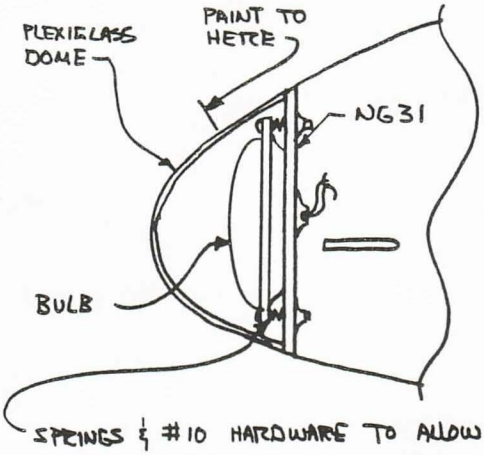
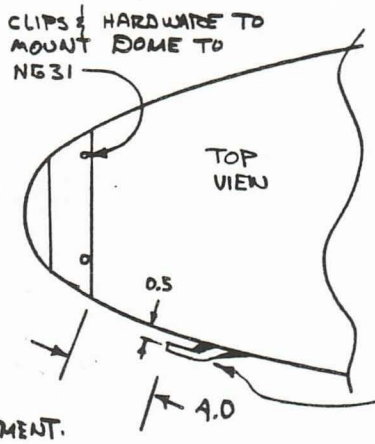
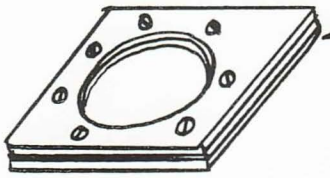
LANDING LIGHT DO NOT CUT INTO THE SURFACE OF WINGS. THE LANDING LIGHT CAN BE A RETRACTABLE TYPE MOUNTED UNDER THE PILOTS THIGH SUPPORT ON THE FUSELAGE BOTTOM, OR THE NOSE-MOUNTED SYSTEM SKETCHED BELOW. THE NOSE SYSTEM IS SIMILAR TO OUR VARI/EZEN INSTALLATION.

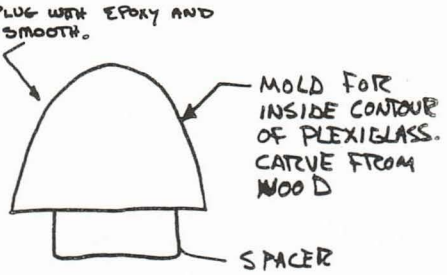


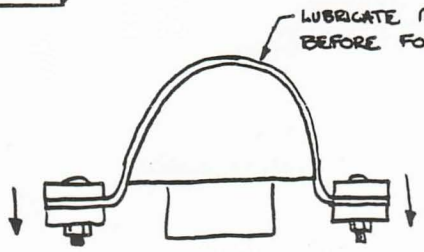


THE BULB IS A SEALED-BEAM 100-WATT UNIT FROM A CESSNA OR FROM A MOTORCYCLE. (GE # 9509 LAMP).

FORMING METHOD FOR PLEXIGLASS DOME.

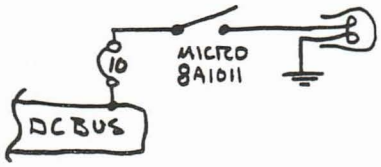






PLEXIGLASS & FRAME ARE HEATED TO 400° IN AN OVEN, THEN THE FRAME IS FORCED DOWN OVER THE MOLD & ALLOWED TO COOL.

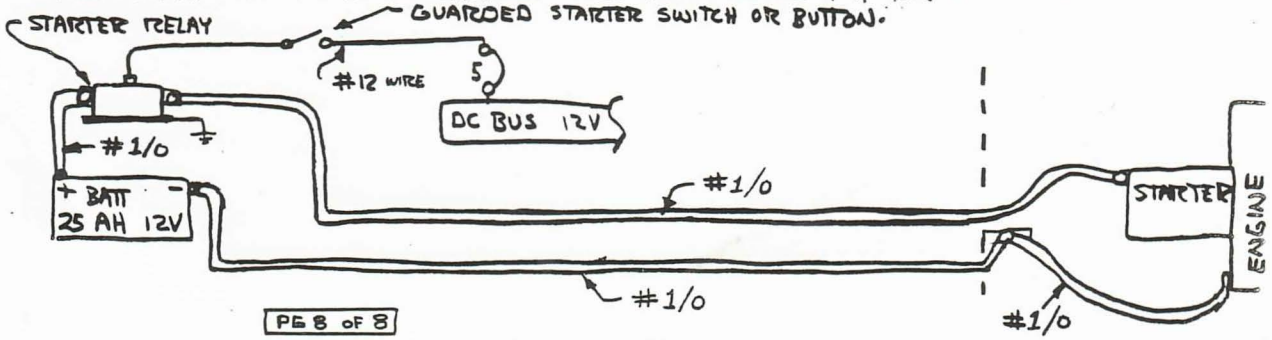
SCHEMATIC FOR LANDING LITE →



ENGINE STARTER

AN ELECTRIC START SYSTEM IS NOT RECOMMENDED FOR INSTALLATION IN THE VARIEZE. TOTAL WEIGHT ADDITION, INCLUDING STARTER, HEAVY WIRING, LARGER BATTERY, ETC, IS ABOUT 40 LB. DUE TO THE SMALL SIZE/LOW WING AREA THE VARIEZE IS NOT AS TOLERANT OF WEIGHT INCREASES AS THE AVERAGE LIGHT AIRCRAFT AND A 40-LB INCREASE IS UNSATISFACTORY. THE USE OF THE STARTER AND ALTERNATOR IS ONLY POSSIBLE ON THE C-85 ENGINES (SEE SECTION IIA). HAND-STARTING A VARIEZE IS CONSIDERABLY SAFER & EASIER THAN HAND-STARTING A CESSNA 150 (SEE OWNERS MANUAL).

WE HAVE HAD SEVERAL REQUESTS FOR STARTER ELECTRICAL INSTALLATION DETAILS FROM THOSE WHO INSIST ON A STARTER EVEN THO IT COMPROMISES THE AIRCRAFT. THE FOLLOWING IS FOR THEM, SHOWING CHANGES & ADDITIONS TO THE BASIC ELECTRICAL SYSTEM TO ALLOW FOR THE STARTER SYSTEM. NOTE THAT THE GROUND WIRES WHICH WERE #10 WIRE MUST NOW BE THE VERY HEAVY #1/0 WIRE TO AVOID EXCESSIVE VOLTAGE DROP OVER THE 12-FOOT LONG STARTER CIRCUIT AND THAT THE MINIMUM BATTERY SIZE IS NOW 25 AMP-HR. STARTER RELAY CAN BE AUTOMOTIVE.



THOMSON™
Linear Motion. **Optimized.**

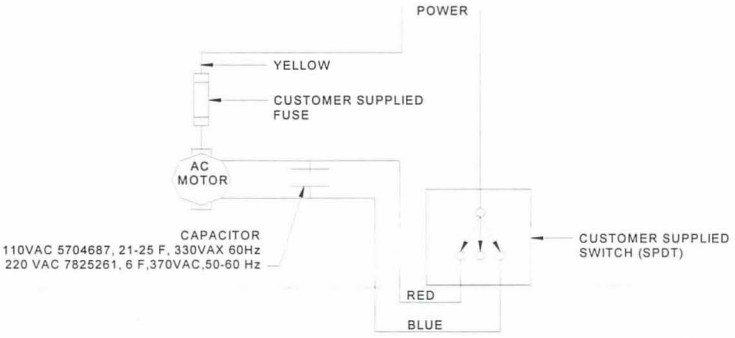
Wiring Installation Specification • 7820270

Performance Pak Wiring Diagrams

The wiring diagrams shown apply to either DC actuators or AC actuators with or without brake, 110VAC or 220VAC. Select the diagram that applies to your specific unit.

NOTE: The switches shown are not supplied by Thomson and are intended to describe the basic switching contacts only. While these switches will operate the assemblies, the final selection of the appropriate switch and /or switching system is the responsibility of the ***end user*** and is to be consistent with applicable electrical standards, reliability, and life requirements as may be required.

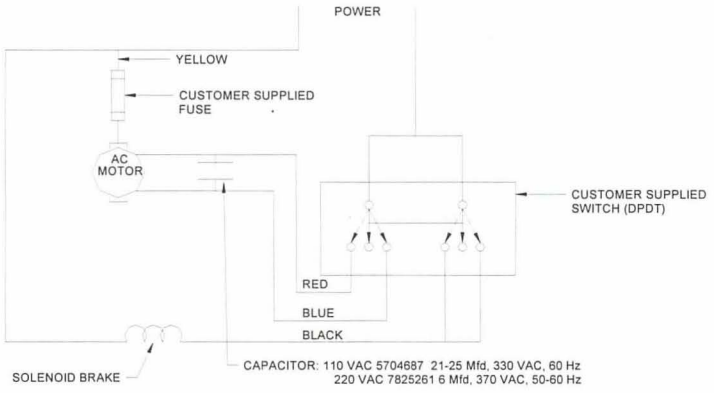
Performance Pak Actuator • Without Electric Brake



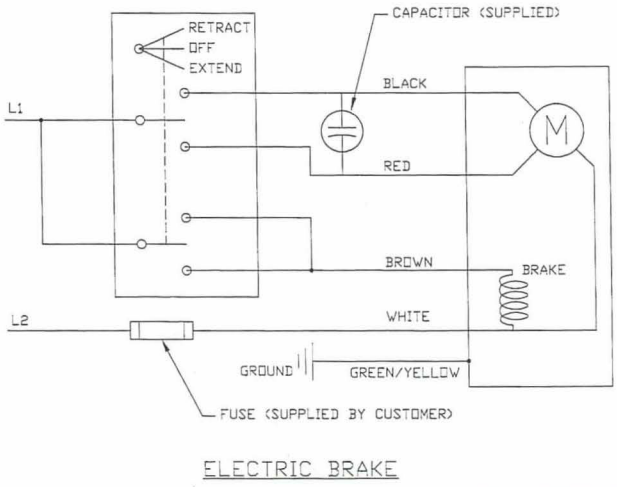
Switching red and blue leads reverses motor

Performance Pak Actuator • With Electric Solenoid Brake • 110 VAC ONLY

Switching red and blue leads reverses motor.



Performance Pak Actuator • With Electric Brake

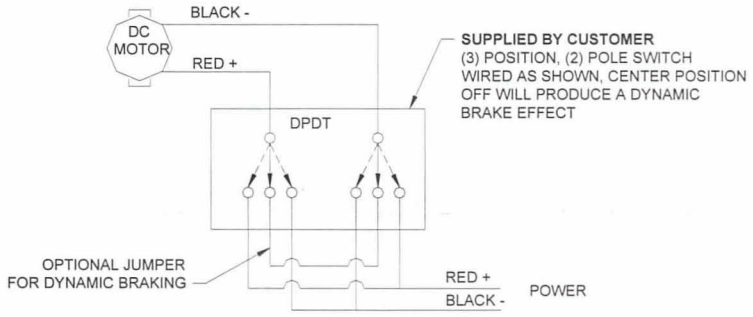


ELECTRIC BRAKE

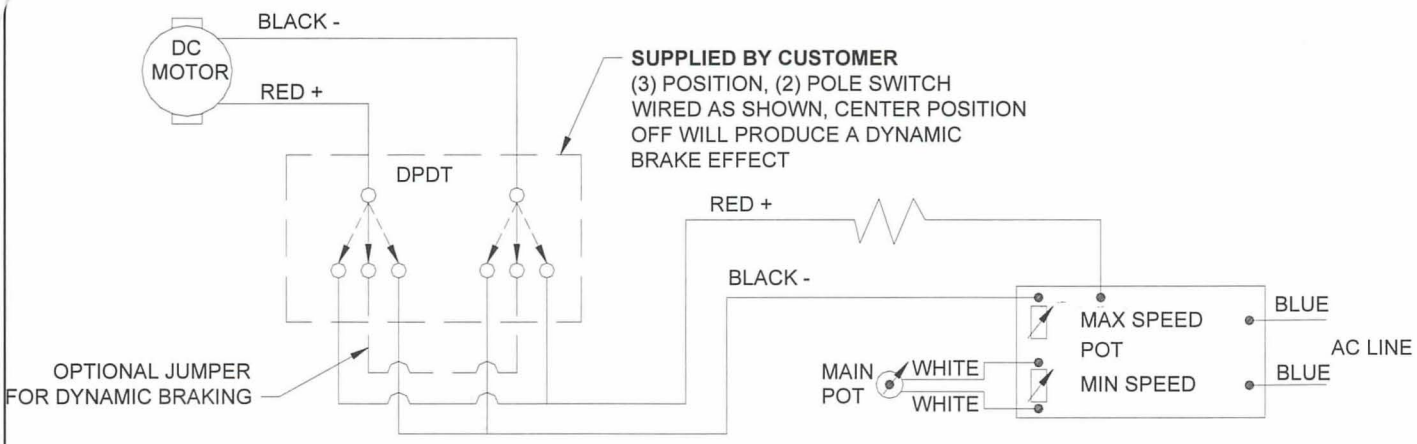
Switching red and black leads reverses motor

All DC Performance Pak Actuators

A change of polarity reverses motor



90 VDC Performance Pak Actuator • With Speed Control



To Adjust Maximum and Minimum Speed: For maximum speed, turn Main Pot clockwise to maximum speed, then adjust Minimum Speed Pot. For minimum speed, turn Main Pot counter clockwise to minimum speed, then adjust Minimum Speed Pot.

Note: Surge resistor (supplied by Customer) should be used on motors having excessive surge currents. Armature switching circuits such as dynamic braking or reversing also require a surge resistor. The resistor should be installed between the Pot control and switch or relay.

Resistor Sizing

AMPS	OHMS (all 25 Watt)
2.5 to 4.0	2
1.6 to 2.5	3
1.2 to 1.6	5

Amps should be measured on AC side of speed control under full load conditions.

Safety Warning! – Please Read Carefully

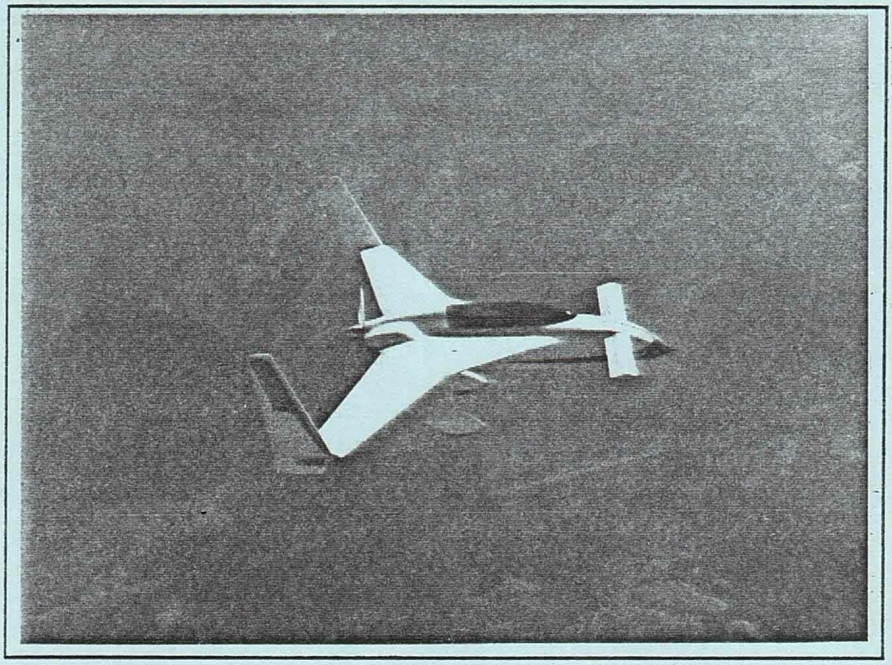
This product should be installed and serviced by a qualified technician, electrician or electrical maintenance person familiar with its operation and the hazards involved. Proper installation, which includes wiring, mounting in proper enclosure, fusing or other overcurrent protection and grounding, can reduce the chance of electric shocks, fires or explosion in this product or products used with this product, such as electric motors, switches, coils, solenoids and/or relays. Eye protection must be worn and insulated adjustment tools must be used when working with control under power. This product is constructed of materials (plastics, metals, carbon, silicones, etc.) which may be a potential hazard. Proper shielding, grounding and filtering of this product can reduce the emission of radio frequency interference (RFI) which may adversely affect sensitive electronic equipment. If information is required on this product, contact our factory. It is the responsibility of the equipment manufacturer and individual installer to supply this safety warning to the ultimate user of the product. (SW effective 11/92)

The input circuit of the control (potentiometer) is not isolated from the AC line. **Be sure to follow all instructions carefully. Fire and/or electrocution can result due to improper use of this product.**

Deborah F. Iwatate

EZ BUILDING TIPS

A COLLECTION OF BUILDING TIPS AND ALTERNATE INSTALLATION IDEAS FOR BUILDERS OF THE RUTAN DESIGNED LONG-EZ AND VARI-EZE AIRCRAFT

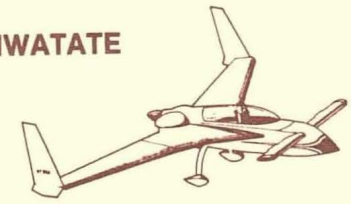


LONG-EZ — N455EZ

DEBORAH & KEN IWATATE

1699 April Loop
Richland, WA 99352
1-509-943-9579

EAA #163969



Debbie Iwatate
1699 April Loop
Richland, WA
99352
1-509-943-9579

Dear Friend and EZ-builder,

Here are the EZ plans/mods that you requested. Thankyou for your support of my writing activities.

As with all the plans I send out, I must add a disclaimer to cover your possible use of the ideas that are presented. A copy of this letter is kept in my files. These plans are intended to be used as suggested, alternate methods of installation or operation. There are no claims made about the modifications/ideas and no guarantees are made as to the results. Any modifications that you make to your airplane, any deviations from the original plans, you make voluntarily and assume all responsibility. I cannot be responsible, in any way, for the performance or accuracy of any of the suggested ideas described in these plans.

I would like you to consider submitting to me, any building tips or component modifications that you may have developed or seen in use by other builders. I will attempt to compile a second collection of alternate methods and builder tips for the EZ aircraft if there is enough interest and enough ideas. All I need is rough drawings, photographs, brief description, etc., the more detailed, the better.

I'd like to take this opportunity to extend an invitation to you to join the International Varieze and Composite Hospitality Club. Whether you are just starting your project or have been flying for years, you will find that this group has a great deal to offer. Unlike the Canard Pusher, the IVCHC newsletter presents the more "personal" side of EZ building and flying. Announcements and summaries of EZ events are provided. Contact Donald or Bernadette Shupe, 2531 College Lane, La Verne, CA 91750 (714-593-1197). The clubs motto is, "Dedicated to promoting hospitality, travel and support for EZ and composite pilots and builders".

Many folks have asked how this booklet was prepared, so here you have it... prepared entirely on the Apple Macintosh plus computer using Pagemaker™, MacDraft™, Microsoft Word™, MacDraw™, Adobe Illustrator™ and printed on the Apple LaserWriter© printer.

Thanks again for your interest and support. Build well and fly safe!

Sincerely,

Debbie Iwatate
(ee-wah-tah-tee)

Debbie Iwatate

Good Luck Bob!

Thanks Debbie

INSTRUMENT ACCESS COVER FOR THE LONG EZ

by Debbie Iwatate

The access cover allows you to reach the entire area just forward of the instrument panel by removing just two bolts and lifting out the cover. An added feature is that it cleans up the appearance of the panel and upper nose section; you don't have that big gaping hole over the instrument panel anymore. Also, I've seen and heard about a number of Longs (and Vari-EZE) that have experienced a "lifting" of the forward canopy edge during flight. Perhaps this has something to do with the length of the flat canopy surface, from the leading edge of the canopy bubble to the forward edge of the canopy frame. Our Long has never had this problem. There are only 4" of canopy frame in this forward area after completing the installation of the instrument access cover, this makes for a very rigid canopy frame in this area. Plus, I installed an overlapping lip and "rain-gutter" all around the edge of the canopy, further stiffening the frame. The entire procedure can be done with just a few hours work.... at the right time in the building program.

1. Build the canopy as per the plans, but prepare the section forward of the instrument panel for future glass release using duct tape. See diagram #1 for an indication of how far aft of the instrument panel the release will be needed. Don't forget to protect the top of the instrument panel and F-28 as well. Glass the entire outer surface of the canopy/nose area as per the plans.

2. Cut the forward edge of the canopy aft of the instrument panel, as shown in diagram #1. Go ahead and finish off the canopy as described in the plans up to page 18-8.

3. Mark out the instrument access hole on the glass as shown in diagram #2. Alter the size as you wish but I suggest you don't try a rounded hole with the type of installation that I'm describing here.

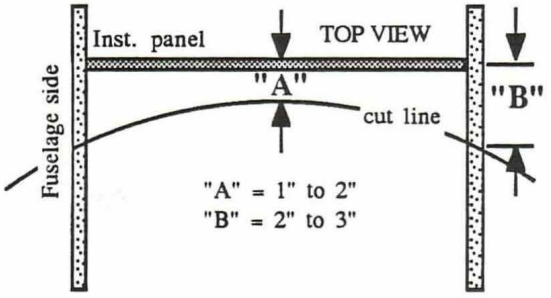


Diagram #1

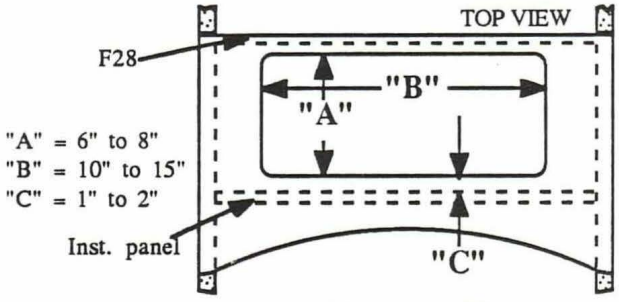
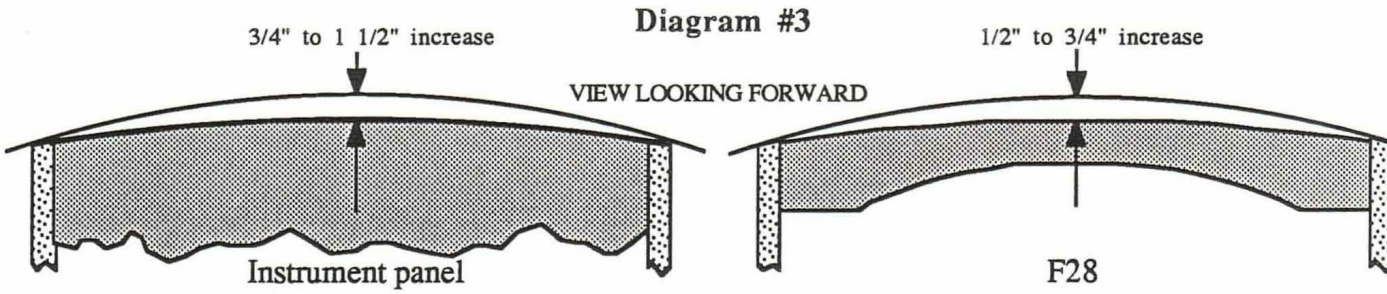


Diagram #2

4. Build a wooden support "brace" on the top of the forward cover area using Bondo to hold everything in place, as you had to do with the canopy construction in the plans. (See photo) You should prepare the wooden brace arrangement in such a way that no twisting can occur that would change the shape of this piece while you're working on it.

