CZECHMATE

By Jack Cox

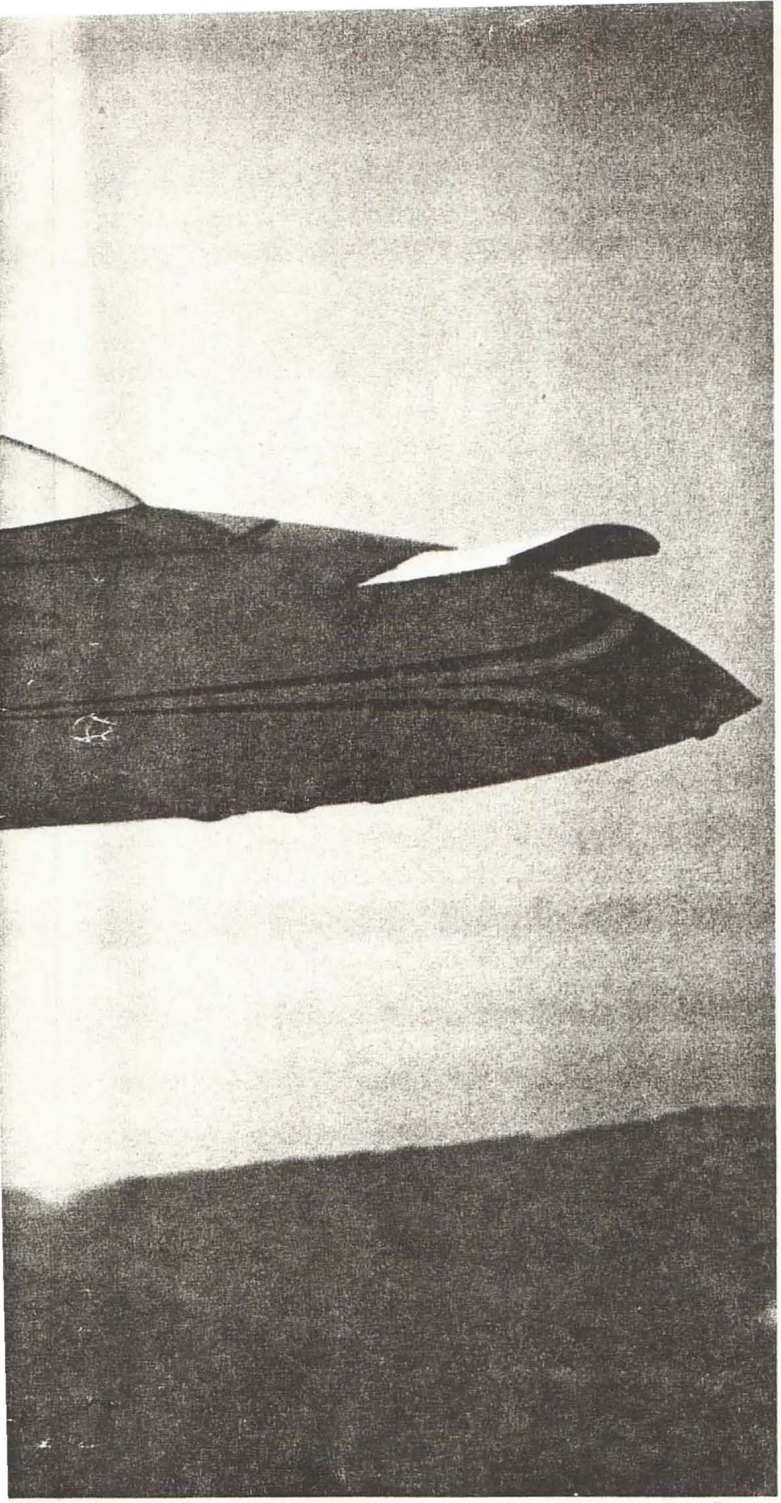
AT 7:27 ON the morning of December 15, 1979 Dick Rutan lifted the Long-EZ prototype off Mojave, California's Runway 12 . . . and 33 hours, 33 minutes and 41 seconds later landed on 24 after covering an incredible 4800.28 statute miles, a new world's closed-course distance record for aircraft weighing between 1102 and 2204 pounds (Class C-1b).

The flight utterly destroyed the old record of 2955.39 miles held for the past 20 years by Jiri Kunc of Czechoslovakia. Rarely is a world's record exceeded by such a wide margin as Dick's 1844.89 statute miles.

The facts and figures of the flight are as follows:

- *The aircraft – Rutan Long-EZ, N79RA, powered by a 108 horsepower Lycoming 0-235.*
- *Fuel on board at take-off – 143.6 gallons.*
- *Weight at take-off – 1904 pounds, 604 pounds over the normal gross of 1300 pounds. The take-off weight, however, was 300 pounds* **under** *the weight limit of the F.A.I. class – which means an additional 50 gallons of fuel* **could** *have been carried.*
- *The course – Mojave to Bishop, California and return equalled one lap. 15 laps were flown.*
- *The average speed for the flight was 145.7 mph.*
- *Average fuel flow was 4.17 gallons per hour, or about 35 miles per gallon.*
- *3.75 gallons of fuel remained in the aircraft's tanks at the conclusion of the flight. 2.3 quarts of oil were consumed.*

All are impressive statistics that forcefully point to the superlative capabilities of the new Long-EZ – obviously



(Photo by Burt Rutan)

the purpose of the flight. But that's only half the story . . . it's in the human element that we find the emotion, the drama, the adventure that set flying apart, that make it one of mankind's last great arena's of individual achievement. With today's reliable engines and airframes, the pilot is inevitably relegated to the role of the weak link in any such test of endurance . . . metal, fiber glass and the elements versus flesh, blood and the human will to survive and to succeed. Dick Rutan survived every test of his skill and physical endurance and he succeeded in achieving his goal of accomplishing what no person had done before . . . but it wasn't easy, as you will see. A day or so after the flight he dictated a tape on his adventure. From it and other information provided by his brother, Burt Rutan, and his parents, George and Irene Rutan, I have written the following account.

– Jack Cox

At 41, Dick Rutan has lost none of the intensity and fierce competitive drive that made him an outstanding fighter pilot in the United States Air Force. In 1975 he flew N7EZ, the prototype VariEze, to Oshkosh where on August 4 he set a world's closed course distance record of 1638 statute miles. A year and three days later, however, Leeon Davis flew his DA-5 2265 miles — a mark that still stands. Having his record snatched away has not gone down gracefully for Dick . . . it has eaten away at him and has kept him awake nights plotting his recapture of the prize. You and I might call it an obsession, but to Dick it's a way of life.

A few years ago Dick retired from the Air Force and joined brother Burt at Rutan Aircraft in Mojave. His ability as an engineering test pilot has added a crucial dimension to a firm that deals only in aerodynamic concepts several light years in advance of the U. S. lightplane industry. Although most of his time has been devoted to the development of the Defiant and the new Long-EZ, Dick has found an occasional spare moment to fiddle with 7EZ, which was stuffed away in a corner of the RAF shop . . . the thought being that he would make the necessary modifications and go for the record again. At one point the VW engine was yanked out and a 2-cylinder Franklin was installed in its place . . . but it was not an entirely successful transplant.

With the advent of the Long-EZ, however, priorities began to change. Feeding a few of that airplane's numbers into the office computer showed it to be easily capable of reducing the record books to confetti . . . and the non-stop flight to Oshkosh last summer was just a tantalizing sample. The Long-EZ would have to compete in the next higher weight class than that of 7EZ so his old record would not be avenged — but now that wasn't so important. There were bigger fish to fry . . . Long-EZ was capable of some truly astonishing feats in distance, altitude, etc. So, it was back to collecting dust for 7EZ . . . and off to the races for Dick and the Long-EZ.

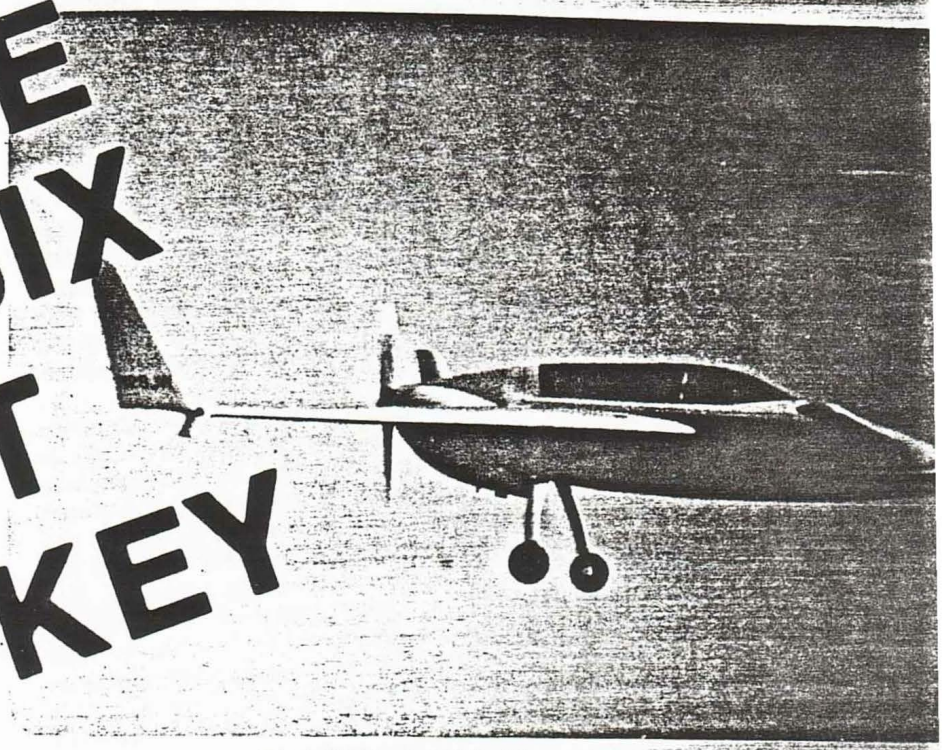
One little problem stood in the way, however. Since returning from Oshkosh '79 the Long-EZ had been undergoing a substantial redesign, involving a completely new wing, rudder system, etc. Initial test flights had been promising enough to give a preliminary go sign for putting the design on the homebuilt market, so final development and a complete flight test program would have to be accomplished before any serious efforts could be spared for a record attempt. NAA/FAI sanction was applied for . . . but testing continued right on into early December.

On December 7, Dick flew the dive/flutter tests and investigated the aft C.G. limits. Finding everything to agree with the computer, the design was frozen that day and, at last, preparations for the record attempt could begin.

Dick had already been working on an auxiliary fuel tank — one that would fit the rear seat area like a hand in a glove. This was finished — in foam and glass, of course — and installed in the airplane. In short order other mods followed:

- The fuel system was altered to route the flow from the tanks to the front cockpit and back to the engine. This was done because a Sears fuel flow meter was installed in the instrument panel to keep the extremely accurate tabs on gasoline consumption that would be absolutely essential for the successful completion of the flight.

VARIEZE TWO SIX JULIET WHISKEY



Third flight of 25JW. All goes well and everything works as it should.

By Dr. James R. Wright, EAA 100661
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IT'S LIFT OFF time and as the ground melts away below the weariness is suddenly gone, the frustrations and long months of work and waiting for this day are worth it.

For me it began July 22, 1976 when I decided it was time to do something with a dream, and mailed my order for VariEze plans. While at Oshkosh I ordered my basic kit, and the first foam shipment arrived August 26. Mike Kinate and I cut the first foam for the canard on September 5, and VariEze N26JW was underway!

What followed was a period of twenty-two months of delays and frustrations, hard work, record cold winters, a whole lot of new friendships established, a bunch of fun and real satisfaction in seeing an aircraft taking shape under my hands. It was a journey whose destination made the trip well worth it.

Jim Ball, a long time aircraft mechanic and private pilot who works for TWA, was my chief resource for advice and help. He worked with me on all major layups, was always available for counsel, did the complete rebuilding of my Continental 0-200 engine, the engine installation, most of the electrical work, and helped with the priming and did most of the paint gun work.

I've been flying since 1943, was a B-24 pilot, and have a lot of time, but was not very current. Toward the end of the building program I met Bill Stansbeary, a TWA pilot assigned to the flight training program. Bill is active and helpful in almost all areas of aviation, and he offered to help me get current before the test flight. In the meantime he introduced me to Sheldon Stafford who was kind enough to let me use his paint booth, and Sheldon's son, Ron, let us use his aircraft for Bill to give me instruction. Bill also gave me some stick time in his Blanik L-13, and I got time in other aircraft, too. Both Sheldon and his wife, Ruth, are top pilots and both ferry aircraft all over the world. Ruth was the pilot of my chase plane, offering her skill and her Bonanza for that task.

First flight for 25JW was Tuesday morning, July 25, 1978, in front of a lot of people who had helped, and a lot more who were just interested. I just had a feeling that the flight would be picture perfect, for I felt good about the little craft. Pride goeth before a fall! After knowing that others had done it, in my excitement I still failed to double check my canopy lock, and it was down on top of the latch fingers, not under them.

All was perfect through the takeoff roll, and rotation and lift off felt really good. Then out of the corner of my eye I saw the canopy flutter and a glance told me I had a problem. I had the safety catch but could not be sure it would hold, so I grabbed the canopy handle with my left hand. In the momentary inattention to attitude and with pitch trim that turned out to have too little up trim I came back on the runway very hard, maybe a little nose wheel first. With a bounce I was flying again with left hand busy with the canopy, right hand busy with the stick, and wishing for at least a third one to reach the trim and the mike button. I now have the mike button on the stick. I just held the canopy and gained altitude, for when I tried to turn loose of the stick the nose would dip down. Finally I could take both hands and lock the canopy.

My wife, Jeanette, and daughter, Jean, were in the Bonanza with Bill and Ruth, and that was heart attack city! They did not know what was going on and could think of all kinds of first flight problems. When I could change radio frequency and say, "You won't believe this, but I failed to lock the canopy!" they knew it was only the nut holding the stick, and no design problem.

The rest of the flight was uneventful, except for the landing. She flew beautifully, required only a little left rudder trim and no roll trim. It would so outclimb the Bonanza even with the nose gear down that Ruth had to request that I do a 360 on the way up. Visual inspection from the Bonanza indicated the nose gear strut was

fractured, and we notified the Kansas City Downtown tower to expect nose gear failure on landing. We declined their offer for emergency equipment stand-by, but they understood this "negative" for they had seen at least two other Ezes on their nose and knew what to expect.

From all reports, including the tower's, my first landing in 25JW was near perfect, which certainly contrasted with the takeoff. The nose held off awhile, and when it came down it continued all the way to the runway. There was hardly any jolt, direction was easy to control with brakes, and I was almost off on the first exit when I stopped. Everything was shut down, I was out and with nose lifted was pulling 25JW home when the others got to me. I had a slightly damaged Eze nose and a considerably bruised pilot ego.

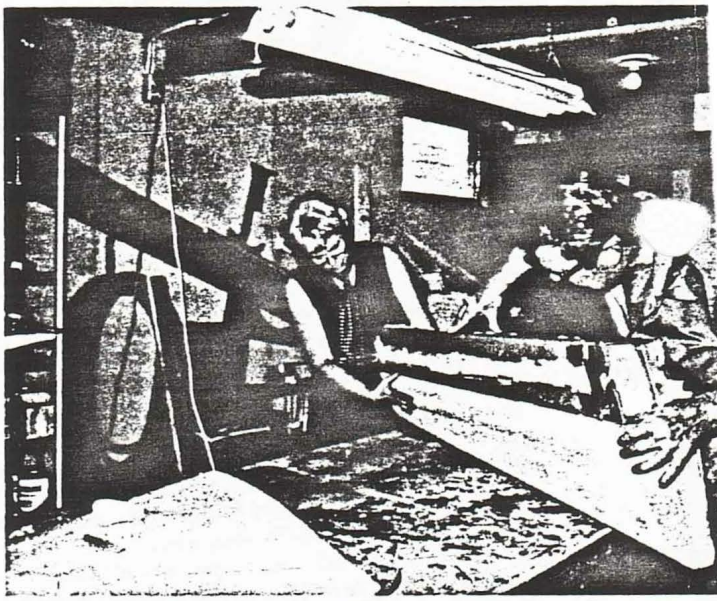
Warren Curd, who built the first VariEze in this area, found me a new strut from another builder not ready to use his, Gordon Durlin loaned me parts I wanted to replace in the nose gear fork, I took everything related to the nose gear apart to check it out, had it all back and was in the air again on August 13, with Ruth and Bill again in the Bonanza to chase. This time everything was fine. But I had missed Oshkosh '78, a goal I had really worked for.

N27JW has given me absolutely no trouble through the 80 hours I have now, and welcomed compliments on the workmanship come wherever we go. When Clarence Graether signed off my restrictions and said, "Jim, it's the best one I've seen," it was again all worth it.

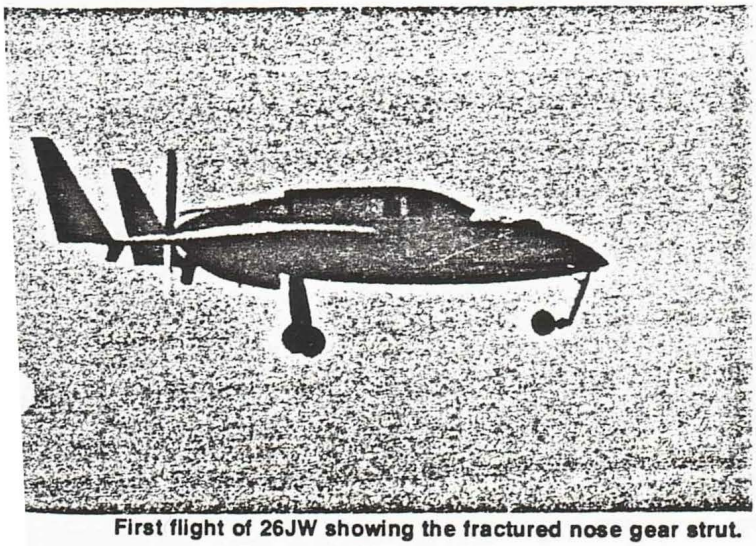
I have the usual instruments including both cylinder head temp and EGT, plus electric T/B, hour meter, Narco Com 10A, Nav 10 and transponder. I'll have the wheel pants and spinner on soon. I started with a Hegy 56 x 70 prop, but it turned too fast. Gordon Durlin let me have his Ted Hendrickson prop and I used it while I consulted with Ray Hegy. Ray made me another prop for no additional cost, this one 58 x 75. It seemed a bit too slow, and Ray suggested trimming down the broad tips, which we did, and now it seems just about right. The Hegy prop will climb with the Ted's and is about two mph faster at the top end, although about 100 rpm slower. At any power setting from 2200 through 2600 rpm it is about five mph faster than Ted's. Some of that does not figure, but it is the way it flies. Ray has been great to work with and really stands behind his work. I can certainly recommend a Hegy prop to those who want a solid performer at a very reasonable price.

My Eze is heavier than I wanted, with empty weight of 639 pounds, but flying it is fun. On one measured and timed cross country of 150 miles, with a little tailwind, I got 200 mph ground speed exactly. On a trip to Texas I put 14 hours on the Eze, loaded always to top gross

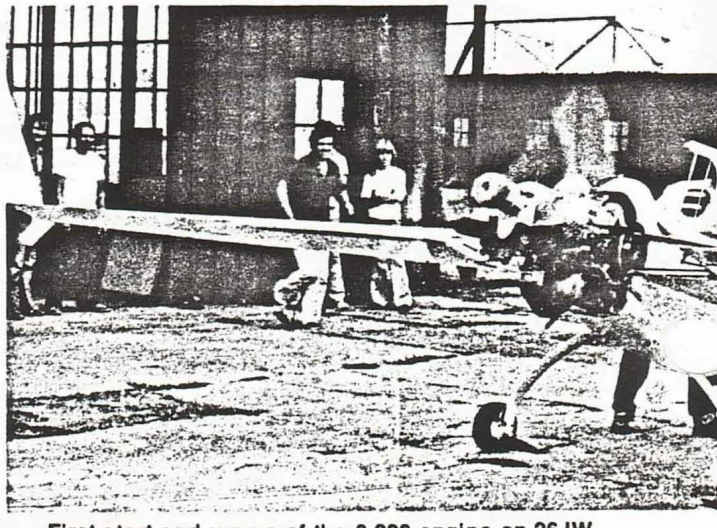
Jim Wright and his "Commander" with their pride and joy.



