Falco Builders Letter

Annie and Stephen Friend with other friends, Solo, Brian, Jimmy and (Dirty) Harry.

The Falco from Snowy River

by Stephen Friend

My decision to build a wooden aircraft was probably made very early in my brief career in aviation, when I learned that a mixture of heat, altitude and freshly-made sausages produce an interesting corrosive mixture to aluminum aircraft. This invaluable bit of information was picked up when, after leaving school and learning to fly at the local aero club, I found myself working on a cattle station (ranch) in Australia's Northern Territory—imagine Arizona with stunted trees, only flatter and emptier. This occasionally involved using the station's C180 to fly the four-hour round trip to Mt. Isa for mail, groceries, spare parts and beer. It was much more fun than building fences or watering livestock.

After two years, I had earned enough to come home and get a commercial license, which I was able to use soon after on another Northern Territory cattle station, flying meat from the station's abattoir to local aboriginal communities and towns. My employers on both occasions were Americans, in fact, a lot of Northern Australia in the 70's was American-owned, one of the more spectacular being Nelson Bunker Hunt.

Using a C185 and a Cherokee 6-300, we could lift 1/2 ton of chilled or frozen beef, provided an early morning departure was made as all operations were from short rough strips. We needed 3 hours of fuel and even in winter 90 degrees is the norm—hence the need to insure that the sausages didn't thaw, allowing copious amounts of a smelly brine to penetrate the fuselage lap joints. After the loads were delivered, we could sometimes pick up a charter for the rest of the day.

This beef operation also used a Hughes 269A helicopter to muster (round-up) cattle for the abattoir. On my first flight in it, first flight in any helicopter for that matter, the Hughes suffered a nasty case of ground-resonance and rapidly chopped/shook itself to bits. Being a bit slow-witted, it took me a while to realize that this was anything but a normal landing. I was chucked out and received only Plexiglas cuts, but the pilot was less lucky and didn't fly again. Apart from the engine which was still running, there wasn't a piece of the wreckage that couldn't be lifted by one man. That saw the end to my commercial flying for a while with the loss of the Hughes, as I was the last hired and the first to go.

I elected to come back to the family mixed farm north of the country's capital, Canberra, which, because it happens to be on the mountain range running up the eastern seaboard, is also one of the colder places. We produce, with varied results, sheep for both meat and wool, beef cattle and a few cereal and oilseed crops.

Originally my Falco was going to be a Kitfox, which would have been a very practical and useful farm vehicle, but then I realized that I may only be allowed to build one aircraft so it had better be a real one. Six years later I have a machine which is of no earthly use for livestock or property inspections, has a cockpit like a terrarium and fits into our airstrip with difficulty. I wouldn't swap it for anything.

Six years is a long time to spend doing anything—it would seem a lifetime if you pondered on your labors having no value whatsoever until it flies, if illness or a change of job or something we won't even consider, Sequoia not selling aircraft, should intervene. I was priviledged in knowing that myself and the aircraft could stay put—having it so close took years off the building time; in fact, I rather miss sneaking out at 3 in the morning, in pajamas, to gusset a rib. I was intrigued to discover my own quality control. Many times I completed a part only to think about it for weeks before finally ripping it out and trying again. This aircraft was built with little local help. I had never seen a wooden aircraft built, however faxed assistance from Alfred is another matter—I'm sure eventually he

In This Issue:

Two weeks after the first flight, Stephen Friend's Falco won the Concourse d'Elegance at Mangalore and strutted his stuff with Guido Zuccoli in the Sea Fury, Wayne Milburn in Guido's Falco.

will reveal the number of notes and overnight replies to have crossed the Pacific.

I chose to build all the timber parts which added a year and used/wasted 15 liters of resorcinol in the process—I could have used epoxy, but from the beginning I wanted it to have the finish of a plastic aeroplane but painted dark—it's deep burgundy (Mercedes Benz Desert Red) with a brass stripe. Not gold, that might look like a Chinese restaurant.

An oft-asked question is what was the hardest part to build. The invariable and not necessarily facetious answer is whatever I was doing at the time. Everyone who builds an aircraft must also at least consider painting it themselves. Unfortunately, I took the next step and actually did it. That took probably 1000 hours all of last year to prepare and complete. My timing couldn't have been worse, as the top coat went on in July/August, in the middle of winter—not easy waiting for the ice to melt from the hangar floor, then get the area up to the curing temperature for the Alumigrip that I used. Maybe I should have used a more forgiving and repairable product, but at least the local U.S. Paint people were always approachable for advice and have even called in for a look. As it was, I needed two compressors to drive the gun at 70 psi and a third to feed an air-wash helmet to keep the isocyanates at bay. By this time, I was running out of electrical capacity, what with 3000 watts of lighting and a 1.5 hp exhaust fan, so one of the compressors had to be petrol driven.