5. Remove the forward cover unit from the fuselage. Remove the duct tape and clean up the fuselage contact areas in preparation for re-attaching the cover; sand surfaces, etc.

6. Carve out and shape the underside of the forward cover unit to the desired thickness. I made ours about 3/4" thick. This provided me with the opportunity to increase the height of the instrument panel by 1 1/2" at the center and F-28 by 3/4" at the center (see diagram #3).



7. Check the fit back on the fuselage. Be sure to keep in mind that a couple of layers of glass will increase the thickness slightly. Later on the edges and sides will be floxed and BID taped back into place.

8. When you are satisfied with the thickness and contour of this inner surface, glass it in the usual manner with a micro layer and 2 plys of BID. When cured, this entire unit should fit back on the fuselage without showing any signs of distortion. Check this out.

9. Remove the wood brace assembly and make a cut along the top access hole layout lines. Don't go any deeper than the thickness of the glass. Use a Dremel tool or die grinder with rotary saw attachment. (diagram #4)

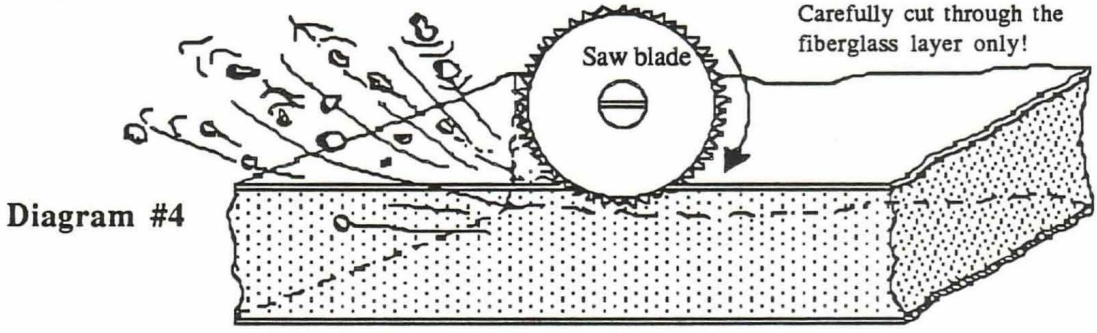


Diagram #4

10. With a small drill, drill "locator holes" along the access hole layout line, into the lower surface. Use these holes to draw a smaller version of the "hatch" on the inner glass surface (diagram #5). Angle these holes (at least eight) at about 45° to 60° inward. You're trying to make the inner surface concentric to the outer one.

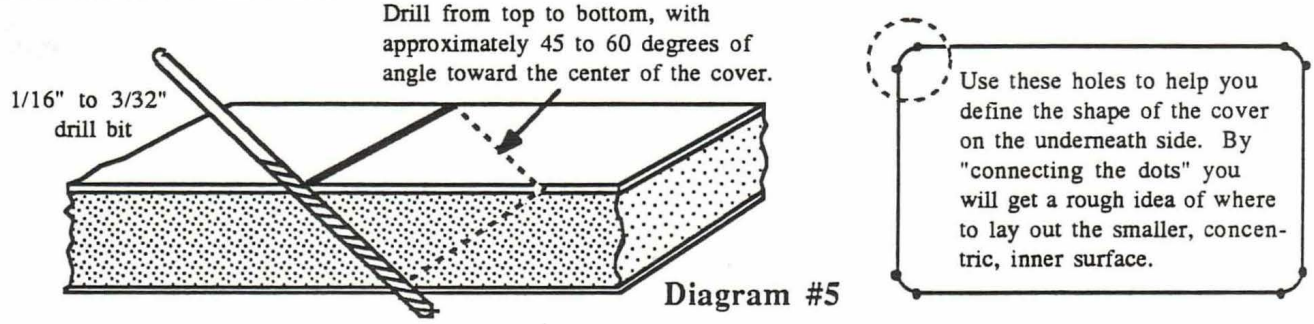


Diagram #5

11. "Connect the dots", outlining the lower hatch perimeter guided by the drilled holes. Cut along this mark as you did for the top surface. At this point you should be ready to cut the foam between the top and bottom layers of glass.

12. Cut the foam between the two surfaces (**neatness counts!!! this edge will be very visible later!!**), maintaining the proper angle; use a long knife blade, coping saw blade, whatever works well for you (see diagram #6a). Remove the rough-cut hatch cover.

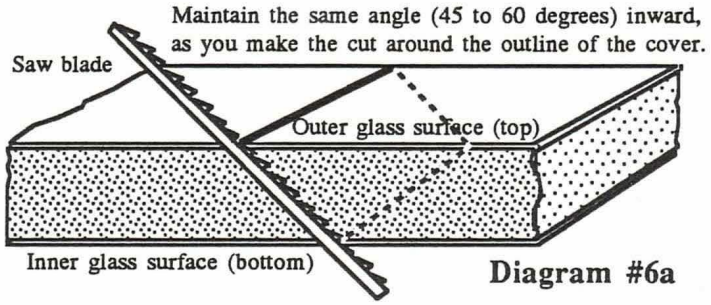
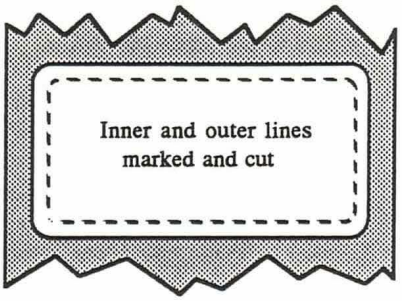
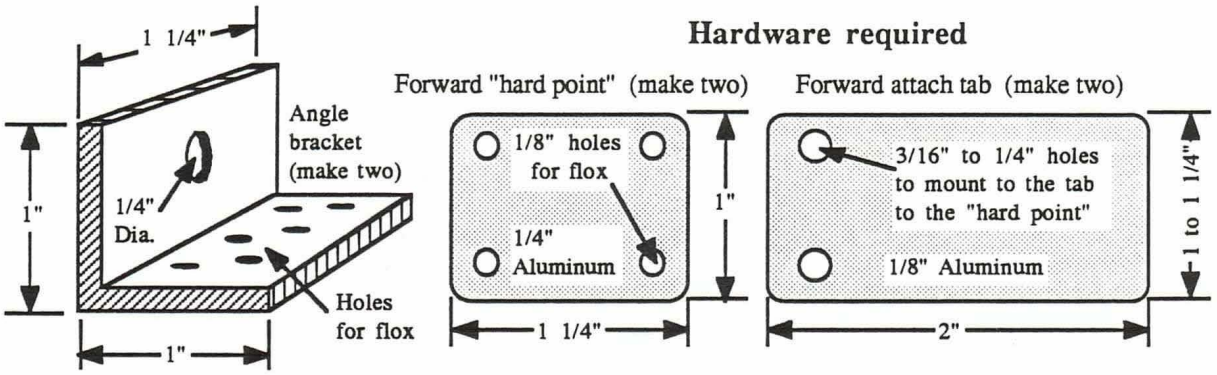


Diagram #6a



13. The next few steps will describe the preparation of the edge of the hatch cover. Determine where the forward metal tabs and aft attach points are going to be installed (diagram #7 and photo will help).



14. Provide "holes" for the metal parts; clear away foam and clean up the glass surface, then insert the forward hard points underneath the inner surface of the access cover. Flox them into place and allow to cure (diagram #7a). Smooth up all the edges, but **don't remove too much glass,** you'll need about a 1/16" space all around when you're finished, to allow for a silicone rubber seal. **Don't flox in the aft angle brackets yet either!** They will require alignment before installation.

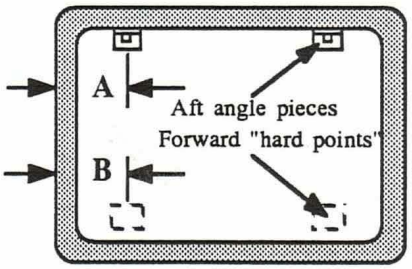
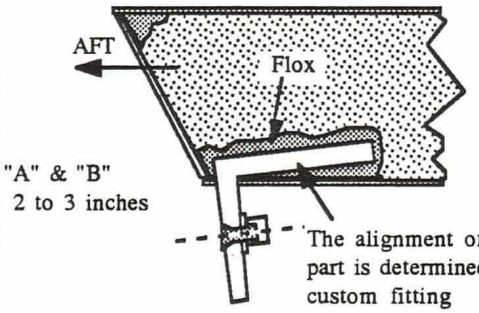


Diagram #7



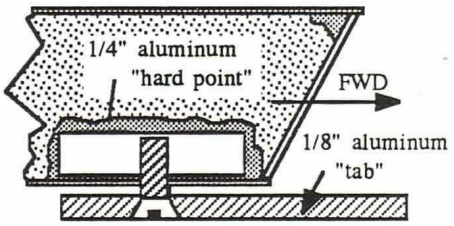


Diagram #7a

15. Glass the edge of the hatch cover with 1 to 2 plies of BID and be sure to flox all the corners first (diagram 7b). Peel-ply if you wish, but try to get this surface flat and smooth. The better the job you do here, the better the seal that you'll get when you're finished. Knife trim the edges when they're ready.

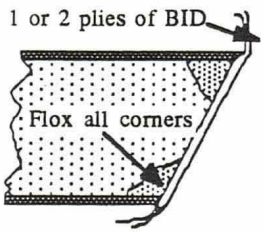


Diagram #7b

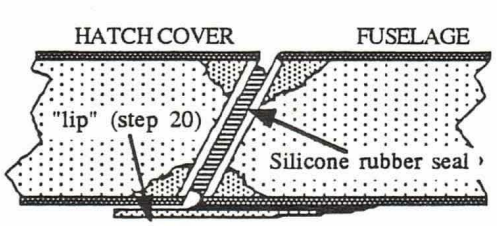


Diagram #7c

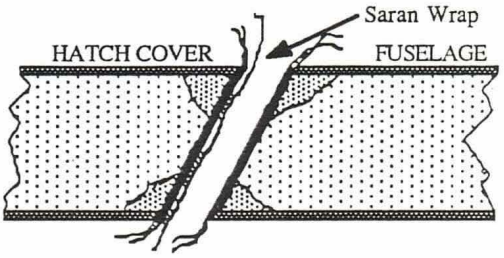


Diagram #7d

16. Prepare the fuselage-side, lower section edges, and apply BID strips to them the same as you did above, pushing the "lid" into position, with Saran Wrap between, to create a custom fit as the layup cures (diagram #7d). I found it convenient to place a few of thicknesses of duct tape on the edges of the lid to provide a spacer to allow for the (future) rubber seal (diagram #7c). You should test this all out for fit prior to glassing. Don't push so hard that you distort the fuselage component. You may

want to temporarily "tack" the fuselage top to the fuselage while this step is being done. Knife trim the edges when they're ready.

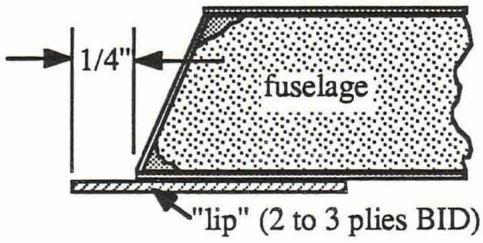
17. Your goal is a tight fitting cover, mated perfectly flush to the top surface of the fuselage and with allowance for a weatherstrip and paint included.

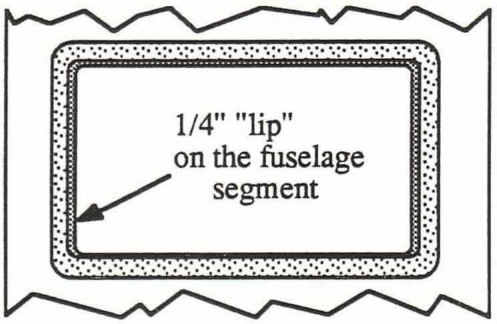
18. As these lay-ups are curing you should keep checking on it and "fine-tuning" the fit while the areas are soft and pliable.

19. When you've completed everything up to this step you should have a slightly loose fitting hatch cover. Keep in mind that the paint and rubber seal will "move" the cover out to its final, snug, flush position.

20. The next few steps will show you how to create a lip on the underside of the fuselage access hole (diagram #8 and photo).

Diagram #8





21. Put Saran Wrap over the underside of the hatch cover. Position the two parts together and Bondo popsicle sticks in place on top to hold the fuselage component and access cover in position with each other (diagram #9).

22. Place peel ply in areas where the forward attach points will be; you won't need a "lip" where the forward metal tabs slide under (you can cut these out later).

23. Glass 1 or 2 plies of BID strips around the cover on the underneath side, overlapping onto the Saran Wrap and peel-ply to the fuselage component surface (diagram #10). When cured, trim the lip back to about 1/4" to 3/8" width (see diagram #8). The lip will act as a light support to the cover and as a second, inner, weather seal (that silicone rubber can be spread on). Be sure that the lip is clear of the area where the forward and aft tabs will go (diagram #11).

View of top surface

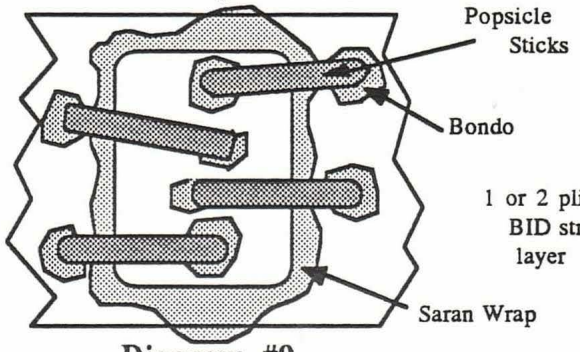


Diagram #9

View of bottom surface

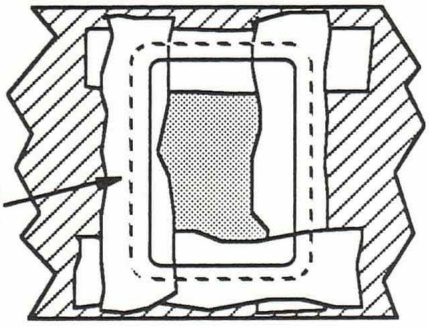
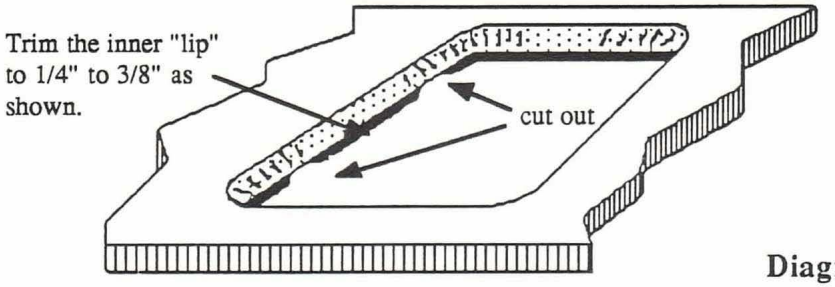


Diagram #10



Trim the inner "lip" to 1/4" to 3/8" all the way around. Then remove glass from the regions where the forward and aft hatch hardware will be located.

Diagram #11

24. Mount the forward metal tabs into position. Drill matching holes into the hard points you installed under the glass, tap with the appropriate thread size and attach with countersunk screws.

25. Glass the outer part of the hatch unit back onto the fuselage using flox (lots) and 1 1/2" BID tapes around all contact corners and surfaces. Don't get your outer fuselage contours too messed up by getting too many tape layers on the outside. Make sure the canopy is down firmly when you do this, you want a good fit between both sections. **Don't get flox or epoxy on your canopy and "seal" it shut** during this step, protect surfaces with duct tape!

26. Rivet nut plates to the aluminum angle pieces. Drill the "flox" holes. Create slots/holes in the hatch cover for the aft attach angle brackets to slip in. Hollow out the foam and push flox/epoxy in the hole. Flox the parts into position. As the flox cures check to be sure that the flat surface of the angle piece is parallel to the instrument panel surface (see diagram #12), 90 degrees to the centerline. Check the alignment frequently during the curing time.

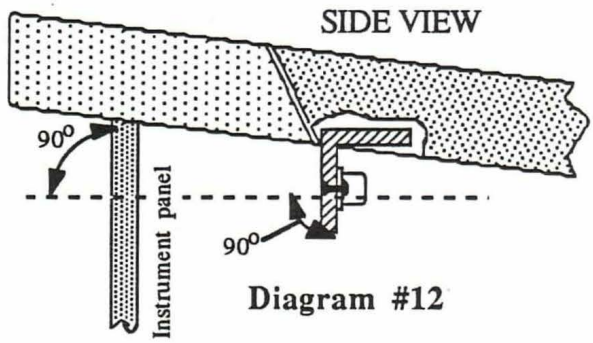


Diagram #12

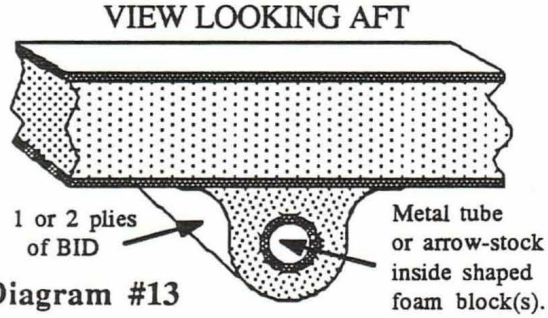


Diagram #13

27. Shape two foam blocks to support the "bolt tunnel" (diagrams #13 & 14). This "delivers" the bolt precisely to the attach point (nut plate on the angle bracket) and prevents any compression loads from breaking the covers' angle bracket installation (diagram #14). You're going to have to be creative and resourceful to position this tube. Drill the hole(s) in the instrument panel so that the bolt hole(s) line up properly when the access cover is down, in the "locked" position. I drilled an 1/8" pilot hole, after a great deal of fussing and measuring, then checked for positioning, then I drilled a 1/4" hole, and . . . . . darned if they weren't in perfect alignment! Then I slid a vaseline coated bolt through the hole and secured it to the angle attach point while mounting the foam block(s) in place with 5-minute epoxy/flox. You want the end of the tube to mate right up against the angle piece as in diagram #14. There should be no forward/aft stress placed on the aluminum angle when the bolts are in place and tightened down. Glass 1 or 2 plies of BID over the foam block after smoothing to shape. Then take measurements for the proper length 1/4" AN bolt.