Builder-Pilot and Commander working together as the spar is fitted to the main wing leading edge.



First flight of 26JW showing the fractured nose gear strut.



First start and run up of the 0-200 engine on 26JW.

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Photo by Jack Cox

John Roncz

The Aristotle of Airfoils

By Jack Cox

John Roncz is a name that has burst upon the aviation scene like a streaking comet in a clear night sky . . . but like one of those spectacular cruisers of the cosmos, what we see is really only a tantalizing hint of deeper, more intriguing mysteries that remain unseen . . . and unimagined.

Most know that John Roncz is a designer of airfoils, that he has worked closely with Burt Rutan on such state-of-the-art stretching aircraft designs as the Beech Starship and the 'round the world Voyager, and that he is one of the new stars of the forums program at Oshkosh . . . but beyond those impressive credentials, just who **is** John Roncz? Where did he come from and how did he get to his current lofty perch as one of . . . some think **the** world's foremost authority on airfoil design? How did he do it as a private individual, without affiliation with a university or a government funded research facility?

For those who **do** know him well and have been exposed to his zany side, the question is not **who** but, rather, **what** is a John Roncz?

Like most complex personalities, the answer depends on **which** John Roncz you're inquiring about, or are encountering at the time. If you are the local census taker, you are only interested in the John Roncz, age 37, who lives at 1510 East Colfax Ave., South Bend, Indiana 46617, who is self employed and whose household contains 2 bathrooms and five (!) computers. For the rest of us, however, it is of great interest to know of the John Roncz who . . .

- At the tender age of five had already mastered the violin to the extent that he was performing concerts and playing with the local symphony orchestra . . . and was considered such a prodigy that he was being personally tutored by the chairman of the Department of Music at Notre Dame University.
- The John Roncz who at age 10 switched to the piano and in six months

had won a state medal, who composed the graduation march for his 8th grade class and who was soon entering national and international piano competitions.

● The John Roncz who attended a special high school for intellectually gifted persons on the campus of Notre Dame University . . . who found he had a "funny talent for languages" and soon was fluent in eight modern and ancient tongues, some of which he taught himself. (He was taught Hebrew **In French!**)

● The rascal who once made 50 gallons of rye whiskey in his school's physics lab. Fortunately, it was so bad no one could drink it.

● The John Roncz who breezed through Notre Dame studying subjects ranging from languages to particle physics, ultimately earning a degree in Arts and Letters.

● The John Roncz who, finding the job market in the South Bend/Elkhart area remarkably bereft of opportunities for particle physicists and/or translators of Egyptian hieroglyphics, was forced to take up carpentry in local mobile home/RV plants. 1971 was a recession year for that industry, so after several layoffs, John finally resorted to supporting himself . . . for 9 months . . . selling paintings he had done (after the styles of Marc Chagall and Miro) through art galleries. He also picked up a few commissions to do large paintings in the homes of wealthy patrons.

● The John Roncz who finally went to work in his father's metal stamping company, learning to engineer specialized metal parts . . . and finding he had a talent for the task. He came to consider himself fortunate not to have had formal engineering training because without the doctrinaire approach to problem solving many schools teach ("brain damage", as John terms it), his imagination was left free to seek unconventional solutions to conventional problems. He later built his own company, Gemini Technologies, Inc., around this free spirited approach. Designing new parts and redesigning old ones that were simpler and less expensive than those of his competition, he made money in a unique way: he provided the design work at no charge but would not reveal what kind of metal he had used, so the customer would have to buy the steel from him!

And that's how John got into aviation.

The metals he utilized to make parts were usually specialized alloys which required an unusually high level of quality control in their manufacture - so much that John would not accept delivery without traveling to the steel mill to personally inspect each shipment. As his business grew, he found himself on the road more and more . . . until one week he spent 5 out of 5 days in a car pounding the pavement between South Bend and Detroit! He decided then and there that he **had** to have an airplane.

John had always had an interest . . . a fascination, actually . . . with flying. His father had been a bombardier in World War II which may or may not have had an influence, but, at any rate, from a very early age, John begged to be driven to local airports where he would sit for hours absolutely enthralled by airplanes taking off and landing. In between his violin and piano lessons, he grew up building models — flying models of the stick and tissue variety — and eventually learned about and joined EAA. He began taking flying lessons during the summer while he was still in school — financed by meager paychecks from minimum wage summer employment. The result was that it took him about 5 years to struggle through, financially, to his Private license. He soloed a Cessna 150 in 1971 and got his ticket in 1975.

After the travel dilemma in his business forced his hand, John bought a used Rockwell 112, got his Commercial license and Instrument rating in it, and went on to earn a multi-engine rating in a Cessna 310. Once committed, he simply couldn't get enough flight time, and soon he was operating his business during the day and flying cargo runs at night for a local FBO. He flew 310s and Navajos . . . but declined the opportunity to fly some much abused Beech 18s.

"I was crazy about flying, but I was at least that cognizant of reality," he says today with the hearty laugh that frequently punctuates his conversation.

John cruised along quite contentedly in this day/night routine for a period of time, but, as often is the case, a couple of seemingly innocent and, at the time, unrelated actions would ultimately come together to dramatically redirect his life and lifestyle.

After joining EAA, John noticed an ad in **Sport Aviation** for the book **Theory of Wing Sections** and promptly ordered a copy. His education at Notre Dame had leaned heavily on math and theory, so the book was right down his alley . . . particularly Chapter 3, the Theory of Wing Sections of Finite Thickness in which the conformal transformation of a circle into a wing section was detailed. He mastered the concept using a hand calculator, but found the process so tedious that for a time he did little with it.

Sometime later, he came across another ad, this one for Heathkit's H-8 computer. For just $300.00 you could build your own personal computer and harness the awesome computational power of 24K, it promised. Although he had no idea at all what he would do with it, John found the thought of building his own number cruncher fascinating, so he bought one.

John still vividly recalls that magic moment . . . at about 5:00 a.m. one morning, after an all-night struggle with wires and electrical components . . . when the LED readout suddenly glowed with the message "Your H-8 is up and running!"

Now, in those early days of personal computers the term "user friendly" " was yet to come into vogue . . . so John was faced with the task of teaching himself some programming language. To his pleasant surprise, he found the language of computers as easy . . . for him . . . to master as foreign languages had been in college.

Having grasped the fundamentals of programing, he began casting about for something interesting to encode . . . and suddenly remembered the circle transformation thing from **Theory of Wing Sections**. The very first code he wrote was an airfoil program — and it soaked up almost all that awesome 24K!

For John personally and the world of aerodynamics in general, the meshing of that airfoil theory and the home computer was an event as momentous as the alignment of every planet, moon and astroid in the solar system would have been to astrologers of old. Putting the computional power of that Heathkit computer, as miniscule as its 24K is today, into the hands of a bonafide genius like John Roncz was like handing a crazed killer a burp gun and a case of ammo. Overnight, he began a wild rampage on airfoil transformation, boundary layer flow and every other aerodynamic abstraction that can be expressed mathematically he could lay hands and mind on. Just like the generation of kids . . . and adults . . . who became computer game junkies and hopeless hackers, John became absolutely obsessed by his new toy; but instead of sitting for hours on end zapping alien space ships, he spent his time visualizing how molecules of air flow around an airfoil and learning how to express that movement in numbers . . . numbers that could be manipulated at will in a computer.

Another star crossing that would have a profound effect on John's life . . . and on aviation . . . was when he had a chance meeting with Dr. Jerry Gregorek of Ohio State University. A renowned aerodynamicist, Dr. Gregorek was amazed to encounter a "layman" so well

versed in his field and, particularly, in the use of the computer. John, in turn, was overjoyed to meet someone with answers to the growing list of questions his self-taught airfoil knowledge was generating. The two hit it off immediately, and Jerry ultimately agreed to work with John to fill in the missing parts of his aerodynamic education . . . largely by pointing him to the best sources. John possesses the gifts of both natural speedreading and near total recall, so he would devour a book, work out all the problems, then check back with Jerry to ask about anything he didn't understand. John says that Jerry has a true genius for explaining things.

After a time, this "out patient" tutoring process began to change direction. Voracious reader that he is, John soon polished off about every source of information that pertained to his interest area and as he began to ascend from the "knowns" to pure theory, he began to question various things . . . and come up with theories of his own. To Dr. Gregorek's everlasting credit, he did not put John down when he came up with some off-the-wall idea.

Instead, he would patiently explore the idea, pointing out and explaining obvious errors and, just as importantly, would maintain an open mind to ideas of John's that went beyond current theory and practice. He didn't always agree with John, but, ever the great teacher, he couched his disagreement in positive rather than negative terms and encouraged him to seek new sources of information or try a different tack in his quest for a solution to some problem.

Others who were sought out and provided invaluable assistance in John's search for the aerodynamicist's holy grail were laminar flow wizard Bruce Carmichael and Tod Hodges of NASA Langley. Both fed him enormous amounts of material, which he soaked up like a dry sponge and used to flesh out the airfoil theory that was slowly coming together in his mind.

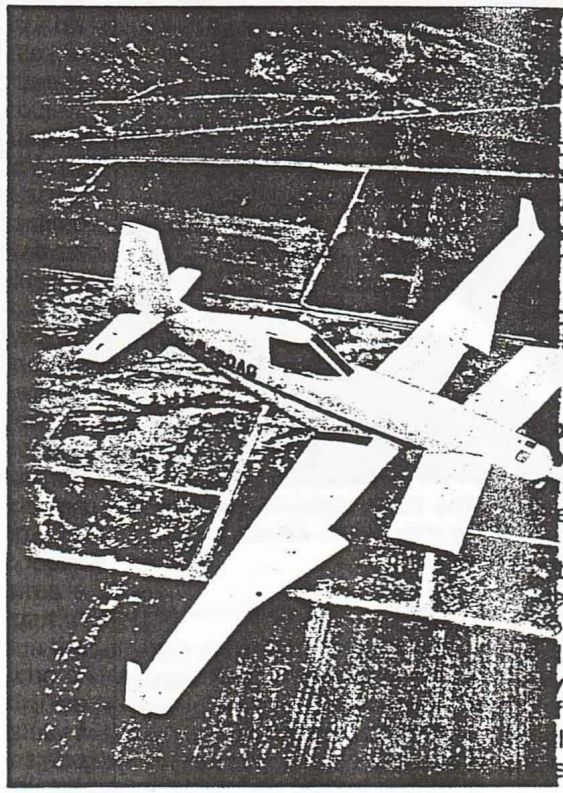
All the while, back home in South Bend, John's little Heathkit computer was also undergoing a metamorphosis. Named "Hal" after the computer in the movie **2001**, it very quickly became inadequate for John's needs. At the time, he could not afford a more expensive, store bought computer, so, instead, he bought a book at Radio Shack on digital electronic theory, devoured it, and began building and installing new circuit boards to add to Hal's circuitry. 2 years later, it bore little resemblance to the kit that emerged from the Heathkit box. John's low Reynolds number theory was developed on the transmogrified Hal, as were the airfoils for the Rutan Solitaire and the Voyager . . . so, however humble its beginnings, it has earned its place in aviation history.

The next significant bend in the road for John came after he ordered a set of VariEze plans . . . he was already a distant admirer of Burt Rutan's highly original thinking. Out of curiosity, he punched the coordinates of the Glasgow University (GU) airfoil used in the VariEze's canard into ol' Hal . . . and found he couldn't make the thing "fly" with turbulent flow. According to his computer program for analyzing the behavior of airfoils, which was pretty sophisticated by this time, the turbulent GU was stalled **at all angles of attack**!

"What is **this**!", John shrieked. "What am I doing wrong?" He knew that about 100 VariEzes were flying at the time with the airfoil — so **something** was obviously haywire. As John explains the phenomenon today, the GU flies, obviously, but it does so in an odd way. If you tuft the tripped canard and go out and fly, the little snippets of yarn will be standing straight up, forward, sideways — any direction except in trail the way they should be — **from lift off to touch down**! The airfoil is actually producing lift with about 50% flow separation. John has concluded that it produces this lift by means of what he terms a "wake body effect", which is, in part, a function of the airfoil's shape and in the VariEze application, its small chord. (Parenthetically, he adds that in the case of the Rutan designs, a slotted elevator is used that ameliorates the condition to a degree. This is why the Ezes have been less subject to loss of lift in rain than Quickies and Q2s which use the same GU airfoil without a slotted elevator.)

At the time, however, John was totally astounded with what his computer told him. How could this be? What could be causing it? True to form, he instantly launched himself into a crash program to find the answers. Right from the beginning, he sensed that the truth and the light lay hidden from view in that foggy bottom that is the lair of the low Reynolds number. Historically, all the big research bucks have been spent on investigation of the effects of Reynolds numbers of about three million and above, and the modelers have done a lot of commendable work below a hundred thousand . . . but in between, where the Eze canards lie, little effort has been brought to bear. So, it was into that uncharted swamp that John manfully marched, armed only with his trusty Hal . . . and an imagination that knew no bounds.

It would be far easier to relate and explain what John spent the next couple of years or so accomplishing if his effort had resulted in some pat formulas or new physical laws that could be verbalized in a trite phrase or two. Unfortunately, it was not that simple. What John did, essentially, was to sit in front of his computer creating endless numbers of airfoils, and endless permutations of each of those airfoils . . . not **drawings** of airfoils but, rather, rows of

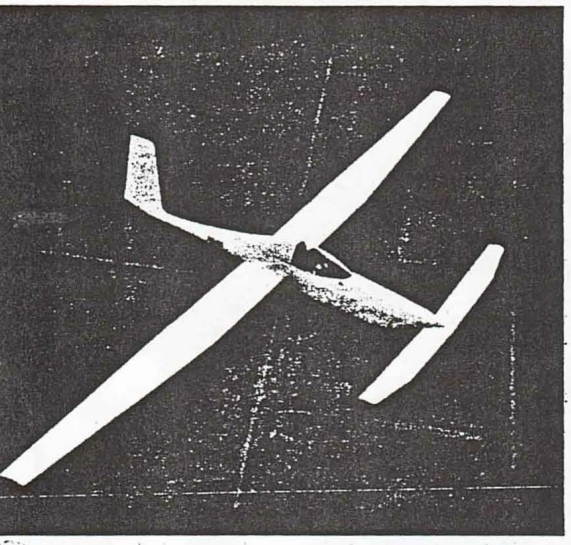


The Predator . . . Airfoils by Roncz.
Photo by Pat Storch

numbers that represented pressure distribution and boundary layer development over the entire chords of the airfoils. Eventually, John began to "see" in these numbers all sorts of nuances that told him how that section would behave on an airplane at various angles of attack and with varying roughness. Today, he "reads" his rows of numbers with the same facility he does Greek or the various computer languages he has mastered . . . often to the complete frustration of observers who cannot possibly fathom what he is getting so excited about as he scans his columns of aeronautical hieroglyphics.

Each day and with each airfoil he analyzed, John inched up another notch on a learning curve that no one else has climbed. There are scientists the world over involved in airfoil research, but none that have used John's specific

methods and particular approach. The process has involved analytic brilliance on his part, certainly, but it has also involved what to the rest of us would be unspeakable drudgery. He thinks nothing of working straight through the night, catching a few Zs the next morning, then going right back at it for another 18 to 24 hour, straight through number crunching orgy. (No, if you are wondering, he is not married.)



The Rutan Solitaire, the third aircraft to fly with Roncz airfoils.

Photo by Pat Storch

The result of all this is that John has achieved a level of both theoretical and practical accomplishment never before achieved . . . and he has done it in an amazingly short time in terms of **years**. If he had logged his **hours** on the job, however, they likely would already equal the working life of the average 8:00 to 5:00 aeronautical researcher.

And, now, the most incredible thing of all — to this point, all this education, all this gut wrenching effort was strictly a **hobby** with John! Being self-employed and having employees who could keep things humming while he was on one of his round-the-clock airfoil analysis binges, he was in a unique position to indulge himself in what was for him an all-consuming passion.

But we're getting ahead of the story.

While John was making his periodic visits to Ohio State to confer with Dr. Gregorek, he became interested in their metal wind tunnel models . . . but he didn't like the way they were being made. Based on his metals business experience, he could see that much could be done to improve manufacturing methods, so he went back home, conceived a new way of making models, designed a special computer driven milling machine . . . and wrote a very complex computer program to operate it. Today, Gemini Technologies supplies almost all of Ohio State's wind tunnel models and orders are now coming in from industry and several of the NASA Laboratories.

Then came the Rutan connection. It began when John read an item in the **Canard Pusher** newsletter about a new canard airfoil Dick Rutan had tried out on his Long-EZ. Anxious to analyze any low Reynolds number airfoil that had actually been flown, he wrote Dick to ask for the coordinates. Since he was unknown to the Rutans at the time, John included some pressure distribution plots and other information derived from his analysis of the GU airfoil to show what he wanted to do with Dick's new airfoil. A few days later, John got a call from Burt Rutan!

In still another of those fortuitous path crossings that seem to have blessed John throughout his aviation experience, it just so happened that Burt was looking for someone to evaluate some low Reynolds number airfoils for what was then his latest project, the Solitaire. John readily agreed . . . but when he ran them through his computer, he found they were lacking in the performance Burt needed for the radical powered sailplane he envisioned. John sent Burt a detailed analysis of the airfoils, plus one of his own design his computer said would be better suited to Burt's needs. Included was a tape recording that talked Burt through all the charts, diagrams, boundary layer profiles and John's analysis of the physics involved. He was hoping to impress Burt and apparently he did . . . but only after Burt had put John's airfoil to the acid test.

Johnny Murphy had completed the first plans built Long-EZ by this time and was encountering some really bad pitch down problems in Florida's torrential rains. This was partially due to some construction irregularities in the canard, but since some other builders were also experiencing pitch changes, the GU airfoil was definitely suspect. Unbeknownst to John, Burt whipped up some drawings for a new canard utilizing John's airfoil (with a slotted elevator) and mailed it to Johnny. To everyone's astonishment, the new canard not only allowed Johnny to fly hands off in rain . . . where formerly he was diving with full aft stick . . . but also lowered his rotation speed by 10 knots and even increased his cruise a bit! While everyone recognized this was, in part, an indication of how bad Johnny's original canard was, still it was an unquestionable fact that John's airfoil was the best one by far Burt had yet encountered.

So, Johnny Murphy's Long-EZ was the first aircraft to fly with a Roncz airfoil. The second was Mike Melvill's Long-EZ. Mike was looking for some more speed for the CAFE race and John, knowing the use of one of his airfoils without a slotted elevator would be a worst case situation and thus the best test of his low Reynolds number theories, was looking for another test bed, so he designed a new airfoil tailored specifically for Mike's EZ. Included was "the most detailed set of plans ever drawn", according to John — 60 pages of building instructions just for a canard! He also included upturned canard tips to direct the canard vortex up a little higher on the aft wing to lower drag and increase maximum lift. This was something he had already designed and had seen flown on a local EAAer's airplane, Jerry Gruber's Long-EZ.

The Solitaire, the third application of Roncz airfoils, was quite a project and served to both cement the Rutan/Roncz working relationship and to establish John as a world class designer of airfoils and an authority on low Reynolds number research **and application**. The problem was that the skinny little Solitaire wings were operating in what John characterizes as a "ridiculous Reynolds number range — 300,000 with lift coefficients greater than 2." Although it has not been a great commercial success, the Solitaire was an engineering *tour de force* for both Burt and John . . . with far reaching effects for a far broader spectrum of aviation than just the homebuilt market.

By this time Burt and his associates had formed SCALED Composites, a private "skunk works" that took on commissions from industry. Soon, John's expertise was being put to work there . . . but because of the veil of secrecy that naturally must be drawn around projects companies are paying dearly for in an effort to get a leg up on their competition, there is little we are at liberty to talk about on John's (and Burt's) work after the Solitaire . . . except, of course, for the Voyager. This is without question the single purpose airplane to end them all. Every aspect of its design — the structure and the aerodynamics — was optimized to do one thing: fly around the world non-stop on the tank(s) of gas it takes off with. The fact that the world flight has never been done and that the Voyager appears capable of finally doing it is testimony enough to Burt's genius as an airplane designer, but in order for his ideas to work, he had to have some airfoils, the likes of which the world had never seen. The canard had to have an L/D of around 200 and the main wing about

134 . . . and both had to somehow avoid the deleterious effects of bugs, rain and even ice for 10 days and through 25,000 miles of the earth's far from pristine atmosphere. It was John's job to supply Burt with such "miracle" airfoils and to figure how they interacted, from canard to aft wing.

