Falco Builders Letter

Ralph and Judy Braswell following his first flight of the Falco. "I'll tell you what, it was fantastic. It was everything I expected and a little bit more. It took me the rest of the day to come down."

My First Flight

by Ralph Braswell

After a tour in the USAF, I came to Florida and went to work in the Aerospace industry. That was the thing to do in the early 60's. In my spare time I built a Sirocco, it was a French design, all wood airplane. It had Hershey Bar wings and a slab-sided fuselage. The drawings were very poor but fortunately the airplane was very simple in construction.

The next airplane I built was a Steen Skybolt. It was an excellent flying airplane, very slow and very forgiving. I flew this airplane for one hundred hours and hopped one hundred rides, I have them all in my log book. Many of them were first time rides.

I sold the Skybolt and started shopping around for something else to build. I ordered the drawings for Beryl, which has Emeraude wings and a steel tube fuselage. I always prefered tandem airplanes which probably goes back to my Air Force days. I considered building the Beryl until my wife, Judy, intervened with, "Ralph, if you're going to build another airplane, build something you really want."

Who can look at a Falco without wanting one?

In This Issue:

Having built a couple of wooden boats and a wooden airplane, and the fact that a freshly opened package of birch plywood smells a helluva lot better than epoxy and I never liked the color white except in women and at Xmas time, I decided on the Falco. I wanted to fly one more good performing airplane so it had to have a 180 hp engine and a constant speed prop. Alfred says the 150/160 hp is best, and he may very well be right. The 180 engine is wider so you have to modify the cowling somewhat. I had a friend with a fresh overhauled 180 for sale and at that time the constant speed prop for a 180 was $1000 cheaper than for the 150/160, besides I wanted an airplane that would go up when I point it up.

I began construction eight years ago. Although I have now flown the airplane, I'm not sure it will ever be finished.

Ralph Braswell: "It is about the lightest plane I have flown. I've flown a Tailwind and Steve Wittman's O&O Special, which had about no feedback. It's not that light, but I was comfortable from the time I broke ground. I don't think it has any bad habits."

No special skills are required to build a Falco, but it is a work-intensive project. I chose to build from scratch. The only kits I bought were the canopy, cowling and a pre-sawed wood kit from Western Aircraft Supply. My advice is to buy all the kits you can afford, but by all means buy the pre-sawed wood kit, otherwise with the woodworking tools the average homebuilder has, half of your expensive spruce will wind up as sawdust.

The only part of my airplane I'm not proud of is the skin on the flaps and ailerons. I had just received the 1mm plywood, and it was extremely dry when I skinned them. Our high humidity here in Florida caused the skins to wrinkle. I could either rip the skins off and redo them, move to Arizona, or live with the problem. I chose the latter.

I have heard a lot of discussion about various glues (adhesives) recently. Personally, I prefer Aerolite. About 3 years ago, Kermit Weeks buzzed the airport I live on with his Mosquito. The Aerolite is still holding it together, so that's testimonial enough for me.

When it finally comes time to fly, use Sequoia's Flight Test Guide. The preflight portion leaves nothing to chance. A lot of would-be pros will think the guide is overdone, but the *old* pros know that it isn't. On the first flight you need to be able to concentrate on flying the airplane, not worrying about what you may have forgotten.

Having flown over 30 kinds of airplanes from Champs to F.86's, I chose to make the first flight. The flight was uneventful, thank God. I was fortunate in having a good friend and neighbor, "Corky" Meyers, ex-Grumman test pilot, fly chase in a Mooney. Corky will be the first to tell you that the next time he flies chase with a Falco, he wants something faster than a Mooney.

After landing and sharing champagne, provide by my lovely wife Judy, with our friends and neighbors I stated, "I can fly the tree they cut that sucker out of."

In short, building a Falco is very simple. Take several thousand dollars worth of spruce, glue this to several thousand dollars worth of birch plywood using a few thousand dollars worth of glue. Then invest a few thousand dollars in sandpaper and sand away everything that doesn't look like a Falco.

Ralph and Judy Braswell after the first flight on November 9, 1996.

The Falco Builders Letter is published 4 times a year by Sequoia Aircraft Corporation, 2000 Tomlynn Street, Richmond, Virginia 23230. Telephone: (804) 353-1713. Fax: (804) 359-2618. Publication dates are the 10th of March, June, September and December.

Subscriptions: $16.00 a year, $20.00 overseas. Available only to Falco builders and Frati airplane owners.

Articles, news items and tips are welcome and should be submitted at least 10 days prior to publication date.

The Glider

Part 13 of a Series

by Dr. Ing. Stelio Frati
translated by Maurizio Branzanti

Chapter 6
Applied Aerodynamics (con't)

31. Airframe Components and Drag. We will now discuss the coefficients of drag of some of the airframe components. As stated earlier, these coefficients are based on the largest cross section perpendicular to the flight direction.

Flat Rectangular Sections. The drag coefficient C_d of a flat surface is a function of its length and Reynolds number. For isolated flat surfaces, $C_d = 0.65$. For flat controlling surfaces, (considering the wing interference), $C_d = 0.85$ as an average value for normal Reynolds numbers found in such aircraft.

Wires, Cables and Extrusions. For round wire normal to the wind, the drag coefficient is $C_d = 0.60$. For cables of non-regular section, $C_d = 0.72$. Due to the high drag generated by wires and cables, they are often substituted with extrusions, generally with lenticular section, which is a good aerodynamic shape and also rather easy to fabricate. The coefficient for such an extrusion is $C_d = 0.20$.

Shaped Supports. In gliders, all of the supports could be made of round steel tubes, but generally in order to reduce the drag, an extrusion or a wood shape with a metal core is used. We will show the drag coefficients for various cross sectional shapes.

As we can see, if the length of the section is increased in relation to its thickness, the drag coefficient also increases. The optimum value for the section's length is three times its thickness. In the following table, the values for sections with their major axis

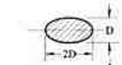
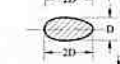
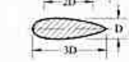
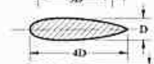
Section	C_d		
	0°	5°	10°
	.62	.62	.62
	.315	.41	.94
	.065	.072	.165
	.028	.0364	.084
	.043	.056	.0129
	.043	.056	.0129

Figure 6-1

at incidence angles of 0°, 5° and 10° are shown. As you can see, the drag increases with the incidence angle.

The Fuselage. Due to the large number of possible fuselage designs, it is very difficult to establish the drag of a new design without conducting wind tunnel tests, however as a rough approximation, you can establish the drag coefficient of a fuselage by comparing it to a similar one with known characteristics.