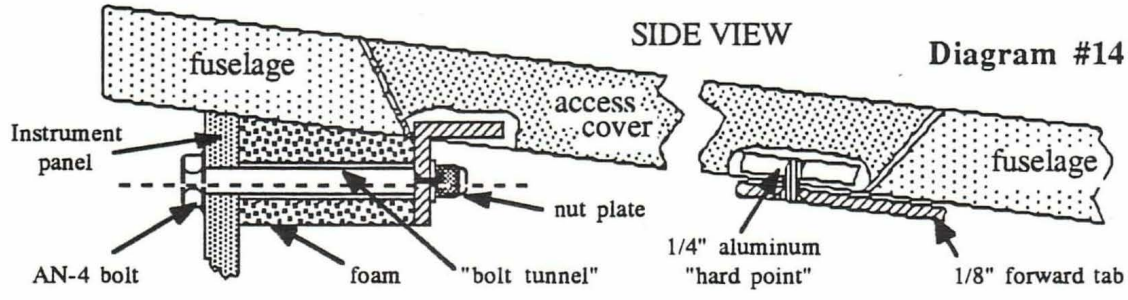
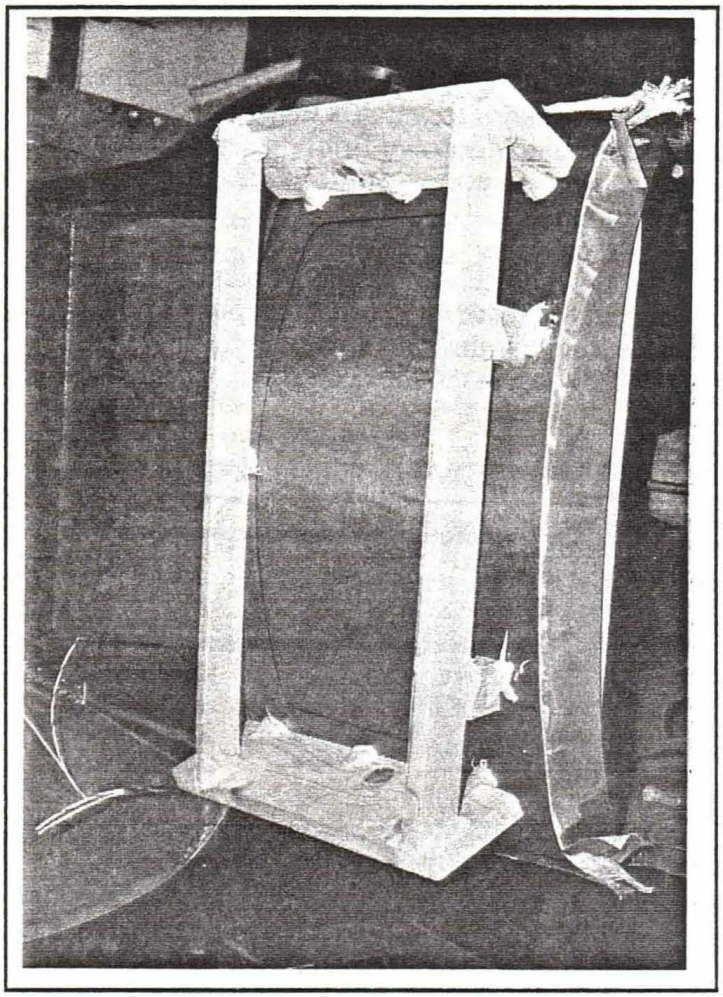
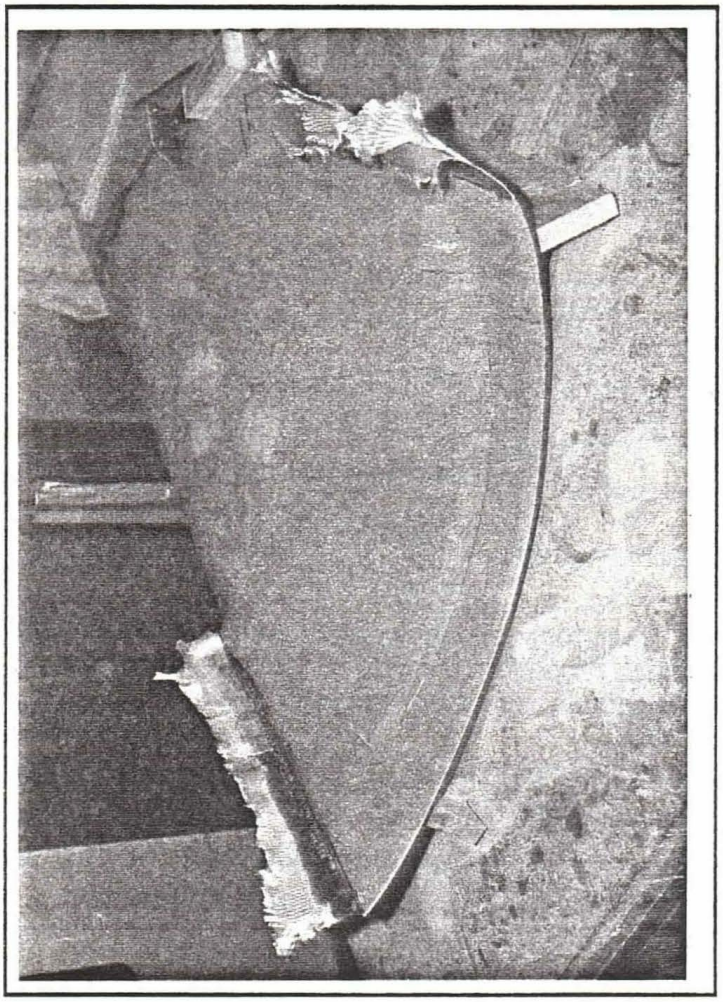


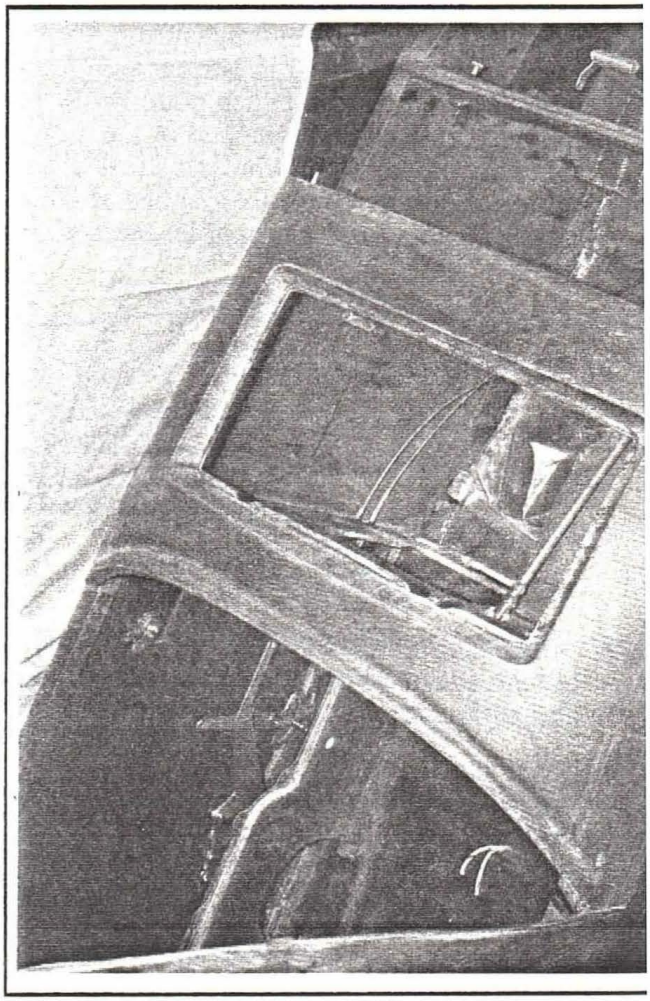
Diagram #14

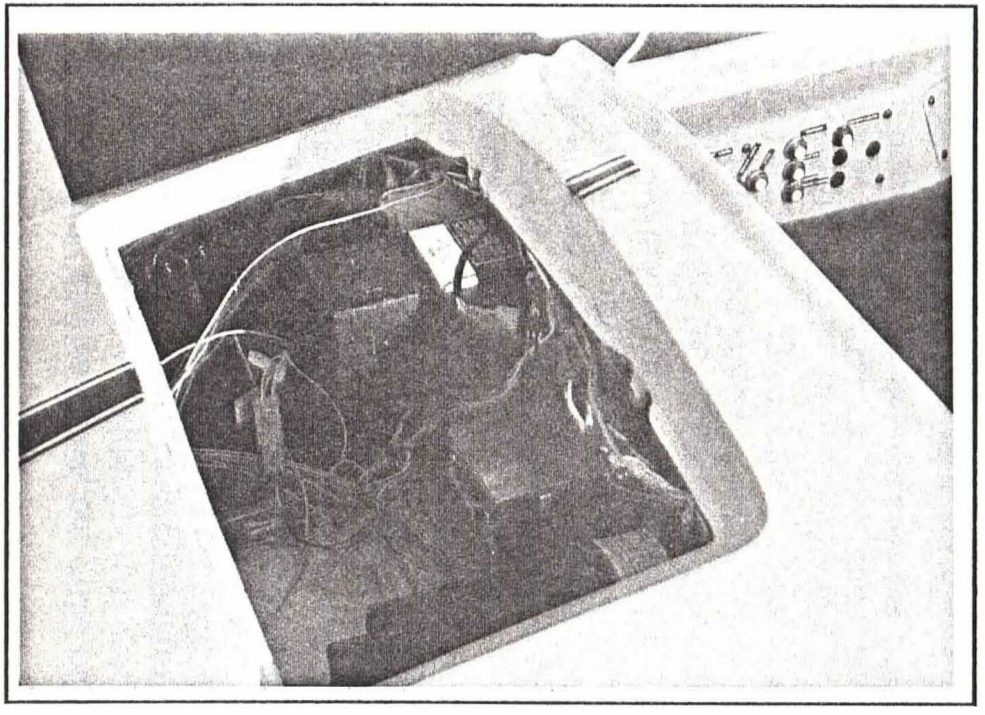
28. After making this installation, I altered the position of the forward canopy latch arm. You might want to plan ahead a little and see if you want to do the same. I modified the canopy latching mechanism and shifted the fuselage access hole aft about 1" after making the canopy cut mod described above.

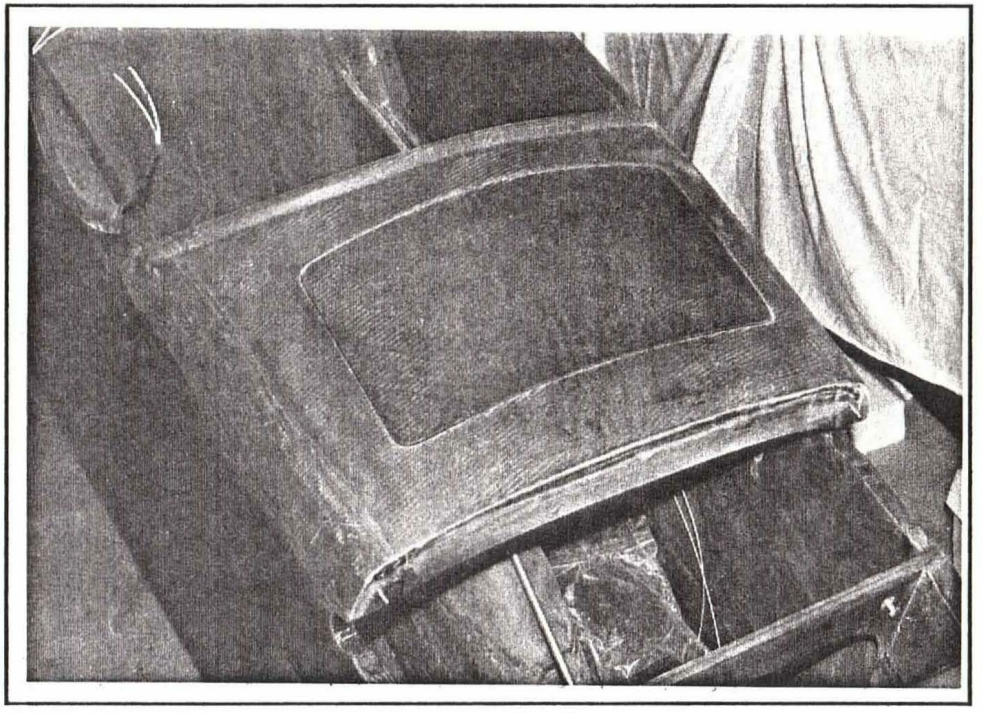
Well, that's "all" there is to it! I've described a lot of detail work, you'll probably be able to come up with some shortcuts, let me know if you do. The hatch that we have on our plane is very secure and the seal is excellent. We have never had the slightest problem with water or dust leaking in. The appearance, with this cover instead of the plans design, is dramatically different..... you'll love it!

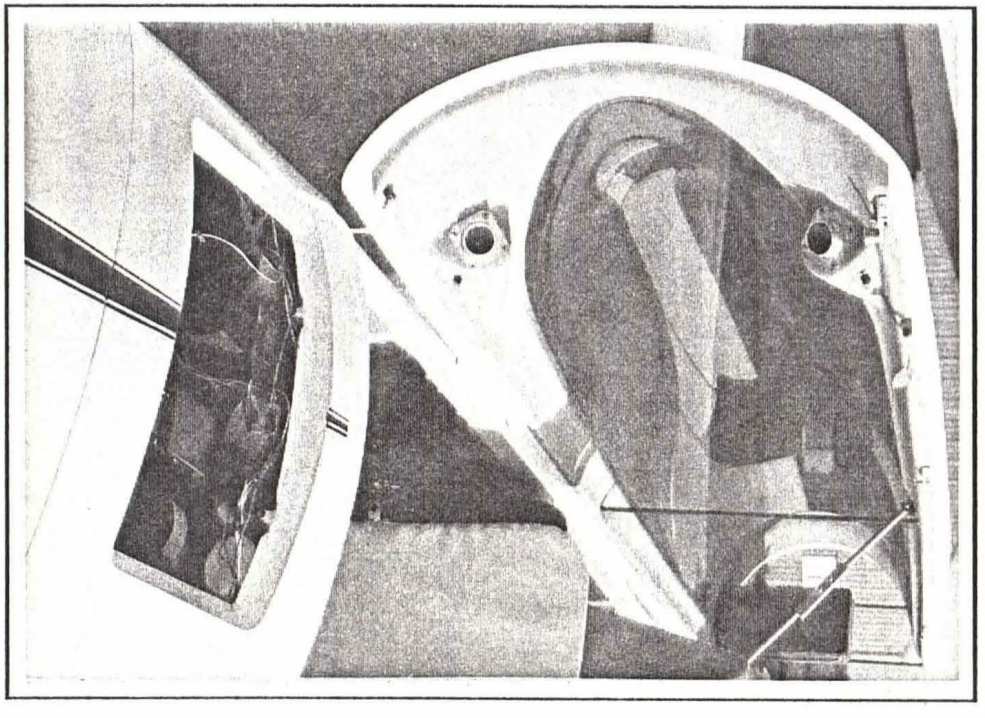


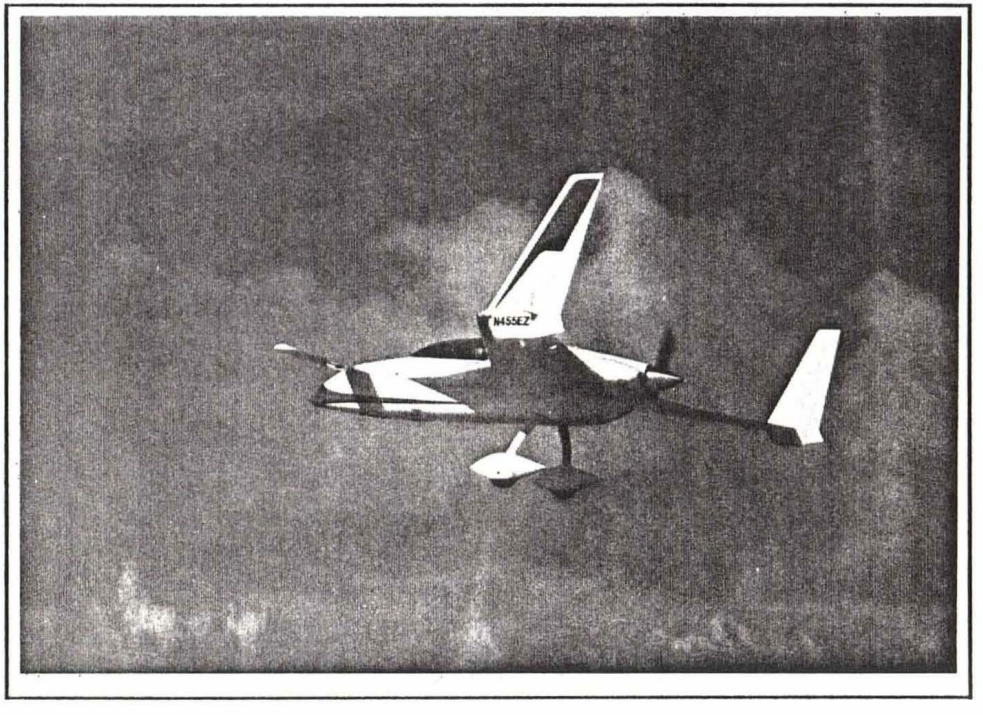











N45SEZ

INSTALLATION OF BRAKE MASTER CYLINDERS IN THE NOSE SECTION

by Debbie Iwatate

At one time I sent out a request for information about how some builders had installed (or were planning to install) a modified brake system for the Long EZ and Vari EZE....with the master cylinders forward of the rudder pedals. Well, Bruce Tifft was good enough to reply almost immediately with suggestions about a system that he had seen on Ed Hamlins airplane. According to Bruce, Ed had installed such a brake system in his Vari EZE and had reported that it was working very well. Bruce installed a similar system in his Long and is very pleased with it. His letter to me included some rough drawings of the installation and directions for making the retrofit. I have been flying our Long for about 80 hours with the new brakes installed and I am pleased to report that the mod is worth every minute of effort.

Since I didn't consider this to be a "minor" modification, I decided to make a couple of phone calls. First, I gave Bruce a call for more verbal details. He had a couple of additional ideas to "beef up" the installation, but all in all he was still very satisfied with the present arrangement and wouldn't make any big changes. He said that Mike Melville had flown his Long and that I should check with him for further comments. Next call, RAF, and a talk with Mike. You must understand that Mike (and RAF) is in no way making an endorsement of any kind about this brake mod. His comments were only about his personal feelings of how this braking system compares to the system described in the plans. Since I was about to be dismantling my brake system and putting Big Bird in a "down condition" for a week or two, I needed to feel confident that the end result would be, at the very least, safe, and hopefully, an improvement over the present system.

Mike was comparing Bruce's system with that of N26MS and N79RA. He felt that there was an improvement. Also, he noted that there was a better "feel" to the brakes with more response at less or equal pressure than before. His bottom line comment to me was, "Deb, you'll like the modification." He also had some builder-type suggestions to make, to be incorporated into the retrofit, I'll point these out as I describe the installation below.

This was a retrofit for us. The mod could be installed during the original building program with slightly less "trouble" than it was for us. Like all modifications made to an already completed project, the first "cut" is always the hardest! For this retrofit "the cut" was when we removed the existing brake lines and pulled them back through, making way for the new, 13 feet of brake line that had to go up to the front. From the moment of the first step to install the new brakes, to the testing of the new installation, we spent about 15-18 hours. Don't forget that this was a retrofit; a lot of time went into "getting into places".....places that were tight with wire bundles, tubes and cables. All surfaces had to be cleaned up and prepared for glassing, parts had to be made and painted. Not to mention the waiting for the UPS man to deliver the box of "odds and ends" from Aircraft Spruce.

All this talk is for a reason. Ken and I get to meet and talk with many builders and EZ pilots, and a lot of them (us included) are very reluctant to go back in a make even the smallest modifications to their planes once they are completed. Well, some changes are really worth the effort; I feel that this mod is one of them. Another one is the new rudder system (we'll be making that change within the coming year). My personal feeling, now that the brakes are changed over and tested, is that they are a great improvement over the plans system. Those of you who know me well may recall that I've always been messing around with parts of the brake system since the first flight. I'm not the only one who was dissatisfied with the braking effectiveness of the Long; most of the pilots I have talked with thought they were "adequate" at best. My own experience with these "new" brakes is that they've turned our Long into a whole new airplane on the ground! Now I can

turn around "on a dime" while taxiing, and with relatively light pressure on the brakes compared t "before". In case you're not convinced yet. . . . . it has also improved landing performance, making it possible to stop in a shorter distance, with less pressure. To summarize, I will say to you what Mike said to me, "If you make the mod, I think you'll definitely like the change!" Especially if you've ever flown a Long with the plans system installed, and therefore have the opportunity to compare the two.

Now I'll get on with describing how I went about making the retrofit. Those of you who are in the middle of construction should be able to figure out what you need to do to make this an original installation. I will call this the Ed Hamlin EZ brake system, since he was the first builder we know of to have incorporated this change into his plane.

The first step is to gather up the different parts and materials that you'll need.....

- The two brake ram arms (BR) are made of 1/8" 2024T3 aluminum.
- The master cylinders are the same as those called out in the EZ plans.
- The arm attached to the rudder pedal (RA) is made of 4130N steel,0.050-0.065" thick.
- The adjustable cable hardware is made and installed exactly as the adjustable rudder hardware described in the EZ plans (pg 16-8).
- The brake fluid tubing has the same specifications as in the plans; you'll need about 13 feet per side (I ordered 30 ft, to be on the "safe" side, and I had about 2-3 ft left over.
- Depending on whether or not this is a retrofit for you, you may need to order new brass fittings for attaching the tubing to the master cylinders and the brake calipers . . . once the end ferrules have been used, they can't be removed from the tubing. The 1/8" weatherhead insert (don't forget that!) that goes into the end of the tubing, can be reused.
- At point "A" you will need the CS-75 bushings that are called out in the plans (pg 15-2).
- Use 3/32", 7x7 stainless steel cable, and don't forget the miscellaneous nicopress fittings (18-2-G) and thimbles (AN-100-3) to complete that part of the installation.
- Bruce suggested that you don't really need to use 3/32" cable from the rudder pedals to the firewall belcranks with this system . . . 1/16" would be adequate to operate the rudders. We left in the original cable (3/32").
- I made our rudder pedals from "scratch" and used slightly heavier steel for the lower attachment tabs. You might consider "beefing up" these tabs in some way. At the very least, Mike Melville suggests that you make the inspection of these points, and the CS-17 bushings, a part of the 100 hour check.
- You might also consider using a bushing at point "B".
- The mounting bracket at point "D" is made of 1" x 1" x 0.125" extruded 2024T3 aluminum angle.
- I bought several feet of Tygon™ (plastic) tubing, with a 3/16" or 1/4" I.D., and used it to "insulate" the brake line from potential hot areas (like cabin heat ducts) and abrasion spots (where wires and tubes were all gathered together in bundles) . . . just slip the plastic tubing over the Nylo Seal tube as you install it.

As you can see, there's really not that much extra "stuff" to buy, you probably have most of it on hand . . . especially if you are including this mod in the original building program.

Now you can really get started with the program.

1. Remove the brake cylinders from the firewall. We left the original mounting brackets in place, since they don't do any harm and they provide the proper spacing so that all the bolts going through the engine mount extrusions can remain the same.

2. Cut off the brass fitting(s) on the end of the brake line tube and pull the tube back through from the brake/wheel end. I say "pull the tube through" because we didn't hard-mount our brake lines when we originally built the plane. Thanks to a tip from another builder, we glassed soda straws into the aft edge of the gear legs, so that the brake lines could be easily slipped in and out!! If you hadn't done this, the removal of the brake lines could present you with the hardest step of the entire mod. Mike suggested that if you want to use the brake line tube that's in place you can "add on" the additional length needed by putting a brass union fitting between them. This could save a LOT of trouble. The part needed for this step is a little hard to find in any catalogs but Mike provided the following part number and address/phone number that you can try: McMaster-Carr, P.O.Box 54960, Los Angeles, California, 90054. Phone 1-213-945-2811. . . ask for a Flareless Tube Union #5053-K22, it should cost about $1.25, and hopefully you won't have to buy a thousand of them to get that price! Another point here, that I should mention before I forget it. Mike suggested that, since this brake system can generate quite a bit more braking force, and you might find yourself taking advantage of this to land shorter or whatever, the brake shoes may wear out a little faster than usual. Mike's suggestion is that you look into using a "metal impregnated" version of the brake shoes, which is supposed to stand up for a longer time. Cleveland carries this type under part number #6656.

3. Route the new brake lines up the gear legs and on their way up front. Keep away from areas of potential "wear" and from cabin heat ducts. Secure these tubes along their entire length.

4. Hook up the fittings that mate the brake line tube to the brass elbows at the brake end, and secure them.

5. You'll still have the old 3/32" cables in place, going up to the belcranks on the firewall . . . I hedged my bets and left them hooked up until after the installation and testing was completed . . "Just in case!?" I was more than happy to remove all that hardware after going out and trying the new brakes. As an added bonus, there's now more room on the firewall to access the magnetoes, oil screen and other engine parts that used to be hard to get at with the master cylinders in the way.

O.K., now you can move up forward to continue the operation. If this is a retrofit for you you'll have to remove the canard and start poking around up inside the nose. If you're like us this is when you dig your Long EZ plans book out of the closet, blow the dust off and start asking yourself, "now how did I do that?".

6. Remove the rudder pedals. Just four words to describe that step! Let me know if you get it done in under an hour! We must have dropped those *&^%$#*!$? nuts down inside the nose wheel retract "box" a half dozen times!