What John came up with was an airfoil shape that controls **where** the inevitable bugs will hit the wing surface . . . one that **aerodynamically** deflects them so they hit near the stagnation line on the upper surface, leaving the lower surface essentially free of strikes. The proof of the effectiveness of his work came when the Voyager landed at Oshkosh last summer. It had flown 21 hours and through a number of take-offs and landings since last being washed, yet the whole bottom of the enormous wing (and canard) was clean as a whistle. John estimates that no more than a half a percent of laminar flow is lost on the lower surface on a long flight like that, but about 50% is lost on the top surface.

This is not a problem, however, because that margin was designed into the airplane. John is justifiably proud of his role in the Voyager design and says, "I have a feeling that we will be able to rewrite certain chapters on boundary layer stability shortly." He also says the project was really tough ". . . because we were really pushing performance to the hilt."

John is also high in his praise and respect for Burt. Despite the fact that the Voyager was such a far out design, its take-off speed, for instance, was within one mph of Burt's estimate.

"It's amazing how Burt can do that," John says. "He is the greatest mind in the world on airplanes. How he can nail things down that close just amazes me. A lot of the reason why what I do (on airfoils) is successful is because Burt knows precisely what he needs. Most designers have no concept of what they need (for airfoils). He knows what makes the design tick, and he will tell me he needs a lot of lift here and he doesn't care about something there. He has a real feel for what is going to make the configuration work. I now have a real feel for how to get what he wants . . . so, between the two of us, we are a pretty dynamite team."

The next project John worked on . . . and keep in mind, all this in a volunteer role to this point . . . was the microlight SCALED contracted to design for the late Colin Chapman. It would come to employ John's favorite of all the airfoils he has designed . . . one that Burt used to have a drawing of on his office wall.

As John recalls the design sequence, "This was an airplane in which Burt had to guarantee a low rotation speed. He kept telling me 'I need gobs of lift, **gobs** of lift!' So, I finally worked out this banana shaped airfoil, employing a preposterous design procedure . . . but one that paid off. It's too complicated to describe, but I came up with another way to design an airfoil and made this funny bent banana shape, then straightened it out. I sent it out to Burt with the designation 'GOLA'. He wanted to know what that meant and I said, 'Gobs of Lift Airfoil — that's the only design parameter I ever got from you!'

"But 'GOLA' worked. Man, that thing would go down the runway with full aft stick and not one little tuft ever raised its head - it had attached flow all the time. It **did** have gobs of lift. The back wing looked like a tadpole because it had a thick spar and there was a need to minimize the foam volume to keep the weight down. It was extremely important in that airplane for me to consider functional as well as aerodynamic needs as I was designing the airfoils. Historically, most airfoils have been designed to decorate text books, but mine are tailored for a specific airplane with a specific set of airframe design and performance goals. I have to consider the fact that the wing has to have a spar, has to blend into the fuselage, etc. We build airplanes, not just airfoil shapes. They have to be structurally acceptable.

"If I am going to claim anything in the world, it's going to be the concept of optmized wing design, tailoring the airfoils to fit the **total** airplane.

"The microlight was a great little airplane. It's a shame nothing came of it after Chapman died."

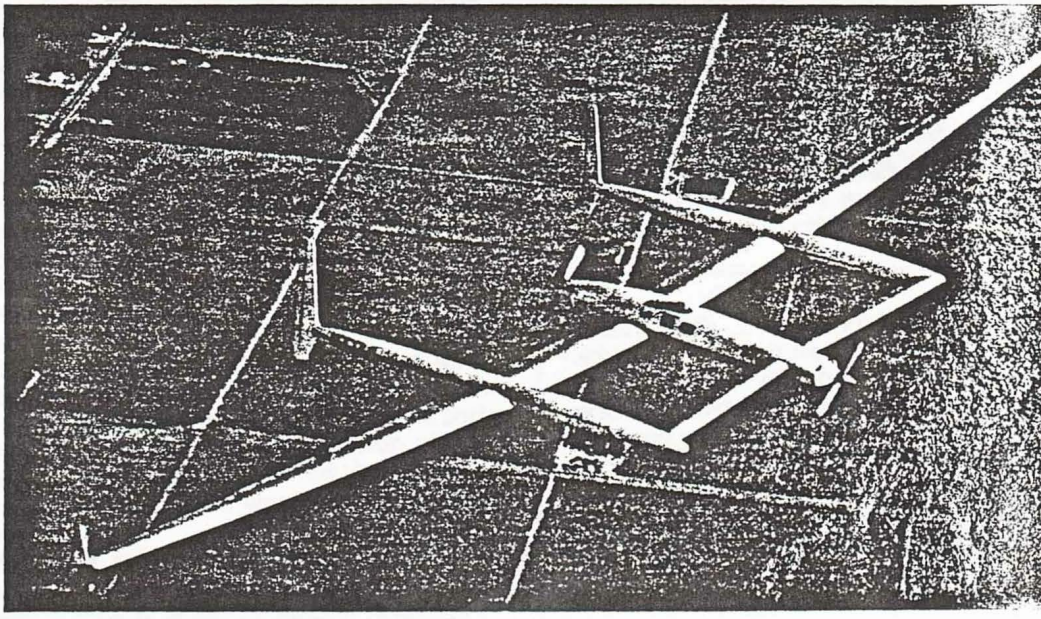
The rest **is** pretty much under wraps . . . but it involves the Beech Starship. John designed the airfoils to meet Burt's performance and structural criteria and they were met . . . in spades . . . when the scaled down flight test article built by SCALED Composites flew. He can only drop a few tantalizing clues as to what the corporate world can expect when the airplane hits the market. John believes it employs the most complex wing ever designed, one that would be impossible to build in anything other than composites. It contains 5 different airfoils, spanwise, that blend together. Special purpose airfoils were also designed for the tipsails and the ventral fin . . . and the swinging canard contains a Roncz airfoil which, during wind tunnel testing at Ohio State, recorded the highest lift ever produced there at its Reynolds number.

The Starship, John firmly believes, is a major milestone in aviation history — one that will forever alter the future direction of aircraft design. He is extremely proud of having had a role in its creation. Actually, he is still involved with it. After making the decision to produce the Starship, Beech signed John to an exclusive personal service contract . . . and sold him a Duchess to use to commute to the factory in Wichita.

"They own me, body and soul," he jokes today . . . and proceeds to relate still another unusual circumstance of his aviation career. Jim Terry, the official he works for at Beech, is the designer of the Rockwell 112 and the Beech Duchess . . . the two airplanes John has

About the Voyager, John says, "I have a feeling that we will be able to rewrite certain chapters on boundary layer stability shortly."

Photo by Pat Storch



owned. Needless to say, they have a lot in common.

His most recent project for Beech — one that is continuing at present — is the application of his airfoil theories to the design of propellers. The Starship will take the propeller past the limits it has previously gone, so some radical new thinking was required to design one to realize the full potential of the airplane. Radical? Where's Roncz?

In between all these exotic airfoil design projects . . . and before he began being paid for them . . . John was still acting as his own computer manufacturer. Hal's capability was quickly exceeded, as already noted, and since John couldn't spare the five grand the early 64K store bought computers cost, he decided to design and build one from scratch. It wasn't a pretty sight — just a tangle of wires, circuit boards, disc drives and such strung along a big piece of 3/4" particle board, and it took 5 months of highly frustrating effort to get it to work, but work it eventually did. Named Hal II, naturally, it did some extremely significant work for aviation.

Then, after getting involved with Burt Rutan, John built Hal III, a computer compatible with Burt's Apple II, so they could exchange software. John, incidentally, never entertained the thought of leaving South Bend to move to Mojave to work in SCALED's offices. He would never, he says, consider living in a city with less than **two** symphony orchestras!

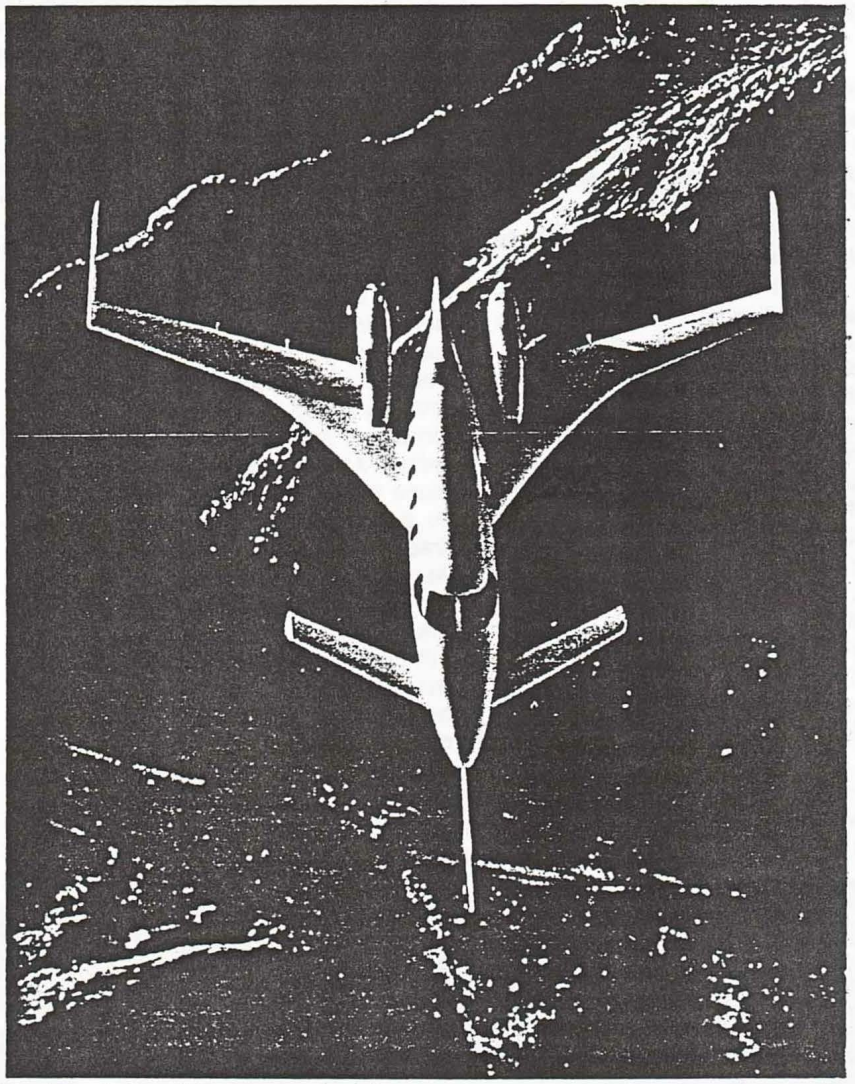
Now in a position to purchase commercial hardware, John recently acquired an IBM AT computer. He still has the Hals, however, and still uses them. It would simply be too time consuming to transfer the programs written specifically for them to the IBM.

One of the most recent projects in which he has collaborated with Burt is the Predator, a large ag plane. It also has a very complex canard/wing system employing nine(!) airfoils in order to obtain optimum performance.

Largely as a result of the notoriety he has received as a result of the Starship and the Voyager, John is now in demand on the university and EAA Chapter lecture circuit. Anyone coming in cold to a Roncz "performance" is in for a shock. The only thing John loves as much as playing Chopin and designing airfoils is stand-up comedy. His lectures are a riot! He has an absolutely outrageous sense of humor and as far as I know is matched only by EAA's Norm Petersen as a connoisseur of outlandish jokes and even worse puns.

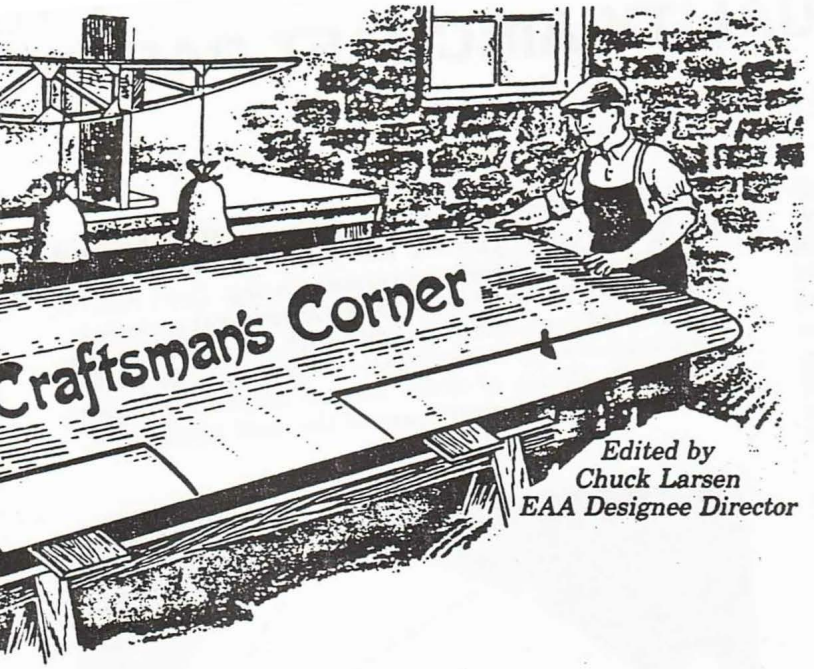
Last summer at Oshkosh, his forum on the design of canard aircraft was a scripted comedy routine from start to finish, complete with an introduction by Nick D'Apuzzo that ran something like this: A Polish scientist named Dr. Gregorek, working in his lab in Transylvania, was trying to assemble a trash compactor kit when it short circuited in a blinding flash and a resulting cloud of orange smoke. When the smoke cleared, there stood his creation — a bizarre Hungarian named John Roncz. For this crime, Dr. Gregorek was banished to a penal colony called Ohio . . . and John was sold to a band of gypsies . . . who, in turn, sold him to then Beech president Linden Blue. It had the audience rolling in the aisles . . . but at the same time was a very clever way of presenting a highly technical subject. All the serious stuff was there, but it certainly was a fun way to take the medicine. You're likely to find standing room only at John's performances, but don't ever miss one!

When EAA was founded 32 years ago, it was hoped that the little group might someday help push back the frontiers of aircraft design. I'm sure, however, that not one of those 31 persons who attended the very first EAA meeting ever dreamed that things would come to what they have today . . . to an era in which homebuilts have become the cutting edge of lightplane technology, when **individuals** like John Roncz would be pushing aerodynamic research beyond heretofore known limits. Every EAAer can be proud that our organization has been the seedbed and has helped create the regulatory climate in which the John Ronczes among us would have the freedom to get their starts. Their achievements are, of course, their own, forged in sacrifice, personal risk and a great deal of hard work. They richly deserve every accolade that comes their way . . . and we are extremely proud of each and every one.



The Beech Starship . . . an aircraft John Roncz believes will forever alter the future direction of aircraft design.

Photo Courtesy Beech Aircraft Corp.



Edited by
Chuck Larsen
EAA Designee Director

MAKING MOLDS FO

By Bob Blaine, EAA 150978
5434 Mason Avenue
Woodland Hills, CA 91364

Bob's article first appeared in S.H.A.P. TALK, the bulletin of the Sailplane Homebuilders Association. These fine homebuilders would be happy to welcome you to their group and provide you with their newsletter upon payment of annual dues of $12 for the U.S. and Canada ($16 outside these countries). Mail your dues to the author of this fine article who serves as Secretary of this group of homebuilders whose special interest is sailplanes. Part I - Template Making and Line Generating Techniques appeared in the August, 1984 "Craftsman's Corner" of SPORT AVIATION. - Ed.-

WE BEGIN OUR mold-making by constructing a **MALE** mold, or "plug". This mold may be used for acrylic plastic canopies, or for lay-up of fiberglass materials. Thermoplastic acrylic sheet may be heated and "drape formed" over the male mold and fiberglass reinforced plastic can be "laid up" ply-by-ply to get desired strength and shape.

Production of several identical parts warrants the making of a **FEMALE** mold that may be constructed over the male mold. Parts can then be pressure blown into the female mold - or vacuum bagged - or "laid up" with polyester or epoxy resin.

When you have a good male mold, you may make the desired part from low cost materials and with the use of simple tools.

Part I of this article left us with our template/structure for a low drag fiberglass reinforced plastic nose cone. There are **NO** flat surfaces on low drag bodies - so get accustomed to working with compound curves in the hope of achieving some laminar flow.

Your visual "measurements" and delicate sense of touch will become your guides to obtaining smooth, flowing curves that are needed for minimum drag. Filling and sanding — filling and sanding — filling and — is the name of this game!

In addition to lots of patience and manual dexterity, you'll need some readily available mold materials and

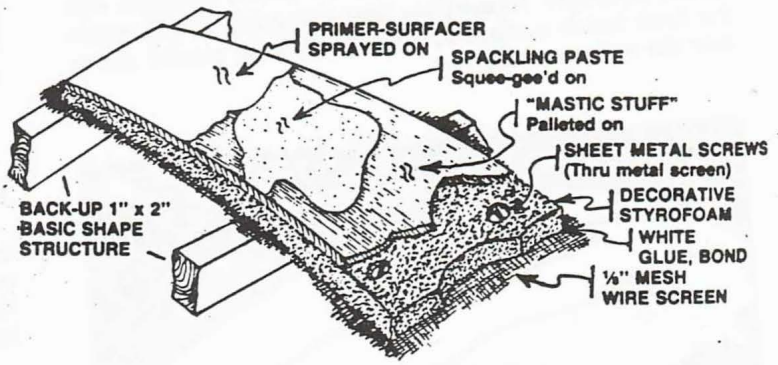
t corrugated carton cardboard in large segments.
nard (tempered) Masonite, ⅛" thick.
Furring strips 1" x 2" and 2" x 2" - select for straightness - these are for building the support frame structure - make it solid and strong to withstand sanding pressure.

A roll several feet long of ⅛" mesh "hardware cloth" from the chickenwire department of your hardware store. Do **not** try to use ¼" mesh.

Blocks, or sheets, of quality Styrofoam from florist, crafts, hobby supply sources. 4" foam is best and it should be 12" or 24" wide by at least 36" long. Use a band saw to make mosaic-shaped blocks, mostly less than 1" thick and shaped into trapezoids, triangles, etc. The trick is to glue up the flat "foam tiles" so that they conform to curved surfaces. Make them overly thick so sanding will bring them down to the desired contour. Sanding styrofoam is so easy it's almost fun - BUT don't get carried away because **filling** and sanding the low spots gets wearysome!

A small, narrow SURFORM plane is needed for rough work. There is one that is flexible for curved surfaces. A block of foam makes a good "sanding" device - no sandpaper needed.

Get #8 or #10 sheet metal screws 1" and 1½" long. Pan heads, or stove heads, are preferable.



ASSEMBLY OF THE MOLD:

Now it is time to apply the ⅛" mesh hardware over the wooden back-up structure you have constructed. It should lie approximately ¾" below the designed final mold surface. Use tacks and soft wire to fasten medium and small pieces of mesh to core structure. Be sure to fasten it solidly.

White glue is used for attaching the "mosaic" of foam onto the wire screen, leaving the template edges untouched.

Sheet metal screws are used for drawing the foam blocks into good contact with the screen while the white glue dries. Turn the screws deep enough so that screws won't interfere with the sanding operation to come.

The sketch shows all the materials which comprise the mold and its bracing, back-up structure, from sticks of wood through final sprayed-on primer, ready for the release wax and a coat of P.V.A. film release.

You'll need T-pins to hold the edges of foam blocks together while the white glue sets. Try to have a minimum gap. You'll use a lot of "white glue". Better buy large containers of it and refill a small squeeze bottle as needed.

Time now to approach the final contour surface for which you are striving. Buy, in 2-gallon plastic buckets.

LAMINATING/FORMING QUALITY AIRCRAFT PARTS

PART II - MOLD CONSTRUCTION

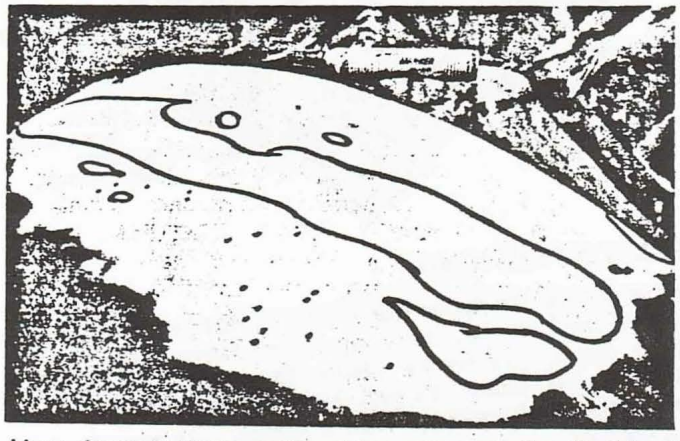
a quantity of a relatively new mastic wall-covering material that comes in whipped cream consistency. It clings, does not sag at normal temperatures, is water based and easy to handle. It dries to a sandable surface and can be worked with SURFORM PLANE. Thick applications need 12 hours for drying. It shrinks somewhat on drying - so allow for this. A 2" wide putty knife, or a kitchen spatula, is good for application. Be prepared to put on second and third coats to build up low spots. Two trade names for this nice material are: "SCULPTURE KOTE" and "RUFF STUFF". It costs about $10.00 to $12.00 per 2-gallon pail.

