the crankcase gases are burned in the cylinders and go out the exhaust. At higher power, the PCV valve closes and the anti-backfire valve opens. The breather gases flow directly into the exhaust system, are burned and expelled through the prop.

I later found that the anti-backfire valve had carboned up to about 80% blocked. I believe that the moisture, normally expelled from the breather, <u>froze</u> in the partially carboned and blocked anti-backfire valve. With the very low temperatures at Telluride, particularly at night, this moisture froze hard. Even though I warmed the engine until the oil temperature read 120 degrees F, this did not help because the breather system is located entirely on the "cold" side of the engine baffles. This means the cold air being pulled through the cowling during the engine warm-up kept the frozen breather frozen. The flight at 14500 feet (minus 20 degrees C) continued to keep the breather frozen.

With the normal crankcase vent (the anti-backfire valve) plugged, crankcase pressure built up and began to force oil out of the seals, as well as <u>through</u> the PCV valve, into the carburetor, up through the manifold and into the cylinders where it was burned and expelled out of the exhaust. I believe this continued at a rate of 6 quarts per hour, or 0.1 quarts per minute. In other words, the engine <u>burned</u> most of the oil while some of it leaked out of the seals. The small amount of oil found on the prop, on the engine and in the cowling supports this theory although, to be honest, not everyone agrees with this hypothesis.

The temperature at Black Memorial airport was cold enough so that the frozen blockage did not melt. The temperature at Boulder City was in the low 80's - this finally melted the frozen breather ice and so we did not use any oil from Boulder City to Mojave.

I replaced every part of the breather system, new hoses, new PCV valve, new anti-backfire valve. I did not find anything wrong with the original parts, for what that is worth. I ran a 3/8" drill through the carboned up anti-backfire valve mounting and was surprised at the amount of carbon that came out. In the 40 hours flown since this incident, oil consumption has been normal (about 1 quart per 14 hours).

I intend to keep on using Wes Gardner's breather system. It has given excellent service for hundreds of hours. **I will, however, do two things differently from now on. I will check the carbon build-up and clean it out every 100 hours and, I will pre-heat the engine compartment before starting it if it has been left out, overnight, in sub-zero weather. I would recommend that anyone using this breather system do the same thing.**

I would value any and all opinions about this incident. Has anyone else out there has anything like this happen to them?

Mike Melvill

****From CP75-3&4 (CH30,CH38)****

LEAKY MA-3 CARBURETOR?

Once upon a time, I believed that OEM (original equipment manufacturer) made parts were the only reliable way to go. After all, if they made it originally, they should be the best equipped to make the replacement parts and have their good name, and day in court, to gamble if the parts are defective. This fairy tale usually ends with "and they all lived happily ever after". Reality is a bit different, I found recently.

My 0-235-C powered Long-EZ has over 1000 hours on it with the same badly worn MA-3 carburetor which was on it at first flight. I decided it would be a good time to comply with all the service bulletins and replace the throttle shaft, 2 piece venturi, and finally, change from the composite float.

Two hundred and seventy-five dollars later, I replaced the freshly overhauled carburetor and turned on the fuel pump to leak check the installation. I was amazed to see fuel pour out the overflow hole at the bottom of the venturi. I returned the unit to the overhaul facility where the mechanic disassembled it and declared it was OK and to try it again. I installed the carburetor and the mechanic decided the needle and seat must be leaking. Sixty dollars later, I put the carburetor back on again. (I'm getting better at carburetor R&R.) Once again, the unit leaked like a sieve. I returned the unit and told the mechanic to lower the float level below what the OEM specified.

The lower float level helped. It passed the pressure test in the hangar. I took the airplane outside and started it up with great difficulty. After a 5 minute run, I shut the engine down and watched fuel run out of the carburetor again. By then, I was assured that Mr. Marvel and Mr. Schebler didn't know who their fathers were.

The mechanic said he had no idea what was wrong and left me to thoughts of getting my glider rating dusted off.

A chance encounter with Bob Wilson of the Ayling & Reichert Company, which manufactured the floats for Precision Airmotive, revealed the reason for my problems. It seems that Marvel-Schebler-Facet-Precision Airmotive are not manufacturers of anything. They just assemble parts that are produced by other manufacturers. I discovered the float I bought for $125.00 from Precision had been sold to them by Ayling & Reichert for $6.00. Who says there is no money in aviation?

I was told that Precision told Ayling & Reichert to manufacture a batch of floats and supplied original drawings. The newly manufactured floats did not fit in the carburetors and, consequently, stuck. Careful dimensional checking by Ayling & Reichert assured that their floats did agree with the Precision Airmotive supplied drawings. The only variable left was the carburetor bowl casting. Ayling & Reichert measured an assortment of MA-3 castings and discovered they varied widely. It was discovered that the original castings were made using badly worn tooling and that each carb casting was slightly different from the previous one. The end effect was that each newer carburetor had a slightly smaller fuel volume and less clearance between the float and the casing walls. I was told Precision Airmotive was informed of the wide dimensional variation problem but insisted on producing the floats to the original plan. Because of this, some MA-3 carburetor floats stick, thereby, causing leaks and very rich mixture settings.

The mixture can be so rich that the engine will not develop full power and runs very roughly. I've heard of cases where pilots have made precautionary landings because the engine was running so roughly that stoppage was predicted. I wonder how many "Engine lost power" accidents can be attributed to sticking floats in these FAA approved carburetors.

Now that the cause is apparently known - what is the fix? Bill Smith of Consolidated Fuel Systems had Ayling & Reichert make a batch of floats that supposedly do fit and work in the MA-3 carburetors with the undersize float chambers. Call him at 205-286-8551 or information.

To fix your existing Precision Airmotive float system, you might try Bob Wilson's suggestion. First, you need to determine where the float is sticking and then increase the clearance so it does not touch in the future.

To do this, you must remove the carburetor and drain it completely. Paint the float with Prussian blue toolmakers ink then reassemble and shake like crazy in all direction. Remove the carburetor top and look to see where the ink has been applied to the casting wall. Those spots are where the float has been touching. Clearance in those areas needs to be increased. I elected to Dremel the inside of the casting and then polish with succeedingly finer abrasive papers. Repeat the blue ink procedure until no more float contact is observed.

I suppose one might also alter the float but that is pretty risky business as leaks are easy to get and hard to fix.

I tried the trick of grinding out the inside of my float bowl and reinstalled the carb, knowing I'd finally solved the problem. Guess what? It still leaked.

I then screwed a fitting into the float bowl drain and rigged a clear tube sight gage to it so I could monitor fuel level while the carb was under pressure. I found the fuel level was moving swiftly up to the desired level and then SLOWLY moving higher and higher until it overflowed out the float chamber vent.

That indicated the brand new Precision Airmotive needle and seat assembly must be leaking. I replace it with an STC'd Consolidated Fuel Systems part and, PRESTO, the fuel level stayed right where it should have stayed. Ahh, so much for OEM high priced parts. Or so I thought.

I took the airplane out to run it up and it worked fine. I cowled it up and tried to start it. It acted too rich - and then I saw the puddle of fuel again!

I then sent it away to one of those high dollar repair places and for $158.60, I found the $3.00 clip that holds the needle to the float assembly was at fault. It no longer provided proper alignment between the needle and seat. I reinstalled the carb and it seemed to work properly. I now have two flights on it and nothing is running out the bottom of the cowl. Could it be the problem is solved?

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****From CP75-4,5&6 (CH38,CH39)****

<u>*SUCKER HOLE*</u>

For several years, when two or more clouds are in the sky, we have heard the Flight Service Station weather briefer say "VFR not recommended". And since this started, I have shouted that they are crying "Wolf". Any experienced pilot knows the briefer is practicing CYA and most briefers are not pilots. So for years, we hear and ignore. Eventually, someone is going to get into trouble, maybe killed and "pilot error" will be the cause as "VFR not recommended" will be on the tape.

Thursday, July 30, 1992

My flight is from Tallahassee to Oshkosh with a lunch stop at Huntingburg, Indiana. The Tallahassee Flight Service weather briefer warns of two frontal areas, one over Chattanooga, TN and one extending from Champaign, IL to Ohio across my route. "VFR not recommended" is read like a Miranda notice. Haze and two miles visibility at TLH means a special VFR departure; no problem. I climb quickly to 6500 feet and head north. Cloud cover below soon becomes solid. At Chattanooga, I am VFR on top. Flight watch informs of the frontal activity from Champaign, IL to Ohio with many thunder storms across my route. "VFR not recommended" results in a "Roger" acknowledgement. The Flight Watch briefer adds, "You are not going ahead, are you?". Another "Roger your information, thanks" ends the discussion. Soon the solid cover breaks and I land at Huntingburg after four hours, thirty minutes flying from Tallahassee.

A microwaved sandwich, some fuel, and I climb to 8500 feet, anticipating the need soon to reach 10500 feet to pass over the Chicago TCA. From west to east, as far as I can see ahead are towering cumulonimbus formations, perhaps ten miles apart. As I approach Terre Haute, IN, I see no breaks in the line. Where a CB ends, solid clouds with light to moderate rain fill the gaps. Turning westward, I head sixty or seventy miles toward Champaign, which is reported to be the end of the easterly moving frontal activity. However, I see blue sky through a gap in the line of CBs at my altitude and I turn into my personal "sucker hole".

Light turbulence and light rain cause me to glance down to pull on carburetor heat, reduce throttle setting, stabilize the aircraft, and slow the Long-EZ to the maneuvering speed of less that 120 knots. The I glance at the altimeter. Instead of 8500 feet, it indicates 13400 feet. Up a mile in seconds! Suddenly, I see lightning off my left wing. The VSI is pegged at 2000 feet per minute, worthless! Now I move the throttle to idle and the nose down ten degrees for an airspeed of 110 knots. The light rain becomes heavy rain, then hail. The turbulence is minor; the altimeter slows at 15600 feet. An ascent of a mile and a half in seconds means the updraft is over 100 miles per hour! There is no sensation of the vertical speed. The plane seems to be flying at 110 miles per hour straight and level. Yet, what goes up . . .!

As the plane passes from the 100-plus mile per hour updraft into the compensating down draft, the sharp shear force is tremendous. The plane shudders, as if it has hit a solid wall. Negative G-forces cause everything in my shirt pocket to fly out; the ELT pops out of the clamps holding it in place. In spite of a tight seat belt, my head hits the canopy. During a flight from Bogota to Panama on AVIANCE Air Line, I experienced CAT. Passengers and hand luggage flew through the cabin but this hammering shock of the sharp wind shear is far, far worse. The shuddering of the aircraft is the heaviest shock I have ever felt in a plane, so bad I do not expect to see the wings still attached. My first thought is "If this is it, so be it". This is interesting, as I never use this expression. My second thought is "Thanks, Burt Rutan for designing a strong aircraft, and thanks Tom Caywood for building to specifications". The rest is anti-climatic as the down draft takes back the free ride up and I enter clear air at 9000 feet.

Using Rich Domke's hand held VOR, I find Mattoon, IL and stop for the night.

After climbing out of the Long-EZ, I was shocked when I saw the hail damage to the leading edges of the canard and wings and the amount of paint removed from the landing struts and winglets. Immediately, I walked to the rear to inspect the prop. By the time I entered the hail, I had pulled the throttle back to idle. With little or no thrust or drag, there was no wood damage. The urethane leading edge of the wood prop eroded slightly along the outer ten inches. Close visual inspection of the EZ revealed no signs of cracks or stressed structural areas from the outside.

Early Friday, July 31, I flew out of Mattoon to Oshkosh. The damaged canard destroyed almost all the laminar flow, requiring full aft trim and some positive stick pressure to maintain straight and level flight. At Oshkosh, I talked to Burt Rutan about the hail damage.

Burt, Mike, Bruce Tifft and I were all parked together. Mike held an informal discussion and information exchange session for Rutan builders and flyers at the Defiant every day at 1:30PM. After the Saturday meeting, he examined the aircraft and reassured me concerning structural damage. **Then, he advised me to flox the holes where the hail cut through to the foam and apply micro to reform the leading edges of the canard and wings.**

Bruce Tifft showed everyone how great his prop resisted the forces that destroyed the leading edges of the wings and canard. He also advised me to sand lightly with a fine grit paper to restore the polish to the urethane leading edge.

CONCLUSIONS:

The hole revealing the blue sky had ample room for the plane to fly through. The surrounding rain and clouds were very light in color, not the dark mass normally associated with cumulonimbus and severe thunderstorms. No lightning was visible from outside the clouds. The thunderstorm was imbedded. Yes, I was suckered.

Once the hole closed, I should have made an immediate 180 degree turn to exit. Then I could have continued VFR westward to pass the end of the line or find an airport and land until the weather improved.

Never let the urgency or desire to arrive at the destination interfere with flying judgment and decisions. Respect the the power of nature. Do not let the attraction of a light, thin area of clouds and light rain prevent thinking rationally. There may be a "sucker hole".

Due to the tremendous sharp wind shear between the strong updraft and down draft, I do not believe an aluminum light aircraft could have withstood the abrupt shock of the shear force encountered. The impact was incredibly severe.

AL Hodges
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305-551-0384

****From CP75-6&7 (CH38)****
HURRICANE ANDREW - (Before dawn, Monday, August 24, 1992)
On Sunday, August 23, 1992 several of us gathered at Tamiami Airport (Miami, FL) to store our planes in a hangar to avoid damage from the impending storm.

"Why did Florida Power and Light fly out instead of storing their jet in their hangar?", I asked Bob Hitchcock, manager for the FBO, Jet Center.

"Would you leave a $10 million jet in a hangar built by the lowest bidder?". I laughed. By Tuesday, it was not funny.

Sunday, we carefully eased the planes into the Jet Center hangar. All the way back against the wall was a beautiful SNJ. My Long-EZ and a Swift filled the back row, nestled but not touching. Each plane was chocked. A Cessna 180, a 172 and a Twin Comanche filled the next row. Then another 172 was eased into safety and steel doors closed to protect our planes. By Tuesday morning, Tamiami was a total disaster. Every hangar except three were destroyed. Approximately 500 airplanes were totaled, later to be piled up in a scrap heap. Driving around the airport caused a big knot in the pit of my stomach. Perhaps 20 to 30 airplanes were flyable, an equal number repairable. Approximately 0.5% of America's total air fleet was wiped out, including the hangars and aircraft in Kermit Weeks' museum. His B-17 came to rest about a mile from the museum hangar. A C-46 ended upside down about a third of a mile from its parking place.

The Jet Center hangar, facing the hurricane, had the steel doors blown away and panels in the rear forced open, letting the full power of the storm flow through the hangar. All planes were pushed back to less than half the hangar floor space. The SNJ was pushed up the back wall, stopping when the tail went through the roof and the propeller was resting on the floor. Blue paint covers part of the Long-EZ upper wing surface, left by the SNJ as it scraped across the top of the EZ wing. The 180 was totally destroyed and the pressure of moving and compacting of scrap aluminum forced the 180's crushed wing under the EZ. This lifted one EZ wheel off the floor and delaminated a few square feet of the lower wing surface, but there seems to be no spar damage. Both rudders and winglets took a beating from flying debris and the bashing from the remains of crushed aircraft. The right wheel was doubled under at about a 30 degree angle. The remains of the Swift scraped the paint off one strut and one layer of glass on the strut is delaminated. No canard damage, no prop damage, no cowling or engine damage, and only cosmetic damage to the fuselage except for a broken canopy.

After removing the aluminum scrap blocking access to the EZ, I was able to walk the plane from under and behind the SNJ wing. When the pieces of the 180 were dragged from under the EZ, the wheel snapped back to its normal angle. Unbelievable! EAA Chapter 620 members, Mike Chenoweth and John Taylor, helped remove the canard and wings. Then, we loaded the bruised bird on a trailer and hauled it to my house for repair. Perhaps by Christmas, I will be flying again. Bruce Tifft can show everyone how his propeller stood up to Andrew and hail.

As a supplement to the "Sucker Hole" storm incident going to Oshkosh, I quickly checked for any crushing or cracking around the wing bolts after removing the wings. What a relief to find no signs of any damage or stress cracks. Again, thanks, Burt Rutan, for designing a strong aircraft. During 30 days, this Long-EZ suffered extreme stress and strain.

Now, let's continue to plan for the flight around the world next May through July.

Al Hodges

****From CP75-7 (CH13,CH38)****
DAVENPORT SHIMMY DAMPER UPDATE
I'd like to report on a letter which was received from Mark Buxbaum of Richland WA. It seems, after making a series of "not so good landings" last summer, he experienced catastrophic shimmy on landing at Dubois, WY. This occurred with the Super Shimmy Damper installed!! After replacing the nose gear assembly with another complete assembly, including a Super Shimmy Damper, Mark continued on his way to Oshkosh with no further problems.

On returning home and checking over the failed nose gear assembly, Mark discovered he had bent the wheel disc on one of those "not so good landings". Run-out was found to be .020" which be believes drove the nose wheel to oscillate beyond the capacity of the shimmy damper.

If that is correct, then we should all check our nose wheels for run-out regardless of the type of shimmy damper installed.

Mark did not indicated which type of wheel was installed, but my guess is his unit was of the single center disc type with the overhung wheel bearings. This wheel is very prone to bending and failing under a side load and could possibly provide a little excitement in your life similar to Marks' experience.

A far better choice would be a Gerdes nosewheel (part # NWA 1230 from Wicks). This wheel is made just like the main wheels and has proven to be very reliable in Mike's Long-EZ for more than 1000 hours.

I occasionally get requests for the Super Shimmy Damper from people who are near first flight. I feel I need to clarify the supply situation. I do not have a machine shop and, therefore, subcontract all parts to a high quality shop. I keep no inventory of parts or complete assemblies. I hold all orders until a total of 25 accumulate. That quantity is required to keep the delivered sale price to $71.48. All checks are kept until two weeks prior to shipping. Save yourself a disappointment by ordering the unit when you can afford a waiting period that won't disrupt your schedule.

Bob Davenport

****From CP75-7&8 (CH30,CH38)****
ANOTHER REPORT OF A CRACKED ENGINE MOUNT
W. A. Theeringer, Long-EZ builder/flyer, discovered several cracks in, or adjacent to, the welds on his engine mount. After 650 hours of flight, per the CP73 recommendation for inspection, hair line cracks were discovered. The engine mount was returned to Ken Brock where it was repaired. So far, with 10 hours on the repaired engine mount, he feels less low frequency vibration and the mount is holding up fine.

Do not neglect to inspect for cracks in your engine mount. This is very important. If you find any cracks, do not fly until they have been repaired by a qualified welder. Also, please send a report in to RAF.

****From CP75-8 (CH30,CH38)****

CRACKING EXHAUST SYSTEMS
Tom Caughlin reports that there have been several examples of his own exhaust system, as well as Hal Hunt's exhaust systems, that have cracked. If you own one of these exhaust systems, please check it for cracks before your next flight.

Contact Tom Caughlin for further assistance:
10958 National Blvd. #1
Los Angeles, CA 90064

Editor's comment: Seven years ago, I designed and built a four pipe exhaust system for my own EZ. It was essentially the same as what Tom Caughlin and Hal Hunt subsequently marketed. I had numerous failures, cracked pipes, cracked supports, all kinds of problems, some of which caused severe damage to my prop! My own solution was to weld a Brock ball joint into each of the four pipes which allowed some movement in the exhaust system. The pipes were connected in pairs with a slip-type connection. (Not welded together). This system has been in service for over 1000 hours with only a couple of minor cracks and no loss of pieces - and no damage to the prop.

Any four pipe exhaust system would have slip joints or Brock ball joints in each pipe. If not, they will crack. Check yours before next flight and get it fixed.

Blank

Update Number 76 to Supplemental Chapter 38 Maintenance and Inspections

****From CP76-3 (CH33,CH35,CH38)****
CP ADVISORIES AND RECOMMENDATIONS
These are for your protection. All that RAF can do is tell you. It is up to you to comply for your safety, as well as any passengers you may take up. Keep your aircraft TOTALLY up to date on all CP advisories and recommendation.

Not everyone who is flying a RAF design receives the CP. If you know of anyone who may not read the CP, make it your business to get involved, lend him (or her) your CPs (or copies of the CPs - we encourage copying the CP). The whole purpose of the CP is to help you fly as safely as possible.

If anyone knows of a condition that may have developed over the years or of any unsafe situation, PLEASE send us a letter detailing the problem. Help us to get the word out.

****From CP76-4 (CH30,CH38)****
PROP BOLT TORQUE
Not again, you say? We are all well aware that there have been many admonishments in the CP over the years regarding the critical importance of correctly torquing your prop bolts, and of doing this often, and at regular intervals.

Recently a friend borrowed a wood prop from an EZ builder in a state where the moisture is much higher than it is here in Mojave. This prop was installed, the bolts were torqued to the recommended value, the bolt heads were safety wired. After only about 30 hours of flight here in the dry desert air of Mojave, this friend discovered that the safety wire had broken and that all six prop bolts were loose enough to be able to turn the washers under the bolt heads with his fingers! What happened? This prop lived for a couple of years in a damp climate. The wood absorbed some of this moisture and swelled a little. After a few weeks in the dry climate of Mojave, the wood lost most of this excess moisture and shrank. The bolts were no longer squeezing the prop between the crush plate and the prop extension flange. The prop began to move just a little, causing the face of the prop to char slightly. The bolts began to unscrew themselves and it literally would not have flown more than a few more minutes before this prop would have come off the airplane.

Wood props, used correctly and properly maintained, are very safe and have an excellent safety record over many years. **However, the torque on the prop bolts must be checked regularly. If you have a new prop from a wetter climate than where you live, check the torque every 10 hours for the first 100 hours. Once the prop settles down, you can extend these checks to every 25 hours. Do not omit this simple safety check. It could be extremely costly if you do.**

****From CP76-5&6 (CH21,CH33,CH38,CH39)****
A VariEze crashed on departure from the Kansas City GIG on June 13, 1993. Since there were a lot of EZ builders and flyers on the field at the time, a rather extensive investigation was conducted on the spot, not only by FAA/NTSB personnel, but also by several EAA members, all of whom are very familiar with EZs. Tragically, two people died in this accident.

By all accounts, the airplane was refueled some time prior to take-off. The fuel caps on this particular VariEze were not the plans-recommended Brock-type fuel caps. They were the "Thermos" expanding 'O' ring-type. **This type of fuel cap requires regular lubrication of the 'O' rings at 25 hour intervals. If this is not done, the 'O' rings will crush and crack and, even though you may have the locking tab down and "locked", the cap in fact will not be locked!**

Shortly after take-off, the engine was heard to surge and loose power. The airplane began a 45 degree bank turn to the left. After completing 90 degree of the left turn, the nose began to drop and the aircraft impacted in a ploughed field, 30 degree nose low in a 45 degree left bank.

The investigators located all airframe parts except for the tip of one blade of the prop and the right fuel cap. The next day, parts of the fuel cap and pieces of the wood prop blade were found near the center line of the runway on the airport. This verified the theory postulated by the investigators that a fuel cap had come off and gone into the prop disc, breaking the prop. The resulting heavy vibration probably caused the pilot to pull the power back. For some reason, he elected to try to turn back to the runway. With little or no thrust, a heavy airplane in a steep bank (which causes high inducted drag) simply got too slow to fly and descended to the ground at a high sink rate.

It is too late for the couple in this VariEze but it is not too late for all of us who fly to learn from this tragedy. **If you are flying a RAF design and have not complied with the CP advisories recommending you chain your fuel caps to the filler neck - do not fly again until you have corrected this omission. If the fuel cap on this VariEze had a chain to retain it, this accident would not have occurred. Please check your back issues of the CP for more information about chaining the fuel caps to the filler neck. See CP28, pg. 7&9; CP 31, pg. 5; and CP50, pg. 5&7.**

Another lesson we should all learn from this accident is the problem of trying to make a 180 degree turn back to the runway while low and slow. A landing straight ahead into the wind (which was 15-20 knots that day) even if near the end of the runway, is much more likely to be survivable than a landing with a 15-20 knot tailwind. Think about it. Assume 100 knots airspeed. With 20 knots of headwind, your ground speed would be 80 knots. Downwind, it would be 120 knots! The kinetic energy in a downwind landing, in this case, is 2.25 times as high as it would be in a upwind landing. This could turn a survivable 15 "G" impact into an unlikely-to-survive 34 "G" impact! This assumes that you have not caused a higher sink rate due to the extra drag in the steep turn!

Please read this accident report and never forget the lessons learned. It is much, much better to land long, into the wind, and roll off the end of a runway at slow speed, even if you have to negotiate obstacles, than to land off field, downwind, at high speed.

****From CP76-10 (CH9,CH38)****
THE "BEAD BUSTER"TM
If you have ever tried to remove a tire from a 500x5 wheel you will understand what a neat tool this is. (Mike purchased one of these tools and wonders how he ever got along without it!) Designed by a Long-EZ builder who became frustrated by this problem, the kit consists of a canvas pouch, a vulcanizing patch kit, cadmium plated fulcrum lever and base, and the heat treated aluminum "Bead Busting" shoe - $75.00.
Contact: Tom Caughlin
10958 National Blvd. #1
Los Angeles, CA 90064

Update Number 77
to
Supplemental Chapter 38
Maintenance and Inspections

Information derived from CP77 published by RAF Jan 1994

From CP77-5 (CH9,CH38)

TIRE WEAR

Over the years, we have seen EZ's, Defiants and even Viggens with horrendous wear patterns on the tires. Regardless of the original main wheel alignment method used during construction, in the final analysis, the wear pattern on the tires tells it all.

Ideally, the main tires should wear evenly across each tire. They should not wear on the outside or inside shoulders. If your tires are wearing unevenly, fix the problem, don't just accept it as inevitable. If the rubber tread is wearing heavily on the outside shoulder, you have too much toe in. If the inside shoulders are wearing badly, you have too much toe out. To correct both problems, install aluminum taper shims as required between the axle flanges and the main gear strut. These taper shims are available from several sources including Aircraft Spruce and usually come in 1/2, 1 and 2 degree increments. These may be combined to give greater tapers if required. (They can be installed so as to remove excess camber as well, if required.)

We have found that it can take several iterations to finally achieve the even tread wear that is most desirable, but it can be done. Give it a try.

From CP77-5&6 (CH30,CH38)

CAUTION: FOD TO PUSHER PROPS

Foreign object damage to your EZ prop, such as a nick or gouge that you might tend to believe was gravel thrown up by the tires, probably is not from the tires at all but most likely is caused by something that fell out of the cowling (off the engine!). My 2100 hours of Long-EZ flight and over 700 hours of VariViggen flight have proven to me that almost invariably a ding in the prop, especially if inboard of 10 inches from the tip, was caused by something coming out of the cowling. A clipped end of safety wire, a washer, a nut, even a bolt and once an exhaust stud, nut and washer! My experience has shown that gravel/sand particles thrown up by the nose tire does cause tiny chips in paint and wood predominantly near the tips of a prop (the outboard 10 inches or so). The main tires seldom, if ever, cause anything to be thrown into the prop arc.

The point I want to get across is this: Any damage to your prop, heavier than sand and light gravel chips and generally inboard of 10" from the tips, is almost certainly caused by something falling out of your cowling and possibly off your engine. Do not ignore this type of damage, even if the prop damage is minor. Ground the airplane - remove the cowl and use a good flashlight to carefully and methodically check for missing screws, nuts, bolts, etc. You will be amazed how often you will find something missing. Over time, you will learn to be more careful about casually clipping a piece of safety wire and having it lodge in a wiring bundle on the firewall. Same goes for a dropped washer, nut or bolt. If it does not fall all the way to the ground - know that it lodged somewhere and will go into the prop disc sometime. With time, you will become an expert at finding lost washers in wing roots or in wiring bundles. Remember, the airplane will always try to warn you before it bites you! An unexplained ding in a prop blade is a warning! Pay attention - Fly safely. - ED.

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Update Number 78
to
Supplemental Chapter 38
Maintenance and Inspections

Information derived from CP78 published by RAF for April & July 1994

****From CP78-1&2 (CH30,CH38,CH39)****

WES AND MILLIE GARDNER, APRIL 1994

Wes and Millie were very good friends and will be sorely missed by all who knew them. On Monday, April 4, 1994, Wes took Millie for her first ride in their recently completed E-Racer. After only a few minutes, Wes called that he had a problem and was returning to the airport. Sadly, he did not make it and they were both killed in the crash.

Several mutual friends have investigated this accident and have reported a consensus that the throttle linkage separated, allowing the engine to return to idle. Unfortunately, idle power was not enough to allow them to return safely to the runway.

All of you who had met Wes knew him to be a regular at the Jackpot, Wendover and Kanab EZ races. He was a truly dedicated and extremely competitive pilot and loved racing of all kinds, including boats and cars. He was one of the first to fly with an Ellison throttle body and an electronic ignition system. His VariEze was not only beautiful, it was very fast! Wes set the fastest time at the Flying Kilometer in Chandler, AZ in 1990 and he was thrilled!

Wes and Millie were some of the kindest, most generous people we ever knew - until we meet again, fly high and fly safe, Wes and Millie.

****From CP78-2 (CH30,CH38,CH39)****

ENGINE CONTROLS

We have talked about this subject several times over the years yet many builders continue to do less than their best work in this area. Pay close attention, Guys: Your ability to control your engine is second only to your ability to control your airplane. You do your very best work on the pitch, roll and yaw control system and you should do the same for the throttle and mixture controls.

Before you do your first flight, and at regular intervals thereafter, get someone to help you check that the throttle and mixture controls do, indeed, move the appropriate range to the full throttle/full rich positions and also to the idle/cut-off positions without the use of any helper springs. If you cannot get the throttle and mixture controls to work satisfactorily without springs, consider going to push/pull cables. I realize this is a hassle, but not nearly as much of a hassle as losing control of your engine at a critical time.

I installed a push/pull throttle cable when I installed an Ellison throttle body almost 1200 hours ago. (This is a mandatory requirement when you install an Ellison and not a bad idea for any carburetor). I carefully measured to determine the exact length required, then ordered a custom-made aircraft push/pull cable from Aircraft Spruce. I removed the throttle lever from the Brock throttle quadrant and scribed around it onto a piece of 1/16" thick 2024-T3 aluminum, adding about 2-1/2 inches to the bottom of the throttle lever. This was band sawed out and deburred.

A small rodend, screwed and jam-nutted to the push/pull cable end, bolts to this lower end of the new throttle lever. The outer cable is secured to a bracket mounted on the inside of the left arm rest (I used a "u" bolt located in the grove machined in the end of the outer cable).

At the engine end, the outer cable fits perfectly into a bracket mounted on the Ellison throttle body (provided by Ellison) and the cable end has an aircraft-type ball and socket. The "ball" bolts onto the throttle lever and the "socket" screws onto, and is jam-nutted to, the cable end. The "socket" fits onto the "ball" and is held securely in place by a threaded insert that can be tightened onto the ball and is safetied with a cotter pin.

Exactly the same system can be used for the mixture control. There are many acceptable ways to obtain reliable engine controls. Just be certain in your own mind that what you have installed is fully functional and safetied so that it cannot possibly come undone or separate in some way. Have other builders or an A&P look at your work, the more pairs of eyes that check your system, the less likely you are to have a failure and a failure in this area is not acceptable and will almost certainly result in, at least, a forced landing. Never forget that!

****From CP78-2&3 (CH21,CH30,CH33,CH38,CH39)****
WATER IN FUEL
A recent off-field landing in a Long-EZ, fortunately with no injuries, forcibly brought to mind the ritual of checking for water at all the drains. A standard Long-EZ has a gascolator drain on the firewall which should be easily accessible through the cowling inlet. This should be drained before each flight, once the airplane is in the level position (on all three wheels). There is a water drain at the forward end of each main fuel tank and these must be drained before each flight but before the airplane is moved. That is to say, while it is parked in the normal nose down position. Do not lift the plane up to the 3-point position until after you have checked these two water drains. If you are in the habit of normally parking your EZ in the level, 3-point position (tying the nose down), you should consider installing low point water drains in each sump blister and then check them religiously before every flight.

Where does the water come from? Sometimes, but rarely, from the gas pump (or gas truck), very rarely, if ever in a composite EZ-type, from condensation in a less than full fuel tank. This is common in metal airplanes. That is why it is normal to top off the tanks in any Spam Can after a flight. Because the fuel tanks in any RAF design are insulated sandwich construction, they are similar to a thermos bottle and condensation does not normally form on the inside of our fuel tanks. The most likely way for water to get into your fuel tanks is a leaking fuel cap on an airplane left out in the rain. **The "O" rings on any of the commonly used fuel caps do not last forever. Far from it, in fact. Ozone, ultra violet light and many airborne pollutants attack these rubber "O" rings. Check them frequently and replace them as soon as you see small cracks in the outer edges of these "O" rings.**

Be especially diligent about checking your water drains if you have left your airplane out in the rain. Also, if you fly into an airport on one fuel tank with no problems, consider taking off and climbing to a safe altitude on that same, known to be free of water, fuel tank. Switch to the other (unknown) tank only after you have plenty of altitude to allow a safe return to the airport in the event water may be in this fuel tank. This philosophy is an old one but a good one. For the same reason, if anything untoward happens when you switch tanks, always switch back to the first tank before you try anything else.

****From CP78-4 (CH29,CH38)****
CAUTION
A Swiss Long-EZ builder/flyer reports finding the four bolts that attach the landing brake hinge to the fuselage badly corroded. He had removed the brake to install an electric linear actuator and found these bolts heavily corroded. He has been flying for 5 years and has 350 hours on his Long. A regular inspection of these bolts is recommended and this is especially important if you live near the ocean or in a wet climate.

****From CP78-4&5 (CH9,CH38)****
BRAKES AND MASTER CYLINDERS
EZ's require serious diligence when it comes to brake maintenance because the brakes are not only used to slow or stop the airplane, but they are the only means of steering while taxiing.

Recently, there have been two incidents involving brake failures resulting in loss of control, running off runways, through ditches, causing no injuries but seriously damaging both airplanes. The damage included ripped out landing gears, broken wings/winglets and even a broken canard.

Maintaining the brakes is absolutely essential to the safe operation of an EZ and is easy to forget or ignore because most EZ's have wheel pants fitted that hide the brakes. Make it a habit to routinely and regularly remove these wheel pants and carefully check the brake linings for wear. Look for any sign of hydraulic leaks. These will appear as a dark stain at the threads of a "B" nut or fitting. Do not use shop air to blow the dust out of the wheel, this dust consists of asbestos or asbestos-like particles which could be very harmful to your lungs over the long term. Rather, use a high pressure water jet (a garden hose) to flush most of the dust, then use a commercial brake cleaner in a spray can (available at auto parts store) to completely clean the entire brake caliper, brake disc and wheel. Replace worn brake linings and fix any hydraulic leaks. Allow the brake assembly to dry out completely before going flying.

If you have Nylaflow brake lines, you should change them out every year when you do your annual inspection. Nylaflow is easily damaged by ultra violet (sunshine) and is prone to damage from the radiating heat of the sometimes red hot brake disc. To be safe, change them out as often as necessary. I, long ago, went to Stratoflex Teflon/stainless braided brake lines and have never regretted this upgrade.

Brake master cylinders are all too often ignored. Every couple of years, or more often if you have a brake problem, you should remove and dismantle these critical parts. Replace any suspect "O" rings and thoroughly clean all the parts. (Denatured alcohol works well). Use a bright light and examine the bore of each master cylinder. If there is any scoring or other contamination such as rust, consider honing the bores prior to reassembly.

Aircraft hydraulic brakes are always filled from the bottom of the brake caliper. The hydraulic lines should run continuously uphill to the master cylinder to assure that the fluid drives all of the air out of the system as it is forced into the small brake bleeder on the lowest part of the brake caliper. Have an assistant watch for the fluid as it gets to the brake master cylinder or reservoir. They should do this using a flash light and looking through the small threaded hole usually plugged with a plastic plug.

If you have to do this job alone, you need to make up a clear plastic tube with a fitting on one end that will screw into the 1/8" pipe threaded hole in the reservoir. The plastic line should be long enough to reach out of the reservoir and down to a can on the floor. You must be able to see this plastic line as you pump brake fluid into the brake caliper. (I use a large trigger-operated oil can and it never gets used for anything else!). Continue to pump until you can see brake fluid flowing through the overflow line you have installed. Usually there are a few bubbles in this line. Continue to pump until there are no air bubbles. Now, as you are pumping, tighten the 1/4" nut that is the bleeder. Do not over tighten this nut, it only needs to be firmly snug. Remove the overflow fitting and plastic line and siphon a little fluid out, lowering the fluid level about 1/2" in the reservoir. I use a 3 foot length of Nylaflow to suck the fluid out. Be careful not to get any in your mouth, it tastes awful! Replace the plastic plug, be sure that it has a small breather hole (1/16" dia. is fine) drilled through it.

Careful maintenance is the key to safe flying - and don't forget, the airplane will usually let you know before it bites you. If you notice a change in your brakes, don't fly - fix it first!

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Update Number 79
to
Supplemental Chapter 38
Maintenance and Inspections

Information derived from CP79 published by RAF Oct 1994

****From CP79-3,4&5 (CH30,CH38)****
At Oshkosh this year, we were shown photographs of a prop extension that had failed, catastrophically, resulting in the loss of the prop and a forced landing that seriously damaged the E-Racer which, while not an RAF design, is a similar pusher. The pilot and passenger were not hurt.

The engine was a Lycoming 0-360, 180hp. The prop was a B&T prop and it was driven by a Brock prop extension 6" long with a 7" diameter flange at the prop end. The fracture started right in the radius between the barrel and the aft flange and propagated across the extension. This fracture has been characterized by experts as being a high cycle, fatigue failure. The total time on this prop extension (and on the aircraft) was 72 hours. What caused this failure? Is it something we should be worried about?

A little history may be helpful here. Several years ago, a good friend who was an excellent engineer and VariEze builder, Bob Beard, experienced a large vibration while in flight, shut it down and glided to a safe landing. He discovered that his 8" long prop extension had an enormous crack in it. (See photo). **PHOTOGRAPH OMITTED** He analyzed the prop extension and found that it was machined from 6061-T6 aluminum instead of the required 2024-T351 aluminum. This happened on his original design aircraft, the <u>Two-EZ</u>, a large four-place <u>similar</u> to a Long-EZ. He had a Lycoming 0-360, 180hp engine and a wood prop.

About the same time, Danny Meyer was flight testing his Velocity, also a pusher, when he had almost exactly the same experience Bob Beard had. It turned out that both prop extensions had come from the same source. Both were made from 6061-T6, both were 8" long and both were using Lycoming 0-360s.

The difference in strength between 6061-T6 and 2024-T351 is only 18-20% so although the wrong material may have been the cause of this problem, at least on an 8" long prop extension, 18-20% is not much margin of safety.

Bob Beard designed a prop extension that had a 4.5" diameter in the middle as compared to a 3.25" diameter on his previous extension. He sent this editor a letter and a drawing of his new design and said that this 8" long extension would be just as stiff as a standard Brock 4" long extension and that its natural frequency should occur above 4000 rpm.

We purchased a billet of aluminum (2024-T351) and machined a 9" long modified Beard design which has a 5" diameter in the middle and which has been tested. in flight, to show that peak stress occurs at an rpm that is out of the normal operating range of the engine. The problem with this design is that it does not lend itself to economic manufacture.

We have borrowed a torsional order analyzer. This is a magic box that has a built-in x-y plotter and receives a signal from a magnetic pickup which is mounted close to the teeth on the starter ring gear. Basically, this machine measures the speed of each tooth passing by the magnetic sensor. As the engine drives the prop, it speeds up and slows down with each firing stroke and each compression stroke, this causes the crankshaft, prop extension and prop assembly to twist like a spring. This "spring" winds up and unwinds many times per second as the engine drives the prop. Now, obviously, the magnitude of this windup/unwind action is very small. In fact, this machine measures the rotational displacement in milidegrees, that is to say, thousandths of degrees. One of the uses of this machine is to determine if an engine/prop combination should have a "yellow arc" on the tach. A Grumman Tiger, for example, has a "yellow arc" from 1500 - 1800rpm. This means that the pilot should not operate within this yellow arc. He may pass through it in either direction but must not fly within the yellow arc.

We are concerned that there may be a yellow arc on some of our RAF designs and we have spent many hours flying several airplanes and a bunch of different engine/prop extension combinations. We have talked to experts in this field and the consensus is that a light weight, low inertia, wood prop simply cannot damage a Lycoming aircraft engine - good news! Introduce a prop extension, particularly an aluminum, spool-type, prop extension, and maybe you can have a problem! It turns out that a spool-type, aluminum extension is relatively soft, torsionally. It also turns out that a crankshaft, prop extension, prop assembly is what is called a first mode shape. This means there is only one node (a node is a point where there is no action or movement - if you grab a spring with one hand at each end of the spring and twist it, someplace in the spring, there is no movement - this is the node). It further turns out that the node in this assembly usually occurs between the crankshaft flange and the propeller. That is to say, most, if not all, of the twisting we are measuring takes place within the prop extension.

With all of the above in mind, we set out to run in-flight tests on Long-EZs with Lycoming engines, 6" long prop extensions and wood props. An 0-235 powered Long-EZ categorically does not have any measurable problem with a 6" aluminum spool-type prop extension. The same is true of a pusher, such as a Defiant, with an 0-320 and a 6" prop extension. It may not, however, be true that an 0-360 with a 6" aluminum spool-type extension on a pusher is as free of problems. (A Long-EZ with any engine larger than a Lycoming 0-235 is not approved by RAF).

We have not fully analyzed all of the data and we plan on generating a finite element model to help with this analysis. At this time, we are unable to say (as we can with the 0-235 and the 0-320) that a Lycoming 0-360 with a 6" or longer prop extension on a pusher-type aircraft is completely safe. Some facts: If you are in the market to buy a Lycoming 0-360 (for your new Defiant), we strongly advise that you purchase one that is equipped with a 6th order damped crankshaft.

We have designed, and are testing, a couple of prop extensions that show promise to eliminate this problem, however, there has been only one failure of a Brock prop extension with many hundreds out there in the field accumulating hundreds and, in some cases, thousands of hours. We will continue to test and evaluate and keep the builders and flyers informed.

The prop extension that did fail had three strikes against it. First of all, the radius between the flange and the barrel of the spool-type prop extension was too small. Other prop extensions we have examined, including several other Brock extensions, have 1/4" radii. The failed extension had only a 3/32" radius (less than half the normal radius). Also, in this radius, there were machine marks, tool "chatter" marks, in fact. Expert opinion says that chatter marks in a highly stressed part are bad news. These chatter tool marks are longitudinal "ridges" and are torsional stress risers. Also, the forward face of the prop flange was in the same plane as a change of inside diameter and this area had a sharp radius.

None of these features are good news - all of them in one prop extension are probably bad news. Add to that the possibility of a slightly out of balance prop and then throw in the possibility that the engine/prop extension/prop may have been running in resonance causing maximum stress in the aluminum prop extension.

The torsional order analyzer shows the rpm at which peak stress occurs, if there is such a point. We tested a long-service Brock 6" long prop extension on a Lycoming 0-360-A4A, 180hp engine (with no 6th order dampers) and measured a peak torsional displacement (windup) of 20 milidegrees at 2770rpm, yet at 2500rpm, the peak displacement was only 3 milidegrees. Running continuously at 2770rpm in this pusher aircraft would probably fail this prop extension. This same test was done using all the same parts, but with a Lycoming 0-360 with 6th order dampers installed, and the peak displacement was only 3-1/2 milidegrees!

With our modified Beard prop extension, these numbers changed significantly even with no 6th order dampers. Peak displacement is only 12.5 milidegrees at 2870rpm! (At 2770rpm, maximum displacement is only 6 milidegrees). This data is all the more impressive when you consider that this prop extension is 50% longer than the 6" Brock extension.

We have designed, and are having made, a 6" long prop extension that we believe will eliminate any problem associated with the 0-360 Lycoming. It has not been tested yet and is not available at this time. We will report on its performance in the next CP.

We would like to state that a correctly designed prop extension should run virtually indefinitely because peak stress would be below the maximum allowable stress. This is the key to the whole problem - the maximum allowable continuous stress must not be exceeded.

We have had the cooperation, not only of Ken Brock Mfg. in this endeavor, but also of Woofter Manufacturing (formally Woofter Custom Metal Fabrication) of Pembroke Pines, FL. We would like to thank Judith Saber of Woofter Mfg. for all of her help. She has machined and sent to us for testing five different prop extensions and she is currently machining a proprietary design which we hope to test soon. If you have not seen a Woofter prop extension, you are in for a treat! Judith runs the CNC lathe and machines all of the various prop extensions sold by Woofter Mfg.- and all of them correct the problems mentioned in this article. The radii are at least 1/4", there are absolutely no machine marks of any kind, and the I.D. has a really clever "S" curve transition from the smallest diameter to the diameter that fits your crankshaft. The workmanship is absolutely first-class and we are very happy to report that just as we were going to press with this CP, Ken Brock Mfg. has decided to order prop extension from Woofter Manufacturing. Stay tuned!

From CP79-10(CH30,CH38)

MANDATORY INSPECTION BEFORE NEXT FLIGHT.
If you use a 6" long or longer prop extension, remove the cowling and spinner and carefully inspect the prop extension using a strong light. Look for machine tool marks (chatter marks) in the two radii or a radius smaller than 1/4" or hairline cracking in the anodized finish in the radii. This is particularly critical if you have a Lycoming 0-360 engine. Discovery of any of these flaws is a ground-the-airplane problem. Contact RAF with a detailed description of your problem.

From CP79-13(CH30,CH38)(PHOTO CAPTIONS)

Left to right: Woofter Mfg. prop extensions; 6" long, 8" long, both with 7" dia. prop flanges in bare aluminum. Normally these extensions are black anodized. 9" long Bob Beard/Mike Melvill design has 7" dia. prop flange but the dia. in the middle is 5" as compared to 3-1/2".

This is the failed prop extension. Failure occurred at the radius where the 7" dia. prop flange intersects with the 3-1/2" dia. barrel.

Bob Beard's original 8" long prop extension made from 6061-T6 aluminum.

From CP79-5&6 (CH30,CH38)

<u>WOOD PROP FAILURES</u> Reprinted from: CLEAR PROP, the newsletter of EAA Chapter 49, Lancaster, CA.
Recent calls from Texas informed us of two Warnke wood props, installed on 180hp RVs, which cracked in flight. There was no perceptible vibration and the damage was not realized until the airplane was back on the ground. Both props were "high aspect ratio" models. Both cracked chord-wise, across the laminations, about 12" from the spinner, right where the urethane leading edge protection is routed into the wood. One prop had been in service 70 hours, the other 130.

Just as we were going to press, we learned of another failure involving a Warnke propeller. We contacted Mr. Warnke and, after some research, he found that this prop was a prototype and no others of the type were in service. (In this case, the blade failed completely on a 160hp RV-4 after 40 minutes of service and no operation above 2400 rpm. About 2/3's of the blade broke off and struck the right elevator, damaging it severely. The lower cowl was also badly damaged as the unbalanced engine thrashed around, but the pilot, in an excellent piece of flying, was able to maintain control and glide to a safe landing at an airport.

We don't know and can't speculate why these failures occurred, but since there seems to be a pattern forming, we felt that all users of the Warnke "narrow blade" prop should be aware that they have happened. We talked with Mr. Warnke and he assured us that he will be doing everything possible to find the cause. Meanwhile, he suggests extra care on both pre- and post-flight inspections. He also noted that, for other reasons, the "high aspect ratio" prop is no longer in production. There are hundreds of these props in use, some with over 500 hours.

From CP79-6 (CH9,CH38)

<u>DOT 5 SILICONE BRAKE FLUID</u>
We recently received our second letter regarding a problem with the silicone brake fluid, this time in a Defiant. John Rippengal, who built and flies his Defiant in Cyprus, found that after 4 years of use, he had a leak at the caliper on one brake. He dismantled the calipers and found that the 'O' rings were sticky and showed signs of roughness.

Some time ago, we received a letter from a Long-EZ builder with similar complaints. At that time, we recommended a complete tear down of the brake system, including master cylinders, and a complete and careful cleaning of all parts before installing new 'O' rings and new DOT 5 brake fluid.

DOT 5 brake fluid is 100% silicone. Silicone is an inert material and should not react with any other material, however, <u>maybe</u>, when mixed with red aircraft brake fluid, it does slowly attack the 'O' rings.

In spite of these problems, we still believe that DOT 5 silicone is safer because it is <u>not</u> flammable. Normal aircraft brake fluid is highly flammable. There have been several brake fluid fires reported in Ezs and one in a Defiant. So far, we don't know of anyone having lost his or her airplane, but it has been close a couple of times. Since silicone can not burn, we feel that even if it requires a complete cleaning and 'O' ring replacement every 3 or 4 years, it is worth it. Mike Melvill has been using DOT 5 silicone brake fluid for almost 10 years. About four years ago, he did a complete tear down and replaced all 'O' rings, including master cylinders. At that time, he did notice what appeared to be rust in the master cylinders. It was very thin and cleaned up easily using 3M Scotch Bright. He has had no brake problems before or since. We know of several antique-ers who fly J-3 Cubs, etc. who have used only DOT 5 silicone for more than 15 years with no problems.

If anyone experiences a problem with silicone brake fluid, please let us know so that we can share it with others. Also, if anyone out there knows of a different 'O' ring material that perhaps should be used, please drop us a line.

****From CP79-7(CH30,CH38)****

LETTERS

"RAF,

During a recent annual inspection, I found the rubber valve portions of my ACS carb heat box to be deteriorated to the point of separation. As you can see by the enclosed sample, it is obvious that a portion of the rubber is about to separate and could have been ingested into the engine causing a possible engine failure.

I purchased the carb heat box for my 0-235-L2C-powered Long-EZ from ASC in 1986 and my first flight was June of 1991. I had logged 450 hours on the airframe when the problem was discovered. I have since replaced the torn rubber with red silicone baffle material and it works fine.

I am writing you about this dangerous and potentially fatal situation so that you might follow-up and inform other ASC customers who may have bought this unit about the obvious flaw.

Sincerely,

Frank Nowak"

****From CP79-8&9(CH21,CH33,CH38)****

STATIC FUEL FLOW CHARACTERISTICS

We often receive inquiries as to what the acceptable static fuel flow is on an EZ or Defiant. While draining all of the fuel prior to installing new fuel caps into his Long-EZ recently, Mike took the opportunity to carefully measure the fuel flow. Here are the results: The fuel line was removed at the carburetor and run into a container. The fuel was allowed to flow for 6 minutes, exactly, then the container was weighed and the fuel flow was calculated. This was done with the in-line boost pump off, and with the boost pump on.

With 12 gallons in one of the tanks, the free flow with the in-line boost pump turned off, was 7.1gph. With the pump turned on, this increased to 21.1gph. With only 2 gallons of fuel in a fuel tank, the free flow, boost pump off, was 5.3gph, with the boost pump on, it increased to 19.8gph.

This airplane has a Lycoming 0-360 engine and the fuel supply to this engine has been very adequate over the past 1400 hours <u>without</u> the boost pump running, and at altitudes from sea level to 27000 feet. If your fuel flows are at least this good, you have nothing to worry about.

This test should be carried out by anyone who is preparing to fly a new airplane. Check the flow with 10 to 12 gallons in either fuel tank, boost pump on and off. Then repeat the test with a minimum fuel, such as 2 to 3 gallons. If you do not have flows similar to the above, you probably have a blockage in the fuel lines somewhere and this should be corrected <u>before</u> you attempt your first flight.

Mike ballasted the airplane so it was level on all 3 gear (not parked nose down). His fuel valve is between the pilot's legs, exactly per the plans. His boost pump is <u>in line</u> (all the fuel must go through the Facet fuel pump) per the plans. The only addition is the presence of a flow-scan fuel flow transducer between the engine-driven, mechanical fuel pump and the carburetor. This transducer was left in place for this test.

****From CP79-9(CH30,CH33,CH38)****

WHAT CAN I DO TO COMBAT THE HAZARDS OF 100LL FUEL IN MY 80 OCTANE CONTINENTAL 0-200 OR LYCOMING 0-235?

We have been asked this question a number of times and, over the years, we have accumulated a few answers for those whose engines simply were not designed to live on low lead fuel.

Use TCP as recommended on the can. Pure TCP can possibly harm glass/epoxy fuel tanks but we used TCP on the RAF Long-EZ prototype, N79RA, all of its life with no measurable problems and the TCP will definitely help your engine digest the modern low lead fuel.

Lean your mixture, even while taxiing. Richen it for take-off and then lean in flight using a good quality EGT gauge. A good rule of thumb is that you can lean aggressively above 8000 feet (below 75% power) or if you have a manifold pressure gauge, when you are below 22"MAP.

The bad news is that, in spite of these precautions, you should expect to have to remove your valves and ream the carbon build-up out of the guides every 300 to 400 hours. If you don't, you will experience sticking valves. If you can get 80 octane avgas, by all means, use it. Your engine was designed to run on leaded fuel and that is why you may be having these problems.

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Update Number 80
to
Supplemental Chapter 38
Maintenance and Inspections

Information derived from CP80 published by RAF Jan 1995

****From CP80-5 (CH21,CH30,CH33,CH38)****
STATIC FUEL FLOW TESTING
In CP79, we reported the results of a thorough static fuel flow test conducted on Mike and Sally's Long-EZ, N26MS. This test was conducted at two fuel levels, tanks with half fuel and tanks almost empty. This was checked with the boost pump running as well as with the boost pump turned off.

The results have been questioned by several builders who generally agreed on the flow with the electric boost pump running but who could not achieve any flow at all with the pump turned off, even with a full tank of fuel!

Well, it turns out that there may be a plausible explanation. We have published static fuel flow results over the years from the prototype Long-EZ, N79RA; from Burt's Defiant, N78RA and from Mike's, N26MS. All of these aircraft had used engines in them which also had used, and probably quite old, mechanical fuel pumps installed on them. All of these pumps were manufactured before 1988. In 1988, Lycoming began manufacturing the AC mechanical fuel pump themselves. All of these pumps have 4 ounce springs installed at both the inlet and outlet of each pump. It takes about 1 psi to open one of these spring-loaded valves. In order to accomplish this, the fuel head would have to be at least two feet above the mechanical fuel pump. Actually, even with full tanks, we only have a little more than one foot of head on a Long-EZ.

AC mechanical fuel pumps manufactured prior to 1988 had only 1 ounce springs installed at the inlet and outlet valves. One ounce springs at the valves will allow about 5 gallons per hour of static flow. We believe this solves the mystery of why some builders have easily achieved the fuel flows called out in the CP and others could not achieve any flow (pump off).

Mike is close to a major overhaul on his engine and will conduct these tests, once again, with 4 ounce springs in the mechanical fuel pump and we will report the results here in the CP. With your boost pump turned on, you should have at least 20 gallons per hour of flow. even if you have the new mechanical fuel pump.

The electric boost pump (Facet Square pump) allows fuel to flow through it even when it is not running, the problem is in the newer AC mechanical fuel pumps. It may be possible to design a fuel system that by-passes the mechanical fuel pump, but keep in mind, that a system like this requires a check valve in the system and check valves, themselves, have spring-loaded valves that require some pressure to open so you may not gain any redundancy. You can take some solace from the fact that every low wing aircraft (Cherokee. Grumman Tigers, Cheetah, Mooney, etc.) suffer from the same situation and we are not aware of any of these aircraft having engine failures due to a double failure (both fuel pumps fail at the same time). We welcome any feedback on this subject. As long as one, or both, fuel pumps are functioning, the engine will run to its maximum power capacity.

****From CP80-5&6 (CH30,CH38)****
ENGINE MOUNT CRACKING
Reports of cracked Dynafocal engine mounts continue to come in - not a lot, but enough to cause concern.

A little history may be in order, to put things in perspective. The original VariEze, N4EZ, was powered by a Continental 0-200. The engine mount and the interface between the steel tube weldment and the fuselage was designed to handle up to the Continental 0-200. Later, several builders began to install the Lycoming 0-235 on the VariEze. A group of VariEze builders on the east coast did the first installation and structural analysis. Burt later checked out their work and approved this engine installation and, in fact, the Lycoming engine installation instructions were produced by this group, not by RAF.

When the Long-EZ was designed, the VariEze Lycoming 0-235 installation plans were used as the basis for the Long-EZ engine installation. There were no modifications to the steel weldment (mount) or to the interface to the fuselage (aluminum extrusions). The plans-built Long-EZ, including the prototype, N79RA, have exactly the same engine mount as the VariEze (which was originally designed for the Continental 0-200 which weighed only 190 lbs.)

Many builder/flyers have seen fit to install larger engines than authorized by the plans. These builders must realize that they have now taken on the responsibility of designing their own engine installation. RAF has not designed the Long-EZ engine mount to handle any engine larger than the Lycoming 0-235 or the Rolls Royce Continental 0-240.

Simply bolting a larger engine onto the 0-235 engine mount is asking for trouble. The extra weight and, more importantly, the extra vibrating mass of the engine/prop extension/prop may eventually result in cracks in the tubular engine mount.

By all accounts, the first indication is what feels, to the pilot, like a rough running engine. **Should you notice a sudden, unexplained roughness or harshness from the engine compartment, land as soon as possible, remove the cowling and conduct a thorough examination of every tube and weld in the engine mount weldment using a strong light. If any cracks are found, do not fly again until this problem has been repaired.**

What to do about this? Unfortunately, RAF is no longer in a position to be able to design and test a new engine mount so, it really is up to each builder/flyer. At the very least, a few well-designed gussets, strategically placed, or even a six point mount, may be required - are there any mechanical engineers out there willing to take on this task?

In the meantime, inspect your mount often and please report all incidents of cracking to RAF.

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

****From CP80-6 (CH30,CH38)****

<u>*LONG-EZ ALERT*</u>

Conduct a thorough inspection of your welded steel tube engine mount before next flight.

Update Number 81 to Supplemental Chapter 38 Maintenance and Inspections

Information derived from CP81 published by RAF July 1995

****From CP81-7&8 (CH13,CH30,CH38,CH39)****
A Texas VariEze which was not built by this pilot but was purchased as a completed airplane, crash landed short of the runway due to a throttle control system anomaly that this pilot was unfamiliar with. This VariEze was equipped with an electrically operated nose gear system. Letter follows:

"On April 8th, my VariEze was force landed after the throttle stuck in the closed position while approaching Addison Field for a landing.

The pilot had been practicing formation flying with a Long-EZ flown by a friend. The pilot had been cleared for an approach, as a flight of two, into Addison. Approximately one mile from the runway, the tower requested that the flight reduce speed to the minimum possible to enable a twin on right base to land ahead of the flight. In complying with this request, power was reduced to a minimum. **Shortly before this power reduction, the pilot noticed that the knob of the throttle control lever had dropped off.** One part of the knob was retrieved and placed under the pilot's thigh for safety.

When the time came to open the throttle to maintain altitude and continue the landing procedure, it was found the throttle would not open more than a half inch. A determined effort to force the throttle open was unsuccessful. The limited opening provided insufficient power to maintain altitude and it was not possible to stretch the glide to reach the runway. It was difficult to try and resolve the problem and fly the aircraft safely at the same time, so the decision was made to concentrate on landing safely. A field that seemed to have fewer wires and other nasties, became the option. The landing was made safely and the aircraft rolled three hundred and fifty feet before being launched back into the air by a sharp rise in the ground. The aircraft then flew over a road and landed on a bank on the other side of the road. The impact came with the plane level but descending almost vertically - what might be termed a genuine pancake. The distance between impact and final stopping place was about ten feet. Damage was extensive; nose gear, which did a great job in absorbing kinetic energy; main gear, folded back; and extensive damage to the fuselage in the attachment area. The landing gear fork, broken by the impact and then folded back under, came through the fuselage floor, through the thigh support and the seat and cut into the pilots right thigh. Far more destructive was the remains of the electric landing gear which tore loose and destroyed the instrument panel bulkhead, both the radio and transponder, the turn and bank as well as severely bruising the pilot.

The cause of the throttle problem: The aircraft had had a plans built cable throttle originally. This was later changed to a push/pull, Morse cable which was different from the original in requiring a straight motion from the bottom attach point of the lever. This was achieved by making a second lever, longer from the fulcrum to the lower attach point than the original but using the same fulcrum and control knob pattern. Instead of removing the original lever, the second lever was placed alongside the original, such that both moved together, although the original was now no longer functioning or attached to a cable. When the knob which went through both levers came off, there was no longer any restraint to prevent the levers from moving independently. One fowled against the other and jammed.

With more altitude and thus more time to fiddle around, the problem might have been overcome, or if the pilot had been aware of the way the system had been installed, he might have come up with a way to overcome the jamming. On the other hand, given the circumstance, making the decision without delay and maintaining control probably was a contributing factor in the limited damage the pilot and aircraft sustained.

I am concerned that builders who have installed electric nose landing gear activation may be in for a rude shock if they ever have an off field landing. The operating mechanism is heavy, and potentially a lethal weapon if it comes loose in an accident. I would strongly recommend to those contemplating the use of this gear to have another think. The only thing that saved me from injury from the gear was the almost zero forward speed on impact. I do not want to think about what that bloody great torpedo shaped missile would do to one in a frontal impact situation. When this aircraft is rebuilt, it will definitely have a plans built nose gear."

Update Number 82
to
Supplemental Chapter 38
Maintenance and Inspections

Information derived from CP82 published by RAF Oct 1995

****From CP82-11 (CH19,CH30,CH38,CH39)****
Broken exhaust threatens wing!
This happened to be a Cozy MKIV, but the wing attach system, exhaust system, and engine cowling area are essentially the same as the Long-EZ and Defiant. RAF is publishing the story here in the hope that this knowledge may prevent a similar incident in one of our airplanes.

While flying at 10,000 feet over the Gulf of Mexico near Pensacola at night, the exhaust pipe on cylinder number 4 broke off. Fortunately it remained, in the cowling and did not go through the prop. However, hot exhaust gases traveled between the wing and the center-section spar, heating the epoxy in the wing near the wing-attach hard points. The epoxy softened enough for both wings to move upward at the wingtips, 1/8 inch on the left wing, and 3/8 inch on the right wing.

The spar caps were not damaged, but the shear web on the right wing actually fractured near the out board wing-attach point, allowing the wing to move to a new dihedral angle.

Unfortunately, the pilot was unable to land when he first heard the exhaust let go, but had to fly for nearly an hour to the nearest suitable airport. It is possible that an immediate landing would have prevented the damage and resulting enormous repair job.

The pilot reported that the engine sound made an abrupt change. Performance was not affected, but the noise level was obviously higher, and led him to suspect a broken exhaust system. He throttled back to 1,800 RPM and continued on. He noticed that cylinder head temperatures on 2 and 3 settled down to around 300 degrees F, but cylinder 4 remained up around 400 degrees F.

He landed safely, and had the exhaust stack repaired. He did not notice the wing problem until the next day. There was considerable foam shrinkage (due to heat) all around the hard points. He found a small hole in the inboard glass rib, near the aileron torque tube bearing, and the heat had gotten into the wing through this hole. The only visible damage anywhere in the cowling was a small blister on the cowl itself. Fortunately all of his fuel lines were fire-sleeved, and his wing ribs were protected with 1/8 inch fiberfrax glued on with high-temp silicone. None of the glass on the firewall or in the wing roots were damaged.

What can be learned from this incident? First of all, exhaust systems are subject to vibration and high temperatures and are vulnerable to cracking, even in an type-certificated aircraft.

Inspect your exhaust stacks often and carefully, using a strong flashlight. All visible glass in the cowling area, firewall, center section spar aft face , wing roots, etc, should be protected using fiberfrax. The 1/8 inch-thick material is best, and it should be cut to fit perfectly, and then glued onto the glass using red (high-temp) silicon, available at any auto parts store.

Seal all possible paths for hot air, such as the gap between the center section spar and the wing, and any holes you may have made in the wing root ribs. All of the air, hot or cold, should have to exit the cowl around the spinner in front of the prop, except the air that flows through your oil cooler.

If you ever hear an abrupt, unusual increase in the noise level from your engine compartment, make a precautionary landing at the nearest suitable airport and remove the cowling for a thorough inspection.

Do not fly until you comply with the plans change section on page 15 of this newsletter.

****From CP82-15 (CH30,CH38)****
Plans Changes

Do not fly until you comply with the following plans change.

MANDATORY GROUND for All RAF DESIGNS until the following changes are made on your aircraft -

All RAF designs
<u>*Check Fuel Pump*</u>
Fuel draining out of the carburetor, as reported by Owen Morris (see Reader Mail on page 9), be it a Marvel Schebler, an Ellison, or a Bendix fuel injection system is a potential catastrophic fire hazard! It is very important to create a small drain hole at the low point in the induction hose. Fuel must be able to drain into the cowling, and you must drill a hole in the low point of the cowling, so that this fuel can drain on out of the cowl.

The fuel comes from priming the engine, prior to and during the start cycle. The worst offender is the carburetor with a throttle pump installed. Some pilots pump these throttles several times just before cranking with the starter. The throttle pump squirts a fine mist of raw fuel up into the intake manifold, but most of the fuel runs back out of the carb, and if the engine backfires during the start sequence you have a fire. Even manually-primed and injected engines can and do have raw fuel drain down the intake manifold tubes and out of the carb or throttle body. You as the aircraft manufacturer are responsible to provide a path for this fuel to get out of the manifold/throttle body/air filter/inlet hose/whatever, and out of the cowling onto the ramp.

This problem only occurs while starting and normally is not an in flight problem. Check your aircraft and if this has not been taken care of, fix it before your next flight.

Supplemental Chapter 38, Maintenance and Inspections

Long-EZ Plans Changes

From CP29-7 (CH33,CH38)
LPC #74, DES
Owners Manual Page 47, add, CAUTION prop bolts - recheck torque (180 in.-lbs.) before next flight when a transition is made from a wet climate (high humidity) to dry conditions. Wood shrinkage in dry environment can loosen prop bolts and result in flight loss of the entire propeller.

From CP30-9 (CH13,CH38)
LPC #86 MAN/10HRS Rudder pedal weldments.
Before 10 hours of flight the top tab welded to the rudder pedal (see section I, page 13-3) must be reinforced per Figure 2, page 5 this newsletter. Also change the full size drawings on page 13-3 to show the top tab per Figure 1, page 5 this CP.

From CP48-5 (CH9,CH38)
LPC #127
A mandatory inspection of your nylon brake lines is required before next flight. If these brake lines have been directly exposed to radiating heat from the brake discs, or to sunlight (UV) they must be replaced.

From CP48-5 (CH9,CH38)
LPC #128
Main gear attach. Inspect with a mirror and a flashlight to determine if the gear attach tabs have slid aft on the LMGA steel tube. We have received two reports of this from Long-EZ flyers. This is not a structural problem, but may cause the nylon brake lines to be pinched between the trailing edge of the main gear strut and the fuselage side where the gear comes out of the fuselage.

If you find any evidence of movement in this area, please let us know. Pry the gear forward to its proper position on the LMGA tube then fill the gap between the aft attach tab and the aft aluminum extrusion on each side with flox. Allow to cure for 24 hours before flying. **SKETCH OMITTED**

From CP51-7 (CH30,CH38)
LPC #132, MAN-GRD
Inspection of engine mixture control system. Before flight, remove the cowling and remove any spring installed on the mixture control and the throttle control which is used to assist the control arms to go to the full rich or the full throttle positions. With the springs removed, pull the mixture control to idle cut-off and the throttle to idle, then push the levers forward and confirm that the mixture positively moves to least the mid range (well rich of idle cut-off) and the throttle moves to at least to two-thirds power without the assistance of any spring. Then re-install springs and put the aircraft back in service.

From CP54-9 (CH21,CH33,CH38)
LPC #133 DES Check the static flow, as well as the flow with the boost pump running per the method shown in this CP.

From CP57-8 (CH11,CH31,CH38)
<u>MAN GRD</u>: Conduct an inspection or provide a certification that the elevator quality regarding correctness of laminate schedule, orientation of plies, numbers of plies and workmanship relative to the weight of the layup and straightness of the primary surface is correct. This should include inspection or verification that additional filler materials have not been added to increase the elevators weight and thus change is natural frequency of oscillation. If you have purchased structure from someone else and cannot otherwise verify the structural quality and conformance, conduct a dissection of the elevator skins to assure the proper structure, or better yet, discard the elevator and build new ones that you <u>know</u> are in conformance with the tested and approved configuration. Any variance in weight, stiffness, or shape should be suspected of being dangerous and not allowing you to rely on the testing that was conducted to verify freedom of flutter. The weight limits shown are absolute maximums. A properly fabricated, accurate core with a properly squeeged minimum-resin laminate will result in weights well below the limits shown in CP 21 pg 5. In order to provide more margin for variables in this extremely important area, we are now recommending that any elevators that require additional mass balancing beyond those weights shown for the basic configuration be discarded and new elevators fabricated. If you are unable to build elevators that can be balanced by the basic balance weights, both inboard and outboard, you are possibly unable to produce adequately safe flying components. Do not compromise by using up to your margin of safety by merely increasing balance weight. This increases the weight of the elevator and lowers the frequency of its oscillation. Above all, be certain that your elevators meet the balance hanging angle of 12 to 20 degrees after painting. If there's any doubt that they are absolutely perfect, discard them and start over. It is possible, with proper tube orientation, to retain the aluminum tubing when building new elevators.

****From CP57-9&10 (CH11,CH12,CH31,CH38,CH39)****
A CENTRAL CALIFORNIA VARIEZE experienced in-flight severe flutter of the elevator and canard which caused a structural failure of the canard, and the pilot was killed when his VariEze crashed on a wooded hillside. He had about eight hours in his VariEze before the crash.

He had not built the airplane but had purchased it with all of the structure done. He then completed the finishing and systems installation. The elevators were carefully checked for correct balance and some weight was added inboard on each elevator to bring the elevators into the proper balance tolerance.

Prior to the fatal flight, the pilot had removed the canard to check something in the nose. Previously, a friend had helped him to install the canard and noted that he had had great difficulty in getting the canard attach bolts to line up and thread into the nutplates.

A very careful post crash investigation by the FAA, as well as by RAF, **determined that the probable cause of the catastrophic flutter was that one of the canard attach bolts was not correctly installed.** Either it was not torqued up at all, or it was cross threaded. In any case, it did not clamp the aluminum lift tab to the F-22 bulkhead. This resulted in the natural frequency of the canard being lowered considerably since it was only firmly attached on one side. A gust, or something, excited the elevators driving the canard into a divergent destructive flutter mode.

Although the elevators were balanced, they were very heavy, having been modified from the original short chord design to the long chord by the addition of a large heavy piece of balsa wood and several plies of BID. This caused the elevators to have a lower natural frequency of oscillation. Thus, these overweight elevators may have contributed to this accident, however, the primary cause was the failure of the pilot to properly install the canard.

This tragic accident brings it home to all of us, just how careful we must be as we work on our aircraft. When you are doing a critical job such as installing a wing or a canard or a control surface, you, and only you, are responsible to ensure that all fasteners are correctly installed and properly torqued. Too often we get sidetracked while working on a critical installation when we get interrupted by a friend or passerby. Should this happen to you, do not stop until you have the critical part installed and safetied - even if you have to be rude to your visitor.

Accidents such as this have been caused by an interruption or disruption of your thoughts while working on an important aspect of the aircraft. A simple example is changing the oil. The oil is drained, the drain plug replaced, then a visitor shows up with a bunch of questions - you forget to fill the sump with fresh oil and - presto - a destroyed engine when you start it. It happens so easily, it seems so unlikely, but it happens. Be conscientious, use checklists, be very particular and careful if you have removed a canard or wing or canopy, etc. Be <u>absolutely certain</u> you have adequately completed <u>any</u> task you do on your airplane. Last of all, be very conscientious about doing a thorough preflight on your creation before you commit you, and perhaps a member of your family's or a friend's, life to your workmanship.

As you know from past Canard Pusher newsletters, the subject of flutter has been a major concern for years. CP numbers 17, 18, 19 and 21 have reported discussions and/or warnings relative to the importance of conformality in the fabrication of the canard and elevator system. *It is extremely important to be aware that elevators improperly fabricated, too heavy or with the incorrect bending or torsional stiffness characteristics which result from improper materials, or fiber orientation, <u>cannot</u> be balanced with any method.*

A mass balance called out for the elevator and the specification for balancing them, applies <u>only</u> to an elevator fabricated with the same weight and stiffness as that which has successfully passed all the flutter testing. It is extremely important, and life-critical, that the manufacturer or owner of each VariEze, Long-EZ or any plane for that matter, assure, without a doubt, that the control surfaces are conformal to those which have passed flight tests and been shown to be flutter free.

The advisory shown in the plans change section must be followed to assure that there are no non-conformal elevators that could contribute to, or result in, an accident. Do not take this situation lightly. As we have indicated before in the CP, - IT COULD KILL YOU.!

****From CP58-10 (CH16,CH19,CH38)****
MAN-GRD: Long-EZ and VariEze - see section on belhorn failure. Replace aileron belhorns within the next 25 hours of flight. If ailerons are vibrating, you must re-balance.

****From CP58-7&8 (CH16,CH19,CH38)****
<u>LONG-EZ AILERON BELHORN FAILURE</u>
RAF has recently received two separate reports of failures of one of the CS132L weldments, the belhorn, which drives the aileron out in the wing roots. One of these belhorns has had lightening holes bored through the .050 steel belhorn and it cracked through one of these holes. However, the second one was as received from Brock and it cracked across at the edge of the weld around the tube. Prior to the failure of the belhorn this builder pilot had had to replace the rod end that bolts to this belhorn, at least twice over the past 350 flight hours, due to the rod end being "pounded out" until it was dangerously loose.

The belhorn failure occurred in flight and caused a few moments of concern, but in both cases the Long-EZ was easily controlled. A disconnected aileron will float trailing edge up. To keep the wings level, the pilot has to raise the trailing edge of the operable aileron which, of course, will give a nose up pitching moment requiring forward stick to fly level. The one operable aileron will provide reasonable roll control and, of course, the rudders will roll the airplane by themselves. The greatest hazard would be if the disconnected aileron pushrod, being loose in the cowling/root of the wing area, ever managed to get itself jammed. Depending how much lateral input there was at the time, you may or may not be able to correct the roll with rudder.

A primary control system failure is cause for strong concern so we at RAF have designed, built and flight tested a new aileron belhorn. Drawings for this new part have been sent to Ken Brock Mfg. and Ken will have these parts available as soon as possible. We will provide a drawing of the new belhorn in this CP for those people who would like to make these parts themselves. (see sketch, page 15) **SKETCH OMITTED**

Why would this belhorn fail on two relatively low time Long-EZs when we have literally dozens of Long-EZs with 1000-plus hours and some with 1500-plus hours with no failures and zero wear on the rod ends? Bill Freeman, Long-EZ builder/flyer and a man whose specialty is working with vibration problems and who has a Master's degree in Mechanical Engineering, has a theory with which we concur. The original control system with aluminum push rod tubes apparently was OK. The natural frequency of this collection of parts was not the same as the normal cruise excitation frequency of the engine/prop. Changing the aluminum tubes to steel as called out in the CP may have moved the control system into the excitation frequency of the engine/prop combination. Bill says that this strongly suggests to him a spanwise vibration of the CS132L belhorn and CS129L pushrod at, or near, its natural frequency, inducing a high-cycle fatigue failure in the CS132L belhorn. The fact that the rod end bearings were beaten out is strongly suggestive of a resonant vibration of the CS132L and CS129L pushrod. This vibration would have the bottom end of CS132L and the aft end of CS129L moving spanwise, bending CS132L in the weak direction with high enough stress levels to initiate a fatigue failure in CS132L.

The new part, part number CS132L-R, has two arms instead of one which will more than quadruple the stiffness of the system and will also provide redundant links in the aileron system as well as providing positive retention of the rod end in the event of a ball slipping out.

If you absolutely insist on flying before the new belhorn is replaced, a careful examination of your CS132L belhorns are mandatory. Use a bright light and a magnifying glass. Examine the area shown in the sketch while gently flexing the CS132L left and right. Any sign of a crack starting requires immediate grounding of the aircraft until the new CS132L-R is installed. Examine the rod ends bolted to the CS132L. Look for a loose ball, or play in the rod end in the fore/aft plane. A worn rod end must be replaced before flight and you should realize from the above discussion that a worn rod end almost certainly indicates that a belhorn failure is imminent. If you have steel tube push rods (CS132L), your belhorns are definitely more suspect. If you have worn rod ends, do not fly until you replace the belhorns and rod ends. Even if everything looks OK, replace belhorns within the next 25 hours of flight. The CAD plated CS132L belhorns should not be painted since the paint may hide a crack.

This is a serious matter and should not be ignored. A primary control system failure could result in a serious accident.

Please report any cracked or broken belhorns to RAF along with the number of hours on the airplane, whether you have aluminum or steel push rod tubes and if you have experienced rod end wear or failure.

****From CP62-7 (CH30,CH38)****

PLEASE NOTE NEW FORMAT

PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION

VARIVIGGEN VARIEZE LONG-EZ DEFIANT	MAN/GND	Each time you remove your cowl for routine maintenance, carefully inspect your exhaust system using a bright light. Pay particular attention to the weld at the flanges. Sometimes small cracks develop in this area and they are difficult to see. Exhaust systems should be carefully inspected at least every 50 hours.

****From CP65-7 (CH21,CH30,CH38)****

PLANS CHANGES/INSPECTIONS

LONG-EZ MAN/GND

Polyurethane fuel and vent lines. Mandatory Inspection before next flight - See article on this page.
Throttle/mixture springs. Mandatory inspection next 10 hours - See article on page 13.