Luckily I raised the Nustrini canopy 38mm but still had to cut the seat cushions in half. I use a pair of Pilot Avionics headsets with the pressure band at the back and a Velcro strap at the top where my head would nor-

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mally hit the canopy. Rather than raise the dorsal, I lengthened the canopy's rear roller support.

Every Easter our Sport Aircraft Association holds its convention (a tiny Oshkosh) at Mangalore in Victoria. Last year I decided my Falco would fly to the next, ignoring the fact that I had been flying only ultralights for the last 8 years. In February, it progressed the 37km to Goulburn Airport on one of our ground-loading trailers with Police Permit and two escort vehicles. Suddenly it was 8 weeks to Easter and no inspection done. I decided to complete everything, including the interior before it flew because I knew it may be difficult to be motivated afterwards.

After building and flying something as minimal as an ultralight, early in the construction I was a little concerned how I might feel about this creation actually flying. As it became more complete this feeling disappeared—something to do with the reduncancy of thousands of glue joints and knowing that forty-odd essentially identical other Falcos housed no real surprises. It behaved so normally on the ground that seeing it taxi out for its first flight, I don't remember being more than just a little apprehensive. My brother flew it for 40 minutes on April Fools Day with nothing more to report than a heavy right rudder and an artificial horizon which had never worked.

Actually, I'm not sure that he totally shared my confidence—as pilot-in-command, he was supposed to sign the aircraft's Maintenance Release before it flew but didn't as he said he couldn't be sure it was airworthy. I had never flown in a Falco (or a homebuilt) until mine, and on its third outing I was in the left seat. A few years of flying in hot places taught me the value of a high wing to escape the sun, but it didn't prepare me for the spectacle of the sun reflected off the disarmingly small wings. I expected to feel vulnerable with so much glass but not a bit of it—just a magnificent view all round. I think the more moving moment occurred some weeks before when the engine started for the first time—this pile of kindling had life!

Less than two weeks later I had done my BFR in it. With 7 hours on the tach, I took the Falco on its first 1-1/2 hour cross-country to Mangalore where the judges liked it enough to give it the *Concours d'Elegance* award. Guido

Zuccoli and Wayne Milburn flew down in the Falco and Sea Fury. Guido liked the idea of a fly-past with the Sea Fury pouring out smoke with Australia's two Falcos tucked in behind each wing and, of course, it had to be caught on film. Since I had done very little formation flying, a friend came along to do the hard work, and I still remember the tiny doubt when we lined up for a formation takeoff behind a T-28 camera aircraft, and the two others; a quick magneto check revealed a greater rpm drop than I am comfortable with but with the 2000 hp in front easily convinced us it was oiled plugs. Wind and low cloud made it a quite unnerving mission especially when being squeezed and buffeted by two large machines. By comparison, later flying with just the other Falco was almost relaxing.

To come back to earth, this Falco is fitted with an IO-360-B1E, King com and transponder, ELT and Shadin fuel totaliser and at 597kg (CG at 1706mm) must be one of the heaviest. Contributing to this last point could be the interior of natural materials; carpeted of gray wool, seats of gray distressed sheep hides and side walls hand-spun and hand-woven gray wool—perhaps I got a bit carried away with my occupation! With only the gear-leg doors fitted, at 5000 ft., 25/25 seems to give about 165kts IAS.

There have been surprisingly few things to tweak—unscrewing the trim tab clevis about six turns cured the lack of aft trim in cruise. On one of the early flights, the lack of a gear-down light certainly encouraged a gentle landing. I had moved the gear-down microswitch to the new "screwjack" position but excessive play in the threads allowed the striker to miss the switch.

I wanted a machine of my own that I could become so comfortable with that I felt I was wearing it. After 20 hours, I can see that this will happen. The Falco is the most beautifully precise handling aircraft I have flown, and eventually I will learn to slow it down to gear extension speed with style, however once the wheels are down it becomes as docile as you could wish—even landings on our 750 meters of grass are a delight, although it would much rather fly than trundle on the ground. To build a Falco is a most unreasonable thing to do, but if someone had said that to me six years ago, I wouldn't have listened either!

Stephen's brother, David, did the first flight of the Falco.

From Another Perspective

by Annie Friend

Probably along with other non-flying wives, I was intrigued that Stephen should even contemplate building his own aircraft. The initial six months or so of poring over plans and specifications didn't mean he was actually going to build. However, when wood started arriving I finally realized he meant what he said, and we have a new member of the family.

The Falco spent the first few years of its construction actually in the house, which meant the removal of a couple of walls and a large hole knocked in a bedroom—rooms, I hasten to add we weren't using anyway, but even so it caused much amusement to friends and family, all of whom wanted to know if we were going to have to demolish the house to get the plane out. I must admit it was very convenient as Stephen was always within call, and I could watch the large piles of wood become smaller and those interesting shapes start appearing. By this time I was beginning to learn the 'constructors' language and pick up useful bits of information, also to stop

worrying about whether the plane would fall apart because resorcinol is obviously a very good glue since it sticks permanently to an amazing variety of household surfaces and fabrics.