The best sanding disc grit is OPEN - 20 or 40 grit. When using electric sander - use caution - don't disturb template edges, or accuracy will be lost. Use a light touch and good illumination. Protect your eyes and lungs with safety equipment and ventilation. A good trick for hand sanding is to wrap abrasive paper around a **used** kitchen sponge. New sponges are too soft.

Splines are important tools. Thin wooden strips work well. Use a movable shop light to find low spots, or unevenness, in the surface. Place spline so that light shows under it to find low places. Move spline and light in all directions. Use your hands to detect irregularities.

Check left and right symmetry with hand-held templates.

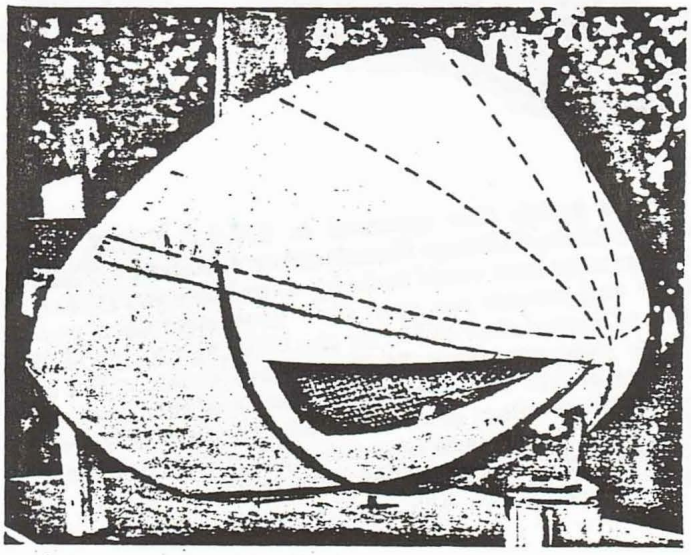
For final shaping, purchase a 2-pound tub of vinyl spackling paste (SYNKOLOIDS is excellent). This stuff is smooth and easy to apply and dries quickly with minimum shrinkage. Thin layers work best. Use a medium soft rubber squeegee. Remember that this surface will create the final inside surface of your mold, so be careful not to mar the soft material.



Lines drawn indicate enclosed low areas needing "build-up" and spots indicating high areas to be sanded.

From an auto paint store, buy a can of PRIMER-SURFACER for spray gun use and spray on 3 or 4 medium coats for a good, smooth protective coating. Don't attempt to use "BONDO" as it is too hard for our soft materials.

Sand between coats of primer with 180-220 grit paper. For plastic canopy work go to a 360 grit abrasive for final smoothing. Optics of drape formed acrylic are directly determined by the smoothness of the mold surface.



Completed upper surface of nose cone mold for Bob's sailplane.

DuPont's 100 series "Multi-purpose Acrylic Lacquer Primer-Surfacer" has worked well.

Be aware that some resins, thinners, solvents, etc., may penetrate the mold release barrier and attack the primer-surfacer. It pays to experiment with your materials on a sample part in order to learn of possible problems. No need to sacrifice all that work of mold making!

Use lots of genuine mold release wax (four coats) plus a carefully sponged-on polyvinyl alcohol (PVA) film. This should furnish a good barrier and assure release of the fiberglass reinforced plastic. Remember that a pin-hole leak will allow the stickiest glue known - catalyzed resin - to penetrate to the mold's surface and cause a problem when you try to get the part out of the mold.

Reference: See **SPORT AVIATION,** Feb. '82, for article on shaping and finishing A/C surfaces.

Our thanks to Bob, the Sailplane Homebuilders and their publication, S.H.A.P. TALK for this fine article. -Ed.-

The EAA member submitting materials published in this feature are awarded the "Craftsman's Corner" Award. The award includes a special, limited edition hat and recognition by EAA Headquarters and fellow members.

A complete explanation of the award was published in the May, 1984 issue of SPORT AVIATION or you may secure it from the address at the right.

Communications regarding the "Craftsman's Corner" and materials to be considered should be addressed to:

EAA "Craftsman's Corner"
Wittman Airfield
Oshkosh, WI 54903-3065
Phone: 414/426-4800

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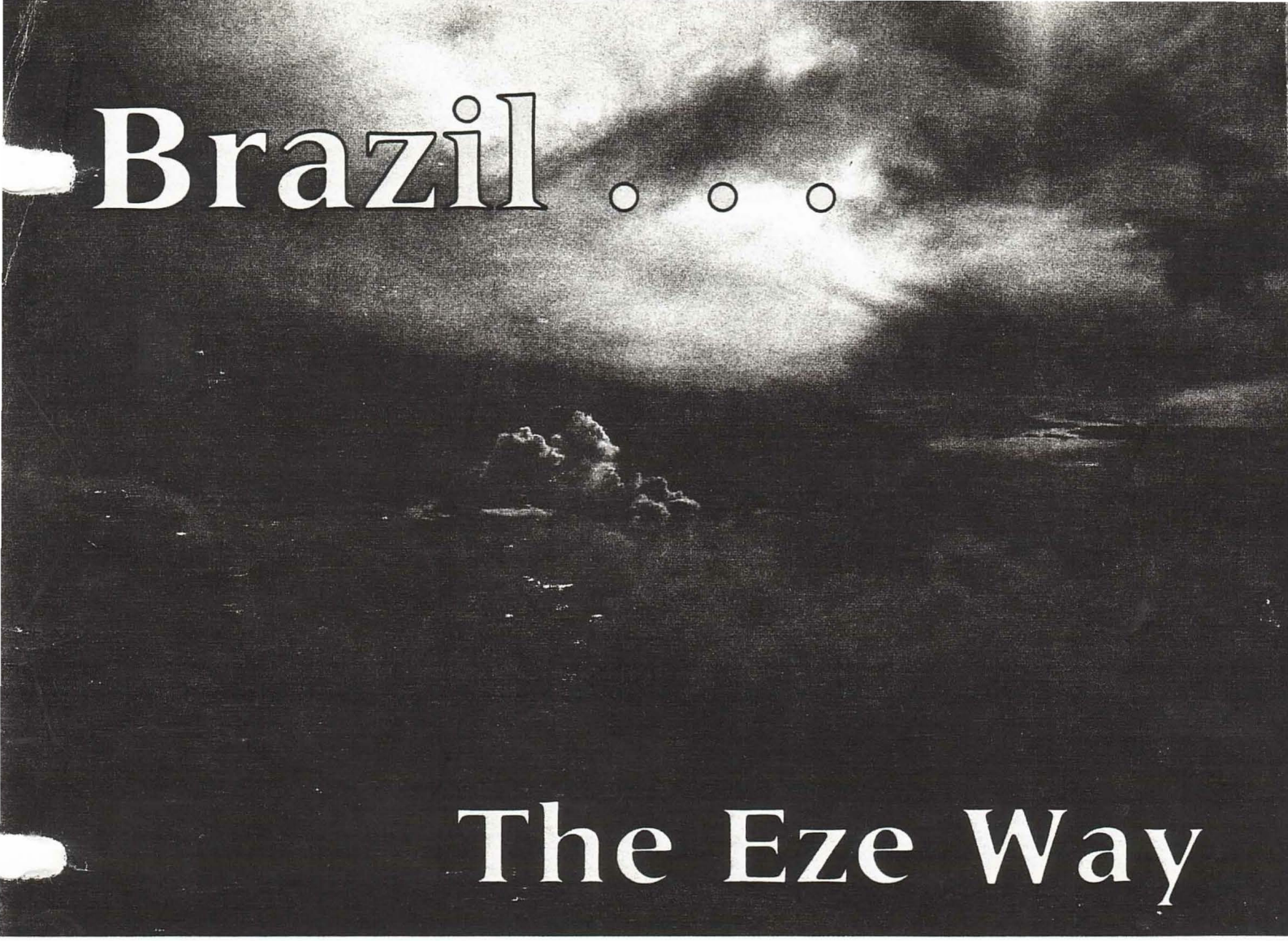


Some "chocolate cake" weather near Martinique.

8.20
#29B

By Mabel Coha
5173 Leo St.
San Diego, CA 92115

IN THE FALL of 1983, a VariEze and a Long-EZ were flown together from Florida to São Paulo, Brazil and return. Other than a persistent rain erosion problem with the VariEze's prop and the inevitable result of using FAA approved 100LL in 80 octane engines, the flight was made with essentially no airframe or engine difficulty, and six hour legs were common. That such a flight could be made with such relative ease is perhaps the best testimony yet of the remarkable capability offered by the new generation of homebuilt aircraft.

The author, Mabel Coha, experienced the over-ocean and jungle adventure from the rear seat of the VariEze and saw 14,000 nautical miles of land and seascape slide by under the wings (and canard) before she was again home in San Diego to pen the following account.

What happens when two pilots get together over cocktails? When Ferde Grofe, Jr. of Ferde Grofe Films, Inc. and Randolph Haynes of the São Paulo Aeroclub were discussing aviation, Grofe had the bright idea for a fleet of "Ezes" to fly from the U. S. to Brazil and demonstrate what pilots, interested in flying economically, can accomplish if they were to build themselves a very efficient, relatively inexpensive airplane. Grofe's responsibility was to promote interest through the Eze Hospitality Group so 5 VariEzes and 5 Long-Ezs could be recruited to make the trip. Haynes job was to secure a sponsor.

The day after the discussion Haynes had completed his responsibility, obtaining a commitment from Claes Mouret of **ICI Brazil** to pay the hotel bills for 11 days for 10 Eze airplanes (2 crew members each). Now Grofe had to obtain the Ezes. Letters went out to the Hospitality Members and there were immediate replies from people like Coha and Hunter who had already been contemplating such a trip. Finally, there were 4 VariEzes and 3 Long-EZs signed up to make the trip. It was a rather loosely organized trip which, of course, was necessary because flying is always dependent on weather conditions.

For one reason or another when the first part of September rolled around, the list of participants dwindled to Rich and Carol Clark from Hermosa Beach, CA, VariEze N89EZ; Alfred and Mabel Coha, San Diego, CA, VariEze N2CR; Harris and Cleta Howard from Groom, TX, Long-EZ N25HC; Neil and his son, Gary, Hunter from Satellite Beach, FL, Long-EZ N141NH. The date was set

to leave Opa Locka, FL, Monday, September 12, 1983.

The Cohas left San Diego on September 8, flew to Las Cruces for fuel then on to San Antonio, TX where we spent the night with Hospitality Members Dale and Evelyn Keyser, formerly of San Diego. The next morning San Antonio was below minimums so an IFR departure was filed for the third leg of our journey.

With a high developing over Louisiana, IFR conditions prevailed until east of Houston. Because of the extra time spent dodging weather, N2CR landed at Lake Front, New Orleans (where the people at Eagle FBO were great) instead of Pensacola. Weather from there to Merritt Island, FL cooperated and for the second day of our journey, we landed after dark.

Neil and Gary Hunter met us at the airport. Neil, who is a retired Air Force Transport Pilot with extensive long distance flying experience, had made up a flight plan for the entire trip, so copies were made for each of the four planes. Repairs on the Coha Eze, paint replacement from rain damage, and an oil change for both planes kept Hunter and Coha busy the next day. Sunday, the Cohas visited the Space Center.

Monday, September 12

The morning of September 12 Hunter and Coha checked weather and all was "GO". Neil and Gary Hunter were to stop at Ft. Lauderdale airport and Al and I were to go to Opa Locka Airport to pick up the Clarks and Howards. Neil just stopped a few minutes at Lauderdale and then started off for South Caicos for refueling. Al had to put fuel on and file a flight plan with Clark and Harris at Opa Locka. By this time weather was marginal so he filed IFR and Clark and Howard decided to stay. We were off the ground at 10:01 a.m. local time and encountered broken clouds until we passed Andros Islands. Flying between Nassau and South Caicos was beautiful. No photograph can depict the colors in the water around each of the islands, ranging from turquoise to indigo. It was also interesting to see the formation of clouds over each island with blue skies over the water.

South Caicos is noted for its lobster sandwiches. However, this information was not available until after the fuel stop. South Caicos isn't an airport that looks thriving but there were several airplanes there. The one that catches your eye first is the one that sits on its belly 500 feet west of the runway in the water.

Customs, immigration, general declarations, landing fees and fuel taken care of and the oil checked, a flight plan was filed. The Cohas were off the ground bound for St. Croix by about 4 o'clock.

Darkness fell just as we crossed Puerto Rico. We were vectored into St. Croix airport. Neil Hunter's Long-EZ was parked in front of the fire station, so Al parked the VariEze next to it. A truck with a flashing red light greeted us to collect the landing fee but customs check-in was postponed until morning.

We were driven a few hundred yards to the airport hotel. At one time, we were told this was an A-1 hotel but years have taken their toll. Not knowing where the Hunters were staying, we decided to remain at the airport inn for at least one night. Being Monday night, pro football was on television, so while eating our supper, we watched the San Diego Chargers get beaten.

Tuesday, September 13

Next morning after checking in with customs and with incoming general declarations filed, the VariEze was moved to the FBO, fueled with auto gas and had the oil checked. By this time Neil Hunter had called the airport. One of the pilots, Cam McCoy of St. Croix, gave us a lift into Christiansted. After settling in at the Camanche Hotel and having lunch, the Hunters and Cohas took a walking tour of Christiansted.

Checking the airport about 7:00 the Clarks and Howards were located, having just landed. About an hour later we were all assembled at the Camanche Hotel.

Wednesday, September 14

On Wednesday, September 14, all 4 crews climbed into a taxi and traveled back to the airport. Upon examination of Clark's engine, which had quit the night before when taxiing off the runway, Rich decided he would have to remain, have it repaired and fly home.

By 11:30 two Long-EZs and one VariEze took off for Trinidad. Again, the flight was in beautiful weather. We landed at Trinidad at 4:13 p.m. and the tower directed us to the parking area where a BWIA airliner, which was surrounded by soldiers with machine guns, was parked. It did not give one a very welcome feeling. (Incidentally the plane had been carrying a shipment of precious metal.)

An official with a spray can greeted us and even though we showed him our spray cans, he sprayed the airplanes again. In fact, he was very upset that we had opened the canopies before he arrived.

The three sets of crews were escorted into the terminal building where we were told six Incoming Declarations should be made out. Some of us were warned about this and we had carbon paper. Now the procession started - one crew at a time - first to Health, then to Immigration, then to Customs and then to the Tower. Of course, by this time we were one copy short of Incoming General Declarations. So, back to step one to have that seventh copy stamped at each station.

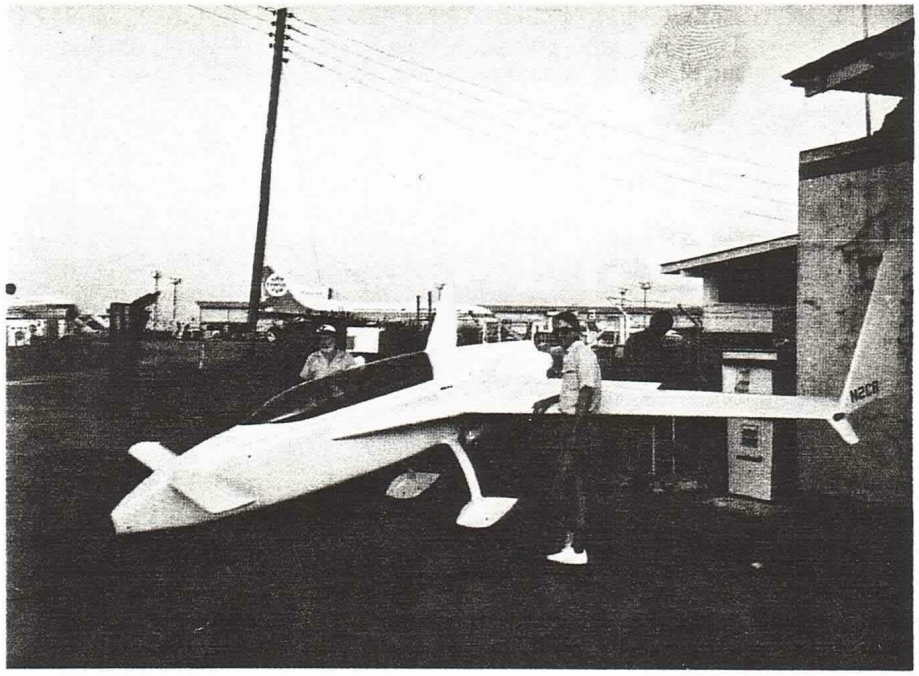
Now for the refueling process. Things weren't complicated enough, so Al decided on automotive fuel for the VariEze. To get it, the airplane had to be pushed 400 yards to a gate where, after much maneuvering by Al Coha and Gary Hunter, it was through. After the fill-up, the same process took place in reverse. The other two planes, having larger and different engines, accepted aviation fuel.

After taxiing the three planes to the other end of the field, we were driven to the hotel at the airport. Dinner was followed by making out 7 copies of Outgoing General Declarations for an early flight to Cayenne in the morning.

Thursday, September 15

Being experienced, all four stops for stamps were made and then it was up to the tower for a weather briefing. By this time, Harris Howard decided he'd better turn back to St. Croix and home. Weather maps were viewed - no clouds along the route to Cayenne, Guiana. Al and Neil were going to monitor their fuel supplies carefully and try to make Cayenne without a fuel stop. A special frequency was agreed upon with which to communicate enroute.

To the airplanes! By this time, the rain was coming down quite hard. However, the satellite map showed no storms, so all we had to do was get away from land and blue skies would prevail. Al and Neil decided to file IFR and off we went. Neil took off first and climbed to 15,000 feet and was soon in the clear on top. Meanwhile, we were held up by an incoming plane. With a cruise prop and rain, Al climbed to 10,500 feet and battled the rain for an hour before emerging into a trough between two layers of clouds with no rain. Finally, clear skies and the coast line came into view. A headwind didn't help the speed of the planes but Cayenne, French Guiana was reached six hours and two minutes after take-off. Upon



Al Coha and Gary Hunter, pump auto fuel into Al's Continental O-200 powered Vari-Eze at a service station just outside the gates of Trinidad's Piarce Airport. The only mechanical problem encountered on the 14,000 mile trip resulted from *not* having auto fuel available in most of the Caribbean and South America.

landing and examination of the prop, Al realized the storm that we had come through was pretty bad. How to repair? It was decided we would go to the hotel and think about what could be done for the propeller.

The lady taxi driver was very helpful. No rooms at the hotels right downtown so off to the Novotel, a new one on the beach outside of the downtown area, relatively inexpensive and lovely. The ride in the cab took us through the whole town. Over cocktails, the propeller repair was discussed.

Friday, September 16

Next morning back at the airport, Al, with Gary Hunter's help, sanded the leading edge of the propeller, wrapped it with packaging tape and put an aluminum tape on the leading edge. He was able to secure some gas cans so he drove back to town for automotive fuel. The flight of two Ezes took off about 9:47 local time. Claes Mouret, the representative of ICI from São Paulo who sponsored our trip, was to meet the Eze crews in Belém, Brazil.

The flight that day was lovely. Over the mouth of the Amazon, the Equator was crossed. Yes, there really was a line depicting the Equator, a line of clouds.

Claes Mouret arrived before the Ezes. By the time we arrived, he had everything working smoothly as far as Customs, Immigration, Police, Health and Landing Fees were concerned. After an hour of paper work, we headed for the restaurant and five steak sandwiches. Relaxed and in Brazil at last, it only took one more hour for the paper work to be completed. Each stop in Brazil after that was simple - show a paper and get it stamped.

At the hotel that night, Mouret introduced us to the Brazilian national drink, caipirinha, and palmetto salad (heart of the palm). Our original itinerary was changed and we were to travel to Fortaleza first. There being only two airplanes and four people, ICI agreed to not only pick up the tab for the rooms but also any extras at the hotels while in Brazil.