The shape of the fuselage is rather simple from the standpoint of construction, but experimental results are lacking. The drag coefficients that we show here do not pertain to any particular glider, but they could be used as a reference to understand the magnitude of these values.

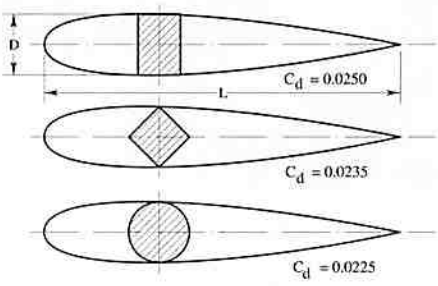


Figure 6-2

In these three shapes, note that there is little difference in the minimum drag. You could assume that the section design has no bearing on the outcome. But let's notice the importance the shape of section assumes once the angle of incidence is increased—with an angle of 10° in respect to the fuselage axis, there is an increase of the minimal drag of 230% if the section is square, while it will not reach 33% if the section is circular. Drag coefficients values for fuselage with open cockpit can vary from 0.09 to 0.18.

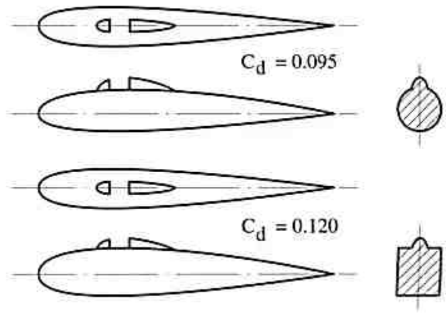


Figure 6-3

Two types of fuselage with open cockpits are shown above, one with a rectangular section, the second with a circular section. For a fuselage with a closed cockpit, drag coefficients can be achieved from 0.045 to 0.050.

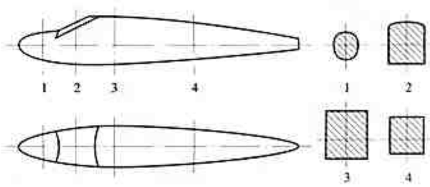


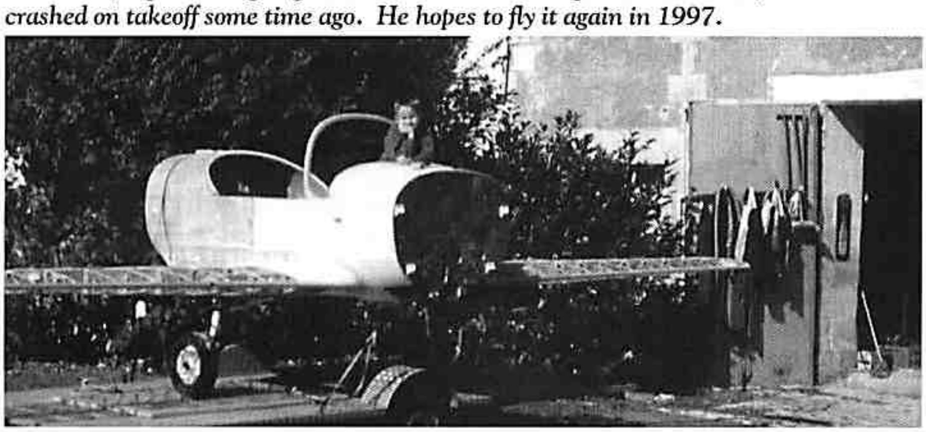
Figure 6-4

For the fuselage shown above, the following drag coefficients were found: 0.044 at 0° incidence, 0.071 at 10° incidence, and 0.1545 at 20° incidence. As you can see, the drag increases considerably with an increase of the angle of incidence, especially with a fuselage of square or polygonal shape.

As an approximation, we can establish the coefficients of drag of 0.08 to 0.10 for a polygonal shape fuselage with open cockpit, 0.07 to 0.08 for the same but with a closed cockpit and 0.04 to 0.05 for a curved, plywood-skinned fuselage.

Wheels. For drag coefficient for low pressure wheels that are usually used in gliders, we can use $C_d = 0.15$ where the section considered is obtained by multiplying the wheel diameter by the largest wheel width. In gliders, the wheels—normally one—are always partly masked by the fuselage, but we can assume the drag for the wheel in its entirety considering the interference with the fuselage.

In France, repairs are going well with Xavier Beck's production Falco, which crashed on takeoff some time ago. He hopes to fly it again in 1997.



Speed Gain From Cowling Modification

by Cecil Rives

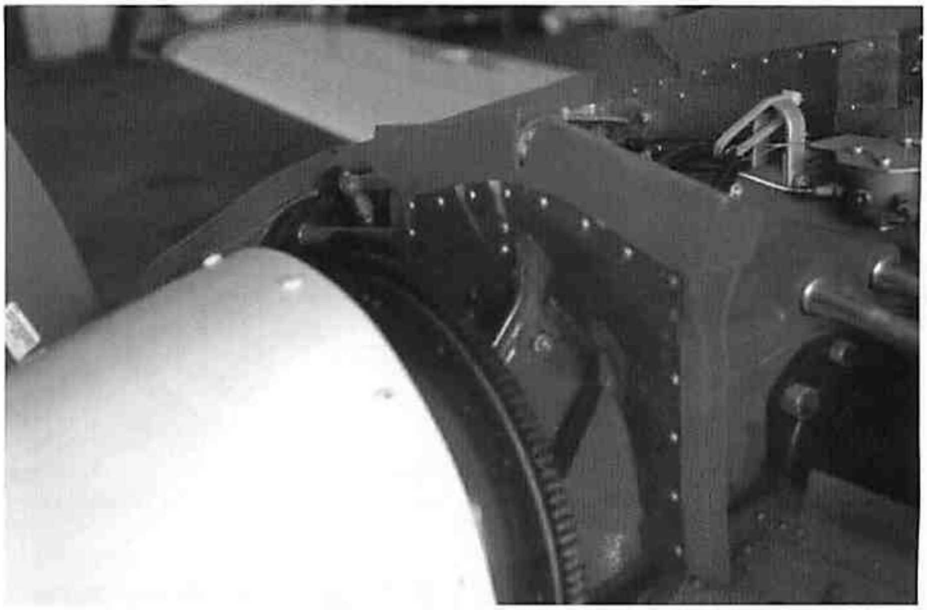
The inspiration for this undertaking came from an observation of cooling air inlets on the cowling of a Glasair II that belongs to a friend of mine. His airplane shares the same roost with a Christian Eagle, a Glasair III, a Mini-Mustang and my Falco. (Sorry folks, but you have to take hangar space where you can find it!) The Glasair II uses the same 180 hp engine that is in my Falco, an IO-360-B1E, and also the same Hartzell prop. What caught my eye was the size of the cooling air inlets that are considerably smaller than mine. In fact, they measured about 38 square inches of total inlet area as compared to 75.5 square inches on N63KC.