7. Make the part "RA" and get it heliarc welded onto the rudder pedals as shown in the drawings. Then prep and paint the pedals and install them back where they belong. I attached the cable to RA before reinstalling, just to avoid working in a tight spot. Leave yourself about a foot or so of cable to hook up to the brake ram arm, "BR", later on.

At this point you should have all of the parts made, the rudder pedals reinstalled, the aluminum angle mounting brackets (MB) ready, the wooden blocks prepared and the necessary bolts, for point "A" attachment, all set to use. It's time for a trial installation of the master cylinders.

8. Attach the mounting brackets to the base of the master cylinders with the appropriate AN hardware, exactly as shown in the EZ plans on page 15-2.

9. Attach the brake cylinder piston ram at point "B" on part BR (use the middle hole for initial set-up).

10. At point "A", put the 1/4" bolt through the (trial) wood block and secure it to BR, going through the CS-75 bushings. Bolt on the adjustment strap to the opposite end.

11. Position the rudder pedal to a neutral (no rudder) position. Lower this whole arrangement down into the nose and into position, just as it will be when you're all done.

What you are trying to accomplish here is to find out where the attach points "A" and "D" are going to be so that you can get on with the glassing. Also, you want to make sure that nothin going to interfere with the operation of the brakes when they are finally installed. For us, that meant messing around with the nose air vents that were located up there. Keep in mind that you want the master cylinder to be vertical **WHEN THE PLANE IS IN A LEVEL POSITION** so be careful if you are doing this trial run with the nose down on the ground. The point "C" should be directly over point "E" on the rudder arm for the best efficiency. By the way, don't picture the components of this mechanism moving any great distances during operation. A quic check will show you that the aft end of BR only moves about an inch for full brake application!

12. Mark the location of MB and point "A" and remove the brake cylinders.

Crank up the epoxy pump and warm up the epoxy, you're going to need it about an 1/2 ho from now. Get some coarse sandpaper and thoroughly rough up the surfaces where those attach points are going to be. Clear areas about 6" square for the lower mounting brackets and about 4 around for the points "A" on each side. You need to glass some "pads" onto the present glass surfaces to create areas of sufficient strength to support the brake cylinders and not crush the fo core structure of the nose area. I always tend to over-kill things like this, but I always feel bette about it. I glassed 3 BID pads on the two side attach points and 4 BID pads on the bottom attach points. Peel ply these and take the rest of the afternoon off!

13. With everything well cured, remove the peel-ply and rough up the surfaces lightly, getting rid of glass needles, etc.. Place the brake "set-up" back down into the nose just as you did in step 11 and re-mark where the attach points will be. Make sure the wood blocks at point "A" are positioned the way you want them.

14. Cut out 3 more glass circles for each of the four attach points.

15. Rough up the underside of MB, mix up some flox and some 5-minute epoxy . . . add some flocked cotton to the 5-minute epoxy and put a dab in the center of the base of MB and on the bottom of the wooden block. Put flox **around** the dabs of 5-minute. Lower the complete set-up back into the nose and hold the attach points in position until the 5-minute epoxy cures. The 5-minute will hold the parts in place while the flox cures. (I must have used this little trick a hundred times during the building of the plane!)

16. Remove the master cylinder(s) and BR assembly. Layup the 2-3 ply BID pads over the attachment parts, using flox to fill in the holes and void spaces around the wood and metal parts (cover the areas that you don't want epoxy on with masking tape . . . especially the threads of the bolts at point "A"). The layups at point "A" will probably extend up onto the top of the inside of the nose (I had to stipple this layup using a mirror and a light!). Let this job cure . . . control yourself, you're almost done!!!

During the trial installation steps you should use non-locking type nuts on the bots so that you can dismantle the whole affair without disturbing the alignment.

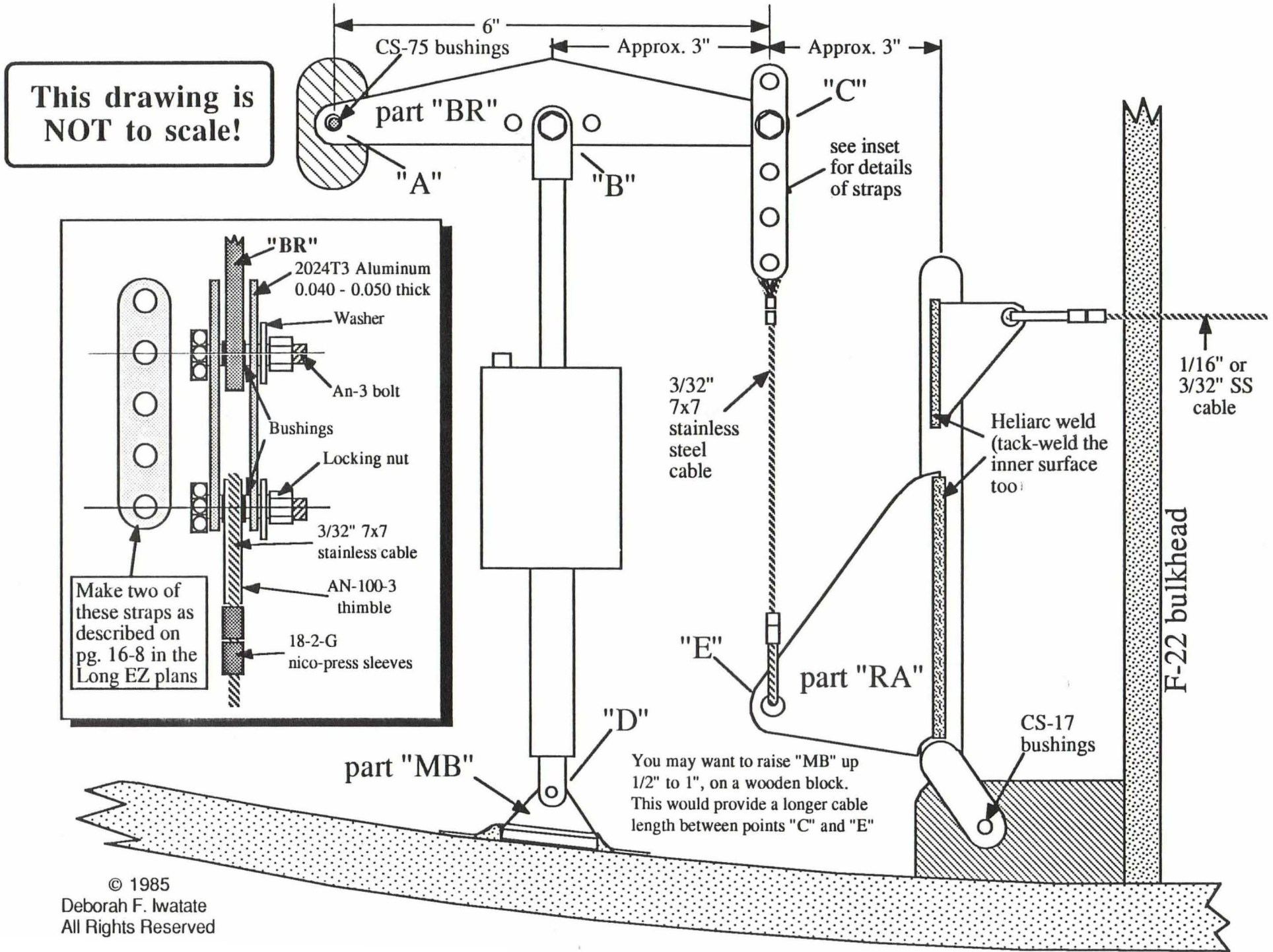
17. When the glass-work is completely cured, sandpaper any rough edges/surfaces, and see how everything fits. Bolt the whole system together.

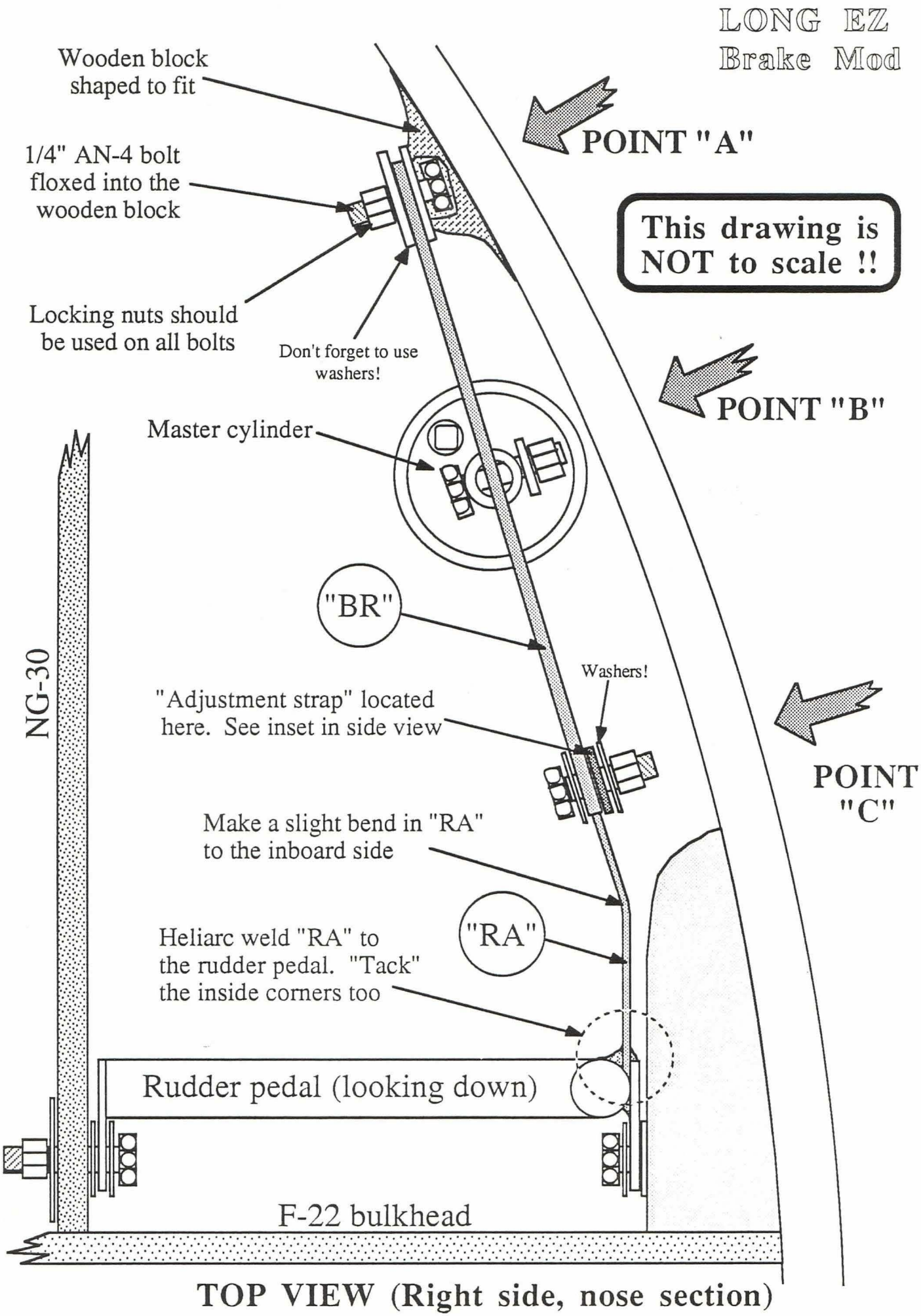
If everything doesn't "go in right" I guess you'll have some work on your hands, but if you've worked carefully you should be ready to "set the brakes". I'm going to leave this step up to you, there's nothing different here from the procedure that's used in the EZ plans. Keep the following points in mind though;

- For the initial set-up, attach the adjustment strap on BR at one of the "longest" settings; this will enable you to take up any "slack" to a greater degree later.
- Rotate the piston ram on the master cylinder to a middle position of its movement up into the bracket that attaches to BR, that will give you maximum movement there, both up and down, for future adjustments.
- The three holes in BR at point "B" are provided to give you a selection of lever moments, and therefore a choice of settings for a different "feel" when braking.
- Don't forget to carry out the setting of the rudder travel when you're doing the brake adjustment . . . make no changes here from the values given in the EZ plans.
- I like to use two nicopress sleeves on all thimble points in the brake system. Even though the little crimping tool does a good job, it makes me feel safer to provide a backup.
- You will find, when making the final settings, that this brake installation provides a tremendous amount of adjustment latitude compared to the "plans" installation. As Mike Melville commented, in his article in CP #46, they will be "tuned" more to one person, within a couple of inches of height.
- Be careful when making adjustments and when using the brakes, **don't "stomp" on the brakes**, you can generate a heck of a lot of force with the increased leverage. This is particularly true if you are used to the old brakes. A lighter touch is advised when using this arrangement, unless you like to change brake shoes!

Since originally drawing up the plans I have made one change that you may want to consider. Where MB attaches to the floor of the nose section, I chose to raise the metal angle bracket (MB) up an inch or so, using a wooden block, floxed into place and covered by 4 plies of BID. This provided a little more length to the cable between points "C" and "E", which made "fine tuning" adjustments easier in the final installation stages.

Well, I hope this description helps you to do a successful installation. As I said before, the effort was worth it as far as I'm concerned. Together with the high performance rudder mod, our Long will, in my opinon, finally have all the major "bugs" ironed out!!





TOP VIEW (Right side, nose section)

Debbie Iwatate 11/85

template for part "BR"

5/16" Dia.

3/16" Dia.

2024T3 1/8" Aluminum

top view

3/16" Dia.

side view

part "MB"

2024T3 Aluminum 1"x 1" x 0.125"

5/16" Dia.

template for part "RA"

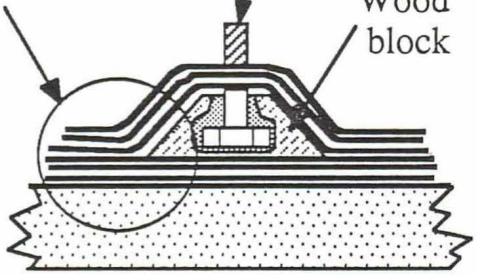
4130N steel 0.050 thick

Heliarc weld along this edge

AN-4 bolt
floxed in place

2-3 ply BID pad over
3-4 ply BID pad under

Wood
block



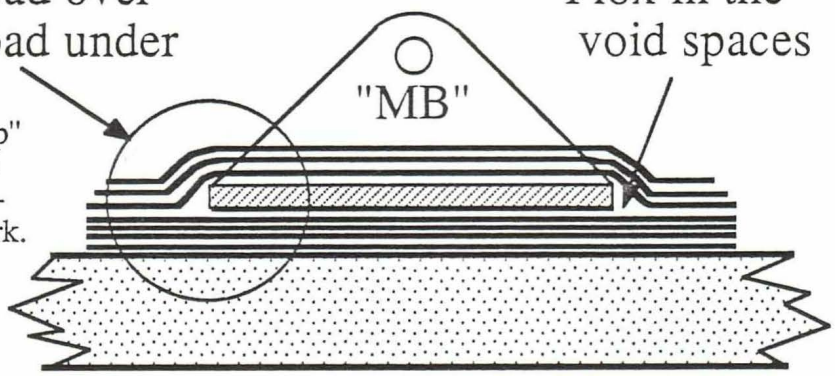
Point "A"

2-3 ply BID pad over
3-4 ply BID pad under

*Be sure to "rough up" the surfaces w/coarse sandpaper prior to beginning the glass work.

Flox in the
void spaces

"MB"



Point "D" Attachment of part "MB"

ALTERNATIVE CANOPY SAFETY LATCH FOR THE LONG EZ

by Debbie Iwatate

The canopy locking "hooks" have proved to be a good system for pulling the canopy down snug on the Long-EZ and Vari-EZE, but the latch retaining system that is described in the plans has bothered me from the start. There had to be a better way. About half-way through building the Long I saw a latch on Ray & Nova Cullen's Vari-EZE (Oregon) with a release system that not only held the front latch tight but also provided a means for the passenger to release the canopy in case of an "on ground" emergency. Their idea was the start of the design for the system that I put into our plane, and have described in this article. The latch locks VERY FIRMLY into place, the micro switch alarm system is still used, one hand can easily open and lock the canopy and the passenger can open the canopy with an easy, 2-step method.

The photographs have been provided to give you some idea of how the system looks when installed. The only moving part is the downward rotating catch arm. This part is positioned so that, as the canopy latch is moved downward and forward the catch arm is forced out of the way until the locking bolt moves into the "slot" of the catch arm, then the arm snaps up and locks the latch into place. To release the canopy latch flip the catch arm down and pull the canopy latch aft and up. The rear seat passenger can move the catch arm out of the way by pulling (GENTLY!!) on a small cable that is attached to a ring in the back seat area. The cable is steel fishing line leader that is threaded through Nylo-Seal tubing that guides it to the lock system. After releasing the catch arm the canopy "hooks" can be swung out by pulling on the push-rods that engage them, then all that's left to do is unhook the secondary safety latch by the pilots left shoulder. The ring in the back seat should be properly labeled so that the passenger realizes that this is an emergency system. You might want to include special covers to prevent anyone inadvertently messing with the release wire or accidentally pulling the ring. But, just pulling the ring won't be enough. . . you have to coordinate the release of the catch arm with movement of the canopy lock push rod. I include a brief description of the system and demonstration of its operation to passengers, as a part of my pre-flight with first-timers.

- I enlarged the fuselage side door opening about 1/2" all around to accommodate this latch, and I changed its position slightly aft, these changes were not absolutely necessary.

- You may want to make mock-up "parts" and see how everything goes together before you commit to making this change on the plane.

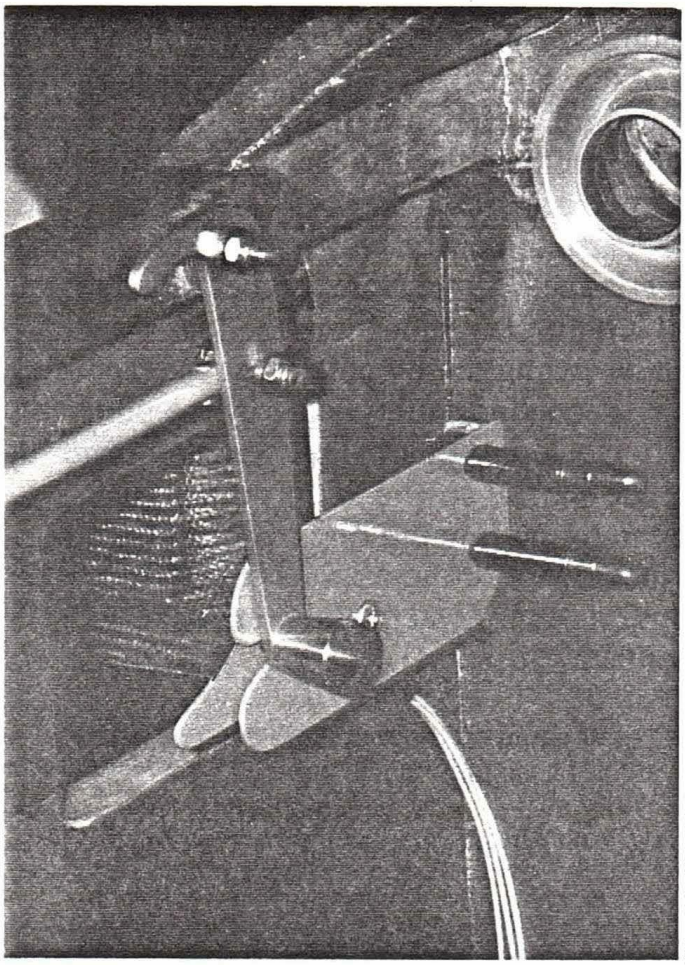
- You might consider moving the safety catch (by the pilots left shoulder) several inches aft, so that the passenger can operate it by reaching over the front seat. With the safety catch positioned as far forward as shown in the plans, the passenger will have a VERY difficult, if not impossible, time getting that latch released even with the main lock released.

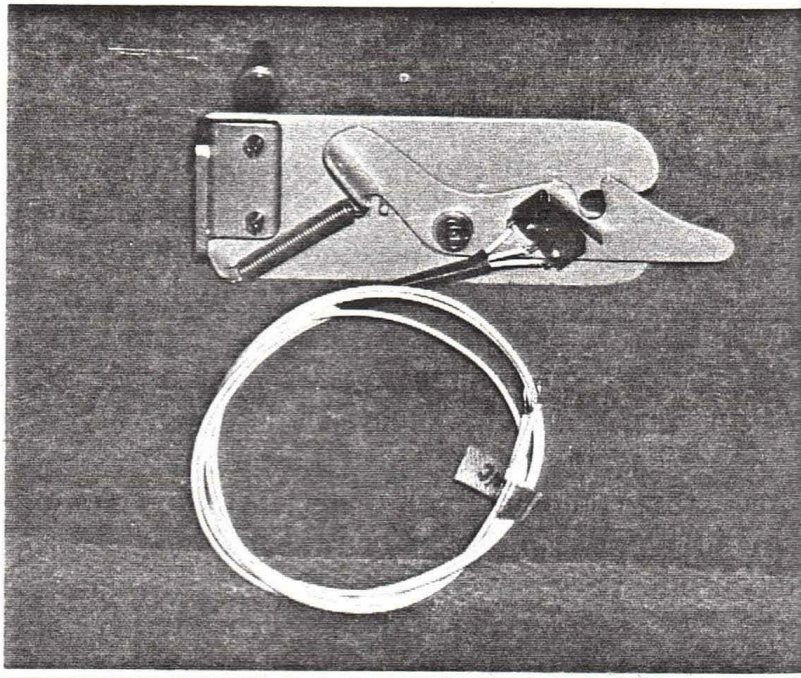
- The micro switch can be epoxied or riveted onto the side of the catch arm. I found this step to be the most difficult of the entire installation. You must be very careful not to break the switch "case" if you choose to rivet it on. Epoxy is probably the best route to take. Whatever method you use, it is important that you maintain the switch as close to the surface of the catch arm as possible so that it can make contact with the bolt head on the latch. The diameter of the bolt head is sufficient to trip the switch as it moves into position.