Saturday, September 17

As we flew into the cities of Brazil, we obtained a bird's eye view of the area. Much is being done to improve the living conditions in the cities. Our taxi ride from the airports gave us an excellent ground tour of each area. The reservations made for us by ICI were excellent. Each time we landed at an airport we drew crowds of laughing people. However, when we told

The beach of Fortaleza, as viewed from the Imperial Othon Palace hotel.

them where we had flown from, how many stops we had to make and how much fuel we used, the laughter turned to amazement. There always seemed to be one person in the crowd who could speak some English and could translate the information into Portugese. A smile and a handshake made many friends. Security at all airports was very satisfactory.

At Fortaleza our hotel was overlooking the beach. Gary Hunter went down to the beach to try wind surfing. The rest of us took a walk along the beach on those crazy sidewalks where vendors were setting up their wares. There were many things that looked lovely but traveling in an Eze leaves no room for any purchases but the smallest of items.

Sunday, September 18

Recife was our next stop. Again our hotel was overlooking the beach. The swimming pool was on the 16th floor - providing a beautiful view of the area. A walk along the beach brought us to a fair a few blocks away from our hotel. On our return, we stopped at the Rodeio for a beer and appetizers, then back to the hotel for dinner.

Monday, September 19

One week after leaving Miami, on the 19th of September, we left Recife for the city of Salvador. Al and Neil took off together and the Cohas had the 8mm camera taking pictures of the Hunter plane. The land between Belém and Salvador is rather arid, not much rain falls.

When we arrived at Salvador airport, Edwardo Hublet Merilli from São Paulo, the APPA representative, met and welcomed us. We taxied the planes to a hangar, secured everything and then were off to the terminal to have documents stamped. A cab ride to the hotel took us through and to the north of the town. The Meridien hotel was fantastic. We were on the 12th floor - one room looked to the east, the other to the west. Both overlooked the South Atlantic Ocean. We could watch the fishing boats come in at night and go out in the morning. After a snack and some liquid refreshment, we went for a swim in the beautiful pool. (As soon as we would land after a leg of from 3 to 6 hours, our first thought was liquid. People who own Ezes will know why. One does not drink much before a trip, particularly a woman in a VariEze with luggage under and on top of her legs.)

Father Mark Tillia, a missionary who has a Brazilian registered VariEze, was waiting for us when we returned to our rooms. He stayed with us and on Tuesday morning took us on a tour of downtown Salvador. That afternoon Father Mark, Gary, Neil and Alfred went to the airport to ready the planes for an early flight on Wednesday.

Wednesday, September 21

The flight from Salvador to Rio was supposed to be an easy one, but there was some bad weather north of Vitoria. We were able to get above the clouds, but at Vitoria we decided to stop and put on some fuel and check the weather for Rio.

By 2:30, we decided to try it again . . . and quickly encountered more weather. Al flew low, sometimes as low as 300 feet above the water. Neil flew high. Just about the time Al was ready to make a 180, Neil reported a break in the weather. Finally, Rio was in sight. Sugar Loaf looked beautiful. Our view of Brazil up to this point was flat land - now we had hills or peaks. Even the Corcovado, the statue of Christ, was visible as we flew over the harbor at Rio. We landed at Aeroporto Santos Dumont.

Many people were at the airport to greet us as we landed at 4:30 p.m. We finally arrived at our hotel about 7 p.m. The rooms at the hotel were only on the third floor, with no view of Copacabana Beach. Each hotel in South America that we had stayed in thus far had a mini bar in each room which had a supply of soft drinks and beer. There was no mini bar in our third floor room, so we asked to have our rooms changed. Next day we were moved to the 7th floor to much nicer rooms overlooking Copacabana Beach.

That morning Al and Neil went to the airport to decide what was to be done with our propeller and for Neil to check his NAV receiver, which had stopped operating in a rainstorm the previous day. Gary and I toured the Stern's workshops and showrooms and the shopping center around Copacabana.

That evening, Ferde Grofe took us to the Platforma 1 Night Club for dinner and the lovely floor show. The costumes were exotic.

On September 23 we departed for the airport to photograph the Ezes flying around Rio. Weather did not permit the camera plane to fly into Santos Dumont airport, so Ferde attempted to have the video cameraman photograph our VariEze from Neil's Long-EZ. However, there was not enough room to swing the camera to the side, so they came down and went up again with a smaller Super 8 movie camera.

Saturday, September 24, was to be filming day again. This time Globo News was to film the two Ezes for a TV program. Many feet of film were taken, so we watched the news Saturday night, but nothing was on about the Ezes. Sunday was spent at the airport waiting for the weather to clear in São Paulo as well as Rio. We tried once to make the trip but made a 180° back to Rio. No visibility.

We decided to stay nearer the airport, so we checked into the Aeroport Hotel. We watched Fantastico, a TV review of the week's important and unusual events and enjoyed the video film of our flight. We were recognized many places after that. We really felt like celebrities.

Monday, September 26

On Monday we arose very early to start our trip ahead of any weather build-up. We landed about 10:15 at Marte Airport, São Paulo, at Aeroclube De São Paulo. Many people were there to greet us. Al and Neil changed the oil in their respective planes, cleaned the plugs, then proceeded to take some of the people for rides. The planes were then put into the hangar and off we went to our hotel. The evening was spent with Claes Mouret and the president of ICI, the sponsor of our Brazilian trip. We had a lovely dinner party with Claes and Anna Marie Mouret, Randolph and Alice Haynes, Fernando Almeida and the president of ICI

Tuesday, September 27

Tuesday was set aside for a trip to San Jose to the Embraer factory. Al was repairing his propeller with the help of the prop shop on the field and Gilberto Falcao de Andrade and Roberto Giovanni. Neil Hunter's plane thus was the only Eze that was flown to San Jose. The rest of us flew in airplanes owned by the Aeroclube. Workers at Embraer were very impressed with the Eze, particularly when they heard where we had flown from and how economical it was on fuel. The president of Embraer, Ozires Silva, accepted an invitation from Neil to fly the Long-EZ from the back seat and was very impressed with its performance.

That evening we were invited to the Haynes' home for a dinner party. Alice prepared some great Brazilian dishes and desserts. The president of the APPA of Brazil, Mario Do Amaral, Ferde and Constanza Grofe, Claes and Anna Marie Mouret, a golf

The Eze adventurers at dinner at Cayenne, French Guiana: left to right, Al and Mabel Coha, Neil and Gary Hunter.

partner of Alice and her husband and the Hunters and Cohas were present.

Claes Mouret obtained some TCP for Al to put in the 100 octane avgas, the only fuel available in Brazil. That nation's auto gas is mixed with alcohol, rendering it questionable for the Continental O-200 operation and material compatibility.

Wednesday, September 28

On Wednesday while Al was installing his prop, Neil took Colonel Samuel Schneider Netto and Fernando Almieda, a Brazilian aviation reporter, for a ride. Everyone who had an opportunity to ride in the Ezes was favorably impressed. Weather was checked and, as usual, we were given a good report, which by this time we questioned but proceeded to Brasilia anyway. We were greeted there by AOPA members Shellie and Jim Walker, Daniel Sheyda and John Harmon and driven to our hotel.

The following morning, Neil and Gary went shopping while Al and I took a tour of the city. It is a well planned capital city with a place for everything. For lunch we were entertained by Shellie and Jim Walker at their home, and, afterwards, toured the facilities of Instituto Lingistico De Verao. This is a very interesting organization that works with the various Indian tribes of the Amazon jungle. They form an alphabet for the tribal language and write primers to teach the people to read. Then they proceed to translate the New Testament into the tribal language.

Friday, September 30

We were picked up at our hotel Friday morning by Jim Walker and taken to the airport. Weather was checked and, yes, there were some clouds around Brasilia but we were guaranteed, "50 miles away, all would be blue skies". Underway, the clouds started building - there were low clouds, high clouds and rain. Neil was ahead and reported "a piece of cake to Carolina". (I have categorized those pieces of cake: chocolate - hard rain; vanilla - clouds and light rain; strawberry - sunshine!) Neil didn't have to stop at Carolina but the vanilla cake turned to chocolate and both Coha and Hunter landed there. The leading edge of our wings, canard and winglets looked like a zebra. It was raining so hard we simply locked the planes and went into the terminal building.

Carolina did have a hotel but it was being renovated. By afternoon they had finished two rooms, so we had air conditioning. The restaurant next door had one menu for lunch and dinner, but it tasted good. Moises, our interpretor, was a big help in getting us settled. Later, we walked around the town, which was very interesting. We were recognized by everyone - all must have watched Fantastico.

Neil Hunter, in the front seat, giving Embraer president Silva a ride in his Long-EZ.

Saturday, October 1

The roosters awoke us early Saturday morning. By the time Moises drove us to the airport, it was raining in a town guaranteed not to have rain. Soon it did let up so everyone proceeded to the planes and, finally, we were off into the vanilla cake. It sure is good to have someone a few miles ahead telling you things are getting better. Arriving in Belém, Al again repaired our propeller. He still had some stainless steel tape which he put on, this time wrapping it with packaging tape.

Reservations in Belém had been made by ICI so off we went to the Excelsior Hotel. It was early enough to do some shopping and looking around the town before dinner. Food in Brazil was very inexpensive in U. S. currency.

Sunday, October 2

At the airport the next morning we checked out of Brazil, which was relatively easy. Our destination that day was Martinique. Neil and Al had planned to stop enroute at Rochambeau airport in Cayenne, Guiana. Neil was ahead, as usual and as he started his descent into Rochambeau, the tower informed him they had no avgas. The winds were in our favor so Neil opted to stop at Zandry, Suriname for fuel and Al, monitoring his fuel carefully, flew to Timerhi, Georgetown, Guyana. At Georgetown the landing fee was $17.50 and customs fee $8.30. In Zandry fees were somewhat higher.

The Hunters arrived in Martinique first and left word at their airplane the name of the hotel at which they were staying. We arrived after dark and had to wait for an airliner before we could land.

Monday, October 3

Neil and Gary Hunter had only one goal in mind on Monday morning - Isla Grande, Puerto Rico, for fuel and then home to Merritt Island, FL. Al and I decided to remain and take a tour of Martinique. A taxi driver who could understand English was hired for a 3 hour tour of the northwest coast around Mt. Pele and St. Pierre, which turned out to be very worthwhile. The afternoon was spent on a boat ride across the bay to the expensive hotels and private beaches.

While in France in 1982, we had met Mme. and Ms. Magnion-Graineau. He has built an Eze in Montpellier . . . and had mentioned his brother was in Martinique. That afternoon we looked him up and spent an enjoyable evening chatting with Felix and his cousin, Michel Yang Ting.

Tuesday, October 4

A taxi ride to the airport on Tuesday morning started us on our way to St. Maarten's Juliana Airport on the Dutch side of the Island. Upon our arrival, we again hired a taxi into town and stayed in a guest house on Back Street, which is two blocks from the water. Front Street is in between. Then it was off to the beach and a walking tour of town.

Wednesday, October 5

Bright and early (6:30 a.m.) on Wednesday, we hired a taxi to take us to the airport for our flight to South Caicos and Georgetown, Great Exuma. All necessary General Declarations signed, Immigration and Customs taken care of, we departed the terminal . . . much to the interest of a group of people gathered to watch "that little airplane" take off. Al started the engine but there didn't seem to be any compression in #3 cylinder - air was leaking past the stuck exhaust valve. At first he thought it would free itself, however, on the runup ramp at the end of the runway, the static rpm was 200 lower than usual. Back to the FBO.

Banging on the lifter did no good. Windward Island Airways International, the FBO, had a hangar which they allowed us to pull our plane into out of the sun. A borescope look into the cylinder made them believe there was a burned exhaust valve so the cylinder was pulled. Luckily, the valve was not burned. Instead, there was a lead deposit on the valve stem. Al had at his disposal all the tools needed for the repairs so he went right to work. One of the interested spectators, Michael J. Ferrier, realized we wouldn't have time to make hotel reservations so he made them for us and also made a reservation for us for dinner. Eventually the engine went back together and the cowling was reinstalled - thanks to all the help from the staff at Windward Island Airways FBO. The engine was tested and the compression was good.

Thursday, October 6

Thursday morning and an early start. People congregated as usual to see our VariEze take off. One of the fellows decided St. Maarten should order 25 for its Air Force. We stopped for fuel at South Caicos but did not order the lobster sandwiches. Bound for Georgetown, Great Exhuma, we again received a very favorable weather report. Al started the engine but decided we should fly direct to Ft. Lauderdale, so he shut down and we added more fuel.

We were able to dodge the rain clouds flying at 8500 feet until we passed Crooked Island, then we hit a trough of weather. Al tried to avoid it, go around it, but we were in the middle of it. An announcement by Al that he was making a 180° startled me. Going into a 180° turn in the clouds gave me the impression we were descending at the rate of 100 feet per second. However, checking the altimeter at the end of the turn, we were at 13,500 feet. We did get clear of the storm cloud and again headed west, however, we did have heavy rain and hail while we were in the cloud.

The weather from there to Ft. Lauderdale was beautiful, just puffy small clouds along the way. Upon landing, we inspected our propeller and the stainless steel tape had stayed on but was now following the contour of the damaged propeller underneath. Again, the customs man took care of us quickly. He wanted to see us take off. We landed at Stuart Airport and were picked up by relatives. A telephone call to Dan Patch in San Diego had a prop on its way to Palm City, FL.

The Cohas spent a week in Palm City, touching up the paint, putting additives in the gas and oil, changing propellers, relaxing and visiting friends. Al borrowed a propeller from Norm Dovey so we could make a trip to Sarasota. The prop from San Diego arrived on Tuesday. On Thursday, October 13, we departed Stuart Airport for Merritt Island.

Neil picked us up at the airport. We were just going to stay a day, pick up some things we had left at his house and head north, but the satellite map of the U. S. on Friday, October 14, looked worse than anything we had seen thus far. We scrapped our northern trip and headed west on Saturday. About 1½ hours out, the weather became impassable, so we did a 180 and headed east again. Back at Neil's we made plans to try again on Sunday.

Thunderstorms on Saturday night caused rain on Sunday, but by 12:30 it let up so we decided to head west again. The weather wasn't too bad, just broken cumulus from the unstable air. Most of the really bad stuff seemed to be to the south of our track. We decided to stop for fuel at Lake-

Marte Airport, São Paulo, Brazil - their destination reached, the Eze crews bask in the admiration of a large welcoming crowd. This was typical of every stop south of Florida where almost everyone was seeing the VariEze/Long-EZ for the first time.

front Airport, New Orelans, again at Eagle Aviation. They were so friendly. They were pleased we had stopped and glad our trip was successful.

It was rather late, about 4:30, but we decided to go on to San Antonio. Weather was great until we passed Sabine Pass where lightning began to appear ahead of us. Houston weather was predicting thundershowers between there and Victoria. Al successfully detoured around one cell but found himself in the middle of a second one. Another 180 was executed, Houston Approach was contacted and we were vectored to the north around the storm. From Eagle Lake we followed the highway into San Antonio.

By the time we landed and parked the plane at Nayak Aviation, it was about 9:00 p.m. Delores and George Scott came to pick us up at the airport. The weather report for the next day was not good, so we decided to stay a day to relax. Monday night, we had dinner with Delores Scott, Evelyn and Dale Kyser and another Eze couple from San Antonio.

Tuesday's weather report wasn't too good but Wednesday's and Thursday's were worse, so we decided not to stop at the Howard's but travel on to Phoenix. The weather along the route seemed more promising. We were able to stay below the clouds at about 100 feet AGL, dodging any showers until we arrived at Van Horn. Over the Sierra Diablo Mountains we had to dodge some heavy rain, but, finally, we came into the clear east of El Paso.

We stopped at Las Cruces for fuel, 80 octane. The weather briefing promised no precipitation to Phoenix, but as we stepped out of the FBO office, we were greeted with a flash of lightning and a clap of thunder from a storm moving in from the south. We quickly took off and headed north around the storm.

We stopped with relatives in Phoenix Tuesday and Wednesday. Thursday, the 20th of October, was a beautiful day and, at long last, we arrived home in San Diego.

Al and I had traveled for 43 days on our Brazilian odyssey, covering 14,000 nautical miles in 120 hours of flying time, using 490 gals. of fuel and 1 quart of oil every 20 hours.

The Hunters traveled 22 days, covering about 10,000 nautical miles in 81 hours of flying time using 405 gals. of fuel.

The Cohas and the Hunters have many fond memories of the people we met, the experiences we had and the places we visited. It was not a trip for anyone who has a tight schedule. A good prop with a tough leading edge is a must. Oil and gas additives that will prevent lead build-up is also a necessity when 100 octane avgas is all that is available.

At São Paulo, Al Coha, left, and Claes Mouret, Director of Divisão de Produtos Organicos of ICI, the company that sponsored the Brazilian adventure.

FLUKE® ELECTRONIC HINTS

EPOXY CLOSET TEMPERATURE CONTROL

By Steven Willhoite
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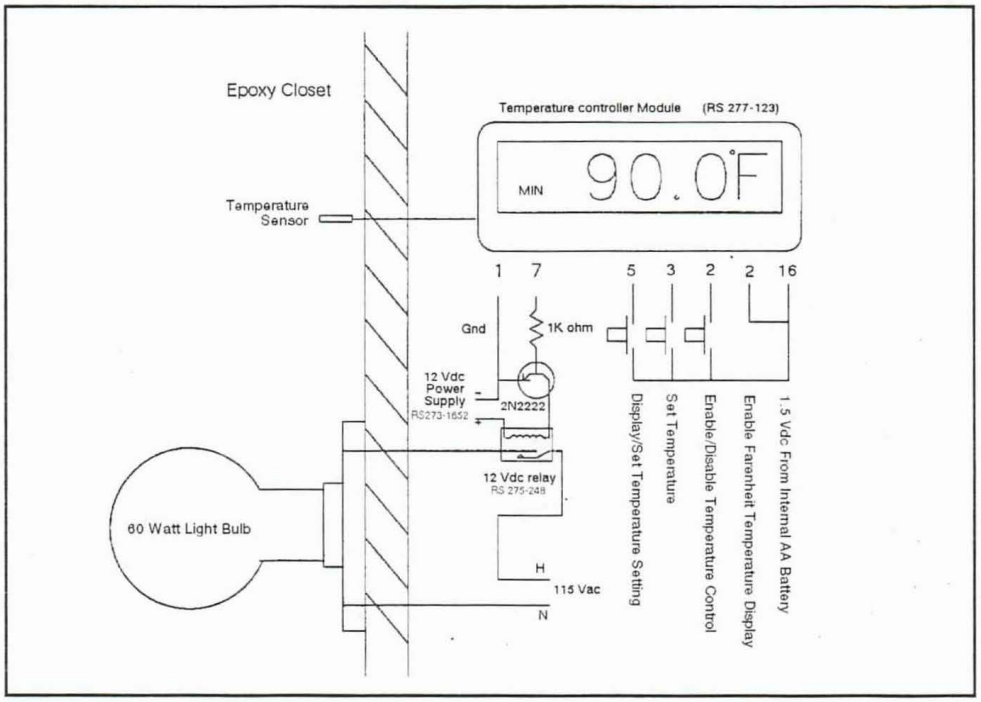
Santa Fe, NM 87505

One of the first construction projects I undertook before starting my Cozy Mark IV composite airplane was to build an insulated closet for my epoxy ratio pump. Ideally, the epoxy and pump should be maintained at a constant 90 degrees F. temperature for the proper viscosity. I put a 60 watt light bulb inside the closet attached to a light dimmer for adjustment, but soon found out that I was constantly making minute adjustments to the dimmer control to maintain the desired temperature.