When I commented to my friend on the small size he remarked that he had just made some inserts to make them even smaller—17 square inches total inlet area! These inserts are claimed to result in an 8-10 KIAS increase. As he had not installed them he was unable to verify the claim. With the 38 square inch inlets, the Glasair will climb at 85 KIAS and never exceed 350°F CHT nor 200°F oil temperature.

Well, all this and conversations with Alfred and John Harns encouraged me to see what could be done with my Falco. Some years ago, John Harns reduced the size of his IO-320 inlets and experienced a significant increase in speed.

I should preface what follows by pointing out that a year or so ago I had made every effort to seal all the nooks and crannies of the high pressure area of the engine compartment. Also, I made and installed a baffle plate on the front of the engine to seal off the starter ring area.

Alfred had suggested that I make some inserts or cuffs and experiment with different sizes to see which might give the best results. Using rigid foam, I roughed out a shape that would reduce the inlets by about three square inches per side, covered them with a mixture of epoxy and West's Microlite to smooth things out and secured them in place with duct tape. The test flight was encouraging as the CHT and the oil temperature all stayed "in the green", even though it was a 90 KIAS climb on a 35°C day.



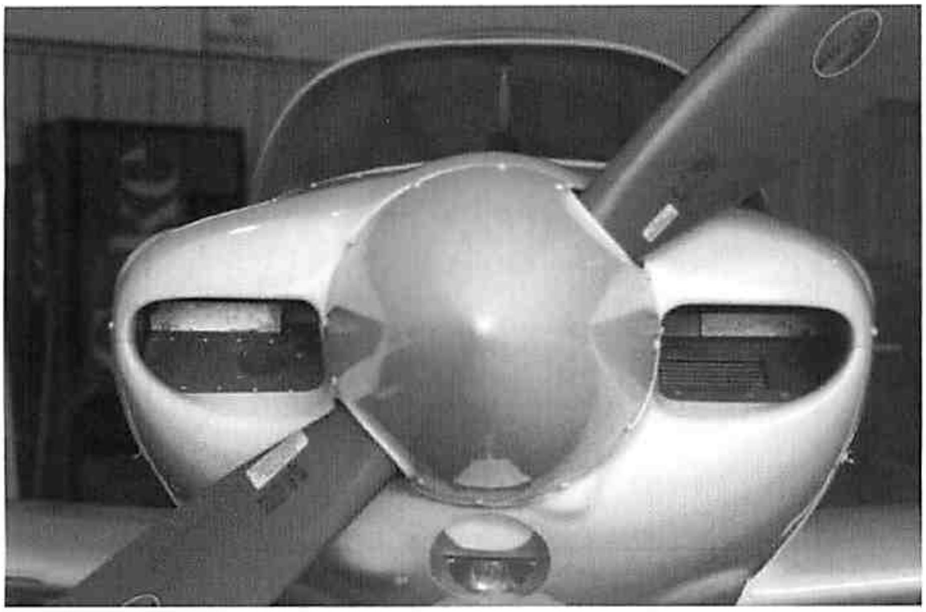
Top: The baffle plate at the starter ring. Above: Cecil's Falco is now a white bird.

Cecil's manometer.

At this point, I decided to reduce the inlets by an additional two and one-half square inches per side. All of this "filling in" was done on the upper lips of the upper cowling half and after this last reduction, little more can be added as you will be interfering with the attachment screws for the two cowling halves. The end result is an inlet opening of 32 square inches per side or 64 square inches total inlet area (measured one inch out from the spinner radius). This is still 26 square inches larger that the Glasair II.

For a climb test, I began at 2000' and leveled out at 8500'. I held 90 KIAS, maximum power, and full rich. Temperatures were stable throughout the last 400' of climb. At an OAT of 28°C, the CHT was 400°F and the oil temperature was 220°F.

The photo top right shows the cowling inlets after they were permanently installed and the cowling repainted (along with the rest of the airplane, but that's another story). I did a speed run at a pressure altitude of 4500' and 15°C OAT. The indicated airspeed was 172 knots, for a true airspeed of 187 knots, or 215 mph. This compares to a speed recorded on a flight a year earlier (at the same pressure altitude and OAT) of 166 knots indicated, or true airspeed of 180



Top: Cecil's new nostrils have that sinister look about them.

knots or 207 mph. Thus, I've achieved an increase of 7 KIAS by a reduction of 11 square inches of cooling inlet area.

In the September issue of *Sport Aviation* there is an article by Jimmy Tubbs entitled "Engine Cooling Problems." The article describes a method whereby the pressure differential between the high and low pressure areas in the engine compartment can be determined in order to assess the cooling efficiency of the system. I assembled the apparatus described (a simple manometer). I installed it in the Falco and conducted a series of flight tests.

In a climb from 2000' to 6500', I held a true airspeed of 85 knots, with full throttle, maximum rpm, and full rich mixture. At an OAT of 17°C, I recorded a CHT of 400°F and oil temperature of 210°F. The manometer reading was 6 1/2" and 3 1/2", for a 3" pressure drop.

For a cruise test, I flew the Falco at 5500'. With a power setting of 23"/2300, and leaned to 100° rich of peak, the plane indicated 150 knots. At an OAT of 20°C, the CHT was 325°F and the oil temperature was 210°F. The manometer reading was 6 3/4" and 1 3/4", for a 7" pressure drop.

Disconnecting the high pressure line of the manometer while in flight enables you to compare the low pressure area in the engine compartment with the static pressure in the cabin. This differential in N63KC is about 7 inches. [*Because the cockpit pressure in a Falco is lower than the outside air—as can be witnessed by the blast of air you get from the back of the cockpit on a cold day—I think this reading is bogus.—Scoti*]

As a result of all this, the following observations can be made.

1. Even though the CHT and oil temperature on my Falco are still in the green in an 85 KIAS climb, the 3" pressure drop indicates a less-than-desirable cooling condition as defined in the Tubbs article. (On a 28°C day it is doubtful that the CHT would stay in the green.)

2. At cruise, the CHT of 325°F is lower than Tubbs' recommended 370-390°F range. (John Schwaner in his book "Sky Ranch Engineering Manual" says that normal CHT range is 350° to 435°F.)

3. The oil temperature appears to be satisfactory in both climb and cruise as Schwaner states that a range of 160° to 245°F with 180° being a median value is desirable. Tubbs offers no value.