****From CP65-7&8 (CH21,CH30,CH38)****

VARIEZE POLYURETHANE FUEL LINES

A VariEze builder/flyer recently reported to RAF that while conducting an inspection of his VariEze, he found all of the polyurethane fuel lines in his VariEze were cracked and when he squeezed these lines in his fingers, they crumbled to pieces. This VariEze is 10 years old and has been flown fairly regularly.

He has removed and replaced every piece of the urethane fuel line. This is a serious matter and for that reason RAF is making it a mandatory requirement to carefully examine every inch of urethane fuel line in all VariEze's. Use a strong light to check for cracks or crazing and squeeze the line at the same time. If the normal resilience is not felt, if the fuel line feels stiff or has any sign of checking, cracking or crazing, it should be removed and discarded. Any fuel lines forward of the firewall could either be soft aluminum tubing, using AN fittings, or as an option, could be new fuel compatible clear polyurethane tubing, or transparent yellow Tygon tubing. McMaster-Carr Supply Co. sells both of these products.

Any fuel or vent lines aft of the firewall should be stainless steel tubing or firesleeved aircraft-grade fuel line, such as Stratoflex stainless braiding over teflon tubing with stainless end fittings. Under no circumstances should there be any urethane or rubber hose in the engine compartment and all fuel hoses in his area should be protected by installing fire sleeve.

****From CP65-11&12 (CH30,CH38)****

LETTERS

"Dear RAF,

Just thought I would drop you a note concerning a problem that I experienced in my VariEze on the way back from Oshkosh that might be of significance to other Ez's. Fortunately, the only harm done was a few minutes of inconvenience instead of what could have been a serious problem. I made a normal landing at Douglas, WY after a 4.5 hour flight from Duluth, MN. After rolling clear of the active runway, I found that advancing the throttle resulted in only a 100 rpm increase over my normal engine idle speed. Surprise! I had just successfully completed my first forced landing without even knowing it!

A check under the cowl revealed that one of the two throttle springs (the one with the most mechanical advantage, naturally) had cut its way through the aluminum bracket attached to a vacuum pump stud on my Cont. 0-200. The second throttle spring was within a whisker (a few thousands) of also cutting through the bracket. Wear at the other end, on the thicker (also aluminum) throttle bracket was quite evident but well short of failure. A check of all other engine related springs showed essentially no wear, so it is pretty obvious that my particular combination of throttle springs was resonating under the influence of the engine vibration, greatly accelerating the wear rate on these brackets. Total time on the installation was just over 800 hours. About 25 hours prior to the failure, I had switched back to a prop that I hadn't used for several years. If anything, this propeller runs smoother than the one that it replace, so I doubt that the "new" prop was a major factor. I would like to think that this problem developed after my last annual inspection (at 730 hrs.), but must admit that it looks like I missed seeing it despite the detailed check list that I use that explicitly includes all the engine controls and cables. I always go over the engine with a clean rag and (I thought) a sharp eye at every oil change looking for trouble, but didn't catch it at 765 hrs. either.

The following lessons suggest themselves to me:

1. Very careful attention to the condition of all engine related controls, as you have pointed out numerous times (e.g., CP61 pg. 7), is critical. A careful inspection of the engine, controls and exhaust system at every oil change could save your plane and/or life.

2. Ideally, the throttle and mixture controls should not require springs to open the throttle or enrich the mixture. This is difficult to accomplish with the Continental 0-200 using a single cable system because of the force required to overcome and positively actuate the accelerator pump.

3. Regardless of whether item 2 can be accomplished, springs are needed as a fail safe backup in case something else breaks (like the cable or outer cable clamp).

4. I believed that either spring alone was strong enough to actuate the throttle arm. With fuel in the carb, this wasn't the case. Instead of having a backup spring in case one failed, I actually doubled my chances of experiencing a throttle linkage failure by having two interdependent flight critical items. Obviously, other EZ builder/pilots need to inspect their particular installations to assure themselves that their controls will function reliably with any single spring failed. In my particular case, even if a single spring had been sufficient to open the throttle, only a few more hours of operation would have passed before the second spring also cut through the bracket.

5. Hindsight engineering makes is pretty clear that my brackets were plenty strong enough to carry the spring loads, but were not designed to withstand (or prevent) high rates of wear.

6. Finally, as my flight instructor told me long ago, "Don't count on being able to add power to make the runway."

To close on a more positive note, I love N862DP. So far it has made eight trips from San Diego to Duluth in nine years, with two side trips to Oshkosh, plus many other places all over the West. Last year I made it from here to Duluth with one stop in Rawlins, WY, and one-day trips over this 1500 nm route are the rule rather than the exception. Three years ago my daughter made the trip back with me when she was not yet five years old. I have and regularly use the Aerox system-it's great! Living in San Diego, I get lots of chances to climb out or land through our coastal stratus. So far, I have accumulated over 25 hours of actual IFR in N862DP. My plane does experience a definite pitch down trim in or near precipitation that requires significant retrimming.

This Spring I really enjoyed attending the EZ fly-in at Kanab, UT and Burt's birthday fly-in at Kern Valley (plus Oshkosh, of course). Enclosed is a picture of a flight of Southern Calif. EZ's returning from Kern Valley fly-in. Sorry I missed you at Oshkosh.

With best regards, Don Patch"

From CP65-13 (CH30,CH38)

THROTTLE AND MIXTURE CONTROL SPRINGS

Referring to Don Patch's letter above, we agree with Don's comments and we really appreciate his bringing this to our attention so that we can bring it to all the EZ builder/flyer's attention. As we have said many times, having perfect control of your engine is just as critically important as having perfect control of your elevators, your ailerons and your rudders. Anything less is almost certain to cause an accident which could result in the loss of the aircraft and possible the loss of life.

The bracket that Don refers to is a 1/16" thick aluminum bracket which he had mounted on his vacuum pump pad. He had drilled several 1/16" diameter holes through this bracket in order to "hook" the two springs through the bracket. Over the 800 or so hours of operation, the vibration had caused these springs to slowly "saw" their way toward the edge of the bracket. One of the springs had, in fact, "sawed" through almost 3/16" of the bracket until it broke through the edge. The other spring was almost at this point.

While this method of attaching a spring works OK (indeed, it was the same method used on Burt's prototype, N4EZ), it is prone to this kind of vibration induced failure. A preferred method is to install an AN-3 bolt through the aluminum bracket with a short spacer. The spring should be installed so that the loop of spring is supported by the spacer. See sketch .
SKETCH OMITTED

We have used this method successfully on several installations, some of which have been in operation for many years, with no failures.

The throttle and mixture both should be set up and adjusted so that they will work with no springs installed. The springs should be installed so that they pull the throttle to full power and the mixture to full rich in case of a cable failure.

These springs, cables and all engine controls should be carefully examined and checked for correct and full operation each time you remove your cowling, whether it be for an oil change or for whatever reason, or every 25 hours.

If you have these springs installed in a similar manner to what Don Patch had, you should check to see that you do not have the same failure, or close to failure, that he had - before next flight.

Miscellaneous

From CP40-3&4 (CH38)

HIGH TIME EZS INFORMATION REQUESTED

A number of VariEzes now have accumulated quite high flight hours, several in fact are over the 1000 hour mark. Some Long-EZs are reaching for the 1000 hour mark. We would like to request from these high time builder/pilots information regarding maintenance type work that may have been required over the past many hours. We are thinking particularly of possible problems relating to paint finish, tire and brake wear, nose gear retraction, nose wheel fork friction, damping, electrical, baffling, engine problems, etc., etc.

We would like to try to accumulate data and make it available to the rest of the builders, to possibly help them to avoid anything that may be preventable. We know of nothing right now that is of any concern and would simply like to set up a means of keeping track for the benefit of all our builders and flyers.

If you have something along the lines described above, please send a brief description of the problem to RAF.

From CP41-7 (CH38)

HIGH TIME EZ'S INFORMATION REQUEST

This request was published in CP 40, page 3. The idea is to try to build a data base of required maintenance items on VariEzes and Long-EZs. The response to our first request has been disappointing. Please send in you maintenance experience. It could be a big help to present EZ pilots as well as future pilots. The highest time VariEze that we know of is just over 1,800 hours. Several more have accumulated over 1,000 hours. At least one Long-EZ is over the 1,000 hour mark, with several in the 800 to 900 hour range.

Don't let this slide guys, if you have had an on going maintenance problem in any area at all on your EZ, drop us a card and we will assimilate the data and publish it a future CP.

From CP42-4&5 (CH9,CH13,CH25,CH30,CH33,CH38)

LONG TERM MAINTENANCE ITEMS ON EZs

Quite a few EZs, both VariEze and Long-EZs have now accumulated over 1000 hours of flight time. We have requested feed back from the builder/pilots of these aircraft regarding maintenance.

Problem - Paint flaking off, particularly at the dry micro to featherfill juncture and especially in humid climates.
Solution - Sand glass and dry micro filled areas thoroughly with 40 grit. Use Morton's Eliminator or Sterling primer filler instead of featherfill. Use primers and finish coat by the same brand name manufacturer, i.e. Dupont primer 131S and Imron or Ditzler primer Preet 33 and Ditzler Durethane polyurethane enamel system.

Problem - Nose wheel friction damper seems to loosen after one or two flights.
Solution - Remove fork and pull phenolic friction button. Ream the hole the phenolic button slips into, to allow a little clearance. The problem seems to be caused by the phenolic button being driven into the hole, against the spring, by a hard landing and then becoming stuck. Get it to work in and out freely, adjust the spring to give 2 to 4 lbs of side force measured at the trailing edge of the nose tire with a fishing scale, and you should have solved the problem.

Problem - Long-EZ exhaust system support bracket cracking. Either the brace or the tab welded onto the exhaust pipe will fail.
Solution - Remove the braces completely and allow the exhaust pipes to float free. They will only be attached at the engine exhaust flange. Experience has shown this to be the best method, no bracing is required.

Problem - A few builders report that nosewheels are turning, not on the tapered bearing, but on the 1/4" bolt at the spacer/bushing. Apparently no combination of torque on the bolt will cure it once this occurs.
Solution - Machine a spacer to install between the aluminum bushings so that when the 1/4" axle bolt is torqued up, it can be tightened up solid on the two existing bushings and the new spacer. The trick is to machine the spacer to exactly the proper length to ensure that the two taper roller bearings in the wheel are just right, not too tight and not too loose.

Problem - Nose gear downlock bouncing out of over center locked position, putting all loads onto wormgear teeth. Of course this strips off about half the teeth on the wormgear.
Solution - Rotate wormgear 180 degrees and you back in business. Worm and wormgear should never see the loads (other than retraction and extension). The mechanism must go over center. To ensure it stays in the over center position, some form of friction must be maintained at the gear handle pivot in the instrument panel. Try shimming the oval shaped green plastic bearing block to misalign it and put the handle shaft "in a bind" so to speak. You just need enough friction so the gear retract mechanism will stay in the down and over center locked position as well as in the up position.

Problem - VariEze main gear attach tabs. The 1/4" diameter holes in the aluminum extrusions elongate and become loose on the AN4 (1/4") bolts. Check for this by lifting the airplane so that the main wheels are clear of the ground. Grab the gear strut close to the tire and attempt to move the wheel fore and aft. Any movement at all would indicate the above condition.
Solution - Remove the main gear attach bolts and ream the 1/4" holes in the extrusions up to 5/16" diameter. Replace the AN4 bolts with AN5 bolts and torque them to approximately 125 in/lbs.

Long-EZ Operations - Carburetor ice can be a real hazard. Do not omit the installation of a good carb heat system. When the temperature and humidity are just right and you are flying at a relatively low power setting, you can get carburetor ice, even in a Lycoming. The classic evidence of ice is an unexplained drop in RPM. Should this occur, go to full power immediately and apply full carb heat. This condition is not nearly as common in the Lycoming installation as in the Continental installation, but given the right conditions it can occur. Do not assume it will never happen to you.

Brakes sticking on - A few builder/flyers have experienced the peculiar phenomenon of brakes that remain on after being applied. The causes of this have not been easy to find, but it does occur. Look for the following possibilities: 1) Automotive brake fluid instead of aircraft grade. This can damage the 'O' rings and seals and cause the brake master cylinders to stick. 2) Check the 1/8" size plugs in the top of the reservoirs to be certain that they have vent holes drilled in them. This should be a 1/16" diameter hole. Without this vent, it is possible to have the brake master cylinders stick. 3) Be certain that your brake linings have not worn down to the point that the pistons in the brake calipers (at the wheel) can be forced out of the caliper far enough, that the piston can become cocked and bind so that it can not retract into the caliper. 4) If these conditions persist, you will have to dismantle the brake master cylinders and overhaul them.

Summary
We have 3 Long-EZs and 1 VariEze here at Mojave, all of which are 4 years old or more. The total hours on these four EZs exceeds 3,300 hours. We have never had a problem related to the composite structure. We have not had a composite structural problem reported to us from the more than 600 EZs that are now flying world wide in all different climates and conditions. We are very pleased with the structural performance of these airplanes and we encourage all builders to continue to send in reports of any maintenance items that you may encounter so that we can look for any trend that may develop and report on it in the Newsletter to help all of the EZ builder/flyers out in the field.

From CP62-5 (CH21,CH33,CH38)
High Performance Antistatic Wax.

Appropriately named Zerostatic, this new product was developed by EZ builders for EZ's and it is excellent. You can wax your entire aircraft, including the canopy, and it will greatly reduce dust build up while parked in the hangar. It is a gel that is easily applied and, best of all, it reduces electrostatic buildup - meets mil-B-8170C specifications for static decay. As an example, a Long-EZ fuel strake, treated with Zerostatic gel and polished with a high speed orbital power buffer, will have essentially no static buildup. Try it, then place your forearm in close proximity to the strake. The hairs on your arm will not react with Zerostatic, but will stand up and tingle with any other wax. Should help reduce the risk of static discharge while refueling.
Wicks & Spruce have this new product in stock. Give it a try.

From CP63-7,8&9 (CH30,CH38,CH41)

COMPRESSION TESTING

There are two accepted methods of testing the compression in a cylinder of an internal combustion engine. One is the "direct" method, generally used by auto mechanics on auto engines. This method uses a pressure gauge which is connected directly to the spark plug hole and the engine is than turned over with the starter or the engine and is run at idle. The peak pressure is read directly from the gauge. This method works but the results are not as precise as the method know as "differential compression" testing. This method is what is normally used in aircraft engines and requires the use of a tester consisting of two separate pressure gauges, a pressure regulator, a calibrated restrictor orifice, and an on/off valve. (See schematic) A source of compressed air (a compressor with a storage tank capable of a minimum of 100 psi) is required to perform the test. When you buy your differential compression tester, be sure it has a restrictor orifice of .040" (assuming your engine has less that 1000 cubic inches of displacement. An 0-235 has 235 cubic inches, and 0-360 has 361 cubic inches). Your can find several suppliers of good reliable differential compression testers at Aircraft Spruce or Wicks, or even "Trade-A-Plane".

SKETCH OMITTED

Continental, Lycoming and the FAA all agree that the compression test should be performed with the engine hot. This assures that you get optimum piston ring and valve seating. In any event, you should try always to use exactly the same procedure with each cylinder and each time you check your compression, if your testing is to give meaningful and comparable results. Careful and regular compression testing say, every 100 hours, can be one of the best, most cost effective preventive maintenance procedures. It is very important that accurate records are kept of which compression reading was for which cylinder! You can read the number of each cylinder at the base of the cylinder. Note that Lycomings and Continentals use a different numbering system.

Remove the top spark plug from each cylinder and, for safety, remove each ignition lead from the bottom plugs. Rotate the prop by hand, in the normal direction of rotation (anti-clockwise for an American engine) until one of the cylinders comes up on compression. You can determine this by placing your thumb over the spark plug hole and feeling for a pressure buildup. Now, install the adapter (normally supplied with the compression tester) in the spark plug hole of the cylinder to be tested. Be certain that the air shutoff valve on the tester is off and connect the differential compression tester. CAUTION: Be absolutely certain the shutoff valve is closed and that you have a firm grip on the tip of one blade of the prop before connecting the system to your source of compressed air.

You will now have to find top dead center on the cylinder being tested. The easiest way to do this is to adjust the pressure regulator to about 20 psi and open the air shutoff valve. Carefully rotate the prop in the normal direction of rotation against the 20 psi pressure until you feel a "flat spot" or rapid loss of turning resistance. If you go too fast, back up beyond top dead center and try again. It is critical that you reach TDC with the prop turning in the normal direction of rotation, not while backing the prop up since this would unseat the piston rings. The piston rings must be at the bottom of their lands in the piston with the piston at the top of its travel.

Now, be certain you have the prop tip securely held. This is a good time to have a second person to help you. The air shutoff valve should be open and the pressure regulator adjusted to show exactly 80 psi on the pressure regulator gauge. Use caution because if you let the prop move in either direction beyond TDC, it will rapidly begin to rotate and it could beat the tar out of the unfortunate person who should have been holding it securely! Now, gently move the prop tip back and forth, just a tiny amount. Watch the cylinder pressure gauge and take a reading from it at its peak steady pressure. Again, this will be while moving the prop in the normal direction of rotation. Be certain that the regulator pressure gauge is holding precisely 80 psi. You should have a differential pressure reading of between 60 and 78 over 80. Repeat this test as consistently as possible on all cylinders.

You should now have a series of numbers something like this, depending on the condition of the engine: 76/80, 74/80, 73/80 and 75/80. These numbers, hopefully, will be fairly close to each other in magnitude. What are the limits? What constitutes a bad (too low) cylinder? It is generally accepted that a cylinder reading below 60/80 would require removal from service. There is no rule or law that says this is the case. In fact, the FAA as well as the two engine manufacturers have no such requirement.

You should probably continue to operate the engine and check the compression every 20 hours or so if the compression is 50/80 or above. Before you remove any cylinder, it would be a good idea to borescope the cylinder. That is, to look inside through a spark plug hole using a light and a special optical device known as a borescope.

A single compression test does not necessarily mean anything. A single oil analysis also means very little. No single diagnostic test should ever be used to decide the health of your engine. The key is to do these tests regularly and keep good records of what you see. Compare each test and make your decision based on several tests conducted over a reasonable period of time.

If you have an abnormally low cylinder, you should start the engine and run it on the ground or even fly around the pattern once. Test it again. If it is still low, use a length of garden hose as a "stethoscope" and listen at the exhaust of the ailing cylinder. If you hear a hissing escape of compressed air here, you have an exhaust valve that is not seating. Similarly, listen carefully with the "stethoscope" at the carb or intake airbox. A hissing sound here would indicate leakage under the intake valve. If neither of these areas is leaking significantly, listen at the breather or oil dipstick/filler tube. A leak in this area is indicative of ring blow-by. This could be ring wear, barrel wear or scoring, or all the ring gaps may be lined up. Hissing between cylinder cooling fins is bad news, possibly a cracked cylinder. Valve leakage is the most commonly found cause of a low cylinder.

The differential compression test has its limitations but it still remains one of the best, most cost effective preventive maintenance procedures available to the builder/flyer. The method described here is simple and it works. Done every 100 hours regularly, you could save big bucks in the long run.

If you would like to learn more about this procedure and many other cost saving tips for keeping your engine in good shape, you could not do better than to obtain a copy of "Top End" from the Light Plane Maintenance Library.
Write to: Light Plane Maintenance
1111 East Putnam Ave.
Riverside, CT 06878

From CP65-3 (CH38)
EDITOR'S CALL FOR HELP!
I would like to make a plea to all flyers of Rutan designs to please send me all reports of any failures, breakdowns, wear problems, anything at all that you think may be helpful to other operators of the same aircraft. Please write a clear report on the subject. Include your own ideas as to what caused the problem as well as what you did or would like to do about the problem. I will do my best to publish anything and everything that might concern operators of the RAF designed aircraft.

Examples of what I am looking for are in this very newsletter. The crumbling polyurethane fuel lines on a 10 year old VariEze, and the throttle springs wearing through an aluminum bracket due to vibration. As the fleet of RAF designs gets older and gets more time on it, various pieces on these airplanes are bound to show signs of wear and tear. I would like to accumulate as much of this kind of required maintenance information as possible and publish it in the CP.

Not just wear and tear items, any item that requires your attention is worth jotting down and sending in to RAF. I may not publish every item, but you can be sure that each will be carefully and individually considered. I look forward to hearing from you soon.

Fuel Valve

From CP24-5 (CH21,CH38)
SOLUTION TO STIFF FUEL VALVES
One homebuilder reported his stiff fuel valve problems were solved by using a fuel valve lubricant called "parker fuel lube" available in most aircraft supply stores. Cost $10 or $12 for a small can. The lubricant is not soluble in fuel. This small can could lube dozens of EZs.

From CP29-6 (CH21,CH38)
STICKING FUEL VALVE
Some VariEze fliers continue to have problems with their fuel valves sticking. In CP 17 we reported that tight valves must be overhauled before flight. The brass valves can be fixed by dismantling, cleaning and installing a lighter spring (or cutting some off the existing spring). If this is not completely successful the valve must be replaced. In CP 18 we switched to a Weatherhead #6749 valve with a Delrin spool. This appeared to solve the problem. However, a few people still had valves that were hard to turn. Recently a VariEze had a forced landing due to fuel starvation. The airplane was damaged, but fortunately the pilot was not hurt. Examination of the valve revealed that the Delrin spool had broken internally and the valve handle would not turn the spool. This valve had become so tight, on one occasion it required pliers to turn. This VariEze should have been grounded for valve overhaul.

CAUTION If your VariEze fuel valve (brass or Delrin) takes more that 5 lbs. of force to turn it, (10 lbs. is ok for long-EZs) ground your airplane until this is fixed.

The best fix is to shorten the spring by cutting some off and lubricate the valve spool and body with Parker fuel lube. (as reported in CP 25, page 5). Do not treat this situation lightly, you could destroy your aircraft for lack of fuel and yet have plenty of fuel on board.

From CP38-5 (CH21,CH38)
Sticking Fuel Valve - VariEze and Long-EZ
Hank Ashmore has found an excellent replacement for a VariEze/Long-EZ fuel valve. It is a Gerdes products fuel selector valve, and is found on Beech Musketeers, Sundowners, Sierras etc. It is a perfect match for the EZ valve and does not stick. Hank found his at an aircraft salvage yard and paid $20.00 for it. Unfortunately they cost around $125.00 new!! We are not advocating that everyone should run out and get one, but for those flyers with a particularly nasty sticking valve problem, it may be an alternative worth considering.

From CP46-4 (CH21,CH38)
FUEL VALVE STICKING PROBLEMS
During the past 1000 hours of operation in N26MS, we like many EZ pilots have had problems with the fuel valve becoming stiff with time. We have used Parker Fuel Lube for about 3 years, but this has been a temporary situation at best. In fact lately

the Parker Fuel Lube only lasts a few weeks, then the valve is just as stiff as before. This is a bad situation, and could even become a dangerous situation.

Recently Dick Kreidel, past president of Squadron I in the Los Angeles Basin area, introduced us to a new grease. This material is very expensive, try almost $800.00 for a one pound can!! Dick gave us a minute amount, enough to cover your thumb nail, and frankly we thought, what a scrooge! Wrong! This is in fact probably a life time supply. Seriously, we ran the Long-EZ down to two or three gallons of gas on each side. We raised the nose as high as we could to get the fuel valve above the fuel level. We tied the nose down to avoid having it fall on its tail and then used a small ladder to reach inside and disassemble the fuel valve.

We removed the whole thing and noticed signs of 'galling' on the tapered brass valve. We cleaned it thoroughly and "lapped" the valve using jewelers rouge. Brasso metal polish or something similar would also work. Then we cleaned the valve and parts and applied the new "Kreidel" magic grease sparingly all over the tapered brass valve. We reassembled the valve and greased the "detent" mechanism. We had also in the past removed a small amount off the length of the spring. This was done by carefully grinding about half the wire thickness in the spring on each end of the spring on a grinding wheel. Don't get the spring too hot or you will ruin the temper.

We reinstalled the valve and have now got over 80 hours operation over a period of a couple of months since the "lube" job. The valve literally turns like it was on ball bearings. We are very satisfied with this system and heartily recommend it.

Obviously, at $800.00/lb this grease is not reasonable for each individual to purchase, so we (Mike and Sally) have bought a small can of it and we would be happy to send a "small" (literally less than 1/2 teaspoon) quantity to any builder or EZ flyer who will send $10.00 to us at RAF. The $10.00 will cover the cost of a small plastic container, a jiffy bag, postage and cost of the grease. It is on back order at the time of this writing, and should be in our hands November 15, 1985.

Dick Kreidel has been using it for almost two years (over 500 hours) in his beautiful Long-EZ and he says that although it does eventually wear down to where the valve starts to get a little stiff, he says it seems to last longer with each application. He has only greased his twice in 500 hours.

****From CP50-4 (CH21,CH38)****

FUEL VALVE LUBE

Mike and Sally offered a very expensive and very special grease for this purpose for some time but have run out. They will not be ordering more. Anyone who would like to may contact:

Burmah - Castrol
16815 Von Karmen Avenue. Suite 202
Irvine, CA 92714
(714)660-9414

The grease was formerly known as Brayco 3L-38RP, now Braycote 601 and can be bought as follows:

2 oz. for $190.00
4 oz. for $300.00
1 lb. for $800.00

Very expensive, but the only grease we have tested that really works.

****From CP51-8 (CH21,CH22,CH38)****

Aircraft Spruce is now carrying the Braycote 601 **fuel valve grease** that Mike and Sally had. 2 oz. syringe cost $209.95 (enough to grease at least 20 EZs). They also have a new, economical flight warning system for gear or canopy warning. Please note that all EZ fiberglass prefab parts offered in the Spruce catalog are made by Larry Lombard and Michael Dilley of Featherlite, Inc., Boonville, CA.

****From CP55-7 (CH21,CH38,CH39)****

A Pennsylvania Long-EZ builder/flyer was fatally injured when his newly completed airplane crashed short of the runway on his second flight.

Apparently, the first flight was picture perfect, a flight that lasted about forty minutes. The second flight lasted about the same length of time. His engine was heard to be cutting in and out, on his second approach to land. He started a climbing left turn in an apparent effort to return and land. The airplane spiraled down from about 100 feet and crashed.

The right fuel tank was intact and contained approximately 8 gallons. The left tank was crushed, but the 1:20 minutes of flight would probably have used about 8 gallons of fuel. The airplane had 8 gallons on each side when it first took off. The pilot's shoulder harness was tight for take-off yet was found to be loose after the accident, so he may have been trying to reach the fuel valve which was reportedly difficult to turn.

An accident like this is very sad. We have repeatedly given the advice "FLY THE AIRPLANE", and this accident brings it home very forcefully. No matter what happens, if you run out of fuel on one tank or you have to shut it down for one reason or another, "FLY THE AIRPLANE". This must be your first priority. It cannot fly itself, you must maintain control, you must maintain airspeed. Then, and only then, switch tanks or do whatever else you may have to do, all the while maintaining control of the airplane.

Check your fuel valves for ease of operation. If yours is stiff, dismantle it, lap it in with jewellers rouge or a metal polish such as Brasso, using an electric drill. Clean it thoroughly and lubricate it with a suitable grease such as fuel lube, etc. Even if you have to do this once every 6 months or a year, do it, do not let your fuel valve get so tight that it becomes difficult to switch tanks.

While we are on the subject of fuel valves, be certain that you know where your valve handle should point when it is on the left and when it is on the right tank. Check carefully that the valve is in the detent and that this is, indeed, the tank you had selected. Clearly mark the position the handle is in when it is switched to the RIGHT, to the LEFT, as well as to the OFF position. It may be possible to select a mid-position between both tanks. This would not be good since, if one tank was empty, the fuel pump would pump air from the empty tank causing the engine to quit. Know your fuel system. Maintain your fuel valve regularly. Calibrate your fuel sight gauges so that you know exactly how much fuel you have on board. If, in spite of all of your care and diligence, something goes wrong, FLY THE AIRPLANE, try to correct the problem, pick a landing site, and execute a normal landing. Don't try anything fancy. A normal landing, maintaining flying speed and control to touchdown is always your best bet.

****From CP58-6 (CH21,CH38)****
FUEL SELECTOR VALVE UPDATE
In CP 57, we discussed the sticking fuel valve problem which is not a problem to be taken lightly. At least one VariEze has crashed due to a stuck valve and the FAA has contacted us asking us to do something about this problem. The Whitey stainless (or brass) valve is a good valve, uses Teflon seals against a ball, and it turns nice and smoothly. The major disadvantage is the configuration. It is not a bolt in direct replacement. It requires a new mounting bracket and the intake is located on the bottom of the valve, making it more difficult to install.

Yesterday, we saw the best fuel valve we have ever seen. It is a direct, bolt-in replacement for your existing weatherhead valve. It uses the same elbows and nipple in the same orientation but, best of all, it turns smoothly and freely with a very positive spring-loaded ball detent system which lets you feel that you are in the left, the right, or the off position. The handle cannot be installed incorrectly and it is not a tapered plug design which can be prone to sticking. It has a parallel shaped valve body that uses replaceable "o" rings. The whole valve comes apart with two snap rings for easy maintenance. It is made of hard, anodized aluminum and is very light. OK, so what's the catch? The perfect valve, right? Yes, but - Wicks Aircraft will need at least 50 firm orders before they will be able to stock them. They will sell to the homebuilder for $118.65! A lot of money, but then again, what is your life worth? And maybe the life of a loved one or friend? A stuck valve can ruin your day. For $118.65, this problem which has been ongoing for several years now, will be gone forever. If you would like to have one, write or call Wicks and place an order. When Bud Myers has 50 orders, he will get them in stock and this fine fuel valve will, hopefully, eliminate this "sticky" problem once and for all.

****From CP58-10 (CH21,CH38)****
"The best fuel valve we have ever seen", will be in stock at Wicks soon. Part #6S122. It is a direct, bolt in replacement for your VariEze, Long-EZ or Defiant, and it is all "O" ring seals (replaceable) with a very positive spring and ball detent system. Place your order with:

Wicks Aircraft Supply
410 Pine Street
Highland, IL 62249
818-654-2191

****From CP59-9&10 (CH21,CH38)****
THE BEST FUEL VALVE we have ever seen - anodized aluminum, replaceable body, easily removable barrel (not tapered!), with 'O' ring seals and an excellent, positive, position spring detent system. Best of all, it is a simple bolt-in replacement for your existing brass weatherhead or Imperial valve. It is now in stock at both Aircraft Spruce and Wicks Aircraft. It is expensive, at around $120.00, but well worth it in the long run, no more sticking fuel valve, no more disassembling and greasing the valve, just easy, smooth rotary action.

****From CP59-10 (CH21,CH38)****
WHITEY BALL VALVES (Fuel Valve)
The SS-44xF4 stainless steel valve which we recommended for a good fuel valve does have one drawback, it does not have a very wide recommended operating temperature range. No one has ever reported this as being a problem, but a better choice of Whitey valve would be their SS-83xF4, a valve specifically designed for temperature extremes. Quite frankly though, the very best choice of fuel valve is the one recommended in CP58 and now stocked at Wicks and Spruce.

****From CP60-8 (CH21,CH38)****
THE NEW FUEL VALVE
Unbelievably, after all the effort to finally find the perfect fuel valve, we still apparently have problems. We have received reports from both Wicks and Aircraft Spruce that some builders have returned the new fuel valve as unusable, won't fit, not as represented in the CP, etc.!! Even the Cozy newsletter condemned the valve without even looking at it!

WOW!! What can we say? The new fuel valve is all we said it was. It is a direct replacement for the original brass valve. Several EZ owners at Mojave, including Mike and Sally, have installed the new valve and have reported that it is great. It turns so easily, and the strong spring/ball detents are very positive. In fact, the valve can be turned to either tank by feel, without ever looking at it!

There may be some confusion about the left-right orientation of the new valve. Keep in mind that the original valve is identical. If you installed your original valve exactly per plans (i.e., left tank goes to right side of valve and right tank goes to left side of valve, see plans page 21-5), your new valve will fit and work exactly as your old one does. You may have to file an additional flat on the valve shank (there are only 3, whereas the original had 4 flats) depending on how you oriented your fuel valve handle. Other than that, the new valve bolts on to the same bracket, same bolt location, uses the same elbows and fittings and, also, uses your original handle. Remember, this valve was manufactured specifically to replace the brass valve in Piper Cherokees. Since this was the same brass valve, it must fit your Long-EZ! If you have any problems, call Mike here at RAF.

The new valve is available at both Aircraft Spruce and Wicks. It uses "O" ring seals, all of which are replaceable. It turns so freely it has to be used to be appreciated. It has the most positive position detents we have ever seen. Don't let yourself be caught with a stuck fuel valve - get one on order today - even though they are expensive, they will prove to be worth it in the long run.

RAF has received many complimentary letters and phone calls on this valve. We appreciate the feedback on this and anything else you feel might be useful

Fuel/Oil Leaks

****Also see CP65-7 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP65-7&8 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP38-4 (CH19,CH21,CH38)****
Fuel Leaks into Outboard Wings - VariEze and Long-EZ
We have now had reports from three different flyers, that they have had small pin hole leaks in the outboard ribs of their fuel tanks, and that fuel had somehow seeped into the outboard wings. Small pin holes in the root rib of the outboard wings have allowed fuel to attack the styrofoam in the wings. This is a serious situation, since the wing structure requires the foam core for buckling support of the wing skins.

The solution of course, is to be positive that your fuel tanks do not leak and any fuel stains observed near the wing would require removal of that wing and careful checking for any loss of foam structure. Fuel will instantly melt styrofoam and will find its way through the smallest pin holes if its allowed to. If this happens, a repair requires removing all of the melted foam, and cutting back into good foam. Then a block of foam must be cut and fitted, then micro'ed into this void. A possible alternative would be to use "pour-in-place" Liquid X foam or equivalent. Sand the foam to the original shape and do a standard fiberglass repair.

****From CP49-5 (CH30,CH33,CH38,CH39)****
A Long-EZ on its first flight after installing a newly overhauled engine suffered an inflight engine fire and was unable to make it back to the runway. The engine quit on approach and the pilot attempted to land in a housing tract. There was not enough room and he rolled into a car which also burst into flames. He landed under control, thus, inflight structural failure or control failure are not suspect. Sadly, the pilot was killed by fire. The fire was so intense in the engine/cowling area the the FAA accident investigator was unable to determine what could have started the fire. The fuel pumps, carburetor, etc., were consumed. The airplane had been airborne for only a few minutes. Reportedly, the engine was an 0-320 and he was using auto fuel. **We may never know what caused the fire, but it is easy to overlook a loose fitting - we have done it ourselves.** A fuel leak, particularly auto fuel, could be ignited by hot exhaust or any number of things. Always try to have at least one other person go over your work, especially engine related work like plumbing or control systems. The more pairs of eyes that look at your engine installation, the better chance that you will catch some overlooked items. This is specifically important if you are developing new, unapproved installations.

Never, ever, cowl an engine that has been worked on without a brief engine run to check for leaks. We, here at RAF, have more that once found fairly drastic leaks during the leak-check engine run.

****From CP49-7 (CH30,CH33,CH38)****
FUEL LEAKS IN THE ENGINE COMPARTMENT
We recently heard from a Long-EZ pilot who had just installed new fuel lines in his airplane. While on a cross country flight, he noticed that his cylinder head temperatures were way down from where they normally ran, and they continued to run cool for the duration of the flight. Upon landing, he removed the bottom cowling and found that the engine looked as though it has been steam cleaned! He turned on the boost pump and a fine mist of fuel sprayed out of one of the new fuel lines. These were stainless braided fuel lines, supposedly aircraft quality, and yet, one of them had several tiny pinhole leaks that had allowed a fine spray of AV gas to drench the engine. Apparently, the high speed cooling air, mixed with fuel, had literally scoured the engine clean as a whistle! Why no fire? Perhaps it is the relatively high flash point of AV gas which is much higher than auto gas. According to Popular Science, March 1986, it is becoming increasingly commonplace to boost octane ratings by dissolving cheap "light ends" such as butane into auto fuel. This increases vapor pressure and volatility and lowers the flash point. If this Long-EZ pilot had been using auto fuel, he may not have been so lucky. See "Accidents" in this issue.

Fuel leaks aft of the firewall are potential killers. If you have recently broken your fuel lines, or if you are in a new, untried installation, it is mandatory that you conduct a short engine run with the cowling removed.

Carefully inspect all the lines and fittings for leaks (including oil leaks) while the engine is running (watch out for the prop!) and fuel and oil is under pressure. It is common to find one or more fitting loose and you would be surprised how much oil you can lose through a finger tight (but not correctly tightened with a wrench) oil line nut.

Some years ago, Dick Rutan had a fuel line fitting break in flight during a speed record attempt. He lost most of his fuel over board before he became aware of the problem. When he landed, the entire aft end of the cowling and wings were stained with 100LL blue stain. This was the result of mounting an electric fuel pressure sender directly to the carburetor. The vibration failed the aluminum fitting. It is very important that fuel pressure and oil pressure senders be remotely mounted with flexible, aircraft quality hoses connecting them to the engine.

Use only steel elbows, nuts and nipples aft of the firewall in the fuel system. In certified aircraft, only steel or stainless steel fittings and tubes are used between the firewall and the engine, and all fuel and all oil flexible hoses have fire sleeves covering them. The reason is that in the event of an engine fire, the fuel and oil system will not burn through, thus allowing the pilot enough time to execute an emergency landing. Other than an inflight structural failure, an inflight fire would have to be the scariest thing that could happen to a pilot. As the builder of your own airplane, you owe it to yourself to do the best possible job you can on your engine/fuel/oil system. If in doubt, have an A&P or AI mechanic look it over. At least, have other EZ builders look at your engine installation. Many times, in spite of our best efforts, we miss something important which may be easily spotted by someone not so close to the project.

****From CP50-7 (CH30,CH38)****

CAUTION - MECHANICAL FUEL PUMPS

It has come to our attention that the FAA has received numerous reports of these pumps leaking; to complete in-flight pump failures; even to in-flight fires. Apparently, the most common cause of this type of problem is the loosening of the diaphragm screws. It has been reported in several national publications that A.C. will no longer be producing these mechanical fuel pumps due to the liability problems associated with such a failure. New pumps are already becoming scarce and rebuilt kits are no longer available anywhere to our knowledge.

Take care of your A.C. fuel pump. Keep it clean. Inspect it carefully for leaks. Be sure that the A.C. pipe thread adapters are tight and the "o" rings are in good condition and are sealing properly. There should be no fuel stains (leaks) anywhere, the AN fittings should be steel and should be tight and have no leaks. It may not be a bad idea to substitute aircraft quality AN-3, drilled-head bolts for the screws and lock washers. Be careful not to overtorque these bolts and do safety wire both bolt patterns.

If anyone has more information on A.C. fuel pumps, repair kits, etc., we would appreciate hearing from you.

****From CP50-7&8 (CH30,CH33,CH38)****

"Dear Folks at R.A.F.

I am very pleased to announce that N721EZ made it's first flight earlier in September and as with many of the other builders the initial flight went off perfectly. Performance has been without exception, right out of the owners manual.. Basic empty weight is 853 lbs., with starter, wheel pants, and a 25 amp/hr gell cell up front. 125kts IAS @ 2500 rpm fits very well within the 65% power range. I now have over 22 hours of very enjoyable time and look forward to completing the required time.

Although I'm happy to report the excellence of this design, I actually wrote to describe a problem I had after the fourth hour. Having made the modifications to the flight controls in the last CP (LPC 131) and coating the firewall with the intumescent paint, I had the crankshaft seal split and lost two quarts of oil over a one hour period. Fortunately, I kept my first 10 hours down to one hour segments. On removal of the cowling, I decided to run a short inspection and **discovered very small fuel stains running down the firewall from the Facet fuel pump.** Had I not had the new firewall paint on, I might not have noticed the stain. The stain was reddish and did not coincide with the 100LL fuel which confused me at first. The stains were not very much at all and I was almost going to dismiss them but I elected to turn on the fuel pump and watch it for awhile. After 5 minutes, a single drop of fuel dripped out from the back case of the pump.

A few drops of fuel over a 5 minute period does not seem like much but it was enough for me and off came the pump. Close inspection did not show any fuel coming from either of the fittings so I pried open the back of the pump and there found a surprise. The central core of the pump was wrapped with coils of enamel coated wire (red) and then finished wrapped with cloth. The cloth was soaked with fuel and stained red I presume from the fuel acting on the enamel wire insulation. It's anybody's guess what further progress this may have taken. I am in the process of returning the pump for inspection.

Since the last newsletter had important information the fire hazards, I thought I would pass this information along to you.

If I may make any suggestions to builders on their initial flight test program, keep the first few flights short and near airports in the restricted areas. Also, even though the cowlings may be a small inconvenience to take off, during these first few hours remove them and check things over.

Once again many thanks,
Rick Glos"

From CP52-5 (CH30,CH38)

CAUTION - Aeroquip 601 Hose Leaks.

We have yet another report of one of these rubber, reinforced-with-stainless-steel, outer, braid hoses that has suddenly sprung a massive leak. Again, it happened after the airplane had not been flown for a while. Our own experience with the Grizzly was that the airplane was not used for almost one year, then when we turned on the fuel valve and the boost pump, fuel ran out of the cowling just as though a line had been removed. A fuel line, an Aeroquip 601, was leaking at one of the fittings. This hose had never leaked before and no one had touched it between flights. We have now heard from at least four builders with this problem.

Here at RAF, we have gone over to Stratoflex Teflon hoses and we order them made up to the length we want. We have them pressure checked and have fire sleeves installed on each fuel line. These fuel lines are more expensive but we believe they are a much safer way to go. We have been getting our hoses from Aircraft Spruce and they are available from dash-3 to dash-8.

Check all your hoses aft of the firewall, both oil lines and fuel lines, frequently, especially if you have Aeroquip 601 hoses and even more frequently if you made these up yourself. A fuel leak aft of the firewall must be considered one of the most hazardous situations that can occur and must be taken care of before it happens while airborne. Replace any suspect fuel/oil lines. Have them pressure tested and have fire sleeves installed on each line.

From CP57-11&12 (CH30,CH38)

AEROQUIP GENERAL AVIATION ALERT NOTICE,

RECALL ON AEROQUIP 601 HOSE.

This week, we received a notice in the mail with the above title. If you look back through past issues of the CP, you will find that we have been reporting incidents with Aeroquip 601 hoses since 1986 (see CP49, and CP52).

We have had these hoses spring a leak in the middle of the hose (not at a fitting), and we recommended Stratoflex hoses instead. We use nothing but Stratoflex hoses on all of our aircraft here at RAF and that is still our recommendation.

This notice says, essentially, that if you made up the hoses yourself, as we have often done, and you obtained the hose from between April 1984 and May 1988, remove it from service and replace it. If you had these hoses made up professionally, they should have a metal identification band. On this band will be an assembly date and cure date shown as follows:
A2Q87 - assembly date, 2nd quarter, 1987
1Q87 - cure date, 1st quarter, 1987.

If you have such a set of numbers you can identify, remove the hoses if the cure date is between the first quarter of 1984 and the third quarter of 1987. Contact an authorized Aeroquip hose shop and they will supply you with new hoses. You will be billed for these until the authorized distributor receives your removed, suspect hoses, then you will be credited in full.

This note is more than a mandatory AD. A leaking hose could easily cause a fire which could have tragic results. Check your hoses and don't fly until you have replaced them.

From CP64-9&10 (CH30,CH38,CH39)

I thought I would write to report an **exhaust failure** on our Defiant that could have been quite serious.

This involved the front engine with about 200 hours on it. The exhaust was a unit purchased from Wag Aero. It is a standard wide deck exhaust for a Grumman Tiger.

The failure occurred at two places on the unit. One spot was on the exhaust stud coming from the right rear cylinder. It was a total fatigue fracture about 1/2" below the weld to the flange.

The other failure spot was on a lower left juncture of the combined pipes as they went into the muffler.

I could not determine which crack was primary and which was secondary, but I suspect one of them caused the other. What was interesting was that the cylinder near the site of the failure had been pulled by a repair facility when an intake valve cracked.

I did not oversee the repair since it was on a standard engine and muffler combination. After a discussion with Aero Fabricators who repaired the muffler, I came to the following conclusions: When the cylinder was pulled, they probably did not loosen the entire muffler from all the other cylinders. When the cylinder was replaced, the muffler was sprung back into place in a stressed condition and was bolted into place. Aero Fabricators suggested that when the exhaust system was reinstalled after repair that it be loosely bolted into place and then heated by running the engine until it was good and hot. In this hot state, the cylinder bolts and sleeve clamps are then tightened to appropriate torque.

This exhaust system was only about 200 hours old. Since this was a certified muffler on a standard engine, things point strongly to an error in installation procedures. This caution might be relevant to other exhaust systems that are somewhat rigid between multiple cylinders.

We are also going to be balancing both engines in the near future since both starter ring gears were not part of the engines when we bought them. What was really scary was that we had a fuel line failure on the same flight on the same engine, within only 1 hour of each other.

The fuel line failure by the way was one of those fancy expensive lifetime custom made all stainless steel lines that come from Aircraft Spruce. It appears that the failure was a combination of a poor weld on the stainless steel tube and vibration failure. I am considering replacing them with good old rubber Aeroquip rubber lines that you periodically throw away. At least I never saw a rubber line fatigue.

Did you ever notice that it is all that metal on our fiberglass airplanes that seems to brake all the time? I think I am ready for fiberglass engine mounts and ceramic engines.
John Steichen

****From CP64-10&11 (CH30,CH38,CH39)****
"Dear RAF,
"LUCKY YOU FLY A LONG-EZ " - AGAIN!

This is to relate to you an incident that occurred last Saturday, May 21.

I was flying PP-ZAD enroute to a fly-in in the south of Brazil at 8500' under positive control area and enjoying, in advance, my participation in the fly-in and the amazing performance of the Navaid Devices autopilot.

I suddenly smelled burning oil and, looking back, I saw some smoke in the cockpit and two trails of oil coming out of the oil filler door. I immediately reduced power to minimum and began to look for a place to land.

The only airport close by was under rain and no safe approach could be attempted due to mountainous surroundings.

Losing altitude slowly (what a splenderous glider is the Long!), it soon became apparent that the only safe place was a new open-to-traffic freeway with not much traffic on it. After some low passes to make clear my intentions (oil pressure was at this time around 40 PSI down from 80 PSI), I was able to make one of my best landings, not even touching the brakes and with only 20 PSI oil pressure even taxied one more mile to an adequate place clear of the traffic to park.

Some 5 quarts of oil poured from the cowling when I lowered the nose. Next day we put in new oil, ran the engine and we observed the oil coming out from the hose connecting the oil cooler to the engine. A new hose was put on, engine checked carefully and I departed form the freeway again to my home airport.

Now, this airplane is very special to me and no efforts nor expenses were spared in all phases of its construction and choice of parts which had to be always of the best quality, not bothering with prices. Even a brand new engine was ordered from Lycoming.

When it was time to choose the hoses, I decided to use the "stainless steel hose assemblies" as advertised on page 84 of Aircraft Spruce's catalog (very expensive) instead of the regular rubber material. These hoses were made to order for the sizes I supplied (copy of invoice enclosed).

I am sending the failed hose to Jim at Aircraft Spruce to have it inspected by the supplier and I also already substituted all other hoses, even those carrying fuel, with standard Aeroquip shielded hoses.

These hoses were not abused in any way and were installed by a certified mechanic of our air club.

I hope that this may help any other builder who may decide to use these hoses in their airplane.

Thanks again for a wonderful airplane that is making me more confident every day in its capabilities and anticipating my hours of safe, enjoyable flying (not quite my wife's opinion).

Next day I was on a national coverage TV network - try to imagine answering all those phone calls!
Andre J. Deberdt"

Fuel Flow Evaluation

****Also see LPC #133 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP50-4&5 (CH21,CH30,CH33,CH38,CH39,CH41)****
A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally fuel associated. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating from the plans is probably the most common reason. Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. Tony Bengelis' book Firewall Forward is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

From CP54-3 (CH21,CH33,CH38)

"The airplane will always try to tell you before it lets you down."

This is a well remembered statement Dick Rutan always preached at RAF when he worked here. Many, many times we have found it to be so very true. The problem is to recognize and act on the information.

A classic case in point occurred a few months ago with Burt's Defiant. N78RA had always had lower fuel pressure on the front engine than on the back, at least as long ago as any of us could remember, even after we installed the 180 hp engines and constant speed props. Lately though, it seemed the pressure was even lower. On the way to Oshkosh 1987, Burt said he had only 2 psi on the front and 6 psi on the rear. Must be the gauge, right? Wrong! On the approach into Oshkosh, the pressure dropped to 1 psi. Mike and Sally moved into very close formation, looking for any sign of a fuel leak - nothing.

On the trip back from Oshkosh, the fuel pressure hung between 1 & 2 psi. The engine seemed okay though, so Burt pressed on. A few weeks after the return from Oshkosh, Burt and Tonya decided to take two friends to Big Bear for lunch. The take off and climb to 300 feet were normal. Then, suddenly, the front engine began to die. Burt was frozen for a second trying to determine if he should turn back and land - should he shut it down and feather it? What?

He happened to glance at the two fuel pressure gauges - the rear was at 6 psi, the front was showing ZERO! He reached down and cross fed the front engine to the rear engine fuel tank - instantly, the front engine recovered and returned to full power! This airplane had been trying to tell us for a couple of years that something was wrong, but no one was listening.

We knew now that it was in the left (front) fuel system. We checked all the screens and filters - nothing. Finally we pulled out the fuel lines themselves and there we found a blockage of foam chips, small pieces of fiberglass and tiny fragments of micro and epoxy. This blockage was fully 4 inches long in the fuel line from the left tank to the fuel valve, right at the fuel valve. We replaced all the fuel line in the airplane and now we have 6 psi, front and rear, at all times.

The moral of the story is this: If you notice anything unusual, pay attention, the airplane may be trying to tell you something. A new noise, a "different" vibration, any change in fuel or oil pressure, don't ignore these things - remember Dick's teachings, "The airplane will always try to tell you, before it zaps you!"

P.S. The accumulation of debris was caused when we had to replace two low-level light switches in the aft sump tank in Burt's Defiant. Apparently, we were not careful enough when cleaning out the tank before closing it. Burt's sump tanks do not have screens in them, the assumption being that the screen in the main tank should do the job.

From CP54-3 (CH21,CH33,CH38)

Similar Problems in a Long-EZ

Marc Borom, N966EZ, writes that he had had many engine hesitations, slight rough running periods, some requiring the use of the boost pump to make it run smooth. All of this was during Marc's first 25 hours in his test area. Needless to say, Marc was rapidly loosing confidence in his new Long-EZ. How would he ever be able to fly cross country in this thing?

He called us here at RAF several times and we had long discussions about his problem. Finally, one day he decided to make a short cross country to visit a fellow Long-EZ builder.

During this flight, the engine literally quit each time he shut off the boost pump. He asked himself, "Am I having fun yet?" The answer was an obvious - NO!

Safely back on the ground, he once more broke down the fuel lines aft of the firewall. Same results, no problems downstream of the gascolator. Then he remembered that when he had done his fuel flow checks, the fuel flow was sluggish at the gascolator (the airplane was trying to tell him!). He mentioned this fact to other pilots who persuaded him that it was due to low fuel "head" pressure with the nose down. He put that important data point aside as probably not being pertinent.

With no other clues, it was time to check the fuel lines forward of the firewall and back to the sumps. He disassembled the gascolator and found he could blow through both lines from the valve to each sump with very little effort. While he had the system apart, he decided to check the line from the fuel valve to the gascolator. To his amazement and horror, he could not blow through this section of fuel line. He had, at last, found the source of his problems.

He called RAF to discuss this problem and we suggested he use shop air to blow the line clear. The blockage cleared itself with a loud "POP". What he found was a 1" long plug of foam and fiberglass chips that had backed up behind a needle of epoxy coated fiberglass that had lodged in the first sharp bend in the aluminum tube.

This problem was very similar to Burt's problem in the Defiant, and it re-enforces the necessity to "listen" to your airplane. When she tries to tell you something, don't ignore her, check it out and you will become more confident in this machine you have built. In time, you will come to trust her and, therefore, enjoy her and to get more utility out of her. Remember, she will always try to tell you.....

From CP54-3 (CH21,CH33,CH38)

Suggested Method of Checking Static Fuel Flow

VariEze, Long-EZ and Defiant - Before first flight, and if you are now flying but have never done this check, we strongly recommend a fuel flow check. Disconnect the fuel line at the carburetor and hold the airplane in the normal level flight attitude of approximately 1-1/2 degrees nose up (a 24" level with a 5/8" block under the rear end of the level on the top longeron will give you this attitude). Now, using a stop watch and a bucket, turn the fuel valve on for two minutes. Weigh the bucket of fuel, then weigh the bucket empty. The result is the weight of fuel that flowed in two minutes. Since a minimum of 10 gph for a VariEze is required, you should have at least 1/3 gallons (2 lbs.) of fuel in the bucket after a 2 minute run.

For a Long-EZ, you need a minimum of 12 gph, so you should have .4 of a gallon or 2.4 lbs. (without the electric boost pump running). This should increase to a minimum of 16 gph with the boost pump running, or 1/2 of a gallon (3.2 lbs.) in the bucket after 2 minutes. Remember to check both tanks in a Long-EZ, left and right.

For a Defiant you need a minimum of 14 gph (NO boost pump), 0.46 gallons or 2.8 lbs. in 2 minutes. With the boost pump running, you should see a minimum flow of 18 gph, or 0.6 gallons or 3.6 lbs. in two minutes. Don't forget to test both tanks as well as cross feed on both tanks.

These flows are fairly arbitrary, but are flows we have tested for and measured on each of the above aircraft. You should get at least, and probably better than, these numbers when you test your own airplane. If you are way down on these numbers, you should disassemble the fuel lines and blow through them to check for a blockage. Use caution blowing through lines that go into fuel tanks. High pressure shop air might rupture a fuel tank even with the fuel cap removed.

This fuel flow test should be conducted on any new airplane and it would not hurt at all to retest at each annual. Keep in mind that foam chips tend to float on the surface of the fuel and may not get into the fuel lines for a long time or, at least, until you run that tank very low or all the way empty.

From CP58-7 (CH21,CH33,CH38)

FUEL FLOW CHECKS

As called out in CP 53 have caused a number of builders some confusion. We even re-checked our numbers to be sure we had not made a mistake! Mike and Sally's Long-EZ and Burt's Defiant are both relatively old (8 years and 11 years) and the electric fuel boost pumps were also this old at the time of the tests, as were the mechanical fuel pumps.

Since we have installed new Facet electric boost pumps on both of the above aircraft, we also cannot get the fuel flows called out in CP 53. We believe that the foot valve springs in the new pumps must be creating enough restriction to fuel flowing by gravity, that it is impossible to obtain the flow rates called out in CP 53. Of course, the "fuel pump on" tests are still relevant and nothing has changed in this test. We believe, now, that the gravity flow check must be conducted by removing the gascolator bowl or breaking the fuel line at the gascolator. You should be able to achieve the flows shown in CP 53 using this method for the gravity flow check. You should re-connect the fuel line at the gascolator for the "fuel pump on" test and break the fuel line at the carburetor. Again, you should be able to achieve the flows shown in CP 53. If you cannot get at least the correct flows shown, you may have a restriction in the fuel lines or fuel valve. This restriction must be cleared before flight.

From CP62-2 (CH21,CH33,CH38)

FUEL LINE BLOCKAGE

This has been a CP subject before, but we continue to receive reports of fuel line contamination. Listen up, People! A fuel line blockage may, at the least, cause a forced landing and at the worst, kill you. Foam chips, fiberglass shards, pieces of micro falling into your fuel tanks when you install the fuel caps, can work their way into the fuel lines and we have even heard of them getting all the way to the fuel valve and jamming the valve! How about that for a problem! Check your fuel lines for obstructions before first flight. Check them again after 50 hours and thereafter at each annual inspection. A fuel line or valve blockage is a very serious problem.

Fuel Caps

From CP24-7 (CH21,CH33,CH38,CH39)

ACCIDENTS

Since CP #23 there have been two off-field forced landings in VariEzes due to engine failure. No injuries, but both aircraft received major damage. The one in Southern California landed in the desert after the engine failed (reason yet unknown) taking the gears off and buckling the forward fuselage. The other in central California - engine failed just after take off when the pilot selected a tank with water in the fuel. (non-standard fuel system). The field was undulating soft grass. When the aircraft touched down it took the main gear off and damaged the under fuselage and wings. The nose gear was not extended. **Rain water got into the tank due to a very badly deteriorated "O" ring in the fuel cap.** The aircraft had no gascolator or tank drains.

What is learned from the above? First, we don't recommend the nose be retracted for any landing no matter what the terrain is, even water. The nose gear provides extra cushion and keeps the nose from slapping down and digging in after the mains hit. The one possible exception could be brake failure after landing to retract the nose to keep from running off into unfavorable terrain or obstacles.

Water in the fuel system - - be sure the cap "O" rings are in good shape. Be sure all three drains are installed and used. If you suspect water, drain at least two quarts. Drain first while the nose is down from the wing tanks then from the gascolator with nose up. Some times it takes a lot of doing to get to the water. Run your engine at high power for awhile before take-off (nose up) to purge the water. Better to have it quit on the ground than just after take-off.

Don't be in a big rush to switch tanks. Have a safe landing area in sight before switching tanks if you can. Especially the first time you take fuel from the tank. In the case of water, even if you switch back to the "good" tank, you may not get it going in time. It takes a long time to purge water out of the carb. Also don't take short cuts on your systems, it takes a lot less time to do it right the first time than rebuild it.

Carburetor/Fuel Pump

Also see LPC #132 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP65-11&12 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP65-13 in the "Long-EZ Plans Changes" section of this chapter.

From CP41-6 (CH30,CH38)

CARBURETOR FLOATS

RAF has recently received two or three reports from EZ pilots who have experienced problems with floats that become fuel logged and sank in the float bowl. This of course will result in a very over-rich condition and could kill the engine unless the mixture is immediately pulled out to almost idle cut off. RAF has tried to find out what could be causing this problem and we hear rumors that a major AD (Airworthy Directive) is in the pipe line and should be published soon concerning this problem. Apparently the composite floats installed in virtually every Marvel Schebler carburetor is susceptible to this problem and may have to be replaced with a metal float.

Keep a sharp eye out for an unexplained over-rich condition. The engine will generally start to run rough, and may even quit. If this occurs, try leaning the mixture control. If this helps, get back on the ground and pull the carburetor. Have it inspected by a competent carburetor rebuild company. If you have recently noticed you are leaning your mixture more than you used to, suspect that this may be the problem. Do not continue to fly. This can be a very serious problem. The company that owns Marvel Schebler carburetors is:

Facet Aerospace Products Co.
#1410 Highway, 70 Bypass
Jackson, TN 38301
(901)423-2500

This company has issued a service bulletin #A1-84A. This bulletin says the float must be replaced at the next 100 hour inspection or if any of the following three symptoms are seen.

1. Evidence of a flooding carburetor.
2. Rough running at low throttle settings.
3. Inconsistent engine shut down.

If your engine is doing any of the above, contact your local carburetor dealer. Here is southern California, our dealer is:

Aeromotive Carburetors
475-479 Riverside Drive
Burbank, CA
(213)845-7455

Tell them the model of Marvel Schebler carburetor and they have a repair kit which includes two or three gaskets, a clip and pin and a new metal float. For the MA3 carburetor, the repair kit part number is #666915.

From CP44-8 (CH30,CH38)

INDUCTION AIR FILTER AD

In January 1985, the FAA put out an Airworthiness Directive #84-26-02 concerning induction air filters. This AD covers almost every civil airplane in the US including homebuilts.

Any induction air filter should be changed at least every 500 hours. This is good practice and all builder/pilots should comply with this. If you are uncertain of how long the filter has been in use, it should be changed within the next 100 hours.

From CP49-4 (CH30,CH38)

CAUTION

On a Marvel Schebler carburetor equipped with an accelerator pump, there is a small "half moon" shaped bowl held on with two screws. Byron McKean reported that while he was inspecting his carburetor float bowl, which had absolutely nothing in it, he removed this little cover under the accelerator pump and found it literally packed with sediment. It had not caused any problems at that point, but obviously it is something to watch for during inspections.

From CP49-4&5 (CH30,CH38,CH39)

A Long-EZ in Illinois landed in a row of trees after the engine quit. The pilot was on a 1/2 mile final at 300 feet at idle power due to another plane in front of him. When he added power, the engine quit. Two attempts were made to start the engine using the electric starter, to no avail. He hit a small electric wire, then landed in a row of trees planted as a wind break. The canard broke on both sides, the right wing broke at 1/2 span, the left wing was damaged near the strake. The main gear was still attached but bent aft. The left wheel/axle was sheared off breaking all four bolts. The pilot received a small cut on his hand and that was all. No cause for the engine quitting has been determined. **The first thing that comes to mind, of course, is the engine idle speed.** This may or may not have had anything to do with this accident, but we have seen airplanes set up with such low idle speeds that they do have a tendency to quit on short final. However, that is normally an occurrence in the flare where it is only an annoyance as far as taxiing after the landing. An excessively high idle RPM is not satisfactory in that it makes it tough to land an airplane with the L/D of a Long-EZ. In general, if your engine will idle OK on the ground, it will idle even easier at approach due to inflow assisting the propeller.

* These values are probably incorrect as a Long-EZ can easily glide 1/2 mile from 300 feet while decelerating 10 knots.

From CP51-6 (CH30,CH38)

MIXTURE CONTROL RETURN SPRING PROBLEM

There have recently been two cases of engine failure resulting in forced landings (luckily without damage) caused by failure of return springs in the engine mixture control linkage. These, we believe, are due to improper installation of the bracket supporting the push/pull cable at the carburetor. The springs as properly designed are intended only to snub the system and improve the fidelity of the mixture control by eliminating free play. The springs should never be required to move the mixture control away from the idle cut-off position. In both instances, the springs had failed or lost their force due to fatigue and vibration. Properly installed, the swage at the cable end should sit very close (within 1/2") to the cable conduit clamp when the mixture is in the idle cut-off position. If your bracket allows excess exposed cable, then the mixture control cable may buckle rather than positively force the arm away from idle cut-off in the event of a spring failure. Do not depend on the spring to bring the mixture control into the mid range, well away from idle cut-off. If you do, the engine can fail due to a spring failure. If your aircraft does not pass the test shown in the plans changes section of this newsletter, ground it immediately and rebuild your conduit clamp so that the exposed cable is short, allowing the mixture lever to force the arm to at least mid range without assistance from a spring. This is required on the throttle as well as the mixture control.

From CP53-3 (CH30,CH38,CH39)

A southern California VariEze was taking off when it lost power at approximately 400 feet. The engine was leaving a trail of black smoke. The pilot was unable to make it back to the airport and crashed on rough ground about one-half mile from the airport. The airplane was severely damaged and the pilot sustained moderate back injuries.

The pilot believes that the **plastic float in his Marvel-Schebler carburetor became "fuel logged" and sank** causing the engine to run so rough it quit. He was aware that there have been some problems with these floats, but he said that the important thing was that he never thought it could happen to him! We appreciate such honesty and frankness and hope this will strike a firm note and prevent more pilots from suffering the same fate. See CP 41, page 6, for details on the float problems and things to watch for.

From CP55-6 (CH30,CH38)

CARB AIR INTAKE HOSE PROBLEMS

Jake Bach, a Long-EZ builder/flyer reports that for almost a year he had an unexplained loss of about 100 RPM. He checked everything he could think of - timing, compression, plugs, etc., to no avail. Then he decided to modify his air intake system and when he took the intake hose off (which looked perfect from the outside), to his amazement, it had imploded! All the wire on the inside of the hose had come loose and had balled up in the hose restricting the engine's ability to breathe. A new hose completely cured the problem.

This is another good point, one that has been covered in the CP before and, also, one that, in fact, caused an accident in a VariEze some years ago. Part of the problem is in the installation of the hose. It is critical that the spring wire inside the hose be bent in such a way that it can be securely trapped under the hose clamps at each end. We like to bend the wire 90 degrees so it comes straight out of the end of the hose, then bend it 180 degrees so it comes out of the hose around the edge and back along the outside of the hose. Then the hose is installed over the filter tube or carb intake tube and the hose clamps are slipped on so that the wire and the outside string wrap are held securely in place when the hose clamp is tightened. This should eliminate any chance of the wire "spring" coming loose from inside the hose, however at least an annual inspection of the outside, as well as the inside, of this hose should be conducted.

****From CP57-7 (CH30,CH38)****
LONG-EZ, DEFIANT--remove, inspect & if necessary, replace the Facet fuel boost pump per page 11 in this newsletter.

****From CP57-11 (CH30,CH38)****
LONG-EZ, DEFIANT, ELECTRIC BOOST FUEL PUMP ALERT.
Returning to his home base airport after a flight, a Southern California Long-EZ pilot was approaching the 45 degree entry to downwind when, abruptly, his engine quit. He was unsuccessful in getting it restarted but, to his credit, he flew the airplane, announced his situation and made an uneventful, successful landing. Feeling a little weak around the knees, he pushed his airplane into his hangar and went home.

The next day, he conducted a careful examination of the aircraft and discovered that the Facet solid-state fuel pump was completely blocked and would not allow any fuel to pass through to the engine driven mechanical pump! One of the two valves in the pump had deteriorated in the 100LL fuel and had worked its way out the metal cage that normally prevents this, and had been sucked into a position that prevented the flow of fuel. The part number on the mounting flange of this pump was 480615. The plunger valve was made of VITON - this pump is no longer being manufactured.

Before next flight, check the part number of your pump. If you have one of the following part numbers 40023, 480615, 480616, remove the pump and replace it.

The most desirable Facet solid-state pumps that we recommend are part #40108 for 12 volts and part #40154 or 480610 for 24 volts. Both pump fuel at a regulated maximum 6 psi, and the valves in these pumps are *pure nylon* which, other than swelling very slightly in avgas, are not affected nor do they deteriorate. The design of these valves (the foot valve and the plunger valve) are such that they cannot physically get into a position where they can prevent fuel from flowing through the boost pump. Both the above pumps have AN-style 37 degree flare fittings which fit 3/8" tube, AN 818-6, nuts.

Facet manufactures over one hundred variations of the small square solid-state fuel pumps. The above two pumps have AN-type flare fittings machined right on the pump bodies and we prefer this type because they are easy to install (no elbows or nipples required), but also because these two models have <u>only</u> nylon valves, no rubber, Buna, or Viton. Many of FACET's other models have Viton plunger valves or Buna N check valves and these <u>will</u> deteriorate in avgas. These are specifically for use in some other liquid known not to affect these materials.

To check your pump, remove it and look into the inlet and the outlet using a small flashlight and verify that the inlet valve (foot valve) is a round, white dome or ball (nylon), <u>not</u> a flat, black rubber disc. Verify that in the outlet there is a white nylon valve under a steel pin which crosses the port and retains this valve. If this valve is dark gray or black (Viton), remove the pump before next flight and discard it. If you have a pump with female pipe threads (to accept elbows or nipples) due to your firewall layout, choose one with 3/8 NPT female threads rather than the 1/8 NPT female threads, but examine it <u>closely</u> to be sure it has white nylon valves in the inlet and the outlet ports. Discard it if there is any black or gray Viton, Buna N or rubber valves.

If you have had your Facet fuel pump more than a year or so, you probably have one that could go bad. AT a cost of approximately $30.00, it is not worth the risk. Remove it, discard it and install a new one as called out. We believe that the serious consequences that could result from a fuel supply stoppage, more than justifies the immediate replacement of any suspect pump.

We have replaced the boost pumps on Burt's Defiant and on Mike and Sally's Long-EZ and *we recommend in the strongest possible terms that you do the same.*

****From CP58-6&7 (CH30,CH38)****
FUEL BOOST PUMP UPDATE
CP 57's fuel pump alert caused many letters and phone calls and there still appears to be much confusion.

RAF recommends, as a first choice, a Facet boost pump with 37 degree x 3/8 flare fittings and with a nylon foot valve on the inlet side and a nylon plunger valve on the outlet side. The Facet part numbers for this pump are:
40108 - 12v 6 psi max. 4.5 psi min. 37 degree flare
40154 - 24v 6 psi max. 4.5 psi min. 37 degree flare

If you do not want to install the aircraft style 37 degree x 3/8 flared fitting type pump, due to plumbing requirements or space or whatever, the next best choice would be to use a pump with 1/8 - 27 national pipe thread internal or female threads, requiring elbows such as AN822-6 to go to 37 degree x 3/8 flared fittings.

40106 - 12v 6 psi/4.5 psi, 1/8-27 NPT internal threads.
40082 or 40164 - 24v 6 psi/4.5 psi, 1/8 -27 internal threads.

Facet does not manufacture a 3/8 - 18 internally threaded pump that meets the 6/4.5 psi fuel pressure requirement with nylon valves. For this reason, RAF is not recommending the larger internal thread style pumps. Anyone who is using one of these pumps should be very aware of the fact that while the outlet plunger valve may be nylon, the intake valve is Buna or rubber and is a check valve, not a foot valve. A check valve will maintain full fuel pressure on your fuel system down stream of the fuel pump and against your needle and seat float valve in the carb. This is not necessary nor is it desirable in any RAF design. **If you are using one of these pumps, a careful inspection of the intake valve at least once a year is strongly recommended.**

Ian Wilde from Olney, England, a Long-EZ builder/flyer, sent this information in and we have included it here to help those builder/flyers of RAF designs in England. "Facet fuel pump, #40108 is not easily obtainable here in England, however, I am told by the Facet agents that #40105 is the replacement for 480615 and that this pump has all nylon parts. (40105 has a maximum fuel pressure of 4.5 psi which should be OK - all the pumps RAF is now recommending have a 6 psi maximum). Price in the UK is 30.00 Sterling. Better still, the plunger assembly of #480615 can be replaced with an all nylon assembly as per #40105 at a cost, including labor, of 10.93 Sterling, including tax and postage. I have had mine modified and I am very happy with it. Anyone interested should contact the Facet agent:

FSE (Fuel System Enterprises)
180 Hersham Road
Hersham
Walton-on-Thames
Surrey, KT12 5QE
Phone: 0932 231973
Telex: 925109 Fuelit

My contact was Mr. Peter Huxley"

****From CP60-8 (CH30,CH38)****
INSTALLING THE RECOMMENDED NEW FUEL BOOST PUMP
The Facet fuel pumps, part #40108 and #40154 which have the 37 degree flares, have caused some builders to feel that the old pump with the 1/8" female pipe thread was easier to install. We have always preferred the 37 degree dash 6 fitting and do feel it offers the advantage of a large passage for the fuel (less restriction in the line. We had new flex hoses (Stratoflex) made up with 90 degree gooseneck fittings on one end to make the installation easy, however, there is a simple alternative. Aeroquip makes a steel elbow with a swivel nut that fits 37 degree flares that really make this installation straight forward and economical. The part number is 2071-6-6S. They are hydraulic, steel fittings made by Aeroquip and marketed by hydraulic dealers who handle Aeroquip parts. Bill says he will have a few of these swivel fittings with him at Oshkosh and would be happy to get them for anyone who wants them.

We would like to thank Bill Bainbridge for this gem of information.

****From CP61-11 (CH30,CH38)****
The engine control cable check called out for the VariViggen applies equally to the Long-EZ.

****From CP61-11 (CH30,CH38)****
PLANS CHANGES AND OTHER IMPORTANT MAINTENANCE INFORMATION
VARIVIGGEN Check engine control cables for secure attachment at the engine as well as at the throttle quadrant. Install springs to guarantee that carburetor controls fail safe.

****From CP61-7 (CH30,CH38,CH39)****
A New York VariViggen crash landed in the Piconic Bay shortly after take-off when the engine quit. The pilot, an experienced Viggen flyer attempted two re-starts but could not get it to run. He then turned into the wind and executed a near perfect gear up water landing.

The Viggen floated and the pilot was quickly rescued by some pleasure boaters. The Viggen was towed to the beach and, after spending some 20 hours in salt water, was returned to its hangar. The left wing root was heavily damaged and the builder probably will not rebuild. The pilot was bruised and shaken up but not seriously hurt.

The cause of the engine failure was traced to the mixture outer cable attach point near the carburetor. This attachment had been perfect for seven years and almost 600 hours but failed at 600 feet over the bay shortly after take-off. This failure was such that the mixture lever arm on the carburetor was pulled to the idle cut-off position. The pilot was unable to richen the mixture, or even to move the mixture at the carburetor, in spite of his best efforts.

What can we learn from this accident? Engine controls are every bit as important and critical to flight safety as flight controls are. **Check your engine controls for correct travel and try to imagine what you could do to make sure that no matter what fails, the mixture fails to full rich and the throttle fails to full power.** The opposite result is simply unacceptable. A spring that pulls mixture and throttle arms to full rich and full power could prevent such a problem. At least with full power you could use the cockpit mixture lever to regulate power (it works just like a throttle) or even the mag switches to cut power off to facilitate a landing. Using mag switches to regulate power is not as good as using the mixture control. Above all, check that the clamp that secures your throttle outer cable and mixture outer cable are as near perfect as your ability and skill allows. A failure here is not acceptable.

From CP61-11 (CH19,CH38)
VARIEZE MAN/GND Ground your VariEze until you have completed a full and careful inspection of your wing attach fittings, taper plugs, and AN 4 bolts as described on page 10 of this CP. The engine control cable check as called out for the VariViggen applies equally to the VariEze.

LONG-EZ The Long-EZ wing attach method is completely different from the VariEze and there is no mandatory inspection or concern for Long-EZs in this area at this time.

Lubrication System

From CP43-6 (CH30,CH38)
Lycoming O-235 Main Bearing Oil Seals
We have had two reported cases of these seals blowing out and falling into the cowling. This is a serious situation, which in one case resulted in an off-field landing with considerable damage to the airplane. At least one of these occurrences was the result of the wrong seal being installed. The O-235 crankcase is machined with retainer groove as shown. **SKETCH OMITTED**

The correct oil seal (Part #LW13792) has a corresponding retaining "lip" that should 'pop' into the groove in the case. The Lycoming O-320 seal does not have this lip to mechanically retain the seal and it could pop out if inadvertently installed in an O-235. Oil seals do occasionally come out but it is rare, according to Lycoming. When they do, it is generally because the breather has become blocked or restricted, or the wrong seal was installed, or the retainer groove in the case had become caked and filled with old permatex and was not cleaned out properly prior to installing the new seal and of course the new seals 'lip' was not able to snap into the groove.

The best way to install these seals is to thoroughly clean the inside of the crankcase where the seal will go with MEK solvent. Use a bent wire or small screw driver to clean out the retaining groove. Don't neglect the crankshaft. It should be cleaned and polished where the seal will be. Clean the new seal thoroughly with MEK as well. Use Goodyear Pliobond (contact cement) and paint the seal and the inside of the case with two coats (allow the first coat to tack). Press the seal into the case while the Pliobond is still wet, and do not run the engine for at least 24 hours.

Carefully check your breather system. If you have an oil separator, be sure that there is no restriction in the line. Check that your plastic breather line is not kinked or folded over. Be sure this cannot occur once everything gets hot. It is very important that the breather line is kept open and clear so that no pressure can build up in the crankcase.

From CP45-7 (CH30,CH38)
CAUTION
All Lycoming Engines. When checking or cleaning the oil screen, it is critical that the gasket between the oil pressure screen housing and the engine accessory case is oriented correctly. If you should inadvertently install it backwards, you could burst your oil cooler or starve the main and rod bearings of high pressure oil.

Tony Gittes of Guayaquil, Ecuador experienced this problem and went through a lot of time and money trying to figure out what the problem was. Don't let it happen. Pay close attention when you check the screen as to which way the housing and gasket was oriented when you remove it and replace it the same way.

From CP47-12 (CH30,CH38)
CAUTION
Breather hose must be clear! This is critical, do not allow the breather hose to kink or fold onto itself. Keep all curves as smooth as possible and for bends use the largest radius possible. Do not neglect to insert a "stretched" spring into the breather hose per CP31, page 4. This will help to eliminate any tendency for the hose to "fold" or kink when it is hot. The "stretched" spring consists of 5/8" O.D. screen door type spring (hardware store quality), which you will stretch until it yields and takes a set with the coils about 1/2" apart.

If your breather hose kinks or becomes clogged in some way, the build up of pressure inside the crankcase will blow the main seal (behind the prop) out and will rapidly pump most, if not all of your oil overboard. Oil temperature will rise and the engine will seize if you continue to fly. Even at idle, the engine might seize!

Oil Analysis

From CP30-3 (CH30,CH38)
Engine Oil Analysis
Gary Hertzler, owner of VariEze N99VE, has made arrangements with Spectro-Chem, P.O. Box 29074, Phoenix, AZ 85036 to do oil analysis for Eze owners at FBO cost price. Contact Lou Brand, and identify yourself as a Eze owner/pilot, and Lou will send you sample kits for $7.95 each in lots of 12 or more. The kits include a sample bottle and mailer. You send a sample of your oil, attention Lou Brand, and in return you will receive an analysis sheet showing metal present in parts per million. Spectro-Chem has built up quite a history on aircraft engines, and can comment on your results with some authority.

This is an excellent preventive maintenance procedure and we thank Gary for setting this deal up so the Eze flyers can take advantage of it.