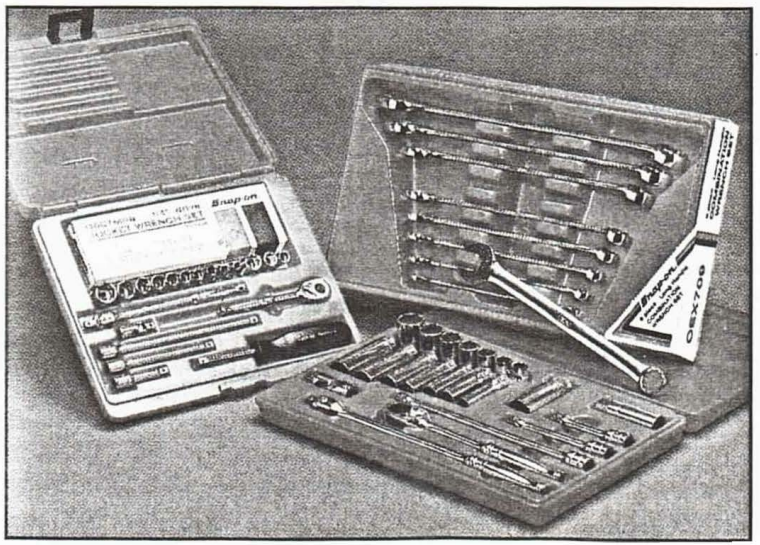
My next stop was at Radio Shack where I picked up one of their digital temperature control modules for $20 (P/N 273-123). The digital temperature control module is powered by a single AA battery and has a large LCD display which displays the current temperature at the connected probe with a 0.18 degree F. resolution. With three normally open pushbutton switches you can display and set a minimum temperature which the module will regulate via a control line to an external circuit.

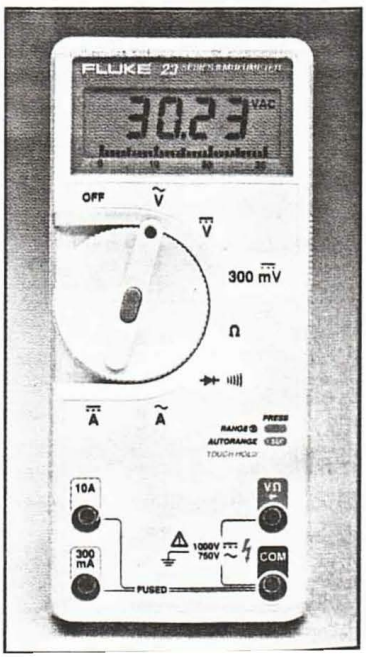
For the external control circuit I used a 12 Vdc power supply (P/N 273-1652), 12 Vdc relay (P/N 275-248) a 2N222 transistor and a 1K ohm resistor as depicted in the schematic diagram. Mount the loose parts on a small pre-drilled circuit board and then mount the circuit board and the temperature control module in a small box which can be attached to the top of the epoxy closet. Mount the temperature sensor probe inside the closet at about the same height as the bottom of the epoxy reservoirs and the light bulb to the top of the closet to keep it out of the way. Use wire nuts inside the temperature control enclosure to join all the 115 Vac wiring.



I have been operating my closet for over a year now and the temperature inside the closet never varies by more than 2 degrees F. (unless I leave the door open) despite the fact that the temperature in my garage varies by 40 degrees F. on some days. Due to the 0.75 inch Celotex insulation on all sides of the closet, the 60 watt bulb is on only a small portion of the time, making the closet very economical to operate.

Readers are invited to submit entries to EAA, Hints For Homebuilders, Att: Golda Cox, EAA Aviation Center, P.O. Box 3086, Oshkosh, WI 54903-3086. Entries will be reviewed by a panel of EAA judges. Readers whose hints are published in any EAA magazine will be awarded one of three monthly prizes by Snap-on Tools - a 3/8" Drive Socket Wrench Set, a 1/4" Drive Socket Wrench Set or a Nine-piece Long-Handle Combination Wrench Set. Members are also invited to submit hints of an electrical nature. Any hint used will receive a Fluke Model 23-2 Multimeter with Holster from the John Fluke Mfg. Co., Inc. The contest will run from August through July of each year with a Grand Prize of a Snap-on Tools KR657 Roll Cab and KR637 Top Chest being awarded the best entry for the year. A Grand Prize will also be awarded by the John Fluke Mfg. Co. These awards will be presented during the EAA Convention. Our thanks go to Snap-on Tools and John Fluke Mfg. Co. for providing these awards.





Pictures by Carl Schuppel

Neil Hunter's Big-EZ. Built around a full IFR panel (below), it is significantly larger than a standard Long-EZ. The bottom picture shows the rear seat instrument panel.

NEIL HUNTER'S BIG-EZ

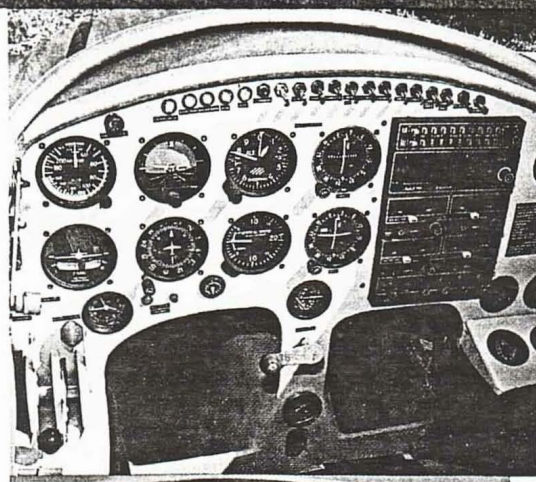
EAAers will recall Neil Hunter as the retired Air Force pilot who, in company with Al and Mabel Coha in their Vari-Eze, flew his Long-EZ from his home in Satellite Beach, FL to Brazil and back in the fall of 1983 (see "Brazil . . . The Eze Way", SPORT AVIATION, January 1985). Just after Oshkosh '84, he sold that airplane to a Tulsa atmospheric research firm to use as a remotely piloted vehicle . . . and very quickly found himself suffering the pangs of withdrawal. He had not been without an airplane to fly for most of his adult life to that point. Predictably, within a few months he was back in his shop slicing up foam and slathering on epoxy like mad — and I mean **really** mad! He began work on November 17, 1984 and rolled out a flyable airplane on July 1, 1985! This in spite of the fact that what to the casual glance appears to be a Long-EZ is to a great extent an all-new design. The airfoils and aerodynamics are Long-EZ, but the airframe is significantly larger than a stock Long.

A high time military transport veteran with thousands of hours of over-ocean and IFR time, Neil expects his personal airplane to be a travelling machine, so it has to have IFR capability. He loved his Long-EZ but always wished he had more instrument panel space. Thus, when he began his new airplane, he drew out the fuselage bulkhead that contains the instrument panel, enlarging it to handle all the electronic bells and whistles he wanted — then built a proportionately larger Long-EZ around it. The end result was a Big-EZ 4-1/2 inches wider at the instrument panel bulkhead, 7 inches wider at the pilot's shoulders and 2 inches wider at the firewall. The entire fuselage was 2 inches deeper, done in such a way as to provide additional prop clearance and cockpit headroom.

To lift this larger fuselage and carry it further, Neil increased the wing span 10 inches. The stretch was done in the area of the strake/fuel tanks, increasing the fuel capacity to a whopping 75 gallons (37.5 in each strake)! The little joggle in the leading edge of the strakes was omitted, which made them easier to build. The final airframe change was to increase the height of the winglets by 3 inches.

For an engine, Neil bought the 160 hp Lycoming O-320-D3G (fuel pump and Slick mags) Johnny Murphy had recently removed from his Glasair, had it majored and installed it in the EZ. A special 4 into 1 exhaust system was built up which produces a very macho, deep throated growl he likes a lot. The wood prop was a 74" x 68" — and a couple of brands have been tried to date.

Some other goodies included a landing light on the nose gear strut. It's turned on and off manually with a cockpit switch and a micro switch cuts it off automatically when the gear is retracted. Neil also installed tie-down rings, tied into the ends of the wing spars, which is the strongest point in the airframe. The rear cockpit has a



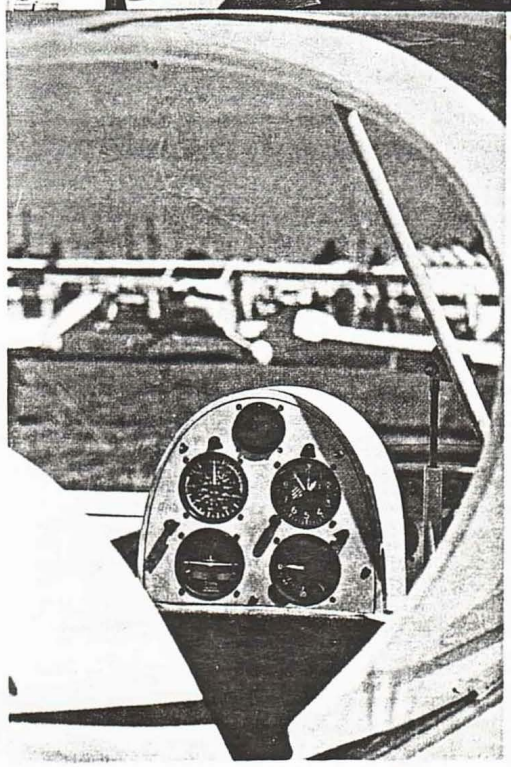


Photo by Carl Schuppel

Neil Hunter

basic instrument panel containing an airspeed indicator, altimeter, ROC magnetic compass and a turn coordinator. The passenger has a throttle and stick but no rudder pedals.

From the beginning of the project, Neil intended to install a Loran C, so in constructing the wings, he built in the ground plane and antenna as per the instructions of RST's Jim Wier. The right wing core was strung spanwise, top and bottom with copper wire to create a ground plane and the antenna was installed inside the winglet. It works great, Neil has found.

All these mods did not come free, of course. The empty weight came out nudging 1,000 pounds and the wetted area was up . . . so even with a big engine, the question was how performance would compare with a stock 115 hp Long-EZ. To Neil's pleasant surprise, his Big-EZ compares very favorably. It trues out at 213 mph (185 kts.) at 2,000 feet and will cruise 190 (165 kts.) true at 2,600 rpm.

3 SA 15

One concern Neil had as he began his test flying was stall characteristics. As an experienced Rutan aircraft builder and pilot, he was fully aware that Burt's canard designs do not lend themselves to modifications as do more conventional configurations. Sure enough, it did react **differently**, though not as he expected.

Lighty loaded, it landed slower and got off quicker than his Long-EZ did and would fly down to 52 knots indicated with full aft stick with no wing rock. The added wing area and the droop tips he installed on his canard (which he had previously found would allow earlier rotation on the Long-EZ) were likely responsible, he felt. With the airplane heavily loaded, however, he **did** get wing rock. He added vortilons to the main wing and that eliminated the wing rock at the weights he has flown the airplane to date — although Neil is quick to point out that he has yet to carry out an exhaustive investigation of the aft end of the CG envelope.

I was particularly curious about Neil's Big-EZ because I know he has aspirations to do some really long distance flying in it. 75 gallons of fuel in something that will fly as fast as an EZ on so little power is definitely overkill for making Oshkosh each summer . . . there **have** to be other reasons for it. Plans are not definite yet, but Neil wants to fly to Europe . . . and there are developments in the Far East in which he may become involved. "Stay tuned" is all we can tell you at this point.

A CONVERSATION WITH

BURT RUTAN

On January 3 Beech Aircraft rolled out the first pre-production prototype of its Starship I, a futuristic machine that seems destined to change the way airplanes look and the way they are constructed. Although the Starship is a large, very expensive corporate aircraft, its development has been of more than passing interest to EAAers because it was conceived in the mind of Burt Rutan . . . and John Roncz, who was responsible for the airfoils. Just as he forever changed the direction of the homebuilt movement with his VariEze and its moldless composite construction, now Burt is having a similar influence on the world of commercially built aircraft.

Having sold his company, Scaled Composites, to Beech Aircraft and become a vice president and member of the board at Beech . . . in addition to retaining his position as president of Scaled Composites . . . obviously Burt is a busy person these days. He has not, however, severed his ties with EAA and the homebuilt movement. He plans to be at Oshkosh this summer, will help man his usual Rutan Aircraft Factory booth G-7 in the display building, will participate in the forums program and conduct his popular under-the-wing talk sessions just as in previous years.

"We'll be there to support RAF licensees (builders), look at all the airplanes and pick up ideas," he told SPORT AVIATION in mid-January. "We'll have some new sales items for the booth . . things like Defiant engine installation plans, 'rain canard' plans and maybe a video tape that combines some of the best footage from our previous RAF tapes."

Burt, of course, wrote the book on dramatic entrances at Oshkosh during the 1970s and early '80s . . . and those days may not yet be over.

"I plan to fly the Defiant prototype to Oshkosh this summer. It is currently being equipped with 180 Lycomings and 3-blade Hoffmann constant speed props with feathering capability. Rodie Rodewald (of Hawaii) is also using these props on his Defiant. I'm thinking about a rear seat tank in the Defiant for long range."

But just **possibly** there may be a Rutan design on hand at Oshkosh '86 far more dramatic than a big engined Defiant. We **could** be seeing another mind blower to rank with the Ezes of the '70s and the Voyager of the 1980's. Before becoming a part of Beech management, Burt was designing a new airplane with which he intended to win the Oshkosh LBF 500 and the CAFE 400.

Designated the Model 81 in his sequentially numbered design sketchbook, the concept was quite a departure in airframe configuration for Burt in that it was a three surface airplane rather than the pure canards for which he had become famous the world over.

Since his affiliation with Beech, the firm has purchased the Model 81 design and has given the go-ahead to begin construction of a proof-of-concept prototype. At this time it is being described only as "a pressurized, three surface, retractable, single engine tractor with 3 plus 2 seating." Projected performance is tantalizingly limited to "275 mph at 25,000 feet and coast-to-coast range."

Burt provided SPORT AVIATION with a few additional glimpses behind the veil.

"It will be powered by a turbocharged 210 hp Lycoming TIO-360-C1A6D which can still produce 159 hp at 25,000 feet. It's a 4 psi airframe and is all composite — a hybrid composite that places emphasis on low-cost manufacture. It will have the ultimate capability of beating Max Conrad's straight line distance records. *(That's 6,966.75 miles in a 180 Comanche and 7,668.48 miles in a 250 Comanche — Casablanca to Los Angeles! — Ed.)* I want to fly it non-stop from Mojave to Oshkosh and win the LBF."

The "3 plus 2" seating means five place and no baggage or three place and baggage.

Of course, if the Model 81 ever goes beyond the proof-of-concept stage, it will be as the first of a new line of certified Beech singles — not as a homebuilt. If, however, it is completed in time to fly to Oshkosh this summer, EAAers will have the opportunity to see possibly the first of the new generation of vastly more capable, more fuel efficient aircraft everyone recognizes must be created if the lightplane manufacturers are to ever break out of the current sales malaise.

Asked about the current status of Rutan Aircraft, Burt said its transition from a homebuilt plans seller to a support service for builders of the various RAF designs was complete. The buildings and equipment have been sold to Scaled Composites and are currently being used to take care of some of the overflow of work from the Scaled facilities next door. Mike and Sally Melvill continue to provide builder support.

Like most EAAers, we look on Burt Rutan's career change with mixed feelings. On one hand, we regret his departure from active participation in homebuilt design . . . we've all grown accustomed to expecting something new and exciting from Mojave every two or three years . . . yet, on the other, we are pleased with the success of one of our own, one who has been so closely identified with our sphere of endeavor for so long.

We take great pride in the fact that through the efforts of EAAers everywhere, we have been able to create and sustain an environment in which an individual can dream his dreams, see them transformed into reality and, in Burt's case, go on to benefit society on a much wider scale. We look forward to seeing him back at Oshkosh each year . . . and we look forward with great anticipation to the prototypes that will emerge from Scaled Composites in the years ahead . . . designs that will change the shape of tomorrow.

— Jack Cox

DRAG REDUCTION POSSIBILITIES

I'll bet your airplane is not as fast as it could be . . . and because of that your fuel costs are higher than they have to be.

Blame it on drag. Drag is a penalty you have to pay for the privilege of flight. However, why pay the full price when you can get a discount. Let's look into this idea a bit further.

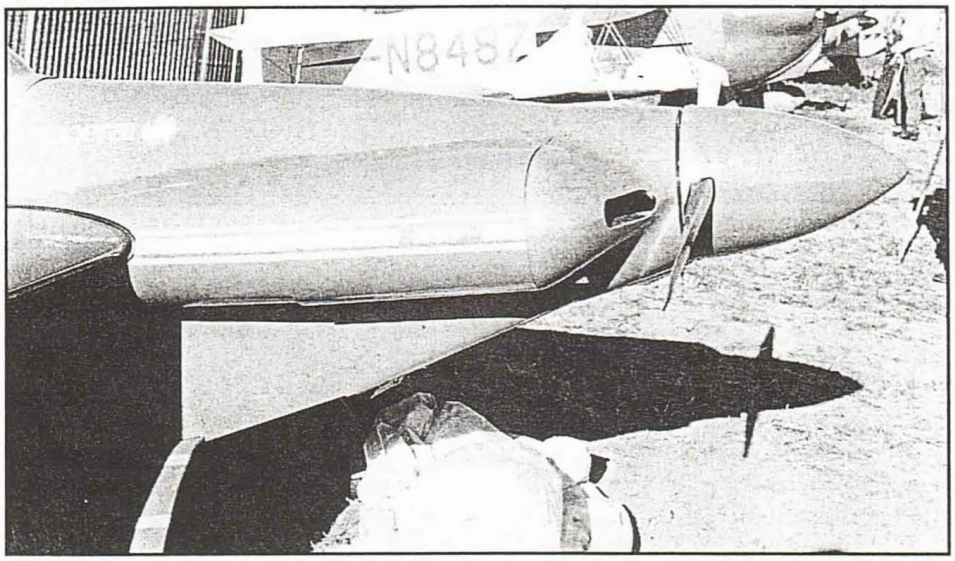
As most of you know, one kind of drag results from the work being done by the wing to sustain flight. It is called induced drag and, like it or not, it is a fair price paid in exchange for the lift produced by the wing . . . after all, it does play a part in keeping us airborne.

There is another kind of drag known as parasite drag. It is not the result of anything productive and serves no useful purpose. In short, it is an airborne freeloader, a parasite that contributes nothing to flight but a needlessly eroded performance.

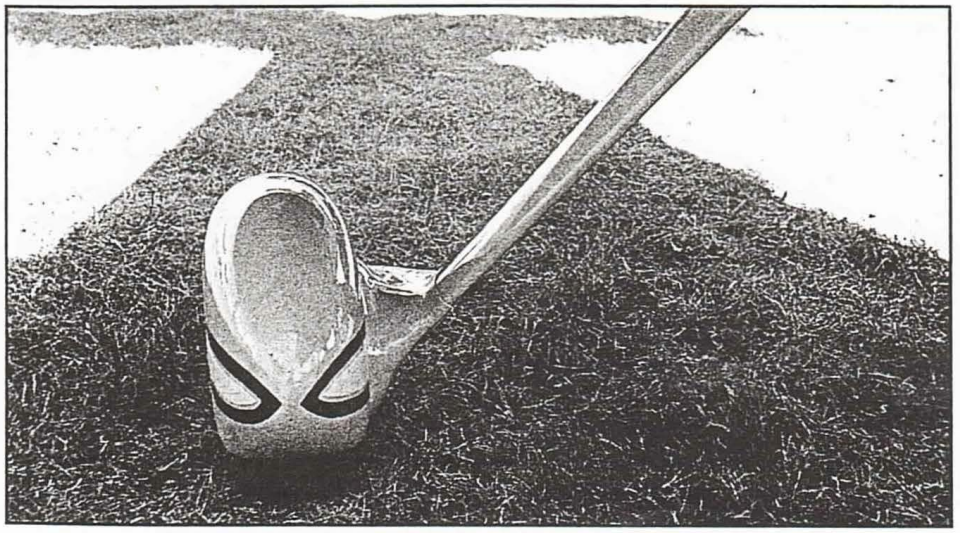
In short, all airplanes suffer from it. This is because parasite drag is produced by most any surface or object protruding from the surface of the airplane that interferes with the smooth flow of the slipstream.

It is reasonable to assume, therefore, that by reducing parasite drag wherever you can, you will enjoy the benefits of reduced fuel expenditures and an ego enhancing increase in airspeed . . . however infinitesimal that may be.

Obviously, the more effective your drag reduction efforts, the greater the rewards.



This Sonerai cowling and spinner installation is a good example of what can be done to reduce overall drag. Note the diminutive size of the air inlet opening. Compare this with the photo showing a single large inlet opening.



The ultimate in drag reduction for a fixed tubular landing gear.

Any Aircraft Can Benefit

How about those speedy composites? Sure, we know that even the slickest high powered composite can be made to be imperceptibly faster by further reducing its parasite drag. Otherwise, what other explanation could there be for two like aircraft differing considerably in performance?