4. The 7" pressure drop from the high to low pressure area of the engine compartment indicates a damming up of the air in the lower part of the cowling according to Tubbs. Therefore, an increase in the exit area should increase the pressure drop with the upper part of the cowling and increase the cooling effect of the air flow. (It should be mentioned here that the total exit air area of the Glasair II is about 50 square inches compared to the Falco's 37 square inches.) [*And Stelio Frati might mention that he did not design the Falco with a nose gear door to block the exit area!—Scoti*]

In conclusion, it seems that we have a dilemma. We can increase the exit air area in order to improve climb cooling but that won't help the already too-cool cruise temperature. However, we could forget about the 85 KIAS climb (what's so sacred about it anyway?) and opt for a 100 KIAS climb. That gives you better visibility over the nose, too!

It does appear, though, that there is potential for a significant increase in speed over what I have experienced if one wants to add cowl flaps or take on the task of an extensive modification of the cowling. We're not even close to the air flow characteristics of the Glasair II. That airplane, by the way, lists a top speed of 228 mph. That's only 13 mph faster! And we're 40 years old! And, we're a lot prettier!

Incidentally, does anybody know of any hangar space in the Houston area? I'm getting a little weary of all the termite and woodpecker jokes.

Construction Notes

Cecil Rives reports that, like Richard Clements, his ailerons were floating up about 1/2" at the trailing edge in flight. In checking things, Cecil found the aileron cable tension to be 25 lbs, far short of the specified 45 lbs. After tightening the cables to the correct tension, Cecil said the ailerons now come up about 1/4" at the trailing edge in flight.

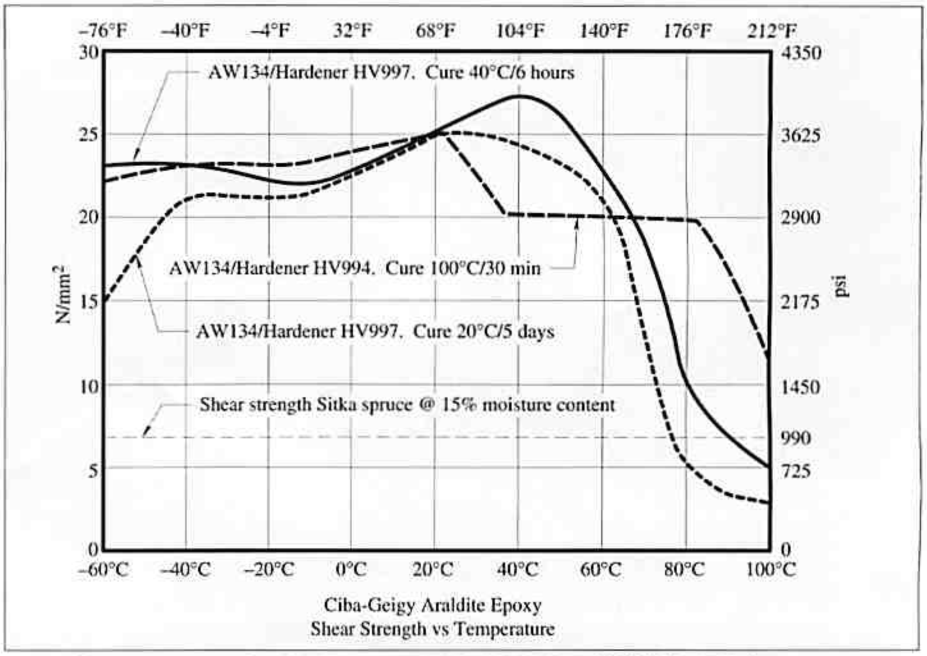
Cecil was also intrigued at the possibility of closing up the cowling inlets for greater speed. His 180 hp engine has always cooled well, and he's seen so many Lancairs and Glasairs with miniscule air inlets that he wanted to see if he could safely reduce the opening size and get some more speed.

There's never been any doubt in my mind that this could be done. The Falco's engine air inlets are generous and have cooled all of the engines well. There has been a lot of good work done in reducing the cooling drag of aircraft engines, notably with the Swearingen SX-300 and some of the LoPresti planes. In all of these cases, the inlet was reduced to a small round opening, well outboard from the propeller, and then a tapered cone of about 7° was used on the inside to decelerate the air. Remember from Bernoulli's counter-intuitive theory that decelerating the air causes the pressure to increase.

To do this on a Falco would require an extensive and expensive re-design process, and then the cowling mold would have to be changed. With an original cost in our cowling mold of $30,000, I don't feel like doing that, and also there would be many people who would rebel at the 'non-Frati' appearance of such a cowling. But I'm happy to see individual builders like Cecil tinker with the opening and in this case Cecil reports that there is a substantial increase in speed. See his "Speed Gain From Cowling Modification" on page 4.

Larry Black points out that you have a 'hot prop' when the instrument panel is removed. Hmmm, I guess I never thought about that before, but it's something to keep in mind since the engine could start if you pulled the prop through in that condition. Larry suggests disconnecting the spark plug wires when you have the instrument panel out.

More on the Aerolite 'controversy'. Much of the misunderstanding about Aerolite rose out of two articles, one by Bob Whittier in the EAA *Experimenter* and another by Tony Bingelis in *Sport Aviation*. Both articles had a lot of merit, but both left the impression that somehow the FAA was banning Aerolite.



Top: Shear strength chart of Araldite epoxy. Center: "The insanity of the Oyster Fly-In" is what Fred Scott called it, and then brought his four-in-hand wagon to a fly-in. Who's talking? Above: A badly frozen Nigel Moll emerges from his Kitfox.

I was not aware that a proposed copy of the FAA's AC43-13 was being passed around for comment. This document covers acceptable methods of repair for certificated aircraft, and in the proposed document, the following language is included: "Plastic Resin Adhesive. Although 'plastic resin glue' (urea-formaldehyde resin glue) has been used in wood aircraft for many years, caution should be used due to possible rapid deterioration (more rapidly than wood) in hot moist environments or under cyclic swell-shrink stress. For these reasons, urea-formaldehyde should be considered obsolete for all repairs. Any proposed use of this type adhesive should be discussed with the appropriate FAA office prior to using on certificated aircraft."

Top: Three of the seven Falcos at the Oyster Fly-In. Joel Shankle with Jim Petty to the left background, and Tripp Jones to the right. Center: Bob Bready and Tony Petrulio arrived in Bob's Falco. Above: Jim Petty's Falco in the front yard.

Let's remember that this document governs the methods used for repairing certificated aircraft, and while it is a good guide for all types of aircraft, it is not binding on kit or homebuilt aircraft. I've had some correspondence with Bob Whittier, and he has written an excellent article on Aerolite that is in the December 1996 EAA *Experimenter*.