From CP32-8 (CH30,CH38)

Spectro-Chem. Oil Analysis, a service we mentioned in CP 30, page 3, has had a price increase. Their price is now $8.95 per kit in lots of twelve or more.

Spectro-Chem
P.O. Box 29074
Phoenix, AZ 85036
(602)253-6515

Contact Lou Brand and identify yourself as an EZ builder/pilot.

From CP33-7 (CH3,CH22,CH30,CH38)

Aircraft Spruce is now stocking the AOA oil analysis kits for $8.95. The David Hoffman cockpit lights are in stock for $12.50 each. They are changing to Latex gloves instead of vinyl, same price and they will also be stocking cotton liner for the Latex gloves.

Spark Plugs

From CP38-5 (CH30,CH38)

Spark Plugs for Hard Starting Engines - VariEze and Long.

Bill Price, a VariEze flyer with over 450 hours on his VariEze, reports that for 400 hours his engine was a real beast to start, particularly while hot. He switched to platinum plugs and reports that his engine is now pure pleasure to start, idles smoother and runs better. Platinum plugs are quite expensive, but last a long time. Mike Melvill had REM40E massive electrode plugs in his Long-EZ engine, an O-235-L2C (as called for by Lycoming) and found that every 10 to 15 hours the bottom plugs would lead foul. Instead of platinum (which may have worked), Mike used Champions REM37BY (extended tip) and the problem disappeared. In fact, the plugs were not cleaned for 260 hours, with no problems.

Magnetos

From CP52-5 (CH30,CH38)

HIGH CHT'S

Recently we have had two separate cases where builder/flyers had been battling with really high cylinder head temperatures. Talking to them on the phone, we discussed baffling, cowling inlet and outlet sizes, carburetion, and spark plug heat range. Frankly, we, and they, were running out of ideas. Amazingly, both of these EZ flyers had obtained their engines in the same way, removed from a factory airplane with relatively low time and running fine when removed. As a result, both of these engines were installed in the EZs and flown as they were received.

The cause of the high CHT's was finally traced to one or both magnetos being timed too far advanced. In one case, one mag was timed 15 degrees ahead of normal. In the other case, both mags were 25 degrees too far advanced!! Beware, guys, some of the supposed FAA approved mechanics, A&P's and even AI's may not be any smarter than you are when it comes to timing magnetos.

In both cases, once the mag timing was adjusted to the normal position, CHT's were immediately reduced to normal. There is a lesson here. No matter where you obtain your engine, whether it is a factory new one, a rebuilt one, or a "used one running well when removed", check the timing before you go flying. If you don't know how to do this, get help from an experienced person who does. Assuming that the timing is correct could be a very expensive mistake.

From CP54-6 (CH30,CH38)

HOW TO REMOVE AND REPLACE SLICK MAGNETOS EASILY ON A LYCOMING POWERED VARIEZE OR LONG-EZ

Have you ever spent an hour just trying to remove or replace the distributor cover on you magnetos? I have and it is very, very frustrating. The main problem is removing and replacing the three (3) slotted-head screws that hold the cover on to the mag. The magnetos are so close to the firewall that it requires a 90 degree screwdriver to get at the screws. Getting the screwdriver into the head of the screw when you cannot see the screw is very difficult, maddening, and time consuming. You can probably tell I hate this job on my airplane and, over the years, I have had to do it more times than I care to remember.

I don't know why it took so long to figure it out, but as I said, the main problem is the three slotted-head screws in each distributor cap. So the easy way to cure that problem is to go to Allen head screws! So simple, yet so effective. I bought 100 screws, they are stainless steel, flat head, socket cap screws and are 10-32 thread, 1" long. It took 20 minutes to remove 3 of the original screws and less than 1 minute to install all 3 of the new Allen screws. I fitted each screw on to the short end of the 3/32" Allen wrench, reached around the mag and simply wound the Allen wrench round and round with my finger until it was tight! Astonished me how easy it was to do!

I do not know of a source of these screws in lots of 6 which is all you need, but I bought mine from Garrett Industrial Supply. They are made by Soc-Pro and cost $16.00 per 100 which was the minimum order. Perhaps a group of 16 could get together and buy 100 at a time. Or better yet, I have 94 left and I know where to get more. I would be glad to mail a set of 6 to anyone who would like a set and would be willing to sen me $1.00 plus a SASE.

Write to: Mike Melvill
Building 13 - Airport
Mojave, CA 93501

From CP55-9&10 (CH30,CH38)

MAGNETOS - TIMING-REMOVAL AND REPLACEMENT

Our experience here at RAF is confined almost exclusively to the Slick magnetos due to Slicks being easier to fit in the confines of an EZ, also due to their being lighter in weight. Since most EZ flyers will have Slicks installed, this discussion will concern only the Slick magneto.

We will start out with the installation of the magneto since this may be the most confusing area, leading to the most starting problems, etc. based on the calls and letters we receive. The older style, 4050 and 4051, "throw away" models probably should be traded in on the newer 4250 and 4251 rebuildable mags. They are more reliable, more readily obtainable, and are easily repaired or rebuilt even by the owner/builder. Basically the differences between the original "throw away" and rebuildable mags is size. The "throw away" being smaller than the rebuildable. Also, when timing the magneto, prior to installing on the engine, you must "spark out" the "throw away" model by spinning the timing gear to set the magneto on cylinder number one. On the newer, rebuildable magneto's, Slick supplies a little "pin", a T-118 timing pin, which is used to set the magneto timing to the number one cylinder. With the distributor cover off, look into the forward end (on a EZ!) of the mag, you will see two holes in the plastic molding, the top one marked for left hand rotation (L), the bottom on for right hand rotation (R). Look on the data plate on the body of the mag for its direction of rotation. Left rotation is normal for a Lycoming O-235, O-320, or O-360. Now, gently push the timing pin into the hold marked (L) until it bottoms. Rotate the timing gear on the shaft of the mag opposite the direction of normal rotation until you feel the pin drop into a hole.

If you have to rotate the magneto very far, you will feel the timing pin trip over a bump inside the mag. Don't force it to rotate. Gently back the timing pin out a 1/4" or so to clear the bump, rotate the shaft and gently push the pin back in. Continue rotating until the pin locates in the hole. The magneto is now internally set on cylinder number one. It is not a bad idea to tape the pin in place with a piece of masking tape. In any case, the pin must remain in this position, without the distributor cover installed, until the magneto is actually in place on the accessory case.

Now, you must set your engine at 25 degrees before top dead center on the number one cylinder (or whatever angle your data plate calls out, 28 degrees for O-235-L2C). Remove the top spark plug from the number one cylinder, hold your thumb over the hole and rotate the engine in the direction of normal rotation until you feel pressure under your thumb. Continue rotating the crankshaft until the advance timing mark (20, 25, or 28 degrees, check your data plate) is exactly opposite the small hole located at the 2 o'clock position on the front face of the starter housing. (This is for Lycoming engines with a starter and starter ring gear installed.)

NOTE: If the prop is accidentally turned in the direction opposite normal rotation, you must repeat the above procedure since accumulated backlash in the timing gears will make the final timing incorrect.

At this point, the engine is ready for assembly of the magneto's. With the timing pin still in place, carefully fit the magneto into its hole. When it sits flush on the machined surface of the accessory case, pull the timing pin out (rotating the prop at this point may shear the timing pin off) and, while holding the mag firmly in place, install the toe clamps, flat washers, lock washers and nuts and tighten until finger tight. Repeat for the other magneto, being certain that the prop has not moved.

Use a battery powered magneto timing light such as a model E50 from Eastern Electronics (available from Spruce). Connect it to a convenient engine case bolt (ground) and to each magneto terminal (the same stud your mag switch is connected to). If the mag switches are wired up, you will have to make both mags "hot" (mag switches to the normal engine running position even though the distributor cover is not yet installed). Make sure the fuel valve is off and the mixture is at idle cut off, and always treat the prop as you would a loaded gun!)

Rotate each magneto in its housing until the timing light comes on. Now slowly turn it in the opposite direction until the light goes out. Slowly turn the magnetos forward again until the timing light just goes on. Tighten the nuts a little.

Now, back the prop off enough to turn both timing lights off. Slowly bring the prop back in the direction of normal rotation until both lights come on. They should come on simultaneously, or very close to it. Now check and see if the appropriate timing mark on the starter ring gear is in perfect alignment with the hole in the starter housing. If it is, tighten the magneto hold-down nuts firmly (maximum torque is 150 inch/lbs., minimum is 110 inch/lbs.). Recheck that the timing lights come on together at the proper time and you are ready to install the distributor caps. If you are working on a Long-EZ, this is the hard part! The distributor covers are so close to the firewall that a 90 degree screwdriver must be used on the standard Slick screws. Believe it or not, this can take an hour or more to do! The Allen head screws Mike called out in CP 54 make this job easy (less than 30 seconds per screw) and he still has a supply of stainless steel Allen head screws suitable for this job. Send $1.00 plus a SASE for 6 screws.

There you have it! If your airplane has a Lycoming engine and no starter or starter ring gear installed, you will need a timing indicator such as model E25 and a top dead center locator (both available from Aircraft Spruce) or an equivalent protractor-type indicator.

This type indicator fits onto the spinner or prop (does not need to be centered) and has a weighted pendulum-type pointer. Use the top dead center finder in the top spark plug hole on cylinder number one, set the protractor indicator so the pointer points at 0 degrees or top dead center (TDC), then turn the prop backwards to about 35 degrees before TDC, then come slowly forward to 25 degrees (or 28 degrees) to be certain to get rid of all backlash.

If you have a Continental engine with Slick mags (O-200 VariEze), the main difference is that the crankshaft flange on Continental engine is marked every 2 degrees from 24 degrees to 32 degrees. You must look on your data plate to determine which to use (O-200 is 28 degrees BTDC). There is also a mark for TDC. It is a line across the edge of the prop flange between the letters TC.

You will need to make a triangular aluminum pointer on which you must scribble an index line that is perpendicular to the base and passes through the apex. The base of this metal pointer should be placed on the machined front surface of the crankcase with the index line exactly on the split in the crankcase halves. Rotate the prop in the normal direction of rotation until the index line points at the 28 degree mark (O-200A). This sets the engine with the number one cylinder at 28 degrees before top dead center which is the point at which you install the Slick magneto (which is also timed to the number one cylinder) per the instruction for the Lycoming.

If you have an older 4051 Slick mag that needs to be "sparked out", remove the bottom vent plug. The distributor cover must be installed and you must find the high tension lead marked T1 or B1 on the spark plug nut. Hold the lead wire spring 1/16" to 1/8" away from the magneto body and turn the impulse coupling one "click" at a time until you see a strong spark jump between the spring and the magneto body. Stop turning the shaft right at the point where the impulse trips and the spark occurs. You may have to do this several times to get it correct. It will not shock you if you do it right!

Now, <u>reverse</u> the rotation about 25 degrees until you can see the timing pin hole through the vent plug hole. Insert the timing pin which will hold the rotor and line the pin up with the center of the vent plug hole. Now install the magneto onto the accessory case.

On a 4050 Slick mag with no impulse, you must turn the shaft <u>vigorously</u> counterclockwise (LH rotation) until a strong spark snaps from the spring to the magneto body.

****From CP55-11 (CH30,CH38)(Photo Caption)****
Slick 4250 magneto - note timing pin in top hole for left hand rotation.

****From CP57-12&13 (CH30,CH33,CH38)****
<u>MAGNETO WIRING CHECK PRIOR TO SHUT DOWN.</u>
The other day, Burt came in from a flight in his Defiant and reported a broken wire on the right rear magneto. He discovered this condition because, it has always been his habit, he conducted a magneto wiring check just before he shut the engine down.

How many of us do this with any regularity? How many do it at all? If you have never done this check, you may possibly have a "hot" magneto, even though you have both mag switches turned off. This is a potentially dangerous situation. Anyone who moves the prop may suffer a prop strike. Many people during the history of aviation have been seriously hurt, even killed, by a "hot" magneto.

The procedure to check if both of your magnetos are correctly grounded, is as follows: Just before you pull the mixture to shut down your engine after a flight (be sure the avionics master switch is off), momentarily flip <u>both</u> mag switches off and then back on. This only needs to take a second or so. The engine should instantly quit. If it continues to run, you have one or both magnetos "hot" or not grounded. Remember, a magneto is <u>always</u> hot unless it is connected to ground. Your mag switches should connect each magneto to ground when they are in the <u>off</u> position. **Check the wiring at the magnetos or between the firewall and the magnetos. This is the most likely place for the wiring to fail due to the movement of the engine during start-up and shut down.** Be sure to have adequate strain relief for the wires, and don't have the wires from the firewall to the engine too tight - you need adequate length to allow for the considerable movement of the engine relative to the airframe.

Try to develop the habit of conducting this test each time you shut down; power to idle, avionics off, both mags off for a second, engine should abruptly quit, mags back on, engine should catch and run, then mixture to idle cut off as normal. <u>Knowing</u>, for a fact that your magnetos are indeed grounded and that anyone, including yourself, is not likely to get surprised by the engine suddenly firing when the prop is moved is very comforting.

****From CP58-12 (CH30,CH38)****
<u>MAGNETO COVER SCREWS</u>
Ever tried to remove the mag covers on an EZ? 90 degree screwdrivers, skinned knuckles, one or two hours of cussing and, finally, you get 'em off. Right? If you have been there, you will love these Allen screws - direct replacements - uses an Allen wrench - remove all six screws in one minute. Send $1.00 and SASE for 6 screws to:

Mike Melvill
Bldg. 13 - Airport
Mojave, CA 93501

Exhaust System

****Also see CP42-4&5 in the "Miscellaneous" section of this chapter.****
****Also see CP62-7 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP64-9&10 in the "Fuel/Oil Leaks" section of this chapter.****

****From CP26-4 (CH30,CH38)****
FROM RAY RICHARDS, TOLEDO, OHIO - "After 150 flight hours (VariEze) I disassembled the carb heat muff and found the carbon steel door spring broken into a dozen pieces. To replace, I wound 0.40 stainless wire into a spring on a lathe mandrel. Works great... other than that all is fine and N48EZ behaved faithfully."
Has anyone else had carb heat spring deterioration? Do check for this, it may be possible to ingest a piece into the engine.

****From CP34-6 (CH30,CH38,CH39)****
A VariEze pilot from Northern California flying from Stockton to Florida, heard a 'different' noise but before he could do anything, one exhaust stack (original style) cracked off and went through the prop removing about 17 inches of one blade. The vibration was so severe that it broke both mag wires and failed the mixture cable/spring assembly. He pulled the mixture and switched off both mags. When this did not work, he turned off the fuel valve and finally the engine stopped. He made an uneventful landing on a highway near Zuni, New Mexico. He found that the top engine mounts had failed and the engine was lying in the cowling. This pilot stayed very cool, flew the airplane and kept thinking all the way. Don't forget to fly the airplane.

****From CP52-5 (CH30,CH38)****
CRACKED WELDS IN EXHAUST SYSTEMS
We have heard of only one instance of cracks in a Brock Long-EZ exhaust system. It occurred at the flange where the pipe is welded to the flange. Careful inspection is necessary to find this type of crack. You may even need to lightly sandblast the area to detect these cracks. After these cracks were welded, there has not been any further sign of a crack but it is being inspected regularly.

There are several types of exhausts that are currently being used on EZs. Our own experience is limited to the exhaust systems made and sold by Ken Brock and to systems we have welded up ourselves. Exhaust systems, even on certified airplanes, are generally on-going maintenance problems. A simple, four separate pipe exhaust system we tried recently has been plagued with cracks. In fact, every time we have taken the cowling off, we have found cracks all the way from minor, little cracks to major cracks, all the way through one tube. So far, we have severely damaged the prop only once, when a rather large piece went through the prop, but we have been fortunate to catch potential problems before they became serious by careful inspection.

Any and all exhaust systems should be removed to be very carefully inspected at least every annual. If you have a history of exhaust system, cracks, check it every 50 hours.

The most reliable exhaust systems we have used on the VariEze were made by Herb Sanders of Memphis, TN, who sold out to Sport Flight which is now located in Florida. On the Long-EZ, by far the most reliable exhaust system has been the one made by Ken Brock Mfg.

****From CP59-9 (CH30,CH38)****
EXHAUST SYSTEM CRACKS
Lew Miller, Long-EZ builder/flyer, reports finding hairline cracks across the flanges and around one exhaust stack after 250 hours of operation. This was a Brock exhaust system and he had been smelling a faint exhaust smell while climbing with the cabin vent closed for sometime and had searched high and low in the engine compartment before he found the almost invisible cracks. He welded up all cracks and has had no more problems and no more smell but says he is not confident he won't have this re-occur since he has done nothing to fix the cause.

We have not heard of a Brock exhaust system cracking before but an exhaust system can, and will, crack if you have excessive vibration. Watch out for this - any exhaust smell in the cockpit is cause to examine the exhaust system with a bright light and possibly a magnifying glass. Please report any cracks to RAF so we may report them in the CP.

****From CP60-9 (CH30,CH38)****
EXHAUST SYSTEM CRACKS
Since we mentioned a crack in a Brock exhaust system in the last CP, we have had four letters from EZ flyers who have had similar cracks. All report that they are hard to see and generally occur around the weld at the flanges.

Next time you remove your cowling, take a bright light and carefully examine the exhaust system, paying close attention to the flanges. Look for a light grey deposit on the pipes or flanges. Any cracks should be welded up before next flight. TIG welding is required for Stainless steel exhaust systems. Do not ignore a crack in any exhaust system. It may cause carbon monoxide to seep into the cockpit, or a piece of the exhaust pipe may depart the airplane and tear up your prop!

Keep in mind that exhaust systems do not last forever, not on homebuilts, not on factory builts, not even on cars! The constant hot gasses, heating to red hot, than cooling, all the vibration, etc., makes for a hard life. Check you exhaust system often and fix it if it is bad.

****From CP61-6 (CH30,CH38)****

WARNING-EXHAUST SYSTEM CRACKS

We have recently seen two sets of Brock exhausts for Long-EZs with cracks around the flanges, in one case the flange itself was cracked in half. We have also received a written report from one other builder who had a similar problem. We do not understand why, suddenly, there are some failures of these exhaust systems. We ran two of these systems for over 1000 hours each here at RAF and Dick Rutan has almost 1700 hours on his Brock exhaust system to date. The Long-EZ was introduced in 1980, the first homebuilts started hatching in 1981 or so. Not one report of a cracked exhaust system until recently. While we do not believe this to be a major problem, we do believe that your exhaust system should be very carefully inspected using a bright light. If any sign of exhaust gas leakage is found anywhere on the exhaust pipes, the entire exhaust system should be removed and thoroughly cleaned and then carefully inspected, paying particular attention to the welds and especially the welds holding the stainless steel flanges on to the tubes.

If any cracks are found, they may be TIG welded if they are not too bad. However, if the exhaust has very much time on it, even the TIG welding won't hold for long due to contamination. In this case, it may wise to simply install a new exhaust system. In any case, new exhaust gaskets must be used when installing any exhaust system unless you use approved re-usable gaskets. Keep in mind that if there is an exhaust system leak inside the cowling, it may be possible for some carbon monoxide to find its way into the cockpit. A carbon monoxide cockpit indicator is an excellent idea.

****From CP62-8 (CH30,CH38,CH39)****

We have just received a telephone report of an engine compartment fire in a Long-EZ just after it landed. The fire was apparently caused by a Sport Flight exhaust system failure. Although exact details are not known at this time, the exhaust header broke for some reason and allowed a hot jet of exhaust gas to impinge on the cowling which caught fire.

Fortunately, this occurred on the ground and a good quality Halon gas fire extinguisher was available to put out the fire - damage was confined mainly to the cowling.

An exhaust system failure in any aircraft is cause for serious concern. Theoretically, if the pipe breaks off in flight it should not cause an immediate fire due to the high speed air being forced through the cowling and "drowning" the fire. However, as you slow down, like on a landing roll, this feature gets to be less and less of a factor and a fire can result.

If you hear a sudden, much louder than normal engine noise, assume you have a problem and that it could be a broken exhaust. Head for the nearest airport but keep your speed up. Land as soon as practical and consider killing the engine as soon as you touch down.

The EZ flyer who called in this report promised us a detailed report on what happened once he has had a chance to really look into it. We will report it to you in a future CP.

****From CP63-4&5 (CH30,CH38)****

SPORT FLIGHT EXHAUST SYSTEM FAILURE/SEPARATION AND FIRE ON GROUND - LONG-EZ, N80EZ

"I had just taken a passenger for a ride. The preflight and run-up were normal as was the full power run-up at take-off. At cruising altitude, I could hear an occasional unusual ticking sound in the headphones, but at the time it seemed like one the those sounds you get on a dark night or when over water (not in my Long-EZ, of course).

Return and landing were normal, as was the taxi in. However, being the ever vigilant, I decided to make a post flight run-up on the ramp. My friend, who is a very highly experienced pilot, was watching. As I was making the run-up, the RPM began decaying and the engine quit! At the same time, my friend called out 'fire!' I immediately shut off the mixture and fuel valve and hastily egressed while lowering the nose.

Unfortunately, I had left my Halon extinguisher in the hangar which was about 200 feet sway. I ran, retrieved my Halon - the hangar-mate next door brought his and we used both on the fire.

I don't know how long it lakes to run 400 feet, but in that period of time the fire had a very good start. Both Halons were discharged and the fire was controlled.

I know there was not an in-flight, or taxi-in fire as my friend was watching. There was probably a crack in the exhaust system which was the sound heard in my headset.

The post flight run-up probably caused the final separation of the exhaust system and, of course, the fire. If I had suspected an exhaust leak, I would not have made the run-up. However, I'm glad it failed on the ground at run-up rather than in the air.

This, of course, is a very serious situation because of the total separation of the right exhaust system and the ensuing fire caused by the direct torching effect of the exhaust emission.

The torching effect probably would not cause a fire while flying because of the airflow, however, the metal parts separating from the aircraft is a sure problem.

This aircraft has a Lycoming 0-320B engine with a Sport Flight exhaust system circa '84. Total time on system, 225 hours.

The engine compartment was uncowled and checked 10 hours previously, with no apparent cracks or breaks.

The break was on the right rear exhaust at a point where the small 'S' tubing is welded to the larger straight exhaust pipe. The break was not in the weld. The break was right outside the weld on the larger pipe. It appears to be fatigue rather than a bad weld. What's puzzling to me is the springs that held the front tubing into the slip joint flange had stretched and given way. So now we have a total separation of the right exhaust system.

I'm sending the exhaust system to RAF for analysis. To my knowledge, this is not a common problem with a Sport Flight system.

I know the gentleman who produced the original system and consider him to be conscientious and capable. However, all systems should be checked. In the meantime, I will endeavor, with help from you folks, to determine the cause.

The damage is repairable. It was confined to the cowling, rib heat shield, right exhaust and finish on the prop. All systems and components in the engine compartment will have to be checked.

I've seen some EZs operating without all the called for heat shields on the spar and ribs. Having these installed on mine helped, as did the fire sleeves on the fluid lines. One fire sleeve was damaged. If it had been unprotected, who knows?!

Some possibilities are:

1) Excess vibration causing the break, although none was detected.

2) The front springs letting go caused the total load to be carried by the welded area.

3) Exhaust system rubbing on the cowling during engine torquing. I did leave adequate clearance and also had someone run-up the engine while I checked the clearance.

4) Simply age fatigue of the system.

I'm sure RAF will have their suggestions to go along with my article. If anyone has had a similar problem, please contact RAF or me at the address below.

Hope to be back in the air soon. The EZ is a great aircraft.

Good luck, fly safely,

Bob Frazier
308 Bayshore Dr.
Cape Coral, FL 33904
813-945-4824

Engine Mounts

****From CP46-6 (CH30,CH38)****

MAINTENANCE ITEMS

VariEze and Long-EZ engine mounts. Ray Cullen, VariEze builder/flyer reports a cracked engine mount. He says his wife noticed a change in the sound of the engine, so he returned to the airport. a subsequent careful inspection of the engine area revealed a crack 1/4" aft of the weld at the upper left attach point. Ray says he almost missed spotting it as it was hidden behind the brake arm. He and his mechanic had completed an annual inspection of this area just 20 hours previous to this, and both failed to find it. Evidently this crack had existed for some time and Ray suggests that the engine mount area should be closely examined on a regular basis.

This is the third known case of an EZ engine mount cracking. One was a Long-EZ (with unauthorized engine), the other also an 0-200 powered VariEze. All were conical mounts, we have never heard of a dynafocal mount cracking. We have carefully examined all of the RAF aircraft and even though they are all high time aircraft, we have found no signs of any cracks.

Inspect your mount regularly, especially the hard to see places around the welds near the firewall. If you notice a change in engine noise or a vibration, land and check the mount and the prop. Please report any findings to RAF.

Cowling

****From CP41-2 (CH30,CH38)****
RECORD SETTING EZ'S
July, Friday 13, 1984. Gary Hertzler's VariEze, N99VE with Jeana Yeager at the controls, took off from Bakersfield attempting to break the CI-A closed course record held by Leeon Davis in his Dave DA-5. Davis' record was 2262 statute miles. Jeana took off at 6:40 p.m. and flew throughout the night between Meadows Field and Merced Airport. This meant she needed to complete 8 laps to break the record, we were hoping for 9. After 8 laps, she figured she could just get in the 9th and in fact she flew over halfway towards Merced before she decided to play it safe and return to Meadows. The rules say you must land at the airport you took off from for a closed course record. So she will only be credited with 8 laps, a distance of approximately 2424 statute miles. Actual distance flown was almost 2700 miles.

Gary's VariEze was flown back to Mojave and given a thorough preflight which included removing the cowling, changing the oil, tightening the alternator belt and retorqueing the prop. **One cowling screw was missing. It was replaced using Loc-Tite!**

At 11:46 p.m., Gary Hertzler took off from Mojave airport in an attempt to set a back to back record this time the straight line distance record in the C1-A class (maximum gross weight = 1102 lbs). Gary had head winds until almost Albuquerque, where they switched to light tailwinds. He had lots of weather, including thunderstorms. After a nasty experience with a thunderstorm over the Smokie Mountains, he decided to call it a day. He landed with almost two hours worth of fuel on board at Martinsburg, West Virginia, approximately 14 hours and 50 minutes after departing Mojave. The straight line distance measures approximately 2227 statute miles, which easily breaks Al Lesher's 1975 record of 1835 statute miles in his Continental O-200 powered Teal.

The important thing to remember is that these results are provisional, and are pending ratification from the FAI. We are confident of ratification though, because in both cases the barograph functioned correctly and all the turn points and landing points were verified.

We are very proud to have these records back in the "fold" so to speak. For those of you who may not remember, Dick Rutan, flying Burt's Volkswagen powered original prototype EZ, broke the closed course distance record during Oshkosh 1975. Leeon Davis broke Dick's record and has held it ever since. Thanks to Jeana and Gary, this record once again belongs to a VariEze. Congratulations guys, you did good!!!

Propellers/Spinners

****Also see LPC #74 in the "Long-EZ Plans Changes" section of this chapter.****

****From CP26-12 (CH38)(Photo caption)****
Johnny Murphy checking the torque of his prop bolts.

****From CP29-2 (CH30,CH33,CH38)****
Warning - Loss of Prop!
Dick recently had an experience with his Long-EZ that would raise the hair of the most experienced pilot. He lost the entire prop and spinner while cruising at 10,000 ft. over a solid cloud deck. After watching the prop cascade away he received radar vectors from center to allow a successful approach to an airport, under weather conditions of 1/4 mile visibility in fog. Investigation revealed that the all-important bolt tension (required to transmit torque through faceplate friction) had been lost when the prop dried out in desert conditions after exposure to the humid-wet Caribbean climate at his world-record arrival location. Note the added caution in the plans-change section of the newsletter. Also, do not, do not exceed the recommended interval on prop bolt torque check. (Owners Manual, Appendix III).

****From CP33-6 (CH30,CH38,CH39)****
ANOTHER PROP INCIDENT
Ray Johnson from the San Francisco Bay area, flew his VariEze to Las Vegas, where it was parked in the desert sun for 5 days. He then took off and headed south at 12,500 feet. About 20 miles north of Apple Valley airport, a horrendous vibration set in. Ray throttled back, pulled the mixture to idle cut off and pulled the nose up to slow down. When the engine stopped turning, the vibration went away. Ray glided in to a landing at Apple Valley. Other than the Cessna that pulled out in from of Ray on final, causing him to have to land off to one side of the runway, it was uneventful. Ray's prop was still on the airplane, 5 bolts had sheared, one was bent but still holding and the spinner retained the prop.

This is a classic case of flying from a moist ocean climate to a dry desert climate. The wood prop shrinks just a little bit, the bolts no longer have the correct torque, so the prop starts to move and in literally seconds, the bolt holes and drive lug holes become elongated, and the bolts break off at the drive lug due to fatigue.

Check your prop torque, it should be between 18 ft/lbs. (216 inch/lbs) and 20 ft/lbs. (240 inch/lbs). With a new prop, you should check the torque after one flight. Then again after 10 hours, then at 25 hours, and thereafter every 25 hours.

****From CP38-5 (CH30,CH38)****
Prop Damage - VariEze and Long-EZ
Remember, flying a pusher airplane, anything that comes off the airplane might possibly go through the prop. This includes cowling screws, loose pieces of safety wire, nuts and washers left loose in the cowling, even wrenches inadvertently left in cowling! Be careful. Be conscientious about working on your airplane. You are the qualified mechanic doing maintenance on the airplane and it is absolutely your responsibility to do the best work you can. A cowling screw or a fuel cap going through the prop, can cause sufficient damage to the wooden prop, that you may have to land and wait for a replacement prop.

****From CP41-5&6 (CH30,CH33,CH38)****
PROPELLER TALES!
Propellers are very important. Check them carefully every flight, and handle them with great caution, they can bite. Check your prop bolt torque regularly. The first check should be done after the first flight on a new prop, then at 10 hours then at 25 hours and thereafter every 25 hours. The recommended torque is between 18 ft./lbs. (216 inch pounds) and 22 ft./lbs. (264 inch pounds). The proper torque on your prop bolts is very important, if the torque gets much below 12 to 15 ft./lbs. it is possible to loose your prop! Recently we were getting the original VariEze prototype out for a flight. It had not been flown or had the prop torqued in almost one year. All six prop bolts were literally finger tight! There was no measurable torque on any of the bolts.

Once the prop has been in operation for a hundred hours or so, you will seldom find the bolt torque low, except when you have flown from a wet or humid area into a dry climate. Check your prop bolts regularly and save yourself from what could be an embarrassing situation to say the least!

There have been one or two EZ pilots recently who have had their hands or fingers hit by the prop. Hand propping an aircraft engine particularly on an EZ is not difficult, but there is not room for carelessness or lack of concentration. The prop should always be treated like a loaded gun. Be especially careful when "backing up" the prop, such as is commonly done to clear a flooded engine. This problem appears to be associated with the larger engines (0-320) more than with the standard 0-235 engines. However, it can happen and if it does it can cause painful cuts and abrasions and even broken bones and will also result in a broken prop. Be careful. Use good safety procedures and never move an aircraft propeller unless you are ready and in position for it to fire.

****From CP42-5 (CH30,CH38)****
CAUTION
Do not neglect to check your prop for the correct torque. We have had this caution in the CP before, but we continue to hear of EZ flyers who have had props come loose or even loosing a prop. As an example, we had not flown the prototype VariEze N4EZ for almost 9 months. It was stored in a hangar on the Mojave airport. The desert dry air caused the prop to shrink and when we checked it prior to flying it, there was essentially no measurable torque on any of the bolts. Mike checked the prop bolts on his VariViggen, N27MS after it sat in the hangar for almost as long. The torque was less than 50 percent of what was normally required. A homebuilder checked the torque, went flying and lost the prop, all six bolts had broken. All six bolts were bottomed out on the threads and were not tight on the prop! This is a real gotcha! Be sure that bolts are not too long. Add a washer or two if they are. Do not ignore this problem. If you do, it will definitely bite you.

We at RAF normally check a brand new prop after the first flight, then after 10 hours and then at 25 hours. Now, after a prop has 100 to 200 hours on it, it is usually compressed and stabilized and in fact, we seldom find any discrepancy in the torque on airplanes that are flown often. However, we still check them, and we strongly recommend you do the same. This is very important and could save you and your airplane from a serious problem, that can be avoided with a few minutes of preventive maintenance.

****From CP46-8 (CH30,CH38)****
NON RECOMMENDED PROPS
We recently heard from an EZ builder pilot who was using a non RAF recommended prop and after only 22 hours of operation, upon noticing a new feeling or vibration, closely examined the prop and found compression failures in the wood about 8 to 10 inches out from the spinner on the forward face of both blades. Remember, most times you will get some type of warning before the prop really lets go. Pay attention. Any new noise or vibration should be investigated. We are becoming more and more advocates of the so called "multi-laminate" Canadian maple wood props. In our experience these props are stronger and allow more torque to be applied to the prop bolts without crushing the prop hub. We have routinely used 300 inch/lb of torque on the 3/8" prop bolts found on Lycoming O-235 and Continental O-200 with these props with no problems at all. Caution: Do not use more than 220 inch/lb of torque on the older style four or five laminations of birch type props. Also, remember to check the prop bolts quite frequently, particularly when the prop is new.

****From CP47-12 (CH30,CH38)****
PROP DAMAGE
Pusher aircraft are probably more prone to prop damage generally speaking, than tractor aircraft. As the builder/pilot and mechanic on your own EZ, you should be aware of this and should pay particular attention when you have been working on the engine, or inside the cowling. Leaving a small wrench on top of the engine can really ruin your day! When it comes out, it will really do a number on your prop. Before buttoning up the cowl, always do a very careful inspection for loose washers, nuts, bolts, even clipped ends of safety wire. All should be removed before starting the engine. Be sure not to leave a wrench or nuts

or bolts on the wings or centersection/strake area - (don't laugh, it happens.) Unless you have a spare prop, the result can be a 6 to 8 week period of waiting for a new prop!

One other thing, if you see damage to your prop, a small gouge or nick, do not assume that it was thrown up by the gear. It may have been, but in our experience if there is a gash in the prop, it almost certainly was caused by something coming out of the cowl. A screw, camloc, washer, whatever. Remove the cowl and carefully inspect the whole engine. Look for missing rocker cover screws or exhaust nuts. Almost without exception, when this has happened to us, we have found a place where something came loose. Be very conscientious about cleanup and tidiness in your engine compartment. Be sure and use new lock washers every time you remove the exhaust system. Check your rocker cover screws for tightness, and safety wire any bolt or screw that you have any doubts about. Above all, don't be careless about laying tools on top of the engine. Be careful and you will get excellent utility and life out of your props.

****From CP49-4 (CH30,CH38)****

CAUTION - PROP BOLT OVER-TORQUING

We continue to hear of various abuses being committed on prop bolts - the latest is over-torquing! A standard O-235 uses 3/8"x24 (AN6) bolts. The recommended limits for these bolts is 225 in/lbs (minimum) and 300 in/lbs (maximum). If you over-torque this size bolt to 400 or 450 in/lbs, you will fail the bolts at the threads. The recommended torque value is 200 to 250 in/lbs (18-21 ft/lbs) for the 5-laminate wood props or as much as a maximum of 300 in/lbs (25 ft/lbs) for the newer, multi-laminate wood props. A quality thread lubricant should be used on prop bolt threads. A 50/50 mix of 50 weight engine oil and STP is also good.

BE CAREFUL AND CONSCIENTIOUS ABOUT PROP BOLTS - THE LOSS OF A PROP CAN BE POTENTIALLY LETHAL.

****From CP51-5 (CH30,CH38)****

PROP BOLT TORQUING

Some builders seem to think that by "overtorquing" their prop bolts they can get around having to check the torque. This is simply not true. There is no way around the fact that you have to periodically check your prop bolts for correct torque. Overtorquing makes no sense and can crush the prop hub over a period of time until the bolts run out of thread and bottom out! Very dangerous since you are not now gripping the prop! Your prop, once badly crushed, may not run true anymore leading to vibration. Also, it is possible to ruin the threads in the drive lugs. The correct prop torque value for 3/8"-24 bolts is 200/250 inch/pounds (18-20 ft/lbs) for any 5 laminate wood prop, and 300 inch/pounds (25 ft/lbs) for the new multi-laminate wood props.

For Defiants and those using the 7" diameter flange with 1/2-20 bolts, we have used 400/500 inch/pounds (33/42 ft/lbs) with no sign of crushing the new multi-laminate props. Even so, you still have to periodically check your prop bolt's torque. This is true whether you fly a factory built Champ, Cub, or whatever. If it has a wood prop, it must be checked every 50 hours or so. If you move from a wet climate to a dry climate, check it more often.

****From CP51-5&6 (CH30,CH38)****

COMPOSITE SPINNERS - GOOD, OR NOT SO GOOD?

Mike obtained a Kevlar spinner a couple of years ago and has been running it on his Long-EZ, N26MS, on and off since then. At first it really seemed like the answer to crack-prone aluminum spinners but now, he is not so sure. This spinner was hand layed up inside a mold and looked like perhaps one ply of Kevlar and at least one, probably two or three plies of glass BID using Safe-T-Poxy. After several hours of flight, the attach screws were found to be a little loose. They were tightened and were noted to have crushed the glass/Kevlar/Safe-T-Poxy locally. A month or two later, the same thing happened. This time, when the screws were tightened, they really "bit" into the spinner. To make a long story shorter, after several such iterations, several of these screws pulled through the spinner!

It was removed for repair before it left on its own! Carefully sanding the inside and the outside of the spinner, a uni-directional glass layup was vacuum bagged inside and outside the spinner. Again, Safe-T-Poxy was used and the spinner was post-cured at 250 degrees F for 2 hours. Much sanding and filling was required to make it fit the Brock spinner backplate/bulkhead and it never did fit as well or look as good again.

This time it lasted almost a year before the same problem occurred to the point where it almost departed the airplane! It has been removed and retired forever and Mike, at least, is very disillusioned about composite spinners. He is currently fitting an aluminum one.

Mike's theory on this is as follows: The screws are tightened and bite into the epoxy/glass/Kevlar and even crush it some. After all, it is not nearly as hard as aluminum. Then, after a flight, the Long-EZ is parked nose down. All the heat in the engine rises out of the back of the cowling and is conducted into the aluminum prop extension - and then into the spinner bulkhead. Feel it sometime ten minutes after you have shut down and parked! This heat then gets into the Safe-T-Poxy spinner and the Safe-T-Poxy softens, allowing the glass/Kevlar laminate to crush thus giving the appearance of loose screws! So we tighten them and the same thing happens. It takes a while, but after a year or less (250 flight hours) the screws are through the spinner and it can come off.

If you are flying one of these hand layed up spinners (obtained from Sport Flight when they were in Memphis), check it often and remove it if it is doing what Mike's did. Use large diameter Tinnerman washers to spread the load. Maybe what we need is a high technology, pressure cured (in an autoclave), high temperature, epoxy-type spinner. Until then, maybe the old aluminum spinner isn't dead yet!

From CP52-5 (CH30,CH38)

PROP BOLT TORQUE PROBLEM

Long-EZ builder, Art Bianconi from Staten Island, NY sent in this hint. While he was torquing his prop bolts, he noticed a suspiciously high torque reading even though the bolt heads had not bottomed on the crush plate. Each bolt was an easy slip-fit in the holes in the wood prop hub and each bolt was an easy fit through the aluminum crush plate. On closer examination, Art noticed that the black anodize finish in each hole in the crush plate was worn off inside the holes, but only in one spot, on the outermost surface of each hole. This indicated that the bolt circle in the crush plate was too small in diameter! He simply drilled each hole out .015" larger and that cured the problem.

It is possible that more crush plates like Art's are out there in the field, so if your bolts are tight, or even difficult to install through the crush plate and prop, take a look at the inside of each hole. If there is a polished spot on one side or the other, consider running a .015" oversize drill through the crush plate. It is very important that there is no such interference to give you a false torque reading on your torque wrench when you are checking your prop bolts. We appreciate this tip from Art Bianconi.

Propeller Balance/Engine Vibration

From CP35-7 (CH30,CH38)

Engine Vibration

Occasionally a builder/flyer will call with a mysterious engine vibration. Our own experience in this area has included, prop balance (never assume even a new prop will be in perfect balance), spinner not running true, baffling touching the cowl (the aluminum, not the neoprene asbestos, which obviously must lap onto the cowl), exhaust system touching the cowl, and one more we had not seen before which Nat Puffer sent in, the hose clamp around the intake manifold rubber sleeve (Lycoming 0-235) was touching against one of the lower dynafocal engine mount donuts. This was not apparent at rest, nor did it occur at run up. Once the engine was turning up a high power, the torque was twisting the engine enough to touch at this point. The result was a high frequency vibration, that was extremely annoying, even worrying.

From CP36-6 (CH30,CH38)

V/E & L/E: John Sheffles (Long-EZ N682S) reports that he recently was able to get his engine checked for vibration on a helicopter balancer. At 2000 RPM his Long-EZ had a reading of '3', about average for a light plane. By adding a nut and bolt of the correct weight at the proper location on the starter ring gear, this reading was reduced to 0.5! John reports a noticeably smoother and quieter airplane.

Any FBO with a helicopter rotor balancer should be able to do this, or stop by Great Falls airport, in Montana. "Rocky Mountain Air" can do the job for a reasonable price. All it takes is a couple of hours - sounds like a great suggestion John, thanks.

From CP48-6 (CH30,CH38)

DYNAMIC PROP BALANCING ACT

A few weeks ago, Jim Fackler brought a Chadwick balancer up to Mojave to check the balance on the props of the Voyager. While he was here, Bruce Evans persuaded him to check the balance on his own VariEze prop and one thing led to another and before poor Jim knew what had happened, he had a flock of VariEzes, Long-EZs and a Defiant waiting in line!

Jim told us that he really did not do this kind of thing for a living. Basically what he does is sell the Chadwick/Helmuth balancing equipment, but said he would be willing to help out the EZ flyers who may be interested in getting this done. He does it on his own time and an appointment would have to be made with him. Jim charges around $100.00 and what you get is a very accurate tachometer check (he uses a strobe) plus, he checks the track of the prop, that is, while it is running the two blades are running in the same plane. If not, he can tell you how far out they are. Then he mounts an accelerometer to the engine and has you run the engine at several different RPMs. His equipment prints out a graph which shows all the vibration characteristics of your engine/prop/spinner combination. Then you shut it down, while he calculates how much out of balance your particular prop may be. He will mount a washer or two on an AN4 bolt through the starter ring gear and have you run it again. That is usually all it takes. With a particularly badly out of balance airplane, he may require one more engine run.

There were six of us who had their airplanes checked by Jim a few weeks ago. All of us were very pleased with the results. Noticably smoother across the board. We did notice however, that after four or five flights in the airplane that the advantage that we had gained seemed to go away. Bruce and Mike noticed this and decided to remove the bolt and washers Jim had added. One flight without the added balanced weight was enough to convince them that it really had made a significant difference and that it was worth the time and the money.

Even if the difference is not all that noticeable to the pilot, you can see on the "before and after" graph printouts that Jim will provide to you, that the vibration peak of the prop is reduced considerably. This must mean less stress on the whole engine/airframe over the long term - see photos for details.

If you would like to get your engine/prop dynamically balanced, a couple of things you can do to help you get the most out of it, is to carefully balance your prop (statically) and check the track when you mount it on the airplane. Keep in mind that Jim will balance the prop even if it is way out of balance. Once this is done, you will have to leave the prop "out of balance" or you will have to have it done again. Give Jim a call after work in the evenings at his home - (818)285-2064.

Also see LPC #128 in the "Long-EZ Plans Changes" section of this chapter.

From CP26-5 (CH9,CH38)
FROM BYRON McKEAN - "I have the Goodyear 6-ply 3.40x5 tires and have ruined 3 inner tubes at the joining of the valve stem to the tube. I enlarged the hole and rounded the edges but it still went flat after 15 landings. Tire repair stations say the rim is too wide for this tire". Ben Duarte machined his wheels (and modified axles) to narrow them to reduce sidewall flexing, as he has had sidewall breakdown with his 6-plies. We at RAF believe the primary cause of both stem failure and sidewall failure is under-inflation. Under-inflation is almost always the cause of stem problems. **When we introduced the 6-ply tires in CP #24 (page 7) we recommended a pressure of 80 psi.** These tires are rated for pressure up to 95 psi. We ran them at 1 10 psi for the world record flight (gross weight was 1920 lbs.). We got over 180 landings on the first set and second set of 6-ply tires. We have run them too low (60 psi) for much of their service. We experienced sidewall breakdown in the form of blisters, near the end of tread wear, but never a flat. Because of the reported incidence of sidewall breakdown be sure to carefully inspect tires on your preflight inspections. (last pages of owners manual). If you have had or do have a breakdown or a flat, report it to us, indicating the service life and pressure history. We will access this data to determine if a wheel modification or change in tire specification is to be recommended.

From CP31-4 (CH9,CH38)
If you are experiencing gear "walk" or shudder as you roll out to take off or land, particularly as you brake to slow down, you should balance your wheels and tires. An out of balance condition that may not be noticeable on a factory built, may be objectionable on a VariEze or Long-EZ due to the relatively flexible gear strut.

From CP32-5 (CH9,CH38)
CAUTION - ROTATION SPEED
Several things influence rotation speed, and thus take-off distance. The fuselage station of the axle centerline is very important. You should hold this within 1/2". (See Chapter 9 and the back cover of Section I). Toe-in of your mains also has a powerful influence on rotation speed (not to mention tire wear!). Accept nothing less than a total of 1/4 of a degree to 1/2 a degree. (N26MS has 1/4 degree toe-in, and still has the original tires, with over 700 landings, 320 hours in one year). If your tires are showing excessive wear, do not accept it, remove the axles and shim them until the toe-in is correct. This can be done quite easily by laying up on or two plies of BID on the strut and bolting the axles back on, gently tightening the bolts until the correct toe-in is achieved (by crushing the BID layup into a taper). Allow the layup to cure, then torque the axle bolts to their proper value of 75 inch/lbs. ft./lbs.). You could also use a commercially available taper shim. Aircraft Spruce sells them in various taper values.

Tire pressure can also influence take-off roll distance/rotation speed (as well as tire wear). Check your tire pressures regularly.

Ground attitude of the airplane can also cause long take-off rolls. Your Long-EZ or VariEze should sit level to slightly nose up on level ground, when loaded to gross weight. If your airplane has a pronounced nose down ground attitude under the above conditions, it should be corrected. Note that a nose-down attitude during construction is normal, before the weight of the engine and wings are added.

From CP47-9 (CH9,CH38)
MAIN GEAR ATTACH ON EZS
Every 100 hours or once per year, you should check your main gear attachment points for any movement. The best way to do this is to lift the wheels, one at a time, clear of the ground, supporting the wing on a piece of foam to spread the load. Get into the rear cockpit and put your hand on the attach point. Have a friend push and pull the wheel in a fore and aft motion. You should not feel any movement at the attach point. If you feel movement, you may have a problem developing. If there is significant movement, you will have to go in and see what it is. It probably will be the bolt holes in the aluminum extrusions, elongating and allowing the bolt to move. This is much more likely to occur in a VariEze than a Long-EZ. Best repair is to ream the holes out to a larger size, press in a steel bushing and bolt the gear back in place.

From CP55-10 (CH9,CH38)
WHEEL ALIGNMENT
When you built your EZ or your Defiant, you should have set the axles on the main gear such that your main wheels were toed in about 1/4 degree on each side. If you have noticed excessive tire wear, inside edges or outside edges, it is time for you to check and possibly adjust the main gear alignment. With an already completed airplane, probably the easiest method of checking this is as follows: Load the airplane to the same load that you normally fly. Now, pull the airplane at least 100 feet forward on a smooth concrete or blacktop surface. This will allow the gear to spread to its normal position, the wheels will be in their natural position for this weight, and this is the condition you want to check the wheel alignment. Using a plumb bob or level, drop the aircraft centerline to the ground (center of the nose, center of the spinner tip), snap a chalk line between these two points. Use a 36" straight edge (hardware store, aluminum yardstick) and hold it so that the center of the 18" mark is at the axle centerline. Hold the straight edge against the wheel rim (or tire if fat tires are used!) and measure from each end of the 36" straight edge to the chalk line aircraft centerline. Record these dimensions and repeat on the opposite wheel. Ideal or perfect results would have A=A2, B=B2 and A+A2 = B+B2 or slightly less. **SKETCH OMITTED**

When A+A2 = B+B2, then the main gear toe-in is zero which is probably the perfect situation for tire wear, but 1/4 degree of toe-in, that is A, would be approximately .080 smaller than B and A2 would be approximately .080 smaller than B2, would be best for ground handling and straight tracking. Measuring to the airplane's centerline lets you know if you have the gear on straight but, realistically, it is not critical of your A and B dimensions are not identical to your A2 and B2 dimension. Wow, hopefully you are not all too confused by the above!

Remove your axles and use metal taper shims (available from Aircraft Spruce or Wicks) or build up the gear leg with glass and grind to set your axles to meet the above dimensions (you also must use 36" straight edges or the dimensions will be different for the same angle!). Once you have the correct toe-in set, you will notice an improvement in tracking, shorter take-off and less tire wear! Go for it!

****From CP61-6 (CH9,CH13,CH38)****
IMPORTANCE OF WHEEL BALANCING
Many builders ignore this rather important step. Our plastic airplanes with their plastic gear are probably more prone to being effected by an out of balance wheel than a standard spam can, but all airplanes will benefit from keeping the wheels balanced.

Do you experience a vibration right after lift-off? Can you see the canard tips vibrating up and down at this point? If so, you need to balance your main wheels, and perhaps even the nose wheel. At RAF we religiously balance all of the wheels on all the aircraft, and we do it fairly routinely, usually at least once a year at the annual.

You will need to build a pair of knife edges. Planer blades from a thickness planer, or jointer will work very well. They should be bondo'd to a "U" shaped wood frame so that the steel blades are level to each other and exactly parallel. Now you will need an arbor. It probably is not practical for each individual to make his or her own arbor, rather a group or chapter could make one (or get it made) and lend it to the members. Dick Kreidel very kindly sent us a drawing of one he machined out of a length of 2" diameter cold rolled steel (CRS). The wheel is slipped onto this "axle" type arbor, an axle nut is used to secure the wheel, then the arbor is set down on the knife edges. Use sticky backed tape lead weights (available from any wheel balancing garage which handles mag wheels) to balance the wheel. The idea is to get it to the point where the wheel will not roll either way. The weights should be stuck inside the wheel or inside the brake disc. Just be certain that there is no interference with the brake caliper. You may be shocked to find out just how much lead weight it takes to balance your wheel, even with a new tire installed. However, you will be delighted when you see the difference just after lift-off. Balanced wheels can also help the vibration some EZ flyers see in the gear on rollout. **SKETCH OMITTED**

****From CP62-2&3 (CH9,CH13,CH38)****
RE: WHEEL BALANCING ARTICLE IN CP 61
George Lyle sends in the following hints to enhance safety when installing sticky-backed weights in your wheels:

1) Make sure that the mounting location is absolutely clean - use MEK and a paper towel, wipe several times until paper towel is clean. Brake residue makes it difficult for the adhesive to grip, and a lead weight in the brake caliper would not be too neat!

2) Bend the lead weight to match the curvature of the wheel - allows 100% contact for the adhesive.

3) Use lead weights with the thinnest adhesive foam tape for best results.

Thanks, George.

Brakes

****Also see LPC #127 in the "Long-EZ Plans Changes" section of this chapter.****
****Also see CP42-4&5 in the "Miscellaneous" section of this chapter.****

****From CP40-7 (CH9,CH33,CH38)****
VariEze and Long-EZ - If you ever experience what appears to be a brake failure, that is to say you hit the brake and it goes all the way down, don't just sit there!! Hit it again and if necessary several times and it will almost certainly be as good as ever. This had been a fairly common problem, and can be caused by several things. The first place to check is the clearance between the brake caliper and the wheel pant and/or the main gear strut. If the strut or wheel pant touches the caliper, this will cause the piston in the caliper to back away from the brake disk, and this will then necessitate several quick pumps on the brake to bring the piston back. Similarly, a disc that does run true can do the same thing. Do not just assume that your master cylinder is shot, do check it for signs of hydraulic fluid leaks, also check the elbow and fitting in the caliper for leaks. Don't forget to check fluid level in the master reservoir. Do not fly if you suspect a bad brake.

Another potential place to keep an eye on is the hole in the firewall where the rudder/brake cable goes through and connects to the CS15 bellcrank. Check and be sure that it is not possible for the nicopress sleeve on this cable to go into the hole and jam. If necessary enlarge these holes a little, or adjust the brake cable length to limit the travel so the nicopress sleeve does not get into the firewall.

Dick Kreidel has been using a new brake lining, a Cleveland part #66-56, which is a semi metallic material with good success. He reports equal brake effectiveness, but about three times the brake lining life. RAF is currently testing these linings and so far have not managed to wear them out, so cannot comment on the brake life.

From CP45-7 (CH9,CH38)

BRAKE LINES

The Nylaflow nylon brake lines which are used on all of the EZs have been generally extremely reliable and on all five of the airplanes here at RAF have performed flawlessly, some of them for more than 10 years. On one occasion we did replace the brake line on the left gear leg of Long-EZ N79RA due to a small blister or bubble that appeared in the nylon line directly opposite the brake disc. At the time we had no insulation on the nylon lines and the heat from the disc heated and softened the nylon line, so that as the brakes were used the pressure blew a small balloon in the line! We replaced the line and insulated them with fiberfrax and silicone and have not experienced any problems. Recently however, we have received two reports of problems with the nylon brake line even though they were insulated. In one case the nylon line blew a balloon and burst causing a loss of brake and a major leak of brake fluid and in the other case, the nylon apparently hardened right at the brass fitting, as though heat was conducted through the fitting into the nylon causing brittleness which due to vibration, broke within 1/4 to 3/8 of the brass elbow.

These are our observations. First of all, the nylon tubing is an excellent, flexible hose, easily capable of handling the pressures required when new and fresh. Sun light is very hard on nylon, the ultraviolet will make it hard and brittle and it then may crack. So keep it out of the sun. When you receive it from the distributor, store it in a black plastic garbage bag until you install it. After it is installed, protect it from sunlight with black electrical tape or something similar. Once you have wheel pants on then the problem goes away.

Protect it from heat. Radiated heat as well as conducted heat can soften the nylon, and also over a long period of time, can cause it to become brittle. Insulate the nylon tube. We wrap it with fiberfrax and glue the fiberfrax on with silicone. Covering the fiberfrax with a reflective aluminum foil such as Reynolds wrap is an excellent idea.

Route the nylon brake line so that it can not "see" the hot disc. Bring it down the trailing edge of the gear leg then around the inboard face of the gear leg into the brass elbow. Do not run the nylon brake line between the gear leg and the disc, this will definitely cause problems. Also it makes it very difficult to change the brake linings!

Last of all, perhaps it is a good idea to install the nylon brake line onto the trailing edge of the gear inside a piece of plastic line, such as hardware store type vinyl tubing or even soda straws stacked together. This allows for easy replacement of the brake line. This is an option not a mandatory change. We have never done this here at RAF, and when we did have to replace a brake line, we found it to be a simple job, but it did mess up the paint job on the gear leg.

From CP51-5 (CH9,CH38)

BRAKE LINES

As mentioned in CP49, page 7, Mike and Sally installed Teflon hose assemblies (Stratoflex part #124001-3CR) in place of the Nylaflow nylon brake lines. These Teflon hoses are constructed with a seamless, smooth-bore, Teflon inner tube wrapped with braided stainless steel cover. These hoses come made to length with the ends swaged (not reusable ends) so must be ordered the correct length to suit your particular airplane. They are not cheap but should last the life of the airframe. Mike and Sally ordered theirs from Aircraft Spruce and the cost was approximately $42.00 per 40" length. These hoses come with a certification tag on them certifying that they are good to 1,500 psi. Mike installed them from the brake calipers to the master cylinders in one piece, mainly to avoid any more joints than necessary and to help eliminate any place for a leak to develop. The smallest hose available in Stratoflex is a -3, so you will have to use -3 elbows and nipples. For example, at the caliper, Mike used AN822-3D elbows and AN816-3D nipples on the master cylinders. The stainless wrapped Teflon hoses were inserted into a hardware store plastic tube (split the plastic tube lengthwise) then Hot Stuffed to the main gear strut trailing edge. One ply of BID was layed up over the plastic tube to permanently hold the new brake lines in place.

With over 200 hours on their Long-EZ since installing these brake lines, Mike reports that he is one hundred percent satisfied with their performance, and it was well worth the higher cost. **While he was at it, he disassembled his master cylinders and installed all new "O" rings, cleaning the parts in denatured alcohol.** The calipers were cleaned up and new "O" rings installed. Dot 5 brake fluid, a 100 percent silicone brake fluid (a General Electric product purchased at a local hot rod auto parts store), was used and Mike does recommend it since it is completely inert and therefore non-flammable. It does not affect seals, "O" rings, paint, or hoses so there has been zero maintenance on their brake system and we are in the process of installing the same system on Burt's Defiant, N78RA.

Be sure to measure your own airplane to get the Stratoflex the correct length for your aircraft. If you have brake master cylinders up front, as many builders do, you can either run the Stratoflex lines all the way (probably best, but expensive) or you can run the Stratoflex up each gear leg and then go with Nylaflow or Nyloseal from there. It will take an AN910-1D coupling (1/8" pipe thread) together with an AN816-3D nipple and a 268P male connector on each side.

From CP53-7 (CH9,CH33,CH38)

CAUTION: BINDING BRAKES

Dave O'Neill, Long-EZ builder from Johannesburg, South Africa, writes of his first flight. Empty weight was 849 lbs. with starter and alternator and 500 x 5 wheels. The only problem Dave had was one that could effect all of us and this is binding brakes. Even a fairly light binding of the brakes can increase rotation speed significantly. Dave had to accelerate to more than 15 kts. above normal rotation speed in order to get the nose wheel off. This is potentially quite hazardous since you are taxiing at above flying speed and things could get out of hand quite rapidly in the event of some small problem. Check your brakes before you go out to do your high speed taxi runs and be sure that the brake discs turn freely between the brake pads when the brakes are not applied. Thank you for this important point, Dave, and congratulations on your first flight.

From CP63-11 (CH9,CH38)

CAUTION - WHEEL BRAKE DISCS RUNOUT.

This can cause vibration in your main gear as you apply the brakes. Use a micrometer to measure disc thickness. Check it in six or eight places around the disc. Thickness should not vary more than .002". Use a dial indicator to check for side-to-side out-of-true. We have seen Cleveland brake discs run out more than .020"! This is completely unacceptable. Sometimes is it in the disc weldment itself, but even more upsetting, it can be in the machining of the wheel halves themselves! If you suspect this, you should return them to Cleveland for replacement.

A better bet may be the new Rosenhaan brakes. While we have not actually tried them, we recently saw a set and they are really neat. They have a very heavy (thick) disc and have dual calipers with four brake linings. Should have serious stopping power. The neat part is they are VariEze to true up if ever they should start to chatter. Simply have them ground flat on a Blanchard grinder. The disc itself is a flat piece of steel. If you are interested in this type of brake, contact: Phil Mattingly

PO Box 8604
Salt Lake City, UT 84108
801-583-2118

Nose Gear

Also see CP42-4&5 in the "Miscellaneous" section of this chapter.

From CP30-4 (CH9,CH38)

CAUTION: Nose gear shimmy can fail the nose gear fork.

Many of us operating EZs are lax on checking the friction of the shimmy damper during preflight. This is EZ to do since we do not see the nose gear when parked nose down. Always check for the 2 to 4 lb. damper friction on preflight. If the damper is free, the gear can shimmy at high speed and fail the fork within 1/4 second. Further, the failed wheel can strike and destroy your prop.

Nose wheel rigged at the proper angle and having at least 2-lbs. friction damping cannot shimmy. Some airplanes have had a bent NG17 tube that binds under load. Then, the owner backs off and the friction adjustment to allow good taxi qualities. Then with little or no load (rebound) at high speed it can and will shimmy. If your gear pivot binds, making taxi turns difficult, check you NG17 for evidence of bending, or ovalizing. Some time ago we increased the wall thickness on the Long-EZ NG17 part sold by Brock to handle the heavier loads. If your NG17 is not perfectly straight, replace it with a steel tube of at least .125" wall.

One of the reasons that the shimmy damper can easily get out of adjustment is that to get the proper force, the spring is coil-bound or nearly coil-bound. Thus, if a little wear or a slight bolt back-off occurs, the damping action is lost. To solve this, Brock is now having made a supply of springs with a heavier (.083 diameter) wire. The orders filled after October will have the heavy spring. Also, as soon as they are received (mid November) Brock will be sending the heavy spring to all who have bought the nose gear assembly. We have tested the heavy spring on N26MS and have confirmed that the adjustment bolt can be backed off a full half turn before losing adequate damping friction. With the old spring a 1/8 turn would result in inadequate friction.

The shimmy failures have resulted in the rumor that the nose gear fork is not strong enough. This is not true. The failures were due to high speed shimmy, not overload. Our nosegears have been extensively tested to in excess of design ultimate loads (CP #18, page 4) and during punishing development tests of the rough field capability (CP #25, page 3). Also, the exact assembly is currently operating at higher weights (2,100 lbs.) and speeds (90 kts) in two jet aircraft, the NASA AD-1 and Model 73 NGT, without problems of any kind. Of course, the friction is checked during each preflight.

We strongly recommend that each Long-EZ and VariEze use the CP #25 spring shock in the nose system. This greatly relieves the shock loads experienced when encountering ruts, chuck holes etc.

From CP30-7 (CH13,CH38)

Worm/Wormgear Retract Mechanism

Some builders have experienced "chatter" when extending the nose gear while static on the ground. While this has never been a problem in the air, due to air loads, it is possible to minimize this by checking alignment of worm and wormgear, and also backlash between worm and wormgear. If you have fore-aft movement of the worm, use a washer to shim it snug. This will eliminate the chatter.

From CP32-6 (CH13,CH38)

CAUTION: Nose Gear Pivot

Correctly installed, the pivot axis should be between vertical and 5 degrees from vertical with the top aft. See sketch on page 13-1, Section I. We recently saw a Long-EZ that had the pivot oriented top forward. Under these conditions, the nose wheel is susceptible to violent shimmy which will fail the fork. Never taxi or fly an EZ if the shimmy damper is not set within limits.

From CP33-6 (CH13,CH38)
NOSE WHEEL SHIMMY/FAILURE
We have heard of three more nose wheel fork failures. This is a part of our airplanes we seldom see; it is retracted when parked and we are usually in the seat when the gear is extended. Do not neglect to check you nose wheel during your preflight. Pay particular attention to the friction damper. You should grab the tire as far aft as possible and swing the fork left and right. It should take 2 to 4 lbs. of force to do this. If you are not certain how much 2 to 4 lbs. is, use a spring scale to calibrate yourself. If you have less than 2 lbs., it is possible for the nose wheel to shimmy. This shimmy or flutter instantly goes divergent and in only a fraction of a second the fork will fail, due to side loads. The nose wheel/fork, can bounce back and go through the prop. The nose wheel fork is designed with more than enough integrity to take the maximum expected landing loads and has been tested to over 80% above the FAR Part #23 requirement without failure (see CP #18). This type of failure caused by shimmy generally occurs with very little load on the nose wheel, usually at the very moment of a nose wheel touch down, or even at the moment of nose wheel lift off during a take off. The new shimmy damper spring called out in CP 30, page 4 MUST be installed and correctly adjusted. Also check to see you have no ovalizing or bending of the NG17 steel tube and that the thick-wall (0.125+ wall) NG17 is installed.

From CP34-9 (CH13,CH38)
Nose Wheel Shimmy
We have cautioned EZ pilots about nose gear shimmy damper adjustment in the last two Canard Pushers, yet we still have EZs losing their nosewheels. It is a fact that your nosewheel fork will fail if you experience shimmy on landing or take off. It is also a fact, that if the friction damper is correctly adjusted, you will not have shimmy at all. The nosewheel fork will not fail due to a normal landing. It is very strong, the original fork has been grossly overloaded to the point of failing the NG15A casting and/or the 1/8" aluminum plate on the forward face of the NG15A casting. Yet the fork was not damaged. This has occurred several times. We are satisfied that the fork will fail only if it shimmies. Therefore if you keep the friction damper adjusted and check it regularly, you will not have this problem. Every time you extend the nose gear, just before you get into your EZ, hold the nose wheel clear of the ground and use your foot on the trailing edge of the nosewheel tire to check the friction. You will soon get "calibrated". You should have to push or pull 3 to 5 lbs to pivot the fork.

When taking off, try to rotate positively, hold it down until you have the proper speed, then rotate smoothly. Try to keep the nose wheel from touching back down or skipping, this is when shimmy is most likely, at the instant of a light touchdown. The same applies to landing. Hold the nose wheel off until you are traveling as slowly as possible. Then let the nose down and hold it down with forward stick. Do not let it skip. Avoid nosewheel touchdown at very high speed.

If you follow these simple steps you will minimize any chance of shimmy and therefore the chances of losing a nosewheel. The prototype Long-EZ still has the original thin wall fork and with over 680 hours, has never experienced any shimmy. N26MS has almost 500 hours with probably more take off and landings than the prototype and it too has not had nose gear problems. Dick and Jeana have the high time Long-EZ with over 700 hours and also have not had shimmy or nose wheel failures. There is a lesson here - get into the habit of preflighting your nose gear. Keep your friction damper correctly adjusted.

From CP38-4 (CH13,CH38)
Shimmy Damper - VariEze and Long-EZ
If your nose wheel shimmy damper is not holding consistently, check to see if the phenolic "piston" is tight in its vertical hole. If so, ream the hole about .005" oversize to allow a nice free fit on the phenolic "piston". Reassemble, being certain to use the heavy duty spring called out in CP 30, page 4 and this problem should be solved.

From CP41-5 (CH13,CH38)
NOSE WHEELS
As we stated once before in CP 34, the nose wheel is prone to being forgotten. After all it is retracted when you are parked and while doing your preflight and when it is extended, you are normally in the front seat and unable to look at it. Get into the habit of extending it and prior to climbing into the seat, use your foot to check the friction damping. It won't take long to "calibrate" your foot and soon you will be aware of how it should feel. If it is loose and swings around with little or no drag, DO NOT FLY. Adjust the friction damper to give 3 to 5 pounds of force required to move it when pushing or pulling at the trailing edge of the tire.

If your airplane has a tendency to turn left or right while taxiing straight ahead on a level taxiway with no wind, you probably have your nose wheel mounted so the the nose wheel itself is not perpendicular to the level ground. We have recently corrected this problem on two Long-EZs by removing the four bolts and the 1/8" aluminum plate from the NG15A casting. Then using a home made "puller", consisting of 4 bolts, lots of washers and a spacer, we were able to pop the NG15A casting loose from the nose gear strut. Local heat such as an industrial heat gun can sometimes help.

We ground away some material at the tip of the nose gear strut, such that we were able to reinstall the nose wheel fork and pivot casting(NG15A) with the wheel itself absolutely perpendicular to the ground, with the aircraft level, sitting on level ground. In both cases this made an immediate and dramatic effect, allowing less use of brakes while taxiing, a shorter take off roll, since little or no braking was required and longer brake pad life.

From CP43-5 (CH13,CH38)
VariEze and Long-EZ - Nose gear chattering.
George Dyer is a gear expert and we sure appreciate this excellent hint.
"The following procedure will reduce and in most cases eliminate the chattering of the nose gear during lowering and some reported cases of inadvertent lowering in flight during turbulent weather conditions. This condition is caused by the weight of the

nose gear wheel assembly pulling the gear housing arm (NG50) and causing it to over run the speed of the rotating worm gear (NG58) during lowering. An axial thrust load on the low speed shaft (NG52) will resist the weight and over running condition. The nose gear housing sides (NG51) and (NG30) are considered a flexible gear housing and require a greater axial thrust load present on the low speed shaft (NG52) than a rigid gear housing to eliminate the low speed gear (NG53) over running the worm hear (NG58) during lowering which results in a chattering sound. This can eventually result in gear fatigue.

To accomplish the axial thrust load, washers (AN960-1016), regular or light thickness, need to be added on the low speed shaft between the NG55 spacer and the NG53 bearing as required to achieve an even clearance of .030" to .060" at points A and B shown on figure #1. Clearance should be set before the gear housing is installed in the plane since you will be unable to determine the thrust load clearance when installed.

Both bearings (NG54) should be lubricated with a grease type lubricant before installation.

If there are any questions or problems, please feel free to give me a call or write: George Dyer, 6221 Chapman Ave, Garden Grove, CA 92645, 714-894-6448". **SKETCH OMITTED**

From CP44-7 (CH13,CH38)

VARIEZE AND LONG-EZ - Nose wheel pivot. Remove the aluminum collar that retains the nose wheel fork. Drop the complete wheel/fork assembly out of the NG15A casting. Check for wear in the bronze bushings. We found quite a lot of wear on a Long-EZ with 900+ hours, and a couple of builders have reported wear in these bushings that warranted replacement. You can obtain replacement bushings from any bearing supply house. We installed longer bushings this time, for more bearing area and hopefully longer life. These were Oilite bronze flanged bushings, part #FF-838-3, obtained locally in Mojave at the King Bearing store. These bushings were 1" long. We cut them down to 3/4" long to leave space between them as a grease pocket. We also bought (from the same source) two Torrington thrust races parts #TRA-1220. These are essentially large, flat, thin steel washers. They are 1/32" thick and have an I.D. of .752 and an O.D. of 1.240.

We installed one of these between the aluminum fork casting and the bottom flange bushing and one between the top flanged bushing and the aluminum retaining collar. Obviously this takes up more space than is available, so we miked the two Torrington washers, and faced that amount of material off the bottom of the aluminum retaining collar. We applied a generous coat of grease on all moving parts and reassembled the fork to the NG15A casting. We then carefully adjusted our friction "shimmy" damper until we had approximately 5 lbs. of side force required to turn the wheel. When we tested this set up, we found that the nosewheel pivoted very smoothly, and nose wheel steering now required much less braking effort. At least 5 local EZ flyers have done this modification to date, and all have reported a big improvement. We are pleased with the results of this mod, and have found that we can increase the friction damping force, without making it harder to steer, thus dramatically decreasing the likelihood of shimmy or flutter on the nose wheel.

From CP46-3&4 (CH13,CH22,CH25,CH30,CH38)

N26MS, MIKE AND SALLY'S LONG-EZ - the first 1000 hours.
As many of you (who attended the RAF flyin in June and also Oshkosh this year), will know we have given our "old" Long-EZ a face lift. It is hard to believe, but she will be 5 years old this December.

It all started when Mike decided (and the check book said ok) that we needed a Loran C!! After much looking around, we opted for the MicroLogic ML6500. Our reasoning included, easy to operate, fully automatic chain selection and a size and shape that would fit our panel. It turned out that the panel had to be cut out and a completely new one be designed, built and installed! While we were at it, we tore out all the wiring (it was done in a hurry and Mike was never very happy with it). Our panel night lighting was never very good, so we installed post lights over all the instruments, as well as a dimmer switch. Panel lighting at night is now superb.

In order to do all this work, we removed the wings and canard, cut out the side consoles, cut out the instrument panel, reshaped the nose to allow installation of brake master cylinders up front and optimum placement of the two 12 volt motorcycle batteries, that make up our 24 volt electrical system. We also reshaped the cowling extending it aft a full 3" to reduce the closure angle and hopefully reduce drag a bit.

The structure was given a very thorough inspection, wing attach hardpoints looked like the first day they were put together. We are extremely pleased with the composite structure. **A few small cracks were found in the paint, all were examined, by removing all finish down to the glass.** In no case did any crack extend into the glass, we are ashamed to admit that each crack was over a rather generous build up of Bondo! The moral here is use dry micro not Bondo. We did a little recontouring, filling with West System, sanding and priming with Mortons Eliminator. We installed the new Roncz 1145MS canard, carefully fairing it into the nose. We designed and built two battery access doors (they work nicely, but are not worth the amount of work it took). We installed the Loran C antenna in the left winglet. Then we wet sanded the original Imron finish down until the whole airplane was dull.

Mike sprayed the entire airplane with Imron using a slightly whiter white than we used last time, and we trimmed it in metallic gray instead of the green we used the first time. We had the seat cushions recovered in gray to match the trim. All the consoles were glued and glassed back into place, the interior was once again painted in charcoal gray Zolatone. We installed the Ian Ayton's canopy/gear warning systems, (it flashes the warning light and buzzes the horn intermittently). We cannot say enough about this system. It is really neat. It is small, easy to install and you absolutely cannot ignore it. If you override the horn, the light continues to flash, and in about 50 seconds, the horn starts to buzz again, a very worthwhile addition and one we both heartily recommend.

When we finally reassembled her, she looked like new! We did a careful weight and balance on 3 certified aircraft scales (naturally she had put on a little weight), then we rolled her outside, fired her up and went flying.

The whole face lift was supposed to take a few weeks and in fact ended up taking over three months. (It only took 5 1/2 months to build her from scratch!!)

The Loran C works well. We get SNRs (signal to noise ratio) of 99 on the master as well as both slave stations, with everything turned on, engine running and in flight. This is true in the Mojave, Bakersfield, Fresno area at least where the testing was done. Obviously there are many places where we cannot get these kind of optimum results. The antenna we use is a 3/16" O.D. hobby store brass tube. We sharpened the end, put it in an electric drill, and "drilled" it into the bottom of the lower winglet, pushing it all the way to the top of the winglet. It goes up the leading edge of the upper winglet. We soldered the preamp to the bottom of this brass tube, removed a wingtip light assembly, dug out a little foam and installed the preamp behind the wingtip light. We are very pleased with this simple, cheap antenna.

We recently installed miniature fuel and oil pressure gauges (1 1/4" dia) that read actual pressure (not electrons!). They are plumbed directly from the engine to the instrument. We used nyloseal tubing fittings. These are really great little instruments, a bit expensive, but worth it. (See page 206 in the Aircraft Spruce catalog). In addition we have an Electronics International digital CHT-EGT with a four way switch, so we can look at all four cylinders. We bought an oil temperature probe and connected the cylinder #1 EGT to the oil temp. Thus we have 4 CHT, 3 EGT and oil temperature in one gauge. Also in this small side panel, is a digital voltmeter by Davtron. Again, expensive but worth it. We know exactly how the electrical system, alternator charge, etc is doing, plus or minus 0.1 volt.

The only item that really required maintenance was the nose gear strut and associated pivots. Mike removed the top bolt and took the whole strut out. The bushings in the NG-6 assembly (NG-23 as shown on Page 13-1) were quite worn allowing considerable side to side play in the top pivot. Mike machined up two steel bushings, pressed them into the NG-6 casting then reamed them to be a very close fit on the NG-7 spacer. A grease fitting (Zerk) was installed in the NG-6 casting allowing future lubrication of this pivot without dismantling it. The two HM-6 rodend bearings in the shock strut were also somewhat worn, allowing some fore-aft movement of the nose gear strut. We replaced these rodend bearings with very expensive aircraft quality rodend bearings (approximately $25.00 each) which essentially eliminate any play.

The vertical pivot at the nose wheel fork had already been overhauled per CP 44, page 7. Thus the entire nose gear strut and wheel has received a complete major overhaul. It is now working flawlessly and we are very pleased with the above modification and repairs.

The brake master cylinders up forward modification was done for three reasons: To help move the CG forward, to allow better access for inspection and hydraulic fluid replacement, and to also allow better access to the magnetos.

Mike designed this particular installation, it works quite well, but if we were to do it again, we would use Debbie Iwatate's method. (See "for sale" this CP).

We did find one drawback to the forward mounted brake cylinders, that we had not foreseen. It is now quite difficult to adjust the rudder position for various size pilots. The original design used only adjustment to lengthen or shorten the cable aft of the pedal. Now we have to <u>also</u> adjust the pedal to brake master cylinder relationship, which with our design is awkward. As a result no one else gets to fly our Long - advantage or disadvantage?!?!?!

We have also done a lot of work on optimizing engine and oil cooling. At this point in time though it is too early for us to comment on the success. We are flying the airplane quite a lot, in fact since Oshkosh we have put over 100 hours on her. N26MS continues to meet or exceed our expectations. We have enjoyed nearly 5 years of fun flying, visiting faraway places and meeting interesting people. We are looking forward to the next 1000 hours.

****From CP46-7 (CH13,CH38)****

<u>NOSE GEARS ON ALL EZs</u>

Several builder/flyers have reported having the nose gear vibrate or jump out of the over center, down and locked position when landing hard, or on a rough runway. Should this happen, it will normally result in the gear retracting, allowing the airplane to come to rest on its nose. This will almost always result in the cast iron worm gear being stripped of its teeth. Keep in mind that this gear is <u>never</u> supposed to see any load greater than the retract or extend load. It <u>will not</u> support the airplane if the load gets into this gear. The design calls for the mechanism to crank the nose wheel down at which point the NG10A strut or shock strut takes <u>all</u> the load in compression and dumps this load through the NG50 weldment into the NG-14 spacer and AN4-41A bolt. See page 13-2 (Long-EZ, Section I). The worm and worm gear see zero load at this point.

If your airplane has shown signs of the nose gear handle trying to wind down on a rough runway, you need to check that your mechanism does indeed go <u>over center</u> and perhaps rig up some sort of a friction device at the instrument panel, behind the gear handle. If you are unfortunate enough to strip a gear, you can save the day, by turning the gear 180 degrees and using the other half. This trick only works once though.