However, the aircraft most likely to benefit from a drag reduction effort is the typical "plain Jane" variety. These aircraft have modest cruise speeds ranging between 100 mph and, let's say, 150 mph.

What about light aircraft and ultralight aircraft? Well, these are obviously designed to operate efficiently on a minimum of horsepower. They fly slow and low and anyone who owns one is more concerned with the importance of keeping the weight down than in trying to go supersonic by reducing parasite drag.

Unfortunately, streamlining efforts usually do equate to added weight, hence most ultralight builders don't bother.

Nevertheless, some parasite drag reduction can often be achieved for these aircraft or, for that matter, for any aircraft without adding appreciable weight.

Is Drag Reduction Worth The Effort?

Yes, indeed. Reducing parasite drag is always beneficial regardless of the aircraft's classification or speed range.

Builders of medium powered aircraft (85 hp to 150 hp) often fail to take advantage of numerous drag reduction opportunities and settle for modest mid-range cruise speeds of 100 mph to 140 mph. And yet, many of these same aircraft have the potential for achieving a 10% to 20% increase in cruise. Of course, how much depends on the basic design of the aircraft and the skill and determination of the builder or owner.

Many of the higher powered homebuilts (160 hp to 200 hp) are already quite fast because their designers took advantage of certain

obvious drag reduction options during the basic design process.

Incidentally, except for special purpose aircraft, there is no aerodynamic reason why a one mph per hp (or better) speed cannot be achieved. Naturally, the ultimate refinement and speed that can be achieved always rests with the amateur builder . . . especially one who is not satisfied with just average performance.

We all know from observation that most composites are molded to highly contoured aerodynamic curves and are relatively free of many of the parasite drag elements found in other types of construction. But these designs are not alone in aerodynamic refinement.

The metal RV's, T-18's and Mustangs (I and II), in spite of their rivets and lapped joints, are just about as fast because their builders, as a group, tend to vie with each other in reducing or eliminating parasite drag wherever they can.

This seems to be a good place to spring another generalized observation. Here it is:

The faster the airplane, the more pronounced the benefits of a reduction in parasite drag. For example, removing an externally mounted antenna from a slow J-3 Cub will, at best, result in an imperceptible increase in speed.

However, removing a similar antenna from a Lancair or Glasair would, undoubtedly, net a measurable increase in speed.

Four Ways To Reduce Drag

1. Remove it.
2. Streamline it.
3. Seal it.
4. Smooth it.

Let's explore each method in detail:

1. Remove It - Anything that is not there cannot create drag. So, if you can remove the object from the surface of the aircraft you will reduce its overall drag and increase the cruise speed. Naturally, this will result in a corresponding reduction in the amount of fuel required to push the airplane through the air.

Of course, you should understand that some of your efforts to eliminate parasite drag by removing some small objects from the slipstream may yield only minuscule changes.

Many of you will say it is not worth messing with. However, rest assured, the effect of all gains is cumulative and will be noticeably beneficial . . . very much like the success of the ant in piling up a large impressive mound . . . grain by grain.

By now you may be trying to think of some of the drag producing objects you could remove from the external surfaces of your aircraft. Let me give you a hand. Here are a few that create drag producing turbulent wakes:

a. Landing Gear - Removing (retracting) the gear would, naturally, involve structural changes and I certainly wouldn't consider doing it unless it was a designer offered option . . . but it is the biggest drag producer of them all. Incidentally, a partially retracted gear may actually produce more drag than a well streamlined fixed gear.

b. Antennas - Some homebuilts have an external communications antenna, a navigation antenna, a transponder antenna and a loran antenna - all drag producers. Remove them if you can.

c. Externally Mounted Nav/Strobe Lights - This may not be easy because when you bury the lights inside the wing tip, you may be reducing areas of their projected coverage. The FAA thinks your lights should, ideally, be visible from all directions.

d. Fuel Caps - Some of these project considerably above the cowl or wing surface.

e. Protruding screws, bolt heads, rivets, brackets.

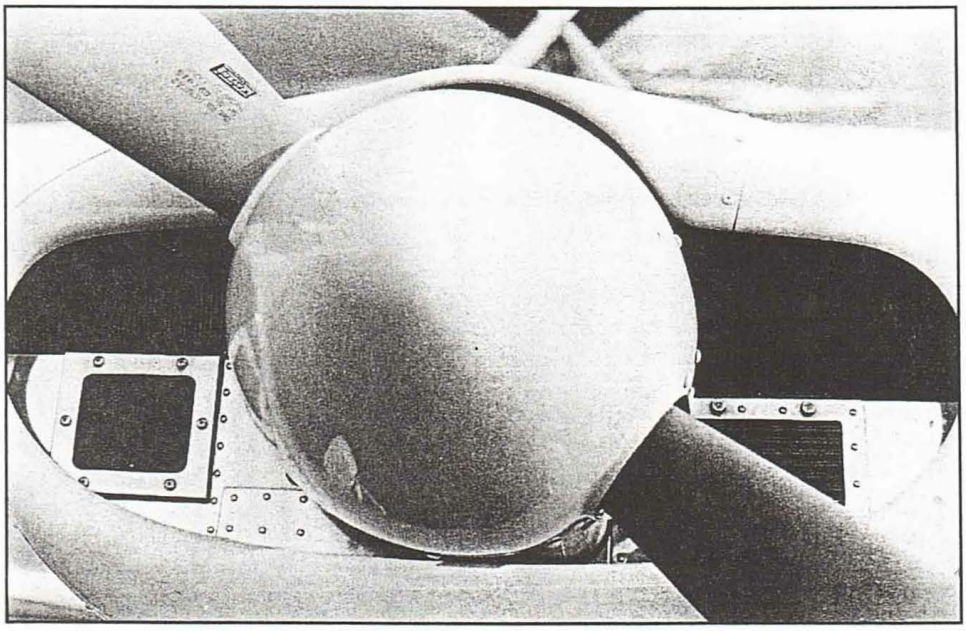
f. Pitot/Static tube installation.

g. Temperature probe.

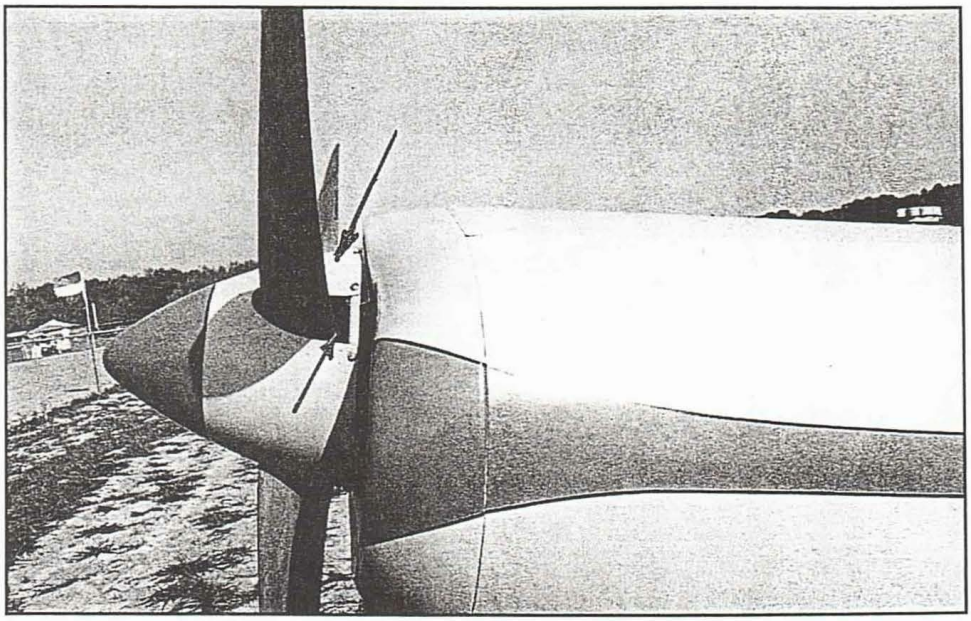
h. External handles.

i. Fuel vents.

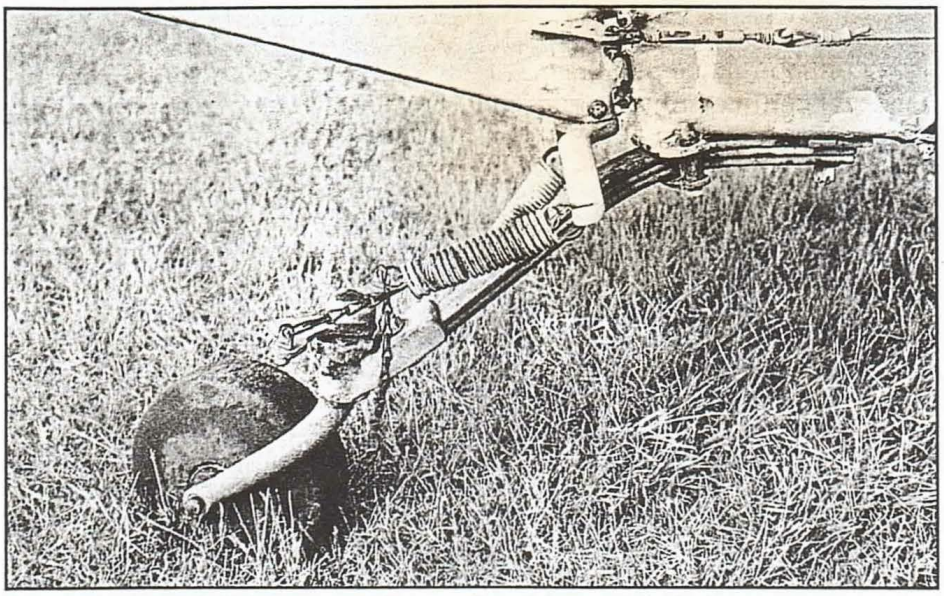
j. Control Balances - Submerging balance weights for control surfaces is a nice effective way to minimize drag. However, making it work may not be worth the effort. It could require a crit-



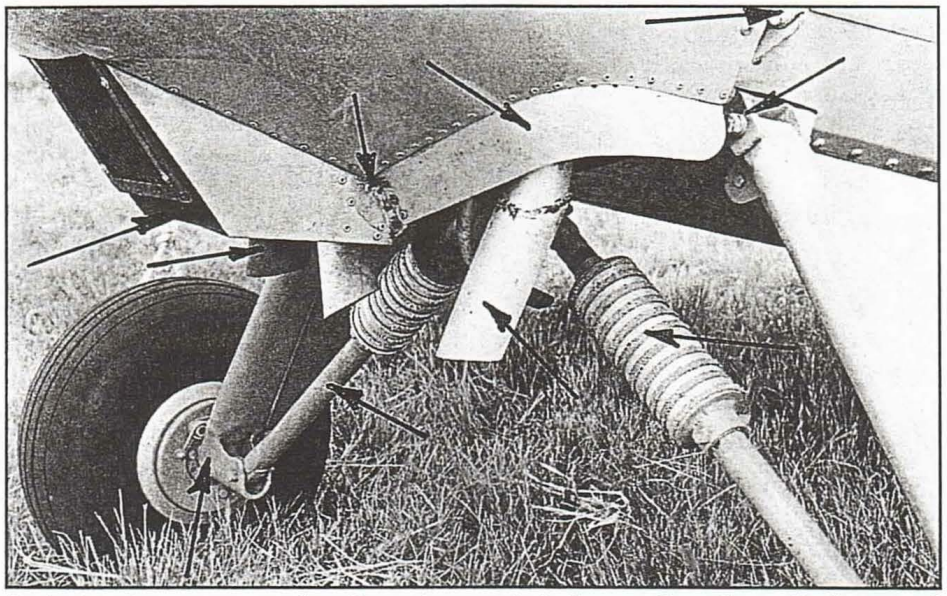
A cowling with a single large opening does not provide the optimum in engine cooling or drag reduction.



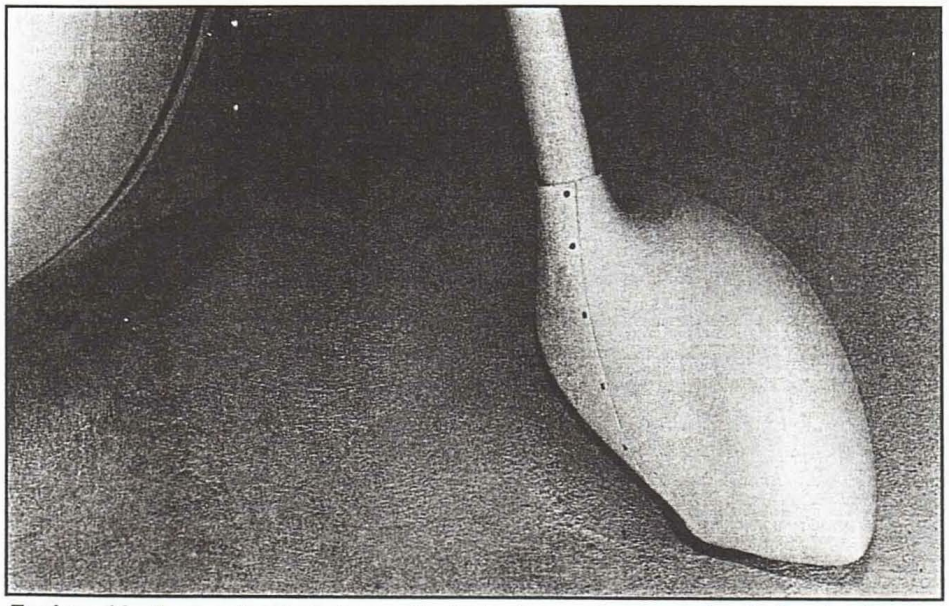
A larger spinner would reduce drag and improve the flow of air into the cowl inlets. A plate installed behind the prop hub cut-out would also help smooth the flow of air.



A typical tailwheel installation produces a lot of drag and looks lousy. Using a tubular strut instead of flat springs would be an improvement. I would, however, question the merit of enclosing tailwheels in streamline wheel pants.



Reducing drag on some aircraft can be a real challenge. Sometimes the improved appearance would be more rewarding than the reduced fuel consumption increase in cruise speed.



Enclosed in these wheel pants are the high drag scissors and axle-to-shock-strut intersection. Result, reduced drag and an enhanced appearance.

ical structural and aerodynamic change. Changes like that should be cleared with the designer.

k. Steps - You could make them retractable. Note: Drag producing elements located within the propeller slipstream are more detrimental than similar objects located outside the slipstream.

2. Streamline It - If you can't remove it, streamline it by fitting it with a fairing of some sort.

In this respect, the tubular landing gear legs and the tail gear installation are about as dirty (drag wise) as they come. Streamline them and you will realize a fairly large increase in speed.

It is very important that the interference between parts be reduced by reshaping the intersection. To do this you may have to reshape the area by adding material (foam, wood, fiberglass, etc.) to it. This reshaping can be in the form of an add-on fairing, or it can be one permanently attached to the structure.

Keep in mind the need for future disassembly of some parts. These should be fitted with removable fairings.

The juncture between the landing gear leg and wheel pants needs to be faired as does the point of attachment for a wing strut.

The junction between the wheel pants and the landing gear leg is another drag area requiring streamlining.

Exhaust pipes that jut straight down out of the cowling are big drag producers. Slant the pipes so they exit the cowling more or less parallel with the slipstream and you may even benefit from the jet-like effect of the exhausts.

Cowling inlets on many aircraft are excessively large. Reduce the inlet openings and you will obtain an increase in speed. Unfortunately, you may also obtain an increase in oil temperature. It is a delicate process and you should approach it with caution. Carve foam fillers to fit the inlets and attach them with strips of duct tape to reduce the openings temporarily.

If your oil temperature is still in the green, close off a bit more. Get the idea?

On my Falco I obtained a very noticeable airspeed increase along with an uncomfortably high oil temperature on my first try.

You may have to readjust the inlet openings two or three times before you hit on the ideal size openings for your airplane.

3. Seal It - Every gap on the airplane is a drag producer. The most

common offenders include cabin doors, canopies, oil inspection doors, fairings and cowls. These must seal tightly and should not suck open in high speed flight. You might have to get someone in a chase plane to check your airplane for improperly closed landing gear doors.

Control surface gaps are notorious drag producers. Sealing them, in addition to reducing drag, also enhances the effectiveness of the rudder, elevator and aileron controls.

Most everyone who has ever raced an airplane has spent much time taping over all gaps and openings with masking tape before a race. This preparation alone can result in a faster airplane.

If ordinary masking tape is offensive to your aesthetic senses you could use colored or transparent tape for sealing the gaps and openings.

The basic idea is to keep the inside air in, and the outside air out. But, most of all, you want to keep the air on the bottom of the wing from leaking up through the top surfaces.

4. Smooth It - The objective is to achieve and maintain a smooth flow of air from the nose of the airplane to the tail and beyond.

If your airplane is still under construction, don't miss the opportunity to get all external surfaces as smooth as possible. Fill all dents and imperfections before priming the aircraft.

After your airplane is completed, a little cosmetic smoothing is still possible but you may be reluctant to undertake it because the paint job will be affected.

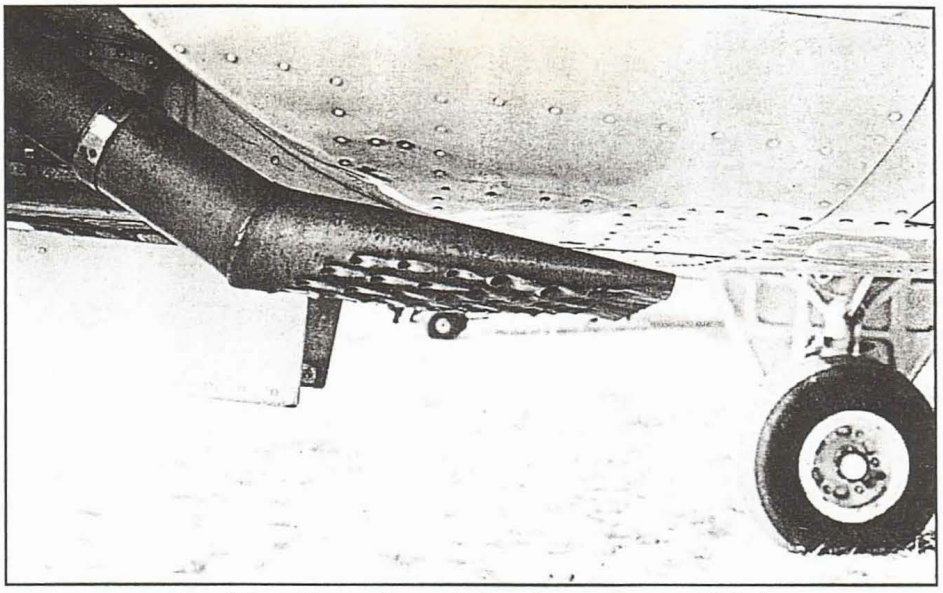
Wing walks as large and as coarse as they are will destroy the laminar flow in that area and produce turbulence and drag. This is because the surface texture of the wing walks is larger than the aircraft's boundary layer. The boundary layer next to the surface skin is extremely shallow . . . something on the order of 1/1000 of an inch for average lightplane speeds.

You can make your wing walks smaller or install them in narrow strips rather than as a single large carpet-like mat.

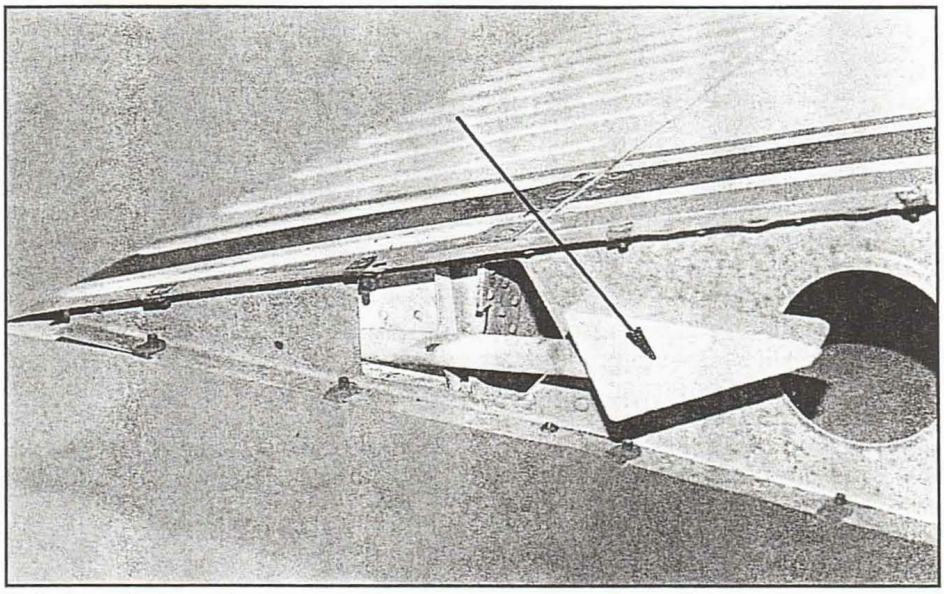
Other Drag Reduction Options

Installing smaller wheels or tires and closer fitting wheel pants could be considered. Remember, however, if you are operating from unpaved strips, smaller wheels may not be advisable as they would transfer higher taxiing and landing stresses to the structure.