My view of Aerolite remains the same. It is good that we are informed about the limitations of the glue, but I think that when you consider the limitations of all of the glues available, Aerolite should still be considered for use. Any blank prohibition of Aerolite would be like banning people with bad tempers or body odor. That would deprive the world of people like Bill Gates (or some might suggest, even me!).

Bob Whittier's latest article included some new and interesting information on West System epoxy. When I last spoke to the folks at Gougeon Brothers, they were not able to supply specific information about the temperature performance of their West System epoxy. They generally felt that it has slightly superior temperature performance when compared to other epoxies like T-88, but certainly not greatly different.

Thomas Pawlak of Gougeon's Technical Services reports: "We believe our epoxy is suitable for use in wooden aircraft if you are aware of its physical characteristics and take precautions to deal with its limitations. It has been used successfully for 20 years to build experimental aircraft. We broadly recommend our epoxies for many critical high-strength applications such as aircraft construction and repair. We also broadly caution all epoxy users to optimize contruction methods and details to get the best results."

"All room-temperature-cured epoxies will soften when exposed to elevated temperatures. Most composite materials soften to varying degrees when exposed to high temperatures. That is why many composite structures including aircraft are painted white or near-white, to reflect most of the sunlight's energy rather than absorb it into the substrate. Even so, surface temperatures can exceed the heat deflection temperature of the epoxy. Fortunately, as soon as it cools to room temperature the epoxy returns to full strength."

"Our West System epoxy has a heat deflection temperature (HDT) that ranges from 118 to 123°F, depending on which hardener is used. This temperature is determined by means of a simple test. A bar of neat epoxy (epoxy without thickeners or fibers) is supported at both ends on triangular blocks and a load is applied to the midpoint. This setup is immersed in oil that is gradually heated until the specimen being tested bends 0.10 inch. The temperature is recorded and is that epoxy's HDT"

"Testing done by us shows that West System epoxy returns to full strength after cooling to room temperature as long as the temperature of the epoxy has not exceeded 200°F for long periods and as long as a joint it is attached to is not subjected to durational load during the heat cycle."

Sawdust

• Falcos 7, Cessnas 3. You really missed it. The Oyster Fly-In was the best ever, with stunning weather and a great time for all. Jonas and Betsy Dovydenas were the first to arrive, in their bullet-ridden, Swing-Wing Falco. Joel and Carolyn Shankle arrived in their red Falco, still yet to be upholstered—but who ever said that finishing the plane was a goal? George and Joy Barrett set a new world speed record between the Gordonsville airport and Rosegill airstrip. Tripp Jones flew in from Charlottesville. Bob Bready and Tony Petrulio came in Bob's Falco from Massachucetts. Steve Bachnak flew in from Munster, Indiana, after climbing (very briefly) to 20,000 feet to get over some weather. And Jim Petty flew in from Dayton, and parked the beauty in the front yard.

Joy and George Barrett

Meanwhile, there was plenty of action on the ground, and Fred Scott arrived with his four-in-hand whisky wagon pulled by four Belgian horses—all this at an oyster fly-in. The Grand Champion Craziness award, however, went to Nigel Moll, who arrived by Kitfox from New Jersey. There's no heater in the Kitfox, and the cockpit is well ventilated with outside air. Poor Nigel had only a single pair of socks on, and no gloves. You never saw such a bitterly cold person. All this for aviation!

But the heart of the Oyster Fly-In is really the mixture of interesting people, the Urbanna Oyster Festival parade, and the endless party. And if you're bored, you can always spend some quality time with Brodie, our crazy Border Collie, who always lifts his left leg, even if the bush is on the right.

• Another Falco takes to the air. G-OCAD, the Falco of David Norwill, Clive Garrard and Gordon Blunt first flew on Saturday, December 21. Clive reports, "We are all absolutely knocked out by it."

Top: Dave McMurray struts his stuff in California. Center: Joel and Carolyn Shankle fire up and then take off at the Oyster Fly-In. Above: Al and Nancy Aitken, Carolyn Shankle and Tripp Jones with Tripp's Falco.

Susan's Corner

Did anyone wonder what happened to "Susan's Corner" in the September issue of the Builder Letter? I was bumped. Erased. Deleted. Gone.

Alfred was putting the articles and pictures together for the last issue, and I was lamenting that I didn't have much to write about. Well, a couple of days went by, and I decided I needed to write something, so with pen in hand I put on my thinking cap. A couple of pages later, I told Alfred that I'd have my column on disk in just a minute or two.

His reply? "Nope—too bad, space is all gone."

Well, I jumped up out of my chair, arms waving, hair on fire and raced into his office. "You're kidding," said I. "You really didn't leave me any room?"

"Nope," says he—with that quirky grin of his. "Newsletter's done. It'll have to wait till December."

So there you have it. Not a very exciting excuse for no column, but I didn't want you, my faithful builders, to think I'd disappeared, or been run over by a truck or washed down a storm drain during our hurricane or met some fate worse than death.

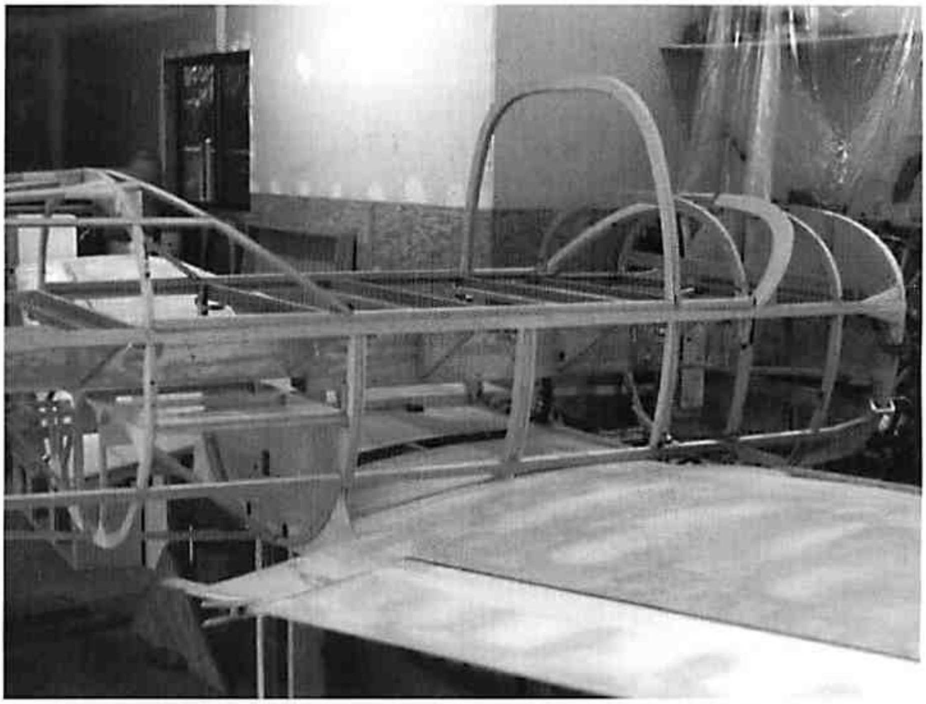
So here we are. The December issue. And I'm not sure I have much to write about.