****From CP50-7 (CH13,CH38)****
"Dear Mike,
Thought I should pass on some information about nose wheel tube failures I've experienced and what was done to hopefully prevent future occurrences.

It all started with about 100 hours on the airframe. The nose tire went flat just after landing touchdown. The shimmy got quite violent and it wasn't until after we got it stopped that we knew is was a flat. I thought for sure we had broken something.

It appeared that the tube had been creased when it was originally installed in the tire by the supplier (back in 1976). The tube through use evidently moved around and the creased smoothed out. The failure occurred where the tube was creased, apparently due to it's age. A replacement was obtained from a fellow builder who happened to have a spare from a kit he had picked up.

Sixty hours later the nose tire went flat again. This time, luckily I had just started to taxi when things went all wobbly. The unlucky part was that I was 400 miles from home on a Sunday morning and I had a golfing date 250 miles away. To make a long story short, I was able to talk a very generous local builder into taking the tube from his project so that I could get under way. The failure this time was due to a pinch on the valve stem. This was either poor assembly or that the tire had rotated slightly to cause the interference with the rim.*

Eight hours later and fortunately, during taxi at the home port, another failure occurred. I was beginning to develop a phobia at this point. The failure this time had occurred in a manufactured seam of the tube. There is a good possibility that this tube also was quite old.

This time we replaced both the tire and tube with new (or at least recently purchased) units. We also drilled the rim and installed three equally spaced screws on each side of the wheel to prevent the tire from rotating. This is the same method used by automobile drag racers for years. The screws are self tapping and extend into the bead of the tire about on eighth inch. So far, we've got thirty hours on this setup with no problems.

I would recommend to anyone who has an old inner tube, especially from the 70's vintage kit, to replace it, or them, if the mains are that old also. I was lucky, these failures could have easily resulted in damage to the airplane.

Best regards,
Herman J. Kuebler"

<u>*EDITOR'S NOTE:</u> **We have found that the best method of preventing the tire from rotating on the wheel is simply to keep it inflated to at least 40 psi.** Because the nosegear is retracted while the EZ is parked, the nose tire gets very little attention and, if the pressure gets down to 15 or 20 lbs., the tire will rotate and the valve will pull out of the tube.

****From CP51-5 (CH9,CH38)****
<u>NOSE GEAR CARE</u>
We recently replaced a nose gear shock spring on our Long-EZ (Brock part #LST-6) and were amazed at the difference. We had noticed that while taxiing, the strut would flex off the stop. The spring very slowly loses its capability to support the nose and, over a couple of years, insidiously, this condition gets worse and worse until you are taxiing nose down a few inches. It happens so gradually that you may not notice it. In fact, since we replaced ours, we have been noticing quite a number of Long-EZs that fly into Mojave are taxiing "nose low". If you have noticed that your nose gear rides on the spring as you taxi on a smooth taxiway, chances are you need a new spring.

<u>Shimmy dampers!</u> This has been by far the most frequent maintenance item on the EZs. The problem is that unless you keep your shimmy damper in perfect adjustment, the results can be a broken nose wheel fork. We recently installed an innovative shimmy damper designed by Bob Davenport onto two Long-EZs here in Mojave and so far, the results have been excellent. Bob has gone out and found an excellent machine ship to produce the few parts required to make this shimmy damper a bolt-on kit. Bob's kit is complete and includes stainless steel Belville washers (which provide the spring pressure), the threaded shaft, and all necessary washers, the nut and cotter pin. We have noticed a marked improvement in several areas. There has been no need to adjust it in over 3 months - about 50 hours of flying time. When the nose wheel touches down, it does not move at all when viewed through the little plexiglass window, whereas the original damper always allowed the nose wheel to shake side to side just a little at touchdown. Also, it seems, subjectively, to be easier and smoother to taxi and make turns using the brakes.

We strongly recommend Bob's shimmy damper for all Long-EZs and it will also work well on a VariEze (Paul Mason has been using one on his VariEze for almost two years with no problems whatever). Bob will sell you a complete kit including the drawings and instructions for $39.05 <u>plus</u> shipping.

Contact: Bob Davenport,
PO Box 650581
Vero Beach, FL 32965
303-567-1844

****From CP52-6&7 (CH13,CH38)****
<u>BOB DAVENPORT'S NOSE GEAR SHIMMY DAMPER</u>
Unfortunately, Bob have us the wrong area code for his phone number - the correct phone number is 305-567-1844. Bob's address is PO Box 650581, Vero Beach, FL 32965. We continue to run two of Bob's shimmy dampers and grow more and more

convinced that this is the only way to go. Bob has complete kits and instructions available for $39.05. We strongly recommend this excellent shimmy damper to all VariEze and Long-EZ flyers.

From CP54-5 (CH13,CH38)
NOSE GEAR SHOCK STRUT SPRING REPLACEMENT
Several builders have reported a 3 to 5 knot reduction in nose wheel lift off speed after replacing the "sagging" old LST spring as called out in CP51. The easiest way to remove the LST spring is to leave NG-3 and NG-5 attached. Remove the retainer bolt nut and, with the gear in the extended position, have someone push down on the nose. You can now easily lift out the retainer bolt and the shock strut will come apart for easy replacement of the LST spring. Look for wear on the retainer bolt, replace the bolt if there is any sign of grooves worn into it. Look for sharp edges on the LST-2 slotted holes, dress these down with a smooth file if necessary. Apply a generous quantity of grease to the shock strut before re-assembly. If your nose gear shock strut comes off the extended stop when you get into your EZ, you need a new LST spring which is available from Ken Brock Mfg.

From CP54-6 (CH13,CH38)
NOSE WHEEL/FORK ASSEMBLY ATTACH
The plans call out for (4) AN525-10R24 screws to attach the NG-15A nose gear casting to the 'S' glass strut. As we have reported previously, a really hard landing can pop the heads off these AN525 screws allowing the 1/8" aluminum plate to separate from the NG-15A casting which allows the whole nose wheel/fork/pivot assemble to depart from the strut! We strongly recommend that these AN525 screws be replaced by AN3-14A bolts. These are much stronger and the heads will not pull off as they can do with the AN525.

We have called out this recommended change before but we still get occasional builder/flyers who did not get the word and have ended up with this failure. It is an easy fix - can be done in a few minutes and it can save you much grief and frustration.

From CP55-6 (CH13,CH38)
NOSE WHEEL CASTINGS CRACKING AND DISINTEGRATING
We have had several reports of this problem from Long-EZ and VariEze builders and, as we stated in a past CP, you should remove your nose wheel periodically and take it apart, clean it and carefully inspect it for cracks in the cast aluminum center bearing holder. This is especially true if you have ever experienced shimmy in your nose wheel. We have disassembled and examined all of the Brock nose wheels we have here at RAF and have found no sign of any cracking. However, we have seen several examples that were cracked and several more examples that broke and, in fact, disintegrated.

Wicks Aircraft Supply in Highland, Illinois sells a nose wheel that is a direct replacement for the Brock nose wheel that is built just like a miniature of your main wheels. This wheel looks like an excellent alternative although it is a little heavier. If you have had one crack and are looking for something stronger, give Wicks a call. Ask for NW-A1230 nose wheel, they cost around $50.00, fit the same tire and tube and will mount into the EZ for with a minimum of fuss.

Control System

Also see LPC #86 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP57-8 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP57-9&10 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP58-10 in the "Long-EZ Plans Changes" section of this chapter.
Also see CP58-7&8 in the "Long-EZ Plans Changes" section of this chapter.

From CP27-13 (CH3,CH16,CH38,CH39)
The following letter was received just at press time for this newsletter. With Victor's permission we are printing it:

Dear Burt and Company,
Thank you for your Christmas card. It found me recovering from a crash landing of my VariEze and with even more respect for the design. On November 11, 1980 I was working to take off the 40 hours a bit at a time. We had about 30 minutes before dark after work (my second mistake) to get a few trips around the patch. Mary-Kate and I had decided to install the new Long-EZ elevator trim but I over-ruled and decided to put it off until certification (my first mistake). I wanted to complete the 8 hours remaining to my certification as soon as I could.

After one touch and go I was climbing out about 600-700 AGL when I eased the stick forward to level off at 800 and nothing happened. **The bolt between BC4W10 and CS136 had come off.** I immediately called "mayday" and requested emergency equipment. I thought I was dead. However, I realized 62MV was still climbing so I began to analyze my possibilities. I could not reach past my right leg to reach CS136 so I experimented with power changes. I found that at about 80 MPH indicated the nose would begin to drop and about 120 MPH it would pick up. The initial oscillations must have been 200-300 feet up and down. I found by careful throttle changes and by moving my body forward and backward I could greatly reduce the up/down changes, but I still was faced with only gross control. I flew 3 patterns, about 15 minutes, and on the last down wind discovered I could touch the elevator balance weight with my right toe. Holding about 100-110 MPH and using the toe technique to give progressive downward dips I made my final approach to runway 10 (4000' long) into a 5 degree right wind of 5 to 10 knots. At about 30 to 50 feet AGL, darkness made judgement poor, I was almost to the runway when the nose began its upward cycle at about 80 MPH. Knowing I would not stand another cycle, especially the 120 mile per hour dive I cut power and dropped it in. At the same time I cut power I deployed my landing brake, I probably should not have used the landing brake since it does tend to increase the sink rate.

The landing was just about 20 feet short of runway 10 in a slight left turn so that I skidded across the corner of the runway and onto the grass beside the runway. I came to a stop in the newly planted wheat field about 20 feet from the runway. I had lowered the nose gear to take up shock as well as the possibility I could make a controlled landing. The nose gear push rod bolt sheared, the main gear attach taps on the gear sheared or split , and the lower cowl was crushed. The intake spider broke and the carb separated as did the gascolator and intake hose. The oil pan was crushed and the bottom 3" of the firewall cracked and bent aft about 15 degrees. We hit so hard that the pilot's seat area broke and combined with skidding across the runway made a hole clear through the pilot compartment floor about 3" from the left console and about 9" wide by 20" long. I was able to turn everything off, release my harness and climb out. I noticed severe pain in my back so decided to lie down because the ambulance was pulling up. I next woke up in the ambulance on the way to the hospital. I suffered shock and two cracked vertebra #L2 and L3. After 11 days in the hospital and a month at home I am feeling pretty well. I will wear a back brace for at least another month but should not have any future problems.

Why did the nut (MS210042-4) come off? I don't know. I may not have had it on all of the way but I am sure I did because I had developed the habit of checking for 2-3 threads through the nut. The canard and of course this nut had been off about 10 times for work on the electrical and instrument systems. Do such nuts wear out? The nut and bolt are included for your inspection. I find I can get it on to almost one thread with just my fingers. The FAA inspector was Glenn Martin of Wichita GADO. He was just as surprised as I to find out the a VariEze will fly without elevator control.

N62MV normally trimmed out level with a slight nose down force required. I was able to correct it with the original spring trim system. At the time of this flight I had 2 gal in the fuselage tank and about 7 gal total in the wing tanks. The engine is an A80-8 and the original long canard is installed.

I expect to wait about a year before repairing the plane. What do you think of having the main gear strut and wing attach areas x-rayed? There doesn't appear to be any damage to the wing or canard attach fittings or surrounding areas. Both lower winglets were ripped off, right rudder was destroyed and of course the gear and gear attachment area. The enclosed photos were taken by Glenn Martin. I would like to have them back because they are all I have. Enclosed find SASE.

Thanks again for an outstanding design. If you would want to question me please feel free to call.

Sincerely,
Victor Sullivan

It should be emphasized that an elevator disconnect downstream of the trim system will not necessarily result in the amount of control Victor was able to achieve. Any small inconsistency in elevator shape could result in a very low or very high trim speed. Victor had rejected his original elevators and build new ones to a more accurate shape - he probably could not have survived a control disconnect with the original ones. The new trim system, of course, could have allowed a satisfactory amount of control and safe landing.

We have inspected the bolt and nut and found it is of the proper length and that the locking friction, though reduced from new condition, seems adequate for proper safetying. It appears improbable that it could have been tightened properly. Victor agrees that it may be possible that he was distracted during canard installation and might not have tightened the nut beyond finger tight. Even the most critical items can be overlooked by the most competent mechanic. For example, one VariEze attempted a takeoff without the 2 bolts that hold the canard on - the canard flew off when the pilot pulled the stick back for rotation. **Builders should follow the accepted practice of replacing critical locknuts after several repeated installations (discard any <u>fiber-lock</u> nuts after <u>one</u> use). Also, discard any bolt or nut that has any sign of reduced locking friction.**

****From CP30-5 (CH13,CH38)****
<u>Rudder Pedal Failure</u>
There have been at least two cases of failure of the top tab which is welded to the rudder pedal, and to which the rudder/brake cable is connected. One case was a gas welded, homebuilt part, and this was attributed to a poor weld. Another case was a prefab Brock part, but according to the owner, the tab had been bent and then straightened cold. If this tab should fail, it will invariably fail while taxiing under braking load, when you need it most, and directional control will be lost.

As of this date (Oct 81) Brock-supplied rudder pedals have been modified per Figure 1, to strengthen the tab. If you purchased your rudder pedals prior to this date, you can obtain from Brock a pair of tab reinforcement brackets. Brock part #LE2026R-1 and LE2026R-2, and these must be riveted into place over the existing tabs per Figure 2. This will stiffen and back up the weld which failed. Of course, you can also homebuild these brackets from Figure 2. This is a mandatory change, see LPC #86.
SKETCHES OMITTED

****From CP33-5 (CH11,CH16,CH31,CH38)****
<u>CAUTION! CONTROL SYSTEM FRICTION</u>
The presence of friction in the pitch controls of an EZ will result in serious degradation in flying qualities. Mike recently installed a different shape canard tip and when reinstalling the elevators one of the pivot bolts was adjusted to bind an elevator. Sally and Mike both flew the aircraft with friction and reported PIO tendencies and over-control difficulty. Adjusting out the bind immediately returned the excellent pitch control and smooth flying qualities.

****From CP34-5 (CH17,CH38)****
Caution
Wes Gardner had a scary experience in his VariEze when the nose up trim spring on his pitch trim system (Long-EZ style) suddenly broke. It made a loud noise with the aircraft pitching nose down. Wes thought he had had a midair. He had trouble pulling out because the nose down spring was pulling the elevator into the nose down position. He got back to his home base ok, but was quite shaken. As if this was not enough, it has since happened to him twice. Should it ever happen to you - remember, FLY the airplane. Even with a broken trim system, it will still fly normally.

****From CP35-8 (CH16,CH38,CH39)****
FROM THE BUILDER/FLYERS
Paul Williams and Max Cortner write that they have over 150 hours on their Long-EZ, also known as "White Lightening". Max is planning on a honeymoon trip to the Bahamas this month and Paul will be flying it to Phoenix in February. Paul recently had a scary incident - pitch control disconnect in flight! Happily he landed uneventfully using the pitch trim system for pitch control. They had had the canard off to seal around it and when it was replaced, the clevis pin was pushed through from the outside, horizontally toward the center, so that the safety pin was easier to install. What they think happened was that the safety pin caught on the pilot's pant leg and was pulled open. The pin eventually worked it's way out due to being oriented horizontally and the pitch control system was disconnected.

This is a very serious thing, we should all be aware of. First of all the clevis pin should be oriented vertically and should be installed from the top so gravity holds it in place. Secondly a piece of gray tape wrapped around the safety pin will stop it vibrating and protect it from inadvertently being opened. One school of thought would be to install an AN3 bolt and locknut in place of the clevis pin. After all, how often do you remove the canard? In any event this connection should be on everyone's preflight checklist.

****From CP35-8 (CH16,CH38,CH39)****
A Southern California VariEze flyer/builder crashed into the bay on short final at Palo Alto, during a night approach. A critical nut and bolt which had not been installed correctly came loose, causing the airplane to suffer a pitch control disconnect. The VariEze was completely destroyed by the impact with the water at approach speed. The pilot suffered a serious back injury but was able to swim to shore.

****From CP38-5 (CH16,CH38)****
Front Control Stick - Long-EZ
Be certain that the lower bolt in the control stick can not catch on the rudder conduit at full left aileron deflection. Check this carefully before next flight. One builder had this occur in flight. He got quite a scare before he forced the stick right and tore the conduit off the fuselage side.

****From CP43-6 (CH19,CH38)****
CAUTION - Aileron to Wing Clearance on Long-EZ and Defiant. With the ailerons in the neutral position, the gap between the lower leading edge of the aileron and the trailing edge of the wing should be a minimum of 1/8". Pay particular attention to this at the outboard end of the aileron. You may have nice free moving ailerons, static on the ground, but when the wing start to carry the load and bend, this clearance actually closes up a little. This is a point to inspect if you have an airplane flying. Look for worn spots in the paint. **SKETCH OMITTED**

****From CP47-12 (CH11,CH16,CH19,CH31,CH38)****
CAUTION: CONTROL SYSTEM STIFFNESS
We have previously warned builders to ensure absolute freedom from stiffness in the pitch control system. This is very important and must be corrected if it exists in your EZ. We never have particularly addressed lateral (roll) control system stiffness. While not quite as important as pitch, tight bearings in the aileron control system really spoils the nice flying qualities inherent in an EZ. Conscientious attention to detail here will pay dividends. Long-EZs and VariEzes have similar lateral control systems, the main difference being that the CS-132L belhorn in a Long-EZ is mounted inside of the wing root, and the same part (CS-132) in a VariEze hangs out in the breeze, inboard of the wing root, close to the bottom cowling.

Both of these areas can be troublesome. In the Long-EZ, you must assure that the end of CS-132L cannot contact the bottom of the wing. Even if you have to dish the skin locally, you cannot accept any rubbing here. In fact, it would be best to have at least 1/4" of clearance. The VariEze though, needs even more clearance between the lower end of CS-132 belhorn and the bottom cowling, because the cowling will tend to flex up in flight and could cause a rubbing interference, or even worse. For example, if your CS-132 belhorn just barely clears the bottom cowl while at rest on the ground, it is possible that in flight the cowl could move up enough to seriously interfere with lateral control of the aircraft! The answer is a streamlined blister on the bottom cowl which will give the required clearance and will stiffen the bottom cowl.

Lubricate all bushings and bearings in the control system and do not fly until you have the control system working nice and free with no tight spots or stiffness anywhere within the full range of control stick movement.

****From CP49-4 (CH20,CH38)****
CAUTION
If someone plays with your rudder, or even if the wind blows your rudder forward, in some cases it may be possible to get the rudder cable snagged inside the cowling. This is especially the case on the left side where most of us have our oil cooler. We

know of at least two instances where this did, indeed, occur, and it really does make for an interesting landing technique. Remove the top cowl and have someone move the rudder back and forth and carefully evaluate the chances of this happening. If it can, it will! Install a guard or shield to prevent this possibility and be absolutely certain that your guard does not make the situation worse! Thoroughly test your installation before installing the top cowling.

****From CP55-6 (CH11,CH16,CH31,CH38)****

CAUTION

Friction in the pitch control system of an EZ can make it very difficult to fly. In fact, it can flat-out make it so uncomfortable to fly that you won't enjoy it at all!

Friction in an EZ's pitch control system is easy to avoid and must be avoided. There are so few parts involved that it is simple to check. Disconnect the pitch trim springs, push the stick forward and aft, or grab the trailing edge of the elevator and move it full travel up and down. There should be no perceptible friction. It should not hang up anywhere, it should easily flop all the way up and all the way down. If it feels stiff or tight anywhere in the full arc of travel, find out where it is binding and fix it before you attempt to fly. Check the rod ends at the stick and at the inboard ends of the elevators. Check the stick's pivot points. Check every one of the elevator hinges. On the original GU canard, it is easy to get one or more hinge points too tight. The washers at the hinge points should easily spin. The bronze bushing should be lubricated and should be a nice easy slip fit on the AN525 screws which are the hinges. Check that the mass balance weights are not rubbing or chafing inside the slot in the canard on each elevator.

Lastly, put a saw horse or chair under each canard tip (well padded, of course) and have someone push down on the nose or center of the canard. Apply enough weight to bend the canard at least 3 or 4 inches up at the tips, then check all of the above for friction or binding or chafing under load. There should be no perceptible drag in the pitch control system (with no pitch trim springs installed) in any of the RAF designs, VariEzes, Long-EZs. Defiants or Solitaires.

****From CP58-8&9 (CH16,CH19,CH38)****

AILERON VIBRATION

Below is an excerpt of a letter received at RAF recently.

"Thanks for all the good newsletters. Just to clarify, I have had aileron flutter (see Ed. note). At 10 hours, I noted a lot of aluminum dust behind the aileron hinges. In flight, I visually could see the tip of both ailerons as a 1/4" blur. I added leading edge weight and installed the Teflon hinge pin setup. At this point, I had no visible vibration at 2000 ft at 120 mph, but still had vibration at 8000 ft., 160 mph. It remained this way for many hours of "hauling rides" but less than 5 cross country hours. Note: I never was able to detect any vibration on the stick.

I recently put more weight on the right aileron which was still vibrating slightly at altitude. This extra weight was along the outboard end where I had previously not had any. This finally cured the problem. Now the ailerons hang with the top surface level. Note: The problem occurred when the ailerons balanced bottom surface level as per plans. Note: Both ailerons had this problem. The left aileron is very accurate dimensionally, the right's trailing edge rises 1/4" in the outboard 8" from a straight line. Also, I have a good surface finish, laminar flow, as evidenced by wing drop before the vortilons.

It is very hard to see the trailing edge of the aileron and difficult to decide if it is indeed vibrating 1/4" or if your eye is just not that sharp, but having fixed it, I can verify that it was not an optical illusion.

I feel that many Long-EZ's probably have this problem and their pilots are not aware of it. Again, there is no indication of stick vibration.

Larry Bush"

EDITOR'S COMMENT

We have published Larry's letter as he wrote it because we believe he experienced the same phenomena described above: Engine/prop excited "forced vibration" driving his aileron at the same frequency as the engine/prop. "Flutter" is an aerodynamic condition and is normally divergent, i.e., expands to destruction. "Forced vibration" can continue as long as the source (engine/prop) is maintained near the same frequency as the natural frequency of the aileron. By over-balancing his ailerons to the top limit as called out in the plans, he has (1) changed the mass of his ailerons thereby lowering the natural frequency of the ailerons and, (2) repositioned the CG of the aileron relative to the hinge, thus reducing the "forced vibration" input.

If your ailerons are vibrating at the trailing edge as Larry's were, you must add more leading edge weight. Note: We checked several Long-EZs here at Mojave and none of them exhibited any visible vibration at the trailing edge, however, all of them show some signs of aileron hinge wear (black aluminum dust on the aileron, particularly after flying through moisture).

Keep in mind that it may be difficult to spot. **Have a passenger in the rear seat look at the aileron trailing edges very, very carefully.** Spend at least 30 seconds staring at the ailerons in level flight, in a climb, in a descent, and in left and right turns. If any vibration is seen, re-balance the ailerons.

The easiest way is to get some lead ribbon from a golf pro shop and stick it to the top of the aileron leading edges, full span, until it balances top skin level. Lay up one ply of BID to permanently secure the lead to the aileron leading edge. (see sketch, page 15). **SKETCH OMITTED**

We would like to thank Larry Bush for the excellent feedback on this situation. This is the kind of information we all need to know about in order to keep the large fleet of EZs flying safely and consistently.

From CP59-9 (CH16,CH19,CH38)

AILERON "VIBRATION"

The reports in CP58 have really put the cat among the pigeons! A controversial topic, to say the least. In spite of all of this, only three flyers have reported finding their ailerons vibrating visibly in flight (one was not sure), one reported finding his vibrating at various RPM's while running on the ground -probably true of all EZ's while they are sitting on their wheels (the tires are like springs, as is the gear), so we believe you must look for this problem while in flight and it will be difficult to see and will require a rear seat passenger to watch the ailerons. If you have a visibly vibrating aileron or ailerons, you should increase the mass balance as required to a maximum of what it takes to balance the ailerons with the top skin level. If it only takes 25% or 50% of the maximum to stop the vibration, then that is enough. Unless you know you have this problem, do not change the mass balance.

Brock has the new aileron belhorns available now and many have been delivered and installed. If you have evidence of worn or beaten out rod end bearings in your aileron control system, you should ground your airplane until you have replace the original belhorns with the new part which is about 8 times stiffer and this is out of the vibration frequency that has been causing the problems. A number of Long-EZ owners have reported worn out rod ends, but far more have reported no sign of wear or vibration. Apparently, it depends greatly on the vibration characteristics of each engine/prop/mount combination and it does not necessarily occur in all Longs - watch for it, though, this is a potential accident waiting to happen - always listen to your airplane - it will invariably try to warn you before it bites!

From CP60-8&9 (CH16,CH19,CH38)

LONG-EZ AILERON BELCRANK VIBRATION UPDATE

We have had only three reported incidents of aileron vibration in flight in the Long-EZ. Since our original CP article on this subject, only a few builders have found their rod ends badly worn. All of these had steel push rods installed (heavier than the original aluminum pushrods). One builder had no problem with rod ends but the rivets holding the inserts into the steel pushrods were loose!

Be sure and check these rivets next time you remove the cowling. Obviously, the heavier weight of the steel pushrods has moved the natural frequency of these parts into a frequency range that can be driven by the engine at certain RPM's. If you have steel push rods installed, check the rivets and the rod ends often, and be sure to replace the original aileron belhorns (CS-132L) with the new double arm belhorns (CS-132L-R) available from Ken Brock.

Instruments

From CP47-11 (CH22,CH30,CH38)

VARIEZE O-200 OIL TEMPERATURES

Most VariEzes powered by the O-200 Continental engines, by all reports, have oil temperatures that, if anything, run on the cold side. However, every once in a while we hear from a builder/flyer with high oil temperature problems!

This has been a puzzle and no one has resolved it 'til now. How could some EZs run cold and others run hot? The answer may be in the oil temperature gauge. If you use a Westach or Westberg oil temperature gauge and you have had low oil temperatures, (maybe you have even wrapped the oil tank with an insulating cover?). Check your oil temperature by some independent means, a different gauge or even a candy thermometer. At the very least, you should calibrate your gauge against a known value.

Our experience here at RAF has been that in 3 different VariEzes using Westberg gauges, showing low oil temps all 3, in fact, have high oil temperatures. One had such high oil temps, the oil pressure would run at the minimum value of 30 psi!

The key is that if ever you see low oil pressure, check your oil temperature even if your gauge says it is OK. **This is particularly true if you are using the Westach or Westberg temperature gauges which in our experience over a number of years, have proven to be erratic and without frequent calibration, not to be relied on.**

From CP53-7 (CH22,CH33,CH38)

CAUTION: AIRSPEED INDICATOR INACCURACIES COULD CAUSE PROBLEMS ON A FIRST FLIGHT.

Fred Mahan, Long-EZ builder/flyer reports that on his first flight he was uncomfortable on final, felt too slow, decided to check his airspeed indicator. Using a water manometer, Fred discovered that his airspeed indicator read 200 kts. when the manometer said 200 MPH. This continued all the way down to 40 kts, so his airspeed had been mis-graduated by somebody. This meant that when he was indicating 75 kts., he was, in reality, only doing 65 kts.! This could have been a "gotcha"! Of course, it was great at the high end. Fred thought he was going really fast! Check your airspeed indicator before first flight. See the neat water manometer suggestion in this CP.

From CP53-7 (CH22,CH33,CH38)

HOW TO TEST YOUR AIRSPEED INDICATOR by Verne Vawter

This neat water manometer article is taken from the Long-EZ Squadron 1 newsletter.

One instrument in my airplane that has been a source of constant irritation is the airspeed indicator. For some reason mine always reads too low and my friends' airplanes, at least during hangar flying sessions, say they are always faster than mine.

On the verge of an inferiority complex. I decided to do some investigation which revealed that the airspeed indicators are based on a well known physical law and that it is feasible for owners to check and calibrate their own aircraft's speedometer.

Before I relate the principles of airspeed theory, based on Bernoulli's Law, let's get right into how simple it is to make an instrument called a manometer, which is easily put together of a little of this and that found at most hardware stores.

EQUIPMENT REQUIREMENTS:

1. Approximately 10 feet of clear plastic tubing preferably 1/8 inch to 1/3 inch inside diameter (it should cost between $1.00 and $1.25).
2. A board 30 inches in length suitable for mounting the plastic tubing in a "U" shape.
3. Some type of "T" fitting. This can be made by soldering small pieces of copper tubing together.
4. A yardstick.
5. A few ounces of water with a little bit of food coloring to aid visibility and a small quantity of detergent as a wetting agent.

TESTING PROCEDURES:

1. Examine the pitot tube carefully and if there is a small drain hole, cover it with tape.
2. Stretch the one end of the plastic tubing over the nose of the pitot tube (see Fig. 1).
3. Blow the manometer until the water level between the two sides of the tube has approximately 20 inches difference in heights. Pinch off the air supply tube and check for leaks. If the manometer and the static system are free of leaks the water level will remain constant.
4. With one person in the cockpit viewing airspeed indicator, bleed off the air by releasing the pinch referring to the chart (see Fig. 2) for proper water level differences. Start with a water level that is appropriate for the speed of your aircraft. For example, if your plane is capable of 180 mph, there should be 16.16" difference between the levels of water in the "U" shaped tube. If your airspeed indicator is reading 183 at the 16.16 inch differential level, you know it's 3 mph fast. Repeat the procedure at 160 mph, 140 mph, 120 mph and so on. Most airspeed indicators are usually two to three mph off somewhat in their range. Naturally if there is a leak in your airspeed system this is indicated by an inability to hold the water level. It is sometimes difficult to bleed the correct amount of air to reach the exact inch difference that you want. Often several attempts are required. The yardstick is moved up and down so as to measure the different levels that the water will reach.

DRAWINGS OMITTED

Bernoulli's Law: The controlling physical law of a manometer

$$hw = \frac{Pair}{Pw} \cdot \frac{V\text{-squared}}{2g}$$

hw = height of water inches
Pair = density air
Pw = density water
V = velocity air miles per hour
g = gravity

V (mph)	Hw (differential height of water in inches)
60	1.77
80	3.16
100	4.95
120	7.14
140	9.73
160	12.7
180	16.16
200	20.0
250	31.6

Wing Attach

From CP52-5 (CH19,CH38)

CAUTION - WING ATTACH BOLTS

We recently heard from a Cozy builder who had been chasing a minor but annoying vibration in his aircraft for some time. He finally traced it to the fact that his wing attach bolts were slightly loose allowing his wings to move a little in flight. After he tightened the three 1/2" bolts in each wing (the Cozy uses the Long-EZ wing and wing attach system) the vibration went away. He checked several Long-EZs in his area and found a couple of them with the same problem. We had not had anything like this reported to us before and we checked the two Long-EZs we have here at RAF, both were solid.

The way to check for this problem is to have someone put their hands on the joint between the centersection spar and the wing to feel for excess movement while you lift at the wing tip. A small amount of movement, less than 1/16" at the wing root leading edge, is normal. If excessive movement is detected, you must remove the wing bolt covers and torque the bolts. It is difficult to use a torque wrench in this area. We simply used two ratchet wrenches, each 6" long, and pulled about as hard as we could. It takes two people to do it right.

Since a person can pull with about 75lbs of force with one hand, we can calculate the torque - 75x5=375in/lbs or 31ft/lbs. Using this method, we have never had one of these bolts work loose. A 1/2-20 aircraft bolt can handle 600in/lbs (50ft/lbs) of torque. However, with the glass plies in between the aluminum hard points, we would recommend no more than 400in/lbs (33ft/lbs) of torque on these bolts.

Composite Structure

****Also see CP46-3&4 in the "Nose Gear" section of this chapter.****

****From CP28-4 (CH38)****

Care of Composite Structures

Composite aircraft such as the VariEze and Long-EZ should have a virtually unlimited life, provided they are reasonably well taken care of. In addition to normal maintenance as required for the systems, oil and grease where required, etc., it is very important to immediately repair any dings, chips or scratches in the paint/skin as well as the cockpit interior. Any scratches or chips that expose the epoxy/glass structure are subject to immediate ultra violet degradation and/or water absorption, depending on the degree of damage. Skin damage that exposes the epoxy/glass structure can result in water being absorbed into the laminate, and then when the water freezes (expands) there is a possibility of local delamination damage.

To sum up, all hangar rash, scratches, chips etc., in the finish should be repaired and repainted as soon as possible.

****From CP47-10 (CH3,CH38)****

DELAMINATIONS

Repairing small areas of delaminated skin, can best be done by drilling several small holes around the effected area and injecting epoxy into one or all these holes until it comes out of the rest of the holes. Cover the area with Saran wrap, a flat board and a heavy weight. Allow to cure. One of the problems with this type of repair is finding a hypodermic syringe. Try this: go to a sporting goods store, buy a cheap plastic repair kit for a leaking basketball.

Drain the tube of glue, wash it out thoroughly with water, dry it and fill it with epoxy. Make your repair and throw it away. Works great. Best way to check for a suspected delamination is to tap the area with a quarter. You will hear a solid clear ringing sound if it is a good layup, but as you cross over a delaminated area, it will sound hollow.

Canopy

****From CP29-4 (CH18,CH38)****

PLEXIGLASS HINTS FOR PERFECT CANOPIES.

1. Cutting: An abrasive disc powered by a high speed drill, a Dremel tool, or a hand held circular saw is recommended. We have found that abrasive cut-off wheels of aluminum oxide or silicone carbide provide excellent cutting results. A six inch disk is available at most hardware stores for around $3.50 A small grinding disc or Dremel saw disc will also give good results. Reciprocating saws like saber saws are not recommended and will probably break your canopy. A tool that progresses slow and hot on the canopy to grind through the canopy is best. Tape a poly plastic cover on the canopy and mark your outline with masking tape. Never cut a cold canopy. Allow the canopy to warm to 70 or more for at least an hour. Don't allow the canopy to vibrate or chatter during the cutting or it may chip and crack. Support your canopy on a flat surface so it will not twist or spread during the trimming. Duct tape is handy to hold things in place. Remember: cut slowly, don't push the cutter. Let the tool do the work. Be sure to use eye protection. Plexiglass chips can be a problem in your eyes since they are clear and difficult to see.

2. Drilling: The drill should be ground off to a zero rake angle to prevent digging in, chipping and cracking the Plexiglass. A standard drill bit, ground with no cutting edge pitch, is a safe method of making holes. Be sure to make the holes oversize to allow for motion caused by thermal expansion and contraction. The drill bit should not be allowed to chatter or will chip and break the Plexiglass. Don't push the drill. Let it cut at its own rate.

3. **Cleaning:** A damp soft cloth or an air blast will clean the saw dust away. The damp cloth will also dissipate static electricity. To clean dirty plexiglass use plenty of water and a non abrasive soap or detergent. Dry with a clean chamois or soft cotton. Never use acetone, benzene, carbon tetrachloride, lighter fluid, lacquer thinners, leaded gasoline, window sprays or scouring compounds. Grease or oil may be removed with kerosene, white gasoline, naphtha or isopropyl alcohol. Small scratches can be buffed out with "Mirror Glaze" HGH-17 and a lot of rubbing. Hard automobile paste wax should be applied as a protective coating and buffed with a soft cotton flannel cloth. Do not use cheesecloth, muslin or shop cloths, they scratch. For deep scratch removal, procure a hand polishing kit from a Plexiglass dealer or your canopy supplier.

Fasteners

****From CP30-4 (CH3,CH38)****

Low-profile Locknuts

The VariEze and Long-EZ extensively use the MS21042 locknuts. These are a high quality all metal aircraft approved type locknut. One builder has reported cracks in several of his MS21042-4 nuts during installation. Our tests have shown that we can torque these nuts to several times the recommended limits and even abuse them enough to round the flats without failure. We have seen no failures in service. If you have had any failure of theses nuts contact RAF describing the conditions of failure, purchase date and vendor.

Corrosion

****From CP53-7 (CH3,CH38)****

CAUTION: CORROSION IN VARIEZE WING ATTACH FITTINGS

A VariEze which had spent most of its life outdoors in the eastern US, but significantly, not on the coast, was found to have severe intergranular corrosion in the top plates of the wing attach fittings as well as in the two aluminum tubes between the top and bottom plates. Very little evidence of this was visible upon casual inspection. However, when the UND wrap on each end of the centersection spar was lifted, the corrosion was rampant and this EZ builder said he would not have flown this airplane knowing how bad the corrosion was.

All VariEze owners should make a very careful inspection of the aluminum wing attach fittings, especially under the glass that laps onto the aluminum plates, particularly if there is evidence that the glass has peeled or delaminated from the wing attach plates, both on the wings and the centersection spar.

For new construction, all aluminum parts, including wing attach fitting, should be cleaned in Alumiprep33 or metal prep #79 and then soaked in Alodine 1201 which is a visible (golden brown) moisture barrier, greatly increasing resistance to corrosion. This also acts as an excellent surface to bond epoxy or paint.

Do not anodize wing attach fittings since this finish, if not done exactly right, can cause embrittlement in the highly stressed wing attach parts.

Alodine is a common aluminum preparation and can be obtained from RAF-approved suppliers such as Aircraft Spruce or Wicks Aircraft.

****From CP55-5 (CH3,CH19,CH38)****

VARIEZE MAIN WING ATTACH - CORROSION

Since we first reported the corrosion problem in VariEze main wing attach plates in CP53, page 7, we have heard from only two or three builder/flyers who had found signs of corrosion. Just this week, we received a letter from a VariEze owner/pilot who found corrosion in the WA-2-2 plate. He has spent a considerable amount of time and energy removing this plate, in fact, he said he almost resorted to using dynamite! He sent us the WA-2-2 plate, the lower plate of the top two plates mounted to the centersection spar. By far the toughest plate to remove and replace. This plate (see photo) has one of the worst cases of intergranular corrosion we have seen. It is absolutely not safe to fly and must be replaced. Unfortunately, this is probably going to be very difficult, and we honestly do not have any simple fix for this. Just removing the WA-2- plate could do serious damage to the centersection spar. The UND wrap around the end of the centersection spar may have to be cut and removed. The foam under the WA-2-2 plate must be dug out, the 8 AN525 (or AN509) screws must be removed (drilling them out may be the easiest method). A replacement plate must be fabricated, duplicating exactly all of the holes in the plate. This is a difficult job and will require an expert machinist and a lot of patience. Brock will not be able to help you with this. Each case will have to be dealt with on an individual basis. The new piece should be alodined and then floxed and screwed back into place. If the UND wrap was damaged, it must be replaced, which requires cutting into the fuel tank (we did say it would be tough!).

This is major work, not anything that could not be done by a person who has built a VariEze, but very tedious, difficult work. And it must be done right. There is no short cut, no easy way. If you find more than simple white powder surface corrosion, stuff you can easily polish off with 320 grit sandpaper, you must ground your VariEze and replace the corroded parts.

A mandatory inspection is required before next flight for all VariEzes. So not take this problem lightly, it could kill you and anyone who may be with you. Remove both wings. Clean all visible aluminum parts at the wing root and centersection spar. Look at the edges of all the WA plates on the centersection spar. Look for a thinner edge or a swollen appearance under the glass. Look in between these plates (where the WA-3 tongue slides in). A white powder appearance that can be completely removed and polished out with 320 grit is OK, but the plates should be very thoroughly cleaned and sprayed with zinc chromate. LPS or a good quality grease as used in marine applications should be generously applied everywhere before re-installing the wings. Check the WA-4 pins and the AN4 bolts and grease both thoroughly. Replace the AN4 bolts if they show any sign of corrosion.

New construction VariEzes, or anyone replacing wing attach fittings with new ones, should clean all aluminum parts with Alumiprep 33 or Metal Prep #79 then alodine them with Alodine 1201 which puts a tough, corrosion-resistant, visible, golden finish on. We are reluctant to try alodining parts in place due to the acid etch (Alumiprep 33) possibly getting under the glass onto the aluminum.

When you inspect your VariEze, be very conscientious. Check very carefully, it is difficult to find, you may have to probe under the glass over the WA-2-2 plates. Look hard and long at it before you decide it is safe to fly.

The only good news about this is that where the epoxy was bonded to this WA-2-2 plate which we have, there is no corrosion. The surface of the metal is as new. Intergrandular corrosion is very common in airplanes that live near the ocean.

Sea planes are especially prone and require constant inspection and maintenance aimed at preventing just this problem. The salt in the air plus water from rain or condensation, plus heat and aluminum and, presto!, you have a battery! Galvanic reaction and you have corrosion. Keep the aluminum parts clean, grease them often, and you will have no problems. People who live far from the ocean may not see this problem but they must check for it just the same.

This problem is confined to the VariEze. The Long-EZ wing attachment is completely different and this same problem should not occur. **Of course, all metal parts must be protected from corrosion - aluminum with alodine or zinc chromate, steel with zinc chromate (after cleaning in metal Prep). Wing attach bolts and parts should be generously covered with a good grease in VariEze and Long-EZs. Replace any rusty bolts and nuts.**

From CP55-11 (CH3,CH19,CH38)(Photo Caption)
VariEze wing attach fitting WA-2-2 removed from a Harlingen, TX based VariEze. Note extensive flaking typical of severe intergranular corrosion.

Update Number 66 to Supplemental Chapter 39 Accidents/Incidents

****From CP66-10&11 (CH30,CH38,CH39)****
P-LEAD TO MAGNETO INCIDENT
"Dear RAF,

I took a trip last August in Norse Nomad, my Long-EZ, which has over 400 hours to date.

I had an uneventful flight to McKinney, TX from my home in Carbondale, IL to visit with my son's family. On the way home via Texarkana and Little Rock, I suddenly experienced a noticeable drop in rpm. Since I had put in 20 gallons of 100LL before departing, I suspected water in the fuel. I did a 180 degree turn and made it to an airport with the engine running rough and surging between 2400 and 2600 rpm's.

I removed the gascolator and found a half teaspoon of sand and sediment but no water. A quick test flight revealed that I had not found the problem. I decided to leave the Long-EZ, fly home commercially and return with a trailer. To make a long story short, when I got my Norse Nomad home, I started the engine and got a bad mag check on the right mag. The mags had checked perfectly on the previous two flights, but not now.

The culprit was a break in the shielded P-lead from the mag to the starter switch. where the wire made a 90 degree turn close to the switch. A single strand had cut the insulation and grounded the center electrode!

Knowing what I know now, I would have simply removed the P-lead from the mag and flown home. This would have left me with a "hot" mag but it would have been much better than the 650 mile trailer trip! Also, I did not check the mags in the air when I had the problem. That check probably would have revealed the problem. A sudden loss of about 10% of your rpm is, in most instances, a magneto problem. Another clue was that the cylinder head temperature on my number 4 cylinder was unusually low. This plug runs off my right mag.

Hopefully, this experience may help other EZ flyers who may run into similar problems. Remember, any sudden drop in rpm, check the mags, if possible, check individual cylinder head temperatures, land and disconnect the P-leads. Watch out no one touches the prop with the mags hot. This may get you home where you can affect proper repairs. Keep in mind that P-leads can shut you down if grounded! These wires should be shielded and installed very carefully to minimize any chance of accidental grounding.

Greeting to all at RAF,
Jake Bach"

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Update Number 68 to Supplemental Chapter 39 Accidents/Incidents

****From CP68-2 (CH37,CH39)****
NEW WORLD RECORD
Magna Liset has been at it again. Magna and fellow Australian Long-EZ flyer, Lindsay Danes, took off from Sydney, Australia and landed in Mangere, New Zealand 7 hours and 25 minutes later. This broke Don Taylor's previous world record for this crossing in his famous T-18 by some 35 minutes. Congratulations to Lindsay and Magna.

After arriving in New Zealand, these two intrepid Long-EZ pilots entered The First International Around New Zealand Air Race sponsored by Air BP. Lindsay finished the race in the money but Magna was not so lucky. Shortly after taking off from Wigram, New Zealand, the crankshaft oil seal popped out and Magna lost all his oil. **Zero oil pressure caused the engine to seize and he was faced with an emergency dead stick landing.** He picked out a road and landed without incident. Even though he was heavily loaded with full fuel tanks, he did no damage to his airplane. Considering the many miles of Tasman Sea, he had so recently crossed, he was extremely fortunate that the seal chose this moment to pop out! Thanks to some members of the Royal New Zealand Air Force who pitched in, obtained another engine and helped install it, Magna was able to fly to the final banquet after the air race!

Long-EZ enthusiasts are apparently the same the world over. Wonderful effort - neat people.

****From CP68-7,8&9 (CH4,CH19,CH26,CH29,CH33,CH39)****
A Long-EZ was involved in an accident in Utah recently that resulted in serious back injury to the pilot who was flying solo. This pilot was a relatively new private pilot with only a few hours in type. While attempting to cut a roll of toilet paper, this pilot managed to get the airplane too slow, with too much angle of attack and the airplane apparently entered a "deep stall" condition. The pilot did not recover from the deep stall condition, and the aircraft descended in a flat attitude (75 to 85 degrees AOA), striking the ground slightly nose high with very little forward speed. The pilot suffered serious back injuries and the entire aircraft bottom and landing gear were heavily damaged.

There were a number of eye witnesses to this accident and our investigation leads us to suspect that the aircraft was being flown with a CG that was well aft of the published aft limit. This aircraft also was not equipped with vortilons.

If you are currently flying a VariEze, a Long-EZ or a Defiant and you are not <u>positive</u> of your aircraft's center of gravity, ground your aircraft until you have conducted an accurate weight and balance using calibrated balance beam scales or calibrated load cells. Do not bet your life on bathroom scales. You must not fly your aircraft unless you know exactly where your CG is. Do <u>not</u> fly a Long-EZ or VariEze without vortilons. In addition, due to the variance in aircraft shapes, and indeed, airfoils shapes possible in a homebuilt aircraft, we would strongly recommend that you conduct a stall test at least 10,000 feet above the ground while wearing a parachute. This will clear the stall envelope on <u>your particular</u> aircraft which, as we have said, may not be identical to the RAF prototype or to anyone else's aircraft. If you see any sign of an unusual or uncommanded pitch up or any hesitance in nose down control power when at full aft stick, go to full power and full forward stick immediately and recover! If your aircraft hangs in a high sink condition, rock it out with ailerons and rudder, using maximum available engine power. Ballast your aircraft to a more forward CG and retest. If you do not want to take the risk of doing this stall test program, do, at least, limit your flying to mid or forward CG.

This particular accident and injury pointed again to the advisability to modify the LB-9 plywood bracket that supports the landing brake actuating weldment. This was called out as a mandatory change in July 1981, CP29, page 7. We have noted that few builders have made this modification. We would like to reiterate this requirement and add an additional change as shown in the sketch below. Cut away the entire lower portion of the LB-9 bracket as shown and remove the lower piece and discard it. Cut out a piece of 1/4" thick birch plywood (firewall material) approximately 8" wide and 9" long. Bevel the edges and flox it onto the <u>forward</u> face of the front seat bulkhead, centering it over the LB-9 bracket. Lay up four (4) plies of glass BID over the entire piece of plywood lapping onto the front seat bulkhead a minimum of 2" all around. **SKETCH OMITTED**

This change is mandatory and should be completed before next flight. Also, strongly consider the use of the energy-absorbing Tempa-foam cushions for both seats. Now, this may seem ridiculous to modify your airplane in order to protect yourself from a full-blown deep stall <u>crash</u> that on a normal airplane would be fatal. However, we continue to be surprised at the protection provided by the EZs composite structure and we always take the conservative approach to increase safety as much as possible.

THE FOLLOWING IS AN ANALYSIS OF THE UTAH ACCIDENT
The Utah accident involved a deep stall, flat descent (angle of attack of about 80 degrees). The fact that the pilot survived and that a slower-than-expected sink rate occurred (confirmed by video tape evidence of the last 2.3 seconds of descent) presents somewhat of a dilemma. We are baffled as to why this can occur. A similar phenomena has been experienced during several deep stall

accidents with the Velocity aircraft. All were survivable and one went into water with the pilot experiencing no injury at all! (See article in July '91 *Sport Aviation.*)

The Utah Long-EZ had a wing-loading of about 12.2 lbs./sq. ft. and, considering all its area, including the wings, strakes, cowl and fuselage, a "flat-plat loading" of about 9.2 lbs./sq. ft. (1150 lbs. divided by 125 sq. ft.). A basic calculation of the predicted rate-of-sink in a flat descent would use a flat-plate drag coefficient of about 1.2 and would predict a sink of about 4820 ft. per minute or 80 ft./sec. This would definitely not be survivable.

Using two different methods, we have calculated that the Utah Long-EZ probably had a drag of about 2.8 times that predicted by simple flat-plat theory, i.e. a co-efficient of about 3.3. This results in an energy at impact of only about 1/3 that which would result from the "calculated prediction" sink of 4820 ft./min. Here's the two methods:

1) Analysis of the video tape shows a sink rate of about 48 ft./sec. (2900 ft./min.). This required measuring the size of the airplane image and may be off as much as 30 percent. The post-crash video data show the rate of drift of dust from impact. Comparing this rate of drift of dust (wind was about 20 knots) to the rate of sink of the airplane (on video) confirms the approximate 48 ft./sec. estimate.

2) Assuming a 48 ft./sec. descent, the main landing gear would absorb 18 ft./sec. before the fuselage strikes the dirt - this is a relatively accurate calculation knowing the gear's stiffness and strength. Absorbing the remaining 30 ft./sec. over a total deflection of approximately 6.7" (cushion, plus fuselage, plus dirt), results in an average deceleration of about 25 G with a peak deceleration of about 40 G. Considering the support and attitude of the pilots back, this is consistent with the injuries he sustained. An 80 ft/sec descent would result in a fatal 150+ G impact of the spine.

Both these methods are very rough but (along with the deep stall accident experience with the velocity) they tell us that an unusual phenomena is occurring. It is likely that a large, trapped vortex forms above the aircraft. It's relatively easy to see how this could increase the drag by 25 to 50 percent, but it makes no logical sense that it could increase drag by a factor of 2.8 - this would require the airplane to decelerate a column of air that is more than 3 times the size of the airplane! What is even more baffling is the report (not confirmed by us) that the Velocity aircraft sinks at less than 1500 ft/min (15 knots!). If that were true, it would have to have a "flat-plate" drag coefficient of about 12! ! (A totally illogical result). We suspect that the Velocity and Long-EZ have similar drag coefficients and that the cushion of water landing provided the difference in pilot injury.

The Utah pilot had one thing going for him, he was sitting on seat cushions fabricated from Tempa-Foam an excellent impact absorber.

CONCLUSION: What can we learn from this accident? First of all, don't just jump into someone's homebuilt airplane and go flying. Insist on seeing a current weight and balance and discuss any possible "quirks" the airplane may have with the owner.

Do not let peer pressure tempt you to fly beyond your experience or capability. Cutting a roll of toilet paper requires absolute knowledge of your aircraft without referring to the instruments. You will be looking over your shoulder for the toilet paper ribbon for most of the flight which requires some aerobatic experience at least. This is not a sport for neophytes. If a VariEze or Long-EZ is not equipped with Vortilons on the leading edges of the wings do not fly it!

Update Number 69
to
Supplemental Chapter 39
Accidents/Incidents

****From CP69-1 (CH39)****

OSHKOSH 1991

Once again a Long-EZ wins Grand Champion, Custom built. Congratulations to Bob and Ginny Greider of Escondido, CA. Jack Cox wrote a great article with excellent photos in *Sport Aviation*, October, 1991.

At Oshkosh this year, Burt announced that RAF would be conducting a full investigation of the deep stall phenomenon as a follow-up to Danny Meyer's testing of his Velocity as reported in *Sport Aviation*. In order to conduct this testing, we need a Long-EZ. It does not need to be complete with engine or instruments. Please call or write if you have one to donate to the cause.

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Update Number 70 to Supplemental Chapter 39 Accidents/Incidents

****From CP70-9&10 (CH33,CH39)****
A French VariEze was ditched off the coast of France when the engine quit while on short final to the Montpellier airport. Fortunately, neither the pilot nor the passenger were injured and, amazingly, the aircraft suffered relatively minor damage. This is the first known ditching of an EZ so we at RAF were most interested to read the report submitted to us by the pilot. We reprint the relevant information contained in his letter with the pilots permission and for the education of those readers who may fly this type of aircraft over water.

Pilot took off using the fuselage reserve fuel tank. Failed to notice the fuel valve position due to epoxy covered sleeve of coveralls. (VariEze fuel valve handle protrudes vertically into forearm when set to emergency reserve fuel tank). After 35 minutes of flight over beaches, the engine starved of fuel when the reserve tank ran dry. Pilot attempted to glide to runway, could not make it, so elected to land in the water due to bushes on approach end of runway. Pilot executed a normal landing on the surface of the water. He did extend the nose gear (but did not say if he extended the landing brake - RAF recommends both.) He touched down on the main gear at near minimum flying speed. The main gear instantly folded aft as the wheels penetrated the surface of the water. (This VariEze was equipped with a Long-EZ main gear strut and mounted similarly to a Long-EZ main gear mount). The nose gear did not collapse, but rather acted as a water "ski", preventing the nose from diving into the water. All of this happened very quickly according to the pilot, and although the stop was abrupt (he estimated less than 100 feet from point of touchdown 'til stopped), it was also gentle enough that he and his passenger did not even suffer any bruising from the seat belt/shoulder harnesses!

The fuselage filled rapidly with water and the pilot and passenger evacuated the aircraft after opening the canopy. The VariEze floated high enough in the water that the magnetos were above the water line and the instrument panel did not get submerged. The aircraft was pushed to the beach, the nose wheel was retracted and it was lifted up onto the beach with minimal damage.

The lower cowl was extensively damaged. The upper cowl, less so. Both ailerons were damaged and, of course, the main gear was torn completely out of the fuselage. The small plastic window used to check nosegear-down, was blown out by water pressure in the nose wheelwell. The ailerons have been rebuilt, both cowlings were replaced. The same main gear strut has been reinstalled and the aircraft is once again in flying condition.

So, how could this have happened? In the pilot's own words: he was in too much of a hurry. He had not expected to go flying, he was wearing his epoxy-covered shop coveralls and did not take the time to change. He raced through his checklist and missed a few important items. He did not climb to the standard pattern altitude, and flew relatively low over the beach. He recommends always taking enough time to do all the things that must be done to accomplish a safe flight. If, in spite of all your best efforts, something goes wrong, keep you head, think about what you are doing, fly the airplane and control it all the way to touchdown, maintaining flying speed without fail. After his experience, he believes the VariEze to be an excellent choice for long, over-water flights! He says that if something goes wrong, simply land in the water, stay with the plane, it will provide you with protection and flotation while you wait to be rescued!

We certainly appreciate this pilot's candor, and we take our hat off to him for keeping his cool and making a safe landing into the water.

****From CP70-10 (CH39)****
A Long-EZ crash-landed in New Mexico when the pilot suffered a stroke while flying and attempted an emergency landing. The aircraft was considerably damaged, but the pilot sustained no serious injuries. Sadly, less than 3 weeks later, the pilot died after radiation therapy for several malignant tumors.

****From CP70-10 (CH39)****
A VariEze crashed in Kentucky fatally injuring the pilot. The aircraft impacted the tops of trees at high power and finally struck a large tree trunk. The airplane burned and was totally destroyed. The pilot took off in adverse weather conditions and, at the time of the crash, a nearby airport reported near zero visibility. The pilot was instrument rated, had thousand of hours in his logbook and over 200 hours in type. Although it is difficult to understand how such an accident could happen, unfortunately, this is one of the most common general aviation type accidents. Weather can get you no matter how experienced you may be. If you have doubts about the weather, stay on the ground and try again when the weather gets better.

****From CP70-10 (CH39)****

A Long-EZ crashed in Pennsylvania and the only person aboard was killed. The NTSB has not yet come out with a finding on this accident. All we have is a letter from the builder and a newspaper clipping. We talked with the FAA who assured us that they had found no evidence of an airframe problem and that, for some reason, the pilot was flying low down a river valley and struck an unmarked cable. The aircraft crashed into the river. What we do not know is whether the pilot was deliberately flying low or, perhaps, had a problem and was attempting an emergency landing. The cable has since been repaired and has had three red balls installed on it.

Update Number 71 to Supplemental Chapter 39 Accidents/Incidents

****From CP71-6 (CH33,CH39)****

DEEP STALL TEST PROGRAM

Some work has been done on how to conduct this test but because we do not have an aircraft (Long-EZ), we have not built any hardware. We have so far received offers of two Long-EZ airframes, one structurally complete with no finish, no engine or cowling. The other has been modified and is not a stock Long-EZ shape.

RAF desperately needs a plans-built Long-EZ, complete, including cowling (engine not required). What we really need is a Long-EZ that has flown (is contoured and is complete) but is not currently being flown for some reason. We will have to cut holes in the bottom of each baggage-strake area and mount a pivot on the vertical and longitudinal CG. The airplane will then be mounted on a custom built trailer using these two pivot mounts and will be ballasted using lead shot bags to the various CGs we want to look at. This "damage" (holes in strakes) will be repaired by RAF prior to returning the airplane.

If you know of a Long-EZ such as this that may be available, please let us know. Possibly someone has one they are no longer flying but they don't get this newsletter. PleasE contact the owner or let us know who and where he or she is.

Update Number 73 to Supplemental Chapter 39 Accidents/Incidents

From CP73-5 (CH30,CH38,CH39)
"Dear RAF:
This letter finds my aircraft N84GR VariEze up and ready to go anywhere. My years of enjoyment with this fine design are pleasant memories which nothing can replace.

I use my aircraft mostly for cross country flights. I rarely get into weather, but have the quals and gages if necessary. I find that 11,500 ft. is max when wet. Rain during takeoff always means an extra 500' roll before lift off. My stall when wet is 10 knots faster than dry....so I advise everyone to watch the wet stuff. Here in Florida we get our share of liquid sunshine. Always watch out for puddles on the runway....can pull you off runway and ruin your whole day (like my friend Byron McKean's previous report).

My only hangertale concerns a flight I took this last summer. I normally fly from Pensacola to Stuart, Florida to visit my family several times per year. It is such a routine flight now, I know the route by memory. I usually fly the VFR corridor just south of Eglin AFB along the beautiful white beaches to Panama City then direct to an intersection just west of Cross City and direct to Orlando...direct Stuart. The flight normally takes 3+00. I was at 9,500' just south of Orlando and waiting for a few more miles closer before beginning my enroute descent (35km) into Stuart when my trusty 0-200 seemed to change pitch and lose some power. I began checking into things not worried too much since I had over 750 hours on that engine and had only 100 plus hours before done a cermichrome overhaul on the top end. Mags checked okay....tank change did not help....(I have the Long-EZ fuel system with separate main tanks plus the emergency)....the emergency tank did not help....(I knew of one guy that had a clogging fuel filter and the higher point of the emergency tank gave more head pressure through the filter....plus RAF reports say the same)....boost pump was okay....oil pressure fine....so I backed the throttle a bit....then she began getting rougher....NO GOOD! I hit emergency search on the loran....(A nice feature to have even if you know your way) figured I best be getting on the ground asap....(I really wanted to go that next 80 miles to Stuart, but knew better....ole Navy flight training and common sense said..."Get it on the ground while she is still running") so....I landed at Sebastian (home of Danny Mayer and Velocity). A nice twin allowed me to have his place in the pattern after I said I had a rough runner. I landed a bit hot (lots of runway) with plenty of altitude in case of failure, but she was running fine at idle...no oil to be seen, so I taxied in to give her a good look-see. After a lot of looking and plenty of advice from Danny and other local folks the problem could not be immediately found. New fuel, plugs, etc...did not help. The next day with the help of my cousin Tim and friend George of Aviation Propellers, Miami we found a *loose exhaust valve guide* on number two cylinder. The keepers were still in and springs working fine. This allowed the engine to run fairly well at idle, but at high rpm the valve was floating some and causing loss of power. (2200 rpm static) Lucky for me the keepers stayed in and no significant damage was done. A new cylinder was shipped out (complete warranty replacement by cermichrome folks and my mechanic Don Freeman, Aviation Engines of Hueytown, Ala..thanks!). My cousin and friend drove up from Miami again and helped me put her together...I mostly watched...then after a short test flight returned to Pensacola....nonstop. This once again reminds us to believe what we have and don't push it. With only one engine back there and God only issuing each one of us one sweet life it is the prudent man/lady who is careful while hurling themselves through the air at tremendous velocities.

That's about it for now. Ken Forrest's old VariEze N84ST is well over 1000 hours now and still flying fine in the hands of my hangermate. Just a thought, I and many others are still awaiting a new 3-4 place bird from Burt which will run the pants off the competition....please.

Together for a GREAT AMERICA
Ralph Gaither"

From CP73-5&6 (CH30,CH38,CH39)
"Dear RAF,
I'm writing this letter in the interest of safety for all canard-pusher type designs. Please feel free to edit or paraphrase it at will; I just want to help others avoid the scare that I had. As a little background, I bought my Long-EZ about two and a half years ago with 400 hours on the airframe. Since then, I have put almost 300 more hours on it, including a trip around the borders of the US last summer. I love my plane, but my only regret is that I did not have the honor of building her myself.

Last week, after doing an oil change, I took off into a quiet Friday evening sky at my home field for a test flight. I climbed to 8,000 feet, where I spent about 15 minutes watching the sun set, after which I started my descent.

Suddenly, there was a loud bang, followed by violent vibrations. I immediately pulled the throttle to idle and shut off the mags as I pulled the nose up. The prop stopped quickly, and I was able to see in my rear-view mirror (a small convex mirror inside the canopy for looking at my passenger) that something had hit my B&T prop and that it was badly broken.

I decided to keep the engine off and glide back to my home field. Fortunately, I was at about 5,000 feet and only 10 miles from my airstrip, a mile-long asphalt runway. This would have been possible in any plane, but was an easy task in the Long-EZ with its great engine-out performance. I announced my problem on unicom and the FBO operator monitored my descent.

As I touched down on the runway, I was amazed as to how dark it was, for I'd forgotten that sunset at 8,000 feet occurs quite a while after it had on the ground at sea level. I rolled out without any problems and got out to inspect the damage and determine the cause.

It was immediately obvious that my right exhaust stack had broken inside the heat muff box and that was what had damaged my propeller. The damage to the prop consisted of complete loss of the plastic rain edge, a gouge out of the leading edge of the blade measuring about 1 inch by six long, and a 5 inch longitudinal crack propagating from the impact point towards the hub.

After pulling the cowlings and exhaust stack, I was able to determine that the cause of the problem had been entirely the result of the builder NOT FOLLOWING THE PLANS and my A&P mechanic and I missing a problem in the recent annual inspection (5.5 flight hours prior). The heat muff and been built as per the plans except that it had not been welded directly to the exhaust stack. Instead, it had been built to be a snug fit. The problem with this was that this design allowed it to vibrate, albeit in very small movements, and this slowly ground away at the wall of the exhaust stack. The groove was deepest on the inside wall of the muff. After almost 700 hours of use, the walls of the stack were paper thin and finally gave way, allowing a half-foot long section of the exhaust stack to separate and hit my prop.

Believe it nor not, this failure may have saved me from an even greater danger - that posed by carbon monoxide poisoning from exhaust gases leaking into my cabin air system.

Lessons learned:

1. With the engine off, I'm glad I have a Long-EZ, as she has a great glide ratio and handles like a dream.
2. I was glad that I had practiced simulated engine failures just the flight before; the practice really helps out.
3. Build your planes as per the plans. If you do buy a used RAF design, go over each and every step in the plans (which should be included as a condition of sale) to find where an error or oversight might have occurred.
4. Pay special attention to the dangers of very small vibrations; small movements over long periods of time can grind through very strong metals.

I hope that this information is of help. If there are any of you out there thinking of buying a used EZ, please call me. The designs are great, but, as experience has taught me, used homebuilts have an unusual number and kinds of pitfalls.

Have a great day flying, and thanks to the folks at RAF for their continuing support.

Sincerely,
Tom Staggs"

****From CP73-6&7 (CH9,CH38,CH39)****

"Dear Mike:
Several weeks ago, I had a right brake failure on landing. Please re-alert others as to the serious nature of a brake failure, and suggest they frequently inspect their brakes. Finally, I suggest there may be a problem with Silicone brake fluid (DOT 5 motor vehicle standard #116).

In the last 2 months, I have flown around 200 hours, and the brakes had been working fine. (Yes, the brakes were inspected twice during this period). The takeoff at MEI, prior to the problem landing, the right brake was nearly gone. Previous flight, only 1 hour before, indicated no problem. I aborted the takeoff to bleed the brake. This seemed to fix the problem and I left with excellent brakes. However, two hours later I landed at RKW with NO right brake.

Assuming I might still have a problem, I landed with the wind on the right side. This worked great down to about 30 knots when it was obvious the nose had to be lowered to stop (I should have cut the engine on landing!). The damage was minor (retract gear and a few scratches) but could have been very serious. For example, had I landed the other direction, I would have left the runway at a much higher speed and went into the trees. The pilot has little control of a Long-EZ without brakes. It's a very sobering, dangerous situation -- best avoided!

I inspected the brakes after the accident, and found three confusing things. The calipers and pads had retracted about 1/4" from the disk. Why? The pads, disk and wheel pant were covered with silicone brake fluid. A leak (but small??) was found in the tube where it connected to the caliper. I believe the leak was initiated by 7 years of age and a "hot" landing several weeks before at a high altitude airport. Finally, there was a "gummy" gray deposit on the O-rings within the tubing and elsewhere. This indicates stability/compatibility/moisture problem with Silicone Fluid. I have changed back to standard good old red aviation fluid. Its thicker, lubricates better, works and leaks are apparent! I had changed to silicon fluid about three years ago after reading about it in a CP.

Mike, I have over 1300 hours in Long-EZ's and I have never had as serious a problem as this. I spend more time inspecting/working on my airplane than flying it! For example, in the last 7 years, I have replaced both master cylinders, upgraded to 50-106 disks and completely dissembled, cleaned and inspected the brake system 3 times. Yet, it got me! I will be even more attentive to the brake system!
Tim Crawford"

Editor's note: We have used silicon brake fluid (Dot 5) in all RAF airplanes for many years, the main reason was aircraft red brake fluid is highly flammable, Dot 5 is not. This is the first problem we have had reported. Mike did replace the o-rings in his master cylinders about 6 months ago and found a "grey" deposit in each cylinder. This was cleaned out and the brakes have functioned perfectly ever since. Has anyone else seen any problems using Dot 5 silicone brake fluid?

Keep those letters coming! Remember, anything that was a problem, or of interest to you, will also be appreciated by other EZ people.

****From CP73-9 (CH30,CH38,CH39)****
"Dear Mike,
On May 20, while doing touch-and-go's at Clark Co. airport in southern Indiana, my VariEze (N64SJ) was extensively damaged. I had elected to go around because of a slower aircraft ahead (C-150). While traveling along the right side of the active about half throttle in a very shallow climb, just past the take-off end of the runway, I moved the throttle to full power. The engine (0-200) started to respond then tailed off to nothing. I turned back toward the airport but came up about 50 yards short of the intersecting runway. It had rained quite heavily for several days previously and the sod was very soft.

The aircraft rolled several yards before the nose gear failed causing the plane to flip forward landing inverted and traveling another few yards before finally coming to rest, tail first, upside down.

Damage included -- Right wing broken just o/b of the wing attach fitting, left wing broken at mid span, Canard separated from aircraft taking a small part of F-22 bulkhead, the elevator control pushrod did considerable damage to the right side of forward fuselage before it finally broke, the canard has a small tension tear in the top skin at mid span, the main gear has some torsional damage, both winglets were broken near mid span, the taper pin holes in the top sides of both inboard sections of the wing attach fitting were slightly elongated from tension, other damage to canopy and cowling that I won't go into here.

After removing the cowling, the cause of the engine stoppage was obvious. The aeroduct between the carb heat valve and the carb had collapsed. A further check confirmed that both ends of the coiled wire were held tightly under the worm clamps. The wire coil had become completely disorganized and, in fact, parts of it looked somewhat like a Slinky that had been mistreated.

On a subsequent engine run, the engine repeated the in-flight shutdown. After removing the aeroduct, the engine ran normally.

I feel the shoulder harness and seatbelt and rollover structure worked very well as I was uninjured.

I can't say how much I enjoyed and miss my EZ. I would appreciate any advice you might have about possibly rebuilding.

Please pass on my experience with the aeroduct,

Best regards,
James Bierly"

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Update Number 75
to
Supplemental Chapter 39
Accidents/Incidents

****From CP75-4,5&6 (CH38,CH39)****

SUCKER HOLE

For several years, when two or more clouds are in the sky, we have heard the Flight Service Station weather briefer say "VFR not recommended". And since this started, I have shouted that they are crying "Wolf". Any experienced pilot knows the briefer is practicing CYA and most briefers are not pilots. So for years, we hear and ignore. Eventually, someone is going to get into trouble, maybe killed and "pilot error" will be the cause as "VFR not recommended" will be on the tape.

Thursday, July 30, 1992

My flight is from Tallahassee to Oshkosh with a lunch stop at Huntingburg, Indiana. The Tallahassee Flight Service weather briefer warns of two frontal areas, one over Chattanooga, TN and one extending from Champaign, IL to Ohio across my route. "VFR not recommended" is read like a Miranda notice. Haze and two miles visibility at TLH means a special VFR departure; no problem. I climb quickly to 6500 feet and head north. Cloud cover below soon becomes solid. At Chattanooga, I am VFR on top. Flight watch informs of the frontal activity from Champaign, IL to Ohio with many thunder storms across my route. "VFR not recommended" results in a "Roger" acknowledgement. The Flight Watch briefer adds, "You are not going ahead, are you?". Another "Roger your information, thanks" ends the discussion. Soon the solid cover breaks and I land at Huntingburg after four hours, thirty minutes flying from Tallahassee.

A microwaved sandwich, some fuel, and I climb to 8500 feet, anticipating the need soon to reach 10500 feet to pass over the Chicago TCA. From west to east, as far as I can see ahead are towering cumulonimbus formations, perhaps ten miles apart. As I approach Terre Haute, IN, I see no breaks in the line. Where a CB ends, solid clouds with light to moderate rain fill the gaps. Turning westward, I head sixty or seventy miles toward Champaign, which is reported to be the end of the easterly moving frontal activity. However, I see blue sky through a gap in the line of CBs at my altitude and I turn into my personal "sucker hole".

Light turbulence and light rain cause me to glance down to pull on carburetor heat, reduce throttle setting, stabilize the aircraft, and slow the Long-EZ to the maneuvering speed of less that 120 knots. The I glance at the altimeter. Instead of 8500 feet, it indicates 13400 feet. Up a mile in seconds! Suddenly, I see lightning off my left wing. The VSI is pegged at 2000 feet per minute, worthless! Now I move the throttle to idle and the nose down ten degrees for an airspeed of 110 knots. The light rain becomes heavy rain, then hail. The turbulence is minor; the altimeter slows at 15600 feet. An ascent of a mile and a half in seconds means the updraft is over 100 miles per hour! There is no sensation of the vertical speed. The plane seems to be flying at 110 miles per hour straight and level. Yet, what goes up . . .!

As the plane passes from the 100-plus mile per hour updraft into the compensating down draft, the sharp shear force is tremendous. The plane shudders, as if it has hit a solid wall. Negative G-forces cause everything in my shirt pocket to fly out; the ELT pops out of the clamps holding it in place. In spite of a tight seat belt, my head hits the canopy. During a flight from Bogota to Panama on AVIANCE Air Line, I experienced CAT. Passengers and hand luggage flew through the cabin but this hammering shock of the sharp wind shear is far, far worse. The shuddering of the aircraft is the heaviest shock I have ever felt in a plane, so bad I do not expect to see the wings still attached. My first thought is "If this is it, so be it". This is interesting, as I never use this expression. My second thought is "Thanks, Burt Rutan for designing a strong aircraft, and thanks Tom Caywood for building to specifications". The rest is anti-climatic as the down draft takes back the free ride up and I enter clear air at 9000 feet.

Using Rich Domke's hand held VOR, I find Mattoon, IL and stop for the night.

After climbing out of the Long-EZ, I was shocked when I saw the hail damage to the leading edges of the canard and wings and the amount of paint removed from the landing struts and winglets. Immediately, I walked to the rear to inspect the prop. By the time I entered the hail, I had pulled the throttle back to idle. With little or no thrust or drag, there was no wood damage. The urethane leading edge of the wood prop eroded slightly along the outer ten inches. Close visual inspection of the EZ revealed no signs of cracks or stressed structural areas from the outside.

Early Friday, July 31, I flew out of Mattoon to Oshkosh. The damaged canard destroyed almost all the laminar flow, requiring full aft trim and some positive stick pressure to maintain straight and level flight. At Oshkosh, I talked to Burt Rutan about the hail damage.

Burt, Mike, Bruce Tifft and I were all parked together. Mike held an informal discussion and information exchange session for Rutan builders and flyers at the Defiant every day at 1:30PM. After the Saturday meeting, he examined the aircraft and reassured me concerning structural damage. Then, he advised me to flox the holes where the hail cut through to the foam and apply micro to reform the leading edges of the canard and wings.

Bruce Tifft showed everyone how great his prop resisted the forces that destroyed the leading edges of the wings and canard. He also advised me to sand lightly with a fine grit paper to restore the polish to the urethane leading edge.

CONCLUSIONS:

The hole revealing the blue sky had ample room for the plane to fly through. The surrounding rain and clouds were very light in color, not the dark mass normally associated with cumulonimbus and severe thunderstorms. No lightning was visible from outside the clouds. The thunderstorm was imbedded. Yes, I was suckered.

Once the hole closed, I should have made an immediate 180 degree turn to exit. Then I could have continued VFR westward to pass the end of the line or find an airport and land until the weather improved.

Never let the urgency or desire to arrive at the destination interfere with flying judgment and decisions. Respect the the power of nature. Do not let the attraction of a light, thin area of clouds and light rain prevent thinking rationally. There may be a "sucker hole".

Due to the tremendous sharp wind shear between the strong updraft and down draft, I do not believe an aluminum light aircraft could have withstood the abrupt shock of the shear force encountered. The impact was incredibly severe.

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Update Number 76
to
Supplemental Chapter 39
Accidents/Incidents

****From CP76-2&3 (CH13,CH21,CH33,CH36,CH39)****

TRUCK-EZ TESTS - THE LATEST ON DEEP STALL

For several years, we have been trying to obtain information and data on the characteristics of various canard-types at deep stall conditions. Data for the VariEze has been available since the late 70's when NASA conducted rotary-balance wind tunnel tests and concluded that the VariEze has no stable spin modes, i.e., that if forced to any angle of attack and spin rate, it will recover by itself. Also, the small model tests showed normal flat-plate drag at high angles of attack. These data and extensive stall-departure flight tests with N4EZ formed the basis for our confidence in the deep-stall safety of these general aircraft types.

Then, about 5 years ago, several accidents occurred with the Velocity aircraft. We think the problem could have been determined if extensive aft-CG departure testing had been done during development, like we did with the Long-EZ and Defiant. Two very noteworthy results from these Velocity accidents were 1). The descent was a stable, non-rotating condition about 50 to 80 degrees AOA, not recoverable with forward stick or by rocking the wings. 2). The descent was slow enough to allow impact in water without pilot injury.

Rumors were abound about this slow, 1000 ft./min. "parachute-like" descent probably induced by a violent, trapped vortex above the wing. Researching this, we found the rumors were just speculation, that there was no hard data on the descent rate. Even the test pilot who stayed with a Velocity to the ocean instead of using his parachute admitted he had not timed the altimeter nor remembered the rate-of-climb indicator's data. He merely climbed partially out, but feeling the "light breeze" of the descent, elected to ride it down. We have been extremely skeptical that an airplane can descend at this low rate, even with the best possible vortex. To put things in perspective, consider what would be required. The EZs and the Velocity have a "loading" of about 10 lb. per square foot of total planform area (including wings, canard, fuselage strakes and cowl). If all this area acts like a "flat plate" in the descent, the airplane would sink at 50 knots or 5000 ft./min. (flat plate Cd=1.24). The very highest Cd we have seen in aerodynamic research papers on trapped vortex is about 10. Using a Cd of 10 for the entire airplane (very unlikely, of course), the sink rate would be 17 knots or 1800 ft./min. If the airplane could descend flat at 1000 ft./min. (only 9.9 knots), it would have a Cd over 30!!

Our interest in this phenomena certainly was increased after the deep stall accident of a Long-EZ at Kanab (CP 68). Now we had some data, but very poor data. Only a tiny image of the airplane during the last 2.8 seconds on a video tape. This airplane hit the dirt without killing the pilot so we believed it could not have been descending at 5000 ft./min. An attempt to analyze the video resulted in a very rough approximation of 2900 ft./min. which results in a Cd of 3.7. Our surprise, of course, was that forward stick did not recover from the deep stall. The surprise subsided when we later learned that the airplane was being flown with the CG well aft of the FS 103 aft limit.

While the 2900 ft./min. sink estimate seemed to make sense, it was not considered accurate due to the problem of measuring a fuzzy blip on the video. We then made a decision to try to gather full scale data on the Long-EZ. The previous full scale tests done in Florida on the Velocity did not measure drag and lift, only the more important data of recoverability with various airplane modifications.

Then, another Velocity deep stall accident occurred. This one descended inverted, hit land, not water, and killed the pilot. In this accident data <u>was</u> available - good, accurate radar and transponder data. Obtaining this data from the FAA is a story in itself.. Finally, after threatening a media expose about government cover-up, we received the data. This Velocity entered a deep stall at about 7000 ft. and descended at a nearly constant 4400 ft./min. (44 knots) for the entire 90 seconds to impact. Of course, this inverted descent data may not apply to an <u>upright</u> Velocity but, at least, for the first time it represented good data during a deep stall accident.