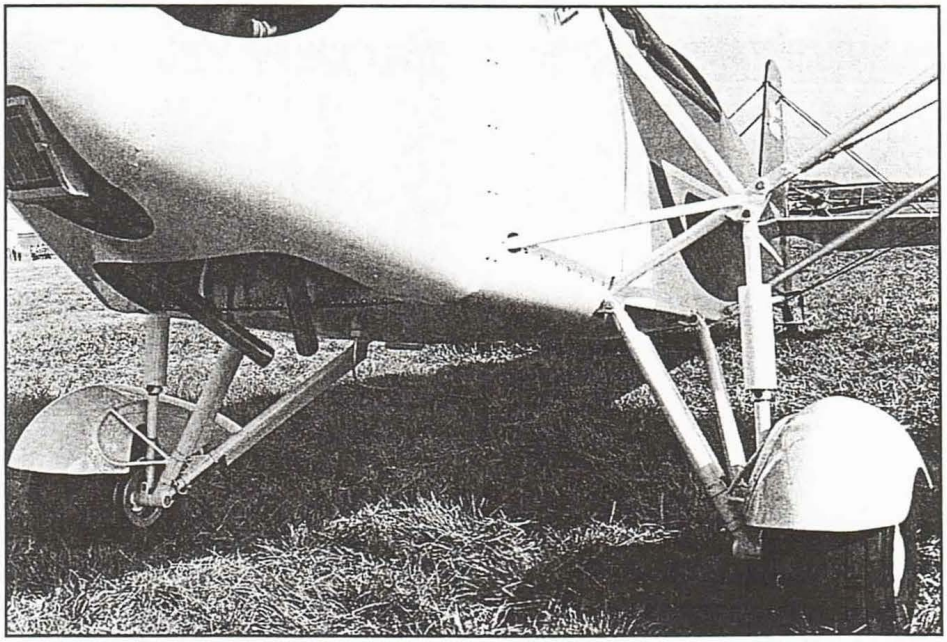
A poor job of rigging could saddle



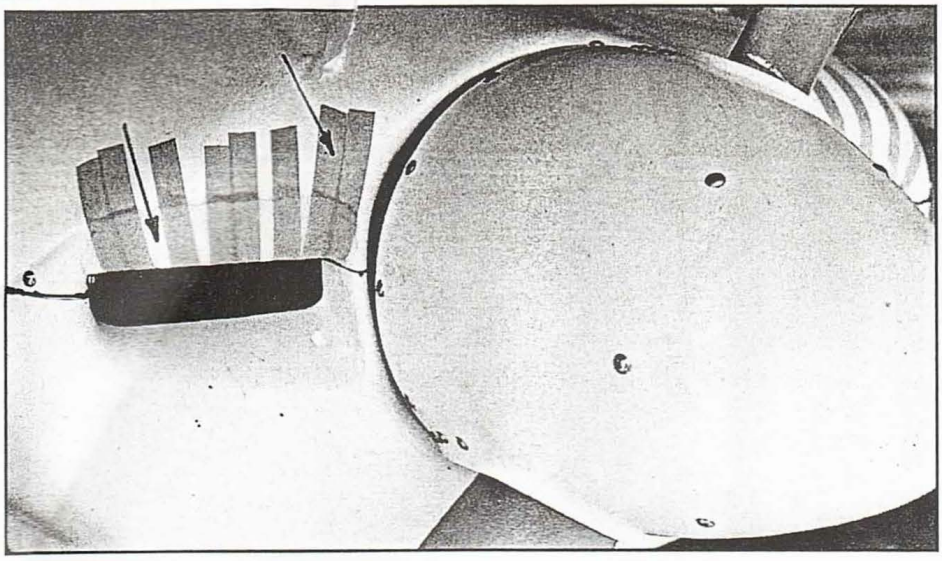
Can this be the optimum in low drag exhaust outlets?



Submerged aileron balance weights create no drag at all. The fiberglass wing tip has been removed to show one way aileron balance can be achieved.



The most effective drag reduction efforts are those implemented while the design is still on the drawing board - not those attempted after the airplane has been built.



Reducing the size of the air inlets can net a significant increase in airspeed. However, a corresponding increase in oil temperature might limit the degree to which this can be carried. Above the opening you can see the foam inset temporarily taped in place. After you determine the best size openings they can be molded permanently to the cowling.

you with unnecessary drag. For example, if the wing/tail incidence is incorrect, drag may be excessive for all flight regimes. Or if the flaps are not properly rigged, you may be flying with the flaps partially deployed all the time. For that matter, one side may even be set lower than the other.

A mismatch between the spinner and the cowling is a common drag producer. A spinner can be much too small or too large.

The propeller blade cut-out behind the prop hub should be sealed with a plate. Try to provide a clearance all around of about 1/8".

A large gap or space between the rear of the spinner and the face of the cowling could mess up the smooth flow of air and cause a turbulent entry into the air inlets. This, in turn, might also affect engine cooling.

A wing that is painted with spanwise stripes will produce drag because the slipstream may burble across the paint line ridge left after the masking tape was removed. Maybe you can minimize the protruding ridge by buffing it out. Be careful though, because you might mess up the paint line.

At any rate, remember that the smooth flow of air over the first top third of the wing is the most critical drag-wise.

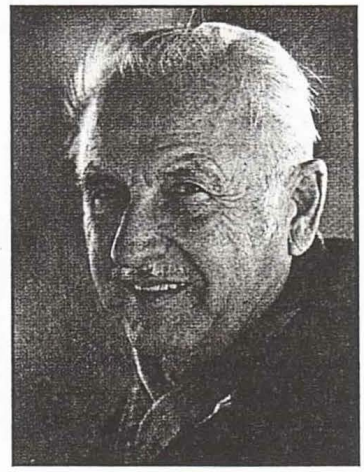
Afterthoughts

Some of you can undertake this business of drag reduction as a casual matter and be happy with whatever increase in indicated airspeed shows up on your airspeed indicator.

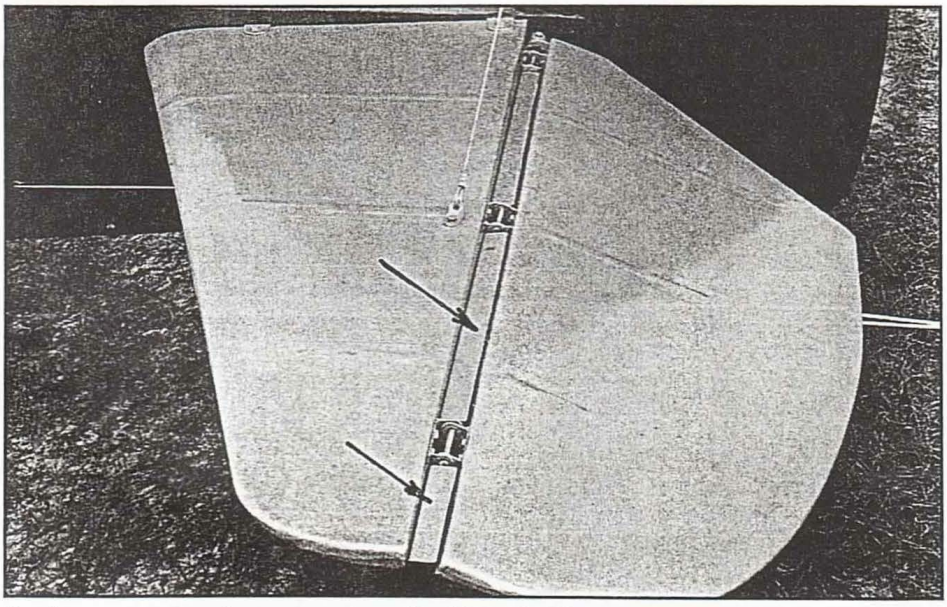
Others of you with a scientific bend will not be content until each and every drag reduction change you make has been calibrated, flight tested and duly documented. Lotsa luck, amigo, this may be difficult to do because the smaller changes will yield almost unmeasurable results. However, I'm sure that won't deter the true experimenters among you.

Back in 1977 an all out drag reduction effort on a 150 hp Mustang II reportedly paid off with a top speed increase from an original 170 mph to 229.66 mph at 11,000'. This speed was clocked during one of the Pazmany contests conducted at Oshkosh.

Can you top such an astounding increase over the original top speed?



If you wish to contact the author of this column for additional information, please send a SASE to Tony Bingelis, 8509 Greenflint Ln., Austin, TX 78759.



Sealing control surface gaps along the hinge line improves the effectiveness of the controls and helps reduce drag.

THE CARBON FIBER SCENE

By Andy Marshall
Marshall Consulting
Walnut Creek, CA

After many years of hope and promise, carbon fiber finally seems to be coming of age. Once an expensive material used only for highly specialized parts, we now see a reduction in cost making it more affordable to the homebuilder.

The fiber that has been used on homebuilt aircraft is T300 (or a similar cloth) and it has been around for 20 years. Improved over the years, it is still very much the same as the original.

A fairly new development is a precured laminate which helps the homebuilder to achieve the properties carbon fiber is capable of. One of these is "Spar-Tuf," available from Gordon Plastics, 2872 S. Santa Fe Ave., San Marcos, CA, phone 619/727-2008. Spar Tuf is available in sheets up to about 12" wide and from .020" to .375" thick. The other one is a new arrival, "Graphlite," available from Neptco, Box 2323, Pawtucket, RI 02861-2323, 401/722-5500. This product comes in the form of round rods, .050" to .250" in diameter. It is the product that when bundled and encapsulated makes up the spars of the Bell VS-22 Tilt Rotor aircraft.

The feature which makes these precured laminates desirable is the fact that their process solves problems which all carbon fiber users share. These problems will cause a decrease in strength of the cured laminate. They might include: wavy or off-axis fibers where the yarn of the cloth is not straight, too much or too little resin, or problems in reduction in strength resulting from improper cure, etc.

Carbon fiber is used more in unidirectional layups of "yarn" than in woven fabric. The reason is that the inherent waviness of the fiber in woven fabric takes a terrible toll on the strength you can develop in the parts when compared to the straight fibers in yarns. The two products mentioned are not based on fabrics, but on straight and parallel fibers laid alongside each other in a minimum of resin.

One homebuilder who designed spar caps in carbon fiber had a friend test them in a commercial lab and was only developing 60,000 psi in either tension or compression; a quite disappointing result. Five years later he worked in a test lab himself and found he could make specimens that tested over 350,000 psi using the same fiber! The difference was all in the process controls applied to the materials, layup and cure of the parts. One way to cut through a lot of problems is to buy the spar cap material from the above shown sources rather than try to fabricate these yourself.

The Bell VS-22 was very weight sensitive, as most aircraft are. The designers were looking at ways to reach the theoretically possible 480,000 psi. The best their test specimens could do was about half that. By reducing the resin content to the laminate and by ensuring near perfect straightness of the fibers, they were able to reach a compressive strength of a little under 400,000 psi! The remarkable performance of this manufacturing method, shown in Figure 1, has been attributed as much to improved fiber straightness as to higher fiber volume content. It is probable that the exact amount of contribution made by each of these improvements will not ever be known, as they are both achieved at once by the same process.

Laminate materials having properties like those mentioned above require some of the "magic" of the new fibers, such as Hercules IM7 or IM8, or Toray T800 or T1000. All of these fibers are currently available and are in production at both the laminate producers mentioned above.

When we make our own laminates, the performance of the laminate may lie anywhere within a curve which probably looks like Material B in Figure 2. When we use a process like that employed in the plants making the materials noted above, the curve takes a shape much more like that of Material A in Figure 2, or possibly even better.

The problems in any composite material are so complex and devious that they are never really absent but usually range from poor to fair, good, or, hopefully, very good control. The difference in the measured strength of your parts can increase 100% or more, just by moving from "poor" to "fair" in this ranking. The improvement in some properties can be as much as 500 to 800 percent, if you go all the way to "very good."

* * *

Editor's Note: One of the best sources for information on composites is the book Composite Basics by Andy Marshall. This book is available at $30 ppd from: Marshall Consulting, 720 Appaloosa Dr., Walnut Creek, CA 94596, phone/Fax 510/945-1461.

About the Author

Andy Marshall, BA, M.E., CA Registered Professional Engineer, is president of Marshall Consulting. He was employed by Hexel Corp. from 1950 to 1978; vice president of Orcon from 1984-1988; a former research engineer at the University of California; a UAL engineer, and publisher of numerous documents on composites. He is an internationally known expert in core materials, sandwich structures and composites in both aerospace and industrial fields.

FIGURE 1
COMPRESSIVE STRENGTH VS. WAVINESS

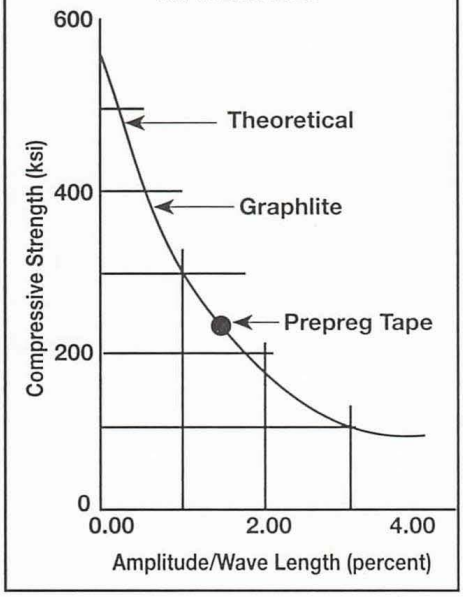
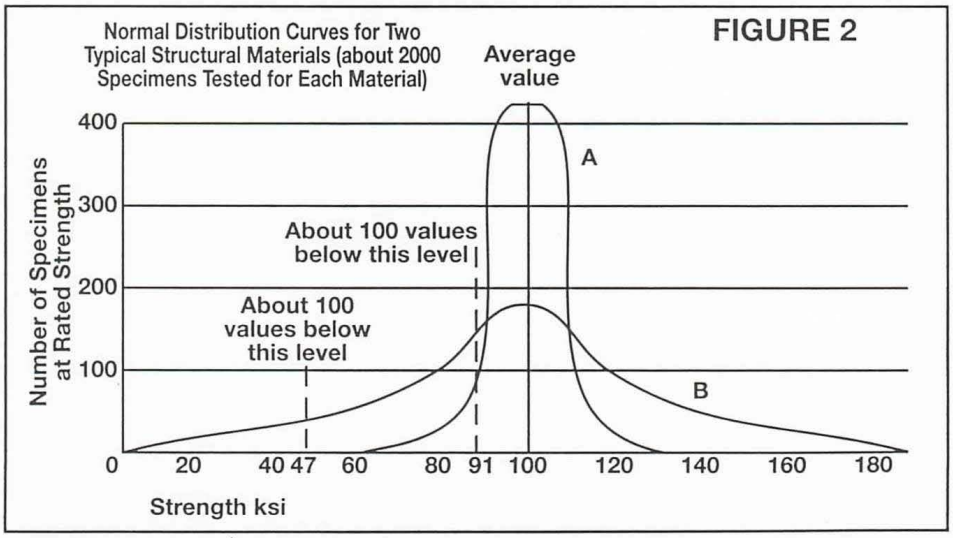


FIGURE 2



The new interim requirements are available at any FAA Manufacturing Inspection District Office (MIDO) or Manufacturing Inspection Satellite Office (MISO) . . . through which the initial applications must be made.

Scaled Composites To Move To Montrose, Colorado

On Monday, July 26, 1993, while on his way to Oshkosh in his Catbird, Burt Rutan landed at Montrose, Colorado and announced that he had made the decision to move his companies to that city. Located in a broad valley in the southwestern part of the state, Montrose has a population of around 12,000. It is in a basically agricultural area, but is also a transportation hub for tourists who frequent the area year round. The Montrose airport has about 15 commuter flights a day (Beech 1900's) out of Denver, but will be adding 737 service at year's end when a new runway is opened. The new runway figured heavily in Burt's decision to move to Montrose.

Jim Koepnick

The present single runway is 8,497 ft. long and is at an elevation of 5,759 feet. A new 10,000 ft. runway is under construction and is scheduled to be opened in December. The city owns 30 acres at the intersection of these runways . . . and Burt will be given title to 10 of them upon which to build his new facility. The land is just part of a very generous incentive package put together by the city, county and state to lasso Burt and his companies. As noted in Hot Line last month, there was considerable competition between a number of states to land Scale Composites, but in the end it was Montrose that prevailed.

Burt says that in addition to the incentive package and the interest shown by Colorado officials, from the governor on down to the local level, the factors that influenced his decision included the natural beauty of the area; the quality of life in Montrose and the surrounding area; good local schools; a lower cost of living than California; year round weather conducive to test flying (without Mojave's almost daily high winds and turbulence); and, significantly, lower property and business taxes. Burt says that Scaled Composites is busy and profitable at the present time, but that he forecasts that if he remains in California, within three years his company will slip into the red . . . due mainly to the state's workman's compensation and health care costs, plus high county property taxes. California, he notes, taxes vehicles such as cars and aircraft on the basis of their value, whereas other states simply have a relatively small license fee.

All of Burt's operations, both Scaled Composites and RAF (his original homebuilt business that still provides builder support), will be moved to Montrose. The move will be made in stages, due to the nature of some of the projects currently in progress at Scaled, but he hopes it will be completed within about 16 to 18 months.

Interestingly, Burt says that Montrose probably would not have been considered 5 or 10 years ago due to its relative geographic isolation. "Today, however, we have modems and fax machines, and Montrose has Federal Express and UPS just as good as Mojave, plus good airline service, so we don't look on it as isolated any more. These modern conveniences have opened up small towns all over the country . . places where the quality of life we'd all like to enjoy still exists."

Sky Struck Presents Builder's Seminars

John Monnett was one of the first to conduct builder's seminars, beginning in the early 1970's at his Sonerai facilities in Elgin, IL and later at Oshkosh. Now, he and Rj Siegel have formed a new company called Sky Struck Enterprizes for the express purpose of taking these types of seminars to a higher level, utilizing teaching aids and techniques derived from the highly successful Macintosh computer seminars, which are Rj's area of expertise. John is also heavily into computers these days.

Sky Struck Enterprizes will be presenting two day and five day aircraft construction seminars and workshops at Oshkosh beginning this fall. Initial two day seminars will focus on conventional (tube, aluminum and fabric) and composite (molded and moldless) construction, as well as powerplant and avionics installation. In-depth seminars dedicated to specific homebuilt designs, with factory participation, will be scheduled for early 1994.

Designed to build confidence and a "can do" attitude for potential aircraft builders, the seminars will be held at Wittman Regional Airport in Oshkosh. For information contact Sky Struck at 167 North Oakwood Rd., Oshkosh, WI 54904 or call 414/231-8297.

Cirrus VK-30 Withdrawn From Homebuilt Market

Cirrus Design announced at Oshkosh '93 that it was withdrawing its VK-30 from the homebuilt market in order to concentrate on the development of "an entire family of certified general aviation aircraft." According to Cirrus president Alan Klapmeier, the firm will fulfill all existing orders and will offer full support to current VK-30 builders, but no more kits will be sold. Cirrus Design is moving to a new facility in Duluth, MN and will continue work on a five-place, turboprop evolution of the VK-30. When certified, production versions will be built by Israviation in Israel, with Cirrus Design responsible for sales in North and South America.

Also at Oshkosh '93, Cirrus Design announced the availability of seats for the VK-30 that are the first to be offered for a homebuilt that have been designed and tested to meet the new spinal injury protection requirements of FAR Part 23. For large airplanes, it has been assumed that a seat with a stroking mechanism incorporated in the frame or a seat pan capable of deflecting to an adequate degree would be necessary to meet the new FAA requirements, but in tests by SAMA and Wichita State University it has been found that a special type of