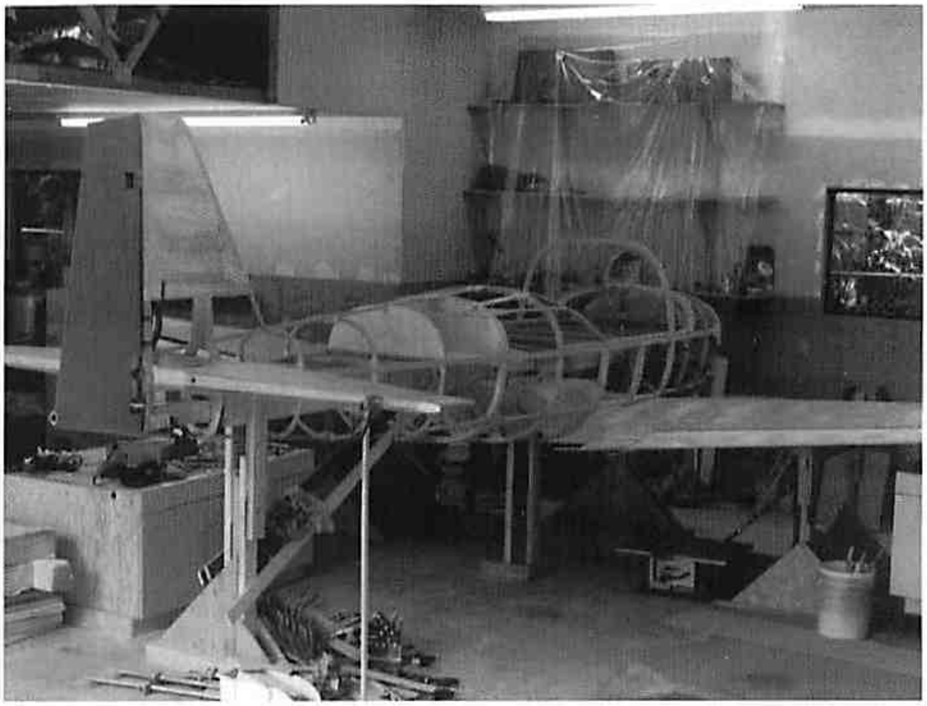
We did have a very busy summer. The first batch of five main wing spars was completed and shipped out, and we have now finished the second batch of five and have them ready to go.

Bill Motley continues to steadily make the fin and stabilizer ribs so we're now in good shape with those.

Our inventory was in great shape a while back, but we've sent so many kits out that we've depleted a lot of our supplies, and all the parts that we've run out of are things that need to be made—not just nuts and bolts. So we're beginning the process of getting together drawings, pieces parts and such and sending them out to be made, machined, welded or whatever the various processes might be.

As 1996 begins to wind down, I must admit that as I look back over the past year and all that has happened and been accomplished, I do feel a small sense of pride. We've had a year of record sales, made major changes and improvements in the warehouse, made 10 complete main wing spars (as well as all the other spars) and shipped out half of them, finished up all of the fuselage frames and shipped out full sets of those, plus all the partial sets that were backordered.





Dave Nason's Falco takes shape in Kent, Washington. This was the state of the airplane as of early September, with the wing and tail 'glassed and ready for paint.

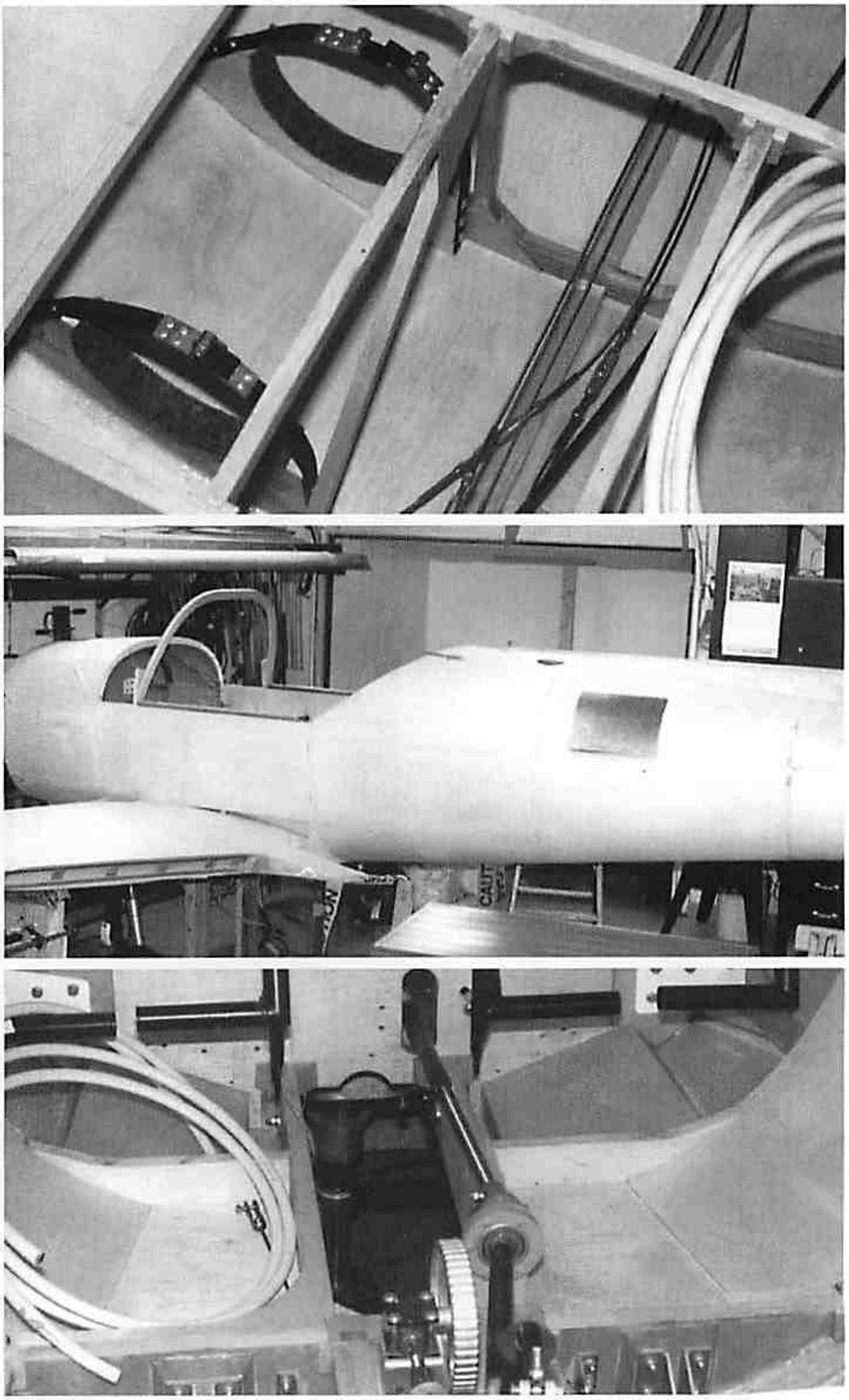
I've also enjoyed the nice face-lift that Bill and I gave the office last February while Alfred was on vacation. We worked about a million hours that week, but it was certainly worth it. And I most certainly must give much credit and thanks to Bill, without whom all these accomplishments would not have been possible. Every once in a while, I come across a real gem of a person, and Bill certainly has earned that distinction.