We proceeded to develop the rig to allow us to measure the Long-EZ. This turned out to be a much more difficult and expensive job than originally thought. It was made possible by the loan from Donald Douglas of Sherman Oaks, CA of his Long-EZ that is accurately built to the plans, without modifications. A 3-axis electronic balance was built to measure lift, drag and pitching moment and an accurate speed indicator was installed in front of an Isuzu truck. These "Truck-EZ" tests can only be done in dead calm winds, so after many delays, we were able to obtain data at 40, 50, 60, 71 & 80 degrees angle of attack.

The data are presented in this newsletter. Note that these are full-scale tests at near the same Reynolds number as flight, so they are much more accurate than the small scale model tests done by NASA in the 70's.

First, let's discuss the lift and drag data. The data show substantial scatter due to the truck riding over bumps in the runway. A line faired through the average of scatter is considered reliable. If we combine the lift and drag resolved to a total reaction that would support the airplane during a stable deep stall descent, we can calculate the sink rate. This data, sink rate vs. angle of attack, is shown. Note that this prediction is very close to the radar data of the Velocity (4400 fpm).

Now, how slow does a Velocity descend upright in the deep stall attitude? We don't know, but we now tend to suspect that it is relatively high, 3500 to 4500 ft./min. We reason that the low damage and pilot survival is related to the fact that the water impact is nose down and the bottom fuselage is curved, this allows a few feet of deceleration at impact which can explain the lack of pilot injury.

How slow does a Long-EZ descend in a deep stall attitude? First of all, our pitching moment data show that it cannot descend at the extremely flat attitude of 70 to 90 degrees angle of attack. The pitch data indicated that if the CG is aft of limit, say F.S. 106, the aircraft may hang up at about 40 to 50 degrees angle of attack. It would then descent at about 5000 feet per minute. Why did the Kanab pilot survive? Possibly the nose-low attitude allowed a couple of feet of "crush and rotate" deceleration that provided adequate protection.

Our concern now is that there are many Long-EZs with extensive modifications that can affect deep stall recovery (long noses, bigger strakes, baggage pods, etc.). While we do not approve these modifications and can't be expected to analyze or test each one, we do feel obliged to encourage everyone to conduct adequate testing to determine the safety of their own modified airplane. Conduct stall tests at the CGs you fly, with adequate altitude for a parachute jump (egress above 8000 ft. AGL). Do not ride it down, even over water.

Another concern is that many of you do not accurately know your CG position. Calculating weight and balance is a pilot's responsibility (FAR 21) for each flight. Be sure you fly within limits (your <u>own</u> test-verified limits for modified airplanes) and check CG when any changes are made.

From CP76-12 (CH13,CH21,CH33,CH36,CH39)
GRAPH OF LIFT COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

From CP76-12 (CH13,CH21,CH33,CH36,CH39)
GRAPH OF SINK RATE, LONG-EZ FULL SCALE TEST, OMITTED

From CP76-12 (CH13,CH21,CH33,CH36,CH39)
GRAPH OF DRAG COEFFICIENT, LONG-EZ FULL SCALE TEST, OMITTED

From CP76-13 (CH13,CH21,CH33,CH36,CH39)
GRAPH OF MOMENT COEFFICIENT. LONG-EZ FULL SCALE TEST, OMITTED

See pages 2 and 3 in this CP for article "Truck-EZ Test.

From CP76-14 (CH13,CH21,CH33,CH36,CH39)
Donald Douglas lent us his beautiful plans-built Long-EZ so that we could generate the full scale, angle-of-attack data using this "Truck-EZ" rig. Many thanks. Don. **PHOTOGRAPH OMITTED**

From CP76-5 (CH33,CH39)
A California Long-EZ struck a pine tree on short final. The airplane pitched down and crashed. The pilot was killed and the passenger was seriously injured. It was late in the evening and the runway lights were on. The pilot had not flown this airplane at night although he had night experience in certified aircraft.

The NTSB has not yet completed their investigation, but we feel compelled to point out that a night approach over trees to a fairly short runway (3600 ft.) can be very tricky. The "black hole" effect on short final can be very deceptive with little or no visual cues as to altitude. Practice night landings (if you must fly at night!) at airports with clear approaches and long, well lighted runways. Always aim to touchdown about 1/3 of the way down the runway. Do <u>not</u> try to hit the numbers at night.

From CP76-5&6 (CH21,CH33,CH38,CH39)
A VariEze crashed on departure from the Kansas City GIG on June 13, 1993. Since there were a lot of EZ builders and flyers on the field at the time, a rather extensive investigation was conducted on the spot, not only by FAA/NTSB personnel, but also by several EAA members, all of whom are very familiar with EZs. Tragically, two people died in this accident.

By all accounts, the airplane was refueled some time prior to take-off. The fuel caps on this particular VariEze were not the plans-recommended Brock-type fuel caps. They were the "Thermos" expanding 'O' ring-type. This type of fuel cap requires regular lubrication of the 'O' rings at 25 hour intervals. If this is not done, the 'O' rings will crush and crack and, even though you may have the locking tab down and "locked", the cap in fact will not be locked!

Shortly after take-off, the engine was heard to surge and loose power. The airplane began a 45 degree bank turn to the left. After completing 90 degree of the left turn, the nose began to drop and the aircraft impacted in a ploughed field, 30 degree nose low in a 45 degree left bank.

The investigators located all airframe parts except for the tip of one blade of the prop and the right fuel cap. The next day, parts of the fuel cap and pieces of the wood prop blade were found near the center line of the runway on the airport. This verified the theory postulated by the investigators that a fuel cap had come off and gone into the prop disc, breaking the prop. The resulting heavy vibration probably caused the pilot to pull the power back. For some reason, he elected to try to turn back to the runway. With little or no thrust, a heavy airplane in a steep bank (which causes high inducted drag) simply got too slow to fly and descended to the ground at a high sink rate.

It is too late for the couple in this VariEze but it is not too late for all of us who fly to learn from this tragedy. If you are flying a RAF design and have not complied with the CP advisories recommending you chain your fuel caps to the filler neck - do not fly again until you have corrected this omission. If the fuel cap on this VariEze had a chain to retain it, this accident would not have occurred. Please check your back issues of the CP for more information about chaining the fuel caps to the filler neck. See CP28, pg. 7&9; CP 31, pg. 5; and CP50, pg. 5&7.

Another lesson we should all learn from this accident is the problem of trying to make a 180 degree turn back to the runway while low and slow. A landing straight ahead into the wind (which was 15-20 knots that day) even if near the end of the runway, is much more likely to be survivable than a landing with a 15-20 knot tailwind. Think about it. Assume 100 knots airspeed. With 20 knots of headwind, your ground speed would be 80 knots. Downwind, it would be 120 knots! The kinetic energy in a downwind landing, in this case, is 2.25 times as high as it would be in a upwind landing. This could turn a survivable 15 "G" impact into an unlikely-to-survive 34 "G" impact! This assumes that you have not caused a higher sink rate due to the extra drag in the steep turn!

Please read this accident report and never forget the lessons learned. It is much, much better to land long, into the wind, and roll off the end of a runway at slow speed, even if you have to negotiate obstacles, than to land off field, downwind, at high speed.

From CP76-6 (CH39)
A California Long-EZ experienced an engine failure while flying level at approximately 10,000 feet. The ensuing emergency, off-field landing, attempted on a California "dry" lake that was not all that dry, resulted in the nose gear collapsing, the nose digging in, and the aircraft flipping over onto its back. The pilot suffered only minor injuries but the aircraft was badly damaged.

From CP76-6 (CH21,CH33,CH39)
An Indiana VariEze departed after refueling. The control tower operator noticed a fire on the wing trailing edge and notified the pilot, suggesting an immediate return for landing. The pilot put the airplane into a high speed dive while returning to the airport to land - and succeeded in putting out the fire. The left aileron, wing trailing edge and engine cowling were slightly damaged by the fire. The fire was caused by the fuel cap being left off during refueling and fuel syphoning out of the fuel tank onto the hot exhaust system.

From CP76-7 (CH33,CH39)
A California Long-EZ descended into the ocean at cruise speed without any apparent effort to slow down or flare for a minimum speed touch down. The pilot, the sole occupant, was killed. It is uncertain at this time what caused this tragic accident.

Remember, if a water landing is imminent, put down the nose gear and the landing brake. Touch down under control, wings level, at minimum flying speed. Do not attempt to "stall" it in or to touch down on water at high speed. At least one VariEze has conducted a safe, successful water landing with no injuries and only minor damage to wheelpants and lower cowling.

We will report further on this accident as more information becomes available to us.

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Update Number 78
to
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Information derived from CP78 published by RAF for April & July 1994

From CP78-1&2 (CH30,CH38,CH39)

WES AND MILLIE GARDNER, APRIL 1994

Wes and Millie were very good friends and will be sorely missed by all who knew them. On Monday, April 4, 1994, Wes took Millie for her first ride in their recently completed E-Racer. After only a few minutes, Wes called that he had a problem and was returning to the airport. Sadly, he did not make it and they were both killed in the crash.

Several mutual friends have investigated this accident and have reported a consensus that the throttle linkage separated, allowing the engine to return to idle. Unfortunately, idle power was not enough to allow them to return safely to the runway.

All of you who had met Wes knew him to be a regular at the Jackpot, Wendover and Kanab EZ races. He was a truly dedicated and extremely competitive pilot and loved racing of all kinds, including boats and cars. He was one of the first to fly with an Ellison throttle body and an electronic ignition system. His VariEze was not only beautiful, it was very fast! Wes set the fastest time at the Flying Kilometer in Chandler, AZ in 1990 and he was thrilled!

Wes and Millie were some of the kindest, most generous people we ever knew - until we meet again, fly high and fly safe, Wes and Millie.

From CP78-2 (CH30,CH38,CH39)

ENGINE CONTROLS

We have talked about this subject several times over the years yet many builders continue to do less than their best work in this area. Pay close attention, Guys: Your ability to control your engine is second only to your ability to control your airplane. You do your very best work on the pitch, roll and yaw control system and you should do the same for the throttle and mixture controls.

Before you do your first flight, and at regular intervals thereafter, get someone to help you check that the throttle and mixture controls do, indeed, move the appropriate range to the full throttle/full rich positions and also to the idle/cut-off positions <u>without</u> the use of any helper springs. If you cannot get the throttle and mixture controls to work satisfactorily without springs, consider going to push/pull cables. I realize this is a hassle, but not nearly as much of a hassle as losing control of your engine at a critical time.

I installed a push/pull throttle cable when I installed an Ellison throttle body almost 1200 hours ago. (This is a mandatory requirement when you install an Ellison and not a bad idea for any carburetor). I carefully measured to determine the exact length required, then ordered a custom-made aircraft push/pull cable from Aircraft Spruce. I removed the throttle lever from the Brock throttle quadrant and scribed around it onto a piece of 1/16" thick 2024-T3 aluminum, adding about 2-1/2 inches to the bottom of the throttle lever. This was band sawed out and deburred.

A small rodend, screwed and jam-nutted to the push/pull cable end, bolts to this lower end of the new throttle lever. The outer cable is secured to a bracket mounted on the inside of the left arm rest (I used a "u" bolt located in the grove machined in the end of the outer cable).

At the engine end, the outer cable fits perfectly into a bracket mounted on the Ellison throttle body (provided by Ellison) and the cable end has an aircraft-type ball and socket. The "ball" bolts onto the throttle lever and the "socket" screws onto, and is jam-nutted to, the cable end. The "socket" fits onto the "ball" and is held securely in place by a threaded insert that can be tightened onto the ball and is safetied with a cotter pin.

Exactly the same system can be used for the mixture control. There are many acceptable ways to obtain reliable engine controls. Just be certain in your own mind that what you have installed is fully functional and safetied so that it cannot possibly come undone or separate in some way. Have other builders or an A&P look at your work, the more pairs of eyes that check your system, the less likely you are to have a failure and a failure in this area is not acceptable and will almost certainly result in, at least, a forced landing. Never forget that!

****From CP78-2&3 (CH21,CH30,CH33,CH38,CH39)****

WATER IN FUEL

A recent off-field landing in a Long-EZ, fortunately with no injuries, forcibly brought to mind the ritual of checking for water at all the drains. A standard Long-EZ has a gascolator drain on the firewall which should be easily accessible through the cowling inlet. This should be drained before each flight, once the airplane is in the level position (on all three wheels). There is a water drain at the forward end of each main fuel tank and these must be drained before each flight but before the airplane is moved. That is to say, while it is parked in the normal nose down position. Do not lift the plane up to the 3-point position until after you have checked these two water drains. If you are in the habit of normally parking your EZ in the level, 3-point position (tying the nose down), you should consider installing low point water drains in each sump blister and then check them religiously before every flight.

Where does the water come from? Sometimes, but rarely, from the gas pump (or gas truck), very rarely, if ever in a composite EZ-type, from condensation in a less than full fuel tank. This is common in metal airplanes. That is why it is normal to top off the tanks in any Spam Can after a flight. Because the fuel tanks in any RAF design are insulated sandwich construction, they are similar to a thermos bottle and condensation does not normally form on the inside of our fuel tanks. The most likely way for water to get into your fuel tanks is a leaking fuel cap on an airplane left out in the rain. The "O" rings on any of the commonly used fuel caps do not last forever. Far from it, in fact. Ozone, ultra violet light and many airborne pollutants attack these rubber "O" rings. Check them frequently and replace them as soon as you see small cracks in the outer edges of these "O" rings.

Be especially diligent about checking your water drains if you have left your airplane out in the rain. Also, if you fly into an airport on one fuel tank with no problems, consider taking off and climbing to a safe altitude on that same, known to be free of water, fuel tank. Switch to the other (unknown) tank only after you have plenty of altitude to allow a safe return to the airport in the event water may be in this fuel tank. This philosophy is an old one but a good one. For the same reason, if anything untoward happens when you switch tanks, always switch back to the first tank before you try anything else.

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Information derived from CP79 published by RAF Oct 1994

From CP79-7(CH33,CH39)

A VariEze got away from its owner recently while hand propping. A friend, a non-pilot, was asked to monitor the throttle while the owner propped it. It started, unfortunately the throttle was full forward, and the non-pilot did not retard it but did hang on for the ride of his life as it scooted across the ramp on its nose. It finally struck a steel fence post which cut a 3" wide slice from just left of the pitot tube in the nose, all the way aft to the shearweb/spar cap of the canard! An expensive lesson. Fortunately, no one was hurt but the damage was extensive.

Always have a pilot who understands the EZ throttle and mag switches monitor your controls while you prop it - or better yet, get a B&C light weight starter!

From CP79-7&8(CH33,CH39)

Charlie Mottier sent this letter to RAF regarding his ditching in the ocean off the Berry Islands in the Bahamas. Unfortunately, the airplane was a total loss but the good news is that Charlie and his wife, Phyl, survived with only minor cuts and bruises. His letter is printed in its entirety in the hope that this information may help someone someday.

"Following Sun-N-Fun '94, nineteen canard-type aircraft flew to Great Harbor Cay in the Berry Islands (67nm south of Freeport, Grand Bahamas) for some well deserved R&R.

On the flight home our Long-EZ experienced a loss in engine power about 15 minutes into the flight and we subsequently ditched the plane in Big Sturrup Bay off the Berry Islands.

When the problem developed, we immediately advised our flying partner and then changed frequency to call in a Mayday which was acknowledged by Customs at the airport. We advised that we were attempting to return to the airstrip and requested landing priority. On that frequency, all inbound and departing aircraft were advised of the emergency.

When it became apparent that we would not make the field, the decision was made to ditch rather than to put the plane in the trees on the adjacent island as I felt there would be less chance of fire in a water landing. Our landing speed into the wind and with calm seas was about as low as possible to keep the sink rate to a minimum. The main gear hit first and pitched the plane forward. The canard was sliced off cleanly at the fuselage on both sides. The plane dove under water and the canopy was lifted right out of its frame. We came to rest dead in the water and perfectly level. With the canopy gone, I simply stood up and turned to check up on my wife who was in the back seat. Boats to help arrived within 3 minutes and, after sending Phyl to the local dispensary, we towed the plane to the shore.

I suffered no injuries other than some minor cuts and bruises and required no medical attention. Phyl suffered some sore ribs on her left side and some minor cuts, but on complete examination in Ft. Lauderdale, was pronounced fit and was released from Browder Memorial hospital.

There are at least two important points for EZ drivers from this experience: 1) A water landing is survivable although it is hard on the plane. My plane floated, it was heavily loaded and it floated entirely level. We walked on the wings as did others and it was very stable. In attempting to stretch the glide to reach the airport, the nose gear <u>was not</u> extended. If I had to do it over again, I would put the nose gear down. That might help soften the forward pitch when the main gear digs into the water. (Also, the landing brake should be deployed - ED.). 2) Most of our problems have developed from dealing with our own FAA. They advised immediately and strongly that we were in violation of the law by being in Bahamas air space without receiving prior written approval from the Bahamas government. That restriction is shown on the back of your pink Experimental

Airworthiness Certificate. It is item D and among other things, restricts experimental aircraft from flying over any foreign country without the special permission of that country. That means "in writing and in advance".

In summary, we do not know what happened to our factory-new, 250-hour, Lycoming 0-320, 150hp engine. The plane took all of the licks and we elected to total it. The passengers suffered almost not at all. Not a pretty story but we think one with a happy ending.

We want to thank our Canard friends who agonized with us as we splashed down and for their continued support through phone calls and cards.

Charlie and Phyl Mottier"

****From CP79-9&10(CH33,CH39)****
<u>*LIGHTNING STRIKE!*</u>
Long-EZ builder/flyer, Dan Worley, sent in a couple of photos and a report of a lightning strike. **PHOTOGRAPHS OMITTED** His Long-EZ, N63EZ, was parked, nose down, at his local airport within 50 feet of other airplanes and a metal hangar during a storm. As you can see from the photograph, the lightning vaporized the copper tape comm antenna under the skin of the left winglet and, in doing so, melted the blue foam core fully 2" wide and through to the outboard skin. The pressure of expanding gasses literally blew the inboard skin off the foam core and split the skin for almost 30". The rudder itself was undamaged and the structural attachment of the winglet to the wing was intact.

In addition to the above damage, his nav/comm was burned out, a handheld wired into the airplane was destroyed, the voltage regulator, intercom and strobe power supply were burned up, a digital CHT monitor, a digital fuel flow meter and bus voltmeter were destroyed. One co-ax antenna cable was burned. No other wiring was damaged. The lightning entered at the NG-3/NG-4 nose gear brackets, burning a 2" hole in the nose gear fairing, then ran around burning out the various electronic items and, finally, traveling outboard along the antenna co-ax and exiting from the tip of the left winglet. This is what we are told probably happened. Andy Plumber is a lightning expert and Burt has talked to him about this incident.

It is Andy's opinion that this was a <u>very tiny</u> lightning strike! He also informed us that had this strike occurred in flight that damage most probably would have been less, not more! He is absolutely adamant that no unprotected composite aircraft should fly within 50 miles of a thunderstorm!

We have a friend who works on a fleet of 4 C-130 aircraft and he tells us that at least one of these airplanes experiences a lightning strike on an average of once a month! Damage is usually small but occasionally results in an antenna being blown off the aircraft! There is even a report circulating that the recent loss of a similar C-130 (not one of his) was caused by a lightning strike which hit a fuel tank blowing the wing in half!

Lightning is not to be taken lightly, but for those who can afford it, there is a full, anti-lightning treatment available as written up in *Sport Aviation* on a Glasair III. A metal screen was bonded to every square inch of the airplane then it was struck by an artificial lightning bolt. There was some damage but mostly cosmetic. I cannot find the article right now but it is an expensive procedure and not something the average homebuilder would normally opt for.

This article is reproduced here simply to let all composite flyers know that flying close to thunderstorms could, quite literally, ruin your day! Stay clear of them, fly well around them, heck, that's the advantage of our canard pushers, we can fly around this kind of hazard with the excellent range we have. Fly safe and report any incidents to RAF so we can keep everyone informed.

****From CP79-13(CH33,CH39)(PHOTO CAPTION)****
Dan Worley's Long-EZ winglet after suffering a lightning strike while parked nose down on the ramp during a storm.

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Information derived from CP80 published by RAF Jan 1995

From CP80-3 (CH39)

MAGNA LISET - May 1935 - February 1994

We were very sad to hear from Magna's wife, Jean, that Magna was killed in his Long-EZ when he flew into power lines on Feb. 12, 1994. Magna was a gung-ho builder and flyer and we enjoyed him and Jean immensely when they visited California several years ago. As reported in the Canard Pusher, Magna achieved great things in his Long-EZ doing very well in the race around Australia, and set records flying coast-to-coast non-stop, in both directions, as well as from Australia to New Zealand.

We will miss Magna, he never took "no" for an answer and spent a tremendous amount of energy battling the Australian equivalent of our FAA over licensing his Long-EZ in the configuration he wanted. He got it done - he was quite a guy!

(I shall especially miss his midnight phone calls - ED.)

From CP80-3 (CH39)

JOHN HAYES - Lost on October 9, 1994 while flying home from the Rough River Fly-In in Kentucky.

John was flying his Long-EZ, N33EZ, with Jack Fehling who was in his VariEze, N444EZ. About 15 miles northeast of Gadsen, Alabama, they encountered rain and Jack lost sight of John. He called John suggesting they land at Gadsen, but there was no response. John has never been heard from again.

The Civil Air Patrol initiated a search the following day and many friends participated. No ELT signal was received, even from the satellites, and no radar information was available. The area is heavily forested with pine and hardwood trees as tall as 60-80 feet. There are many ridges as tall as 2900 feet in the vicinity. The weather was 500' overcast with rain showers.

A rather massive search, both ground and from the air, failed to turn up anything and the CAP search and rescue was called off the first of November, 1994.

Our thoughts and prayers go out to John's wife and family members.

From CP80-4 (CH39)

ACCIDENTS AND INCIDENTS

A Cleveland, Ohio, Long-EZ pilot walked away from a crash which occurred shortly after take-off from the Cleveland Hopkins airport. The pilot did not build the airplane but reportedly had flown more than 400 hours in the airplane. Apparently, he had some sort of control system problem but the pilot said he did not know what had caused him to loose control and crash. The aircraft was severely damaged and the pilot was very fortunate to escape with minor bumps and bruises.

We are attempting to obtain more information on this accident but it does bring to mind the subject of loose objects in the rear seat. When flying solo, your preflight must include a thorough check of the rear cockpit for loose objects that may jam the control stick. It could be something as unlikely as lipstick or a pencil falling from the baggage strakes. This could have very serious consequences should the controls become jammed - preflight your airplane thoroughly!

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Update Number 81
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Information derived from CP81 published by RAF July 1995

****From CP81-4,5,6&7 (CH30,CH39)****
BRUCE AND BONNIE TIFFT

Synopsis of Accident - N115EZ was a highly modified aircraft based on the Long-EZ.

Powerplant--although there was no data plate installed, this appeared to be a Lycoming IO-360-B series, angle valve, 200 HP engine.

The accident occurred on the morning of March 18, 1995 on the Tiller Trail Highway approximately 20 miles east of Myrtle Creek and 30 miles southeast of Roseburg, Oregon, only 55 miles from their departure point of Cottage Grove, Oregon.

Weather in the Roseburg area at the time was reported to be 3000 ft. overcast with good visibility. The overcast began to break up south of Roseburg and it was CAVU south of Myrtle Creek.

Based on all of the findings, it appears that the engine was not turning at the time of impact. Therefore, it is assumed that an engine related problem drove Bruce to attempt an emergency landing on this rather narrow mountain road near Tiller, OR. He appears to have approached from the south, made a left base to the west to line up on the road. The blacktop road bed is only 20 feet wide with approximately 6 foot wide shoulders on each side. There is a rocky hillside on the left side and a steep drop-off on the right, sloping down to Elk creek which roughly parallels the road. The airplane struck the tops of several pine trees which flexed and gave way but, unfortunately, the left wing then hit a large oak tree which tore this wing completely off the airplane. This caused the airplane to roll/yaw left where it impacted against some rocks in a nose low attitude, with at least 90 degrees of left roll. It then bounced/slid down the slope into the rain swollen Elk creek where it came to rest. Forward of the firewall, the fuselage was submerged. The engine cowling, engine, right wing and right winglet/rudder were not under water. Both occupants were killed instantly by the impact and did not drown.

The prop was stopped in the horizontal position. The right prop blade was completely undamaged, while the only damage to the left blade was that the outboard 8" was bent/broken straight aft, not at an angle against the direction of rotation as it would have been if the engine was turning or developing any power. This damage to the tip was caused by the left wing root as it was torn aft by the oak tree. There is evidence of yellow paint on the prop tip as well as on the left exhaust stack which was dented by the left wing root as it departed the airplane. The cowling was essentially undamaged, as was the right fuel tank/strake, right wing and right winglet/rudder. The engine was undamaged and still attached to the engine mount and firewall. The main landing gear also suffered little damage. The left side of the fuselage, aft to the centersection spar, including the left fuel tank/strake, was destroyed. The right fuselage side was destroyed aft to the leading edge of the right strake. The canopy was also destroyed. The instrument panel was heavily damaged, making it impossible, except for the radio, to determine the position of any of the switches. The control system was severely bent and even broken in several places, but all parts were recovered and all failures were due to massive overload. It is believed that the airplane was under control until impacting the oak tree and, it is the opinion of several of the accident investigation team that the pilot would probably have landed successfully, if he had not struck the oak tree.

Considerable damage was done to the airframe by the salvage crew while removing the aircraft from the creek and transporting it to the police impound area in Myrtle Creek. Although this was taken into account during the investigation, we may have been able to learn a great deal more had the salvage been supervised by someone intimately familiar with this type of aircraft. The NTSB would not allow any examination of the wreckage by us until a representative from Lycoming, Mr. Greg Erickson, had completed his inspection. He, together with a representative from the FAA, arrived several days later, removed the cowling, and discovered that the engine had "non standard" cylinders, ignition systems and carburetor. Also, the engine data plate was missing. At this point he concluded his investigation and left. He later called Fergus Fay, who had requested to be present at the investigation (but was not notified) and told him of the "non standard" nature of the engine. He said that with no data plate, non standard cylinders, a non standard ignition system and "other modifications", he considered that it was no longer a Lycoming product. NTSB lost interest immediately, and within 48 hours the FAA turned the wreckage over to the insurance company who released it to the family who, in turn, gave permission to Ferg Fay to conduct an inspection of the engine.

Ferg removed the engine from the aircraft and transported it to his home where he suspended the engine in level flight attitude and drained the oil. There were only 3.8 quarts in the crankcase. The engine was initially very tight and it took a measured 1200 inch pounds of torque to break it loose. A compression check was conducted with the following results:
Cylinder #1 - 40/80 - leaking from the exhaust valve.
Cylinder #2 - 50/80 - leaking from the exhaust valve and the rings.
Cylinder #3 - 75/80 - slight leak by the rings but OK.
Cylinder #4 - 20/80 leaking from the exhaust valve and the rings.
The valve clearances were checked with the lifters compressed and were found to be between .028 and .066 (the Lycoming standard spec. is .028-.080). The three worst cylinders were removed (cylinder base nuts were found torqued to 450-500 inch/lbs.) and carefully checked with a micrometer and a dial indicator. The bore diameter and choke were consistent with Lycoming standards. Definite, light scoring was found in the upper cylinders. The top compression rings were removed from the pistons and the ring gaps were checked. They were found to vary from .010 to .040. These rings were found to have unusually sharp edges, particularly for so little running time.

There were no magnetos on the engine. The left mag hole was covered by an aluminum plate. In its place, a Jeff Rose electronic ignition system module was used. Instead of the right mag, there was an automotive type electronic ignition system of unknown origin. complete with distributor cap, rotor and automotive high tension cables. On disassembly, the distributor cap was found to be cracked and the center carbon was broken and found lying loose under the distributor cap.

Ellison throttle body (carb) looked OK but the throttle linkage had been bent during the crash making it impossible to move the throttle slide. There was fuel in the right fuel strake and, although the linkage had been badly bent in the crash, the fuel shutoff valve was in the on position. When the fuel line was disconnected at the firewall, fuel ran out.

The crankshaft flange was checked, using a dial indicator, and the total indicated runout was only .002". The case was not disassembled because, at this point, the family sold the engine.

Analysis

Bruce had recently overhauled this engine using four new Superior millennium cylinders, pistons, valves, guides, etc. He had reported that the engine was running very hot but that it was using no oil! It is not normal for a newly overhauled engine to use no oil. The condition of the baffling verified the report of a hot engine. It was obvious that he had been working hard on tightening up all baffle leaks. There was an extraordinary amount of RTV all over the baffling and cylinders. We have learned that Bruce had ordered a new digital scanning cylinder head temperature gauge just the day before the accident (further indication that he had high temperatures). There are no logs to verify the engine running time since the overhaul but it is believed that he had only flown it about 5.5 hours before departing for Mojave, CA around 7:30am on March 18.

The crash site is 55 miles south of the Cottage Grove airport suggesting that they probably were airborne for only about 20 minutes. Assuming Bruce topped off his oil, which was his usual habit, how could he have used 3 to 4 quarts of oil in only 20 minutes? There were none of the usual signs of heavy oil use, the tops of the pistons were not heavily carboned up, nor were the exhaust stacks excessively oily or sooty. The light, but definitely noticeable, scoring in the upper portion of the new cylinders is indicative of tight rings; the unusually sharp edges found on the compression rings indicates excessive wear caused by tight rings and/or overly expanded pistons. caused by excessively high cylinder head temperatures. Compression ring gaps were measured at .010-.040 (Lyoming spec. calls for a minimum gap of .030-.045 in a nitrided, choked cylinder barrel). There is, however, no evidence that the engine actually seized (at least, in the cylinders).

Compression reading as low as 20/80 in essentially new cylinders is indicative of possible ovalizing of the barrels due to extremely high cylinder head and cylinder barrel temperatures. This condition would cause unusually high pressure in the crankcase due to ring blow-by and could have blown a lot of oil out of the breather. Since Bruce's breather system dumps into the exhaust system, all evidence of this loss of oil would be eliminated by being burned in the exhaust stack.

It could not be determined if the cracked distributor cap or the broken carbon existed prior to impact, so it is not known if the experimental ignition systems contributed to the cause of the accident. It is a fact, however, that if Bruce had suffered a complete electrical failure, both of these ignition systems would have eventually cease to function. The battery was never found and it is assumed that it is at the bottom of the creek.

Summary

While weather was probably not a direct factor, the ceiling between Cottage Grove and Roseburg was reported to be around 3000 ft; we assume that he remained below these clouds. This would account for the fact that he did not have enough altitude to glide west to more favorable terrain. From 7500 ft, for example, he could have reached open, flat fields near Canyonville, east of Interstate 5. From 3000 ft, he was little more than a normal pattern altitude above the Tiller Trail, leaving him with no other choice. On reaching clear skies, southeast of Roseburg, he may have initiated a climb. Adding power at this point may have exacerbated the high cylinder temperatures problem and he may soon have felt compelled to reduce power to near idle. The engine might have stopped because of the internal friction evident by the upper cylinder scoring and ring wear. Had the engine been developing any power at all, it is certain that Bruce would have nursed it over to one of several airports that were less than 20 miles away., His radio was still on 122.8, the frequency used at Cottage Grove. He probably did not have time to switch to 121.5 and declare an emergency.

Bruce was the epitome of the experimenter and was always testing some new idea on his airplane. In this case, however, what with two different electronic ignitions systems, two different types of spark plugs, new design, relatively un-proven cylinders, a non standard crankcase breathing system, etc., maybe he was simply trying too many new things at one time. Bruce had a history of high oil temperatures with this engine, even before this latest overhaul, and he had installed a larger than normal oil cooler. This oil cooler was installed in an unusual position - just inside the engine cooling air inlet, in the cowling, where it looked as though it would impede the flow of cooling air to the cylinders. This is not a normal oil cooler installation and may have contributed to his high temperature problems.

Perhaps the lesson for those of us who fly these little airplanes is to try only one new idea at a time. We need to recognize the wisdom of FAA's requirement to <u>test any</u> "major alteration" in a suitable test area prior to returning to "normal" operations. Completely evaluate each new idea, one at a time, accept or reject it, then go on to the next new experiment.

Mike Melvill

PS. I have recently been in touch with the person who bought Bruce's engine and he has a few interesting observations. First of all, he says the weather in Cottage Grove that morning was much worse than the weather reported at Roseburg. He believes that there was no more than an 800 foot ceiling with poor visibility. Furthermore, he says at least one other aircraft departing from Cottage Grove to fly to Roseburg that morning, was forced to return to Cottage Grove due to low ceilings and bad visibility.

While he has not torn down the engine, he did look at the mechanical fuel pump. He found that it contained only water, no fuel. This may, or may not, be significant. Since the aircraft ended up in a river, it is possible that the fuel system got water in it directly from the river. However, I can think of no way that water could get into a mechanical fuel pump if the pump is not operating, (The engine was not turning at impact) especially if the fuel lines between the mechanical fuel pump and the carburetor were intact. The same person, who has the hangar next to Bruce's on the Cottage Grove airport, says that Bruce fueled up his airplane the night before his planned flight to Mojave, by way of two Jerry cans. He had never seen Bruce do this before and it is possible that one, or both, cans may have had water in them. This scenario would require that only one fuel tank got contaminated by water and that they took off on the "clean" fuel tank, then switched to the tank with water close to the accident sight.

All of this is supposition, none of it is hard proof, and I am very sad to say that we may never know exactly what it was that caused us to lose our friends, Bruce and Bonnie. They were neat people and will be sorely missed by all of us in the sport aviation arena.

Mike M.

From CP81-7&8 (CH13,CH30,CH38,CH39)

A Texas VariEze which was not built by this pilot but was purchased as a completed airplane, crash landed short of the runway due to a throttle control system anomaly that this pilot was unfamiliar with. This VariEze was equipped with an electrically operated nose gear system. Letter follows:

"On April 8th, my VariEze was force landed after the throttle stuck in the closed position while approaching Addison Field for a landing.

The pilot had been practicing formation flying with a Long-EZ flown by a friend. The pilot had been cleared for an approach, as a flight of two, into Addison. Approximately one mile from the runway, the tower requested that the flight reduce speed to the minimum possible to enable a twin on right base to land ahead of the flight. In complying with this request, power was reduced to a minimum. Shortly before this power reduction, the pilot noticed that the knob of the throttle control lever had dropped off. One part of the knob was retrieved and placed under the pilot's thigh for safety.

When the time came to open the throttle to maintain altitude and continue the landing procedure, it was found the throttle would not open more than a half inch. A determined effort to force the throttle open was unsuccessful. The limited opening provided insufficient power to maintain altitude and it was not possible to stretch the glide to reach the runway. It was difficult to try and resolve the problem and fly the aircraft safely at the same time, so the decision was made to concentrate on landing safely. A field that seemed to have fewer wires and other nasties, became the option. The landing was made safely and the aircraft rolled three hundred and fifty feet before being launched back into the air by a sharp rise in the ground. The aircraft then flew over a road and landed on a bank on the other side of the road. The impact came with the plane level but descending almost vertically - what might be termed a genuine pancake. The distance between impact and final stopping place was about ten feet. Damage was extensive; nose gear, which did a great job in absorbing kinetic energy; main gear, folded back; and extensive damage to the fuselage in the attachment area. The landing gear fork, broken by the impact and then folded back under, came through the fuselage floor, through the thigh support and the seat and cut into the pilots right thigh. Far more destructive was the remains of the electric landing gear which tore loose and destroyed the instrument panel bulkhead, both the radio and transponder, the turn and bank as well as severely bruising the pilot.

The cause of the throttle problem: The aircraft had had a plans built cable throttle originally. This was later changed to a push/pull, Morse cable which was different from the original in requiring a straight motion from the bottom attach point of the lever. This was achieved by making a second lever, longer from the fulcrum to the lower attach point than the original but using the same fulcrum and control knob pattern. Instead of removing the original lever, the second lever was placed alongside the original, such that both moved together, although the original was now no longer functioning or attached to a cable. When the knob which went through both levers came off, there was no longer any restraint to prevent the levers from moving independently. One fowled against the other and jammed.

With more altitude and thus more time to fiddle around, the problem might have been overcome, or if the pilot had been aware of the way the system had been installed, he might have come up with a way to overcome the jamming. On the other hand, given the circumstance, making the decision without delay and maintaining control probably was a contributing factor in the limited damage the pilot and aircraft sustained.

I am concerned that builders who have installed electric nose landing gear activation may be in for a rude shock if they ever have an off field landing. The operating mechanism is heavy, and potentially a lethal weapon if it comes loose in an accident. I would strongly recommend to those contemplating the use of this gear to have another think. The only thing that saved me from injury from the gear was the almost zero forward speed on impact. I do not want to think about what that bloody great torpedo shaped missile would do to one in a frontal impact situation. When this aircraft is rebuilt, it will definitely have a plans built nose gear."

From CP81-8&9 (CH8,CH21,CH30,CH39)

A Southern California Long-EZ crashed shortly after departing from the Santa Monica airport. The pilot survived but was badly injured.

A careful post-crash investigation revealed that this airplane's fuel system had been extensively modified by removing the engine driven mechanical fuel pump as well as the electric boost pump. The fuel tanks had been plumbed together to form a gravity fuel system similar to a Cessna 150.

This pilot had also modified the front seat shoulder harness attach point and had installed a "Y" type shoulder harness, installed using a single bolt in the center of the seat bulkhead. There was no provision to carry the crash loads, no hardpoint and no beef-up of the bulkhead skins. The result was predictable. This single bolt pulled through the seat bulkhead and the should harness provided zero restraint. The seatbelts were installed per the plans and survived undamaged.

This is an absolute No-No! *RAF* Thoroughly explored the possibility of a gravity fuel system for the Long-EZ back in 1979 using the prototype, N79RA. Flight test results forced us to conclude that the margin of safety using a gravity fuel system was too slim and we opted to use a fuel system similar to a Grumman Tiger or Cherokee that includes two separately selectable fuel tanks, an electrically powered in-line fuel boost pump and an engine driven mechanical fuel pump. All of the above are mandatory in order to provide reliable fuel delivery to the carburetor on a typical Lycoming-powered Long-EZ,. This information was published in several *Canard Pushers* as well as in the plans and engine installation instructions. The following is taken from page 3 of the Section IIL of the Long-EZ plans:
"The most important item to consider is the mechanical fuel pump. The Long-Ez's fuel system is designed to require the use of an engine driven mechanical fuel pump, backed up by an in-line electric pump. This is a mandatory requirement and there is no acceptable way around it."

This important safety requirement was not just dreamed up, it was derived from a carefully conducted flight test program - do not try to second-guess the designer's motives behind critical systems such as the fuel system. The plans built fuel system on the Long-EZ is an excellent, trouble free system that is known to work on hundreds and hundreds of airplanes.

If you know of someone who may be contemplating a change to his or her airplane like this, get involved, help him or her out, don't let another unnecessary accident happen.

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Update Number 82 to Supplemental Chapter 39 Accidents/Incidents

Information derived from CP82 published by RAF Oct 1995

From CP82-8 (CH33,CH39)
A VARIEZE crashed in Illinois recently, and unfortunately the pilot was killed. The passenger survived with severe burns.

After this VariEze landed on the 2,300-foot paved landing strip, the two occupants complained that they smelled fuel fumes in the cockpit. They spent considerable effort trying to locate a fuel leak. No leak was found, so they purchased fuel and took off.

At least four eyewitnesses saw the crash. The VariEze reportedly used nearly the entire 2,300-foot runway before breaking ground. It did not climb out of ground effect, and struck the corn in a field off the end of the runway before crashing on the runway centerline a quarter of a mile from where they broke ground.

Witnesses reported that the engine sounded normal, and there was no sign of an in-flight fire.

The VariEze was destroyed, and a fire broke out shortly after impact. The passenger was able to evacuate the aircraft, but received severe burns trying to get the pilot out.

This VariEze was known locally as a "heavy" aircraft, and routinely used lots of runway to take-off. The pilot did not build this aircraft, but purchased it three years previously. He was a proficient pilot, and flew his VariEze often. The pilot was a large man, weighing between 270 and 280 pounds. The weather was clear with temperatures in the high 80's. The pilot's home base runway was 4,000 feet long.

CONCLUSION
This was a heavy example of a VariEze, and had a reputation of needing a long take-off roll. The day was hot (upper 80's) and the pilot was a heavy man. With a load of fuel and a passenger, this aircraft was undoubtedly over gross. Even a lightweight VariEze (630 lbs) would be at the maximum allowable gross weight just with this pilot (270 lbs) and full fuel, not including a passenger! An over gross weight take-off from a 2,300-foot strip on a hot day is simply a recipe for disaster.

From CP82-8 (CH33,CH39)
A LONG-EZ crashed on take-off in Arizona. The pilot was killed but the passenger survived with serious head injuries.

The aircraft was attempting to take off on a 7,000-foot-long runway with an 1 percent uphill grade. The long-EZ was loaded to more than 150 pounds over the maximum allowable gross weight. The temperature was 85 degrees F, and density altitude was over 8,000 feet.

It was almost dark, 8:30 pm in August 1995, and the tower operator reported that the aircraft initially broke ground at the 4,800-foot mark, but settled back onto the runway. The pilot continued the take-off attempt, lifting off briefly twice more before finally chopping the power and steering around the approach light system.

Unfortunately there was a six-foot chain link fence around the airport perimeter. The Long-EZ crashed into this fence, striking two fence posts, and breaking through the chain link. It crossed a road. broke through a wood-pole fence and came to rest upright on a golf course.

There was no fire, but the chain link fence and/or fence posts severely injured the passenger and fatally injured the pilot.

CONCLUSION
This was yet another example of an attempted take-off at over gross weight! Add to that, a hot, high density evening, plus an uphill runway! This pilot might have been successful with any one of these problems individually, but was unable to overcome them all.

****From CP82-8&9 (CH33,CH39)****
A LONG-EZ crashed near an interstate highway in New Mexico. Weather at the time was bad with low ceilings, poor visibility in rain.

The aircraft struck a tree (a very low tree) and was totally destroyed. Both occupants were killed. Several eyewitnesses reported seeing this aircraft flying very low near the highway.

There was no evidence of any kind of mechanical problem, and it is believed that this accident was caused simply by the pilot attempting to fly VFR in IMC conditions.

CONCLUSION
This particular case is even more difficult to understand since this pilot was very experienced and IFR capable. Was this another case of "get home itis"? Certainly, a 180-degree turn before the weather degraded would have been prudent, and they both may have lived to fly home the next day.

In a tragic accident like this one, it is of course impossible to know what the pilot was thinking, or why he continued in such poor conditions, but having done our share of skud-running, we have had to make many 180-degree turns due to bad weather. So far, we have been lucky, and have made the correct choice. But it is not always easy and many things can cloud your judgment - having to be at work the next day; make a doctor's appointment; deal with a family emergency, etc., - please friends, know your and your aircraft's limitations, and fly within that envelope.

****From CP82-9 (CH33,CH39)****
EDITORS COMMENT
The above accidents were preventable and unnecessary. The pilot-in-command is responsible to check the gross weight and to make a "go" or "no go" decision based on the available runway and density altitude. An uphill runway, even an 1 percent grade, is a lot. A 7,000-foot-long runway. with an 1 percent grade is 70 feet higher at one end than the other.

Think of this as a seven-story building being at the end of the runway. It is hot, it is dark, you are over gross with a high-time Lycoming 0-235 engine. The wind is calm, so no help from the wind (although a downhill take-off should have been an option with no wind). Would you attempt a take-off in these conditions, particularly if you think of the uphill grade as a seven-story building you would have to clear!?

Hopefully not. For most pilots this situation would be unacceptable.

Recently we read in the Cozy newsletter of an attempted over gross weight take-off from a short runway. The take-off attempt was aborted, but the brakes failed to stop the aircraft and it broke through a fence and hit a berm, failing the canard, both wings and the landing gear. Fortunately both occupants survived with minor injuries.

How can accidents such as this be prevented? Know your aircraft's limitations, and know your own limitations. Never try to operate outside of this envelope. Use your common sense. if you don't like the look of a situation, *STOP and RE-EVALUATE* what you are trying to do. *NEVER* allow yourself to be driven by schedule - much better late in this world that early in the next!

To report accidents and incidents

Write: Rutan Aircraft Factory
1654 Flightline
Mojave CA 93501

or Fax: (805) 824-4174
Attention RAF

From CP82-9 (CH30,CH39)

Fuel Pump Fire

We recently had an event with our Long that may be of interest to other builders that use Ellison carburetors. We were out in front of our hangar starting our Lycoming 235. After turning on the fuel pump to check its operation I cracked the throttle, primed the engine, fooled around with the primer awhile getting it re-seated, and then hit the starter. The engine did not start immediately and I waited a few seconds then tried again.

The second time the engine back-fired but did not start. Thinking that it was flooded I opened the throttle and was waiting again when I noticed a puff of smoke drift by. This caught my attention immediately!

Fortunately the wind was blowing from behind so I could see the smoke. We were able to extinguish the fire with the use of two big C02 extinguishers but the damage was significant. All the wiring from the firewall (aft) was destroyed, the skin and foam were destroyed around the inlet and the cowling damaged.

Upon investigating the cause it was found that if the fuel pump was turned on and the throttle was advanced any amount above idle cutoff gas would pour from the carb. This had obviously been going on during the starting process and had resulted in fuel gathering in the bottom of the cowl which was then ignited by the backfire.

The carb was returned to Ellison for repair and they determined that some fine dirt and microscopic aluminum particles had gotten under the ball valve which allowed gas to flow even when the engine was not running. They said that a finer filter was required upstream of the carb to prevent this. The carb has a final filter built in but that is not good enough to protect the carb. The built-in filter is rated at 70 microns and there is a 25-micron filter in the Aircraft Spruce catalog that is stated to be approved for the Ellison carb so I guess that the problem is not altogether new even though Ellison seems surprised that we had a fire.

It seems bad practice to put a final filter in a system that is not good enough to protect the downstream components. It has been my practice to start with coarse "rock catchers" and then have increasingly finer filters downstream. The coarse filters then prevent large particles from clogging the finer filters and the final filter protects the system.

To prevent this problem from re-occurring we are installing a drain from the bottom of the aeroduct overboard through the lower cowl. This will not only prevent fuel puddling but it will also let us check for proper operation of the ball check by turning on the fuel pump, advancing the throttle, and looking for fuel from the drain before getting in the airplane.

Once Burned Always Careful,
Owen G. Morris

From CP82-11 (CH19,CH30,CH38,CH39)

Broken exhaust threatens wing!

This happened to be a Cozy MKIV, but the wing attach system, exhaust system, and engine cowling area are essentially the same as the Long-EZ and Defiant. RAF is publishing the story here in the hope that this knowledge may prevent a similar incident in one of our airplanes.

While flying at 10,000 feet over the Gulf of Mexico near Pensacola at night, the exhaust pipe on cylinder number 4 broke off. Fortunately it remained, in the cowling and did not go through the prop. However, hot exhaust gases traveled between the wing and the center-section spar, heating the epoxy in the wing near the wing-attach hard points. The epoxy softened enough for both wings to move upward at the wingtips, 1/8 inch on the left wing, and 3/8 inch on the right wing.

The spar caps were not damaged, but the shear web on the right wing actually fractured near the out board wing-attach point, allowing the wing to move to a new dihedral angle.

Unfortunately, the pilot was unable to land when he first heard the exhaust let go, but had to fly for nearly an hour to the nearest suitable airport. It is possible that an immediate landing would have prevented the damage and resulting enormous repair job.

The pilot reported that the engine sound made an abrupt change. Performance was not affected, but the noise level was obviously higher, and led him to suspect a broken exhaust system. He throttled back to 1,800 RPM and continued on. He noticed that cylinder head temperatures on 2 and 3 settled down to around 300 degrees F, but cylinder 4 remained up around 400 degrees F.

He landed safely, and had the exhaust stack repaired. He did not notice the wing problem until the next day. There was considerable foam shrinkage (due to heat) all around the hard points. He found a small hole in the inboard glass rib, near the aileron torque tube bearing, and the heat had gotten into the wing through this hole. The only visible damage anywhere in the cowling was a small blister on the cowl itself. Fortunately all of his fuel lines were fire-sleeved, and his wing ribs were protected with 1/8 inch fiberfrax glued on with high-temp silicone. None of the glass on the firewall or in the wing roots were damaged.

What can be learned from this incident? First of all, exhaust systems are subject to vibration and high temperatures and are vulnerable to cracking, even in an type-certificated aircraft.

Inspect your exhaust stacks often and carefully, using a strong flashlight. All visible glass in the cowling area, firewall, center section spar aft face , wing roots, etc, should be protected using fiberfrax. The 1/8 inch-thick material is best, and it should be cut to fit perfectly, and then glued onto the glass using red (high-temp) silicon, available at any auto parts store.

Seal all possible paths for hot air, such as the gap between the center section spar and the wing, and any holes you may have made in the wing root ribs. All of the air, hot or cold, should have to exit the cowl around the spinner in front of the prop, except the air that flows through your oil cooler.

If you ever hear an abrupt, unusual increase in the noise level from your engine compartment, make a precautionary landing at the nearest suitable airport and remove the cowling for a thorough inspection.

Do not fly until you comply with the plans change section on page 15 of this newsletter.

Supplemental Chapter 39, Accidents and Incidents

****From CP24-7 (CH21,CH33,CH38,CH39)****

ACCIDENTS

Since CP #23 there have been two off-field forced landings in VariEzes due to engine failure. No injuries, but both aircraft received major damage. The one in Southern California landed in the desert after the engine failed (reason yet unknown) taking the gears off and buckling the forward fuselage. The other in central California - engine failed just after take off when the pilot selected a tank with water in the fuel. (non-standard fuel system). The field was undulating soft grass. When the aircraft touched down it took the main gear off and damaged the under fuselage and wings. The nose gear was not extended. Rain water got into the tank due to a very badly deteriorated "O" ring in the fuel cap. The aircraft had no gascolator or tank drains.

What is learned from the above? First, we don't recommend the nose be retracted for any landing no matter what the terrain is, even water. The nose gear provides extra cushion and keeps the nose from slapping down and digging in after the mains hit. The one possible exception could be brake failure after landing to retract the nose to keep from running off into unfavorable terrain or obstacles.

Water in the fuel system - - be sure the cap "O" rings are in good shape. Be sure all three drains are installed and used. If you suspect water, drain at least two quarts. Drain first while the nose is down from the wing tanks then from the gascolator with nose up. Some times it takes a lot of doing to get to the water. Run your engine at high power for awhile before take-off (nose up) to purge the water. Better to have it quit on the ground than just after take-off.

Don't be in a big rush to switch tanks. Have a safe landing area in sight before switching tanks if you can. Especially the first time you take fuel from the tank. In the case of water, even if you switch back to the "good" tank, you may not get it going in time. It takes a long time to purge water out of the carb. Also don't take short cuts on your systems, it takes a lot less time to do it right the first time than rebuild it.

****From CP24-7 (CH33,CH39)**

Reference the Australian fatal VariEze accident reported in CP #23 page 7. We have learned that the pilot's total flight experience in the last 2 years had consisted of 1 hour solo and about 3 to 4 hours dual. He grossly over-controlled the aircraft in pitch on his first take off, flying at a relatively heavy weight at a relatively aft cg. Based on this and analysis of a previous accident with similar statistics, we are recommending additional limitations for the VariEze operators manual. These are listed in the VariEze plans changes section of this newsletter (page 6).

****From CP25-3 (CH36,CH39)****

CAUTION - AMATEUR DESIGN

In 1977 an amateur designer/builder highly modified a VariEze with all-flying canard and other modifications. It crashed on its first tests, injuring its designer test pilot. Recently a new design, with the outward appearance of a VariEze, crashed on its first flight attempt, killing the pilot (a professional Cessna test pilot).

If you are contemplating a new design or modifications to an existing design be sure you understand that aerodynamic design, particularly for tandem wing configurations, is an engineering discipline that requires the appropriate analysis and test before risking ones life.

****From CP26-10 (CH8,CH39)****

1) An Illinois VariEze crashed on landing approach, fatally injuring the pilot/builder. The pilot had turned sharply from a low slow downwind and failed to upright the aircraft. Impact was 150 feet short of the end of runway. Weather conditions were low ceilings and strong gusty direct crosswinds of about 25 mph. The pilot was thrown forward through the instrument panel and clear of the fuselage. The seat belt (EON 8000 type 4) was found open. (see CP 24 page 4). This airplane had previously been damaged when landed short of a 5000 ft runway.

****From CP26-10 (CH16,CH39)****

2) A VariEze crashed as it entered the downwind leg of the busy approach pattern at the Oshkosh EAA convention. The aircraft was observed to maneuver erratically then turn and dive at very high speed, with high power maintained to impact. Both occupants died immediately. The aircraft struck a concrete street in a near vertical (60-70 degree) dive, at a low angle of attack. A pilot witness 200 feet away observed that it did not appear that the pilot was attempting to pull out of the dive. This points to a possibility of either a pitch control system disconnect or pilot incapacitation. All but two parts of the control system were found - they did not indicate control system disconnect. The aircraft did not have a rear seat control stick. Thus, pilot incapacitation is the suspected cause.

Destruction of the aircraft was unbelievable, only small parts remained. The engine struck the concrete road at the same point that the nose did. The bow shape of the main gear strut was clearly imprinted on the concrete at the impact point.

Initial investigation at the scene of this accident suspected fuel starvation because there was no evidence of fuel and there was no fire. It was determined that the tremendous force of the estimated 200 mph impact resulted in a fuel and oil explosion, however there was no resulting fire. There have been no fires associated with any VariEze accident.

From CP26-10 (CH39)
3) A Washington state VariEze crashed on approach while making a series of touch and go circuits. It was observed on a high final when the pilot initiated a sideslip. The airplane then rolled inverted and the pilot attempted to pull out in a reversing direction. Insufficient altitude was available for the pullout. The aircraft struck the ground in a near level attitude removing the landing gear and the bottom of the fuselage. The pilot's injuries were fatal. The departure that rolled this aircraft over appears to be the winglet stall discussed in CP #22 page 7 and 8. While the pilot appears to have disregarded the operational limitations recommended, this still should not have resulted in a departure. We intend to inspect the winglet contours of this aircraft to determine if any variances may have changed its susceptibility to winglet stall.

To prevent possible recurrence of this type of accident we urge all VariEze operators (does not apply to Long-EZ or VariViggen) to again review the information on page 7 and 8 of CP 22. Check your rudder rigging, wing cuffs, and winglet contours. In addition, to determine the actual departure susceptibility of your particular aircraft, conduct the following test at an altitude of 10,000 feet: full rudder sideslip, abruptly applied left and right at speeds of 100 kts, 90 kts, 80 kts, 70 kts, and full-aft stick. Your airplane should yaw, under control, with no tendency to stall or roll off. If your airplane has any undesirable characteristics, report these to RAF so we can analyze the causes and the extent of any variations.

From CP26-10 (CH39)
4) A VariEze pilot ran out of gas on an extended trip. He selected the fuselage tank, restarted the engine and continued, overflying one airport, attempting to stretch his range to another. Total fuel depletion occurred several miles short of his destination. His forced landing was downwind in a turn. The airplane was damaged extensively and ended upside down. There were no injuries.

From CP26-10 (CH9,CH24,CH33,CH39)
5) A Nebraska VariEze equipped with the original 2-ply tires, was making a gross weight takeoff. The pilot began rotation at 85 or 90 mph, (above the normal lift off speed of 75 mph), when the right tire blew. He aborted the takeoff, using left brake all the way to stop to maintain directional control. He reported it was not hard to control even though the right brake bleed failed and the right wheel pant and brake rotor was destroyed. His gear strut was the original configuration, not reinforced. He placed the right wheel up on a dolly tilting the aircraft with most of the weight on the left wheel, then pushed it half mile to a hangar. On arriving, the left gear strut buckled a few inches above the axle, inside the tightly-sealed, non-vented wheel pant. The cause of the strut failure was heat. The long, continuous high speed braking resulted in a very hot brake. This heat, sealed in by the wheel pant, slowly permeated the fiberglass strut allowing it to soften and buckle under load. Lessons learned: Do not use the two-ply tires. Ventilate the top of your wheel pants. If unusually heavy braking is done, 'set' the gear to relieve load or jack the airplane to relieve stress while the strut cools. Glue a piece of your fiberfrax fire wall insulation material to the strut (use silicone rubber adhesive) adjacent to the brake disc. Your VariEze and Long-EZ should lift off and land at under 65 kts and 60 kts respectively, unless you have an airspeed instrument error or airspeed position error. Leaving the airplane on the ground above this speed increases tire stresses and reduces tire life.

From CP27-6 (CH39)
A Tennessee VariEze crashed, fatally injuring the pilot and passenger. The aircraft was observed making a low pass by his house when the aircraft hit a tree and crashed. The pilot had a reputation for this type of flying and had been warned by others in the past but to no avail. The accident was late in the afternoon and the fact that the pull out from a steep dive was into the sun could have been a factor in the pilot's inability to judge the pull out angle. No malfunction of any part of the aircraft could be found. This flight was clearly in violation of FAR minimum altitude criteria.

From CP27-13 (CH3,CH16,CH38,CH39)
The following letter was received just at press time for this newsletter. With Victor's permission we are printing it:

Dear Burt and Company,
Thank you for your Christmas card. It found me recovering from a crash landing of my VariEze and with even more respect for the design. On November 11, 1980 I was working to take off the 40 hours a bit at a time. We had about 30 minutes before dark after work (my second mistake) to get a few trips around the patch. Mary-Kate and I had decided to install the new Long-EZ elevator trim but I over-ruled and decided to put it off until certification (my first mistake). I wanted to complete the 8 hours remaining to my certification as soon as I could.

After one touch and go I was climbing out about 600-700 AGL when I eased the stick forward to level off at 800 and nothing happened. The bolt between BC4W10 and CS136 had come off. I immediately called "mayday" and requested emergency equipment. I thought I was dead. However, I realized 62MV was still climbing so I began to analyze my possibilities. I could not reach past my right leg to reach CS136 so I experimented with power changes. I found that at about 80 MPH indicated the nose would begin to drop and about 120 MPH it would pick up. The initial oscillations must have been 200-300 feet up and down. I found by careful throttle changes and by moving my body forward and backward I could greatly reduce the up/down changes, but I still was faced with only gross control. I flew 3 patterns, about 15 minutes, and on the last down wind discovered I could touch the elevator balance weight with my right toe. Holding about 100-110 MPH and using the toe technique to give progressive downward dips I made my final approach to runway 10 (4000' long) into a 5 degree right wind of 5 to 10 knots. At about 30 to 50 feet AGL, darkness made judgement poor, I was almost to the runway when the nose began its upward cycle at about 80 MPH. Knowing I would not stand another cycle, especially the 120 mile per hour dive I cut power and dropped it in. At the same time I cut power I deployed my landing brake, I probably should not have used the landing brake since it does tend to increase the sink rate.

The landing was just about 20 feet short of runway 10 in a slight left turn so that I skidded across the corner of the runway and onto the grass beside the runway. I came to a stop in the newly planted wheat field about 20 feet from the runway. I had lowered the nose gear to take up shock as well as the possibility I could make a controlled landing. The nose gear push rod bolt sheared, the main gear attach taps on the gear sheared or split , and the lower cowl was crushed. The intake spider broke and the carb separated as did the gascolator and intake hose. The oil pan was crushed and the bottom 3" of the firewall cracked and bent aft about 15 degrees. We hit so hard that the pilot's seat area broke and combined with skidding across the runway made a hole clear through the pilot compartment floor about 3" from the left console and about 9" wide by 20" long. I was able to turn everything off, release my harness and climb out. I noticed severe pain in my back so decided to lie down because the ambulance was pulling up. I next woke up in the ambulance on the way to the hospital. I suffered shock and two cracked vertebra #L2 and L3. After 11 days in the hospital and a month at home I am feeling pretty well. I will wear a back brace for at least another month but should not have any future problems.

Why did the nut (MS210042-4) come off? I don't know. I may not have had it on all of the way but I am sure I did because I had developed the habit of checking for 2-3 threads through the nut. The canard and of course this nut had been off about 10 times for work on the electrical and instrument systems. Do such nuts wear out? The nut and bolt are included for your inspection. I find I can get it on to almost one thread with just my fingers. The FAA inspector was Glenn Martin of Wichita GADO. He was just as surprised as I to find out the a VariEze will fly without elevator control.

N62MV normally trimmed out level with a slight nose down force required. I was able to correct it with the original spring trim system. At the time of this flight I had 2 gal in the fuselage tank and about 7 gal total in the wing tanks. The engine is an A80-8 and the original long canard is installed.

I expect to wait about a year before repairing the plane. What do you think of having the main gear strut and wing attach areas x-rayed? There doesn't appear to be any damage to the wing or canard attach fittings or surrounding areas. Both lower winglets were ripped off, right rudder was destroyed and of course the gear and gear attachment area. The enclosed photos were taken by Glenn Martin. I would like to have them back because they are all I have. Enclosed find SASE.

Thanks again for an outstanding design. If you would want to question me please feel free to call.

Sincerely,
Victor Sullivan

It should be emphasized that an elevator disconnect downstream of the trim system will not necessarily result in the amount of control Victor was able to achieve. Any small inconsistency in elevator shape could result in a very low or very high trim speed. Victor had rejected his original elevators and build new ones to a more accurate shape - he probably could not have survived a control disconnect with the original ones. The new trim system, of course, could have allowed a satisfactory amount of control and safe landing.

We have inspected the bolt and nut and found it is of the proper length and that the locking friction, though reduced from new condition, seems adequate for proper safetying. It appears improbable that it could have been tightened properly. Victor agrees that it may be possible that he was distracted during canard installation and might not have tightened the nut beyond finger tight. Even the most critical items can be overlooked by the most competent mechanic. For example, one VariEze attempted a takeoff without the 2 bolts that hold the canard on - the canard flew off when the pilot pulled the stick back for rotation. Builders should follow the accepted practice of replacing critical locknuts after several repeated installations (discard any <u>fiber-lock</u> nuts after <u>one</u> use). Also, discard any bolt or nut that has any sign of reduced locking friction.

From CP28-7 (CH39)

<u>Accident</u>

Letter from Alden Andrew, 24531 Vanessa Dr., Mission Viejo, CA

Dear Burt,

This note is to alert VariEze owners of problems that made me an ex-owner! I had the Brock fuel caps as specified in the plans. As per original instructions, a vent hole was drilled in the cap for the auxiliary fuselage tank. I did not modify the auxiliary cap with the aluminum tube as per CP 25 page 4.

Recently I removed the left main fuel cap and went to the restroom while the attendant put in the fuel. Upon my return, the left cap was on and the attendant was fueling the right main. I replaced the right cap and went flying. Shortly after take-off I was notified over the Unicom that fuel was being dumped overboard. Sure enough, the attendant had set the left cap on but had not engaged the Dzus fastener and I had neglected to check or notice that is was not secure. I landed immediately and discovered that the cap had hit the prop and left a gash 1/2" wide and 5/8" deep about 4" from the tip. After this experience I considered putting a tether chain on the fuel caps but business matters soon consumed my full attention and the idea went by the wayside.

With a different prop, the plane was again serviceable. On February 6, over the telephone, I gave permission for a 3,000 hour pilot (with 10 hours in my VariEze) to use the plane the next day. Before his flight he attempted to obtain fuel but the fuel pit was temporarily out. Even so, they removed the left main cap as well as the auxiliary cap and attempted to obtain some fuel that might
possibly be in the long hose of the fuel pit. After this unsuccessful attempt the caps were replaced (with the <u>un-vented cap being put on the auxiliary tank</u>) and it was decided that with about 1 3/4 gallons in the auxiliary tank that the pilot and his passenger

could make Corona Airport from the present Chino location (about 5 minutes). They took off on the auxiliary tank and at about 100' at 105 knots they lost power. In the knowledge that there was fuel in the auxiliary tank the pilot did not try to select the mains which still had adequate fuel. An off airport landing (?) was made in a rough grassy field. The nose wheel was left retracted. (The aircraft was forced to the ground at high speed and high rate of sink because of a fence ahead.) The plane came to rest about 300 ft from the original touchdown point. The pilot escaped with scratches and bruised legs and toes but no broken bones. The passenger was not scratched or bruised at all. The plane did not fare so well; collapsed main gear, main center-section spar broken and ripped off with the left wing, canard ripped off, the total front end from the trailing edge of the canard was completely severed from the rest of the fuselage, as well as the top and bottom kevlar cowling was ruined. The prop was horizontal at the time of impact so the prop, spinner, hub extension and engine were undamaged as was most of the instruments. The canopy was unscratched.

To sum it up, I would recommend either a mandatory change to include a ram air vent leading to the auxiliary tank or the tethering of the fuel caps.

As my 86 delightful hours in the VariEze has spoiled me, I desire another canard pusher. I guess a Long-EZ is the next project. Does anyone want to but a good VariEze canopy and a 96 hour SMOH Continental O-200 complete with hub extension, prop and spinner?
Sincerely,
Alden Andrew.

RAF comment: The two VariEze plans changes in this newsletter are intended to prevent recurrence of Aldens accident. We have before considered tethering the fuel caps, but were concerned that major tank damage would be done by a cap flailing against the surface. Note that, as was explained in CP 13 page 5, loss of a wing cap on a VariEze will cause all fuel to be slowly drawn into one tank (and overboard if tanks are more than half full) and result in fuel starvation, requiring the selection of the fuselage tank to maintain engine operation. Loss of a cap on a Long-EZ does not effect engine operation due to its left/right isolation and pumped fuel system. Also, the Long-EZ's caps are outboard of the prop to eliminate prop damage should a cap not be secured.

****From CP29-3 (CH30,CH36,CH39)****

ACCIDENTS

Power Loss - A south eastern VariEze crashed into trees after power loss on its first flight. The power plant was a conversion of a Chevy Corvair automobile engine. The aircraft was destroyed. The pilot was not injured.

****From CP29-3 (CH39)****

ACCIDENTS

Known Icing conditions/fuel management - A Midwest VariEze pilot began an extensive trip in IFR and icing conditions. His flight was a classic condition of many things going wrong in combination. He reluctantly accepted an altitude assignment in known icing conditions, only 1,000 ft. above the MEA. The pilot became quite busy as ice was building, switching the single Nav to identify intersections then noting an impending failure of the gyro horizon - nose high at normal airspeed. Also, he reported a Nav problem and center lost radar track of him. They were talking to him but did not know his position. At 40 minutes from takeoff the engine abruptly quit cold. He descended through the clouds breaking out at about 500 ft. AGL and put it in a freshly plowed field approximately 30 miles off course, carrying a large amount of airframe ice. The pilot received a fractured vertebra. The aircraft's wing, belly, landing gear and canopy received major damage. Investigators found the fuselage tank empty, speculating that the pilot had departed on the fuselage tank and the engine failed due to fuel exhaustion. Probably the pitot-tube had iced up resulting in his thinking the speed was ok and the gyro horizon was failing. His airspeed was thus too low to allow a restart even when main fuel was selected during the power-off descent through the clouds (windmilling not maintained).

Many builders, including this one, have modified the positioning of the fuel valve on the VariEze, defeating its feature of reminding the pilot (by interference with his right wrist) that the fuselage tank was selected. There have now been two accidents caused by a combination of incorrect fuel management and defeating the interference design feature of the valve handle.

****From CP29-3 (CH39,CH40)****

ACCIDENT ANALYSIS

As you know from reading the Canard Pusher, we report a synopsis of each accident and make recommendations to builders/operators on any item we feel should be changed or emphasized to decrease the probability of reoccurrence. We have reviewed the data available and have found one factor that is significant. A high percentage of the accidents (minor and serious) have occurred within the first few flights after a new owner has bought the airplane from a previous owner. Statistically, you are far more likely to have an accident flying a homebuilt built by someone else. This is true for experimentals, not just for VariEzes. For example, an all-metal type that recently was grounded for a series of structural failures - all the failures occurred after non-builders had bought the airplanes.

The factor may be a combination of inadequate familiarity with the airframe and systems, inadequate checkout and inadequate transmittal of documentation. Putting things in perspective, it is important to note that the builder is an aircraft manufacturer. As such, he may be responsible to a buyer for the quality of the machine and for properly educating the buyer in it's safe use and the extent of his flight test program. We at RAF provide builder support to our customers - those who may need assistance or have questions on how to interpret the plans to build or how to interpret the Owners Manual to fly the completed aircraft. But, if you sell your airplane to another person you cannot expect that we can support him. He must go to you, the aircraft manufacturer. For example, if he needs to do a fiberglass repair, but does not have the plans and educational material he will not know how to do the job. He needs to get that information and documentation from the manufacturer.

- Homebuilt accident record statistics were reported for a three year period by The Aviation Consumer last year. They show an overall accident rate for VariEze of 2.59 (1.55 fatal) per 100 aircraft during the 3 years. Average for all homebuilt aircraft was 3.93 (1.07 fatal). We are not happy with this result, as we had expected the VariEze to be significantly better than the average homebuilt due to it's strong structure and good stall characteristics. Structurally the fiberglass VariEze has a perfect record - no inflight airframe failures in 100,000 flight hours. Also, there have been no fires either in operation or due to accident impact.

Data published by one source show that flying amateur-built aircraft is statistically a very risky sport, with an accident rate (per individual) higher than that for racing cars.

From CP30-9&10 (CH39)

Take Off Incident

Byron McKean damaged his VariEze in an aborted takeoff. He took time off from the repair job to write the following story for us in the hopes that publishing this information may prevent someone else from having the same problems:

"The takeoff direction was to the SE with a mild left cross wind. The runway is 2,650 ft. long, very narrow, and very bumpy and rough. There is considerable grass that is six to eight inches high growing onto the edges of the runway. There had been considerable rain in the early hours of the morning and there were numerous puddles of water on the runway. My takeoff attempt was intended to miss the majority of the puddles but my right wheel hit a long puddle causing the aircraft to veer about ten degrees to the right. I was near take off speed and saw the grass on the runway ahead of me so I attempted to lift off unsuccessfully. Seeing that flight was impossible I reduced the power, the nose dropped sharply breaking off the nose wheel followed by the nose strut collapsing into the retracted position. Additional resistance of the grass on the right side caused the aircraft to veer off the runway and into the muddy plowed field where the main gear collapsed and we all came to a stop. From the spot of the main gear collapsing to the stopped position was around fifty feet. I turned the switches off then got out and assisted my passenger out. There were no injuries other than my passenger having sore knees from pressure against the back of the front seat. We both wore seat belts and a two strap shoulder harness. The ELT did activate.

Later, upon investigation, I found a small piece of broken fiberglass wedged between the right brake puck and the brake disk. I was unable to rotate the wheel. Since the right wheel pant was torn off the landing gear prior to the main gear collapsing I now wonder if this could have caused more drag on the right side far greater than what the grass caused. Without this additional drag a "save" may have been possible.

I can understand now that when I hit the water and was pulled slightly to the right the wheel entered increasingly deeper water causing more drag and more turning to the right. There is that moment of delay while the mind digests what is happening until a response is initiated. That moment is too long.

It is interesting to me what thoughts go through the mind during the short interval of an emergency.

Some of my thoughts...

Look at all those puddles of water. Better choose a good path and try to miss most of them.. Narrow runway, run the engine up full before releasing the brakes. 2,500 rpm ok, oil pressure up, let's go. Boy is this a rough runway, nose bouncing, come on airspeed let's get the nose off this rough stuff. Ah here comes some airspeed, nose slightly off, not too much. Now here comes that long puddle, left cross wind, going to hit the water a little bit with the right wheel.. Airspeed approaching lift off, my God that water is pulling me right, this isn't supposed to happen, come on airspeed, here comes that grass, can't hit that, can't fly if I hit that, try for a lift off, nose up... up... nose is plenty high, if it does lift off can I fly out of ground effect, don't want to end up in the bay at the end of the runway, what if the wing drops and hits the ground, no good, won't fly, damn, hit the grass, noisy, lots of drag, being pulled to the right, this can't happen... chop the power, keep wings level, bang! my gosh, I broke something, this is a crash, What an experience for my passenger, first time in a homebuilt and doesn't particularly like flying... sick... sick... sick... there goes the main gear, here comes the field, turning right, keep it level, keep eyes open, keep thinking, look... I'm still ok, hang on, brace, keep looking, it's stopped, I've really messed it up. Switches off, get out now, what about a fire, get my passenger out. We are both ok but look at my pride and joy, belly in the mud, mud everywhere, look back at where I've been!

My VariEze is equipped with a Compucruise computer that includes a fuel flow sensor. In order to use a fuel flow sensor on a VariEze you must install an electric fuel pump. I also installed a four-way fuel selector valve so that I could select a "by-pass" position in the event of a malfunction of the electric pump, flow sensor, or inline fuel filter.

I mounted the electric fuel pump and fuel flow sensor on the center section of the main landing gear behind the rear seat. I now recognize that this is a no no! When the main landing gear collapsed it tore the fuel lines loose. Had the fuel flow sensor and electric pump been attached to the fuselage or firewall no leak would have occurred. Even the gascolator that extends slightly below the firewall into the air intake scoop was undamaged".

From CP30-10 (CH39)

Forced Landings

The following information was supplied by Bruce Muirhead, from Colorado:

"Dear Burt,

I guess I should report a couple forced landings we experienced.

The first was on an early frosty morning flight from Pagosa, NE, over the Rockies to Boulder. I may tell the whole story in more detail another time but suffice to say here that it was a variation of the old "gas cap" story. The right cap didn't get secured, fell off on take off (damaging the prop some), but I didn't catch on until a temporary power loss got me to thinking over the Sangre de Christos. As Mary continued to report plenty of gas in the right tank but left running low, I was guided to make a sharp right turn and head for the plains.

There we spotted the Air Force Academy chapel and turned north, still at 12,000. A minute or two later, flame-out. We did a 180 and glided 20 miles, straight into the Academy's north-south runway, unannounced, uneventful and followed by lots of red tape.

The second was on the way to Taos for the IVHC fly-in just 35 minutes from here. Just over the mountains and letting down 25 miles from Taos it quit. Fuel starvation on descent? Nose up - no luck. No reserve - faulty valve. A straight section of highway complete with a convenient turnoff made for another uneventful landing - at the New Mexico Port of Entry! Borrowed the officer's pickup, got five of regular, prop, run up ok, and took off on our "runway" for Taos. There most of the 19 VE pilots discussed my problem and the consensus was clogged vent line. That's what it was, thought what I dug out of it was hardly enough to analyze. Even the little fuselage tank vent was plugged. Anyhow, you can bet those other 18 pilots at Taos will check their vent lines, and probably also,
Yours truly,
Bruce Muirhead.

RAF comment - we don't know why Bruce was unable to use the reserve tank to save the situation for both these cases - apparently the "faulty valve". You VariEze guys should always keep your reserve system in good operating order - its your redundancy to protect against vent clog, lost cap etc. Note: The Long-EZ while not having the reserve tank, has separate left and right pumped systems (which feed with a lost cap) and separate vents.

From CP30-10 (CH22,CH30,CH39)

Engine Failure, On Top, Over Lake Michigan

A VariEze accident claimed the lives of a New York couple and their son enroute home from Oshkosh. The pilot was a low-time relatively new private pilot taking his first cross-country trip in the airplane, which had 49 hours total time. The following information is from a VariEze pilot who was flying with the Eze that crashed, and from FAA investigators.

The flight was heading east across Lake Michigan to save trip length even though it was over a solid under cast with tops at 10,000 feet. They were cruising at 11,500 feet directly over the center of the lake when the pilot noticed zero oil pressure. They continued another 10 to 15 miles when the engine lost power, then quit. The wingman noted that the pilot kept turning right during the trip and he had to keep instructing him to turn left to remain on course. He repeated this instruction as the pilot descended into the clouds in a right turn. Radio communication was lost when he tried to get him to switch to Muskegon Tower frequency for vectoring. Weather at the surface was a variable ceiling ranging from 500 scattered to 1,500 broken to 4,000 overcast.

It is not known whether the pilot became disoriented in clouds during the descent. The last call heard by the wingman was a very upset voice repeating 'engine quit, going down'. Flight service received a call of 'shoreline in sight' with no further communication. The aircraft crashed while in a turn in a down-wind direction at the far end of a 150 foot long clearing, immediately cartwheeling into trees. There was no way to survive a landing where the aircraft impacted. There was no fire. It is not known why the pilot selected the small clearing when the shoreline with alignment into the wind was apparently available to him.

Investigators determined the cause of engine failure to be oil loss through a broken oil pressure sender line. The line was aluminum tubing, flared with an incorrect automotive flaring tool. It fractured at the fitting sleeve where it had been previously bent 45 degrees.

The purpose of us printing details of this kind of tragedy in this newsletter is to alert those flying other airplanes to conditions that might cause another accident so that recurrence can be prevented. If you are flying an airplane that may have an engine installation that has not been inspected by a qualified A.I., ground it until it is adequately inspected for aircraft-approved installation materials and workmanship. All plumbing of oil and fuel lines must be of components approved for a certified installation. If you have aluminum tubing installed, replace it with approved flex hose before flight.