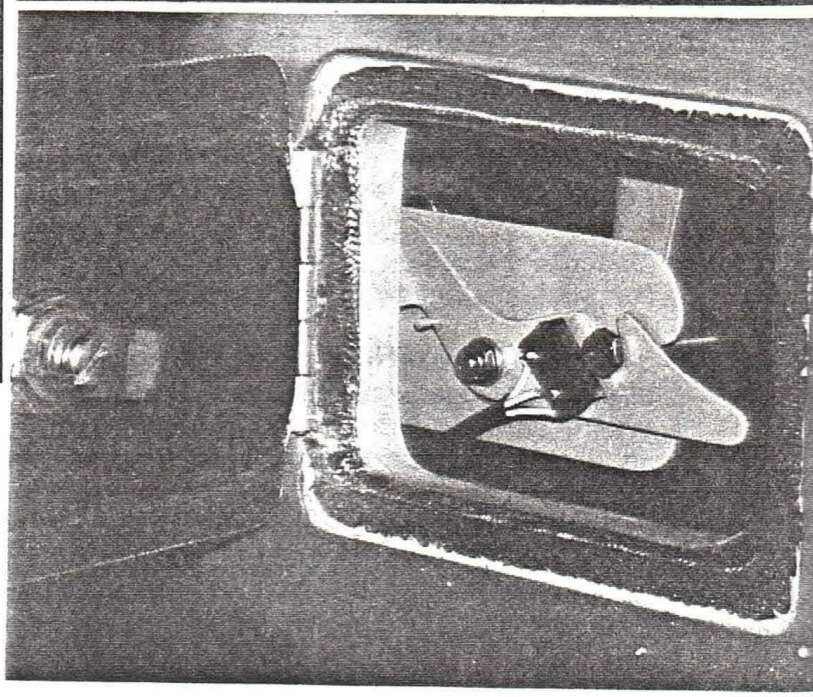
- A small retaining pin or plate needs to be fastened to the main arm support plate so that when the canopy latch arm (the actual handle) isn't snapped into place the catch arm doesn't just swing around. I used a small metal pin and force-fitted it into the hole. The spring tension on

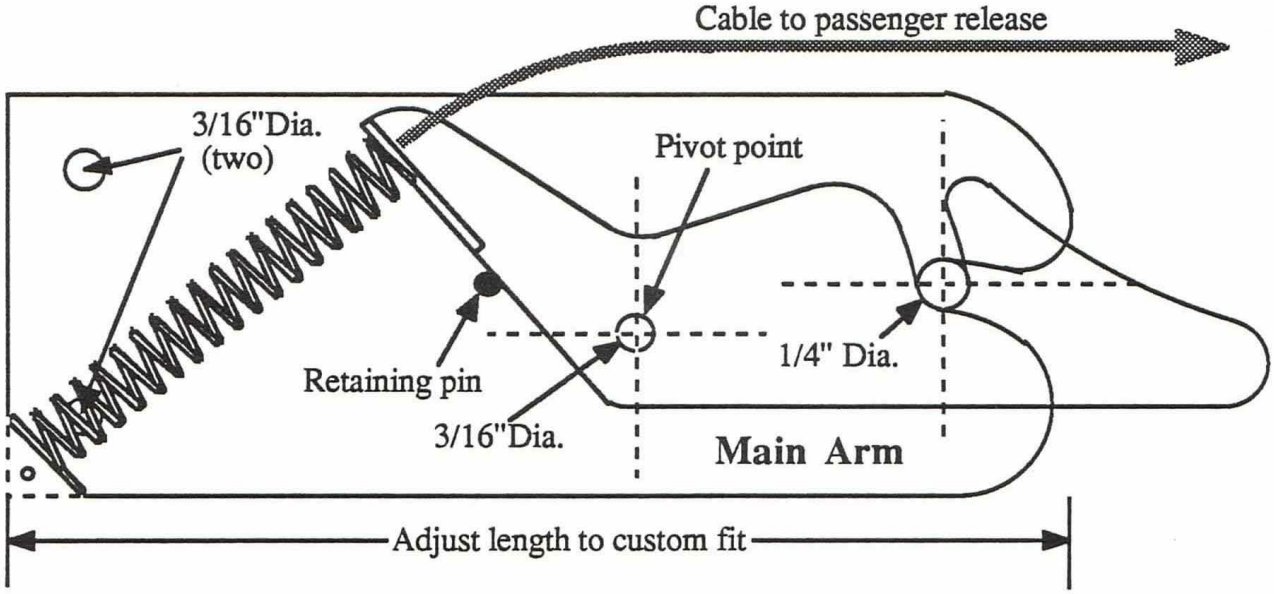
this part can be adjusted by taking out lengths of spring during a trial and error installation. I used about a 5/16" diameter spring. The spring doesn't have to be very strong, the one I used was bought at the hardware store.

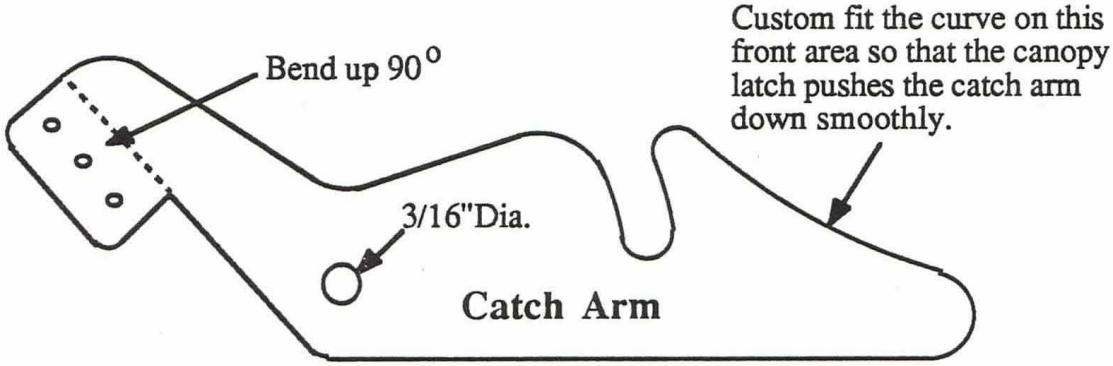
- There is a very thin, plastic washer between the catch arm and the main arm, to allow for smooth movement.
- Adjust the length of the main arm to provide a custom fit. Use a small section of 1/8" aluminum angle to mount it to the instrument panel.
- Use a locking nut to fasten the catch arm to the main support arm.
- 0.040 to 0.050 inch aluminum should be used for the parts.

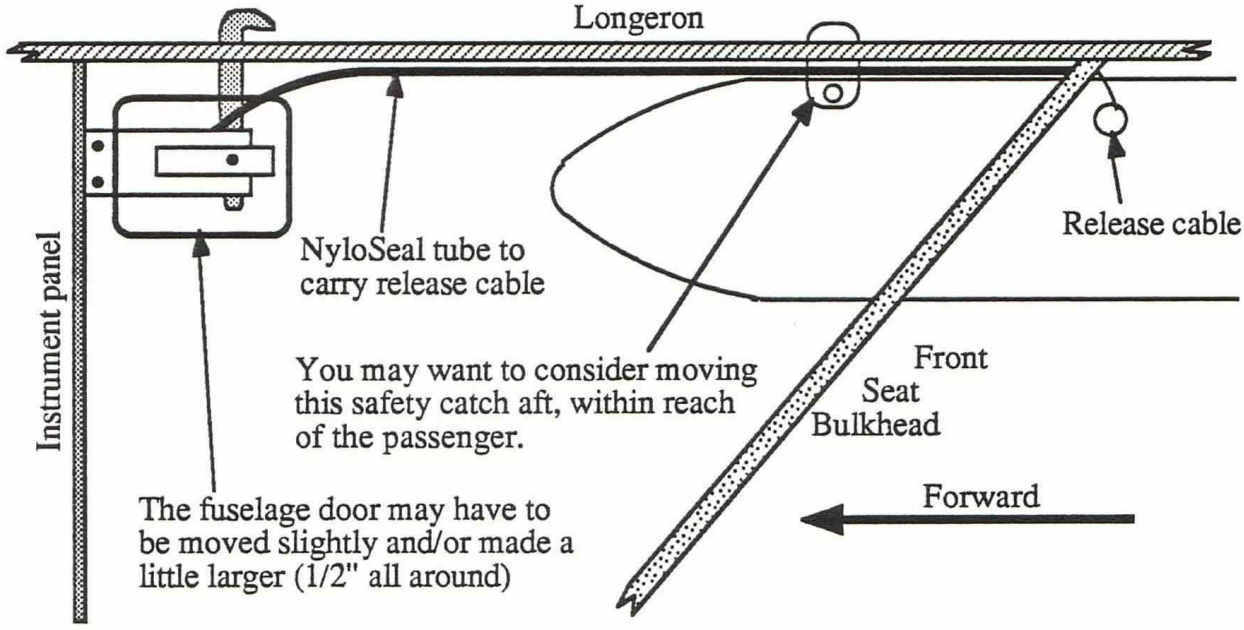












ALTERNATE CANOPY LATCH FOR THE LONG EZ

INSTALLATION OF AIR VENTS IN THE LONG EZ NOSE

by Debbie Iwatate

At almost every fly-in or air show we attend, EZ builders ask us about the air vent system that we built into our Long. Like so many things, it seemed fairly easy to design and install . . . but to try and describe all the steps that went into the process! . . . To make a Long story short, the following is my third attempt at providing you'all with the sequence of events and some tips on how we went about the task. This installation works beautifully! We get exceptional airflow in nose-high attitudes (take-off) and at all speeds. At first we were a little concerned that the force of the air would "rip the vent doors off" and on the first flight I was even hesitant to try them at all. But, it turns out that the control cable (locking) actually serves the purpose of keeping the vent open! The air flow tends to want to close the vent. Even in heavy rain I have had the vent door open about 1/4" and had no problem with moisture coming in with the air. I think "exit air" vents, on the aft canopy section, help aid the flow of air through the cabin, in combination with these forward vent inlets. In colder weather we close the rear vents up almost completely allowing control of the air with the eye-ball vents, down to just a whisper.

I glassed the vents in place on our plane right after completing the inside of the nose section, prior to installing the top component. You can install them as a retrofit, but it is more awkward to work inside the nose section when it's all "buttoned up". Well, ... here we go!

1. Draw the outline of the vent door (figure 4) on the outside of the fuselage. Ours were 15" aft of the nose and in a line, horizontally, with the pitot tube. This measurement is to the aft edge of the door. **Custom position your air vents so that they will not interfere with the battery, PLAN AHEAD!**

2. To obtain a perfectly contoured cover, that will match the outer surface of your plane, Tape some Saran Wrap™ over the outline. Layup 5 plies of BID over each marked area, these will be the vent doors. When cured, trace the outline of the door onto the glass (it will show through the layups). Remove, cut out, trim, then install hinges (use rivets **and** flox).

3. Make the vent arm, "VA". The "length" will depend on the thickness of the foam inlet. Flox, rivet and glass this arm to the door just prior to installation, "to be safe".

4. Draw the shape of the hole going through the fuselage side (figure 4) and cut it out. Clean out the urethane foam from the nose wall at an angle aft. Micro a small block of urethane foam to the inner surface, where the hole is, and carve to the proper shape. Make the aft surface flat to accept the duct flange. 1 ply of BID covers the carved foam on the inside and one ply BID is applied to the bare foam on the inside of the vent inlet coming through from the outside. Flox the corners.

5. Now the "detail stuff" begins. Flox and rivet the aluminum duct flange in place (figure 2).

6. The hinge on the door is the same type used for the ailerons and canopy, just slide out the pin, "reverse" the hinge and put the pin back. I cut our hinges down so that they were only 1/2" or so wide on each side. The area where the hinge lies has to be recessed . . . I just cut away some of the outer skin glass, put micro (**dry,** with just a little flox in it) into the area and used a dremel to clear out a depression for the hinge and rivets. The aft side of the hinge was slid under the fuselage skin, rivet holes drilled and clecos used to hold it until later.

7. Install the arm, VA, with clecos, and see where a "slot" will have to be cut in the inner vent side to allow it to pass to the inside of the fuselage. I then cut out a hole bigger than needed, piled in some dry micro and used a pin router to clear out an accurate fitting path for the arm to slide through. By the way, don't worry about air "leaking" through this slot (it should be a tight fit anyway); when

the slot is exposed the vent is open, and that's when you want air anyway. . . when the door is closed, it seals very well.

8. If you like the way everything fits and there is no binding on the vent door as it moves back and forth, you could go ahead and permanently attach the door at this point. Fair in the door with micro (with a little flox mixed in to prevent any chipping on the edges). Layup one ply of BID (a small patch) over the base of VA to smooth out the attachment point and to add a little extra strength.

9. The control cable I bought for our installation was the locking type from Spruce. . . they're a little expensive (like $20 each!) but they are worth it since they get a lot of use and need to be strong. We have one vent on each side of the fuselage, in the upper corners of the instrument panel . . . the control knob is positioned close to the eye-ball vent.

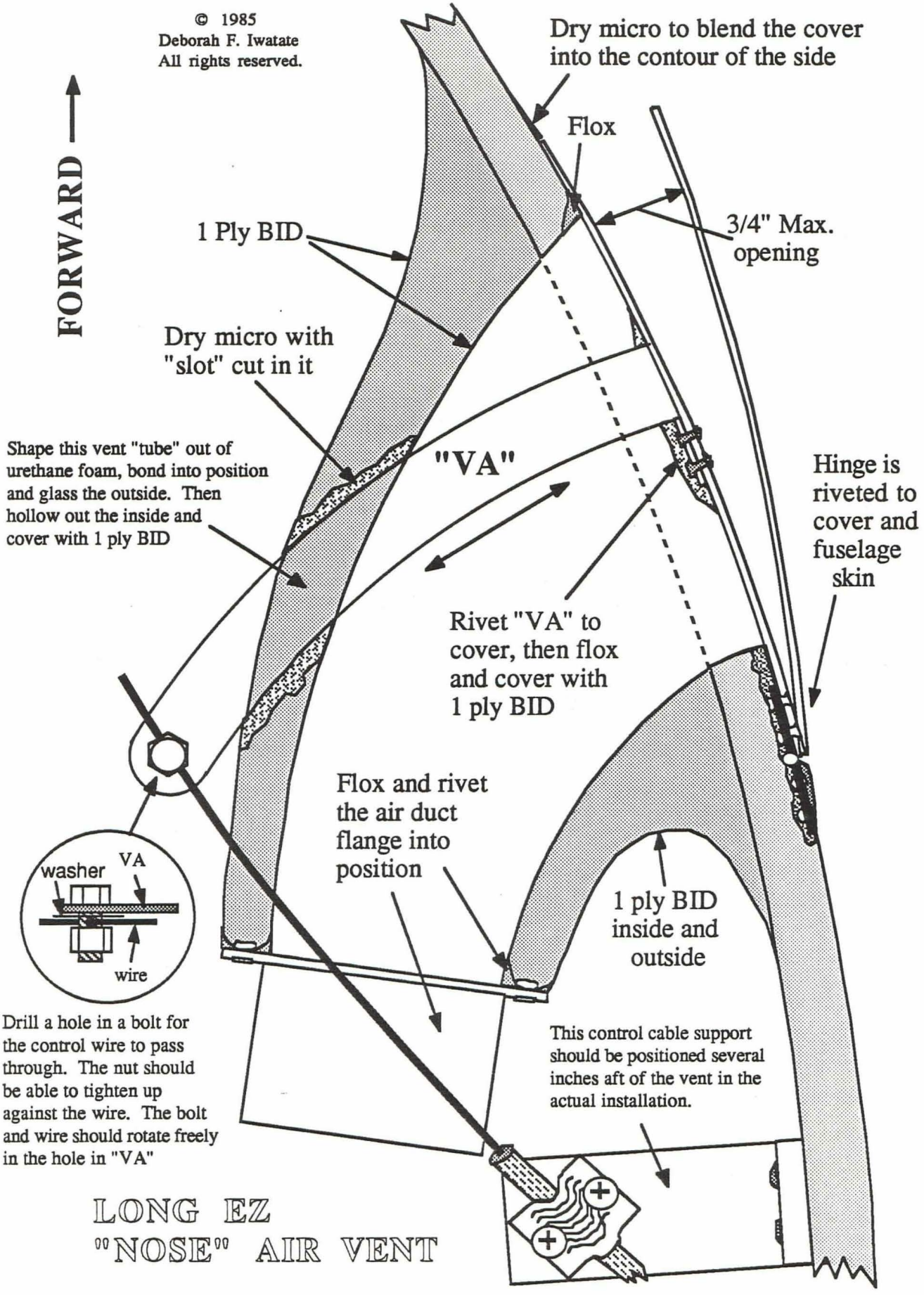
10. In figure 1 you will see the position of the fiberglass vent segment. This was carved out of urethane foam and glassed over with two plies of BID (1 extra ply around the hose attach area on each end) on the outside. The shape is carved to "aim" the duct in the right direction(s), toward the vent inlet and the eyeball vent. I guess you could just run the duct the whole length, but my thinking was to be sure that nothing could ever interfere with the movement of my feet in the area of the rudder pedals. I flattened the area as it passed under F22 to provide more room. This segment was then floxed and glassed into position.

11. A small screw was drilled to accept the control cable and attach it to the end of VA (see diagram). This should rotate freely in the hole in VA as the cable pushes the vent door in or out. The cable holder was positioned to allow the cable to pass under the duct flange.

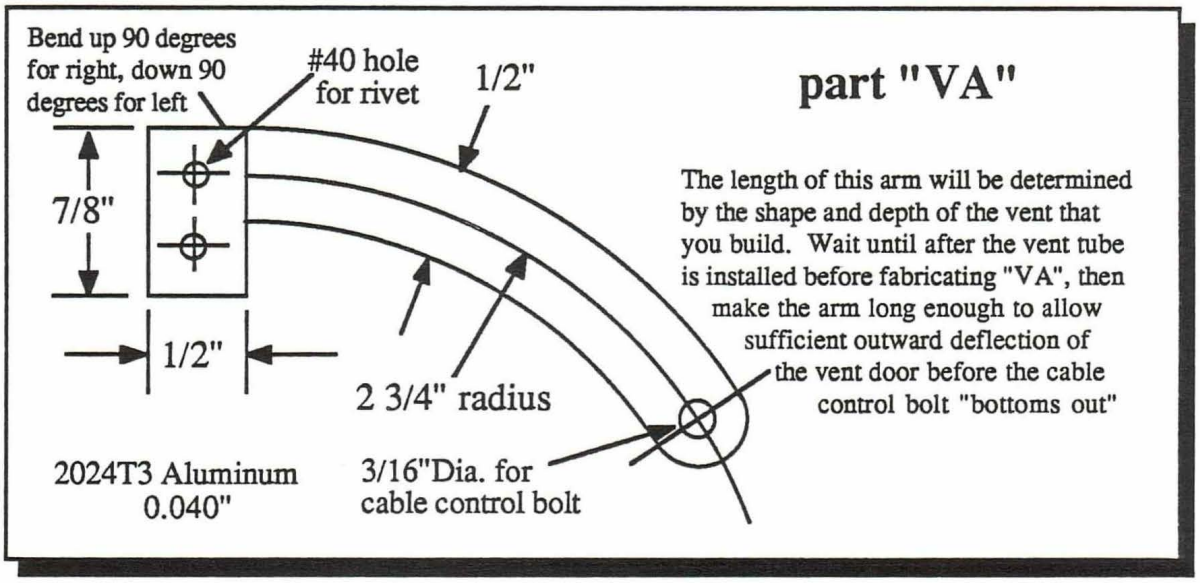
When you are making the final installation, limit the outward travel of the vent door to less tha 1". Ours is set at about 3/4" maximum travel and has been more than adequate. This "distance of doo movement" is a good reason to wait until the inner vent area is made before making the part, VA, sinc it will have to be long enough to reach all the way inside. And also, you may find that you need to change the radius on VA, to provide a custom fit. The small bolt on the end of VA, where the cable attaches, serves as an additional safety "stop" for the outward movement of the door.

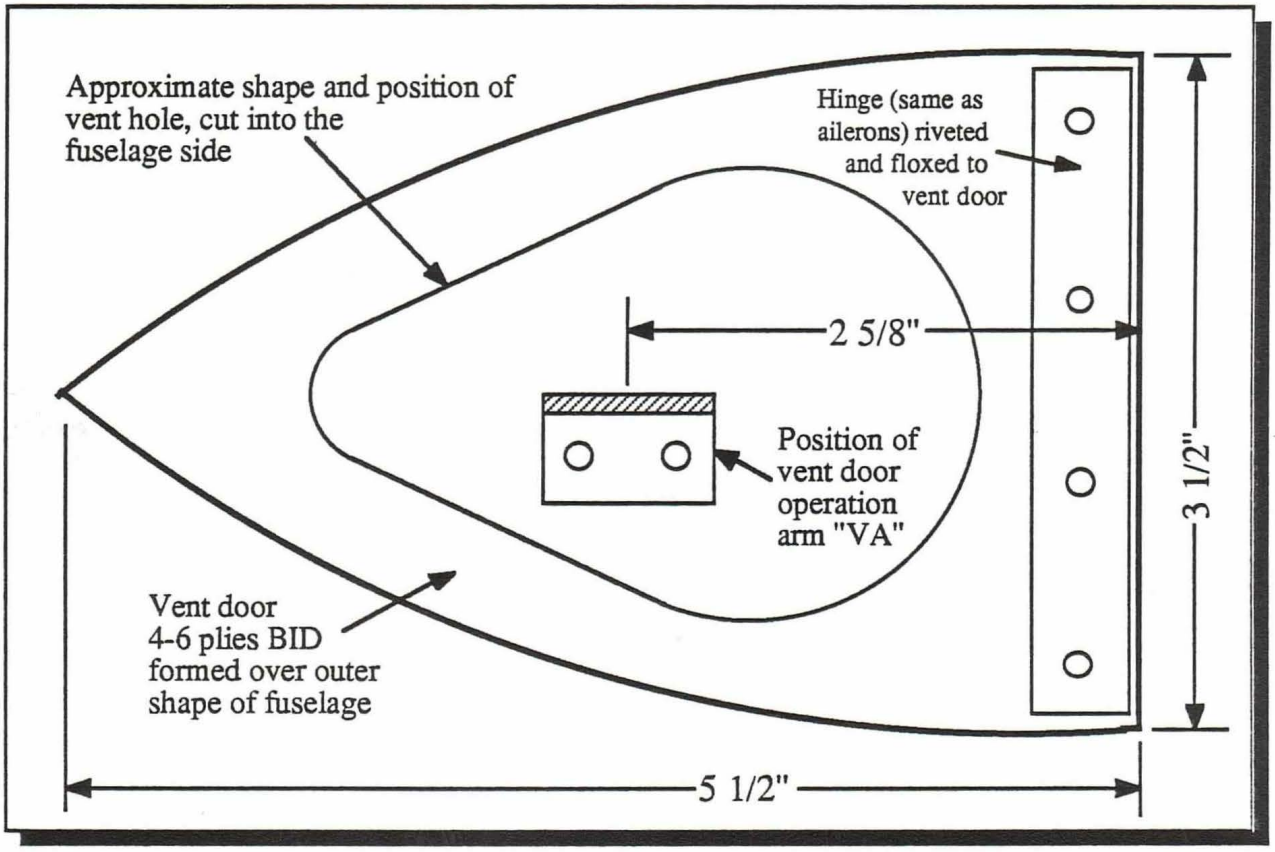
That's about it. One additional thought. If I had it to do again I would still have the two vents coming into the main cockpit, but on one of the vent lines I would put a "Y" segment with a direction control so that I would have the option of directing air into the nose area. A lot of times some cooling air around your legs (and the instruments) can feel very good. We have had no trouble getting **plent** of air to the back seat area . . . the eye-ball vents can direct the flow across the top of the canopy, over the pilots head. Don't forget, during the layout step (#1), **plan ahead for the positioning of the battery!** Position your vents so that they don't interfere with the (future) wires that may be installed in the nose.