This past year has also been a year of tremendous learning and personal growth for me, and I certainly hope that 1997 continues in the same fashion.

So for all you wonderful builders out there, I wish you a good and productive new year. And for those of you whose Falcos are already airborne, have a safe and exciting new year. And for everyone, I wish you a safe and peaceful holiday season.

—*Susan Stinnett*

Mailbox



Al Dubiak's Falco takes shape. Note the header tank supports and lowered floor.

You haven't lost your touch for stirring me up. Your comments in your Construction Notes said that I was "deliberately vague" in my article (true). You also added: "and said his source was the article in *Experimenter*". Not true. I only mentioned Bob's article to you because I thought it was worth reading, and I didn't know if you had seen it.

Anyhow, I view this as another instant in our long association where you typically leave the impression that Tony's comments/ suggestions are shallow assumptions not worthy of note. Actually, my "vague" treatment and conclusion on the urea-formaldehyde subject was based on the following:

1. The draft revision of AC43-13-1B (April 4, 1996) in which I participated. However, I did not comment on the FAA's paragraph which I quote in its entirety: "Plastic Resin Adhesive. Although 'plastic resin glue' (urea-formaldehyde resin glue) has been used in wood aircraft for many years, caution should be used due to possible rapid deterioration (more rapidly than wood) in hot moist environments or under cyclic swell-shrink stress. For these reasons, urea-formaldehyde should be considered obsolete for all repairs. Any proposed use of this type adhesive should be discussed with the appropriate FAA office prior to using on certificated aircraft."

2. Information I had previously seen in the Australian magazine *Air Sport*.

3. Information received from Victor Boyce (Corby Starlet Newsletter Technical Editor) back in 1988. He was the "expert witness" for the government. This eventually led to the Department of Aviation banning the use of this type of glue for aircraft construction.

4. Australian Airworthiness Advisory Circular, No. 108, January 1979 regarding the Australian prohibition of ACP or UF glues.

And for the last laugh, I am now preparing the December issue article for *Sport Aviation*. It is the last one. EAA believes it. They invited me to a farewell banquet November 1.

Alfred, stay in touch. I'll need the stimulus.