From CP30-10&11 (CH39)

Canopy Emergency

Joan Richey, Los Cruces, NM experienced a canopy emergency in her VariEze. As is generally the case, she forgot to lock it due to an unusual break in routine. Her full story follows:

"Charles, and my instructor, Joe Gold, had started the Eze and said he'd like to fly it a little, too. So I took off, flew over town and up the valley some, came back, landed, taxied up to where Joe was waiting, got out, he got in (engine still running), a friend came up and asked for a ride. Joe shot a landing, came back, jumped out, ran around the plane sniffing - smelled something burning. Took up the passenger, came back, changed passengers, said the radio had burned up. Took off, flew a short time, came back and I decided to fly again. "Ok" says he "but don't even fool with the radio because it's not working". Didn't turn off the engine. I climbed in, said I'd shoot 3 landings and take it to the hangar. I always fly with earplugs under the head-set - didn't take time to put them in. That's #1. Engine hadn't been stopped - didn't do my standard check with run up. That's #2. Took off and did not bring up the gear since I was just going to shoot landings. On turning downwind to base, the sound in the cockpit changed but I could not identify it (no earplugs). Base to final, the canopy popped up to the full throw of the safety latch. I panicked! All the stories Charles had told me and I had read of canopies coming open, all of a sudden, seemed to have culminated in funerals. My initial thought was "I'm dead". Tried to hold the safety latch down, tried to latch the canopy. After the initial panic, I remembered some words of wisdom in a CP Charles and I had discussed. FLY THE AIRPLANE! Next thought - "Climb, gain altitude and latch the canopy". Third thought - "Land it!" By now, the panic is gone, I'm a little high and a little fast. Have not managed to trim it to landing speed. After all, a girl's only got two hands and both are holding down the canopy! Actually, I manhandled it down, long and hot luckily 12/30 at Las Cruces is 7,500 feet. Let it roll to a stop and then drove it to the departure end of the runway. (Furthest from buildings and people). Stopped - knees weak could not latch the canopy. Opened it completely, latched it. TURNED ON THE MASTER - CHECKED THE SAFETY LIGHT AND BUZZER - turned around and took off on 12. Shot two more landings, took it to Las Cruces Aviation, met on the ramp by Joe Gold, illustrious flight instructor, and my brother who was about to go up in his Citabria. NO ONE EVEN NOTICED! but to me it was scary".

****From CP31-6 (CH18,CH39)****

Long-EZ - Runway And Visibility

A Long-EZ crashed on takeoff from a small Minnesota airport. Conditions were clear, it was dark (about 1 hour before sunrise),the runway was hard surfaced, but covered with ice and snow, some large lumps of ice up to 4" thick. The runway was 2,000 ft. long and ended near the edge of a lake. The aircraft was in excellent condition with approximately 60 hours total time, with 5 hours flown the previous day. It had been hangared and had no frost on the wings, however an eye witness reported that the canopy was frosted over on the inside such that he was unable to see the pilot just before take off. The pilot commented that it was no problem because his experience was that the canopy would clear as soon as he had some speed. It appeared from wheel tracks in the snow that he had a very extended takeoff roll, in fact rolled virtually the full length of the runway. He struck several hard lumps of packed snow/ice with nose and main wheels, which probably slowed him down. When he lifted off he did not climb enough and flew into the tops of some small trees of the end of the runway. The left canard and left elevator were torn off at this point, which caused the airplane to roll left. The left wing then struck the ground and was broken off at BL57. The airplane rolled inverted and crashed into a frozen swamp on the edge of the lake. It then slid over a small embankment and broke through the ice coming to rest in four feet of water. The fuselage remained essentially intact, however the pilot was killed instantly.

The cause of this accident appears to be a combination of several things. 1) Takeoff attempt on an uncleared runway with snow and lumps of ice. 2) Frosted canopy probably restricting visibility. 3) Total darkness with lake at end of runway resulting in "black hole" visibility effect at lift off, causing disorientation. As is often the case in accidents, one problem could probably be handled by an experienced pilot, but a combination of the right conditions can be enough to result in disaster.

****From CP31-6 (CH30,CH39)****

Composite Structure Fire - There were no instances of fire on any VariEze type structure in over 200,000 flight hours of operation - until last fall. Here's the report from Ron Walter:

"I pulled in front of my hangar, shut down the engine and put the plane on its nose. Looking back I noticed flames coming out the back and proceeded to get an extinguisher to control the flame. This was to no avail and resulted in completely destroying the plane within approximately 12 (more) minutes."

A fellow VariEze builder arrived on the scene after the entire engine area and cowl were involved and he offered the following, cautioning that some is conjecture.

"At runup area engine did not sound normal. After several tries at runup he taxied back to hangar parking. Time of run was about seven minutes. On shutting down the engine with the idle cut off he noted smoke from engine compartment. He retracted the nose gear, got a small fire extinguisher and emptied it into the fire. By that time however the fire was out of control."

"Fire definitely was well along in the engine compartment when aircraft was shut down. It might have been arrested if fuel valve had been closed when smoke was detected and fuel burned through engine. Initial cause was stuck float in carburetor which kept feeding fuel to point of overflow (conjecture)."

"The aircraft was headed west and wind was from 240 degrees about 3-5 knots. This fact inhibited the fire somewhat but I was surprised at the slow propagation of the fire, about 2 to 3 inches per minute forward on both wings. The heat softened the upper wing strake to the point that when the gas in the tanks ignited there was only a large "poof" - no contained explosion or any shattering. Even at this point neither the outer wing spars nor the center section box, showed deformation. Obviously they were getting soft but no sag. Within the next minute the fuel from the tanks intensified the fire to where everything melted down and completed burning forward to the front cockpit. At this point the main gear softened and gave up. Fire truck arrived and put out remaining fire.

Findings: Carburetor completely melted down to point of distortion - recognizable, but that's about all. Fire wall took a lot of heat before allowing fire to progress forward. Fuselage tank failed through sight gauge first. I could not tell whether the fuel feed line from the tank to the shut off valve had softened and burned feeding the fire. Engine mount distorted but intact. Top of wing tanks burned but bottom remained intact until almost complete collapse of main gear."

Ron also shared with us a poem written after the fire by his wife.
"You were the diversion he needed in times of stress.
You were solace to him when he was not at his best.
When the world was to much for him to cope,
He turned to you, and you gave him hope.

In the wee small hours when sleep wouldn't come,
You were there - always something to be done.
You and he saw the world from a different view,
When you soared together to the distant blue.
You're gone now - no more obsession.
Only memories left - the only possession.
You were the joy and the pride of his life.
I can't fill the void. I'm only his wife".

From CP33-5 (CH20,CH39)

ACCIDENT - Inflight Airframe Failure

The thought of an airplane coming apart in the air brings chill to most aviators and certainly to aircraft designers. Despite many horror stories related to severe weather, drastic overspeed in dives, and even airframe flutter (unbalanced elevators), we had yet to hear of an inflight failure of a Rutan design - until June 21st when the caller described a winglet ripping off a VariEze at 200+ mph during an airport buzz job. Within two hours Mike Melvill and Dick Rutan were airborne in the Defiant for a non-stop flight to Dallas, Texas to investigate. What they found, though, did not lead to grounding or flight restriction of other VariEzes. The cause was tantamount to leaving the wing attach bolts off your Cessna and expecting the fairing strip to hold the wing on. Their report follows:

An aerobatic pilot witness standing nearby described what happened when the winglet came off. The aircraft yawed, rolled, and pitched up 90 degrees. The calculated 13-g loads did not fail the wings but twisted the fuselage enough to shed most of the plexiglass from the canopy frame. The aircraft impacted inverted on the prop and top cowling, then it slammed down, shearing the pilot's rollover structure, the top of the instrument panel and impacted the canard/fuselage fairing. It then bounced back into the air, rolled left to upright, and struck the ground upright,failing the main gear (pulled brackets and major glass structure from the fuselage). The aircraft came to rest 90 feet from the initial impact point at a heading of 110 degrees right of flight path. The nose gear was retracted. The right winglet was located about 1,900 feet short of the wreckage. Parts of the plexiglass canopy were found 1,000 feet short. With the exception of the right winglet and rudder assembly, and parts of the plexiglass canopy, the wreckage was essentially complete and in one spot. Although it had sustained major damage, the airplane was located in a small area, not over 20' x 30'.

The right winglet failed inward during the high speed low pass. Sample sections were cut out of the winglet-root/wingtip. Skin coupons were burned out and the number of plies were counted. The type of glass and fiber orientation were determined.

Figure 1 shows the VariEze design structure and the structure found on the wreckage of N11CH. The major tension layup (#8) that was omitted was, without question, the primary weakness which allowed the winglet to fold inward and fail at high speed. The winglets lift inward and, at high speed (with zero sideslip) have an inward bending moment that is equal to that attained in a 15 degree sideslip at the maneuvering speed. Note that with layup #8 omitted, and with layup #9 not extending to the lower skin, the only structure opposing the bending was the foam core acting through rib #6 to the bottom skin. It is conservatively estimated that the structural strength of the winglet-to-wing joint of N11CH was less that 1/20 of what it should have been. It is very surprising that it did not fail sooner. The incredible thing that was not answered was how the builder could have omitted the primary structure and why it had not been noticed. Even after the final paint job, it was obvious that the #6 rib could be seen on the surface.

This aircraft throughout showed evidence of poor workmanship. Poor workmanship in itself had not precipitated structural failure with these construction materials. Prior to this accident the VariEze type had amassed approximately 150,000 hours flying without inflight airframe failure, even though many of the aircraft have relatively poor workmanship. The omission of important primary structure was clearly the cause of the structural failure. **SKETCHES OMITTED**

From CP33-6 (CH30,CH38,CH39)

ANOTHER PROP INCIDENT

Ray Johnson from the San Francisco Bay area, flew his VariEze to Las Vegas, where it was parked in the desert sun for 5 days. He then took off and headed south at 12,500 feet. About 20 miles north of Apple Valley airport, a horrendous vibration set in. Ray throttled back, pulled the mixture to idle cut off and pulled the nose up to slow down. When the engine stopped turning, the vibration went away. Ray glided in to a landing at Apple Valley. Other than the Cessna that pulled out in from of Ray on final, causing him to have to land off to one side of the runway, it was uneventful. Ray's prop was still on the airplane, 5 bolts had sheared, one was bent but still holding and the spinner retained the prop.

This is a classic case of flying from a moist ocean climate to a dry desert climate. The wood prop shrinks just a little bit, the bolts no longer have the correct torque, so the prop starts to move and in literally seconds, the bolt holes and drive lug holes become elongated, and the bolts break off at the drive lug due to fatigue.

Check your prop torque, it should be between 18 ft/lbs. (216 inch/lbs) and 20 ft/lbs. (240 inch/lbs). With a new prop, you should check the torque after one flight. Then again after 10 hours, then at 25 hours, and thereafter every 25 hours.

From CP34-5 (CH39)

A southern California VariEze headed for Oshkosh flew into trees in a steep box canyon east of Salt Lake City airport resulting in two fatalities. The weather in the mountains east of Salt Lake was clobbered with low clouds. A pilot who departed Salt Lake City just before said that he would not have tried to go east, due to low ceilings and poor visibility. The pilot apparently selected the wrong canyon thinking it was the main pass that would lead him through the mountains.

From CP34-5 (CH39)
The pilot and passenger of a California VariEze were fatally injured in northern California. According to the NTSB, the pilot was giving a friend a first ride, made a low altitude pass over the runway, started to climb and as the aircraft passed over the lake shore began a barrel roll to the right. The airplane only completed about 270 degrees of the roll when it struck the surface of the lake.

From CP34-5 (CH39)
The pilot of a southern California Long-EZ was seriously injured and his passenger suffered a broken hip when the airplane crashed into a dry river bed. The eye witnesses to the accident reported that the airplane was doing aerobatics. It appeared to enter the beginning of a loop, did not have enough speed, fell out of the maneuver. The engine stopped, (negative "g" will cause a carbureted engine to suffer fuel starvation) the aircraft nosed over and spiralled down to about 100 feet, where its wings were leveled and it descended until it struck the ground. The aircraft hit a 20 degree embankment almost wings level and slid forward only about two feet. There was no fire, although the right fuel tank was ruptured.

From CP34-5 (CH39)
Incident - A VariEze pilot from Colorado reports that his VariEze received extensive damage during an aborted take off. A thunderstorm was located at the upwind end of the runway, so a downwind take off was initiated. Unfortunately the runway sloped uphill in this direction. The pilot aborted at about 3/4 of the runway length, but was too late to stop on the wet runway. The aircraft ran off the end, crossed a ditch, went through a barbed wire fence and down a rocky embankment. The pilot was unhurt.

From CP34-6 (CH33,CH39)
Don't allow yourself to be deluded into thinking that you cannot get into trouble in your VariEze or Long-EZ. These aircraft are tremendous confidence builders, but they are still aircraft and unless treated with respect, will bite. A VariEze pilot, trying to fly through a canyon near the Snake River, encountered such a severe down draft, that he only just managed to execute a 180 degree turn. He lost 2000 feet and recovered less than 300 feet from the ground. He had previously believed that no matter what, his VariEze would get him out of trouble. Don't push your luck. We recently checked what would happen to a Long-EZ, with full aft stick, both rudders all the way out, nose gear extended and engine at hard idle. The airplane developed a sink rate that varied between 950 fpm and 1250 fpm. This was also tried with the prop stopped. You cannot expect to walk away from this kind of impact. 1250 fpm is 21 feet per second or 14.5 mph. You must get the nose down and build enough airspeed to have sufficient energy to arrest your descent with a flare.

From CP34-6 (CH30,CH38,CH39)
A VariEze pilot from Northern California flying from Stockton to Florida, heard a 'different' noise but before he could do anything, one exhaust stack (original style) cracked off and went through the prop removing about 17 inches of one blade. The vibration was so severe that it broke both mag wires and failed the mixture cable/spring assembly. He pulled the mixture and switched off both mags. When this did not work, he turned off the fuel valve and finally the engine stopped. He made an uneventful landing on a highway near Zuni, New Mexico. He found that the top engine mounts had failed and the engine was lying in the cowling. This pilot stayed very cool, flew the airplane and kept thinking all the way. Don't forget to <u>fly the airplane</u>.

From CP34-6 (CH39)
The reason we report accidents and incidents such as these above, is in the hope that someone may benefit by the experiences related. Aerobatics can be fun, but they can also be very dangerous, especially at low altitude. RAF does not recommend aerobatics in either the VariEze or Long-EZ. Apart from the obvious reasons, airfoils, no inverted systems, etc., both of these aircraft are extremely clean and will build up speed in a dive with frightening rapidity. A competent aerobatic pilot can do some of the positive "g" maneuvers, however it takes very careful speed control and anyone contemplating such a thing should take a course in aerobatics from a professional.

Because of the excellent flying qualities of the Long-EZ it is a temptation to do more than that for which we are qualified. Do be aware of this, get the necessary training before going out in your VariEze or Long-EZ and "train" yourself.

From CP35-8 (CH39)
<u>From Bruce Tifft, B & T, Propellors</u>
"Bonnie and I have always enjoyed writing articles for the CP and the Hospitality Club Newsletter about our wonderful trips and adventures in our VariEze. This article is not fun to write, but necessary. We feel it is very important to share experiences - good and BAD.

Our VariEze has been destroyed in an accident that occurred on November 20 at Santa Paula Airport. I was checking out a very good friend in the front seat of the EZ. Al is a top-notch pilot and is retired Navy with thousands of hours in all-types of aircraft. In fact, he checked out both Bonnie and me in different airplanes. As you can tell, he is a very competent pilot and one I did not hesitate to let fly the EZ from the front seat. Now, as many of you know, Santa Paula is a terrific little airport, but is notorious for it short runway (2,500), obstacles and obstructions at the end of the field, and unusual wind conditions at times. We have operated our EZ out of this field for over 4 years and thus far never had any problems. Burt has always warned about operating out of such a short field with the EZ. For 4 years we had no problems, however, when we needed that little margin for unusual conditions, it wasn't there! On this particular Saturday, we encountered a very severe wind shear, (a phenomenon that Santa Paula is also famous for). The airplane performed as usual, but we went from a substantial head wind to a tailwind. Just after lift off, the EZ fell back to the ground with all three wheels. Not too many options were available - couldn't abort and couldn't gain sufficient altitude to clear the obstructions. Al navigated us through a very thin "eye of a needle" space. We went under some telephone lines and barely over a house. The landing gear clipped the very upper portion of the roof of the house, and the left wing collided with the T.V. antenna. This dropped the nose just enough to miss electrical wires carrying 440 volts.

Under the wires, a cable T.V. coax one inch in diameter went over the pitot tube and around the canard and stayed with us turning us around 180 degrees. The airplane impacted the ground on the spinner and flipped almost inverted. Al remained in the front seat, and I was thrown through the canopy. Dragging this huge cable slowed the plane sufficiently to allow us to escape with our lives and relatively few injuries. We also attribute our survival to the incredible strength of the EZ. We feel sure if we had been in a conventional airplane we wouldn't be here to write this story. Also, there was no post-impact fire, a fact that again saved my life since I was saturated with gasoline. We would also like to pass on our thanks to Jack Hooker at Hooker Harness Company. Al's seat belts were intact, and he had to release them to get out of the plane. I was thrown from the plane on impact, but my seat belts held through all that crashing around and when they did fail, actually pulled part of the fuselage with them. The shoulder harness attach straps were bent up past 90 degrees. Certainly can't beat that for strength. Only one engine mount extrusion failed at a bolt hole, the mount itself let go. The airframe has been demolished, however, the Lycoming rep feels sure the engine is still useable and the front cockpit are pretty much intact. The radio and most of the instruments are still good. Al sustained a nasty cut on the back of his head, cut behind his left ear and miscellaneous cuts, bruises and aches and pains. I cracked my pelvis in two places, broke a rib, bruised a long, had gasoline burns on my back and under left arm and a burn on my left hand from pushing away from the exhaust pipe, also a nasty blow to left kidney and shoulder. However, we are feeling very lucky to be here.

As far as our B & T Propeller customers, I have been slowed down a bit from all this, however, I am back in the shop (with the help of a cane) and will get your props to you as soon as possible. Would appreciate any time you can give me if your project isn't ready to fly.

It was heartbreaking to lose our beautiful little airplane, but we have received so much support and expressions of caring from so many people that it really pulled us through this tragedy. Bonnie and I have often talked about what a terrific life-style we have enjoyed since having the EZ and all the wonderful people we have met and made friends through it. Our very deep appreciation and gratitude goes out to all of you who helped us through this difficult time (especially Mike and Sally Melvill, Les Faus, Frank and Margie Tifft).

Now, to end on a happy note . . . we have made arrangements to buy a very good friend's Long-EZ project. Chuck Gardner has modified the fuselage somewhat, but it is still basically a Long. Chuck has done impeccable work and we are thrilled that he will let us take over his project. Chuck was sensitized to the epoxy and felt he could not work on the plane, but had put so much hard work and love into it, he wanted to see it finished and flying. We'll work together on getting this accomplished. So, we will have another EZ flying before too long and join in again with all the fun and happiness that goes along with owning one of these terrific airplanes".

Comment: EZ builders/flyers operating over normal gross weights and out of short airports, take note!

From CP35-8 (CH16,CH38,CH39)

FROM THE BUILDER/FLYERS

Paul Williams and Max Cortner write that they have over 150 hours on their Long-EZ, also known as "White Lightening". Max is planning on a honeymoon trip to the Bahamas this month and Paul will be flying it to Phoenix in February. Paul recently had a scary incident - pitch control disconnect in flight! Happily he landed uneventfully using the pitch trim system for pitch control. They had had the canard off to seal around it and when it was replaced, the clevis pin was pushed through from the outside, horizontally toward the center, so that the safety pin was easier to install. What they think happened was that the safety pin caught on the pilot's pant leg and was pulled open. The pin eventually worked it's way out due to being oriented horizontally and the pitch control system was disconnected.

This is a very serious thing, we should all be aware of. First of all the clevis pin should be oriented vertically and should be installed from the top so gravity holds it in place. Secondly a piece of gray tape wrapped around the safety pin will stop it vibrating and protect it from inadvertently being opened. One school of thought would be to install an AN3 bolt and locknut in place of the clevis pin. After all, how often do you remove the canard? In any event this connection should be on everyone's preflight checklist.

From CP35-8 (CH16,CH38,CH39)

A Southern California VariEze flyer/builder crashed into the bay on short final at Palo Alto, during a night approach. A critical nut and bolt which had not been installed correctly came loose, causing the airplane to suffer a pitch control disconnect. The VariEze was completely destroyed by the impact with the water at approach speed. The pilot suffered a serious back injury but was able to swim to shore.

From CP35-8 (CH39)

A California VariEze pilot was fatally injured when his recently completed VariEze crashed. Eye witnesses reported hearing the engine missing, then finally stopping. The aircraft banked into a right turn, which rapidly developed into a tight spiral. Just prior to impact the engine roared into life. The aircraft was destroyed by fire after the crash. The accident is under investigation. Cause has not been determined.

From CP35-8&9 (CH39)
A VariEze crashed on its first flight in Southern Indiana. The builder/flyer was fatally injured. The following report is from the pilot of a chase plane. "He was in no hurry at all to fly. Did not intend to fly. Took off, looked good, well under control, climbed to about 300 feet. Used runway 04. I was in a Luscombe. The VariEze made shallow turns, when he got on downwind, it was obvious that he was descending. His turn and descent continued until he clipped the top of a low tree (30 ft) and then hit the ground. The airplane broke up, pilot was thrown out. Fire broke out about 5 seconds after the impact. Flight was not erratic and I feel that maybe something happened to the pilot, since he never made any recovery motion at all, did not retard the throttle at all to impact nor did he try to level the wings, nor did he try pull up. He was about 59 years old."

From CP36-4 (CH33,CH39)
Unintentional Spin in Homebuilt - Long-EZ N711QA
As you know, our Long-EZs have undergone extensive high angle-of-attack testing at all cgs and configurations and the results have shown them to be immune to stall, departure or spins. Vigorous and sustained combinations of all flight controls were input, by us and by a NASA pilot with the same results. The Owners Manual does caution, though that experience has indicated not all examples fly the same and that the builder should be aware of differences. We have recently heard from a Long-EZ owner who has experienced a spin and his report is published below. It is possible that he was operating aft of the aft limit cg. His impression of the effects of power for recovery are probably due to the oscillatory effects of the incipient spin since it lasted only two and a half turns. Conclusive data on power effects can only be made after a stable (developed) spin rate is achieved (over 2 or 3 turns) and by study of flight test instrumentation-obtained data. See also our LPC #115 on page 6.

Pilot Info: Age 63, 30,000 plus hours, flew Aeroncas, Cubs, Monocoupes, Cessnas, Stinsons, Wacos, Fairchilds, Douglas DC 3-4-6-7-8, Boeing 747 etc. Currently own half interest in a Pitts S-1, Long-EZ and a 1927 Monocoupe".

"Conditions - Gross weight 1070, Fuel 84 lbs left tank and 42 lbs. right tank, CG - maximum aft, altitude 3000 ft, SL - 2200 ft above ground, WX - CAVU.

While approaching a stalled condition with the nose about 15 degrees up, air speed 62-65 mph, the left wing went down about 60 degrees followed by the nose dropping and the airplane entering a left spin. The nose was at least 60 degrees down. After the spin had started, an attempt to recover was made by using forward stick and opposite rudder. There was no response. Opposite aileron was also used which may have aggravated the situation. The aircraft had a rather rapid rate of rotation - faster than a Citabria type but less than a Pitts S-1. Also there was pressure to the right - being pushed against the right side of the cockpit. With no response from basic control inputs the throttle was "jabbed" which resulted in a momentary slower rotation rate. When the engine idled back, the rotation returned to its original quite rapid rate. The throttle was then opened (1/8 - 1/4) and left there. The spin rate decreased and a recovery was effected. The pull out from the dive did not result in high air speed. The actual speed was not observed: however, the G load was not excessive - less than the bottom side of a loop with the airplane.

The number of rotations was about 2 and a half and 800 to 1000 feet of altitude lost. After climbing a few thousand feet a half hearted attempt was made to duplicate the situation, but it was unsuccessful.

With the many times that the almost identical flight conditions have been explored that is the only time this condition ever surfaced or gave any indication that it might surface. The airplane has about 180 hours on it and flys and performs beautifully.

Approaches to stalls have been very normal and docile. Usually a wing will drop (30 degrees at the most) followed by the nose dropping, and then wings can be leveled with either rudder or aileron. During this incident no attempt was made to level the airplane until the resulting spin was entered.

That the gyration was a tight spiral does not seem logical for a couple of reasons. From past experience with spins and spirals, had the airplane been spiraling considerable speed would have built up and basic control would have been regained. Also the pull out would have had much more speed.

As to the effect that the engine had on recovery, one wonders whether it was the thrust that aided recovery or the resulting torque, or both.

The only change to the aircraft since the original flight test is the addition of wheel fairings. It would not appear that they would cause appreciable change in flight characteristics particularly at such low air speeds.

Sincerely, Paul Wallace.

Paul reports that he installed 10 lbs of lead in the nose and his Long-EZ now flies at full aft stick per the book.

NOTE: When doing the original envelope expansion on your new Long-EZ, wear a parachute and have at least 7000 feet of altitude. If you find yourself routinely operating at aft CG, ballast to around mid CG. Any aircraft flies better at mid CG, a little lead up in the nose does not hurt a thing.

From CP37-5 (CH39)
ACCIDENTS
Unfortunately this newsletter we have several bad accidents to report. As always, we publish this information in the hope that it may save someone else in the future. The really distressing part about these accidents is that it appears that almost all of them have one thing in common. Low level, close proximity to the ground, high speed flying. This fact has nothing to do with the

airplane. This is purely pilot. We all should be aware of this and each of us should realize that the risk of flying fast and close to obstacles is very high risk and if you continue to fly this way, it is only a matter of time before you too become a statistic.

A northeastern California VariEze pilot and passenger were fatally injured when their VariEze crashed into trees on a ridge at 7,000 feet. The aircraft was traveling upslope towards the ridge when it struck the tree tops. The engine was developing power at the time of impact. No control system failures or airframe failures were found or suspected. The aircraft had been reported to be flying at extremely low altitudes earlier.

A Long-EZ crashed in central California. Both occupants were fatally injured. The aircraft was observed flying low down a river. As it flew over a bridge it struck unmarked power lines. The aircraft continued on for about a half mile where it crashed into trees. No problems were found or suspected with the aircraft.

A Long-EZ flying over the ocean in south western Florida crashed into the water. Both occupants were fatally injured. This aircraft was observed by several eye witnesses to be flying at cruise speed low across the water, estimates of from one wingspan to 100 feet above the water. It hit the water and was heavily damaged. The pilot was found to have a brain tumor and had been experiencing severe headaches. It is not known however if there is any connection.

A VariEze in France, took off from the Nice, France airport with two people aboard. The airplane climbed straight ahead to about 150 AGL, turned left, started losing altitude while continuing the left turn until it impacted the ground at a point at about midfield on a heading 180 degrees opposite the take off heading. We have not had much information on this, but there is reason to believe that the canopy may have been unlatched.

From CP37-5 (CH33,CH39)
Shortly before this newsletter went to press, we began investigation a fatal accident in which a Long-EZ apparently struck the ground in a flat attitude, possibly from a flat spin or deep stall. Of course, the results of all testing shows that a Long-EZ is not capable of a flat spin or deep stall, when flown within the allowed limits. Preliminary information shows that the cg may have been behind the aft limit. Even though this aircraft was highly modified, we are concerned that it is possible that others operating near the aft limit and with contour tolerances that degrade flying qualities from the intended and tested configuration, may also be susceptible to spins. At least until this accident is totally investigated and understood we are recommending the Long-EZ aft cg limit be moved forward one inch. Also be sure you follow to the word all information on Pages 44 and 45 of the Owners Manual.

From CP38-10 (CH33,CH39)
The following is a letter from Ken Swain on his incident at Oshkosh, 1983. We have printed the letter in its entirety as maybe it will help someone in a similar situation one day.

"On August 2, 1983 my VariEze N4ZZ suffered a total power loss over Lake Winnebago and was substantially damaged in the ensuing off airport landing. Since it happened at the EAA Convention, there were a lot of stories that were semi-correct floating about. I would like to give the complete one to C.P. for dissemination along with my personal analysis of the apparent causes. Also, while I in no way consider myself the world's most experienced pilot, I do believe that my recurrent emergency training as an active duty, current Air Force pilot gives me a perspective on emergencies not held by the average private sportsman pilot. Hopefully some of the low time EZ drivers can get some food for thought from my actions.

THE FACTS: The flight before the ill fated one was the Oshkosh 500. During the race I noticed that the fuel flow would occasionally drift up from the set 6.4 gph to 9.5 gph. Since additional leaning had no effect I concluded that my Compucruise had swallowed a few bad electrons and would have to be looked at after the Convention. Each drift up episode lasted only 15-20 seconds. I completed the race, bought 9.5 gallons of gas, and 2 hours later took off in a flight of 10 race aircraft to return to the Convention as the beginning of the pre-airshow. We were on downwind, over land, within landing distance of the field when we were sent to a VFR holding pattern over Lake Winnebago. five to ten minutes later we were cleared for approach and we headed for the field. I soon reduced power to idle to slow to gear lowering speed, got the gear down, then left power back until I hit pattern speed. When I advanced the throttle there was no response. Tach showed windmilling RPM and all temperatures and pressures were in the green. My position was approximately 1 1/2 to 2 miles from shore over the lake at 100 ft agl at 100 mph. I immediately initiated a turn towards the closest land while switching to the header tank. I then raised the gear and slowed to best glide for my aircraft. While cycling mags, mixture, and throttle I made my first of two terse unanswered radio calls: "4ZZ has lost power over the lake and is attempting to reach the shoreline just south of Oshkosh". By this time I was 1 mile from shore and the prop had stopped. A cornfield was the only area that wasn't wet, hard (trees, houses, wires) or full of people that was clearly within my small energy envelope. I kept my eyes on it while I made my last airborne call: "Hey people, listen up. 4ZZ has lost power over the lake and is headed for the shoreline just south of Oshkosh". There was a strip of grass running through the field so I decided to try for it. I cleared the 75 ft. tall trees at the shoreline by about 20 feet, lowered my gear again and made a left turn to line up with the length of the cornfield. Just prior to touchdown I slowed to between 50 and 55 mph indicated, a speed I have often flown during flight tests. As I touched down it turned out the ground beneath the grass was not level and the grass to my left was taller. The left main then failed torsionally, pulling the nose left, causing the aircraft to enter the corn. The nose was now pointing 45 degrees to the left of the motion vector. The aircraft wound up on the nose and right main gear. The momentum continued the rollover on the right canard tip and wing tip. The canopy shattered as I hit the ground inverted. The aircraft came to rest on the rollover structure and the remains of the rudder tips. The nose of the aircraft was pointing 90 degrees to the left of the direction of landing. I was about 100-150 yards from the lake, hanging in the straps, trapped in the wreck. I dug my head set out of the dirt where the front of the cockpit used to be and got off one call to Johnny Murphy who was circling overhead, to let him know I was ok. Then I smelled gas so I shut off the master.

AIRCRAFT DAMAGE: Besides the rudders and canopy, the main gear strut is failed torsionally on the left and right sides. The right gear attach is 100 percent intact. The left tabs and attach are intact but the pad layup has separated from the strut on the front half. The motor mount failed in tension at the first welds at each bottom corner; the aluminum extrusions are intact. Wings are intact. The right strake tank is separated from the spar all the way around and leaking freely. The left tank appears to have held, with minor fill cracks. Compression damage done to the inboard rib of the right aileron by the cowling are intact. Seat belts and attach are 100 percent intact. The forward fuselage sides and top will have to be completely rebuilt from just in front of the instrument panel forward. Nose gear, strut and box are intact. F28 is broken in two places. F22 broke in 6 places. The top right longeron is crushed. The canard lift tabs are twisted and the outer left of the right tip will have to be replaced. The possibility of damage exists in the canard center spar but I have yet to strip the cover off the canard center to inspect it.

POST CRASH INVESTIGATION: When the wreck was pulled off the trailer used to get it back from the cornfield, the engine started on the forth blade and ran strong. After shutdown a small but steady stream of fuel ran from the carburetor. Tapping on the bowl eventually made it stop. Later, with representatives of both the FAA and NTSB present, the fuel system and carburetor were disassembled and inspected. There was some sand in the VA-6 fuel filter. There were a few infinitesimal slivers of teflon tape and a small amount of fine sand in the carburetor bowl. Less than 200 gallons of gas had been run through the system since cleaning at annual on June 30. The needle valve was clean and free and the float was undamaged. There was extensive fuel staining of my brand new ram air elbow.

MY ANALYSIS OF THE CAUSE: First, I totally rule out carb ice. I have 800 hours experience with my Lycoming and have only had it ice a couple of times in the most severe carb ice conditions. What I believe happened was this: One of the four FBO's that I bought fuel from after my annual passed some sand along with the fuel. Some of that sand eventually made it through the filter and was intermittently preventing my needle valve from closing completely. The teflon tape shreds could also have done it but there were only 3 of them and there were lots of grains of sand, 300 to 400 grains. Under pressure from the fuel pump the bowl would then overflow out the atmospheric vent, into the elbow. I believe the high fuel flows I noted during the race were grains of sand in the process of passing the needle valve. Since the power setting was high, the engine just ran a bit rich for a short while. The worst case would be to experience a needle valve clog at the moment of quickly reducing power to idle. The engine would then flood since fuel pump out put is proportional to prop rpm, not power demand. It would be so loaded up that it could take quite a while to clear, certainly more than the 15-20 seconds of windmilling prop time that I had.

Other support for this view: The stream of gas from the carb after shutdown and the fuel stains on the elbow where 2 hours earlier there were none. Also, at the completion of the Oshkosh 500, Gene Sheehan looked at my exhaust stacks and commented on how lean I must have been running the race since they were almost white on the inside. After the crash and at most 10 to 15 minutes of flight, they were heavily caked with black soot.

MY ANALYSIS OF MY INFLIGHT ACTIONS: In retrospect, I feel I did a few things wrong and a bunch of things right handling the inflight portion of my emergency. My biggest mistake was not turning off the master before impact. I should have. My biggest correct action was not even a conscience one. Both the military and FAA part 121 operations require seat belts and shoulder harness to be worn by flight crew for all takeoffs and landings. My habit is to always keep them both on. I loosen, but never remove, the harness only once in a great while at high altitude cruise. Had I not had a tight seat belt and shoulder harness, I would be dead! Instead I walked away from a pretty spectacular crash literally without a scratch.

Other "right actions": My immediate turn towards shore at the first hint of trouble. 2. My immediate raising of the gear. 3. My immediate switch to the header tank which, 4. allowed the rapid, and correct, decision that the engine wasn't coming back; this prevented me from wasting precious energy/altitude on keeping the prop windmilling. 5. My rapid attaining of best glide speed for my airplane as determined by flight test. 6. I picked out the only field that I was certain I could make and never let it out of my sight. Remember, I cleared the trees by only 20 feet from almost 2 miles away. Had I omitted any one of the above actions, I probably would have hit the trees or lake. Cornfields are rough on airplanes, but not nearly as rough as trees or water at high speed.

Some additional right actions: I devoted my full attention toward stabilizing the situation before giving any thought to a radio call. I also got the aircraft as slow as I had been able to demonstrate good control in flight test before touchdown. Another very important action was the relowering of the nose gear before touch down. Judging from the damage to the gear doors and paint abrasion on the strut, grass drag (=slow down help) on the strut was significant. Had it not been down, I probably would have gone over at 50 mph vs. 20 mph.

My last correct decision was to leave my seat belt buckled when the 160 lb. fireman said "OK, unbuckle the belt". About 15 people had lifted the airplane, still inverted, about 5 feet off the ground. I said to him, "Are you ready to have 215 lb. come tumbling down on your head as soon as I open it?" He said, "Wait a minute", and got another fireman to help. I could just see me surviving the crash unscathed only to break my neck in the rescue!

SOME FINAL THOUGHTS: Thanks Burt, for designing a super strong airframe and especially a super strong rollover structure. Without it I would have been severely injured or worse. The TV newsman asked if I was scared. I told him that I was too busy doing my job, flying the airplane, to be scared. Every military flight manual I've ever used has virtually the same basic instructions for handling any emergency:

1. Maintain aircraft control
2. Analyze the situation
3. Take corrective action.

Nowhere does it say to wring your hands, go berserk yelling for help in the radio, or to contemplate your navel. The only person who can help you out of your hard spot is you, and you won't be any good whatsoever to you if you don't keep a calm, clear mind and concentrate on the business at hand.
Ken Swain"

****From CP39-5 (CH21,CH33,CH39)****
A modified Long-EZ crashed on the Southern California coast. (This accident was mentioned briefly in CP37). We have actively been trying to determine a possible cause on this one but so far have been frustrated. Although there were a few eye-witnesses, their information is sketchy and contradictory. Several witnesses reported seeing the aircraft flying low along the beach and pulling up into steeply banked turns. No one we have talked to saw the actual impact. We have carefully examined the wreckage and it appears that the airplane struck the beach with very little forward speed in a flat attitude. There was no evidence of rotation. This aircraft has a non standard fuel system. A header tank containing 5 gallons was built into the space over the centersection spar, aft of the passenger's head. This tank was kept full with a fuel pump at all times, and the engine was gravity fed from this header tank.

The aft cg, and the vertical cg of this fuel possibly contributed to an unacceptably aft cg condition for the airplane, particularly at higher deck angles, when the vertical cg would cause a worse aft cg condition. We know this aircraft made its first flight with 30 lbs of ballast in the nose. There was no evidence of any ballast in the wreckage.

<u>NOTE</u>: We would like to reiterate what we said in CP 37. Due to individual builder tolerance build-ups, and contour variances, you <u>cannot</u> assume that your airplane will behave exactly like the original prototype, N79RA. Because of possible variances, we are now making the aft cg limit of F.S. 103 (recommended in CP 37), a mandatory permanent change.

****From CP39-5 (CH39)****
An Australian VariEze struck a power transmission line. The airplane crashed into a reservoir. The pilot and the passenger were fatally injured. The weather was reported a factor, for in order to stay in VMC conditions they were flying at low altitude.

****From CP39-5 (CH39)****
A Southern California VariEze crashed while attempting to land. The pilot was fatally injured. The weather was clear with unrestricted visibility. The wind was directly down the runway at 5 knots. The pilot made two attempts to land. Making a second go around, the airplane climbed steeply, turned left, the bank angle increased to 90 degrees, hesitated for one or two seconds, the rolled inverted and crashed nose down in a wings level, inverted attitude. No control systems or engine problems were found. This pilot had recently bought the airplane. He had entered VariEze time in his log book. However, evidence suggested he was on his first flight and had improperly logged time for insurance purposes. He was a low time pilot with very little recent time. The probable cause of this accident was lack of experience and low proficiency.

****From CP39-5 (CH39)****
A VariEze crashed in Arizona in front of several eye witnesses. The pilot was fatally injured. The aircraft made several high speed low passes in the vicinity of the witnesses, then on the last pass, pulled up steeply and initiated a roll. The roll maneuver was not quite completed and aircraft struck the ground. This pilot was observed a few days earlier doing "aggressive aerobatics" in his VariEze. The aircraft had only 14 hours total time since new.

****From CP39-5 (CH39)****
A Long-EZ ran off the end of the runway during an attempt to take off in the threat of a rapidly approaching thunder storm. The pilot broke both ankles and passenger suffered some heavy bruising when the aircraft overturned and was seriously damaged. A thunderstorm was closing in from the north. The wind was only about 5 knots when the pilot began to taxi out. He elected to take off downwind. According to eye witnesses the wind rapidly built up to an estimated 45 knots on the tail during the aircraft's take off roll. In the pilot's words "the accident was caused by pilot judgement, not by the plane".

****From CP39-5 (CH39)****
A California VariEze, travelling through Arizona was destroyed in a weather related accident. The pilot and passenger were both fatally injured. The weather was reported at 500 foot ceiling, poor visibility in sleet and freezing rain.

The aircraft totally disintegrated in the air. Very little damage was due to the impact with the ground. We spent a lot of time looking for possible causes, and we carefully examined all of the pieces which were found. The wreckage was spread down wind for over two miles. The damage showed signs of extreme high speed flutter, rather than overload due to excessive g. This accident was probably caused by the pilot pushing on into bad weather, or possibly trying to climb over bad weather. He may have become disoriented or overcome by hypoxia, the aircraft probably ended up straight down at very high speed. Finally it reached a speed beyond anything intended for this design, when it literally experienced flutter over the entire airframe.

The important point to note is that there was <u>no</u> evidence of a massive 'g' overload, such as would be expected if the pilot tried to pull out of a high speed dive, was found. All of the evidence points to total catastrophic failure due to high frequency, divergent flutter. The damage could only have resulted from and <u>extreme</u> overspeed condition possibly in the region of 400 knots plus.

****From CP40-4 (CH18,CH33,CH39)****
<u>Canopy Opening In Flight In An EZ</u>
Ralph Gaither, an experienced naval pilot with over 26 years of experience in airplanes and a VariEze pilot/owner called the other day to let us know of a canopy opening that he had. First of all his canopy warning system was out of order, a micro switch had failed. (Don't laugh, this can happen to you!) Secondly it was a hot day in Arizona. The canopy was kept open while taxiing

out to the runway. The canopy was locked, then the wind shifted necessitating a long taxi to another runway. The canopy was opened for better ventilation (you can see it coming, right?) To make a long story short, he had to quickly fit in between traffic for take off, his safety catch had somehow gotten bent and did not catch, so the canopy opened fully at between 200/300 feet AGL during the climb out. Ralph, kept his cool, he flew the airplane, maintaining the climb, left the throttle full up, reached with his left hand and grabbed the canopy rail. He pulled the canopy down and closed it on his wrist (not fully closed). He climbed out in this configuration until at 1000 feet AGL. He trimmed the airplane as best he could, and throttled back to fly level at a reasonably slow speed (100 to 110 knots would be best). Then he took his right hand off he stick and calmly locked the canopy and continued on his way. Ralph's canopy does not have the throw over stay that was shown in CP 30, page 8. Rather he has a simple retaining cable. He expressed the concern to us that he felt that the over-center type throw stay may have made it much more difficult to close the canopy in flight. We have given this some thought and we agree. It would be more difficult to close the canopy, but certainly not impossible. Anyone who flies an EZ with this type of stay, will know that it takes both hands for about a second to flick it over center and close it.

It is food for thought and we wanted to give the builder and flyers the benefit of Ralph's experience. We believe the throw over stays advantages out weigh its disadvantages. It is very light, it will hold your canopy open in a wind without allowing it to crash closed or open against the fuel tank. It does not impose the tremendous torsional loads through the canopy frame that the gas spring type canopy restrainers do.

Consider also that there has to be literally a triple failure before this would become a factor in flight.
1. The canopy warning system must have failed.
2. The safety catch has to fail.
3. The pilot must have a brain failure, or fails to comply with his or her checklist.
All three of the above have to occur before the throw over stay becomes a factor. We at RAF have elected to keep our throw over stays but we feel that each individual builder should make his or her own decision.

Incidentally, Ralph reported that the airplane was not at all difficult to fly, he easily maintained heading and continued his climb. The biggest thing to remember is to <u>FLY THE AIRPLANE.</u>

From CP40-4 (CH33,CH39)
"Dear RAF,
The weather here in the northwest has been terrible, so I have not been flying much. The aircraft is a super flying machine and a compliment to Burt's designing and engineering skills. The only incident to report is an engine failure. Airplane fault? NO. Pilot stupidity? Yes. I was flying up the Columbia river gorge towards the Dalles at about 3,000 feet when I suddenly heard the ominous sound of nothing but air, and sudden deceleration,. You always think the worst in these kinds of situations, but since there were no loud noises, I figured that fuel starvation must be the problem. I checked the boost pump, it was on. Mixture was rich, throttle was full open. All the time I was looking for a spot on the freeway below, thinking, 6 o'clock news, here I come. (I really did not want to break into show business in this manner) I then reached for the fuel valve (had to loosen my shoulder harness first) and switched tanks. As I was reaching for the starter, the engine roared into life. Music to my ears!! I added full power and climbed to 5,000 feet so that if it dare happen again, I would have a shot at the airport. All of this happened in a matter of seconds but, with absolute fear coursing through every cell of my body, it seemed like an eternity.

On the ground I checked the drain on the suspect tank and only a few drops dribbled out. Before take off I had <u>assumed</u> I had about 3 gallons in that tank. I had 5 gallons added to it. I took off on this tank and flew for about an hour at high power settings when the failure occurred.

Evidently there was little more than the 5 gallons when I took off. I am only thankful that it occurred with enough altitude to handle the situation, and that it ended up a learning experience and not a tragic one. Additionally thank goodness for the other tank!

Sincerely,
Dave Perrosino"

<u>Editors note:</u> If you do hear the sudden silence, <u>always</u> assume it is fuel related and switch tanks immediately., Check mixture rich, throttle open. The prop will continue to windmill if you were cruising along, so you do not need a starter. It will windmill down to 65 knots in fact.

From CP40-4&5 (CH30,CH39)
A southern California VariEze was seriously damaged during a forced landing caused by the catastrophic failure of a home made kevlar prop. The pilot suffered a serious foot injury.

This propeller was reportedly designed and built by the pilot. The laminate consisted of multiple plies of kevlar layed up with room temperature cure epoxy, similar to that used to build the VariEze. The prop had a total running time of approximately 3 minutes when during the first take off, one blade failed completely near the hub.

Composite props may eventually be built that will be safe for us to use on our homebuilt airplanes, but we must caution builders that composite props require careful design and very, very thorough testing under controlled conditions. Propellers especially on a pusher, operate in a very stressful environment, the average homebuilder simply does not have the facilities at his or her disposal, necessary to tackle such a project.

From CP41-6 (CH18,CH39)
A northern California VariEze crashed soon after take off. Several eye witnesses observed the canopy open immediately after lift off. The pilot was observed to reach up to the canopy with both hands. The aircraft veered to the left and struck the ground 200 feet left of the runway centerline. The pilot did not survive. The NTSB investigator confirmed that there was no damage to the canopy latches and that they were in the unlocked position. They noted that there was no canopy safety catch.

See Cp #40, Page 4 for more information on canopy opening in flight. The biggest point is FLY THE AIRPLANE. You can not possibly get back safely if you don't gather your thoughts and concentrate on flying the airplane.

From CP41-6 (CH22,CH39)
A Long-EZ was seriously damaged after the engine failed a few moments after take off in Minnesota. The pilot executed a 180 degree turn and attempted to land on the runway he had just lifted off from. Unfortunately he misjudged his glide landing on the last 1/3 of the runway. A 15 knot tailwind did not help and he rolled off the end, down a slope into a ravine. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger suffered only minor cuts and bruises. There was no fire and in fact neither of the fuel tanks was even damaged. An FAA/NTSB investigation failed to reveal any clue as to why the engine had quit. The aircraft had had a similar incident occur just a few days prior to this accident. That time the pilot managed to execute a safe landing. A careful examination of the engine, mags and carburetor revealed nothing. The airplane was then successfully tested, and in fact had flown from southern California to Minnesota with no problem at all.

We talked with the pilot this morning and while driving his damaged airplane home, he had plenty of time to try to think of all that had happened and why it had happened. He came up with a theory that certainly could have been the cause. This airplane had the mag switches (two toggle switches) mounted on the left side of the roll over structure. The switches were not covered or protected inside the roll over structure. Two spiral bound note books were stored in the roll over structure. The pilots theory is that possibly one or both books moved against the terminals of the mag switches and possibly shorted the mags to ground. This would certainly cause the engine to quit. This will be investigated further, but it certainly is something to think about. If you have your mag switches installed in your roll over structure, insulate the back of the switches or install a cover over them to prevent anything from coming in contact with the bare terminals.

From CP41-7 (CH3,CH30,CH39)
VARIVIGGEN NEWS
We have heard from two Viggen builders this time. Wayne Wilkins reports that his Viggen is rapidly approaching completion, but that although he had high hopes of flying to Oshkosh 1984, it is just too soon. Too bad Wayne, last year we had 3 Viggens at Oshkosh, it would be nice to get a few more all parked in a row.

Arthur Schwartz has repaired his Viggen "Birdie" after his gear failure and subsequent trip off the runway and says that this year he will be at Oshkosh. He plans to fly in the company of his friend Sid Stiber who will be flying his recently completed Long-EZ. We are looking forward to seeing both aircraft at Oshkosh.

We recently heard second hand, of an incident with a VariViggen in southern California. Charles Cowan reportedly took off with a friend from Rialto airport with the intention of visiting the island airport in the sky on Catalina Island. As he overflew the airport at Corona, he experienced a severe vibration, a loud bang and the engine quit abruptly. He whipped his Viggen around and landed successfully on the Corona runway. The Viggen was not damaged, but the engine was shot. Apparently the cylinder base nuts had worked loose, due to excessive paint on the flanges. One cylinder actually fell off, and the resulting damage essentially destroyed the engine. This is a potentially serious problem and all of us should check all nuts, bolts and screws on our engines for correct torque.

This VariViggen was dismantled and trailered back to the shop, there builder Bill Campbell did a very thorough inspection of the airframe. No damage was found. However, this inspection did turn up a few cracks in the end grain of the composite outboard wing stub spar. These were caused by shrinkage of the spruce. In this case the exposed end grain of the stub spar had no moisture protection at all and the dry desert air had caused the exposed portion of the end grain to shrink and develop several cracks. The fix was to "wick" warm epoxy into these cracks and paint several good wet coats of epoxy over all of the wood that was exposed.

Wood aircraft are subject to changes in humidity and it is very important to protect every bit of wood by coating it with a moisture barrier. In the past this was usually spar varnish or something similar. We believe that the best possible protection is Safe-T-Poxy. All exposed wood surfaces should be coated with a good moisture barrier. Inspect your VariViggen carefully all over for any signs of wood shrinkage or surface cracking. Sand all such surfaces and coat liberally with Safe-T-Poxy.

From CP42-5 (CH33,CH39)
A South African Long-EZ crashed off the end of a 1700 feet rough field when the pilot attempted to take off with a quartering tailwind. The airplane accelerated slowly on the very rough strip and failed to lift off before running off the end of the strip into a marsh. The nose gear collapsed, the nose dug in and the airplane flipped. The pilot and passenger were both injured and airplane badly damaged.

This accident was one that need not have occurred. The Long-EZ is not suitable for short rough fields. You can land a Long-EZ on a rough strip that you may not be able to fly out of. Remember, with a canard pusher configuration, such as the Long-EZ, you have no prop blast over the elevator, and therefore you can not force the airplane to rotate early and start the wings carrying load. You have to accelerate to flying speed, 50 to 60 knots depending on the cg and a rough field or even a grass field with long grass (anything over 2" long) will greatly add to the rolling drag and slow down your ability to accelerate to the point that you may need more runway than you have available. As long as you fly your Long-EZ from a hard surface or a smooth grass field at least 2500 feet long, you should have no problems. All aircraft are compromises, you cannot have a Lear jet and a J-3 cut in one aircraft. The Long-EZ is no exception. It does what it was designed to do very well. High speed, economical transportation is the Long-EZs forte.

****From CP44-2&3 (CH8,CH39)****
VARIEZE/LONG-EZ ROLLOVER/HEADREST
We have received a letter from Andrew Detroi of the FAA concerning the forced landing/crash of a Long-EZ that he investigated. This crash involved a Long-EZ that lost power after takeoff. The pilot made a successful 180 degree turn, landed long and left the runway. The nose gear collapsed, the nose dug in and the aircraft flipped inverted with enough forward velocity to break the canard in half and rip one wing off at the end of the centersection spar. The rollover/headrest was broken off. The pilot and passenger received minor head cuts, scratches and bruises.

This letter has been distributed to the various FAA offices and in some cases redistributed with some inaccuracies. This has caused some consternation among the local FAA and among groups and individual Long-EZ builders.

We have spoken to the FAA in Chicago and they have agreed with us that obviously the pilot's head rest is not, nor was it ever intended to be strong enough to resist the forces imposed in an inverted crash with any appreciable forward speed. It is a roll over structure, and has proven that it will remain intact in the event that one of these aircraft should roll over with little or no forward speed. This was in fact the case, when Ken Swain flipped his EZ in a corn field near Oshkosh after an engine failure. His aircraft ended up resting on the rollover structure (canopy broken), the firewall and two broken winglets. He was not injured, but had to wait for others to lift the aircraft to get out. The rollover has provided this protection in at least two other cases, one example is in CP #14. However, the rollover structure is obviously not designed to handle an inverted landing! This structure is also a head rest and doubles as a map case/storage area. It will not protect you should you strike the ground inverted or roll over with any significant speed or impact energy.

We of course object to Mr. Detroi's inference that the rollover should have (or could have) provided protection in an earlier Minnesota Long-EZ accident that was not survivable, regardless of the head rest. (See CP #31).

Design loads for an "adequate" roll over protection are difficult to define. Obviously, a second landing gear on the top could protect for 10 ft/sec drop at full landing speed and just as obvious a very heavy structure would be snapped off by a hole or curb at only 10 mph. RAF does not have a specific recommendation in this area and we will not be reinforcing our headrests. The decision to do this rests with each individual homebuilt manufacturer. RAF will continue to strive to openly pass along all information to help you in your building decisions. You may for example want to change references of "rollover structure" to "headrest" if you feel this is more appropriate.

****From CP44-8 (CH39)****
A Florida Long-EZ was substantially damaged when it struck two power lines while flying level at approximately 140 knots, between two islands. The lower power line removed the main gear entirely, including the attach fittings, some lower fuselage structure and some of the prop. The upper power line cut the upper left winglet off just above the standard rudder. This piece was recovered by fishermen and measured 37" at the leading edge and 27" at the trailing edge. The pilot reported that the impact felt like light turbulence!!

The aircraft was put into an immediate climb. The pilot managed to fly at 600 feet using nearly full right aileron and full right rudder, for a distance of 4 miles over saw grass and trees to a power plant. A 1,500 foot strip of rock and dirt was chosen (all that was available) and a normal off field landing was executed. The pilot was not aware that the main gear had been torn off, so he put down the nose gear and speed brake. The Long-EZ was damaged in the crash landing, but both people on board suffered only bruising from the seat belts and shoulder harnesses. The aircraft was losing altitude and thrust even though the engine was developing good power, due to prop damage. The pilot did a really excellent job in keeping his cool and flying the airplane.

****From CP44-8 (CH39)****
A Connecticut Long-EZ with only 9 hours since new landed short of the runway due to running out of gas and was substantially damaged. With the pilot/builders permission we are printing his report below in the hope that a problem like this can be avoided in the future by other EZ pilots.

"Don Eckbert and I (Richard Marr) built Long-EZ N49EZ over a three year period. It flew for the first time in early March of this year at the hands of Norman Rossignol, a 350 hour VariEze pilot.

The plane had about 9 hours on it when I took it up on the morning of March 19. After about 90 minutes of flight, I noted that the gas in my right tank was getting low. I decided to do a little more sight seeing before heading toward Waterbury-Oxford Airport for a refill. I did not switch to the left tank, reasoning that I should have the airport in sight before doing so, in case I had a water problem.

When I did head for the airport, I forgot about my mental note to switch tanks. As I turned base, the engine quit. I immediately switched tanks but the engine did not restart. The prop had stopped windmilling, we do not have electric start, and I was too low to gain the necessary airspeed to windmill it. I was also too low to make it to runway 36. I hit the slope leading to the runway. The impact destroyed the nose, removed the main landing gear, broke the engine oil pan, prop, carb etc. I got a broken sternum and a squashed vertebra.

I had made two pilot errors. I forgot to manage my fuel and I flew the pattern too low. Another ten feet of altitude and I would have made it to the grassy area in front of the runway without incident.

In all other ways, the Long-EZ is an incredible design. I believe the impact absorbing nature of the composite saved my life. I would not have walked away if it were a conventional aluminum two seater.

The plane is insured so that repair money will not be a problem. My injuries are healing rapidly. My biggest regret is that my partner Don, had little more than an hour in it before the accident. A few years from now (after a Defiant) he will look back on this and laugh. For now, he is contemplating murder.

Thanks again for an incredible design. Richard Marr"

****From CP44-8 (CH33,CH39)****
HOT DOGGING EZs - Is The Thrill Worth It?
We have received comments and complaints about pilots flying their EZs at low altitude, over beaches, over ski slopes etc. LISTEN UP GUYS!! It may be fun to buzz when you are in your EZ. You really do feel like you have the world by the tail and nothing can happen to you. No denying it, any airplane that is this small, maneuverable and responsive, will tend to build your confidence. The Long-EZ's flying qualities give the pilot the sense that he is "a part of the airplane" and that he can make the combination fit into the smallest areas with ease. The thrill of this capability has made many of us do dangerous flying.

This must stop. The majority of EZ builder/flyers fly by the rules but some of you are putting us all in jeopardy.

We recently reviewed the data and have found that in seven of the eleven Long-EZ accidents, buzzing was either the primary cause, (like the Florida one discussed in this CP) or a contributing cause. In general, the offender is the one with the loss, but if an EZ is involved in an accident on a crowded beach or ski slope, we are all out of business, no more experimental aircraft flying.

****From CP46-8 (CH30,CH39)****
The following is an incident report from VariEze builder/pilot and Defiant builder, Emerson Grooters of Norway. It concerns the failure of a propeller and points up the importance of selecting a good reliable prop. If you want to experiment with untested or unusual props, do yourself a favor and follow the Formula one racing guys lead, install a safety cable on your engine. This is at least a 1/8" aircraft cable that ties the engine to the airframe. If you lose a prop blade, and don't get the engine shut down in time, the engine could come loose from the firewall.

"During testing of a new wood prop which I intended to use for some altitude and speed records, the prop failed with multiple fractures in the root area of both blades - forward face. The prop was not one recommended by RAF, however, I think that there may be a good point here for everyone - that is, just because you have a wooden prop don't think that it will automatically work with your aircraft/engine combination. I has 2.15 hours on the prop when I retorqued the bolts prior to an altitude test of the aircraft, my RR O-240 powered VariEze. I took off, climbed to 10,000 feet and checked various power/cruise settings for about 25 minutes. I then climbed direct to 20,000 feet and started full throttle cruise test prior to further climb. At about 107 KIAS and 2700 rpm I noticed an increase in vibration from the engine. The vibration was not severe; however as it was a change from the norm, I cancelled my next planned step to 25,000 feet, reduced power to about 1/4 throttle and descended for landing. Total flight time 1.25 hours and total on the prop, 3.40 hours. On landing I saw the cracks in the prop. I was also glad that I had just had my chute inspected and repacked, even though I hadn't had to use it.

Last summer, my wife and I stopped to talk to another couple about their new beautifully executed homebuilt. They were both dead about 15 minutes later in a crash resulting from losing most of a prop blade. It was a one piece wooden prop recommended for their type aircraft - not a RAF type. I mention this because, just because you have a nice looking wood prop does not mean that you are home free. Also any change from the normal operating conditions of your aircraft should be fully investigated as soon as possible. A precautionary landing may be inconvenient and take a little time but it could save your aircraft and yourself. Emerson Grooters"

****From CP47-2&3 (CH30,CH33,CH39)****
ARE HOMEBUILTS SAFE?
FAA accident statistics show that per hour flown, a homebuilt is at least three times more dangerous than its general aviation store bought certificated counterpart. We have studied the accident records of these aircraft and have found some specific information that highlights the reasons for this large difference. The reasons are these general categories.

1. Low Flying/Buzzing/Aerobatics
This cause results in a relatively small percentage of accidents for the Cessna, Cherokees etc. We are astounded to see that the vast majority of serious homebuilt accidents fall into this category (3 out of 4 Long-EZ fatal accidents, 7 out of 11 total accidents/ incidents). It seems that the homebuilts are such fun to fly that the pilots take risks that they generally do not take when flying their Cessna 172.

2. Engine/Prop Failure
Engine failures on homebuilts occur much more often than factory-builts, basically because many homebuilders do not apply adequate workmanship in the engine installation. A homebuilder who is not an A and P should get one to inspect his work and better yet, have an FAA designated IA approve the installation as would be required for a certified aircraft.

Note that the 2 categories described are items that you as a homebuilder pilot have complete control of if you fly your aircraft as you would your Cessna and inspect and maintain your power plant as you would your Cessna. Your exposure to the risks of an accident should be as good or probably better than that for the general aviation average. It is a shame that while we see many cases of a homebuilder being spared because he was in a homebuilt (safer stall characteristics and longer glide after engine failure), we still, due to things under his control, find him in a much riskier environment.

From CP47-6 (CH39)
A California based Long-EZ landed over 100 feet to the right of the runway centerline. Touchdown occurred off the runway, one mainwheel almost two feet lower than the other down a burm. The airplane hit hard and flipped over, sliding to a stop upside down. There were strong gusty crosswinds at the time, so much so, that an experienced A-36 Bonanza pilot aborted his landing attempt and went to another airport. The pilot suffered neck injuries and the passenger had minor injuries.

This accident was definitely avoidable. You should never commit to land if you cannot comfortably hold the airplane on the extended runway centerline. Go around, go somewhere else, nothing should be important enough to loose your airplane.

From CP47-6 (CH21,CH39)
An Alabama VariEze took off after a thorough preflight with full tanks. At 400-500 feet AGL, the engine quit with no warning. All attempts to restart failed. The choices for a landing site were bleak, trees or a small road. This pilot chose the road and lowered his nose gear. Just as he was really committed, a truck came over the rise. Trees and utility poles would not allow him to move over far enough, so his left wing hit the truck and broke off. The VariEze was pretty much totally destroyed, although the cockpit remained enough intact that the pilot got out with only a broken leg.

The accident investigators found a mud dauber (wasp-like insect) had built a nest 6" up the fuel tank vent line where it was very difficult to find, even with a thorough preflight. The FAA investigator recommended a screen over the fuel tank vent.

We believe a screen over the vent would reduce the necessary ram pressure to near static pressure. Our recommendation would be redundant vents. Put another 'T' in the vent such as downstream of the top 'T' and run a second vent. Be sure and check both vents for obstructions every 100 hours.

From CP47-6&7 (CH33,CH39)
This letter from Rob Cook, VariEze builder, is printed in its entirety. Hopefully, it will prevent anyone else from making the same mistake. Rob was doing a high speed taxi run with the canard installed, but with his main wings still in his garage! NEVER attempt a high speed taxi run unless you are mentally and physically and mechanically prepared to fly.

"Dear Mike,
First, thank you for your help and understanding. Feel free to publish the following account of my accident any way you see fit.

If you don't believe that the little canard on the front end of your VariEze produces all that much lift, listen to this! I've been taxi testing my VariEze for about two months. At the Concord, California airport it's easier to taxi to the other side to see friends, get advise, etc. than it is to drive around on the surface streets. I've taxied at indicated speeds up to 60 mph and found the airplane easy to handle throughout the speed range. These tests were done with and without the canard installed. The main wings are in the final finishing stage and the airplane has only been taxied once with them on.

On August 16, at 6:30 pm I lined up on 19 right and pushed the throttle to the firewall. The acceleration was brisk to say the least! I was indicating 60 mph in about three hundred feet. I pulled the throttle back half way and made sure I wasn't still accelerating. Everything was stable. I eased back on the stick and the nose came up slowly. The airplane was rolling straight but the nose kept coming higher. Pushing the stick forward resulted in no gain except in angle of attack. The throttle was off by now.

I remember thinking "Why am I going through this? I'm going to end up in the grass and be really embarrassed!" I was pressing full force on the brakes but to no avail. At 15 degrees angle of attack the prop started to contact the ground. I could hear it. The resulting torque transfer to the ground caused the airplane to start turning sharply to the left. I saw the tower and at the same time heard them dispatch the fire truck.

By now I was just along for the ride. The tires couldn't resist the turn and the airplane flipped. I remember seeing the tower roll inverted. The first thing to hit was the left wheel. The gear had enough spring to throw me into one more roll, this time landing inverted. The canopy shattered, the headrest collapsed forward, and the slide began. Thank God I didn't have my seatbelt on! I was conscious for the whole hundred foot ride. When everything stopped, I turned off the master and mag switches and started talking to myself. Just wanted to be sure that I stayed awake!

I was laying upside down on the back of my neck and bleeding pretty good. The fire truck was there immediately and I was pulled out and taken to the hospital. Three hours of surgery and six days in the hospital is mighty expensive learning. It took two more hours and two more days to have me back to being pretty again!!

Well, it has been three months and I'm back full time on the airplane again. It's in much better shape than I was. It's going to need a new canopy. right upper wing attach fitting, prop (the old one will make a nice sixteen inch clock), and what the hell, I knew I'd end up with the Long-EZ gear in the long run anyway. Oh, I almost forgot, the canard snapped five inches outboard of the spar on the under surface. It's already repaired and looks as good as new.

The FAA, bless their hearts, didn't call it an accident ... no intent to fly. Even though this has been written in a light vein, I think the message is pretty loud and clear. THINK, and after you've given an idea a thorough brainstorming, try it out on someone whose judgement you trust. And then .... be careful. The only reason I can give for still being alive is that it just wasn't my turn.
Sincerely,
Rob Cook"

****From CP48-1 (CH39)****

SUN-N-FUN 1986

Unfortunately, due to other commitments, no one from RAF was able to attend this fly-in. However, we have received reports from several builders/flyers who did go.

Once again, there were more composite type airplanes there than any other kind, including approximately twenty EZ types, ten Glasairs, one Q2, one Velocity, etc.

The Sun "60" Race was held again this year over a slightly different course, 67.7 nautical miles (76 statute miles). This race is a flat out race from a standing start with no consideration for fuel flow, miles per gallon or cabin load. This race sorts the fast ones from the slower ones and, generally, is a really fun race. Of course, as in any race held around a closed course, navigation has to be dead accurate or you will not win!

This year the race had a much broader variety of airplanes from Glasairs to Long-EZs to VariEzes to Cozy, to Cassutts to a Velocity and a TC-2.

It is interesting to note that while most of the EZs posted ground speeds very close to their owner's manual speeds, most of the other makes certainly did not. The moral? Don't always believe the performance figures quoted in the color brochures!!

Place	Name	Aircraft	Eng.HP	Time	SpeedMPH
1	Richard Poter	Glasair-RG	180T	21:20.5	213.68
2	Charles Largar	Glasair-RG	180	21:33	211.50
3	Donald Yoakely	Glasair-TD	160	21:44	209.85
4	James Cline	Glasair-TD	160	23:13	196.38
5	Neil Hunter	Long-EZ	160	23:55	193.63
6	Steve Wiggins	Long-EZ	160	23:63	192.98
7	Danny Mayer	Velocity	180	24:22	188.27
8	Paul Mason	VariEze	115	24:33	187.42
9	Steve McCaskie	Long-EZ	115	24:33	187.42
10	Ed Albers	Cassutt	100	24:42	186.73
11	Jack Fehling	VariEze	100	25:32	180.09
12	Nat Puffer	Cozy	115	25:34	179.95
13	Tim Gehers	VariEze	100	25:39	179.66
14	Jim Rutland	Long-EZ	115	25:56	178.40
15	Ken Wheeler	TC-2	100	26:85	169.83
16	Gary Price	VariEze	108	26:85	169.83
17	Robin Yound	Glasair-TD	160	26:86	169.77
18	David Haggard	Long-EZ	115	29:83	152.87
19	Dick Dobson	Glasair-TD	160	34:43	134.44

Sadly, this year there were several accidents associated with getting to or during the flyin. A good friend with probably the high-time Quickie, Doug Swanningson, was killed in his well-known "painted like a waving American flag" Quickie. We will miss Doug, he had almost 1000 hours on his rather stock Onan-powered Quickie. A Q-200 and a T-18 were both involved in fatal accidents. Our sympathy goes out to those bereaved. With Oshkosh not too far in the future, it is time to review our piloting skills. Perhaps a ride with an instructor to brush up and point out potential bad habits that tend to creep in! During take-off and landing especially, we must be at 100%. Practice flying a slow approach such as may be forced on you in the Oshkosh pattern. Do it up high and see how your own airplane behaves at low speed. Watch out for getting too slow on short final, a high sink rate can develop very rapidly resulting in a very hard arrival that can easily break a prop or nose gear - or even main gear! Proficiency, knowledge of your limitations and your airplane's limitations can make all the difference. Do yourself and every member of EAA a favor, get a few hours of serious, quality practice (with an instructor?) before you set out for Oshkosh 1986.

****From CP49-2 (CH39)****

JACKPOT 1986

Over 40 VariEzes and Long-EZs flew into Cactus Pete's Jackpot airport, just a stones throw south of the Idaho border and almost into Utah. This is high country, the airport is at over 5,000 feet elevation, the scenery is beautiful, the nearest town of any consequence is Twin Falls, Idaho. On the morning of the 4th of July, the winds were really blowing. Conditions at the airport were steadily getting worse with strong gusty crosswinds of 30 to 40 knots almost 90 degrees to the only runway. To the credit of the pilots, all but seven of the aircraft to arrive at the flyin managed to land without incident. A dinner show in the casino was enjoyed by all, followed by an impressive fireworks display.

On Saturday morning, the famous Jackpot 120 Races were held. Shirl and Diane Dickey go to tremendous lengths to make this both a fun and safe event. It is, however, an out and out race and the fastest airplane will win. There are no tricky formulas or pilot techniques that can help you - it is a "no messing around" speed event.

The first race was for unlimited aircraft, those with larger than standard engines, and this year that event included a 160HP tail dragger Glasair. This race was very close, with the first three airplanes crossing the line within 15 seconds. The first seven airplanes averaged over 200 MPH!! The Glasair was soundly beaten by Long-EZs and VariEzes with similar power plants! The second race was for "standard Long-EZs" powered by 0-235 Lycomings. The third and final race was for "standard VariEzes" powered by Continental 0-200 engines. The three races went off without a hitch and some very impressive times were turned.

Following the races, a spot landing contest was held and this one always sorts out the pilots! Debbie Iwatate touched down only 11" from the line and we figured she was a shoo-in for the second year in a row. However, along came Joe Moore in his Rolls Royce powered VariEze and touched down just 8" from the line! Incredible.

Next, came the ribbon cutting contest which is always good for a few laughs. It looks alot easier than it really is. After that, everyone retired to the swimming pool and a little sun tanning.

Unfortunately, this year one of the Long-EZs was involved in a takeoff accident. The airplane veered off the runway and flipped over. Fortunately, the two people onboard suffered only minor injuries. The airplane should be repairable though probably not in time for Oshkosh.

Saturday evening brought the usual great banquet. Cactus Pete really does us proud. Over 100 people enjoyed the food and the conversation. After dinner, Shirl and Diane presented the prizes and trophies.

Jim Shultzman won Grand Champion, or People's Choice and was presented with a magnificent silver tray. This was the second such win Jim had received for his beautiful Long-EZ. He won Grand Champion at Porterville just a few weeks previous. The silver tray was conceived and presented by Ian and Chris Ayton who won this award last year. Race results as follows:

Unlimited				
	1st Place	--	Mike Melvill	209.14
	2nd Place	--	Dick Kreidel	207.66
	3rd Place	--	Wes Gardner	205.56
Stock Long-EZ				
	1st Place	--	Ian Ayton	182.91
	2nd Place	--	Gus Sabo	181.00
	3rd Place	--	Mark McHenry	180.25
Stock VariEze				
	1st Place	--	Klaus Savier	207.90
	2nd Place	--	Shirl Dickey	191.16
	3rd Place	--	Joe Moore	186.75

Once again, many thanks to Shirl and Diane Dickey who, for four years in a row, have organized the best flyin there is anywhere. It was great! Don't miss it next year.

****From CP49-4&5 (CH30,CH38,CH39)****

A Long-EZ in Illinois landed in a row of trees after the engine quit. The pilot was on a 1/2 mile final at 300 feet at idle power due to another plane in front of him. When he added power, the engine quit. Two attempts were made to start the engine using the electric starter, to no avail. He hit a small electric wire, then landed in a row of trees planted as a wind break. The canard broke on both sides, the right wing broke at 1/2 span, the left wing was damaged near the strake. The main gear was still attached but bent aft. The left wheel/axle was sheared off breaking all four bolts. The pilot received a small cut on his hand and that was all. No cause for the engine quitting has been determined. The first thing that comes to mind, of course, is the engine idle speed. This may or may not have had anything to do with this accident, but we have seen airplanes set up with such low idle speeds that they do have a tendency to quit on short final. However, that is normally an occurrence in the flare where it is only an annoyance as far as taxiing after the landing. An excessively high idle RPM is not satisfactory in that it makes it tough to land an airplane with the L/D of a Long-EZ. In general, if your engine will idle OK on the ground, it will idle even easier at approach due to inflow assisting the propeller.

* These values are probably incorrect as a Long-EZ can easily glide 1/2 mile from 300 feet while decelerating 10 knots.

****From CP49-5 (CH33,CH39)****

A Northern Nevada VariViggen was involved in a first flight, take-off accident. The airplane was demolished but the pilot suffered only minor cuts and bruises. Unfortunately, this accident could easily have been avoided. The pilot had no current medical or biennal, nor had he flown at all in the past 3 years. He did not inform the FAA of his intention to fly and he attempted to take-off on an uphill runway with a tail wind.

****From CP49-5 (CH39)****

A California VariEze crashed on final approach. The pilot was seriously injured and the airplane was badly damaged. His approach was at a busy flyin with a lot of airplanes on final. He got gown too low and far too slow. Eyewitnesses saw the airplane very low with wing rock. The airplane caught a wing on the approach light system, 800 feet short of the runway and 15 feet above the ground. The airplane cartwheeled and hit upside down and slid to a stop 300 feet short of the runway. The moral here is "never be too proud to execute a go-around, no matter how much pressure there is to land."

From CP49-5 (CH30,CH33,CH38,CH39)

A Long-EZ on its first flight after installing a newly overhauled engine suffered an inflight engine fire and was unable to make it back to the runway. The engine quit on approach and the pilot attempted to land in a housing tract. There was not enough room and he rolled into a car which also burst into flames. He landed under control, thus, inflight structural failure or control failure are not suspect. Sadly, the pilot was killed by fire. The fire was so intense in the engine/cowling area the the FAA accident investigator was unable to determine what could have started the fire. The fuel pumps, carburetor, etc., were consumed. The airplane had been airborne for only a few minutes. Reportedly, the engine was an 0-320 and he was using auto fuel. We may never know what caused the fire, but it is easy to overlook a loose fitting - we have done it ourselves. A fuel leak, particularly auto fuel, could be ignited by hot exhaust or any number of things. Always try to have at least one other person go over your work, especially engine related work like plumbing or control systems. The more pairs of eyes that look at your engine installation, the better chance that you will catch some overlooked items. This is specifically important if you are developing new, unapproved installations.

Never, ever, cowl an engine that has been worked on without a brief engine run to check for leaks. We, here at RAF, have more that once found fairly drastic leaks during the leak-check engine run.

From CP50-4 (CH39)

A Kansas based VariEze crashed, fatally injuring it's builder/pilot. The circumstances of this crash are the stuff nightmares are made of. The left wing separated from the fuselage in flight and the airplane fell out of control to the ground where the right wing also separated from the fuselage. Examination of the wreckage showed that the 16 screws (AN-509/AN-525) that must be used to fasten the wing-attach fittings to each wing spar were never installed! Surprisingly, the same 16 screws that are used to attach the wing-attach fitting to the centersection spar were installed. As a result, only the epoxy bond held the wings to their fittings. Incredibly, this enabled the aircraft to fly for a number of hours before the top and bottom spar caps simply pulled out of the metal wing attach fitting.

This builder/pilot, by all reports, was a careful builder who built his VariEze closely to the plans, yet while he did install the wing attach screws into each of the centersection spar, he somehow overlooked the installation of these critical screws into each wing. Why? We will probably never know, but we should all learn a lesson from this. Even though the plans are clear and concise, with full size drawings showing the location of these screws, it is apparently possible to overlook such a vitally important structural attachment. Every VariEze builder or flyer should check to be absolutely certain that all 64 screws are installed in the wing/centersection attach fittings. If you have already covered these screws, such as in an already completed and finished airplane, you can easily check using a small magnet hanging on a string, or a stud finder such as carpenters use to locate vertical studs is a wall (it's also a magnet). Carefully mark the exact location of each screw head with a pencil. Compare your bolt pattern with the full scale drawing in the plans. Be sure that you have all 64 screws in the correct positions. This applies especially to those who have not done this work themselves and therefore would not know.

From CP50-4&5 (CH21,CH30,CH38,CH39,CH41)

A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally fuel associated. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating from the plans is probably the most common reason. Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. Tony Bengelis' book Firewall Forward is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

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From CP51-6&7 (CH13,CH33,CH39)

Long-EZ N218EZ: Incident Report

Scenario: I was the pilot in command of Long-EZ N218EZ at Scottsdale Municipal Airport when it crashed into a Cessna 152 after hand propping the engine. The situation occurred as follows: I had just fueled up for a local flight and was preparing the aircraft for engine start. I placed the wheel chock under the port tire and set the magnetos for ignition. I set the throttle position incorrectly although I did not realize this until it was too late. I then hand propped the engine and she started on the first pull but the RPMs were too high and the Long-EZ jumped the chock. I ran around the port wing but then my last failsafe malfunctioned. The rubber stopper under the nose, which was made out of a hockey puck, sheared off and the Long-EZ raced away toward the active runway. A previous gear up landing prompted the installment of a stainless steel plate under the nose in the event that a gear up landing occur again. The steel plate offered little friction to the asphalt and she accelerated away from me (I am slow of mind not of foot). I was only able to get alongside the wing at full sprint and the plane was still accelerating toward the active runway. I decided to try to alter the plane's course and at my last chance grabbed the port winglet and pulled myself up off the ground. Off balance, the Long-EZ did veer away from the runway but my troubles were just beginning. Now a less than willing passenger on the wing of a pilotless plane going approximately 25 mph, I helplessly watched as the Long settled on a course directly at a parked Cessna 152. I had no choice but to release and watch the planes collide.