By installing these vents and eliminating the NACA vent in the canopy, as per the plans, we wer able to cut the canopy back further aft and form the "lip" over the instrument panel. An instrument access hatch was built over the instrument compartment to allow complete and easy access to the entir back surface of the instrument panel.

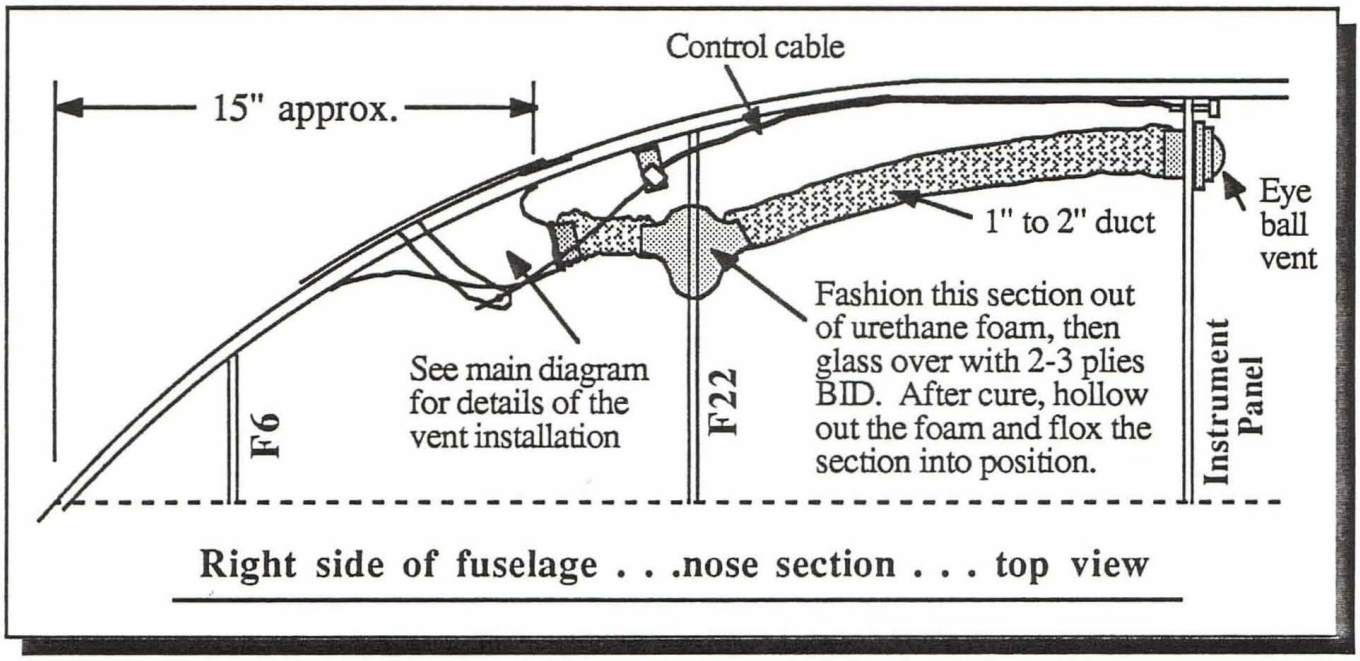


LONG EZ "NOSE" AIR VENT

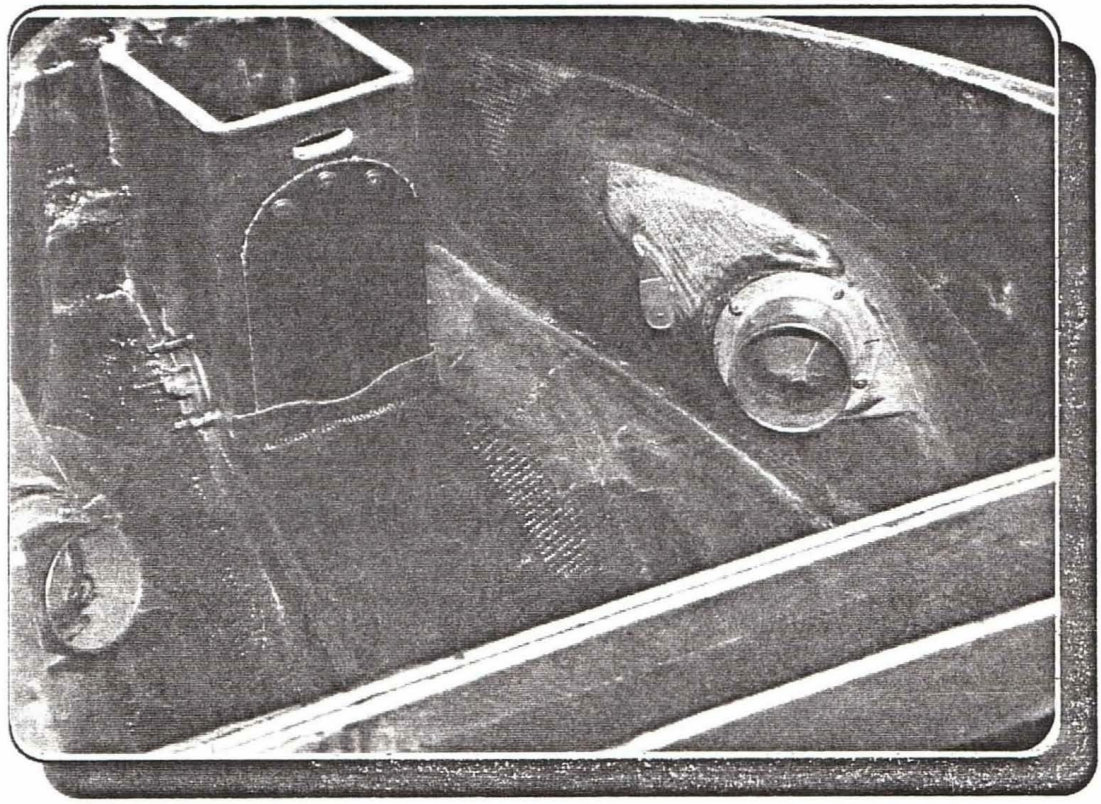




LONG EZ NOSE AIR VENT



Right side of fuselage . . .nose section . . . top view



Photograph of the right side nose vent installation with the vent operation arm, "VA", in position and the duct flange floxed and riveted in place.

LONG EZ "NOSE" VENT INSTALLATION

INSTALLATION OF REAR (EXIT) AIR VENTS IN THE LONG EZ

by Debbie Iwatate

The following instructions describe how I installed rear air vents, or air "outlets", in our Long, 455EZ. There are probably many ways to do this, but our installation is quite simple and it works very well. These exit vents, together with the nose/side inlet vents, provide ventillation in flight that is comparable to driving down the road with your head out the window! And yet, you can adjust the flow to give just a slight whisper of air when that's all you need.

If you would like to envision how these vents work, before you install them on your plane, just look at the top of a grated Parmesan cheese can because that's where the idea came from! We have two vents installed, one on each side of the canopy above the centersection spar. You can't (and don't need to) adjust them from the front seat. The passenger can reach them, but there's really no need to be messing with them once they're set for a certain time of year.

1. Cut out two "discs" of 1/8" aluminum, about 3" in diameter.

2. Locate where you want the vents to go, on the inside surface of the canopy side. At the center point, cut away a small section of the glass and hollow out some of the foam to accomodate the 1/4" piece of aluminum (see diagram). This will serve as the anchor point for the center bolt. Flox the aluminum piece into place, flush with the surface of the surrounding glass and cover with a small BID patch. The aluminum will be drilled and tapped later.

3. Now you have to provide a flat surface for the vent "disc" to sit on. Since the surface is curved in this part of the canopy, you will have to build up the area above the inset metal piece. Keeping track of the "center" of the aluminum piece, pile a few tablespoon-full "gobs" of dry micro over this area. Wrap your aluminum disc in Saran Wrap™ and push it into position against the side to create a flat surface underneath. The micro that oozes out the sides can be smoothed to create a fairing and make the installation look tidy.

4. Drill out the center hole in the disc, cut out the vent hole, make a knob out of aluminum rod and mount it to the disc.

5. Rough up the back surface of the disc and epoxy a piece of neoprene/asbestos baffle material to it. When it cures, trim to the outer edge of the vent disc.

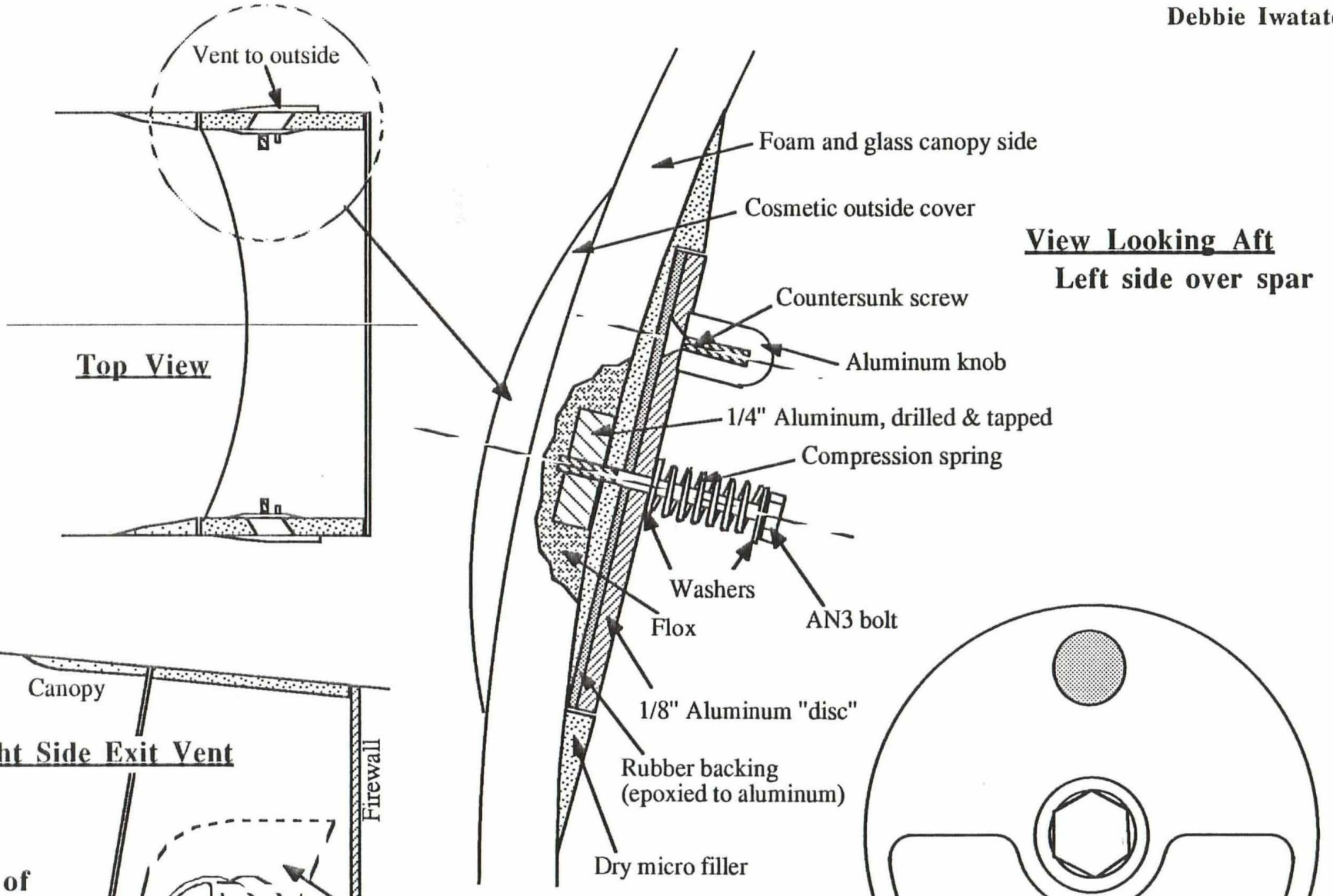
6. Now position the disc into it's "seat", locate the center hole, drill and tap the "hidden" 1/4" aluminum piece to receive the attachment bolt.

7. Trace the shape of the outlet hole onto the canopy side (the inside surface, on the micro) and cut the hole through to the outside. You will want to think about this and angle the hole so that rain water won't flow off of the cowling and into the vent holes when the plane is parked nose down! Angle the cut aft. Close out the exposed urethane foam through the canopy side with 1 ply of BID. Flox all the corners.

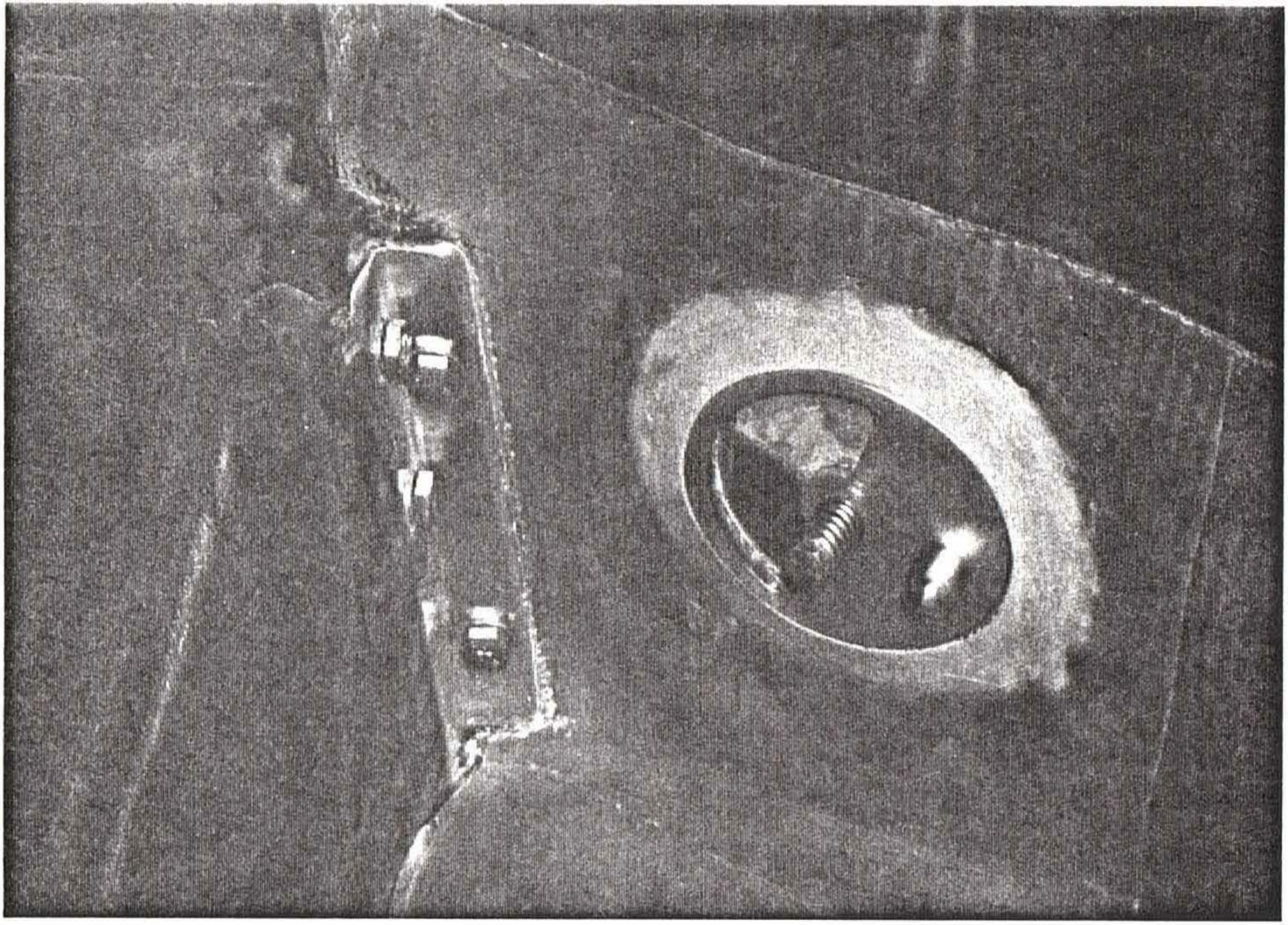
8. Fashion a "cosmetic cover flap" to hide the vent hole on the outside. This will also help to create a light vacuum which will draw air out of the cockpit and help to create a good air flow.

9. Attach the bolt and spring as shown in the diagram and mount your vent into place. . . that's all there is to it!

Debbie Iwatate



REAR AIR VENTS FOR THE LONG EZ



INSTALLATION OF ALTERNATE ROLL TRIM ADJUSTMENT

by Debbie Iwatate

This is not a modification to the roll trim system. The following discussion describes two alternate systems for installing the roll trim control lever. As built, in the Long EZ plans, the roll trim is adjusted by moving "RT1" vertically with a small "handle" that is formed at one end of the part. There are a few reasons why you might want to consider changing this part and rearranging the activation system. The first reason is to preserve your upholstery! I found that when the cushions were finally completed and fitted into the cockpit, nice and snug, the lever arm of RT1 protruded into the soft foam and began rubbing the fabric. After twenty hours or so there was signs of wear on the seat cover and I was afraid that this was headed for a repair job if I didn't do something quickly. Another reason is because of the awkward position of the lever (at least for me!) for making in-flight adjustments. I didn't like having to "dig" down the side of the cushion, which was even tighter fitting once I was sitting on it, to reach for the trim control. The final reason was that I was still going through "withdrawal" from completing the plane, and was desperately looking for something to "make" or build or at least tinker with to fill all the idle time that was created since the project ended!

As you can see in the drawings, two installations are suggested. The first one can easily be made during the initial building schedule, but may be somewhat difficult as a retrofit. A few builders have done it, having had (smart people!) totally removable side consoles, allowing them to access the entire control system by removing a dozen or so screws. You could do the job without the convenience of take-apart panels, but it would take some effort. I like the looks of the finished mod using method #1. The lever protrudes above the upper surface of the console, resembling the pitch trim control lever on the left side and gives a nice appearance of symmetry. The second method, and the one that I did in our Long, is much easier as a retrofit and doesn't require poking around inside the console. A minimum of effort is needed to remove RT1, work it over and get it back into position.

ALTERNATE INSTALLATION #1

There is no change in the method of operation for the roll trim in either installation. Assemble and install the roll trim control system as described in the plans. Do not permanently attach the springs to RT1. When you have completed the initial system you are ready to make the alterations that will allow a shift of the control lever to an easily accessible position on the top of the right side console.

1. Remove and modify RT1 as shown in the first drawing. You will be cutting off the extension "handle", **but not entirely!** Leave enough of the old part to create the small extension needed for the push rod, leading down from the new main trim lever, "TL". RT1 will be turned around, so that the modified end faces in the opposite direction. Control will now be applied from the outboard side, by way of the trim lever, and control forces will be conducted by either a 3/32" piano wire push rod or a strip of aluminum.

2. Fabricate the new part, "TL", out of 2024T3 aluminum, 0.125" thick. Drill holes to accept whatever bolt(s) you intend to use. I used a 3/16" AN-3 bolt for the central pivot point. The music wire was inserted into about a 1/8" hole, allowing enough room for movement without binding. You might have to drill this hole a different size if you chose to use an aluminum strip instead of the wire.

3. You'll need a couple of washers, one rubber washer, a locking MS21042-3 nut and an AN-3 bolt with enough reach to pass through the parts shown in the drawing. Cut out a small piece of 1/4" wood or phenolic block into a 1" square. This will provide the surface area and support for the AN bolt. Also, the wood will provide a better bond with the flox and glass that's used to hold in the bolt.

4. The trim lever can be mounted using a duplicate set of hardware as that used for the pitch trim control lever on the left side. The spring assembly of the pitch control is not a bad idea, since it maintains the constant pressure/friction for control and allows variable settings.

5. Drill out the wood piece, insert the bolt and bond the two together using epoxy (with flox) or five minute epoxy. Cut away glass and foam to allow for the movement of the protruding end of RT1 after it's turned around. Close off the bare foam with at least one ply of BID.

6. Make a practice installation of the assembled parts; RT1, the push rod and TL. If you don't have a removable top to your console (as a retrofit) you"ll have to cut out the "slot" for the lever to fit through, above the console. Determine the pivot point and location of the bolt. Mark the glass so that you can remove material and mount the bolt.

7. Cut away the exterior fiberglass where the pivot point for TL will go and remove the proper amount of foam to allow the bolt and wood to fit flush with the surface. Protect the threads and the shaft of the bolt with tape and cover the wood and bolt head with a couple of plies of BID. **Make sure that the bolt is properly aligned as the flox, epoxy, etc. cure!** It's not a bad idea to have the lever on the bolt as the epoxy cures, ensuring that the alignment is accurately positioned in the upper slot (console).

8. The hardest part of this installation is the bending of the 3/32" piano wire push rod. That stuff is very tough to bend at short lengths. If you get frustrated after about ten attempts you should consider using an aluminum strip, twisted 90° in the center, to accomplish the same job. Whichever way you decide on you will have to experiment to determine the proper length of the pushrod. Keep in mind that you aren't going to be making in-flight trim adjustments that require "inches" of lever movement. Most adjustments are only slight touches on the control. Our plane, for instance, seldom requires more than a 1/4" of control input to accomplish the proper trim adjustment. Only occasionally will the pitch trim control require a shift of more than a half inch off center.