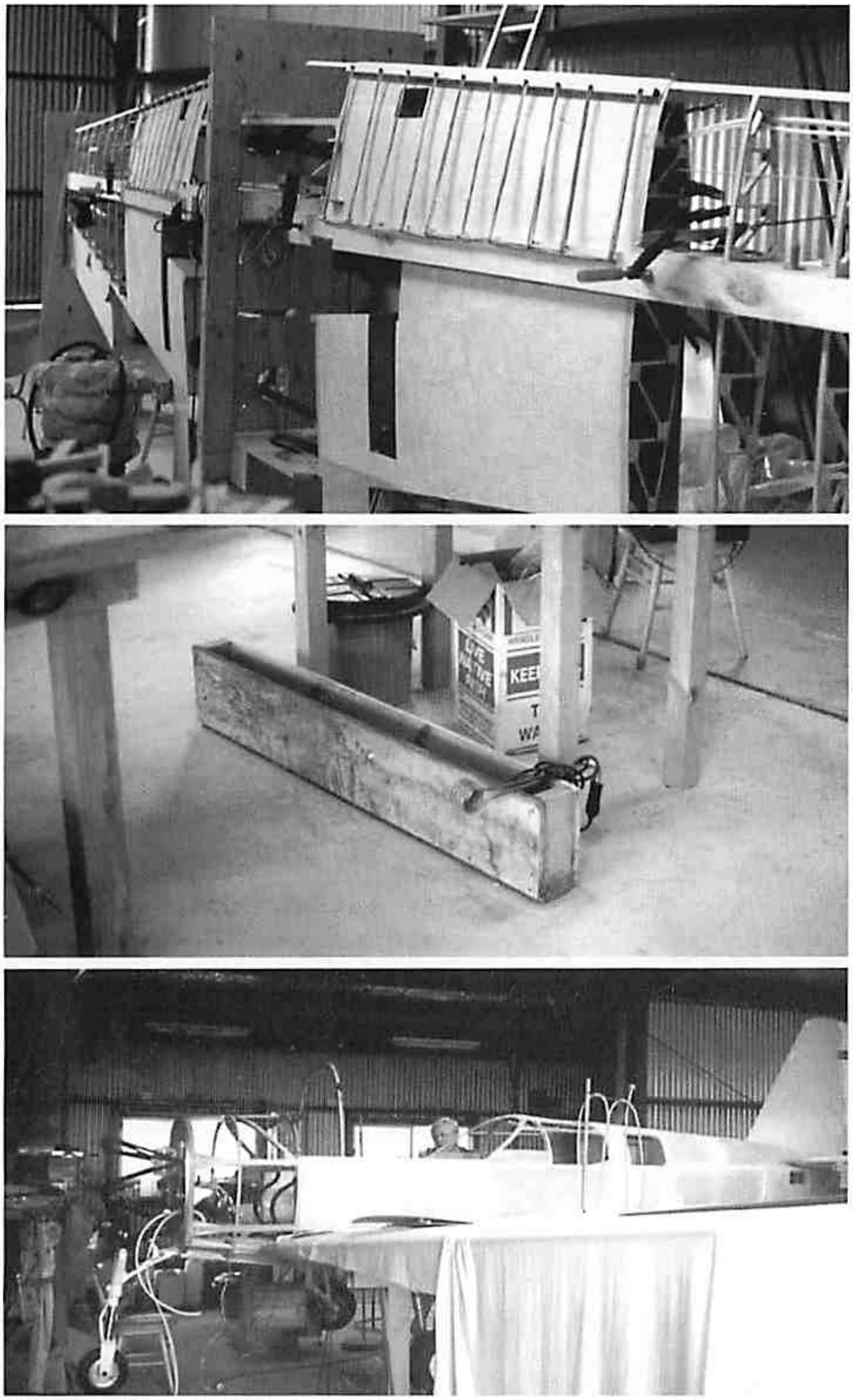
Tony Bingelis
Austin
Texas

I didn't mean to misquote Tony, irritate him or demean his views in any way. Ben and I were merely curious about the validity of the "FAA's ban on Aerolite". I did not know of the proposed wording in the AC43-13, and I wish Tony would have mentioned it because I certainly would have used it in the article. I didn't mention the other sources which discuss the merits of Aerolite, because I was mainly interested in whether the FAA has banned Aerolite, which is what builders were perceiving from the various articles. The AC43-13 document applies to certificated aircraft, and thus there is no 'ban' on the use of Aerolite in homebuilt aircraft.

Tony can have all the farewell banquets he wants, but I ain't going to believe it till I see a year pass without more articles!—Alfred Scott

Most of the empennage is built and ready for skin but I have been delayed for the last 3 months due to relocating but I will be back on track very soon and still hope for completion within a total of 3 years or less.

Tony Petrulio
Portsmouth
New Hampshire



Ian Ferguson's Falco project and immersion heater.

The airplane is in progress. I have completed the elevator, stabilizer, fin ribs and rudder assembly woodwork and have started on the fuselage assembly. I find the plans and technical manual very good and easy to work with.

Hans Saborg
Kramfors
Sweden

I enclose some photos of my Falco project. Some are of the process of bending the plywood for the wing leading edge. The trough and immersion heater were used to boil the leading edge of the plywood prior to bending. The bending itself was done with ordinary office-type rubber bands attached at the plywood end to wire hooks through holes in the plywood and at the spar end to screws in a board clamped to the spar. The innermost panels had extra wood glued to the leading edges but this was not necessary further out. With the further aid of a steamer, the plywood practically fell around the leading edge.

A tool I have found to be very useful is a balance beam for mixing glues and resins of various types. [*Ian's balance beam is a board pivoting on a fulcrum, but with a moveable balance weight on one end that's mounted on a threaded rod.*] The procedure is to balance two cups, the one to contain resin on the mark 100mm left of the fulcrum, and the one for the hardener the appropriate distance to the right—500mm in the case of a 5-1 ratio. These are balanced empty using the moveable counterbalance to the left of the resin site. The required amount of resin is placed in the left cup, and sufficient hardener to balance in the right cup. The right end of the beam can be marked for any ratio needed.

A problem associated with liquid hardeners is the error associated with the residue left in the resin container, especially in small batches. This can be overcome, or eased in two ways. The first is to mix in both cups, *i.e.* tip the hardener into the resin and mix, then tip the mixture back into the hardener cup and mix again. Not 100% and wastes a lot of glue, especially in small batches where the error is most important.

Another solution is more elegant but somewhat involved. You will require a 100mm mark to the right of the fulcrum on your beam, and mixing cups all of which weigh the same. The resin is placed as before to the left of the fulcrum, but this time water is added to the hardener cup to balance. The resin and the hardener cup are removed and the beam is re-balanced with two empty cups each at the 100mm mark. The empty cup is then removed from the left side and replaced with the cup of resin. Water is then added to the right cup to balance the water in the right cup, and then add hardener to balance to the left (resin) cup. A bit more tedious no doubt, but think of the money saved in disposable cups. You will destroy only half the number!

You may have got the impression that I use a lot of epoxy; you are right. The epoxy I use, Araldite AW 134, is produced by Ciba-Geigy in Australia. It maintains its strength up to 80°C and is still at half strength at 100°C. Given that the glue is considerably stronger than necessary to begin with there appears to be little risk of glue failure due to temperatures even in our climate. Add to that the margin of strength in the aircraft structure, and the rapidity of cooling in flight, the risk attached seems slight. There are two rules I intend to follow however. Never take off with a jet of steam coming from *any* breather hole, and no more than 3 Gs immediately after takeoff. If the thing falls to pieces before leaving ground, injuries should not be serious.

There are many joints in the Falco that I—and I am not very skillful I admit—find very difficult to make really accurately and which are also difficult to clamp with adequate pressure. With my level of skill, I believe that had I used resorcinol throughout there would have been many more poor joints in the machine than I have made with epoxy and at 80°, or even 100°C, the machine will be safer than it would have been with resorcinol.

Ian Ferguson
Dookie,
Australia

In the U.S., most people who use epoxies have metering pumps that dispense the proper amount of resin and hardener, so Ian's elaborate procedure is something you don't have to worry about. You just put the mixing cup under the pump and pump away. Ian also sent along product literature on Araldite AW 134. The literature is impressive and gives charts (see page 6) showing the strength of the glue vs temperature—that's something I've never seen before in product literature on epoxies.—Scoti

I've finished the structural repairs now on N134AH. It's amazing what a sharp block plane will do to remove plywood skin from the ribs. With care, it's not that hard to get down to the glue line and then shave through it. Build up where needed, float sand and you're ready to cover. I then recovered the cloth surfaces in plywood as well as resurfaced the tops of the ailerons and flaps with new plywood.

I completely stripped the Stits fabric and now have the plane coated in West System and microballoons. Now need to continue the process of "fill and sand, fill and sand" prior to encapsulating in fiberglass cloth, primer and paint. I'm learning the difference between "smooth and straight". Some job! The airplane now has 70 hours on it. It's a pleasure to fly both cross country and just playing around.

Martin Pierce
Muncie
Indiana

Martin Pierce has purchased Alan Hall's Falco, and the plane required some extensive rework due to gaps between the wing ribs and the wing skin.—Scoti

More from Mendocino. Top: Christine Monahan and Dan Dorr pretend they own the Falco, while 'gas boy' Dave McMurray handles the refueling. Center: Ann and Larry Black. Above: Susann Flowers, Garn (um?), Sherry Purkiser, Pat Harns, Ann Black, Sherry's sister-in-law, Doris Kennedy and Barbara McMurray.