During this period our home insurance was canceled, It seems we were now operating a carpentry shop on the premises and this was deemed to be a great fire hazard, heaven only knows why! It was, however, reinstated after about four years when we threw a big party for our largest and strongest friends and amongst much joy and hilarity removed the Falco, broken into two pieces, the 50 yards to the hangar.

I must admit I rather missed it, and Stephen, being in the house, but with the purchase of an intercom I could now listen to the weeks of sanding *and* still have the odd conversation. Thus the Falco progressed through a long, cold winter into its final stages and finally emerged into the sunshine primed, painted and ready to go. For me, it didn't even have to fly at this stage. It was a thing of beauty just as it was. It didn't have to do anything else.

Those last few weeks were quite emotional, getting through final inspections, approvals, paperwork and waiting by the telephone for *the* call, it had flown! Then it was Easter and the all-important trip to Mangalore was upon Stephen, and in perfect weather he was off. What an amazing weekend it was too, awarded the top accolade, the *Concours d'Elegance*, and that flypast, in formation with Guido and Wayne. Not bad for a country boy and to think it was probably great fun. As a culmination of all that time and effort, I don't think anything else could have bettered it.

On the mundane side, I also got a bonus. I now have at least one part of my house that is refurbished, redecorated and looking as good as the plane. The 'Falco Wing' is now duly opened and ready for business, international Falco builders receiving a huge discount, of course!

With upholstery of all natural materials—sheep hide for the seats, glareshield and trimming, wool carpeting and the sidewalls handwoven from a mixture of mixture of commercial and hand-spun wool—the Falco is not fully appreciated by all inhabitants of the farm. Stephen Friend's airstrip runs diagonally under the wires of the power poles.

The Glider
Part 11 of a Series

by Dr. Ing. Stelio Frati
translated by Maurizio Branzanti

Chapter 5
Mechanics of Flight

26. Glide Angle and Glide Ratio

To understand the flight of a glider, we will set up a simplified situation. Let's stipulate that the flight is performed in calm air, in a straight line, and at a constant velocity. In these conditions, we have a flight path that follows a linear slope at angle φ, called the glide angle.

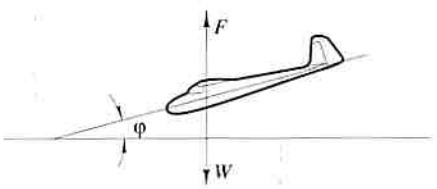


Figure 5-1

The forces that act on the airplane are the weight W and the aerodynamic force F. For any attitude, we will have equilibrium when these forces are on the same vertical line (W is always vertical), intersect the center of gravity CG, are opposite, and have the same magnitude. Consequently, the moment of these two forces in relation to any point in space will be nil. For simplicity, we will further suppose that the point where force F is applied is also the center of gravity CG.

Let's consider the components of the forces F and W in relation to two directions, one vertical and one parallel to the flight direction. The F components are the lift L and the drag D. The components for W are W' and thrust T, and they will be opposite to L and D. The thrust T determines the motion along the trajectory and depends on the glide angle φ and the weight W. In the diagram, we can see how the triangles

Engine startup on the prototype Falco.

F-CG-L and W-CG-W' are equal and similar to the triangle ABC. Consequently,

$$\frac{L}{D} = \frac{d}{h}$$

knowing that

$$\frac{L}{D} = \frac{C_L}{C_D} = E$$

we also know that

$$\frac{d}{h} = E \qquad [16]$$

The ratio d/h is called glide ratio, and its value represents the aerodynamic efficiency E as well. Its reciprocal, h/d, represents the trajectory slope p.

$$p = \frac{h}{d} = \frac{1}{E} \qquad [17]$$

which is trigonometrically expressed as

$$p = \frac{h}{d} = \tan\varphi \qquad [17']$$

To summarize, the greater the efficiency E, the smaller the trajectory slope. Therefore, for a given altitude loss, the distance travelled d is proportional to the efficiency E.

27. Horizontal and Vertical Speeds

Velocity V on the trajectory is due to the thrust T, a component of the weight W, in the direction of motion. In equilibrium conditions, T = D, thus

$$T = D = C_d \cdot \rho \cdot S_w \cdot V^2$$

from which we have

$$V = \sqrt{\frac{T}{C_d \cdot \rho \cdot S_w}}$$

which can be calculated from the other equation as

$$L = C_L \cdot \rho \cdot S_w \cdot V^2$$

therefore

$$V = \sqrt{\frac{L}{C_L \cdot \rho \cdot S_w}}$$

Since L = W cosφ, we have the more practical equation that will give us the velocity as a function of the wing loading W/S_w.