9. When you're satisfied with the fit of all the parts it's time to make the final installation. Attach the thimbles to RT1, as shown in the Long EZ plans book. Connect the springs and attach RT1 to RT3 using all the proper hardware, as called out in the initial plans. Make one more test for clearance of the outboard "tab" on the modified RT1 part. You don't want the RT1 or the push rod touching the fuselage side in any positions (check out the most extreme positions, even though you probably won't ever use them).

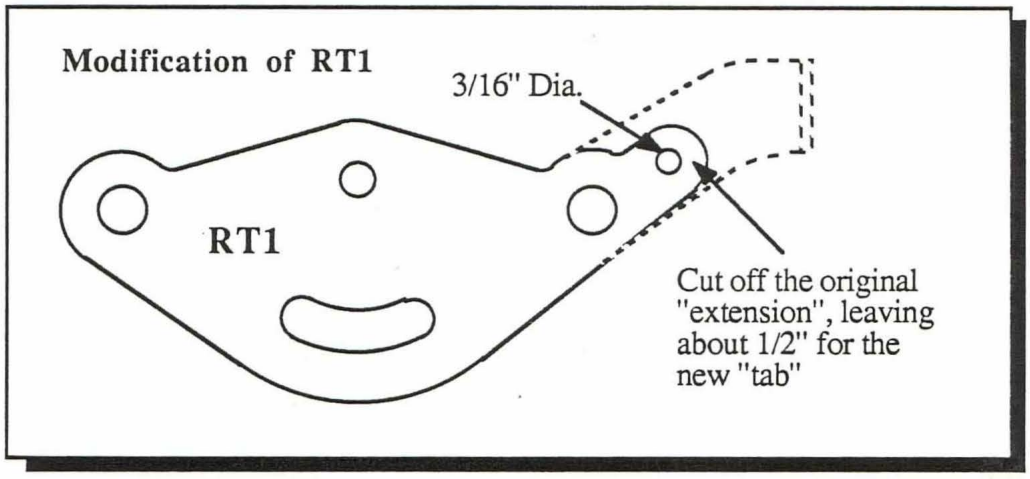
10. Connect up your push rod and TL assembly and slide TL onto the new bolt. Use all the proper hardware and don't forget to use either a locking nut or one with a cotter pin lock. Position the console back into place, with the lever arm, TL fitting into it's slot. If you have done everything just right you should be able to operate the lever easily while resting your arm on the top of the console. There should be no binding of any parts and the lever should "hold" any position that you input.

ALTERNATE INSTALLATION #2

This method also requires that you modify RT1 and you must fabricate a new control lever, "TL1". There is no change in the method of operation of the trim system. Assemble and install the roll trim control system as described in the plans. Again, don't permanently attach the springs to RT1 because you will have to remove them to make the modification.

When the installation and test of the initial system is complete you are ready to make the alterations that will provide a control lever on the inboard side of the right side console, just aft of the control stick area.

1. Remove RT1 and cut away most of the extension "tab" that was used as a handle. **Leave about 1/2" to provide enough area to drill a 3/16" hole** for the aluminum push rod strip attachment. With the push rod attached to the new control lever, trim control will be applied by up and down movement of the lever, TL1.



2. Fabricate the new part, "TL1", from 2024T3 aluminum, 0.125" thick. As shown in the drawing, the TL1 part will have to be bent in two places. I did this to make it easier to grab hold of, you might not feel this is necessary. You need to "lift" the lever away from the surface of the glass, far enough to be able to get your thumb and fingers onto it. This could be accomplished by using extra washers, but the bent lever adds a touch of class and the 2 to 3 inches of flat surface in the center of the lever, against the side of the glass, provides a more rigid installation. When I'm flying, I make trim adjustments with my thumb only. I keep the palm of my hand on the top of the console and "reach" down for the control lever with my thumb. As was mentioned above, only small control inputs are usually required, sometimes these are inperceptable movements of the lever! Drill out the two holes that will accept the bolts/screws you intend to use. For my installation I used 3/16", AN-525 type screws, mostly due to the low, smooth profile.

3. Fabricate the aluminum push rod from 2024T3 aluminum, 0.040" to 0.060" thick. This must be the proper length to allow TL1 to be level at the neutral control input position. You'll have to determine the measurement according to you own installation. Drill the holes for the attach points. Make the 90° twist in the strip, carefully, keeping good alignment.

4. Gather up the necessary hardware; washers (including a couple of "wide area" types), locking nuts, screws and/or bolts.

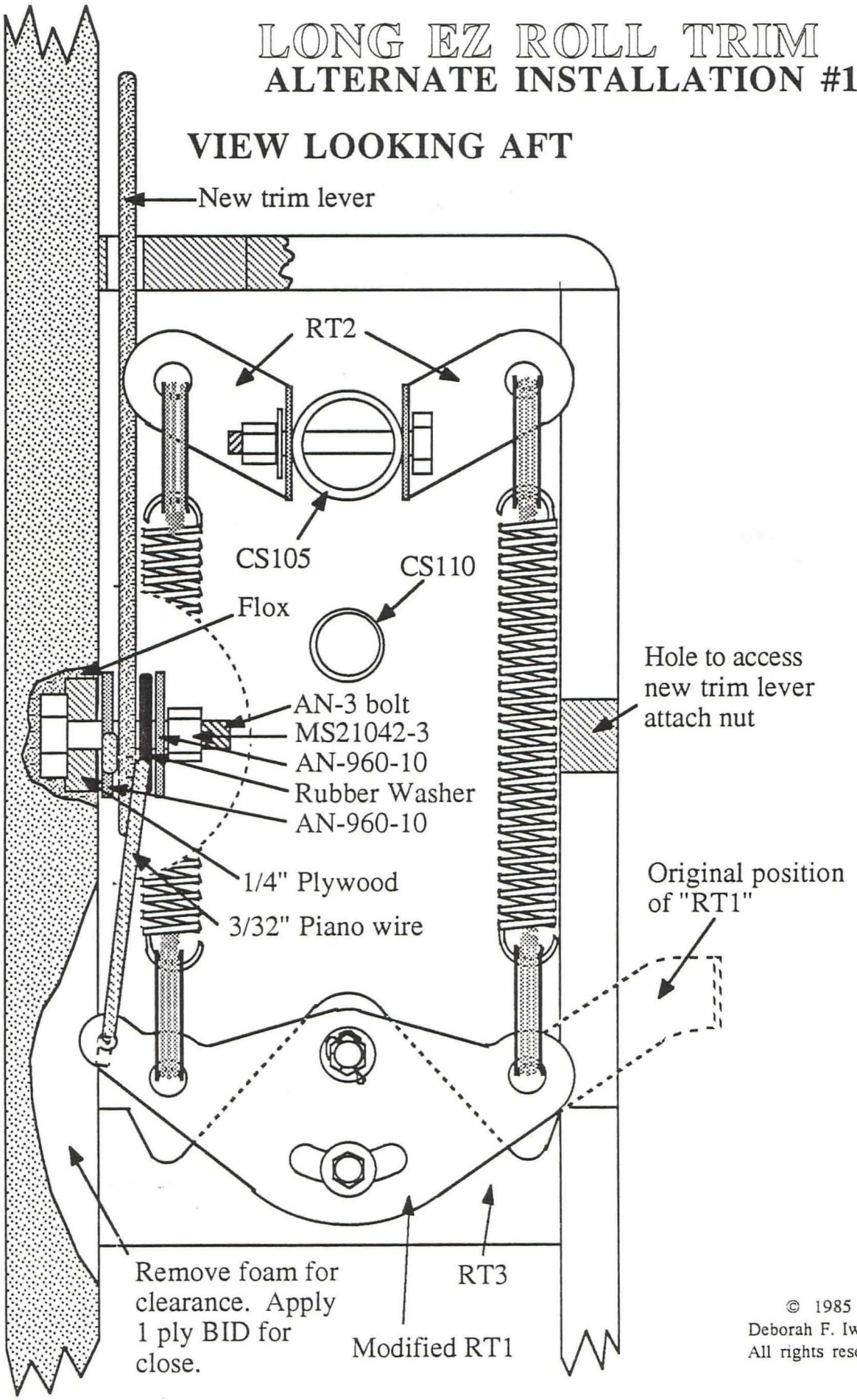
5. The drawing provides a pattern for cutting away the glass and foam where the lever will go. By removing this material you are able to mount the lever so that it doesn't protrude into the seat area. I think the lever would keep catching on everything if you didn't do this, especially the seat belts, and I'm sure it would rub contantly on the right side of your leg! After estimating where the center, pivot point of TL1 will go you can trace the pattern onto the console. Don't go entirely by the drawing I've made, you may need to customize the shape a little. Cut away the glass, being careful not to cut too deep into the foam. The glass will peel away with a little tugging (it does have surprisingly good "peel strength"!). Then remove foam, tapering the sides down to the center as shown in the drawing. There should be bare glass, from the inside surface, showing in the center area. Once you have this cleaned out and smooth, close the area off with a couple of plies of BID. You need a few layers down in the center area, to provide stiffness where the lever will attach. Flox all the corners and use a little wet micro on the foam.

6. Once this has cured you should be ready for a trial installation. Bolt TL1 to the upper end of the push rod. Attach RT1 to the lower end of the push rod. Fit RT1 back into position and hold TL1 flush against the console side. TL1 should be level at the neutral control input position of the trim system. You might have to remove some of the foam and glass at the point where RT1 and the lower push rod bolt together, due to the extra thickness created by the additional hardware. When you're satisfied with the "fit" you can go ahead with the final installation.

7. Be sure and use locking nuts. Also, use the wide area washers when attaching the TL1 lever, to provide good stability. When you're finished you should be able to make control inputs smoothly by using just your thumb. That's it! You're done!

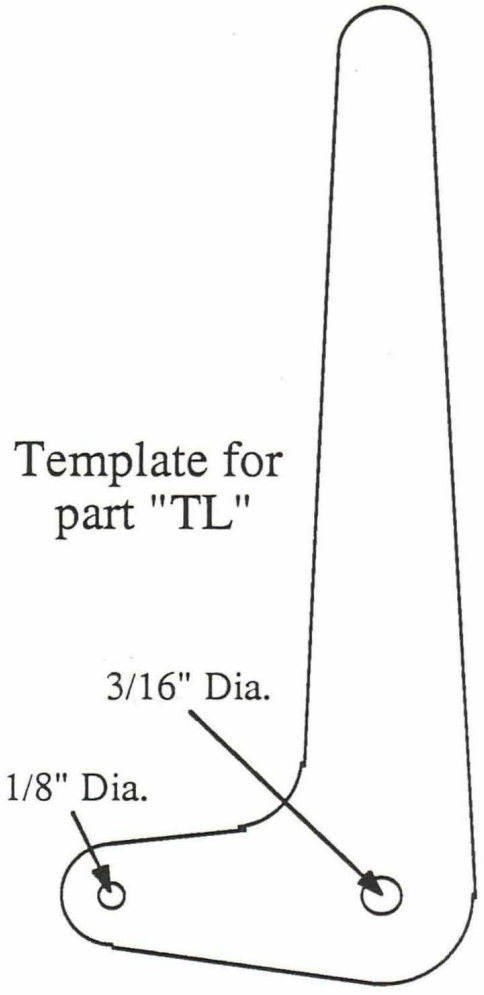
LONG EZ ROLL TRIM
ALTERNATE INSTALLATION #1

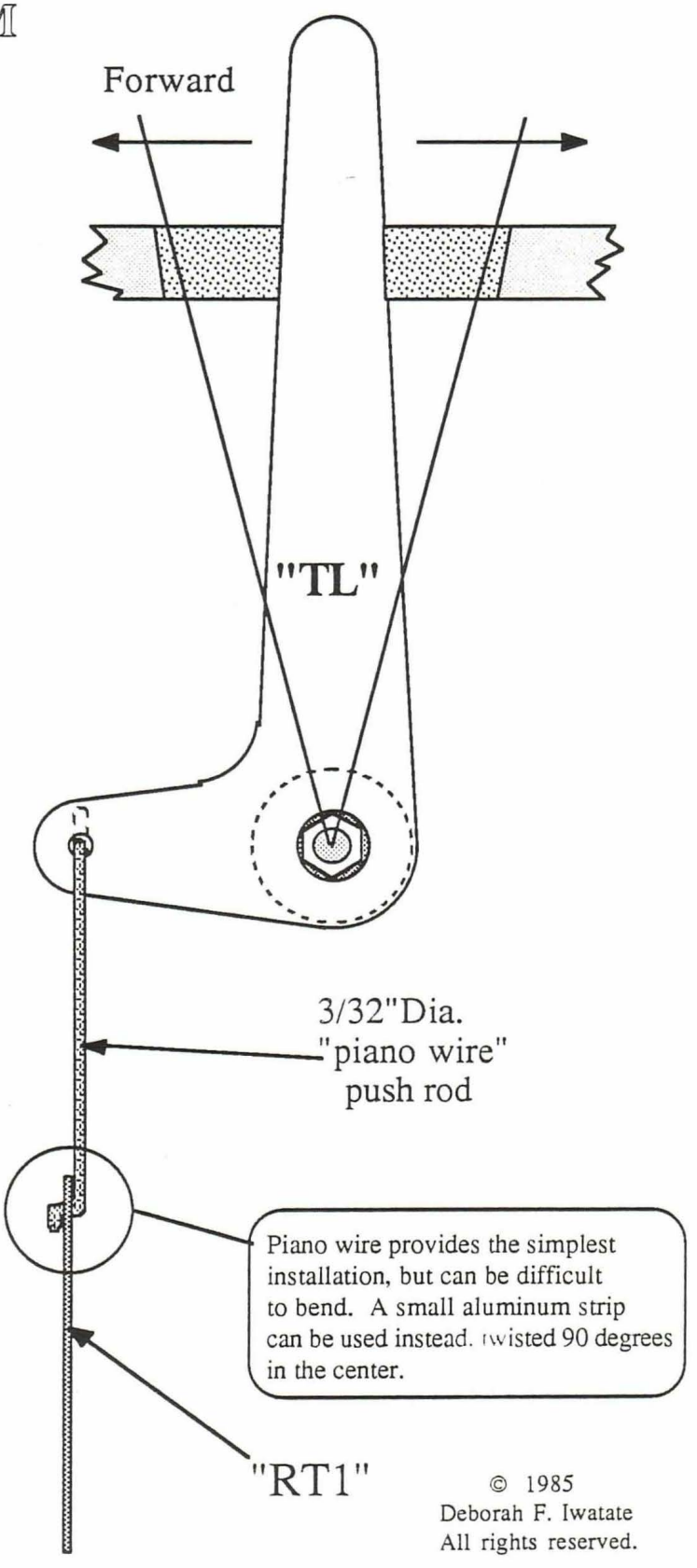
VIEW LOOKING AFT



LONG EZ ROLL TRIM

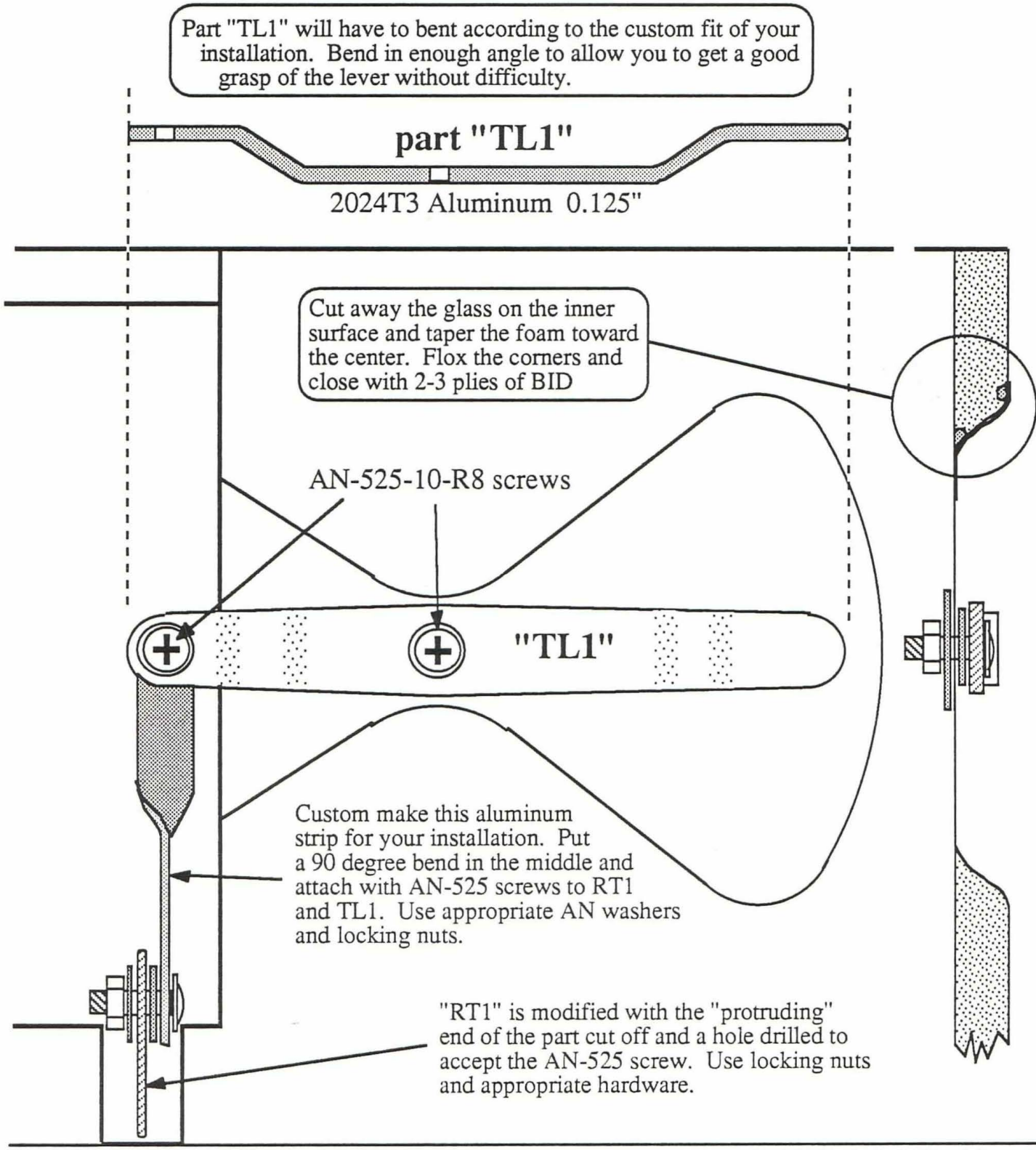
ALTERNATE INSTALLATION #1





VIEW LOOKING OUTBOARD
Right Side

LONG EZ ROLL TRIM
ALTERNATE INSTALLATION #2



VIEW LOOKING OUTBOARD
Right side

VIEW LOOKING AFT
Right side

GEAR DOORS

1) Lay up on a flat surface, 4 plys BID large enough to cut out a 6 1/4" x 12" door plate plus two 1" x 1" pads for the spring.

2) Lay out a center line and cut out the door 12"long by 6" wide on one end and 6 1/4" on the other end, symmetrical to c/l. I made it wider at the front to have the air flow tend to pull the doors open instead of neutral or trying to close them.

3) Rivet the hinge material to the plate (hinge on the inside) with flush rivets (small). Drill random holes in the outer hinge surface to accept flox for bonding, align center line to aircraft c/l, and put small amount of flox under hinge (being careful not to get flox in hinge pin), and bond down to fuselage by covering with one ply of BID. Ramp up around edges with flox for transition.

4) After cure, carefully cut a nice smooth center line. Remember to cut out around the nose fork attach plate to fit.

5) To make the spring, I used a 3/8" screen door spring cut to 6 1/4". Take a 4 ply BID pad, put a glob of flox on it (enough to go up inside the spring 1/4"), radius around outer edge, and reinforce with one or two plys of BID. Stand up and jig perpendicular to pad for cure. Same both ends.

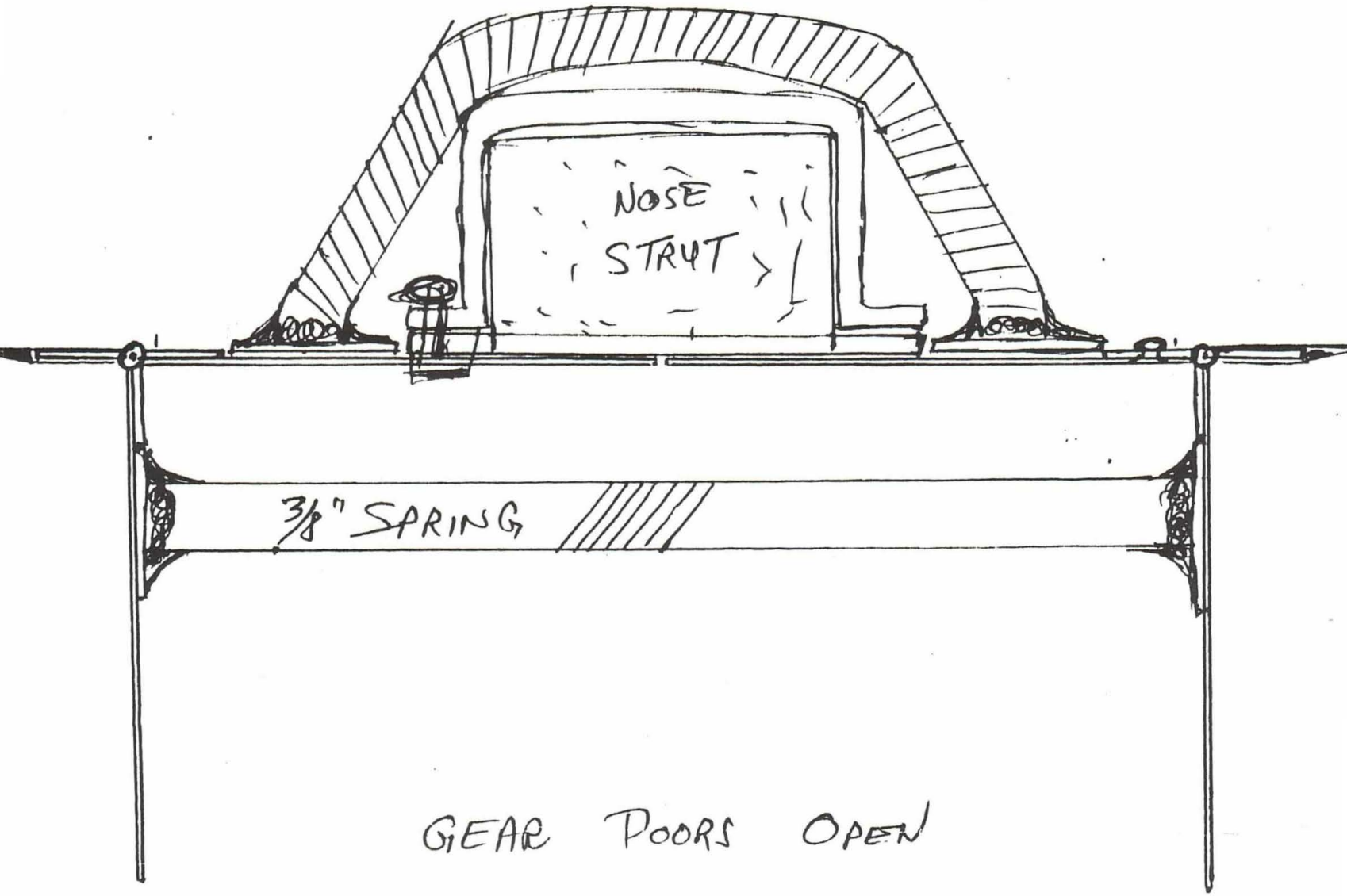
6) To attach the spring, I would drill into place and cleco and operate the gear to be sure the spring strikes on the attach housing, does not bind or hang up on anything, and holds the doors open symmetrically before making permanent. When everything suits and works properly, sand the surfaces and put some flox in the mating area and pop rivet the spring in place.