Damage: The Cessna suffered a collapsed wing and sustained propeller, nose gear, and engine cowl damage. The Long lost the canard and punctured the port wing strake on the Cessna's propeller.

Recommendations: This situation arose primarily because the throttle was set at too high a power setting thus initiating the runaway condition. Second, the rubber stopper was made out of the wrong material (hockey pucks are designed to slide) and it was not secured to the fuselage properly. For those who hand prop their planes, I would recommend installing a parking brake and/or some remote cutoff switch for the engine. A simple procedural solution would be to set the fuel valve to off so that if the plane runs away, it won't get too far. Always be certain of your throttle setting. By Michael Best

From CP51-7 (CH39)

I had an unfortunate accident to my Long-EZ in mid-January when as a result of heavy snowfall the hangar it was kept in at Biggen Hill collapsed on top of the machine. Estimated weight was around 100 tons! Much of this was taken on the canard - a girder across each side. One side was snapped off - the other side believe it or not when the weight was removed returned to its normal position. Other damage was a smashed canopy, damaged fuel tanks, undercarriage pulled forward slightly by the immense pressure. In addition, I had to saw off the top of one winglet above the rudder to release it. Plus some easily rectified damage to the other winglet. I was thinking of building a new canard anyway! Hope to be back in the air in a couple of months if everything goes well. by Robin Smith

Editor's note: This incident occurred in England at the famous World War II aerodrome at Biggin Hill. England had one of the worst winters in living memory in 1986/87. Another Long-EZ in the same hangar was also seriously damaged.

****From CP52-5 (CH39)****

A VariEze at an Airshow in France was seen to take off and fly low to the end of the short grass runway. He then pulled straight up, barely made it over the top of the half loop, then attempted a "Split S" recovery but was too low. The VariEze hit the ground just as the pilot leveled out, tearing out the main gear and sliding for over 70 yards on the belly. The bottom was ripped off from the nose to the rear seat. The pilot was seriously injured.

What can you say about such an accident? Don't let it happen to you. Low level aerobatics and buzz-jobs cause more accidents in EZs than all the rest of the accidents put together!

****From CP52-6 (CH13,CH33,CH39)****

The following two incident reports were sent in by Long-EZ builder/flyer, Jimmie Hays.

"I had a totally unnecessary off-airport landing the other day. I pulled the airplane into an exceptionally nose high attitude while bleeding off speed from cruise to do some stall tests. As I pushed over to recover, the carburetor became unported and the engine quit. This wasn't altogether a surprise, but when the engine would not start right away after speed and "G" forces were returned, it was a definite surprise!

I went through all the emergency procedures (several times!), switched tanks, boost pump on, pumped the throttle, tried carb heat, talked to ATC, all to no avail! I was over distinctly unhealthy terrain but, fortunately, there were a couple of fields in gliding distance. I made the decision to lower the nose gear on short final, to absorb some of the landing shock and minimize nose-over possibilities. At about 25 feet, I noticed, for the first time, the tach was resting on <u>zero</u>! Too late to hit the starter, I went ahead with the landing. A very short landing roll in very sandy, loose soil. I am sure happy I decided to put down the nose gear. The only damage was some paint damage and the loss of one vortilon while loading it onto the wrecking truck which got stuck 4 times getting out of the field!

Obviously, checking the tach has now become VERY MUCH a part of my personal engine-out procedures. The prop had stopped in the horizontal position and may not have been noticed, even if I had looked back."

<u>Canopy/Nose Gear Experience</u>

"Less than 6 hours into my test flight period, I failed to lock the canopy before take-off. Everything went perfectly normally through rotation and until the mains came off the runway. Suddenly, the canopy slammed open against the safety catch. The noise level immediately went up from wind and engine noises. I, also immediately, thought of all the stories I'd read about control problems with the canopy open. I reached to grab the canopy with my left hand and my right hand subconsciously followed, driving the nose gear smartly back into the runway. I reacted almost as quickly, raising the nose again, but, alas, the nose wheel was no longer there. What a strange looking thing that nose gear strut is in the bare state when you look at it through the little plexiglass window.

Naturally, the nose wheel assembly had found the prop, so now I also had a lopsided prop to add to my problems. The nose wheel and fork assembly came through the whole affair quite nicely (and is still doing well with 200-plus hours). The only damage was the four bolts having failed as described in CP51. I retracted the nose gear strut and landed with minimal skin damage in the nose area. LESSONS LEARNED: 1) Fly the airplane! 2) the airplane would have flown quite nicely with the canopy open against the safety catch. 3) the airplane is distractingly noisy with the canopy partly open. 4) the canopy won't lift against the safety catch until just at take-off speed and attitude. 5) wooden props will keep going with quite a lot of damage. 6) FLY THE AIRPLANE, STUPID!"

****From CP52-6 (CH21,CH33,CH39)****

<u>REFUELING FIRE</u>

We received this information third hand. We have <u>not</u> had any contact with the Long-EZ pilot. Apparently, after a flight in his Long-EZ, a Norwegian builder/pilot landed at an airport in Norway and requested fuel. As the attendant started to fill one of his tanks, a static spark jumped and ignited the fumes around the fuel cap area. Fortunately, a fire extinguisher was available and the fire was extinguished.

The above is <u>all</u> the information we have. We are endeavoring to find out more about this incident and we would appreciate any information anyone may have about this or any other similar incident.

This is the first time we have had a report of a fire while fueling an EZ. We have, of course, fueled many composite airplanes here at Mojave, literally hundreds of times, and we have never even seen a static spark. That is not to say it could not happen but of all the places it should happen, Mojave, with its extremely dry climate, would seem to be a likely candidate.

What can be done to prevent such an incident? If you built a ground strap into the tank connecting the fuel cap ring to the aircraft ground, and you grounded the aircraft during a refueling operation, this should not be able to occur. However, if your airplane was ever struck by lighting, the ground strap would conduct the charge. It would become red hot and melt which may cause an explosion/fire! Not a good alternative.

The most practical thing to do would be to always touch the fuel truck's ground cable to each fuel cap <u>BEFORE</u> you open these caps. This would discharge any static build-up on the aircraft skin/strake area. Another suggestion was made in EAA's <u>Sport Aviation</u> magazine and that is to make up a length of brass bathroom chain with a small clip on one end. Clip it to the fuel nozzle and drop the chain into your fuel <u>BEFORE</u> pumping fuel into the tank. The idea is to discharge any static that may build up due to the friction of the fuel running out of the nozzle into the tank. This would be in addition to the first suggestion.

We are not experts in this field at all. During fueling we, ourselves, have never taken any special precautions other than the normal grounding of the exhaust pipe (which may or may not do anything at all!) We have been fueling composite airplanes here at Mojave and, indeed, all over the United States for more than ten years without any evidence of a problem. We simply present the report of this incident as food for thought. If anyone has any suggestion as to what could be done to prevent such a thing, we would be pleased to hear from you.

From CP53-3 (CH30,CH38,CH39)
A southern California VariEze was taking off when it lost power at approximately 400 feet. The engine was leaving a trail of black smoke. The pilot was unable to make it back to the airport and crashed on rough ground about one-half mile from the airport. The airplane was severely damaged and the pilot sustained moderate back injuries.

The pilot believes that the plastic float in his Marvel-Schebler carburetor became "fuel logged" and sank causing the engine to run so rough it quit. He was aware that there have been some problems with these floats, but he said that the important thing was that he never thought it could happen to him! We appreciate such honesty and frankness and hope this will strike a firm note and prevent more pilots from suffering the same fate. See CP 41, page 6, for details on the float problems and things to watch for.

From CP53-3 (CH21,CH33,CH39)
REFUELING FIRE IN A LONG-EZ
"To Ground Or Not To Ground?" By Alfred K. Tiefenthal
"I had intended to carry out an exact calibration of the fuel sight gauges of my Long-EZ. While in my hangar, and using a metal funnel and "Jerry" cans, I began pouring Avgas 100LL into the right tank. The metal funnel had three legs, but due to the cross wire in the Brock fuel tank opening, they were too short. I supported the funnel with pieces of wood and foam. With that arranged, the funnel did not touch the metal tank opening or cross wire but was a few millimeters away from it. I suppose it was at this gap that a spark jumped over and ignited the fuel.

This happened when I was pouring in the third can. The tank was about half full. Fortunately, there was no explosion, the fuel just started to burn. I must have bumped the funnel when the ignition happened because there was splashed, burning fuel all around the tank opening and dripping down the leading edge. The can I was pouring from was on fire and I, myself, got burned on my right hand, fortunately, not seriously.

I will never forget the nasty sight of my beautiful and beloved Long-EZ, after four years of hard work, burning all over the wing strake with the flames reaching almost to the roof! A few seconds later, I managed to extinguish the fire with a single blow from a powder-type fire extinguisher I found in the hangar, and it was all over.

There was very little damage, some discolored spots on the strakes and a few paint blisters along the leading edge. These were quickly repaired and, surprisingly, I actually flew the plane the next day!

There is no doubt in my mind that the source of the fire was a spark caused by static electricity. It was my fault, of course, that I did not ground the aircraft. Nor had I any grounding connection between can, funnel, and aircraft. I will never pour any amount of fuel into any aircraft without ground, and if I have to fill from "Jerry" cans, I will also make a ground connection between the can, funnel, and grounded aircraft.

It is illegal to refuel an aircraft in a hangar and without grounding and I was fined 500$ (Norway money!), but what is that?! I could have lost my airplane, or even my life, if the ignition had occurred earlier while there was a combustible mixture in the fuel tank- or it could have exploded.

My hope is that this story will prevent other builder/flyers from having a refueling fire."

The above letter was received from Alfred Tiefenthal who lives in Norway and it is the same incident as was described in CP 52. We made a couple of suggestions then and have received several comments concerning this incident.

A fueling fire is a very, very serious situation and anything that can be done to prevent it should be done. Also, be sure to have a suitable fire extinguisher at hand whenever you are doing anything with fuel.

Haley Haynes wrote to us concerning our suggestion of a brass chain and he is concerned that the chain should not be grounded to the fuel nozzle until after it has been dropped into the fuel. The connection to the fuel nozzle should be made as far away as possible and upwind from the fuel tank opening.

He says that at the present level of understanding, a static charge can and does build up on the surface of the fuel, probably due to molecular friction between two dissimilar materials, like cat hair and plastic.

The obvious solution would seem to be to install some form of uninsulated metal ground into the tanks during construction, and securely connect these to the aircraft ground and engine. Thus, the gas truck operator grounding your exhaust system would be grounding the fuel. Unfortunately, the problem is not that simple. This solution, in event of an airborne lightning strike, could result in the inside-the-tank ground strap becoming red hot and causing an explosion! Also, the fuel acts as a dielectric between the metal fuel lines and the static charge on the surface of the fuel. Therefore, a very large area ground is needed in the fuel tank.

The aluminum mesh called "Explosafe" and advertised in Sport Aviation, if properly grounded to the engine during construction, may be a good way to go.

We would welcome suggestions and comments on this problem. The other side of the coin is, of course, the fact that many hundreds of EZ's have been fueled many thousands of times all over the world without any reported problem until we heard from Alfred Tiefenthal. Is the problem really as big as it seems? We wish we knew, but unfortunately, we are not experts in this field and we would truly welcome the view of any experts.

Our biggest concern, now, is that someone may actually cause a fire trying to avoid the problem by grounding his fuel incorrectly or in the wrong sequence. We are certainly going to have a nice big Halon fire extinguisher at hand for all fueling operations here at Mojave, but what to do on a cross-country?

From CP53-9&10 (CH33,CH39)

The following three letters are concerning a lightning strike on a Long-EZ flown by Dick Kreidel. We certainly thank Dick for taking the time to write the account which Burt sent to Andy Plummer for his comments. Mr. Plummer is one of this countries leading authorities on lightning strikes and his letter is, also, reproduced here for all of us to read and inwardly digest. Pay attention, guys, our EZs are not indestructible, although many of us fly them as though they were.

"I deliberated for a long time whether to publish this account of poor judgement and foolish mistakes. When I read it now, on the ground, three months later, the faulty reasoning is easy to see. But I assure you, that the decisions and events on May 23rd were made to the best of my ability and skills. My hope is that someone will benefit from my errors. It is a fine line between being around to tell a story and not being around.

This account was originally sent to RAF for their comments. Burt passed it on to Andy Plummer of Lightning Technologies who is reputed to be the foremost lightning expert. Mr.Plummer's comments follows my tale......

I departed New Orleans Lakefront Airport IFR to El Paso at approximately 9:30 a.m. local on Sunday, May 23rd. I had received a thorough weather briefing from Flight Service only 20 minutes earlier and they indicated that westbound I shouldn't have much problems; rain showers and multiple cloud layers with tops at 14,000' to 16,000' MSL with a thin cirrus layer at 25,000'. Live Radar and FSS painted a line of thunderstorms about 20 miles south but it probably wouldn't arrive at Lakefront for at least an hour. I was cleared to 16,000' and had gone through multiple layers of cloud and picked up some light clear ice after a climb through 12,000'. I requested from ATC to hold at 14,000' for a while since I was between layers and the next ceiling didn't look as thin as advertised. The OAT at 14,000' was +1 degree C. I flew through some heavy rain and more ice accumulated on the plane, especially the canard, elevators and vortilons. The wing did not appear to have much ice on it and I could not see any on the winglets or the intersection between the wing and winglets. Indicated airspeed at 2400 RPM was 122 KIAS. The ice on the canard covered about 20-25 percent of the chord with some "streamers" that went back to perhaps to 50 percent chord line. Ice formed below the trailing edge of the elevator about 1/8" thick with a uniform spanwise distribution. The ice on the canard was definitely clear ice but what was below the trailing edge of the elevator looked more like mixed or rime ice. The elevator position was about 5/16"-3/8" T.E. down. The airplane was very controllable with good elevator responsiveness. I could have easily climbed if I had wanted to so I was not overly concerned.

ATC was giving me radar vectors to stay clear of any CB's but indicated that contrary to my preflight weather briefing, the "weather west of New Orleans is really wicked with the big boys having trouble going through!" Center advised that the only way they felt would be O.K. would be to deviate approximately 60 nm due North - obviously I followed their recommendation. After a few minutes I was again in cloud and it became increasingly difficult to hear radio transmissions - static was all that came through the headset.

I started receiving small electrical shocks from the roll trim lever through my jeans and shocks from the microphone to my lips. I became aware of the transparent blue glow that was on the nose and canard. I say blue but somehow it seemed blue with a pink tinge. The color was similar to the bright blue from a gas welders flame. This halo was about one chord width above the canard and seemed to "move" - it is very difficult to describe in words. I was now getting shocked through the speed brake handle and from the rudder pedals to my ankles (my feet were in the relaxed position forward of the pedals). The B&D tachometer was bouncing erratically from 500 RPM to full scale and both Nav CDI displays were swinging from stop to stop. The electric engine instruments were also useless - I didn't notice what the wet compass was doing. Here I was: IFR conditions, icing, no communication or navigation, thunderstorms and weird light. So far the ride was smooth with no rain or hail in the cloud - the cloud was not a dark, heavy one. The blue (pink) glow increased in intensity and its movement was more rapid. I am not sure but I believe that the blue glow was now inside the cockpit between my face and the instrument panel, but I could still easily read the gages; it was right out of the Twilight Zone.

I saw a bright flash way ahead of me that seemed to go from left to right that really lit up the cloud I was in; I assumed that it was cloud to cloud lightning and that I was definitely in deep grease! The com was still all static and calls to center were unanswered (or perhaps unheard). I was so scared that I was sure that this would be the way it would all end and Kay (my wife) would really be pissed! I smelled a thick sweet odor, got one good shock from the microphone and then there was a tremendous flash of light and an incredibly loud "crack" - I felt it in my bones and chest as opposed to hearing it.

I had been looking out at the right wing trying to figure out why the blue halo was not on the wings, only the canard, when the flash occurred. I was temporarily blinded so I removed my hand from the stick hoping I wouldn't enter a spiral dive. When I could see again (10-15 seconds), to my amazement 1) I was still alive and 2) the plane was still level at 14,000' on my last assigned heading of 060 degrees. The blue halo was gone and I heard a transmission on the com for a Delta jet. I called center to see if my radio was blown and they immediately answered my call! Apparently they had been trying to reach me to give me a new vector and immediately turned me to 330 degrees. The airplane was again between layers and the visibility was good, I could even see patches below. Everything appeared to be working O.K. but the plane still had a lot of ice on it and I didn't think I was in any mental state to fly an approach. The airspeed now read less the 50 knots so I knew that the pitot tube had iced over. The weather seemed to be improving rapidly with a broken layer above and below with some beautiful blue sky far in the distance. Since the plane would easily climb with full power and the remaining aft stick I saw no reason to descend and kill myself making a lousy IFR approach after all of this! I then saw several dark patches on the wing and winglet leading edges that upon later inspection were areas where only the glass skin remained. In about 20 minutes all of the ice melted and the elevator position returned to 1/16" T.E. up and the airspeed increased to 140 KIAS at the same power setting of 2400 RPM. The flight continued normally in IFR and I landed at El Paso International four hours later.

So what is there to learn from this unwanted experience? Probably several things. First, that the invincibility I felt in B888EZ contributed to my cavalier attitude in flying in bad weather - this certainly was not the "California IFR" that I was used to. After nearly 1100 hours of flying in a plastic cocoon, I had developed a false sense of immortality - after all, the EZ had gotten me through some tough situations before. Also, I learned to never, ever trust ATC and/or FSS - the pilot must make his own decisions and evaluations on when to commence or terminate a flight.

Another significant revelation is that although the Long-EZ is a great plane and can leap tall buildings with a single bound, it is <u>not suited</u> for <u>hard IFR</u> flights with <u>embedded thunderstorms</u>. I consider myself <u>extremely lucky</u> to have survived this flight - my skill and judgment (or more correctly - lack of both) hopefully will serve me better in the future.
Dick Kreidel"

SKETCHES OMITTED

FIG. I Ice distribution on canard and elevators.
FIG. II Ice on vortilons.

SCALED COMPOSITES INC.

0554/87
3 June 1987

Andy Plummer
Lightning Technologies
10 Downing Parkway
Pittsfield, MA 01201

Dear Andy,

As you may recall when you visited about 10 years ago, we, as well as hundreds of other homebuilders have been flying without lightning protection and with apprehension as to what would occur in a lightning strike. The enclosed account is from Dick Kreidel of Yorba Linda, California who was flying his Long-EZ when it was struck by lightning.

I would appreciate any comments you could pass on to us or any recommendations of analyses which should be done. I am wondering if any data is available on laboratory strikes on fiberglass skins with foam cores. If so, I would like to look at that information to get some idea of the intensity of Mr. Kreidel's strike.

Best regards,

Burt Rutan

ELR/kl

cc: Mike Melvill
Dick Kreidel
Jim Terry

LIGHTNING TECHNOLOGIES, INC.,
10 Downing Parkway,
Pittsfield, Massachusetts 01201
(413)499-2135

22 July 1987

Subject: Long-EZ Lightning Strike

Reference: Your Letter of 3 June 1987, Same Subject, with
Dick Kriedel's Letter Attached

Burt Rutan
Scaled Composites, Inc.
Hangar 78,
Mojave Airport
Mojave, CA 93501

Dear Burt:

I have studied the interesting account of a lightning strike to a Long-EZ by Pilot Dick Kreidel, accompanying your letter of 3 June, and have the following comments:

1. After beginning the deviation North, the aircraft entered an electrically charged region, as indicated by the static in the communications system, "small electrical shocks" and "blue glow" (corona) on aircraft extremities. The electric shocks were due to electric field penetration of the non-conductive fiberglass airframe. The erratic behavior of the instruments was also due to electric field interaction with the interconnecting wiring. It is very likely the the corona was indeed occurring inside the cockpit as Mr. Kreidel suspected.

2. The synoptic weather conditions reported by the pilot are very characteristic of those reported by other operators when lightning strikes have occurred (~14,000 ft; icing, precipitation, within a cloud, OAT +/- 5 degrees of freezing). Apparently the aircraft was near embedded thunderstorm cells, though lightning strikes have been known to originate in "layered" clouds as well as CB clouds.

3. The "flash of light" and "loud crack" indicate a lightning strike, although evidently one of mild intensity as indicated by the comparatively minor effects on the aircraft. At 14,000 ft. it is likely that the aircraft encountered a branch of a flash, rather than the main channel of a cloud-to-earth flash; as illustrated in the following sketch. **SKETCH OMITTED**

4. The electric currents in a branch (of which there are a lot in a typical flash structure) are usually much less than that in the main channel. Even so, the flash and noise can be frightening if experienced close at hand.

5. Apparently the lightning current entered one wing tip (take your pick) and exited from the other, being conducted by internal metal conductors between. The amount of damage to the fiberglass and foam structures indicates a very mild strike - perhaps 5 kiloamperes or less (Part 23 rules require an airframe to tolerate 200 kiloamperes).

Comments

1. Pilot Kreidel was lucky! A more severe strike may well have caused major structural damage and lethal voltage difference among metal objects in the cockpit (column, pedals, headphones, etc.) as well as severe damage to internal electrical conductors such as control cables, hinges, bearings, rods, electrical wiring, etc. These voltages and currents can be far in excess of fatal levels. Electric fields and lightning strikes themselves will directly penetrate unprotected fiberglass structures, attracted by metal objects within - not matter how small.

2. This is another example of the fact that ATC cannot be relied upon to vector an aircraft safely around- and clear of - hazardous thunderstorms. Controllers are not provided with sufficient (and timely) information for this purpose. Even though avoiding areas of heavy precipitation the aircraft ran into an electrically active region.

3. This incident is not a good example of what would occur to a Long-EZ in a lightning strike. A "full threat" stroke would likely have ripped a hole a foot in diameter through the composite and vaporized small diameter control cables and interconnecting wiring. The accompanying shock waves would have caused extensive internal damage, delamination, etc. I doubt very much whether the aircraft or pilot could have survived such a strike.

Recommendation

1. Continue to warn pilots of this class of aircraft to stay VFR and avoid "weather" clouds, precipitation and icing within 5 degrees of the freezing level should especially be avoided.

2. This Long-EZ should be thoroughly inspected to be sure that there has not been damage to any internal metal parts. All internal parts should be inspected. It is quite probable, for example, that this strike burned some strands of control cables, electrical wires, etc.

Thank you for sharing this interesting account with me. Please give me a call if you have any further questions.

Yours truly,
J.A. Plumer, President
Lightning Technologies, Inc.

From CP54-8 (CH39)
An Anchorage, Alaska Long-EZ pilot took off from Merrill Field one afternoon with about 2 hours fuel on board. He flew to nearby Birchwood Airport where he practiced takeoffs and landings for almost an hour. Then he headed back to Merrill Field at 2,000 feet (required to cross above the approach corridor at Elmendorf Air Force Base). He intended to switch tanks over Elmendorf, but when he ran into low ceilings and had to descend to 600 feet to cross <u>under</u> the approach corridor, he forgot. During the descent from 2,000 feet to 600 feet, he was at hard idle and was cleared for a straight-in to Merrill Field's runway 18. Seeing that was was going to be a little bit short, he added power only to find that the engine had quit.

Too late to switch tanks and restart, he was committed. A tiny 550 foot long empty lot was in front of him and he went for it. Nose gear down, landing brake down, and put it down firmly on the end, too short to finesse the touchdown. The nose gear NG-15A casting failed and the nose gear strut dug into the soft field. He rolled/skid only 225 feet! The Long-EZ stopped short of a chain link fence between the empty lot and 5th Avenue's busy traffic in downtown Anchorage! No other damage occurred to the plane or pilot.

This pilot's recommendation, based on this incident? Post a landing check list on the panel and use it religiously every time you land - a very good suggestion. This is at least the second time an incident such as this has occurred with Long-EZs. Good as they are they can not fly if the pilot screws up. Learn from this close call and <u>use your check list</u>. You may not be as lucky or as skilled as this Alaska pilot.

From CP55-3&4 (CH21,CH33,CH39)
<u>REFUELING FIRE</u>
"I knew it was possible, but surely it wouldn't happen to me. How many thousands of times have EZ's been refueled without any incidents of fire? One reported in Norway (see CP 52 and 53) and now me. Why does it happen? It is carelessness, or is it preventable?

After a 40 minute flight in my LEZ N8HA, I called for the fuel truck and parked on the ramp with the nose headed into an 8 knot breeze. The fuel truck drove up and was parked about 8 feet behind the plane - downwind. Gary, the driver, unreeled the ground cable and clipped it to the exhaust stack, just the same as we had done about 30 times before. Gary then brought the fueling hose around the left wing and I removed the left tank fuel cap. Eleven gallons of (100 LL) fuel was pumped into the tank and it was about an inch and one-half from being full. He then shut the nozzle down to slow the flow and with both of us looking directly at the fuel tank opening, the fumes from the tank started burning. No explosion. The flame above the tank was a couple of feet high and was being blown across the wing aftward about 4 to 6 feet. I remember seeing the end of the fuel nozzle positioned even with the fuel tank opening and in the center of the 3 inch flush filler ring when the fire started. We don't know if the nozzle had touched the ring or not. The nozzle was also on fire.

By very fast reaction and a dry powder extinguisher from the rear of the fuel truck, we had the flame out in about 12 seconds from the time it started. Gary had one hand singed and I was spitting dry powder. I had just turned around from getting a small Halon unit in my cockpit when he shot across the wing with the powder. Damage to my LEZ was mostly cosmetic, but with a couple of heat wrinkles in the skin just aft of the filler ring, and some places in the centersection and wing spar area where the finish paint was blistered up from the primer coat. A large area was smoke blackened from the filler ring to the trailing edge. If we had been standing on the downwind side of this operation it may have been a tragedy for both of us.

The main thing I will do for sure is to install a grounding lug onto the metal fuel filler ring and use it instead of the engine exhaust. Also, a jumper groundwire will be clipped to that lug and to the fuel nozzle BEFORE removing the jumper wire or ground cable. The fuel truck should be parked crosswind from the plane and <u>not</u> downwind of it, and should be grounded into earth rods. The fuel handler should not be wearing any nylon clothing. A two pound Halon unit will be mounted in my EZ and it will be "IN HAND" or "WITHIN ARMS' REACH" each time the plane is fueled. If this fire had burned another few seconds the top of the tank may have melted away and then it might have been uncontrollable.

Alfred Tiefenthal of Norway and I have learned from a first-hand experience. I hope it will not happen again, anywhere, but I am sure that it will - Maybe to YOU, so please be prepared.
Herb Anderson
Montrose, Colorado"

<u>EDITOR'S COMMENT</u>
The above letter was sent in by Long-EZ builder/flyer, Herb Anderson of Montrose, Colorado after he had experienced a refueling fire. The only other case ever reported to us was written up in CP52 and CP53. We have refueled EZ's literally hundreds of

times ourselves here at Mojave where it is very dry and static electricity is quite prevalent. You can get a nasty jolt just getting out of you car. For some reason we have never had a fire. Now that we know of two instances, it is obvious that we cannot go on without doing the best job we can to prevent such a disaster.

Refueling fires, surprisingly, are not all that uncommon, even in metal airplanes. In the military, for example, the gas truck is grounded, the nozzle has a ground strap that is connected to the fuel tank near the gas cap before opening the gas cap.

We can learn from this. We are equipping our Long-EZ's with a ground lug which is connected to the gas cap ring. This is where the gas truck will connect his groundstrap instead of onto the exhaust as he usually does. We believe that a ground wire should go into the tank from this ground lug or the gas cap ring such that it is immersed in fuel even when the airplane is parked nose down with minimum fuel in the tank. When we get ready to take on fuel, the procedure will be this: a short cable with alligator clips will be kept in the EZ and will be connected to the ground lug and to the gas truck's fuel nozzle BEFORE opening the gas cap. The gas truck's grounding cable will also be connected to this ground lug BEFORE the gas cap is removed. This will drain any static off the airframe, out of the inside of the fuel tank and also off the surface of the fuel in the tank where static can build up. Then we will open the cap and pump in fuel.

The friction of fuel through the nozzle and pouring from the nozzle to the inside of the fuel tank creates static electricity but this charge will drain away from the nozzle, the tank, and the surface of the fuel through our internal cable and ground lug, as well as through the truck's ground lines.

We are not experts in this area, however, we believe what we have outlined is a good common sense approach to eliminating the threat of a fire caused by static electricity arcing from the fuel nozzle. We are open to suggestions on this potentially serious problem, but what we have outlined above is what we are doing to our airplanes, and we believe every builder/pilot should do to his or her airplane before the next time you refuel it. In addition, as Herb Anderson has recommended, we will carry a good quality Halon fire extinguisher which will be available to the pilot or person refueling the airplane. Once the refueling operation is complete, the gas cap should be closed and locked before any ground strap is removed.

We would like to thank Herb Anderson for writing his report for the CP. Taking these actions now, before it happens to you, may save you from a potentially very, very serious problem.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON "STANDARD" AIRCRAFT 2" DIAMETER OR 3" DIAMETER GAS CAP ASSEMBLY (MIL-C-7244B)

SKETCH OMITTED

Top skin is spot faced through the ring. A reverse spot face is required to remove foam and glass from under the ring, as shown, to allow the steel tube spacers to clamp up tightly onto the ring for a good electrical contact. Care must be used to avoid contaminating the inside of the fuel tank.

SUGGESTED INSTALLATION OF ANTI-STATIC GROUND LUG ON BROCK FUEL CAP ASSEMBLY

SKETCH OMITTED

Use a Dremel to cut a 3/8" diameter hole through the top skin of each fuel tank adjacent to the Brock fuel cap, as shown. Remove all foam and micro down to the inside skin, but do not penetrate inside skin. Fill this hole with flox - allow to cure. Drill a number 12 hole through the cured flox into the tank close to the edge of the Brock fuel cap ring, as shown. Care must be used to avoid contaminating the interior of the fuel tank.

From CP55-6 (CH39)

We have had an indirect report of a Texas VariEze that crashed in Arkansas. One witness reported watching the VariEze take off and disappear immediately into the "muck" - apparently the "muck" (bad weather) snared this VariEze a little later on near Little Rock.

This is a particularly tragic accident because it was easily avoidable. Flying into bad weather in a marginally equipped sport plane like an EZ is a hazardous business. Our fun-to-fly EZ's were never intended to be all-weather capable. Too many EZ pilots seem to think that these planes make us into supermen or women. Far too many EZ pilots are trying to do things in their EZ's they would never have considered doing in their Cessna 150 or Piper Tomahawks. We are only fooling ourselves. If we continue to push our luck like this, we will end up paying the ultimate price and it simply is not worth it.

Used properly, an EZ can be a delightful, economical, high-speed transportation machine - a machine you and yours can get years of enjoyment out of. Used carelessly, an EZ can get you into so much trouble you may be incapable of getting out of it in one piece. Use discretion, good judgement and enjoy.

From CP55-7 (CH21,CH38,CH39)

A Pennsylvania Long-EZ builder/flyer was fatally injured when his newly completed airplane crashed short of the runway on his second flight.

Apparently, the first flight was picture perfect, a flight that lasted about forty minutes. The second flight lasted about the same length of time. His engine was heard to be cutting in and out, on his second approach to land. He started a climbing left turn in an apparent effort to return and land. The airplane spiraled down from about 100 feet and crashed.

The right fuel tank was intact and contained approximately 8 gallons. The left tank was crushed, but the 1:20 minutes of flight would probably have used about 8 gallons of fuel. The airplane had 8 gallons on each side when it first took off. The pilot's shoulder harness was tight for take-off yet was found to be loose after the accident, so he may have been trying to reach the fuel valve which was reportedly difficult to turn.

An accident like this is very sad. We have repeatedly given the advice "FLY THE AIRPLANE", and this accident brings it home very forcefully. No matter what happens, if you run out of fuel on one tank or you have to shut it down for one reason or another, "FLY THE AIRPLANE". This must be your first priority. It cannot fly itself, you must maintain control, you must maintain airspeed. Then, and only then, switch tanks or do whatever else you may have to do, all the while maintaining control of the airplane.

Check your fuel valves for ease of operation. If yours is stiff, dismantle it, lap it in with jewellers rouge or a metal polish such as Brasso, using an electric drill. Clean it thoroughly and lubricate it with a suitable grease such as fuel lube, etc. Even if you have to do this once every 6 months or a year, do it, do not let your fuel valve get so tight that it becomes difficult to switch tanks.

While we are on the subject of fuel valves, be certain that you know where your valve handle should point when it is on the left and when it is on the right tank. Check carefully that the valve is in the detent and that this is, indeed, the tank you had selected. Clearly mark the position the handle is in when it is switched to the RIGHT, to the LEFT, as well as to the OFF position. It may be possible to select a mid-position between both tanks. This would not be good since, if one tank was empty, the fuel pump would pump air from the empty tank causing the engine to quit. Know your fuel system. Maintain your fuel valve regularly. Calibrate your fuel sight gauges so that you know exactly how much fuel you have on board. If, in spite of all of your care and diligence, something goes wrong, FLY THE AIRPLANE, try to correct the problem, pick a landing site, and execute a normal landing. Don't try anything fancy. A normal landing, maintaining flying speed and control to touchdown is always your best bet.

From CP55-7 (CH30,CH39)
A Southern California Long-EZ was involved in a forced landing resulting in considerable damage to the plane although the pilot suffered only minor cuts and bruises. The cause of this accident was the use of a molded plastic prop that came apart a few minutes after take-off. This resulted in a forced landing where there was no airport.

This is silly, People. Long-EZs and VariEzes are not good airplanes to test new-fangled props or engines. With a stall speed close to 60 knots, your chances of making a successful forced landing when (NOT IF), when, the plastic prop breaks or the engine quits (because it will, make no mistake about it) are very, very low. If you are into testing new plastic props or constant or variable speed props or auto engines, please, please, do all homebuilders a favor, and do yourself a favor (you may even save your life), use a Piper Cub or at least a factory built Cessna 150 or something with low wing loading that gives the best chance of making a successful off-field landing when you have your failures. At least, then this will not result in a blot on the record of homebuilt accidents but rather, will go down against factory built airplane accidents or incident statistics.

All of us who build and fly homebuilts must have in mind at all times that it is us, all of us as a group, who have the responsibility of policing our own actions and making sure that we do not end up as ammunition for those who are against us and who use every incident against us to shut us down and prevent us from flying and enjoying our creations.

We are not against experimenting, on the contrary, that is the business we are in and we encourage it. However, an experiment such as the above accident was virtually guaranteed to end in failure from the beginning and it should not have been conducted on an airplane as poorly suited for this type of experiment as a Long-EZ.

From CP56-6,7,&8 (CH33,CH39)
ACCIDENTS AND INCIDENTS
Bob Yarmey, a professional pilot and Long-EZ builder, was involved in a serious accident in his Long-EZ. Recently he offered to share his thoughts with all of us and he wrote this accident report and comments. It is not often that any of us who fly get to hear the thoughts and opinions of a pilot involved in a serious crash for obvious reasons. Bob is a very experienced pilot and a very observant person whose views may be very important to all who fly. We found his comments on how to touch down in a short field in a emergency such as he had, most instructive and very perceptive. The average homebuilder/pilot is so concerned with damaging his creation that in a bad situation, instead of trying to preserve the safety of the people aboard, he or she is likely to try to preserve the airplane at all costs. As Bob has pointed out, this is not the way to go. We can appreciate this point, particularly, having been there a time or two ourselves. Every EZ builder should read this accident report several times. The time may come when knowledge such as this could save your life. We are most grateful to Bob Yarmey for taking the time and having the courage to write this report so that others may benefit.

REQUIEM? FOR A LONG-EZ
With much excitement, I awoke on the morning of June 14, 1986. The previous night, I had been up late - washing and waxing my Long-EZ, N23RY. I wanted her to look her very best while on display at the big Texas Sesquicentennial Airshow in Waco, Texas. With my wife, Margi, settled in the back, we enjoyed a comfortable 45 minute flight from our home base at the Addison Airport in North Dallas.

It grew to be an oppressively hot day - right at 100 degrees. We enjoyed a great airshow, yet after having answered hundreds of spectator questions, we were anxious to get airborne once the field reopened. A little over half way back to Dallas at approximately 2500 feet AGL, we experienced a sudden complete loss of power. Searching around, I spotted a field about a mile off the right wing. As I swung into a wide right-hand turn to land into the wind, I turned on the boost pump, switched fuel tanks and checked the mixture and mags - all to no avail. Established on a base leg, I can recall observing a line of trees at the roll-out end of the field and utility lines at the approach end. Given what I estimated to be about 2,500 feed of field in between, I decided that my approach path should be planned to just clear the wires. I felt well prepared for this situation since I had performed a good number of practice forced landings and actual engine shut-downs both during my thorough flight test phase and subsequently. My 170 hours in this Long-EZ had been accumulated since her maiden flight four months previously. My overall experience includes 9,300 logged hours as a professional pilot in a wide variety of aircraft.

Once on final, Margi recalled me saying that I needed to go a little bit lower. I remember feeling confident on a short final that everything was going to turn out OK. Tragically, this was not the case as I was to realize while slowly emerging from heavy morphine sedation a week or so later.

I was disappointed with the FAA's investigation of the accident. Once the badly damaged forward fuel lines were by-passed and the prop replaced, the engine started up and ran satisfactorily. Despite the extensive damage at the fuel selector location, the FAA said the AN 818 aluminum coupling nuts were found to be finger tight and listed this as the probable cause. This was hard for me to accept as I had recently applied fuel lube to help unstick the fuel selector valve and had checked that these fittings were plenty snug. I personally suspect that given the hot conditions and my use of mogas that the occurrence of vapor lock was a possibility.

The accident investigation revealed that after impact with some smaller gage wires near the top of the cluster, the aircraft impacted the ground 70 degrees nose down at approximately 70 kts wings level. The fuselage shattered with severe damage extending to and including the front seat bulkhead. I was ejected at the impact point as the aircraft flipped over and came to rest 27 feet further on. Margi was terrified as she remained secured in the inverted aircraft with fuel coming out of the broken vent lines. Other damage included: a clean shearing off of the right winglet at the attach juncture, one-third of the top left winglet crushed (with no apparent damage at the juncture), the left-hand baggage pod sheared off in the wing saddle area although the right-hand pod remained attached intact, the canopy and aft turtle-deck were flattened to within approximately 4 inches of the longerons, the head rest sheared off along with a good portion of the front seat bulkhead, the canard remained surprisingly intact except for major crushing damage to the center section area.

We thank God that given the severity of the forward fuselage and canopy damage, that both Margi and myself came out of it alive and reasonably well. She suffered a concussion and a cracked rib. We were very fortunate that bystanders were immediately available to re-right the aircraft and extricate Margi. Also, a veterinarian was right on hand and administered three tourniquets to me. A Care-Flight helicopter delivered me to the emergency room in quick order. I don't know how, but I appeared to have maintained consciousness during the whole ordeal. Unfortunately, both my legs were eventually amputated just above the knees. I am thoroughly convinced that my decision to employ approximately 15 pounds of extra thickness thermo-foam absorbed a great deal of the impact forces and prevented both of us from receiving any internal or spinal injuries. In reflecting on how this tragedy might have been avoided, I would advise against the use of any automotive fuel. Although I had no problems in using it up to that day, operating temperatures had never exceed about 80 degrees. In all honesty, I cannot rule out that human factors may have played a part. The long hot day standing on the concrete ramp left me feeling irritable and not too perky. It is possible that my judgement could have been impaired.

The point at which my landing gear snagged the thin wires indicated that just another two feet of altitude would probably have put me in the clear. In evaluating the position of the canard relative to a line extending from my eye level to the aircraft flight path it appears to be within the realm of possibilities that the highest thin gage wire that I struck could have been hidden from my view by the canard. With this in mind, I would caution anyone flying a canard aircraft to closely eyeball the approach area well prior to getting set up on final approach.

Besides being concerned with the utility lines at the approach end, I was equally preoccupied with the consequences of not stopping before reaching the trees at the end of the field. I suppose its a natural feeling for a pilot - especially a homebuilder to avoid anything that could inflict even the slightest damage to his creation. Had I been willing to just get it down and accept the possibility of minor airframe damage, I could have avoided all personal injury.

No other aircraft has ever come close to providing me with the great satisfaction and sheer flying excitement as N23RY did. Given the nature of my disability (specifically, loss of ankle articulation), the rudder/brake combination of an unmodified Long-EZ represents a viable and realistic opportunity for me to get back flying again. I am contemplating a static load analysis of my aircraft which has been stored in my garage. Amazingly, close visual inspection of the wings, spar, strakes and rear half of the fuselage reveals no apparent damage. Any builder/flyer of a properly constructed Long-EZ is entitled to utmost confidence in its structural integrity, energy absorbent characteristics and resultant crash worthiness.

My twin brother, Al, and his wife, Cathi, are heading towards completion of their beautiful Cozy later on this year. I'm really excited and will not hesitate to go up and fly that Rutan derivative.

(Signed)
Bob Yarney

From CP56-10 (CH39)(Photo Caption)
BOB AND MARGI YARMEY IN THEIR BEAUTIFUL LONG-EZ BEFORE THE ACCIDENT THAT BOB HAS WRITTEN UP IN THIS NEWSLETTER

From CP57-9 (CH33,CH39)
A TEXAS HOMEBUILDER took eight years to complete his VariEze. His total experience consisted of about 150 hours in Cessna 150's and 172's. He had not flown solo for some time. He called RAF and explained what had happened. He successfully made his first flight, although it was very short and he had a lot of trouble with pitch control. On the second flight, during the take-off and climb, he again had difficulty with overcontrolling in pitch. At higher speeds, it flew great, but when he slowed down to land, he got into a PIO (pilot induces porpoising), got slow while trying to get it under control, the EZ pitched up then pitch down, crashing hard on the runway. The nose gear and left main gear were torn off; the prop and lower winglets were broken.

By his own admission, this pilot said he was anxious to fly, but he overstepped his ability and his experience. He says, "Don't lie to yourself, don't fool yourself. If you are not ready, get someone else to fly it and check you out, or get the necessary training".

We appreciate this pilot's honesty and his guts in calling us with this accident report. Don't kid yourself into believing you can do it if you know in your heart that you are not ready - profit by this pilot's experience - it cost him his airplane and eight years of hard work. Don't let it happen to you.

From CP57-9&10 (CH11,CH12,CH31,CH38,CH39)
A CENTRAL CALIFORNIA VARIEZE experienced in-flight severe flutter of the elevator and canard which caused a structural failure of the canard, and the pilot was killed when his VariEze crashed on a wooded hillside. He had about eight hours in his VariEze before the crash.

He had not built the airplane but had purchased it with all of the structure done. He then completed the finishing and systems installation. The elevators were carefully checked for correct balance and some weight was added inboard on each elevator to bring the elevators into the proper balance tolerance.

Prior to the fatal flight, the pilot had removed the canard to check something in the nose. Previously, a friend had helped him to install the canard and noted that he had had great difficulty in getting the canard attach bolts to line up and thread into the nutplates.

A very careful post crash investigation by the FAA, as well as by RAF, determined that the probable cause of the catastrophic flutter was that one of the canard attach bolts was not correctly installed. Either it was not torqued up at all, or it was cross threaded. In any case, it did not clamp the aluminum lift tab to the F-22 bulkhead. This resulted in the natural frequency of the canard being lowered considerably since it was only firmly attached on one side. A gust, or something, excited the elevators driving the canard into a divergent destructive flutter mode.

Although the elevators were balanced, they were very heavy, having been modified from the original short chord design to the long chord by the addition of a large heavy piece of balsa wood and several plies of BID. This caused the elevators to have a lower natural frequency of oscillation. Thus, these overweight elevators may have contributed to this accident, however, the primary cause was the failure of the pilot to properly install the canard.

This tragic accident brings it home to all of us, just how careful we must be as we work on our aircraft. When you are doing a critical job such as installing a wing or a canard or a control surface, you, and only you, are responsible to ensure that all fasteners are correctly installed and properly torqued. Too often we get sidetracked while working on a critical installation when we get interrupted by a friend or passerby. Should this happen to you, do not stop until you have the critical part installed and safetied - even if you have to be rude to your visitor.

Accidents such as this have been caused by an interruption or disruption of your thoughts while working on an important aspect of the aircraft. A simple example is changing the oil. The oil is drained, the drain plug replaced, then a visitor shows up with a bunch of questions - you forget to fill the sump with fresh oil and - presto - a destroyed engine when you start it. It happens so easily, it seems so unlikely, but it happens. Be conscientious, use checklists, be very particular and careful if you have removed a canard or wing or canopy, etc. Be <u>absolutely certain</u> you have adequately completed <u>any</u> task you do on your airplane. Last of all, be very conscientious about doing a thorough preflight on your creation before you commit you, and perhaps a member of your family's or a friend's, life to your workmanship.

As you know from past Canard Pusher newsletters, the subject of flutter has been a major concern for years. CP numbers 17, 18, 19 and 21 have reported discussions and/or warnings relative to the importance of conformality in the fabrication of the canard and elevator system. *It is extremely important to be aware that elevators improperly fabricated, too heavy or with the incorrect bending or torsional stiffness characteristics which result from improper materials, or fiber orientation, <u>cannot</u> be balanced with any method.*

A mass balance called out for the elevator and the specification for balancing them, applies <u>only</u> to an elevator fabricated with the same weight and stiffness as that which has successfully passed all the flutter testing. It is extremely important, and life-critical, that the manufacturer or owner of each VariEze, Long-EZ or any plane for that matter, assure, without a doubt, that the control surfaces are conformal to those which have passed flight tests and been shown to be flutter free.

The advisory shown in the plans change section must be followed to assure that there are no non-conformal elevators that could contribute to, or result in, an accident. Do not take this situation lightly. As we have indicated before in the CP, - IT COULD KILL YOU.!

****From CP58-4&5 (CH18,CH33,CH39)****

BIRDSTRIKE! BIRDSTRIKE!

"On the Sunday after Thanksgiving, my wife and I departed Inyokern airport (Mojave desert) for a casual Sunday morning flight in our Long-EZ. I climbed out to 5500 feet MSL (approx. 2500 feet AGL), leveled off and throttled back to approximately 150 mph TAS. I looked up just in time to see a bird about 50 feet above my flight path and several hundred feet ahead. I didn't have time to determine its direction of flight or which way I could turn to avoid it. I had probably less than 2 seconds between first sight and impact. Just before impact, the bird winged over and dove down, striking the canopy head on .....instant explosion/implosion? The canopy was shattered and completely missing from my head forward. From my head back, the canopy stayed intact.

The bird and/or plexiglass struck me, knocking my headset off and giving me a fat lip. The bird ended up in the back seat. My glasses were undisturbed.

I immediately throttled back and nosed up slightly to reduce airspeed to keep the debris from flying around and anything else from ripping out. I was in control of the airplane at all times and slowly turned for the airport 8 miles away. I reached for my headset microphone, cupped my hand around it and declared an emergency. I was later able to put my headset on while my wife took the stick.

We proceeded to motor back to the airport at about 100 mph. The direct wind in the face was no worse than riding a motorcycle at 80 mph. My glasses stayed put with no problem. The plane flew fine and a normal landing was made.

The prop was totaled. There was a chunk missing from each blade (approximately 1" x 1/2" x 1/2") and one blade had a split from the tip toward the center about 10" long. I experienced no noticeable vibration on the flight back or in taxiing. The bird's head was missing and probably went through the prop. The leading edges of the prop were severely chewed up by the canopy fragments. The webfooted bird (Duck??) weighed in at 1-1/2 pounds. My wife was bloodstained but unhurt with a duck in her lap.

My canopy was formed from 1/8" thick plexiglass. The manufacturer increased the thickness for Long-EZ canopies to 3/16" a few years ago.

Prop and canopy: On order!

Gary Spencer"

EDITOR'S COMMENT

Char and Gary Spencer's experience with a birdstrike that broke the canopy is the first reported EZ incident of its kind. Gary remained cool and FLEW THE AIRPLANE and with no further problems, made a safe landing at his home airport. Congratulations, Gary!

We have had several reports of birdstrikes on the canopy, as well as other parts of the airframe, but none resulting in a broken canopy. Now we hear from a Texas Long-EZ builder/flyer who inadvertently took off without latching his canopy. His safety catch had been bent so it did not catch as it should have and the canopy opened rapidly, and with enough force to fail the "throw over" canopy stay bracket on the canopy frame. This allowed the canopy to open beyond its normal position and smash into the right fuel strake, breaking the plexiglass canopy into small pieces. This occurred right after lift off and, to make matters worse, it was raining! Well, our intrepid pilot remembered to FLY THE AIRPLANE. He ignored the canopy problem, slowed down to cut down some of the stinging effect of the rain and flew a normal pattern back to a safe landing on the same runway he had so recently departed from. Apart from the stinging raindrops, he suffered more form hurt pride than anything else. His canopy frame was in perfect shape, all the plexiglass was gone, but incredibly, there was no damage to his prop! Presumably, the pieces departed toward the right winglet with enough velocity to completely miss the prop. He reports that the Long-EZ flew OK, he had no trouble maintaining control or in making a normal landing. Now he is faced with the unenviable job of replacing the plexiglass canopy.

All of this goes to show that as long as you continue to think and continue to FLY THE AIRPLANE, you can fly away from even this kind of a serious emergency problem. Replacing the plexiglass is tedious, hard work but it can be done, and it's a lot easier than trying to repair a badly damaged airplane - or worse.

1) NEVER fly with your canopy warning system inoperative - NEVER EVER.
2) CHECK YOUR SAFETY CATCH FOR CORRECT FUNCTION BEFORE EVERY FLIGHT, it could save your canopy or even your life. - NEVER FORGET that there have been several fatal accidents because the canopy opened on take-off or in flight.
3) IF you are unfortunate enough to have an emergency situation such as an open canopy in flight, if you do nothing else, FLY THE AIRPLANE, then, and only when you have the airplane under reasonable control, you might consider what else you could do.

4) When pilots are faced with an emergency, frequently their first problem is realizing (or admitting) that it is an EMERGENCY. That is the first switch that must be thrown. After the pilot accepts that he or she has an emergency, and is FLYING THE AIRPLANE, and has reasonable control, obviously the flight may have become non-standard to some degree or other, depending on conditions, careful evaluation of the situation must then determine the extent of deviation from normal procedures. You must get back on the ground as quickly and as safely as possible, but NEVER exceed your own capabilities. If necessary, declare an emergency, but get an immediate clearance for any runway (if at an airport). You may have to land downwind, or crosswind, whatever. Keep your cool, watch your speed and make as normal a landing as possible, depending on the circumstances.

****From CP58-13&14 (CH30,CH33,CH39)****

A California VariEze suffered an engine failure over the airport and crash landed short of the runway in two to three feet of water. The airplane flipped over and the pilot did not survive. The FAA has stated that their initial findings are that carb ice was probably the cause.

This was carefully looked into by people much more expert in these matters than we here at RAF, and their report to us was that, yes, they would have to agree with the FAA. The weather was conducive to induction icing with light rain, fog and high humidity. This pilot was in the process of fine-tuning his EZ with the intention of entering it in the CAFE 400 efficiency race. With this in mind, he was after fuel efficiency at medium power setting. He made a number of improvements to his Continental 0-200 engine but one of these changes was probably very significant in light of the accident. He altered the intake manifold to include an expansion chamber, or plenum, downstream of the carburetor or, in this case, a throttle body. While throttle body types, in general, are highly resistant to carb ice, it is strongly suspected that the induction ice in this case probably formed in the plenum downstream of the throttle body. Tests have shown that allowing the fuel/air mixture to rapidly expand after it comes out of a venturi, or throttle body, can cause immediate and severe induction icing in the plenum and intake tubes, yet not form any ice in the carburetor or throttle body.

In view of the situation, this is very likely what happened. The builder/pilot had been experiencing power related problems since installing the new plenum -type intake manifold and had, in fact, been working on a carb heat system. He arrived over head the destination airport and reported having lost power. Visibility was poor, but he was seen on short final, gliding toward the runway threshold. Tragically, he was about 50 yards short and touched down in 2 to 3 feet of water on the extended runway centerline. The EZ pitched nose down and flipped on its back where it remained until rescuers lifted it out of the water. The plexiglass canopy was broken, the canopy frame was undamaged as were the latches and hinges. The canard failed aft on both sides, leaving a short center section of the canard still attached to the fuselage. Left and right pieces of the canard from the fuselage sides out were torn off. The fuselage was damaged below and aft of the canard. The wings and winglets were not damaged. After drying out the engine, it started and ran OK although a magneto was replaced due to waterlogging.

What can we learn from this tragedy? The pilot was unable to exit the airplane, either because it was inverted with its nose and canopy imbedded in the mud on the bottom of the shallow bay, or because he may have been incapacitated by the impact, or both. Obviously, this situation was very bad and the chances of surviving a crash landing in shallow water are very slim. Since this accident, RAF has received a number of calls and letters wanting to know how to ditch an EZ. We honestly do not know of a safe way to ditch any fixed gear airplane. The possibility of nosing over is very high with fixed gear since the gear dragging in the water produces a powerful nose down pitching moment.

If we were faced with an unavoidable water landing, we would put the nose gear and landing brake down and we would fly into the water as slowly as possible while still maintaining control. We would not unlock the canopy because when the nose dives under water, a 60 mph jet of water entering under the canopy and striking the pilot in the face, would almost certainly be incapacitating. We would recommend carrying a canopy breaking tool such as a heavy, short bladed knife, kept where the pilot could easily reach it. After the airplane has come to rest, be it upright or inverted, if the canopy was intact, the canopy breaking tool should be used to break the plexiglass, making a large enough hole to exit through. Since an EZ will almost certainly float, particularly if it remains mostly intact, the surface would not be far away.

Prior to touch down, declare an emergency and, if possible, give an accurate position report. (A Loran would sure be handy here, since you could broadcast your latitude and longitude position.) Tighten your seat belt and shoulder harness as tight as you can bear it and brace yourself as best you can. Try for the slowest controlled touch down, no fancy stalling maneuvers, these will usually only compound the problem. Since the EZ-types will almost certainly nose over, be prepared for this. Remain calm, release your seatbelt, break out and swim to the surface.

Better yet, since a successful water landing is so uncertain, perhaps we should all seriously consider remaining within gliding distance of land at all times. EZ's were never designed with landing in water as one of the goals, and they are almost certainly not at all suited for this activity.

One other VariEze crash landed in water. The cockpit area broke up and the pilot found himself swimming. He made it to the beach but had a fractured back and wound up in a body cast for two months. His EZ was severely damaged and he never did rebuild it.

Surprisingly, or perhaps not surprisingly, one of the phone calls we got suggested we, or someone, should conduct a test by deliberately crash landing an EZ, preferably by remote control, in water!

From CP58-14 (CH39)

CAN YOU HELP?

A Kansas City pilot traveled to the Grand Rapids area of Michigan where he purchased a VariEze. With no check out or weather briefing, he took off and headed for home. He landed at Peoria, Illinois for fuel. An attempt was made to repair a small gas leak in one of his fuel sight gauges before departing for Kansas City. The pilot then took off into what eye witnesses have called "marginal VFR conditions" with heavy rain, thunderstorms with tops to 41000 feet, turbulence and icing conditions reported up to 6000 feet. His last known position was 20 miles southwest of the Peoria airport. The pilot did not arrive at his destination, nor has anyone see or heard from him. His wife has been working very hard with FAA and CAP and the CAP conducted an intense search of the area for almost three weeks. Initially, the search was conducted with no snow on the ground and with good visibility, but with no sign of the VariEze.

This pilot's wife is determined to try to find her husband and has asked Burt to help in any way he can. We would ask any of you who may be in this general area, that is on a line from Peoria to Kansas City, to assist in the search. Keep in mind that a VariEze is tiny. If an EZ crashed into a wooded or brush covered area, it may not even look like a VariEze any longer. If you are flying over this area, look for anything white, not necessarily the shape of a VariEze, and please report anything to the CAP in Kansas City (phone 618-256-4815) or, if anyone knows of this VariEze, N234EZ, having landed somewhere else, please contact Mrs. Jo Ann Wilson, phone 913-888-5023.

From CP59-8 (CH39)

ACCIDENTS AND INCIDENTS

A Washington Long-EZ was circling low level over a sparsely inhabited area when the pilot felt/heard a creaking sound and immediately smelled gasoline. There was obviously a major gasoline leak as he picked out a relatively smooth area and executed an emergency landing. The pilot got out and on his way out thought he saw a hole in the fuel gauge area but right then the fuel caught fire and, unfortunately, the entire aircraft was consumed. The pilot was not injured but the cause of the fuel leak/fire is unknown. There is a highly speculative theory that the aircraft was hit by a bullet! This pilot was a Viet Nam war helicopter pilot and highly experienced in such events and is sure that is what he felt/heard just before he smelled the gasoline.

Not much we can learn here except, perhaps, to refrain from flying low over what could be someone's property - someone who may not want your flying over them and may take action against you. Keep in mind, this is speculative theory, not proven, but a strong possibility. An experienced pilot, well known to RAF and respected by all who know him as a man of integrity.

From CP59-8&9 (CH30,CH39)

A Los Angeles Long-EZ pilot/builder installed a breather system from his engine to one of his exhaust headers, similar to the system developed, tested and sold by Wes Gardner and similar to one Mike and Sally have had on their Long-EZ for over 5 years now (with excellent results). The only difference was the fact that an anti-backfire valve (one directional check valve) that Wes calls out and that Mike and Sally have installed, was omitted. On top of that, this aircraft was known to have one cylinder pumping oil (turned out to be a seized piston ring). Oil consumption was very high and this pilot had filled it with 8 quarts prior to taxiing out for take off. Just prior to taking off, the tower informed the pilot that smoke was coming from the engine. His rear seat passenger looked back and saw flames coming from the cowl near the wing root. The tower dispatched a fire truck and the fire was quickly extinguished.

The Long-EZ was seriously damaged, all engine compartment wiring was burned and the foam was melted out of the wing root. It will take several months of hard work to fix.

What caused this fire? Well, this pilot and Mike, at RAF, don't fully agree. The builder feels that the breather tube welded into the exhaust header cracked, allowing oil onto the outside of the hot exhaust, which caught fire.
Mike believes, based on his own experience, that without the anti-backfire valve, the hot exhaust gases went into the breather line, melting or burning it off. Since the engine was burning excessive amounts of oil, this line probably had oil in it and when the rubber hose caught fire, it also ignited the oil which then turned into a hot fire causing lots of damage including melting the rudder cable pulley and bracket. Mike speaks from experience! When he first installed his breather system, he also tried it without the check valve, or anti-backfire valve. He was lucky, he ran it on the ground and, when the hose melted through, he saw it before any more damage could occur. There was no fire in his case, probably because his engine was not using much oil, but the hose from the crankcase to the tube welded into the exhaust was melted/burned beyond recognition in a matter of minutes!

If you are planning on installing a breather system such as Wes Gardner's, be absolutely certain you do it right! He has lots of experience with this, so contact him, better yet, buy his kit and install it exactly per his instructions, and you will have an excellent breather system that does not throw oil all over your cowling.

From CP59-12 (CH30,CH39)

"Dear RAF:
I now have about 200 hours on Long-EZ N88LE which was completed in June 86. I have been very satisfied with its book performance and reliability. I was pleased to receive "best homebuilt" at the Eastern Regional Fly-In in Orange, Mass. this past June 88. **My most memorable "incident" occurred while flying on a cross-country a few months ago.** While over Michigan, shortly after I had switched tanks, the engine went silent and could not be restarted. I was vectored by Grand Rapids to Sparta Airport. The Long-EZ is truly an excellent glider when the chips are down, and handles nicely. Water was found in the gascolator and was found to have come from the tank filled at the last fuel stop. I don't know how this could have been prevented. The suggestion of being within reach of a landing site when switching tanks or having plenty of altitude certainly holds true. I would also like to mention that when I constructed the EZ, I installed a fuel filter after the electric fuel pump. Even though I was extremely careful to keep the wing tanks cleaned at all times during construction, I am still finding

very small (1/32 inch dia.) pieces of blue foam in the filter. I have found extremely small trace amounts also in the carburetor filter. I am convinced that frequent inspection of the carburetor filter is critical, and I would recommend the additional filter. I installed it so that it can be viewed easily before flight, and can be easily removed and cleaned.

Keep up the good work with the CP. I've found it to be an invaluable "extension" of my Long-EZ.
Bill French"

****From CP60-3&4 (CH33,CH39)****
LOSS OF POWER ON TAKE-OFF. (PIREP from Bill Perry).
"I am sorry to have to report an off airport landing with my Long-EZ due to loss of power on take off. The result was damage to the landing gear, canard and left wing.

The Long-EZ, serial no. 132, is powered with a Continental 0-200 and has been a joy to fly for the past two years and 200 hours flight time. Recently, I flew the Long-EZ to a nearby airport in Alabama for an "Aviation Day" event. About an hour after landing, I was to participate in a flyby. It was about 12 minutes after I started the engine, with outside temperatures near 90 degrees, before getting into takeoff position. The oil temperature was up to 200 degrees and I was considering cancelling the flight when we were cleared to go. Even though the engine was very warm, the temps were in the green and a crowd was watching, so I decided to takeoff. The takeoff roll was normal although an observer later told me that he saw what appeared to be smoke coming from the engine. The climb seemed a little sluggish and, at approximately 60 feet, the engine lost power.

I verified that the booster pump was on and, pumping the throttle, got a couple of very brief surges of power. The flight was so short and I was so busy looking for a place to land that I did not look at the fuel pressure and did not attempt to switch fuel tanks. The aircraft was put down in virtually the only field available. It was about 1000 feet long with the always present powerline on the approach end and was ringed with trees. Touch down was 1800 feet beyond the end of the 4300 foot runway and was 300 feet into the field beyond the powerline. The aircraft slid 240 feet in a straight line. It remained upright with the engine still running at a rough idle. The ELT was activated. The engine was shut off with the mixture control. I was not bruised or scratched. The aircraft touched down nose low because the canard was stalled and apparently the left wing was slightly low. The nose gear shock strut broke and the lower NG-15A casting cracked and came off the gear strut. The gear strut appears to be undamaged. The left main gear leg twisted with some damage to the gear attach point. The prop did not make contact. The left tip of the canard touched, breaking the canard with some damage to the F-22 bulkhead. The left wing made contact with slight damage to the lower winglet and buckling the skin aft of the outboard attach fitting.

I fully expected to go through the trees at the end of the the field and was surprised that the aircraft stopped just beyond midfield. If the plane had not been stalled in, it would have touched down much further down field and would surely have gone into the trees with probable injuries to me and major damage to the aircraft. I feel very fortunate to have avoided injury and to be left with a repairable aircraft. I am impressed that the Long-EZ could be put down in so small a field with so little damage.

I have not been able to identify a probable cause for the power loss. The engine was restarted about an hour after the landing. It ran and accelerated smoothly and both mags checked ok. There was an unusual sooty deposit in both exhaust pipes. After the aircraft was brought home, the engine was run and checked again. The throttle, mixture and carb heat controls have been checked. The fuel tank vents (two per tank) are clear. The fuel flow rate with booster pump on is 25.8 gal./hr. for both tanks. The booster pump was replaced in Nov. 1988 as recommended by newsletter CP 57, pg 7. The engine driven fuel pump has a cooling shroud as per CP 48, pg 4.

It seems likely that there was a partial vapor lock due to the heat soak from the warm engine and minimal cooling air flow. It is also possible that the engine driven pump over heated and caused a loss of pressure. When I look at the carburetor mounted behind, and very close to, the oil tank on the Continental, I suspect the possibility of fuel boiling in the carburetor. This however will not be easy to prove since I don't plan to try another takeoff with an overly warm engine."
William R. Perry

Editors comment: We have talked at length with Bill Perry about what may have caused his loss of power and we suggested carb ice as a possibility. Certainly, as a student pilot flying a C-150 (Cont. 0-200) in the humidity of the midwest, we saw carb ice on take-off at least once when it required full application of carb heat just to make it back to the runway. This would also explain why the engine ran fine an hour later - the ice melted. Whatever it may have been, we have asked Bill to keep us apprised of anything he may come up with during his rebuild and, of course, we will pass it on via the CP.

****From CP60-4,5&6 (CH30,CH39)****
PROP BOLT TORQUE. (Letter from John Bridges to Arnie Ash passed on to RAF)

"How many times have we been cautioned about checking the torque on wooden props, especially when climates change? Here's the new wrinkle that happened to me.

My Long-EZ, N642JB, has been flying since July, 1987, and has accumulated 283 hours. I have made several trips from Michigan to Phoenix, been to Sun-&-Fun twice, and many more short hops like Rough River and Oshkosh. It has been a great joy to fly and share with others. While in Phoenix, about a year ago, I talked to Great American about the poor climb performance with my 62x62 prop and 0-235C1 engine. They recommended a change to a 60" pitch would solve the problem. I flew to San Luis Obispo on the next day and Fred Griffith met me at the airport where we installed the new prop. I must add that Fred is a super guy and really helped to solve my problem.

The new prop did the job - better climb performance and I could see 2800 RPM at full throttle.

Returning to Phoenix, I removed the spinner and re-torqued the bolts. After returning to Michigan, I checked torque again at 10, 25 and every 50 hours.

Last November, I flew the airplane back to Phoenix for the winter. The airplane stayed in Phoenix until I headed for Sun-&-Fun on April 6th. I checked the prop torque on April 5th to make sure the dry climate wouldn't come back to haunt me. Prop torque was perfect and had remained unchanged all winter.

I arrived at Sun-&-Fun on April 6th and stayed until April 13th, and then flew home to Michigan. During the next week, I changed oil, cleaned the airplane and checked prop torque - no change.

On April 23rd, I flew over to visit a friend at another airport. Upon departing that airport, I could not fully retract the nosewheel. It was rotated 90 degrees from normal. I tried twice to coax it back into position without success. Since I only had 20 miles to go, I decided to leave it partially retracted. This was the first time this had happened. About 10 miles later (about 1000 AGL), I started to make a climbing turn to the left and reduced RPM to 2000, and all hell broke loose. I thought I had been hit by another airplane.

These were my thoughts as the airplane began shaking violently. I looked out - both wings still on - something's wrong with the engine - shut everything off - slow so vibration stops - look for a place to land. The City of Rochester was in front of me so I did a 180 degree looking for a place with no houses, people, cars, wires or trees. There it is, green grass - looks flat - plenty of open field - set up for landing - gear down - slow it down - trees at the other end of field - set it down. Snap, the nosewheel assembly departed the the strut - canopy shattered - nosewheel collapsed, mains folded - wheel pants (Sport Flight) stuck into wings - now I was totally a sled - started turning to the right - left tip of the canard dug in, cut into the fuselage and broke - left wing tip dug in - wing broke at corner of wing spar to inboard aileron cutout - went a few more feet and stopped.

FAA came out to investigate and stated I had picked the best place around but, if I had kept it up another 30 feet I would have missed the tire ruts that I couldn't see, and probably saved the aircraft.

What caused the sudden vibration? One prop blade broke off at the hub. Why? The threads on the prop bolts had bottomed out. Why? Apparently, the prop hub was a little thinner. The prop dried out during the Phoenix winter and the bolts could have been about 1/8" shorter. I was reading torques, but there was no clamping pressure on the prop. I also feel the nosewheel hit something on take-off and threw it into the prop, causing damage to the blade and when I retarded the throttle, it was all over.

Let this be a lesson to all of us, not only to check prop torque, but to also recheck bolt length to ensure any slight variation in hub thickness will not result in running out of threads.

PS I suffered a minor cut on the forehead (no stitches) and a very sore shoulder - it cracked the left side of the fuselage."
John E. Bridges.

Editor's comment. Many of you will recall a similar incident that happened to Dick Rutan while flying the prototype Long-EZ, N79RA, (See CP 32, page 5). Due to the spinner backplate interfering with a radius on the prop extension, the prop bolts did not provide any squeeze up or crush between the crush plate and the prop extension. Neither the drive lugs nor the prop bolts have anything to do with driving a wood prop. Only the friction between the flange on the prop extension and the forward face of the prop, plus the friction between the crush plate and the aft face of the prop, drives the prop. Once you lose the friction grip on the prop by bottoming the bolt threads, as John did, the prop is free to oscillate slightly with each piston firing stroke. This begins to elongate the drive lug holes in the prop and causes vibration. If the pilot allows this to continue for more than 30 seconds or so, the bolts will break at the base of the threads and the prop will depart the airplane (which is what happened to Dick!). The damage to the prop is usually quite graphic, huge elongation of the drive lug holes which causes the bolts to bend back and forth and ultimately break, but also usually the prop face will have evidence of charring. - Yes, lots of heat is generated by the oscillation and it burns the wood! We believe John's problem was bolts bottomed on the threads. Therefore, little or no gripping pressure between the crushplate and the extension flange, therefore prop oscillates, elongates drive lug holes, perhaps chars the wood, vibration sets in and John shuts the engine down. Prop stopped near vertical and when the gear folded the lower blade broke off when it struck the ground. The loss of one prop blade almost certainly did not occur in flight. We would be most interested to examine John's prop, but the above is our opinion here at RAF based on many accident investigations as well as some personal experiences.

From CP60-6 (CH22,CH39)
A FLORIDA VARIEZE crashed during an attempted forced landing and the pilot, the only occupant of the aircraft was fatally injured. An eye witness reported that the engine cut out and that the pilot subsequently attempted to land on a road. A local EZ builder/flyer reported to RAF that he believed the pilot may have accidentally turned the mag switches off. The mag switches in this airplane were small toggle-type switches mounted high in the center of the instrument panel close to the air vent. The theory is that perhaps because it was hot, the pilot may have attempted to adjust the air vent and accidentally knocked the toggle mag switches off. Of course, no one will ever know for certain, but this theory is plausible and we have certainly seen mag switches mounted like this that could easily be inadvertently switched off.

Use only the "locking" type switches, the ones you have to pull out to move up or down. Or place the switches where they could not possibly be accidentally turned off or on without the pilot's knowing about it.

****From CP60-6&7 (CH11,CH39)****
A TEXAS LONG-EZ experienced an unintentional landing on the dirt foundation of a future runway, causing some minor damage to the airplane but no injuries. During a fly-in, while flying in a high speed/low speed competition, this pilot was slowing to his minimum flying speed and was indicating 65 knots, very nose high, when he noticed he was sinking. At what he judged to be about 20 feet, the nose pitched down. He immediately applied power which he said had no effect, so he pulled the power to idle and held the stick full back. The nose continued dropping and he hit the soft dirt in a 3 point attitude. The Long-EZ slid to a stop in about 300 feet. Damage was minor and he had it flying again the next day.

The weather conditions were good, no rain, light winds and the airplane was being flown very light. What caused this problem? We experienced a situation very similar to this once ourselves, but at the time we were flying with an experimental canard airfoil and it was raining. This test airfoil was retired and not put into production!!

It is not normal for an EZ to behave in this way. There have been rumors over the years that EZ's were prone to this behavior, but that is simply not true. At least of a plans built, correctly rigged EZ. A Long-EZ using the original GU canard, with the elevator rigged so that the full aft stick (FAS) mechanical stop is at a point beyond maximum lift coefficient, approx. 22 degrees trailing edge down, would possibly exhibit the same characteristics described by this Texas Long-EZ pilot.

It is critically important that the maximum attainable lift on the canard occur at full aft stick. A perfectly built canard/elevator will reach maximum lift at 22 degrees of elevator deflection, however beyond 22 degrees, the lift available will decrease. When you do your initial flight testing check that you are, indeed, getting maximum lift at full aft stick.

We believe it is possible that the above incident may have been caused, at least in part, by the elevator having been deflected beyond the point at which it allows the canard to generate maximum lift. Another contributing factor may have been an incorrect airspeed indication. At 65 KIAS, a light weight Long-EZ certainly should not be at such a nose high condition that the pilot cannot see forward, nor should it stall at 65 KIAS. This pilot may have been much slower than he thought, and had actually reach the stall condition - normally a pitch bucking as the canard stalls and unstalls. If this were the case, this condition might have been aggravated by the main wing getting into ground effect which would cause a small nose down pitching moment due to the long moment arm of the swept main wing and the "cushion" between the wing tips and the ground.

It must be pointed out, however, that it would be a problem to land an EZ if this were a normal characteristic of all EZ's! After all, we have all probably landed at 65 KIAS or slower many times without having the nose pitch down prior to touch down or even after touchdown. When the prototype Long-EZ was in flight test back in 1979, we landed it many times at full aft stick. This is not a good method of landing but it can be done with some practice. It does not produce the shortest landing distance, however, and is not recommended. It is only brought up here to make the point that a Long-EZ should not do what this Texas Long-EZ did.

****From CP61-7 (CH30,CH38,CH39)****
A New York VariViggen crash landed in the Piconic Bay shortly after take-off when the engine quit. The pilot, an experienced Viggen flyer attempted two re-starts but could not get it to run. He then turned into the wind and executed a near perfect gear up water landing.

The Viggen floated and the pilot was quickly rescued by some pleasure boaters. The Viggen was towed to the beach and, after spending some 20 hours in salt water, was returned to its hangar. The left wing root was heavily damaged and the builder probably will not rebuild. The pilot was bruised and shaken up but not seriously hurt.

The cause of the engine failure was traced to the mixture outer cable attach point near the carburetor. This attachment had been perfect for seven years and almost 600 hours but failed at 600 feet over the bay shortly after take-off. This failure was such that the mixture lever arm on the carburetor was pulled to the idle cut-off position. The pilot was unable to richen the mixture, or even to move the mixture at the carburetor, in spite of his best efforts.

What can we learn from this accident? Engine controls are every bit as important and critical to flight safety as flight controls are. Check your engine controls for correct travel and try to imagine what you could do to make sure that no matter what fails, the mixture fails to full rich and the throttle fails to full power. The opposite result is simply unacceptable. A spring that pulls mixture and throttle arms to full rich and full power could prevent such a problem. At least with full power you could use the cockpit mixture lever to regulate power (it works just like a throttle) or even the mag switches to cut power off to facilitate a landing. Using mag switches to regulate power is not as good as using the mixture control. Above all, check that the clamp that secures your throttle outer cable and mixture outer cable are as near perfect as your ability and skill allows. A failure here is not acceptable.

****From CP61-7,8&9 (CH26,CH33,CH39)****
"Dear Burt,
I regret to inform you that VariEze Serial No. 235, N13EG, "Old Dog's New Trick", was destroyed in a landing accident at Blackhawk Airport, Cottage Grove, WI on Saturday, July 29, 1989.

After planning to fly to Oshkosh on Thursday, the weather wasn't reported as good until Saturday when the Washington FSS allowed as how it was good weather all the way to Oshkosh so I took off and flew to Findlay, Ohio, planning a fuel stop there. When I got to Findlay, they were giving Special VFR clearances from the FSS there. I called the FSS and when they answered my transmitter went out so I could not reply to them. So I flew on to Putnam County Airport about 30 miles west of Findlay, landed and called the FSS on the phone and explained the situation. As Oshkosh did not want you to talk to them, I decided to press on as I could receive very well. I then flew to Porter County Airport at Valparaiso, IN. Findlay FSS also gave me a good forecast for my route. After refueling at Porter County, I proceeded to the Peoria VOR and took up a 337 degree heading to miss the Chicago TCA. When I reached the town of Marengo, IL, I was due south of Oshkosh so took up a 360 degree heading. I had not been able to go higher than 3500 MSL after leaving Putnam County and the ceiling now started dropping. Soon it started to rain and I did a 180 and ran out of it again. Deciding that sitting it out on the ground would be the best idea, I started to look for airports on my chart and spotted Blackhawk about ten miles east of Madison. I was tuned to the Madison VOR and was on the 90 degree radial. According to my chart, there was a super highway running near Blackhawk so I flew until I spotted the highway and turned west, as I got onto base leg the rain started again. I could see alright out of my canopy except for the critical lower front area where I needed to see the runway. On my first pass, I could see that I was too low so I released the landing brake, added power and started a go-around. Just then I heard and felt a thump but the airplane kept on flying and climbed out. I checked what I could from the cockpit and discovered that the front of my left winglet had a crushed area about the size of my hand just above opposite the top of the rudder.

The only thing I can figure was that I had hit a big bird as I was flying over a cornfield and there were no trees or poles in the field. I climbed out and then tried to land the other way. This time I was all set up but had closed the air vent to keep the rain out of my face and just as I came down final the canopy steamed up so it was another go-around. On my final pass I tried Runway 27 again. I was set up well and as the runway was 2600 feet I was trying for the numbers. I could see that I was to the left of the runway so I banked right to line up, just as I banked left again, I felt it hit.

What I hadn't seen in the rain was that Runway 27 had a 275' displaced threshold because of a mound with a cornfield and a road that was about two feet higher than the end of the runway. The main gear and the left wingtip hit the edge of the road and separated from the airplane. The fuselage then skidded across the grass and up the runway, stopping just on the right edge of the runway just before the displaced threshold markings. I was completely unhurt so unbuckled my harness, opened the canopy and stepped out into the rain. The ELT worked because even though the radio was tuned to 119.3 the sound of the ELT signal could be heard.