7) Clean up everything and sand the appropriate areas and transition all areas with micro. The fairing ahead of the door is glass and is permanent to the strut.

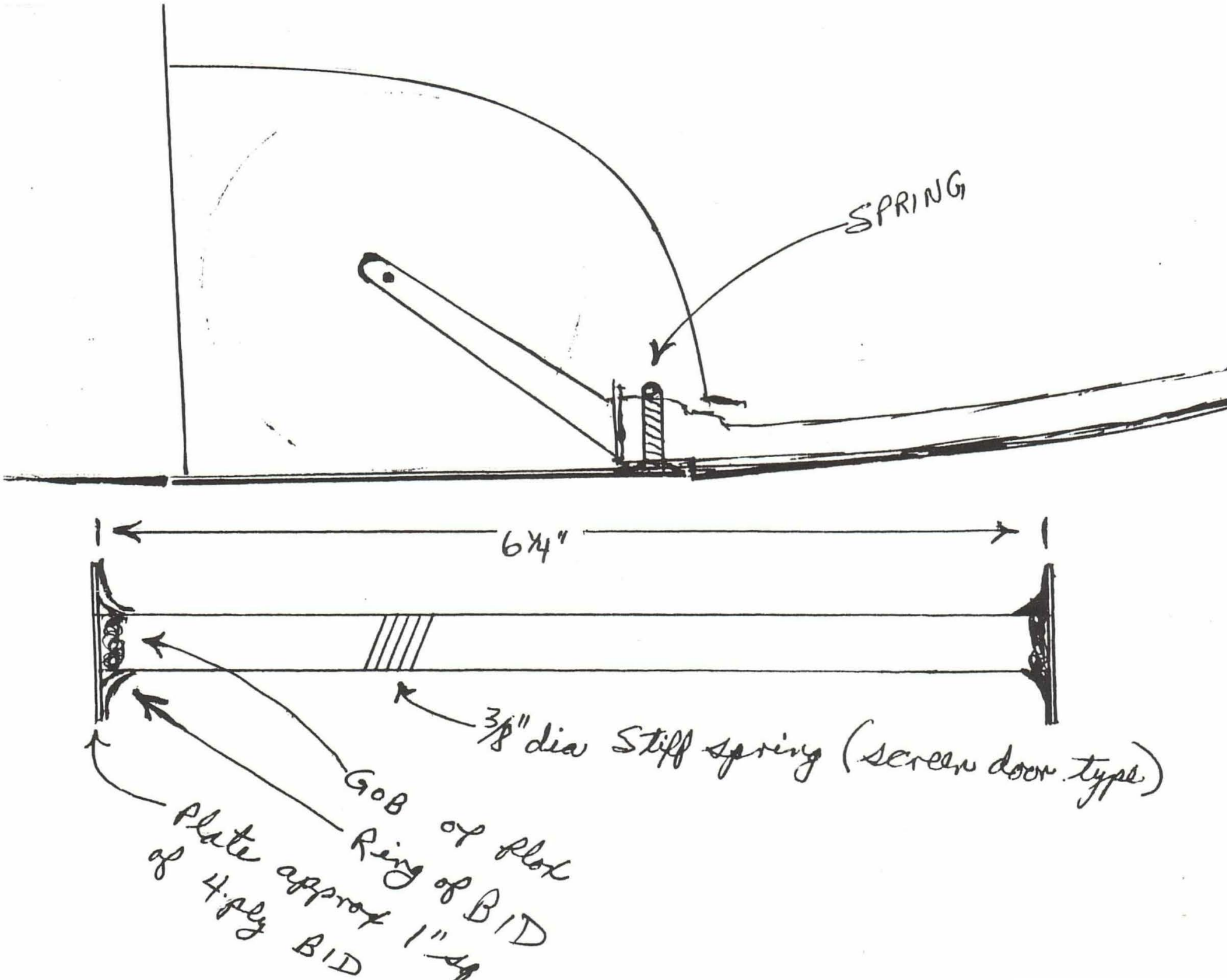
8) Any thickness, dimension, spring diameter, etc may be changed to suit. Gold plate hardware to taste.

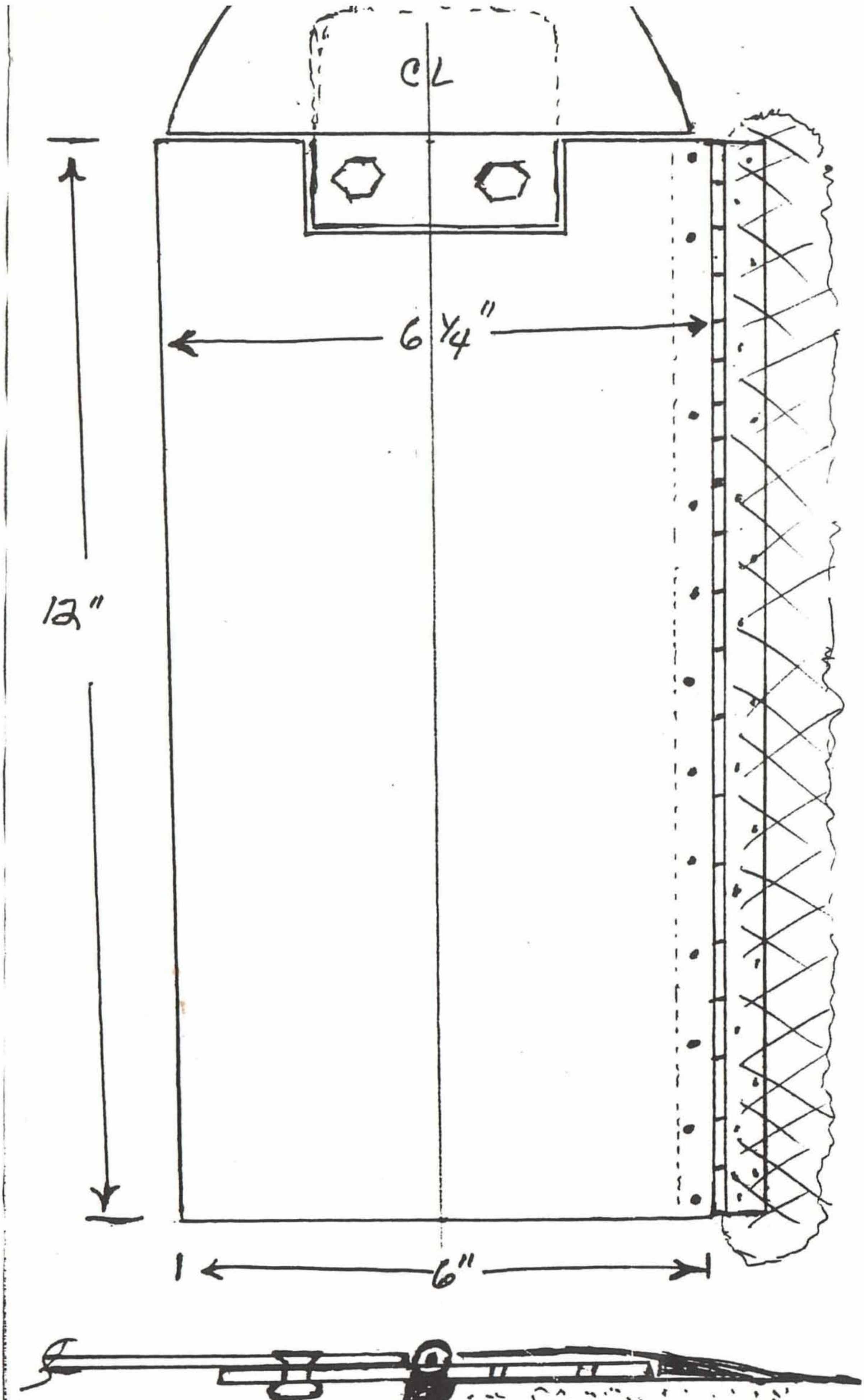
J-1-9

GEAR DOORS CLOSED



GEAR DOORS OPEN

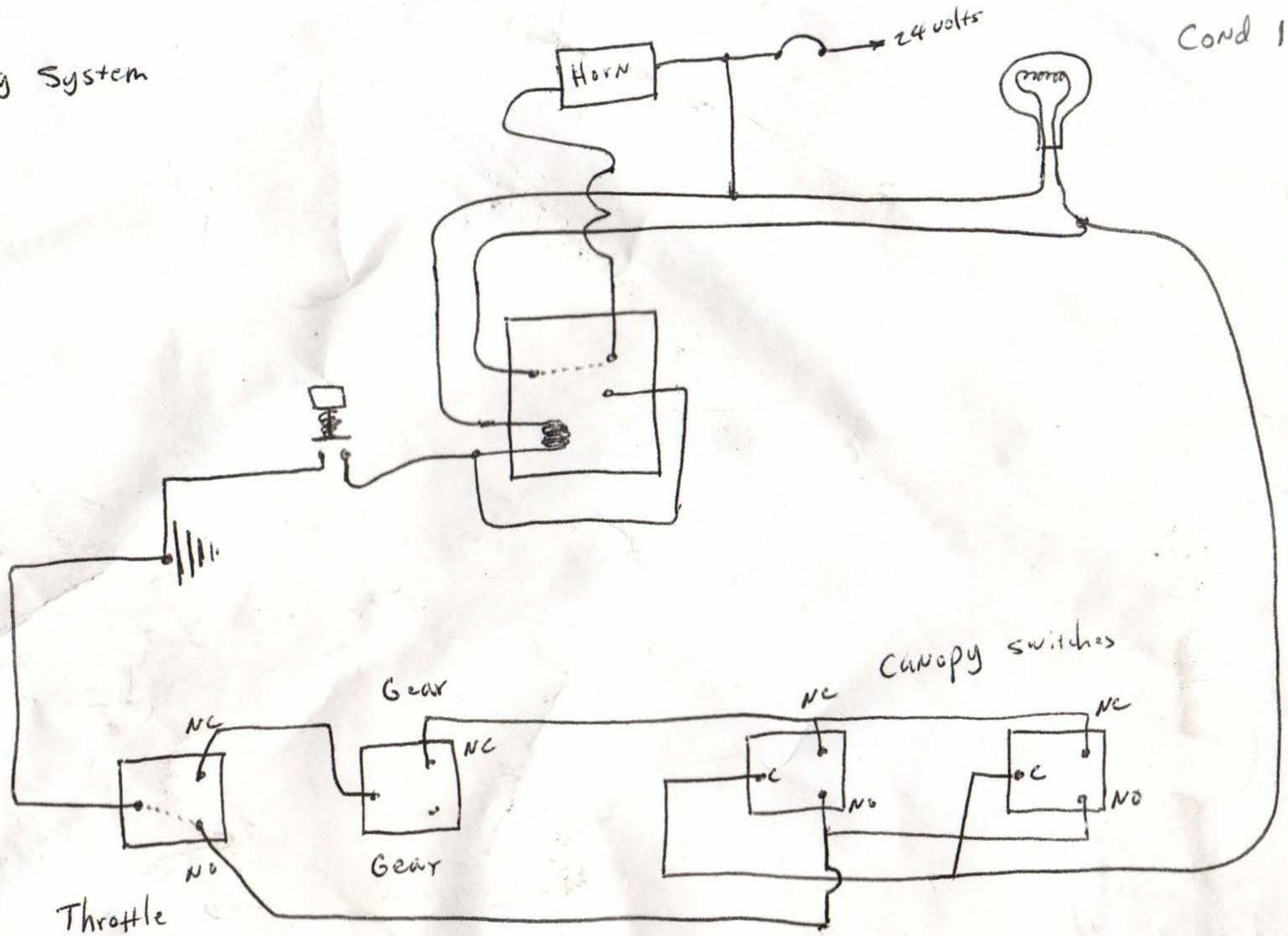

SPRING
6¼"
3/8" dia Stiff spring (screen door type)
Glob of flox
Ring of BID
Plate approx 1" sq
of 4 ply BID



CL
6 1/4"
12"
6"
FOAM

Gear Warning System

91 DR

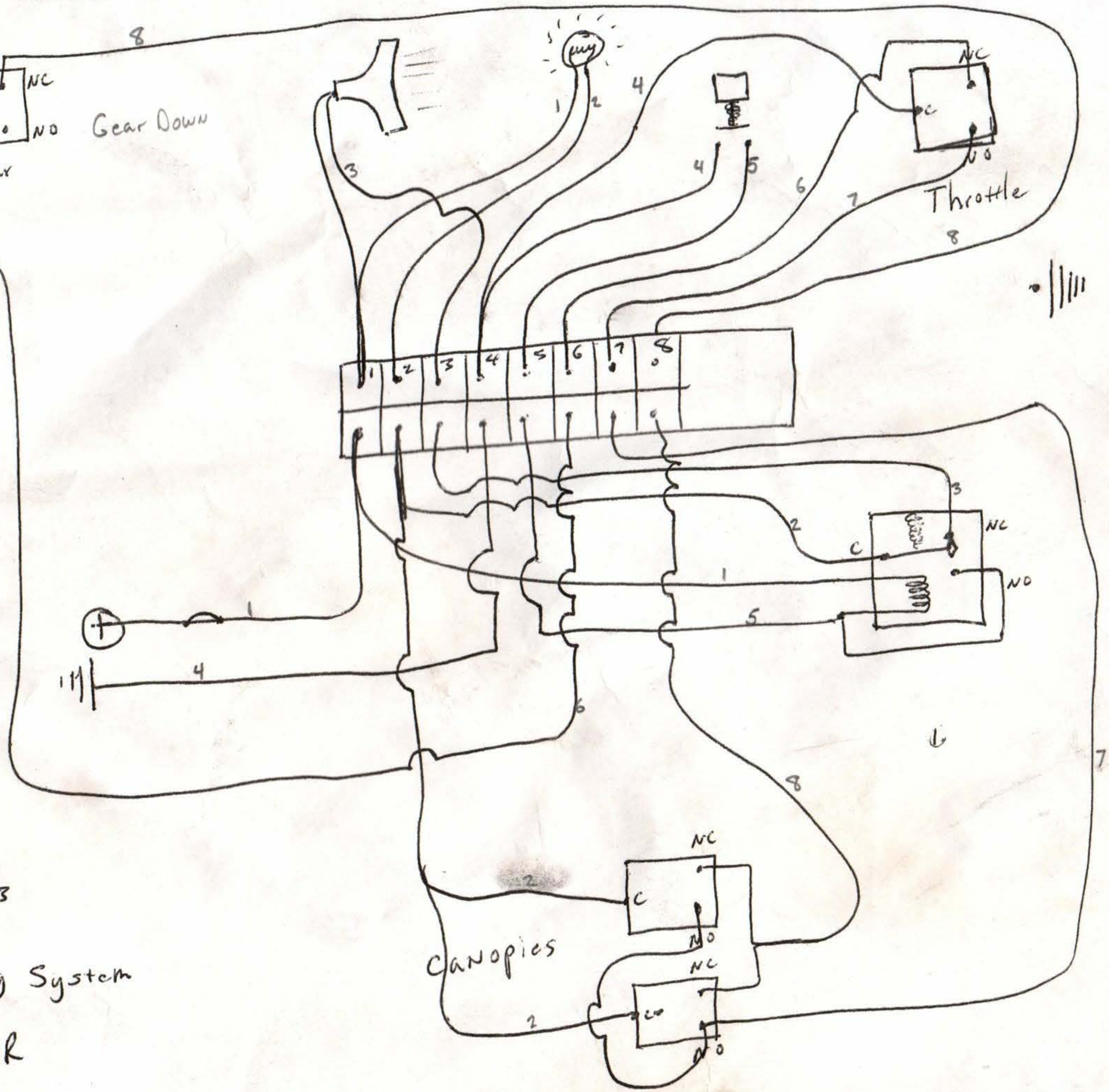


Cond 1 Gear Down
Canopies open
throttle adv.
Horn sounds

Cond. 2 Gear up
throttle idle
canopies closed
Horn Sounds

Cond 3 Gear up
throttle adv
canopies closed
NO horn

Cond 4. Gear Down
canopies closed
throttle adv.
NO horn



1. 24volts +
2. lite
3. Horn
4. Neg 24volts
5. main switch
6. throttle NC
7. throttle NO
8. Gear NC

Gear Warning System

91 DR

ITEM	PART NO.	REQD	DESCRIPTION
35	AN822-4D	1	ELBOW - 90°
36	AN823-4D	1	ELBOW - 45°
37	NG-22	2	BUSHING
38	802-0040	1	FORK
39	802-0036	1	SLEEVE - PILOT
40	802-0018	1	LOWER PIVOT HOUSING
41	802-0019	1	PLATE - LOWER PIVOT HOUSING
42	MS24665-359	1	COTTER PIN
43	802-0039	1	PIVOT SHAFT
44	AN320-12	1	CASTLE SHEAR NUT
45	AN970-6	1	WASHER - SPL (OPENI.D TO 7/16)
46	802-0045	4	SPRING WASHER
47	AN970-6	1	WASHER - SPL (OPENI.D TO 1 1/16)
48	802-0045	1	ROLL PIN
49	A02-0038	1	PIN - ALUMINUM 3/8" DIA.
50	A02-0044	1	ROD - PHENOLIC
51		1	LOCK WASHER 10-32
52		1	SCREW 10-32 THD. X . LG
53			
54	A02-0059	1	THRUST WASHER
55	802-0028	1	ROD TENSIONER DR NOSE GR.
56	802-0026	1	SPRING - DOORS NOSE GEAR
57	802-0027	1	RETAINER - ROD TENSIONER
58	302-0010-01	1	DOOR - RT SIDE NOSE GEAR
59	802-0002-01	1	DOOR - LFT SIDE (NOT SHOWN)
60	802-0029-02	1	HINGE - AFT RT SIDE DOOR
61	802-0029-01	1	HINGE - AFT LFT SIDE DOOR
62	802-0030-02	1	HINGE - FWD RT SIDE DOOR
63	802-0030-01	1	HINGE - FWD LFT (NOT SHOWN)
64	A02-0041	2	PIN - HINGE DOOR
65	MS24694M-5B6	8	SCREW 10-32 THD x 5/16 LG.
66	802-0043	4	SLEEVE - ROD TENSIONER
67		4	SET SCREW - 2-56 THD x 1/8 LG
68	M-BSP-44		RIVET 1/8" DIA x .25 GRIP LGTH.
69	MS35338-138	8	WASHER - TINNERMAN C'SNK. #10

ITEM	PART NO.	REQD	DESCRIPTION
1	802-0023	2	PLATE PIVOT
2	802-0005	1	SPACER - LONG, RETRACT ARM
3	802-0006	1	SPACER - SHORT, " "
4	802-0004	1	RETRACT ARM
5	802-0008	1	ASSY - SPRING/STRUT " "
6	802-0046	1	ASSY - WHEEL & TIRE
7	802-0049	1	HYDRAULIC CYLINDER
8	802-0035	1	SPACER - HYDRAULIC CYL.
9	802-0007	2	SLEEVE - COMPRESSION
10	802-0048	2	BUSHING - RETRACT ARM
11	802-0016	1	SLEEVE - COMPRESSION HYD CYL.
12		4	WASHER - 2671 D x 1.250 D x .06 THK
13	AN365-428A	3	LOCKNUT 1/4 - 28 THD.
14	MS21044-3	26	LOCKNUT 10-32 THD.
15	HFS-5FG	1	ROD END (F) - 5/16 BORE x 5/8-24 THD
16	AN365-524A	2	LOCKNUT 5/16 - 24 THD.
17	AN 970-5	2	WASHER - 3.121 D x 1.250 D x .06 THK
18	AN5-41A	1	BOLT - 5/16-24 THD x 4 3/32 LONG.
19	AN 960-5	2	WASHER - FLAT 5/16
20	AN5-30A	1	BOLT - 5/16-24 THD x 3 3/32 LONG.
21	AN4-41A	3	BOLT - 1/4-28 THD x 4 3/32 LONG
22	AN 960-4	4	WASHER - FLAT 1/4
23	802-0025	2	WASHER - SPL. PIVOT NOSE LEG.
24	MS51958B12	8	SCREW 10-32 THD x 25/32 LG.
25	AN960-3	26	WASHER - FLAT 10-32
26	MS24694M-B11	10	SCREW 10-32 THD x 11/32 LG.
27	802-0022	1	PLATE - UPPER PIVOT HOUSING
28	802-0023	1	UPPER PIVOT HOUSING
29	802-0024	2	SLEEVE - UPPER PIVOT HOUSING
30	802-0033	2	BUSHING - " " "
31	802-0034	1	SLEEVE - HYDRAULIC CYL.
32	802-0031	1	HOSE - LONG, HYDRAULIC CYL.
33	802-0032	1	HOSE - SHORT, " "
34	802-0026	1	NOSE LEG.

REVISIONS	BY

F.S -30.00 F.S -25.00 F.S -20.00 F.S -15.00 F.S -10.00 F.S -35.00

WL -19.00

(DN. POS) (UP POS.)

BERKUT

SCALE: FULL

DRAWN GRUFF

DATE: NOV 6-90

ASSY - NOSE GEAR

NO. REQD: ONE PER ASSY

DRAWING NO. 802-0000