The destruction was almost total, the only thing that could have been salvaged was the canard and that had some tip damage. The left wing had been torn from the center section spar. The left side of the center section spar outboard of the fuselage had been torn off separately,. The center section spar with the engine mount, engine, and fuselage tank had ripped loose from the fuselage and the fuel strakes, the only thing keeping it with the fuselage was the aileron torque tube. The right wing attach fitting was wrenched both at the wing and the center section spar. The fuselage lower aft cover was ripped off when the gear separated. It had the all glass gear tabs according to CP 14 and the tabs stayed in the airplane, although the gear legs did delaminate between the tabs. The nose gear failed to the right and crushed a small section of the lower nose. The belly of the airplane was surprisingly unscathed, just some paint scratches, at no point was the fiberglass abraded through. The engine sustained some damage, the main thing was the air intake pulled the carburetor with the intake spider attached loose from the case, breaking one bolt and cracking the boss where the other bolt was attached. The carburetor and intake spider stayed with the carcass held on with the fuel line. When the left wing separated, it swung in and dented the valve covers on cylinders 1 & 3. The propeller was shattered and the spinner had a few dents. I was lucky that it was raining as the center section spar coming loose dumped all the fuel into the engine compartment. The lower cowling and wheel pants disintegrated.

What should I have done? The first two things were lapses of memory. When I was getting the airplane ready for the trip I had planned to put RAIN-X on the canopy after polishing it but I left the RAIN-X home. The second item was that I forgot my handheld radio when I started on the trip. I'm sure that the canopy would have been easier to see through with RAIN-X and the handheld radio would have allowed me to go into a controlled field with long, wide runways. Next, when I ran into rain again I should have headed south again until I was well in the clear, there was plenty of fuel on board, having flown less that 2 hours on full tanks. Also I could have dialed up 7700 on my transponder and gone on ten miles to Truax Field which has an ARSA, I was definitely in an emergency situation.

To what do I attribute my luck in being unscathed? First of all to a great design, the one witness to the accident stated that the airplane came apart just as it was supposed to,. The fuselage cocoon ended up intact. The seat belt and shoulder harness helped. Also had TEMPER FOAM cushions, even though the airplane hit with such force that it broke the bracket on the back of the radio stack the cushions absorbed the impact so that I could not feel it. I'm sure that the TEMPER FOAM saved me from serious back injury.

Such is my sad tale and is the reason that I did not see you at Oshkosh this year.

Sincerely
James O. Eggleston"

Many thanks, Jim, for this accurate and honest accident report. We can all learn from an accident like this. Rain-X is a great idea when flying into rain, and carrying a hand held radio for emergency use is another. ED.

From CP61-9 (CH39)
A Florida Long-EZ was heavily damaged during a landing attempt on a grass strip. Reportedly, the aircraft drifted off the edge of the runway area during the landing roll and struck two concrete culverts. The pilot sustained serious leg injuries and had to be cut out of the airplane. There was no fire and the pilot, who never lost consciousness, was able to talk with the firemen and medics who were helping to get him out. We are hoping to receive a report from this pilot when he has fully recovered. If he agrees, we will publish it in the CP at that time.

From CP61-9 (CH39)
An Alaska Long-EZ struck the top of a tree and crashed, fatally injuring the builder pilot. The pilot was apparently practicing night landings and got too low on final, crashing into the tree.

This kind of accident is by no means confined to homebuilt aircraft, in fact, it is unusual in homebuilts. Night landings, especially at a country airport with few lights around, can be demanding and require lots of proficiency and extra care.

From CP61-9 (CH39)
A California VariEze crashed during an attempted go-around after landing and drifting off the runway.

The aircraft struck several landing lights then hit a 10 foot high earth berm and crashed into a fence. The aircraft caught fire and was completely destroyed. The pilot was severely burned and is in critical condition. His passenger was killed.

The pilot was not the builder of the VariEze. He had recently purchased the airplane and had his instructor with him to help him get comfortable in the aircraft. It was only his fourth flight in his newly acquired airplane. The FAA has not concluded their investigation as yet but at least for now, it does not appear that there was anything amiss with the airplane.

From CP61-9&10 (CH39)
A VariEze crashed in Southern California recently and both occupants were killed. There was one eye witness who reported observing the VariEze performing some aerobatic maneuvers before it abruptly lost power and fell to the surface of a wet salt pan. The VariEze hit the surface essentially flat with little or no forward motion and was inverted. These very unusual circumstances called for a full investigation. Two representatives from RAF assisted the FAA in trying to determine what might have caused this tragedy. The investigation team was forced to use a helicopter to examine the crash site since it was not possible to walk across the muddy salt pan which was many feet deep in places.

It was obvious from 300 feet above the crash site that the VariEze had impacted inverted, with little or no forward or lateral velocity. This was evidenced by the mud splash marks radiating out from the center of impact.

The RAF representatives returned to the crash site several times over the next three days and many photographs were taken, and there was much discussion and theorizing. While the exact cause may never be known for absolute certain, it is our belief, based on our knowledge of the VariEze design as well as our previous experiences examining several crash sites somewhat similar to this one, that this aircraft fell essentially vertically onto the surface of the salt pan. It struck the salt crust in a nose low, wings level, but inverted attitude. There was no evidence of a spin, no sign of rotation at the time of impact. The engine was not developing power and, most probably, was not even windmilling.

Two of the the eight large wing attach taper plugs were missing. We believe they departed the airplane in flight, as did the AN-4 bolt and nut that secures them in place. When the remaining six taper plugs were removed, they were easily removed <u>without</u> having to drive them out. All three AN-4 bolts had had the length of threads increased to about 3/4" using a threading die to cut these additional threads. All three bolts showed evidence of elongation of the threaded area where they had stretched possibly due to being over-torqued.

We theorize that possibly the fourth bolt was over-torqued to the point of failure, or almost failure. During this last flight, and probably aggravated by the acrobatic maneuvers, this bolt failed. None of the taper plugs fitted very well into the tapered holes in the wing fittings. For this reason, we believe that the two forward plugs on the left wing worked their way out of the tapered holes after the bolt broke, thus allowing the left wing to pivot aft on the aft two tapered plugs. There are marks on the left wing attach fittings which clearly show that the wing pivoted aft as much as 15 degrees.

The wing swinging aft by itself would not have caused this accident, however the winglet mounted on the end of the wing swinging 15 degrees left would create a powerful yaw with perhaps four times the authority of the rudder alone. Such a huge yaw angle would immediately drive the aircraft into a drastic departure from controlled flight. The airplane would flip over and experience heavy negative "G" forces which would cause the engine to starve of fuel, whereupon it would quit.

Apparently, this tumbling departure occurred at a rather high speed because the enormous negative, as well as positive "G" forces overstressed the aluminum wing fittings as evidenced by the considerable elongation of the taper plug holes in the outer plate, both top and bottom, of each wing. The inner plates of each wing fitting, top and bottom, showed much less evidence of elongation, leading us to conclude that the home made taper plugs did not perfectly fit into the tapered holes.

It is probable that the left wing, swept aft, may have caused the airplane to fall in a somewhat stable inverted spiral (as described by the eye witness). Flight experience and NASA testing have shown that a normal VariEze cannot maintain an inverted developed spin.

There is no evidence to suggest that there was any inflight structural failure of any composite parts. Every single part of this aircraft (with the exception of the two wing attach taper plugs and the securing bolt) were found at the impact site.

From CP62-7&8 (CH33,CH39)
<u>*ACCIDENTS AND INCIDENTS*</u>
A VariEze crashed soon after takeoff in Aspen, Colorado. The pilot and passenger were both killed. Engine failure is suspected. The damage to the prop is such that the engine was not running when it crashed. The FAA has not officially come up with a probable cause for this accident, but their investigation is looking seriously at fuel exhaustion or, at least, a fuel stoppage as

being the likely cause. This VariEze had been flown for at least 3-1/2 hours since the last time it was known to be refueled. Depending on the power setting and fuel tank capacity, this is very close to enough to have used a full tank of gas.

At the last known refueling, this VariEze was refueled while parked nose down. Also, the pilot did not supervise the refueling, rather, the line boy was told to fill it up.

First of all, it is not possible to completely fill the fuel tanks of an EZ while parked nose down. If for some reason you require all the fuel you can get, top if off in the 3-point position. Second, we have had it happen to us, that a line boy failed to top off an EZ fuel tank when using a very high rate of fuel flow due to the baffles in the tank causing the tank to momentarily appear full. Some refueling trucks and pumps have more flow capacity than the baffles in the fuel tank can allow the fuel to drain to all corners of the fuel tank. Don't forget this fact if you absolutely need to have the maximum fuel for a long trip. Most important of all, remember it is the pilots responsibility to check how much fuel he or she has onboard, not the line boy's. On a VariEze, built per plans, you have a 2 gallon-plus emergency reserve fuel tank in the area above the centersection spar forward of the firewall. Don't forget to check the level in this tank and to fill it if necessary. This is a get-you-home fuel supply, but it will do you no good at all if it has been used or has drained through a leaky fuel valve into the main fuel tanks. Keep this tank full, always - it could save your bacon.

From CP62-8 (CH30,CH38,CH39)
We have just received a telephone report of an engine compartment fire in a Long-EZ just after it landed. The fire was apparently caused by a Sport Flight exhaust system failure. Although exact details are not known at this time, the exhaust header broke for some reason and allowed a hot jet of exhaust gas to impinge on the cowling which caught fire.

Fortunately, this occurred on the ground and a good quality Halon gas fire extinguisher was available to put out the fire - damage was confined mainly to the cowling.

An exhaust system failure in any aircraft is cause for serious concern. Theoretically, if the pipe breaks off in flight it should not cause an immediate fire due to the high speed air being forced through the cowling and "drowning" the fire. However, as you slow down, like on a landing roll, this feature gets to be less and less of a factor and a fire can result.

If you hear a sudden, much louder than normal engine noise, assume you have a problem and that it could be a broken exhaust. Head for the nearest airport but keep your speed up. Land as soon as practical and consider killing the engine as soon as you touch down.

The EZ flyer who called in this report promised us a detailed report on what happened once he has had a chance to really look into it. We will report it to you in a future CP.

From CP62-8&9 (CH33,CH39)
A Louisiana Long-EZ crash-landed on its first flight. The pilot was not injured. Although we have very sketchy data on this incident, as is our policy, we are publishing all we do know as we do on all accidents and incidents we hear of.

Apparently the pilot got behind the airplane on final, got too slow and developed a high rate of sink. The airplane hit hard failing the gear, slid along leaving the runway and flipping over. The winglets were broken, one wing was ripped off and the canopy was smashed. The head rest broke off, but incredibly, when the airplane was lifted, the pilot had only minor cuts and bruises.

As with all accidents and incidents reported in the CP, the only reason we print them is to hopefully help someone else and maybe prevent a similar situation by being forewarned. There is no intention of judging a pilot or his or her actions.

What can we learn from the above accident? Although our own records do not show it, the FAA says that a high percentage of accidents in homebuilts occur on the first flight. This is one that did. There is no question that the sight picture out of the front seat of an EZ on final, is not like anything the average low time private pilot may have seen. It is unlikely that he has ever sat on the aircraft centerline before. The EZ must be set up to land a little differently than the "standard" Cessna, Piper, etc. In fact, it is much closer to a modern jet fighter in some respects. There is no prop in front of the pilot, the airplane does not pitch nose down as a Cessna or other single engine certified airplanes do when flaps are lowered, and it does not have to be rounded out or flared when close to the ground as a Cessna does. Rather, the landing attitude is set on 1/2 mile final by simply slowing to 80 or 90 knots. The landing brake creates no lift, no pitching moment as flaps do, all it does is provide drag to steepen the glide slope a little. The nose high attitude necessary to land is strictly a function of airspeed. Slow to approach speed and the airplane will automatically set itself to the correct touchdown attitude. Now, simply fly it onto the runway. When you have 20 to 50 landings in your log book, you can finesse the touchdown with a tiny flare, but for the new EZ pilot, this is not necessary or desirable.

Because of this "difference" in an EZ, whenever it is possible, always try to get at least a back seat ride in an EZ before you attempt your first flight, particularly if you don't have much flying experience. This can easily make the difference between a successful and unsuccessful first flight.

Just as you carefully, even meticulously, prepare your airplane for first flight, so must you prepare yourself if you are to be the pilot. Get yourself current and proficient in at least two different aircraft: A Grumman TR-2 and a Cessna 150 would be excellent, or a Champ or Luscombe and a Piper would be fine. The point is to be as sharp as you can be. Then find someone who will give you a ride in their EZ. A VariEze or a Long-EZ, it does not matter. Get a little stick time, maybe even fly an approach, it will make an enormous difference if you have at least flown in an EZ.

That is not to say they are difficult to fly - they are not, they are just a little different. Another thing to keep in mind is this - ANY aircraft will develop a high sink rate if you get it too slow, including canard types. Don't be lulled into a false sense of security by thinking you can pull the stick all the way back on short final and the airplane, because it is a canard, will look after you! A canard airplane is just like a conventional airplane, it must be at or above flying speed to fly. Get it too slow and a canard airplane will sink just as a Cessna or Piper will.

From CP62-9&10 (CH30,CH39)
Dear RAF;

My Defiant now has 350 hours on it and I've had a couple of experiences that remind me of why I built the Defiant, i.e. I've had to go single engine twice and it was a piece of cake as far as safety goes and ease of flying the airplane.

The first instance was last Spring when my rear engine broke an exhaust valve that then went thru the exhaust and splintered one blade of the rear prop. I was at gross with 4 aboard at 10,000 feet over hostile Arizona terrain and all of a sudden there was a pitch change and a slow degradation in airspeed. As I had been suspicious of #4 cylinder because of a wet spark plug and some "shavings" seen inside of the valve cover I was monitoring the EGT on 4 and it rapidly went from 1450 to 1200 or so and told me which engine lost power. I shut down the rear engine and turned around and flew the 20 miles back to Scottsdale uneventfully. On final, my 12 year old daughter, Sara announced that "her whole life just passed before her eyes". The point is that this was basically a no sweat situation due to the design of the plane and with fixed pitch props and 50% power on the front engine was all that was needed to get us home with a 9,000 foot descent. Now there is a learning point here - I had my cylinder checked out with an A&P professional and was told the shavings were from the exhaust valve springs wearing on a washer and that the wet cylinder was due to the ring slots lining up. What I should have done was to have pulled the cylinder and investigated further. By the way, about 6 weeks before this I'd switched from Aeroshell to Mobil 1A total synthetic oil. Aviation Consumer has an article that cautions that in engines with time on them, you may mobilize sludge and perhaps have problems. Aeroshell is designed to keep particles in suspension--guess what oil I'm now using.

The second incident occurred this Fall when I was commuting to Santa Maria from Scottsdale for a few weeks of work in my field of Anesthesia. I was coming home and 100 miles out over Lake Alamo, I started smelling smoke. I was at 11,000 feet and glad I was alone and not too happy, I shut down the front engine and the smoke smell went away. I've had a nuisance oil leak for 300 hours from my front engine and since it is updraft cooling it gets on the windscreen. I'd noticed that lately there had been some black streaks in the oil and figured that it was oil that was being carbonized from cylinder head heat. So I flew the plane on home and was only able to maintain altitude at 90 KIAS without the oil temp going plus 200 with the prop windmilling. So I stopped the prop but there was a strange air sound so I let her windmill and brought her on home and by descending to 7000 feet, maintained 110 KIAS and had adequate cooling. After investigation, I discovered 2 broken prop bolts and an almost-to-fail prop, the hub of which was charcoaled. The black streaks on the windscreen was prop wood. Now I had 40 hours on this prop from Great American and about 10 hours since retorquing to 40 ft. lbs. I almost checked the torque when I was in humid Santa Maria but decided, if anything, the wood would have swelled and therefore any checking could be done in Scottsdale. When I got the prop from Great American, the lug holes were too shallow and I deepened them with a plug cutter and flew all this time with what probably was a prop that may not have compressed all the way to the flange of my 8" extension. The second thing is that I relied on advice that grade 8 hardware bolts may be OK for prop bolts. I now question this and feel personally that the extra expense my be worth it, especially to all of you single engine pilots out there.

Other than these problems, the Defiant has been a delight to fly and the only advice to you other Defiant builders is that I would do a fixed windscreen for safety like Johnny Murphy did and would do a fixed front gear that would be similar to the Wheeler Express with a wheel pant. The speed penalty might be very small and the gear box could be done away with.

Mike, I'll be seeing you at Jackpot.

George (Best)

EDITOR'S NOTE; Grade 8 bolts have no place on an airplane, especially as prop bolts. They are much too hard and therefore too brittle. Aircraft bolts are ductile, not brittle!

From CP63-10&11 (CH33,CH39)
VARIVIGGEN MAN/GND
VARIEZE MAN/GND
LONG-EZ MAN/GND
DEFIANT MAN/GND

The cause of the VariEze accident that was reported in CP 62 that occurred at Aspen, Colorado has been determined by the FAA to have probably been fuel starvation resulting in engine stoppage. Since this EZ was definitely fueled while parked in the nose down position, the FAA has asked RAF to remind our VariEze, as well as Long-EZ, builders/flyers that if you are planning a long cross country and expect to have full fuel tanks, it is mandatory that you fuel the aircraft while it is sitting level on all three wheels. This is the only way you can actually fill the fuel tanks to their maximum capacity. Obviously, if parked nose down (nose wheel retracted), you will not be able to completely fill the fuel tanks and depending on where you installed your fuel caps, you may, in fact, be several gallons short. We would also recommend that you fill the tanks yourself rather than have the line boy do it. Depending on how large the vent holes are in your fuel tank baffles, to someone not familiar with your airplane, your tanks may appear to be full when, in fact, they are not. Above all, remember you, the pilot, are responsible to see to it that you have sufficient fuel for the proposed trip.

From CP64-3 (CH1,CH39)

CAUTION

How do you know what you are getting when you buy a complete, or even a partially complete, composite aircraft?

RAF gets this question more often than we care to relate. It's a tough question and we honestly don't know the answer. Perhaps the most logical approach would be to look at one with plenty of hours on it. At least, the structure is proven. The other thing to look at is the structural weight. Beware of an unusually lightweight EZ (might have some lay-ups missing, also, watch out for an excessively heavy airplane. It will probably fail at a lower "G" than a normal weight EZ).

We recently heard of a nasty accident in a VariEze that really drives home the point we are trying to make here.

The buyer purchased a structurally complete VariEze. Most of the contouring was done but not the engine installation or the wiring/instrumentation. This person spent a couple of years of hard work and lots of dollars until he was finally ready to try out his new bird. On the first high speed taxi run, with the nose wheel off the ground, he started to get it light on the main tires when suddenly the left wing folded. The right wing was lifting quite strongly and, without the left wing to balance the lift, the airplane abruptly rolled over and left the runway. It slid to a stop inverted, and although the damage to the airplane was fairly minimal, the pilot was seriously injured and spent several months in the hospital recovering.

Close examination of the wing attach area disclosed the fact that the wing fitting attach screws had never been installed! Since the micro used to contour the wings was already installed, the buyer had no way of knowing. This is just one way you could get in trouble when you buy a composite homebuilt. RAF has always been a strong advocate for build-it-yourself. If you want an airplane, build it yourself. Follow the plans as closely as you can. Have your friends or fellow EAA chapter members look at it over your shoulder as often as possible. Be conscientious and accept only your very best workmanship.

There are currently somewhere between 1200 and 2000 Rutan designs flying. By far, the majority fly well and safely because their builders took care to build their creations as perfectly as they were capable of doing. By all means, build it yourself, but if you decide to buy one, keep this true story in mind, you cannot be too careful.

From CP64-3&4 (CH33,CH39)

A Long-EZ based in Oregon crashed on take-off and the pilot was fatally injured. The cause is not known at this time but, as always, RAF publishes all accident reports we know of in the hope that these reports and analyses may help others to avoid the same problems.

The Oregon EZ had been flying for just over a year. It was reported to be a "work of art", a potential show winner. The pilot was in the habit of flying locally at least once or twice a week so he was very current. He was known for his steep climb-outs after take-off, so it was no surprise to the eye witnesses on the day of the accident when he climbed very steeply. However, at about 300 feet above the ground, the engine quit and the Long-EZ nosed over and crashed. There was no attempt to flare or land, it simply flew a parabolic arc and crashed nose first. The forward fuselage was heavily damaged but the wings, fuel tanks and centersection were essentially undamaged.

We may never know exactly what happened here, but the lesson that comes to mind is, as always, "Fly The Airplane". If you are still physically able to, you must maintain flying speed and you must contact the ground wings level, nose high at, or slightly above, minimum flying speed. Try to aim between any obstacles to minimize damage to the fuselage/cockpit area. You have an excellent chance of surviving any landing if the aircraft is under control when it touches down. Above all, never give up! Continue to fly the airplane right to the ground and then brake as required to guide the plane to a stop.

From CP64-9&10 (CH30,CH38,CH39)

I thought I would write to report an exhaust failure on our Defiant that could have been quite serious.

This involved the front engine with about 200 hours on it. The exhaust was a unit purchased from Wag Aero. It is a standard wide deck exhaust for a Grumman Tiger.

The failure occurred at two places on the unit. One spot was on the exhaust stud coming from the right rear cylinder. It was a total fatigue fracture about 1/2" below the weld to the flange.

The other failure spot was on a lower left juncture of the combined pipes as they went into the muffler.

I could not determine which crack was primary and which was secondary, but I suspect one of them caused the other. What was interesting was that the cylinder near the site of the failure had been pulled by a repair facility when an intake valve cracked.

I did not oversee the repair since it was on a standard engine and muffler combination. After a discussion with Aero Fabricators who repaired the muffler, I came to the following conclusions: When the cylinder was pulled, they probably did not loosen the entire muffler from all the other cylinders. When the cylinder was replaced, the muffler was sprung back into place in a stressed condition and was bolted into place. Aero Fabricators suggested that when the exhaust system was reinstalled after repair that it be loosely bolted into place and then heated by running the engine until it was good and hot. In this hot state, the cylinder bolts and sleeve clamps are then tightened to appropriate torque.

This exhaust system was only about 200 hours old. Since this was a certified muffler on a standard engine, things point strongly to an error in installation procedures. This caution might be relevant to other exhaust systems that are somewhat rigid between multiple cylinders.

We are also going to be balancing both engines in the near future since both starter ring gears were not part of the engines when we bought them. What was really scary was that we had a fuel line failure on the same flight on the same engine, within only 1 hour of each other.

The fuel line failure by the way was one of those fancy expensive lifetime custom made all stainless steel lines that come from Aircraft Spruce. It appears that the failure was a combination of a poor weld on the stainless steel tube and vibration failure. I am considering replacing them with good old rubber Aeroquip rubber lines that you periodically throw away. At least I never saw a rubber line fatigue.

Did you ever notice that it is all that metal on our fiberglass airplanes that seems to brake all the time? I think I am ready for fiberglass engine mounts and ceramic engines.
John Steichen

From CP64-10&11 (CH30,CH38,CH39)
"Dear RAF, "LUCKY YOU FLY A LONG-EZ " - AGAIN!
This is to relate to you an incident that occurred last Saturday, May 21.
I was flying PP-ZAD enroute to a fly-in in the south of Brazil at 8500' under positive control area and enjoying, in advance, my participation in the fly-in and the amazing performance of the Navaid Devices autopilot.

I suddenly smelled burning oil and, looking back, I saw some smoke in the cockpit and two trails of oil coming out of the oil filler door. I immediately reduced power to minimum and began to look for a place to land.

The only airport close by was under rain and no safe approach could be attempted due to mountainous surroundings.

Losing altitude slowly (what a splenderous glider is the Long!), it soon became apparent that the only safe place was a new open-to-traffic freeway with not much traffic on it. After some low passes to make clear my intentions (oil pressure was at this time around 40 PSI down from 80 PSI), I was able to make one of my best landings, not even touching the brakes and with only 20 PSI oil pressure even taxied one more mile to an adequate place clear of the traffic to park.

Some 5 quarts of oil poured from the cowling when I lowered the nose. Next day we put in new oil, ran the engine and we observed the oil coming out from the hose connecting the oil cooler to the engine. A new hose was put on, engine checked carefully and I departed form the freeway again to my home airport.

Now, this airplane is very special to me and no efforts nor expenses were spared in all phases of its construction and choice of parts which had to be always of the best quality, not bothering with prices. Even a brand new engine was ordered from Lycoming.

When it was time to choose the hoses, I decided to use the "stainless steel hose assemblies" as advertised on page 84 of Aircraft Spruce's catalog (very expensive) instead of the regular rubber material. These hoses were made to order for the sizes I supplied (copy of invoice enclosed).

I am sending the failed hose to Jim at Aircraft Spruce to have it inspected by the supplier and I also already substituted all other hoses, even those carrying fuel, with standard Aeroquip shielded hoses.

These hoses were not abused in any way and were installed by a certified mechanic of our air club.

I hope that this may help any other builder who may decide to use these hoses in their airplane.

Thanks again for a wonderful airplane that is making me more confident every day in its capabilities and anticipating my hours of safe, enjoyable flying (not quite my wife's opinion).

Next day I was on a national coverage TV network - try to imagine answering all those phone calls!
Andre J. Deberdt"

From CP65-8&9 (CH39)
ACCIDENT DATA FOR HOMEBUILT "EZ" TYPE AIRCRAFT
RAF recently received a summary of all reported accidents during the period from 1983 to 1989 for various selected homebuilt aircraft. This document was put out by the NTSB and is indeed a very sobering document.

Since there are more EZ's flying than any other type of homebuilt, it was to be expected that there would be more EZ accidents. According to this report, there have been 71 accidents during this time period and, of these, 24 of them were fatal accidents (or

33.8%). Thirty-three of these accidents were caused by mechanical failures of one kind or another while 38 were caused by pilot error.

The pilot error accidents are to be expected. Even factory built, certificated airplane accidents are mostly caused by pilot error. The unsettling thing is the very high rate of accidents caused by mechanical failures. In certificated aircraft (factory built), mechanical failures account for only 1.6% of all accidents. In homebuilt aircraft (not just EZ's, but all homebuilts), mechanical failures account for 19% of the accidents. With the EZ-type aircraft, 47% of all reported accidents from 1983 to 1989 were caused by mechanical failures.

While it will always be difficult to control the pilot error-type accidents in any type aircraft, as responsible builders of homebuilt aircraft, we need to be more aware of the things that can cause mechanical failures and possibly lead to accidents. Some of the mechanical reasons pointed out in the NTSB report are as follows: Mud wasp plugged fuel tank vent, Contamination in float bowl, Teflon tape in float bowl, Propeller failure/loss, Water in fuel, Drain not installed in lowest point, Carb ice/carb heat inadequate, Throttle spring failure, Canopy not latched, Grip came off control stick, Crankcase breather kinked (blew all oil overboard), In-flight fire, Improper wing incidence, Landing gear improperly installed (attach tab), Excessive connecting rod bearing wear.

You will note that only one of the above was an actual mechanical failure of the engine. All of the rest were simply caused by mistakes made by the builder and, essentially, all could have been eliminated by a careful, systematic approach to the important tasks of building and flying your own aircraft.

The only pilot oriented reasons called out by the NTSB report were: Careless hand propping, Lack of training (familiarity with type), Fuel mismanagement and Failing to extend the landing gear. From our own investigations of EZ-type accidents, we know that low flying, buzz jobs and low level aerobatics account for an abnormal number of accidents.

As always, the only reason we publish information of this nature is in the hope that it may help prevent more accidents.

Supplemental Chapter 40, Liability and Insurance

****From CP26-5 (CH40)****
FROM ED ROCKWELL - "I've decided to sell my VariEze, can you advertise it in the newsletter?"

Answer - Due to the inferred approval of airplanes that we do not have control over their quality control and workmanship, we cannot do this. It presents a possibility of liability on our part if it were defective. The builder of a homebuilt should seriously consider the liability aspects before selling his aircraft. Since he is an aircraft manufacturer todays American legal system may charge him for strict liability in tort. What this means is, if the airplane he builds injures someone he may be held liable even if he is not proven to be negligent! It's surprising what a lawyer may dream up if the airplane you built should ever crash. Even though you are not negligent in any way it could cost you more that the airplanes worth just to defend yourself. The following is a true story: An individual conducted all the flight tests of a new homebuilt in a competent and professional manner. He then put it up for sale. A buyer arrived and the seller conducted a full checkout. The buyer nearly crashed on his first flight due to low pilot proficiency and low threshold of panic. The seller worked with him until his proficiency improved to the point where he was more comfortable, but cautioned him to not carry passengers and to fly in a limited envelope until he had a great deal more experience. The buyer left with the airplane and as soon as he arrived at his destination he took off with a passenger and with the cg out of limits. He crashed, killing both occupants. Now nearly two years later, the seller is being sued for ten million dollars.
Because of the present ridiculous legal liability situation we at RAF would never sell any of our experimental aircraft. Both the VariViggen prototype N27VV and the VariEze prototype N7EZ were donated to the EAA museum.

****From CP29-3 (CH39,CH40)****
ACCIDENT ANALYSIS
As you know from reading the Canard Pusher, we report a synopsis of each accident and make recommendations to builders/operators on any item we feel should be changed or emphasized to decrease the probability of reoccurrence. We have reviewed the data available and have found one factor that is significant. A high percentage of the accidents (minor and serious) have occurred within the first few flights after a new owner has bought the airplane from a previous owner. Statistically, you are far more likely to have an accident flying a homebuilt built by someone else. This is true for experimentals, not just for VariEzes. For example, an all-metal type that recently was grounded for a series of structural failures - all the failures occurred after non-builders had bought the airplanes.

The factor may be a combination of inadequate familiarity with the airframe and systems, inadequate checkout and inadequate transmittal of documentation. Putting things in perspective, it is important to note that the builder is an aircraft manufacturer. **As such, he may be responsible to a buyer for the quality of the machine and for properly educating the buyer in it's safe use and the extent of his flight test program.** We at RAF provide builder support to our customers - those who may need assistance or have questions on how to interpret the plans to build or how to interpret the Owners Manual to fly the completed aircraft. But, if you sell your airplane to another person you cannot expect that we can support him. He must go to you, the aircraft manufacturer. For example, if he needs to do a fiberglass repair, but does not have the plans and educational material he will not know how to do the job. He needs to get that information and documentation from the manufacturer.

Homebuilt accident record statistics were reported for a three year period by The Aviation Consumer last year. They show an overall accident rate for VariEze of 2.59 (1.55 fatal) per 100 aircraft during the 3 years. Average for all homebuilt aircraft was 3.93 (1.07 fatal). We are not happy with this result, as we had expected the VariEze to be significantly better than the average homebuilt due to it's strong structure and good stall characteristics. Structurally the fiberglass VariEze has a perfect record - no inflight airframe failures in 100,000 flight hours. Also, there have been no fires either in operation or due to accident impact.

Data published by one source show that flying amateur-built aircraft is statistically a very risky sport, with an accident rate (per individual) higher than that for racing cars.

****From CP31-3 (CH36,CH40)****
BUILDER-INITIATED CHANGES
This is an item that needs to be put into perspective, since we often answer questions and often observe activity that we consider questionable. First, we do recognize that you are the manufacturer of your aircraft and that if you do not agree with us on specific details you have every right to modify, redesign, substitute etc., on your aircraft and to then take the risks of trying something new and untested. We do recommend only that which we have tested, since it is the only configuration we know is adequate and, by our own experience we can report on and support.

Any builder (at least U.S. builder) has the freedom to build his own aircraft exactly as he sees fit. Changes he makes will be opening up new areas not substantiated by test. We have no argument with this. However, if he makes recommendations to other builders on a change that he likes, but has not verified by test, he should realize that he may be liable for loss or injury caused by that change.

If, for example, you recommend a larger engine or a substitute of an inferior foam core to someone else, without fully qualifying and testing the many design changes that may be required, you must remember that those builders are now counting on you to be right and that your responsibility is then extended beyond your own risk with your own airplane.

From CP46-9&10 (CH40)
LICENSE TO BUILD RAF AIRCRAFT
Those of you who are active builders know that your purchase of plans from RAF, entitles the holder to apply for a license to allow him to construct one aircraft from the purchased set of plans. Plans sold without the license indicate that the purchaser has obtained the plans for the purposes of using as a book or educational material to learn fabrication or design processes but not to build and airplane of this specific design.

In the past, RAF has accepted transfer of that license from the original purchaser to a second party when that transfer was requested by the licensee and the license was transferred. However since this summer, current agreements specify that RAF support only those who are previously licensed to build the RAF designs and we cannot issue further licenses for any further production of the designs. In order to provide the best possible service to those licensed to build the aircraft with the remaining funds available for support we must insist that the support be limited to only those who are legally building the aircraft. ie; those who have obtained a license to build one of the designs from RAF.

We are aware that there are instances where people are fabricating an EZ without a license from RAF. If those people have gotten information or authorization to do so from one of the licensees it must be made clear as to what the licensees' responsibilities are. Keeping in mind that the individual that has obtained a license to build a Long-EZ for example, has the permission of RAF to copy the prototype Long-EZ for one airframe. He is the aircraft manufacturer and he is using certain design information purchased from RAF as well as other design information that he has generated himself or obtained elsewhere. There is no such thing as a conformal amateur built aircraft since there are no official conformality drawings accepted by the FAA or anyone. The FAA thus assumes that each aircraft is indeed a new type and does not have to conform to specific drawings or manufacturing processes. The drawings and manufacturing processes to be used on each airplane are totally the decision and right of the homebuilding manufacturer.

Now if you, as a licensee, wish to discontinue your project and sell it to someone, the new buyer is dealing with you, the licensed manufacturer, not with RAF.

RAF's responsibility is to support the individual that has the license, not a third party. Thus keep in mind that if you are selling a project, don't expect that RAF can or will provide builder support to the person buying your project. That responsibility rests with you the manufacturer. You are then effectively licensing the third party to produce an aircraft of which you own all manufacturing rights. It is strongly suggested that if you do sell a project, either a completed airplane or a partially built airplane or a set of plans, that your contact an attorney and have him draw up an agreement between yourself as manufacturer and the new party whom you are authorizing to build an airplane and be certain that the agreement provides you with some release or indemnification from liability should that aircraft ever be completed and flown. Keep in mind that you are ethically obligated and responsible to the person who has trusted you for that information and that he may need continuing support to allow him to operate the aircraft safely. If you own a license from RAF, RAF will provide the support to you, however, it is your responsibility to pass that on to the individual that you have your own agreement with.

Refer to the adjacent diagram. **DIAGRAM OMITTED** In order for us to provide adequate support to those that have the legal right from us to manufacture the design, we must deal only with the licensee. Keep in mind that if you sell your plans, you are not merely selling someone a library book. **You are authorizing them to build an aircraft and warranting the information.** You ethically should promise to them that you will follow up whatever support is needed in the future to allow them to safely operate any aircraft built from the design information you have sold them.

Many people do not realize the responsibility that may be attached to providing an agreement or license for someone to build a design based on information provided in the sale of plans. We do and that is why we intend to maintain our policy of providing to those licensed to build the aircraft any safety information that may come up in the future as a result of operational experience indicating any modification required or revision in the operating limitations.

This is why we at RAF intend to continue to provide the support necessary to allow a conscientious homebuilder to have the information at his disposal to build and operate a safe aircraft. The support role is not an easy task, it is one that involves many facets. Communication with the builder, continued testing of required modifications, follow up communication with the operators to determine if safety problems exist, accident investigation to determine if a cause is something that could be common to more than just the one aircraft, etc. The costs of maintaining all these activities have been extremely high, thus we have had to seek out other jobs and activities for the personnel involved. We anticipate that the support will be limited to those items relating to safety of operation and to provide those licensed to build the aircraft.

From CP46-10 (CH40)
LICENSED MANUFACTURER/HOMEBUILDER DIAGRAM OMITTED
Note: The licensee, not RAF, is responsible to the new manufacturer. If you sell a completed aircraft, you may be liable for any manufacturing flaws. If you sell a partially completed aircraft, you may be liable for any flaws in your work. If you sell your project, or even just your plans, you are ethically responsible to provide builder support and to pass on safety information.

From CP47-5 (CH40)

INSURANCE FOR EZ'S

This is a subject we at RAF have not addressed before. We believed it was up to each individual. Lately, however, we have been receiving and inordinate number of requests and inquiries. We have done a little investigation into the insurance situation and what we have found is not very good news.

From what we can learn, very few insurance companies will even cover experimental aircraft, particularly composite aircraft. One insurance agent told us that part of the problems have been caused by a very high accident rate of two other composite canard designs (not RAF airplanes). Most of these accidents were takeoff or landing accidents that resulted in considerable damage to the aircraft involved. Many of these aircraft had full hull coverage and the builders involved put is claims out of all sensible proportion to what it would have realistically cost them to do the repair. The result of this, predictably, has been an unprecedented increase in insurance premiums and, in a lot of cases, it has become very difficult to even obtain insurance. Several major companies now refuse to insure composite homebuilts. Unfortunately, all composites have been lumped together, so those of us who fly EZ's are being penalized even though the EZ's have an excellent safety record.

Many of us who have been flying EZ's for several years now have been shocked by insurance premiums that have doubled or more. We at RAF have been insured through the EAA recommended insurance company, Aviation Insurance, P.O. Box 19267, Greensboro, NC 27419, for a number of years, yet this year, our premiums have almost doubled. We have heard from several builder/flyers who have received quotes of between $500.00 and $800.00 a year for liability coverage only! Our approach to this problem has been to request a quotation for liability insurance to cover only the pilot and aircraft and not the passenger. This has dramatically reduced the quoted premium to between $250.00 and $300.00 per year depending on pilot experience and time in type.

Full comprehensive or hull coverage on an airplane which you have built yourself is probably a waste of money. Full hull insurance is very expensive. Most companies have a deductible of $500-$1000.00. Most accidents that would result in damage to the aircraft requiring an insurance claim probably would be taxiing accidents, brake failure, 'run into the hanger' type accidents. The kind of thing that might require a new canard or wing, at most. Think about that - you built the original, obviously you can build a new one and, probably, at less cost than the deductible!

Some builders have difficulty obtaining even liability insurance coverage for first-flight and first 40 hours of testing. The insurance companies' reasons for this is that the pilot has zero time in type. This leaves our first time builder/pilot with no insurance coverage. This is an added mental burden that the new pilot does not need at a time like this. What other choice does he have? Get a check out in a Long-EZ or VariEze? Who will let him fly their pride and joy from the front seat? Very, very few builder/pilots will do that. No, he has no choice. He goes ahead, he flys his first flight, flys off his 40 hours. Now, he can get liability insurance coverage, because, now he has time in type - ironic, it is not?

If you have any questions, contact Harry Hannish at the EAA headquarters, (414)426-4800. Harry may be able to help.

This editorial is printed here not to offer solutions, we know of no solutions. It is published in the hope that it will result in some input from you, the reader. If you have any experience, suggestion, or solutions, we would like to hear from you. Write to the Canard Pusher at RAF.

From CP50-5&6 (CH3,CH30,CH40)

MAJOR CHANGES - YOU AND THE FAA

Quite a number of EZ builders have been making "major" changes to their EZ's and not working with the FAA, either because they don't realize they are required to or because they don't realize that what they have done is a major change. A classic example is an engine change to a larger engine. Now RAF cannot recommend a change such as this, but we don't like to see our builders getting into trouble.

If you decide to make such a change after you have already had the airplane licensed and signed off, you must contact your local FAA and work with them to keep yourself and your aircraft legal. "Who will ever know?", you may say! "We did not even change the cowling.", you say! Well, here is the straight skinny. As soon as your make a major change as defined by the FAA, your airworthiness certificate is automatically invalid. **Worse than that, your insurance is also invalid.**

If you should have an accident that would damage someone else's property, your insurance will not pay - you or your survivors will pay. That could be a really nasty problem. On top of that, the FAA takes a very dim view of this sort of thing and they will prosecute you. The penalty is not some little thing to laugh off, either. The fine is $1,000.00 per flight!!

As you can see, very obviously, it is not worth the risk, especially since it is so easy to comply and keep everything above board and legal. All you have to do is to inform your local FAA what it is that you are planning to do. They in turn, will issue you a new, temporary, airworthiness certificate which will again limit you to within a 25 mile radius of your airport for a certain number of hours. Normally, this will be from 5 to 25 hours depending on the change and on the local FAA official. After you have successfully completed your test flying in the local area, or have flown off the hours, the FAA will issue a new "permanent" airworthiness certificate, and you are back in business, and your insurance is valid.

Do yourself and the homebuilt movement a favor, comply with the regulations and keep yourself and your airplane legal. It is an inconvenience and may take a week or two but, in the long run, you will be much better off and you may save yourself or your family untold grief.

From CP54-1 (CH35,CH40)
WHAT HAPPENS IF YOU SELL YOUR PROJECT OR YOUR PLANS?

ILLUSTRATION OMITTED

Note: The licensee, not RAF, is responsible to the new manufacturer. If you sell a completed aircraft, you may be liable for any manufacturing flaws. If you sell a partially completed aircraft, you may be liable for any flaws in your work. If you sell your project, or even just your plans, you are ethically responsible to provide builder support and to pass on safety information.

LICENSE TO BUILD RAF AIRCRAFT
Those of you who are active builders know that your purchase of plans from RAF, entitles the holder to apply for a license to allow him to construct one aircraft from the purchased set of plans. Plans sold without the license indicate that the purchaser has obtained to plans for the purposes of using as a book or educational material to learn fabrication or design processes but not to build an airplane of this specific design.

When RAF had been selling plans, RAF had accepted transfer of the license from the original purchaser to a second party, when that transfer was requested. However since mid 1985 when rights to the RAF designs were sold agreements specify that RAF support only those who are previously licensed to build the RAF designs and we cannot issue further licenses for any further production of the designs. In order to provide the best possible service to those licensed to build the aircraft with the remaining funds available for support we must insist that the support be limited to only those who are legally building the aircraft ie; those who have obtained a license to build one of the designs from RAF.

We are aware that there are instances where people are fabricating an EZ without a license from RAF. If those people have gotten information or authorization to do so from one of the licensees it must be made clear as to what the licensees' responsibilities are. Keep in mind that the individual that has obtained a license to build a Long-EZ for example, has the permission of RAF to copy the RAF prototype Long-EZ for one airframe. He is the aircraft manufacturer and he is using certain design information purchased from RAF as well as other design information that he has generated himself or obtained elsewhere. There is no such thing as a conformal amateur built aircraft since there are no official conformality drawings accepted by the FAA or anyone. The FAA thus assumes that each aircraft is indeed a new type and does not have to conform to specific drawings or manufacturing processes. The drawings and manufacturing processes to be used on each airplane are totally the decision and right of the homebuilding manufacturer.

Now if you as a licensee wish to discontinue your project and sell it to someone, the new buyer is dealing with you the licensed manufacturer, not with RAF. RAF's responsibility is to support the individual that has the license, not a third party. Thus keep in mind that if you are selling a project, don't expect that RAF can or will provide builder support to the person buying your project. That responsibility rests with you the manufacturer. You are then effectively licensing the third party to produce an airplane of which you own all manufacturing rights. It is strongly suggested that if you do sell a project, either a completed airplane or a partially built airplane or a set of plans, that you contact an attorney and have him draw up an agreement between yourself as manufacturer and the new party whom you are authorizing to build an airplane and be certain that the agreement provides you with some release or indemnification from liability should that aircraft ever be completed and flown. Keep in mind that you are ethically obligated and responsible to the person who has trusted you for that information and that he may need continuing support to allow him to operate the aircraft safely. If you own a license from RAF, RAF will provide the support to you, however, it is your responsibility to pass that on to the individual that you have your own agreement with.

Update Number 69
to
Supplemental Chapter 41
Additional Reading

****From CP69-1&2 (CH35,CH41)****
ATTENTION BUILDERS
If you are currently building a Long-EZ, you are missing a bet if you do not subscribe to the Central States newsletter. Editor Terry Schubert is doing a tremendous job of writing and publishing really helpful builder hints.

Contact: Terry Schubert
9283 Lindbergh Blvd.
Olmsted Falls, OH
44138-2407

If you are currently building a Defiant, you should subscribe to the Defiant Flyer. Defiant builder/flyer John P. Steichen is the editor of this excellent newsletter which is full of information on building and flying the Defiant.

Contact: John Steichen
960 86th Street
Downers Grove, IL 60516

****From CP69-3 (CH22,CH41)****
THE AERO ELECTRIC CONNECTION
is a book published for people who desire a working understanding of aircraft electrical systems and components. It is produced as a periodical publication of chapters on specific topics. For example, issue #1 covers d.c. electrical fundamentals, batteries, engine driven power sources, voltage regulators and grounding. Issue #2 continues overvoltage protection, low voltage warning systems, wiring, wire terminations and circuit protection. This first of a series of simplified wiring diagrams for composite airplane with high capacity alternators was published with issue #2. Issue #3 added diagrams for airplanes with and without starters plus versions using small permanent magnet, dynamo type alternators. A series of do-it-yourself avionics articles and kits are in planning. An entire issue will be devoted to providing a customizable book form wiring diagram for your airplane.

Contact: The AeroElectric Connection
Medicine River Press
6936 Bainbridge Rd.
Wichita. KS 67226-1008
316-685-8617

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Update Number 73 to Supplemental Chapter 41 Additional Reading

****From CP73-8&9 (CH22,CH41)****
OVER-VOLTAGE PROTECTION
Most modern homebuilts today have very expensive avionics in the panel, yet few have protection from a run-away alternator. Don't think this never happens - we have reports from two builders since last CP! The cause can be as simple as a loose or badly corroded connection on the "field" nut on the alternator. The result can be the total loss of such items as radios, transponders, lorans, intercoms, even Bose headsets!

A simple fix is to use one of Bill Bainbridge's linear voltage regulators with built-in over-voltage protection. Don't risk your expensive avionics - install some form of over-voltage protection before you fly again. A truly excellent source of information on things electrical is Bob Nuckoll's AeroElectric Connection.

Contact at: 6936 Bainbridge Road
Wichita, Kansas 67226-1008
316-685-8617

The service is offered by subscription; back issues are available and strongly recommended. The major effort now is to write and illustrate a book. Work in print right now totals about 200 pages with lots of illustrations. Chapters presently cover:

1 D.C. Fundamentals
2 Batteries
3 Engine Driven Power Sources
4 Voltage Regulators
5 Grounding
6 Over Voltage Protection
7 Electrical System Instrumentation
8 Wire Selection & Installation
9 Wire Termination & Connectors
10 Circuit Protection
11 Switches, Relays & Contactors
12 Lighting & Lighting Controls
13 Antennas and Feedlines
Appendix A List of Supplies for New & Surplus Parts
Appendix H Collection of Hot Flash Newsletters
Appendix K Collection of Do-it-yourself Avionics projects
Appendix Z Power Distribution Diagrams (Big Foldouts)

Future chapters will cover noise and interference, motors and controls, audio/intercom systems, ignition systems, system reliability, pilot workload reducers, electrical load analysis, failure mode effects analysis, and how to develop a customized wire-book for your airplane. Appendix K will continue to grow. Planned projects include an audio/intercom system, hall effect battery ammeter, an accurate, used calibrated fuel gaging system, expanded scale voltmeter, and many more. Appendix D is being planned to carry excerpts from various manufacturers' catalogs with detailed information on components and supplies. Appendix S will outline custom design, fabrication and documentation services to be available soon. Issues consisting of chapters to the book are supplemented by Hot Flashes from the AeroElectric Connection: a newsletter which addresses timely topics and carries errata information for the book.

The service will shift to quarterly newsletter when the book is finished. Newsletters will carry regular features in addition to timely topics and error corrections. A planned feature is a "Catalog Watch" column where items for sale and of interest to readers will be listed. We'll carry articles from readers on discoveries or ideas they wish to share. The newsletters will provide a vehicle for periodic updates, sometimes complete replacement of chapters in the book as new technology or information dictates.

Subscriptions are $10.00 per issue. Back issues should be ordered and they are always available. Issues #1 through #4 may be purchased as a group for $32.00. Subscriptions for other than USA or Canada should include $4.00 per issue for first class, air mail postage. Book material has been planned for at least 7 issues. The Connection is published in three-ring, loose leaf binder format; a "living" work that will be updated as technology advances and/or new information is found. From time to time, Hot Flashes will be mailed to subscribers when an important subject must be addressed between regular issues of the Connection.

Update Number 80
to
Supplemental Chapter 41
Additional Reading

Information derived from CP80 published by RAF Jan 1995

****From CP80-4&5 (CH30,CH33,CH41)****
SKY RANCH ENGINEERING MANUAL
(SECOND EDITION) BY JOHN SCHWANER
This is quite simply the best book on the subject of air cooled aircraft engines that we have ever read. Covering a variety of subjects including engine inspection, engine performance, cylinder repairs, lubricants and wear, hose assemblies, trouble shooting, performance limits, vibration and balance, and an excellent section on fatigue analysis, this book is easy to read and understand. It contains valuable "gems" of information derived from a lifetime of overhauling engines and a hobby of studying failures. It is an absolute must for anyone interested in operating and maintaining a Lycoming aircraft engine. There is a complete list of all Lycoming engines in the Lycoming engine specification chapter.

There are many operational techniques described from how to start the engine through proper leaning, to taxiing and shutdown techniques, oil and grease specification and uses, etc., etc. We highly recommend John's book.

Call: Sacramento Sky Ranch
916-421-7672

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Update Number 81
to
Supplemental Chapter 41
Additional Reading

Information derived from CP81 published by RAF July 1995

****From CP81-3&4 (CH30,CH33,CH41)****
"Dear RAF,
Greetings from Houston... I had come across some information recently that would probably be of interest to EZ drivers and builders for your next CP.

I noticed in CP 79 your comments about using TCP to counter the effects of lead in the fuel. I had been suffering from sticking exhaust valves over the years in my 0-200 and finally had decided best to do a complete overhauls and install new (millennium) cylinders. The engine work was done by Dick Demars Aero in Fort Collins, CO. - they do excellent work and I highly recommend them to anyone contemplating an overhaul. At their suggestion, I've started using "Av-Blend" an oil additive that is supposed to be a big help in preventing exhaust valve sticking. Although it is too soon to tell (I've only 100 hrs. SMOH), I have been using it at each oil change and subjectively, (sound, smoothness) it seems to be helping. I'm told that TCP will help in the lead fouling area, but ultimately won't solve the "caking" of oil that occurs on the valve stems. The Av-Blend folks sent me some technical data on their product which I'm forwarding to you. I get mine from Engine Additives, Inc. in Humble, TX (800-672-7262), but it is produced by TechniFlyte Corp. in Chicago (800-209-0083). They've got some fairly impressive test results to back up their claims.

There are two very interesting NASA reports available to the public that were written in '85 and '86 on the results of the wind tunnel tests they did on the full scale VariEze and the 2/3 scale VariEze. One is about 80 pages, the other 60, and they are full of interesting data on the basic aerodynamic characteristics as well as the aircraft's stability and control parameters. I'm sure you at RAF have seen them - but it is not generally known that copies can be obtained by anyone wanting to add to their "canard-pusher library". They are excellent reference material for anyone flying an EZ. They are available through the National Technical Information Service by calling 1-800-553-6847. The first report is entitled "Wind Tunnel Investigation of the Flight Characteristics of a Canard General Aviation Airplane Configuration". The document number is NTIS No. N-87-10039. (NASA Technical Paper 2623). The second is entitled "Wind Tunnel Investigation of a Full Scale Canard Configured General Aviation Airplane (NASA TP 2382). The document number is NTIS No. N-85-19935. The only hitch is they aren't free - they are about $19.50 each, but they will take your order by phone at the NTIS 800 number if you use a credit card.

Deep Stall info update: I was perusing these wind tunnel reports recently when I noticed an interesting piece of data about high angle of attack characteristics of the EZ. I remember a couple of years back when we had our discussions about the Long-EZ deep stall incident that someone had asked about the possibility that engine power could aid recovery. At the time, I think we concluded it would not since the thrust line was basically through the cg. However, the wind tunnel data does show a fairly significant restoring moment is added in the pitch axis by going from idle to full power - about as much nose-down moment as the elevator provides, at the high angle of attach of a deep stall. A good piece of data to keep in your hip pocket should you ever encounter a deep stall inadvertently. Applying full power could aid in recovering an EZ - this is a characteristic of pusher prop configuration.

Well that's about all for now in the airplane department - I'm fully engaged in training for my next shuttle fight scheduled for this June. I've been assigned as pilot on the Atlantis crew with a mission to take two Russians up to the Russian MIR Space Station. We'll be making the first ever docking of a space shuttle with another space shuttle. Two 250,000 lb. vehicles will come together at little over 1/10th of one foot per second relative velocity. It's an interesting (and fun) flying task. This is also the first time we've docked with the Russians since Apollo-Soyez in 1975. We'll remain docked for 5 days and will leave the 2 Russian cosmonauts on board their MIR station and will bring home the 3 crew members who are up there now (2 Russians and an American - our first to fly on a Russian craft). They will have been there 90 days when we arrive so will probably be ready to come home. If all goes on time, I'll look forward to seeing you again at Oshkosh.

Fly Safe,
Charlie Precourt"

Ed. Note

We concur with Charlie on the use of engine power to aid in recovery from a deep stall in a canard pusher-type. In fact, we used this successfully on several occasions during high angle of attack testing of the Mercury aircraft, a development of the Microlite which was designed and built for Colin Chapman, Lotus Cars of England.

ACCIDENTS AND INCIDENTS

As always, the following reports are published for the sole purpose of helping others to avoid the same problems that caused the accidents.

Supplemental Chapter 41, Additional Reading

****From CP28-4 (CH41)****
<u>New Book Details Rutan and RAF Evolution.</u>
A new Tab publication (TAB books, Blue Ridge Summit, Pa, 17214) written by Don and Julia Downie, titled "Complete Guide to Rutan Homebuilt Aircraft" is now available. It is the result of several months of research by the Downies. While much of the book consists of previously published information, the reader who is curious about the early years of Burt Rutan's aircraft work will find extensive information never before written. Also the book is profusely illustrated with over 100 photos.

****From CP32-1 (CH41)****
RAF has made a "few" covers of magazines since the beginning of '82. The following is a list. The first three are photos taken by our own RAF photographer, Pat Storch.

Popular Science - May
Homebuilt Aircraft - April
Aviation Week and Space Technology - January 25
AOPA Pilot - April
Plane and Pilot - April
Private Pilot - April
Homebuilt Aircraft - May

****From CP33-6 (CH3,CH41)****
<u>Moldless vs Prefab shells for Homebuilt Construction.</u>
We often get requests to provide molded shells of the Long-EZ to make it "easier to build". Our experience with molded shells has indicated that the full-core moldless structures provide more reliable structures without compromising building time. The most meaningful demonstration of this though, is actual homebuilder experience. Johnny Murphy, who has built four different moldless aircraft, recently completed a molded Glasair. **His comments on relative simplicity are printed in the Spring '82 issue of Sportsman Pilot magazine. Sportsman Pilot is a quarterly with very quick response publishing of current homebuilt news. Each issue has a wealth of the latest happenings in the experimental world. Subscriptions are $7.50 a year, Box 485, Hales Corners, WI 53130.**

****From CP36-1 (CH41)****
<u>RAF ACTIVITY</u>
Since the January newsletter RAF had a trip to the Annual Sun 'n Fun flyin at Lakeland, Florida. The Solitaire was shown with the retractable engine at the Soaring Society of America's convention in Reno, Nevada. The doors were installed on the Solitaire and much work has been done toward preparing the distributors for the Solitaire program. Mike and Sally's Long-EZ made the cover of Technology Illustrated magazine. Builder support and Saturday demos continue as usual.

****From CP41-5 (CH9,CH41)****
<u>Brake pads</u> - As reported in a previous newsletter, Dick Kriedel and Mike Melvill have been trying a new Cleveland brake pad. This is a semi-metallic material and works quite will. Brake effectiveness is increased and brake pad life is extended. It is important however to use the correct break-in procedure for this type of pad or you will not realize its full potential.

Remove your wheel pants and taxi at 40 to 50 knots. Execute <u>three</u> consecutive <u>hard</u> brakings to a stop. Do <u>not</u> allow brakes to cool between brakings. This procedure will glaze the brake pad surface and prevent uneven pad wear and brake disc scoring. This is Cleveland's recommended procedure for the semi-metallic brake pads, Part #66-56. These pads are available from Aircraft Spruce.

If you are using the regular organic Cleveland brake pads (Part#66-2), and entirely different break-in procedure is called for. Remove the wheel pants and taxi at 25 to 40 knots. Brake to a stop using <u>light</u> pedal effort. Allow the brakes to cool. Repeat this procedure a <u>minimum</u> of six (6) times. This will generate sufficient heat to cure the resins in the pads, but will not get so hot as to cause carbonization. A single hard brake application on organic linings can carbonize and prevent attainment of the correct coefficient of friction for the entire life of the linings (which won't be long).

The above information was sent in by Long-EZ builder, Dick Kriedel, who tells us that you can get an informative catalog containing lots of wheel and brake information for $2.00 from:

Cleveland Aircraft Wheel and Brake Division
Parker Hannifin Corp.
P.O. Box 158
Avon, Oh 44011

From CP42-8 (CH41)
New Book News. "Canard - A Revolution in Flight" by Andy Lennon, Foreword by Burt Rutan. A complete history of canards, tandem wings and "tail first" airplanes. $17.95. Order from RAF or

Aviation Publishers,
P.O. Box 234,
Hummelstown, PA 17036
717-566-0468

From CP43-2 (CH41)
1/5 SCALED LONG-EZ MODEL UPDATE
Four different model airplane magazines are doing "in-depth' reviews of the 1/5th Scale Long-EZ. Look for them on the newsstands. **We read an article in March 1985, "Flying Models"** by Nick Nicholson, who built and flies one, and for anyone interested in the model, this is an outstanding article. The kit is really top class and easy to build. RAF has kits in stock for pick up or you can write to St. Croix Models, P.O.Box 279, Park Falls, WI 54552. (715)762-3226. Talk to Jim Schmidt.

From CP43-2 (CH3,CH30,CH35,CH41)
HOMEBUILDER RESPONSIBILITY
Reading through Rex Taylor's "Dragonflyer" newsletter #17, we noted an excellent article covering homebuilder responsibility. We would like to reiterate on this because we believe that you the homebuilder should be aware of what you are taking on when you build your own aircraft.

The FAA has set up the Experimental Amateur built category (thanks mainly to EAA) to allow an individual to design, build and fly his own aircraft. The FAA lists that individual as the manufacturer. As the manufacturer, the builder is entirely and totally responsible for that aircraft. The builder has passed judgement on the quality of workmanship and he alone has made the decision that each and every part that he has put into that aircraft, is in his opinion, airworthy.

A lot of builders are under the mistaken impression that the FAA inspector will guarantee that the aircraft is airworthy when he inspects the aircraft and issues a airworthiness certificate. The FAA does not decide your aircraft is airworthy, you do.

For this reason, every builder should become involved with the EAA. Join your local EAA chapter. Attend their monthly meetings, talk with other EZ builders. **Many good books are available from EAA. Supplement your plans with a few, such as Tony Bingalis' "Firewall Forward".** After you have got something built, get as many people as you can, to look over your work. Don't be embarrassed. If someone critiques your work, take a strong look at it. If it is not right, throw it out. Your best assurance of success is to adhere strictly to the plans and to build it from the correct materials. In order to be positive that you are using the correct materials, buy them only from the recommended suppliers.

The same philosophy is also true for engines. Almost daily we receive calls or letters from builders wanting to substitute some wizz-bang engine for the recommended one. RAF can not ethically recommend an engine we have not installed and tested. For the Long-EZ we recommend any model of the Lycoming 0-235. If you wish to install some other engine, please do not call us. We can not help you. As an experimenter, you can of course, use any engine you want to. You should be aware that you will be involved in redesigning engine mount structure, cooling may not be adequate and you will be testing an unknown when you fly your airplane. You should expect surprises.

If you want a reliable cross country airplane, do yourself a favor and buy a real aircraft engine such as a Continental or Lycoming. These engines have literally millions of hours of field testing on them and have a proven record of reliability.

You the builder have the sole responsibility to produce a safe, reliable aircraft. Take that responsibility seriously. The bottom line is this: The designer has absolutely no control over what material, power plants, etc. go into your aircraft. No control of quality of workmanship and no opportunity to inspect work or materials and therefore cannot be responsible for your actions. Most designers will do everything in their power to ensure your success with one of their designs, since problems are just plain bad for business. The best advertisement for the designer, is an airplane that does what the designer said it would and a builder/pilot who is happy with what he builds.

From CP43-6 (CH41)
We have the second edition of the "Complete Guide to Rutan Aircraft" by Don and Julia Downie in stock. Cost $13.50.

From CP43-6 (CH41)
We also have the book "Canard" a Revolution in Flight" by Andy Lennon. Cost is $17.95. This is a history of the canard.

From CP47-13 (CH3,CH33,CH41)
SHOPPING AT RAF
The following items are available from RAF. Of course, all the additional plans (meaning engine installation, owner's manuals, speed brake etc) are also available.

Moldless Composite Construction Book	14.50
VHS and Beta Tapes	
Moldless Construction	59.95*
Weight and Balance	59.95*
Both tapes bought as set	99.95*
*Plus $4.00 postage	
Gold and Silver VariEze and Long-EZ tie tacs	6.50
Books:	
The Complete Guide to Rutan Aircraft	
by Don & Julia Downie	**13.95**
Canard - a Revolution in Flight	
by Andy Lennon	**17.95**
T-Shirts:	
Blue - Long-EZ logo with "Laughter silvered wings" - small, medium, large, Xlarge	8.00
White Polo shirts - Long-EZ logo with "RAF"	14.00
Caps - blue with white front and any aircraft patch of your choice	7.00
Patches-VariEze, Long-EZ, Defiant, Solitaire	3.00
Rutan Aircraft patch	3.00
Aircraft name patches	1.50
Some assorted belt buckles, mainly VariEze and Defiant and Solitaire	25.00
Posters:	
Long-EZ two ship	2.00
Defiant on Water	8.00
3-ship Defiant, VariEze and VariViggen	2.75
8 x 10 color Long-EZ	1.25
8 x 10 color Defiant	1.25

****From CP47-13 (CH13,CH41)****

Debbie Iwatate (Long-EZ builder/flyer) has updated and improved her forward mounted brake plans to include several cosmetic and functional changes that she incorporated into her beautiful Long-EZ. She has put this collection of neat ideas into one very attractive booklet which she has available for $20.00. Debbie has done a super job on this little book.

Contact: Debbie Iwatate
400 South 41st Ave.
West Richland, WA 99352

****From CP50-4&5 (CH21,CH30,CH33,CH38,CH39,CH41)****

A Texas Long-EZ lost power and hit power lines as the pilot attempted an emergency landing. The airplane nosed over and crashed, seriously injuring the pilot. The reason for the power failure has not been positively determined.

A California VariEze lost power while on a cross country flight still 200 miles from the pilot's intended destination. The pilot landed on a highway, crashing through a fence. The VariEze was heavily damaged but the pilot walked away with cuts and bruises. The reason for the power failure has not been positively determined.

What can be learned from this type of accident? Complete engine failure, if not a mechanical failure such as a broken crankshaft or connecting rod(s), is generally fuel associated. With redundant magnetos, ignition is seldom cause for a complete and sudden engine stoppage. Catastrophic mechanical failures, while they do occur from time to time, are quite rare in aircraft engines. Sticky or stuck valves occur more often, but again, this seldom causes a complete power failure., Most of these types of failures will result in a partial loss of power which, while very nerve wracking, should still enable a pilot who stays cool to reach an airport or, at least, make a safe emergency landing.

Fuel related engine problems in homebuilts generally come under two headings: Simply running out of fuel (brain failure!), or a faulty fuel system that for one reason or another fails to allow fuel to reach the engine. This could be caused by many things. Deviating from the plans is probably the most common reason. Clogged filters, substandard hoses or fittings, old, worn-out carburetors, sticking floats, wrong fuel pumps, disregarded inspection, - we could go on all day!

RAF is not an engine oriented company, our expertise is in aerodynamics and composite structures. While we have some experience with engines, we can only offer general guide lines. Get expert help with your engine installation. Check with the local airport mechanics, have other members of your EAA chapter look at your engine controls/hookups, your baffling, your fuel lines, etc. **Tony Bengelis' book Firewall Forward** is a great source of information on engine installations.

Before first flight, do conduct a fuel flow evaluation per owners manual Appendix I. For a Long-EZ, this test should also be conducted with the electric boost pump running. The flow should now be at least 20 gph. If these flows are not achieved, do not attempt to fly until your have located and corrected the problem. If your engine cannot get fuel, it will cease to run. This will give you an immediate, very serious problem which, unless you happen to be over or near a suitable landing site and unless you keep cool and judge it perfectly, could possibly result in the loss of your life.

From CP51-7 (CH41)
LIGHT PLANE MAINTENANCE is published monthly by Belvoir Publications, Inc., 1111 East Putman Ave., Riverside, CT 06878. Subscription is $72.00 annually, $6.00 per single issue. This is an excellent publication and, although aimed primarily at A&P mechanics working on factory built airplanes, there are occasionally articles that do apply to the engines and accessories we use. Gary Fisk was kind enough to sent us a list of potentially interesting articles for EZ builders.
Dec, 1986 - "Continental's O-200: An up-close look" by Kas Thomas - 6 pages.

Aug, 1986 - "Lycoming's O-235: An up-close look" by Kas Thomas - 5 pages.

Sept, 1983 - "An owner guide to TBO-Busting" by Kas Thomas, 5 pages.

Back issues can be ordered for $6.00 each plus $0.75 for postage and handling. We recently read the above articles and there are some excellent observations and helpful hints - we strongly recommend them.

From CP53-5 (CH41)
A truly excellent book has just been printed by the Light Plane Maintenance Library called Firewall Forward: The Top End. Price is $17.95.
Send check to: Light Plane Maintenance Library
1111 East Putnam Avenue
Riverside, CT 06878

Some of the subjects covered are: Top overhaul, when is it necessary? Post top overhaul breakin. Compression testing, dealing with low compression. Step-by-step removal of cylinders. Remedies for stuck piston rings. Cures for sticking valves. Checking mag timing, etc. A "must" for anyone building an airplane and doing his or her own engine maintenance.

From CP56-2 (CH41)
DEFIANT FIRST FLIGHT IN AUSTRALIA
Clive Canning writes that on May 14, 1988 he flew his new Defiant VH-001 on its initial test flight from North Brisbane's Redcliffe airport.

He has now completed the Department of Aviation required flight test program (a 22 page document!), part of which had to be written for him since his Defiant was the first multi-engine aircraft (other than factory built) to be certified in Australia. Congratulations, Clive, welcome to the ranks of RAF design flyers.

Clive Canning is the builder of a Thorp T-18 which he flew from Australia to England some years ago, and then wrote a book about his trip - and what a trip it was! He was shot at by MIG's in Syria, and ended up in prison there. Charlie Mike Charlie, **an excellent book, is must reading for anyone interested in flying and, especially interested in flying homebuilts.**

From CP57-13&14 (CH22,CH41)
ELECTRICAL WIRING AND ASSOCIATED PROBLEMS
Wiring an airplane is relatively easy for some builders and very difficult for others, depending on your background/experience. If you are one of the latter, try contacting Bob Nuckolls. Bob has been in electronics and aircraft wiring for over 20 years and is incredibly knowledgeable about the dumb little nit-picking questions I always seem to have. Finally, here is a guy that can answer these questions and not only that, but he speaks a language even I can understand! The best news of all is that Bob is now writing a neat newsletter called "The Aero Electric Connection". He plans on producing two of these a year and the subscription is $20.00 annually with a $2.00 deduction if you an EAA member and a further $2.00 deduction if you are a member of AOPA.

The first edition, Volume 1, number 1, is now out and we have it in our hot little hands! It is excellent. He encourages you to send him wiring problems or questions which he will research and answer in his newsletter. What a deal, this man knows his electrical stuff and we heartily recommend subscribing to his newsletter or, at least, writing him with your question.

Bob works with Bill Bainbridge of B&C Specialties and the linear voltage regulator Bill sells is one of Bob's designs. Contact Bob Nuckolls at "The Medicine River Press"
PO Box 12703
Wichita, KS 67277-2703.

From CP57-14 (CH30,CH41)
TIME FOR AN OVERHAUL? TIRED OF LEAD FOULING YOUR PLUGS?

If you have an O-235-L2C and it is getting tired or fouls its spark plugs in spite of using REM37BY Champions, this may be something to consider.

Light Plane Maintenance, October, 1988, Vol. X, No. 10, page 21, suggests an interesting compromise. You can get rid of the -L2C's tendency to lead-foul spark plugs by having Engine Components, Inc., 9503 Middlesex, San Antonio, TX 78217, 512-828-3131, convert your engine. ECI has STC's to convert your present 7/16" exhaust valves to O-320 1/2" valves and to machine an anti-lead-fouling valve pocket into the cylinder heads. This pocket increases the cylinder volume by approximately

5% which enables you to install the -F high compression pistons without ending up with too high a compression ratio. Your standard -L2C has 8.5:1 compression, the -F has 9.7:1, but the above conversion would give approximately 9.2:1.

According to *Light Plane Maintenance*, "This might offer the best of several worlds: A little higher horsepower (122hp approx.) reduced lead fouling problems and better knock resistance than the 125hp -F engine." You should get more power and longer life out of your O-235-L2C.

This mod is not recommended for the low compression O-235-C2C which does not suffer from lead-fouling and is generally extremely reliable. Also, these older O-235 LYC's do not have crankcase through-bolts. High compression pistons would certainly result in a lower TBO, or worse. Contact Engine Components, Inc. for prices, and keep in mind, with the extra horsepower, you will need one-to-two inches more pitch in your prop. (Submitted by Buzz Talbot, Long-EZ builder/flyer - Thanks, Buzz).

A subscription to *Light Plane Maintenance costs* $72.00 for 12 issues (expensive, but worth it), PO Box 359135, Palm Coast, FL, 32035.

****From CP60-3 (CH22,CH41)****
THE AERO-ELECTRICAL CONNECTION
Specifically, a very smart electrical engineer named Bob Nuckles, is alive and well. Bob can help with wiring and electrical problems and his newsletter is well worth subscribing to. Bob will be at Oshkosh and will be conducting a couple of seminars consisting mainly of question and answer sessions. If you have any electrical questions, wiring, radios, loran, etc., don't miss the opportunity to get help in person from Bob. His forums will be at 3:30 pm Sunday and Tuesday, and 10:00 am Thursday.

****From CP61-12&13 (CH22,CH41)****
"The Aero Electrical Connection", a homebuilders guide to the design and construction of aircraft wiring and electrical systems. This publication, a newsletter that, unfortunately, comes out rather infrequently, is positively the best source for anyone trying to wire up a homebuilt aircraft. It is especially good for those of us who are trying to complete plastic airplanes such as EZ's, Defiants, etc. Bob Nuckolls is an extremely knowledgeable electrical wizard who can and will answer your questions and help solve your problems. The newest newsletter, Volume 1, #2 has an excellent schematic wiring diagram in it, specifically for composite aircraft using an alternator and starter. Contact:

The Aero-Electrical Connection
PO Box 12703
Wichita, KS 67277-2703
Subscription is $20.00 per year.

****From CP62-1 (CH35,CH41)****
CENTRAL STATES ASSOCIATION
Please note that the Central States Newsletter/editor has a new address. Arnie Ash has retired and passed on the editorial responsibilities to Terry Schubert.

New members are encouraged to join Central States and receive a quarterly newsletter and attend the annual flyin. Membership is $15.00 -
Contact: Terry Schubert
9283 Linbergh Blvd.
Olmsted Falls, Ohio 44138

****From CP62-4 (CH13,CH17,CH41)****
SHOPPING
Debbie Iwatate's EZ ideas book is still for sale - still costs only $20.00 and you can get one from Debbie at her new address:
1699 April Loop
Richland, WA 99352
509-943-9579

This little book contains plans, done EZ-style, for forward mounted brake master cylinders, a nifty roll trim system, and other neat little ideas that Debbie and Ken came up with while building their excellent example of a Long-EZ.

****From CP63-7,8&9 (CH30,CH38,CH41)****
COMPRESSION TESTING
There are two accepted methods of testing the compression in a cylinder of an internal combustion engine. One is the "direct" method, generally used by auto mechanics on auto engines. This method uses a pressure gauge which is connected directly to the spark plug hole and the engine is than turned over with the starter or the engine and is run at idle. The peak pressure is read directly from the gauge. This method works but the results are not as precise as the method know as "differential compression" testing. This method is what is normally used in aircraft engines and requires the use of a tester consisting of two separate pressure gauges, a pressure regulator, a calibrated restrictor orifice, and an on/off valve. (See schematic) A source of compressed air (a compressor with a storage tank capable of a minimum of 100 psi) is required to perform the test. When you buy your differential compression tester, be sure it has a restrictor orifice of .040" (assuming your engine has less that 1000 cubic inches of displacement. An 0-235 has 235 cubic inches, and 0-360 has 361 cubic inches). Your can find several suppliers of good reliable differential compression testers at Aircraft Spruce or Wicks, or even "Trade-A-Plane".

SKETCH OMITTED

Continental, Lycoming and the FAA all agree that the compression test should be performed with the engine hot. This assures that you get optimum piston ring and valve seating. In any event, you should try always to use exactly the same procedure with each cylinder and each time you check your compression, if your testing is to give meaningful and comparable results. Careful and regular compression testing say, every 100 hours, can be one of the best, most cost effective preventive maintenance procedures. It is very important that accurate records are kept of which compression reading was for which cylinder! You can read the number of each cylinder at the base of the cylinder. Note that Lycomings and Continentals use a different numbering system.

Remove the top spark plug from each cylinder and, for safety, remove each ignition lead from the bottom plugs. Rotate the prop by hand, in the normal direction of rotation (anti-clockwise for an American engine) until one of the cylinders comes up on compression. You can determine this by placing your thumb over the spark plug hole and feeling for a pressure buildup. Now, install the adapter (normally supplied with the compression tester) in the spark plug hole of the cylinder to be tested. Be certain that the air shutoff valve on the tester is off and connect the differential compression tester. CAUTION: Be absolutely certain the shutoff valve is closed and that you have a firm grip on the tip of one blade of the prop before connecting the system to your source of compressed air.

You will now have to find top dead center on the cylinder being tested. The easiest way to do this is to adjust the pressure regulator to about 20 psi and open the air shutoff valve. Carefully rotate the prop in the normal direction of rotation against the 20 psi pressure until you feel a "flat spot" or rapid loss of turning resistance. If you go too fast, back up beyond top dead center and try again. It is critical that you reach TDC with the prop turning in the normal direction of rotation, not while backing the prop up since this would unseat the piston rings. The piston rings must be at the bottom of their lands in the piston with the piston at the top of its travel.

Now, be certain you have the prop tip securely held. This is a good time to have a second person to help you. The air shutoff valve should be open and the pressure regulator adjusted to show exactly 80 psi on the pressure regulator gauge. Use caution because if you let the prop move in either direction beyond TDC, it will rapidly begin to rotate and it could beat the tar out of the unfortunate person who should have been holding it securely! Now, gently move the prop tip back and forth, just a tiny amount. Watch the cylinder pressure gauge and take a reading from it at its peak steady pressure. Again, this will be while moving the prop in the normal direction of rotation. Be certain that the regulator pressure gauge is holding precisely 80 psi. You should have a differential pressure reading of between 60 and 78 over 80. Repeat this test as consistently as possible on all cylinders.

You should now have a series of numbers something like this, depending on the condition of the engine: 76/80, 74/80, 73/80 and 75/80. These numbers, hopefully, will be fairly close to each other in magnitude. What are the limits? What constitutes a bad (too low) cylinder? It is generally accepted that a cylinder reading below 60/80 would require removal from service. There is no rule or law that says this is the case. In fact, the FAA as well as the two engine manufacturers have no such requirement.

You should probably continue to operate the engine and check the compression every 20 hours or so if the compression is 50/80 or above. Before you remove any cylinder, it would be a good idea to borescope the cylinder. That is, to look inside through a spark plug hole using a light and a special optical device known as a borescope.

A single compression test does not necessarily mean anything. A single oil analysis also means very little. No single diagnostic test should ever be used to decide the health of your engine. The key is to do these tests regularly and keep good records of what you see. Compare each test and make your decision based on several tests conducted over a reasonable period of time.

If you have an abnormally low cylinder, you should start the engine and run it on the ground or even fly around the pattern once. Test it again. If it is still low, use a length of garden hose as a "stethoscope" and listen at the exhaust of the ailing cylinder. If you hear a hissing escape of compressed air here, you have an exhaust valve that is not seating. Similarly, listen carefully with the "stethoscope" at the carb or intake airbox. A hissing sound here would indicate leakage under the intake valve. If neither of these areas is leaking significantly, listen at the breather or oil dipstick/filler tube. A leak in this area is indicative of ring blow-by. This could be ring wear, barrel wear or scoring, or all the ring gaps may be lined up. Hissing between cylinder cooling fins is bad news, possibly a cracked cylinder. Valve leakage is the most commonly found cause of a low cylinder.

The differential compression test has its limitations but it still remains one of the best, most cost effective preventive maintenance procedures available to the builder/flyer. The method described here is simple and it works. Done every 100 hours regularly, you could save big bucks in the long run.

If you would like to learn more about this procedure and many other cost saving tips for keeping your engine in good shape, you could not do better than to obtain a copy of "Top End" from the Light Plane Maintenance Library.

Write to: Light Plane Maintenance
1111 East Putnam Ave.
Riverside, CT 06878