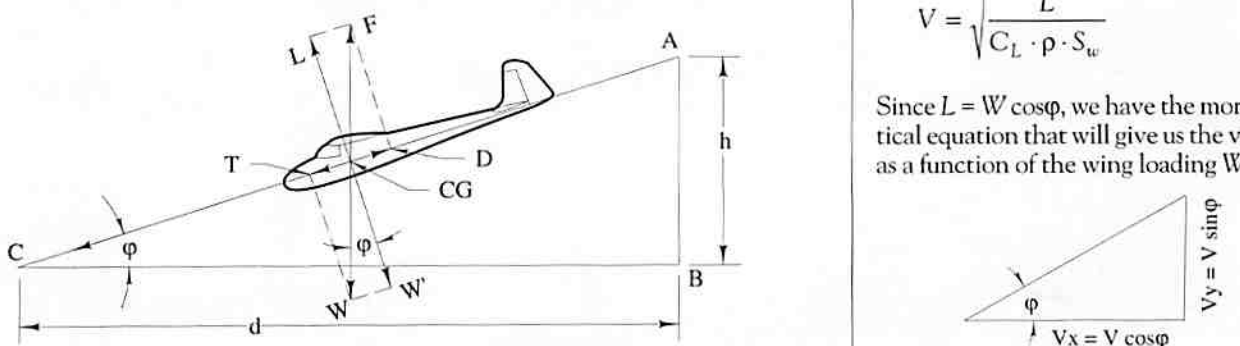


Figure 5-2

Figure 5-3

To the airport for the first flight.

$$V = \sqrt{\frac{W}{S_w} \cdot \cos\varphi \cdot \frac{1}{\rho \cdot C_L}} \qquad [18]$$

From the velocities triangle we can see that the horizontal and vertical velocities are

$$V_x = V \cdot \cos\varphi$$
$$V_y = V \cdot \sin\varphi$$

therefore, from formula 18 we know that the horizontal velocity V_x is

$$V_x = V \cdot \cos\varphi$$

$$V_x = \cos\varphi \cdot \sqrt{\frac{W}{S_w} \cdot \cos\varphi \cdot \frac{1}{\rho \cdot C_L}}$$

and V_y, the vertical component of V, is

$$V_y = V \cdot \sin\varphi$$

$$V_y = \sin\varphi \cdot \sqrt{\frac{W}{S_w} \cdot \cos\varphi \cdot \frac{1}{\rho \cdot C_L}}$$

or

$$V_y = \frac{V_x}{E}$$

$$V_y = \frac{\cos\varphi}{E} \cdot \sqrt{\frac{W}{S_w} \cdot \cos\varphi \cdot \frac{1}{\rho \cdot C_L}}$$

On normal flight attitudes though, angle φ is very small. For an example, given a standard value of efficiency for a glider of E = 20, we know that $1/E = \tan\varphi$ or $\tan\varphi = 1/20 = 0.05$. From trigonometric tables, we find the value of angle $\varphi = 2° 50'$, which corresponds to a value of $\cos\varphi$ = 0.99878. For normal flight attitudes, we can use a value of 1 for $\cos\varphi$ without introducing too much of an error. The equations will then be

$$V_x = \sqrt{\frac{W}{S_w} \cdot \frac{1}{\rho \cdot C_L}} \qquad [19]$$

$$V_y = \frac{1}{E}\sqrt{\frac{W}{S_w} \cdot \frac{1}{\rho \cdot C_L}} \qquad [20]$$

These are the formulas of current use for the calculation of both the horizontal and vertical speeds of a glider in a linear and uniform flight.

28. Minimum Horizontal and Vertical Velocities.

From the previous relation, for the wing loading W/S_w and the air density at a constant altitude, at any given value of attitude C_L, we have velocities V_x and V_y. Of all these values, the only ones of interest in the case of the glider are the minimum horizontal speed, the minimum vertical speed, and the top speed in a dive. The minimum horizontal speed can be easily calculated from formula 19 with the maximum coefficient of lift C_{Lmax}.

$$V_{x\,min} = \sqrt{\frac{W}{S_w} \cdot \frac{1}{\rho} \cdot \frac{1}{C_{L\,max}}} \qquad [21]$$

To determine the minimum speed of descent, formula 20 is written

$$V_{y\,min} = \left(\sqrt{\frac{W}{S_w} \cdot \frac{1}{\rho}}\right) \cdot \frac{1}{E \cdot \sqrt{C_L}}$$

In this equation, we know that the factor that is rooted is constant for a certain altitude. It follows that velocity V_y is dependent on the factor $E \cdot \sqrt{C_L}$.

The Power Factor

The velocity of descent V_y will be lowest at an attitude where the factor $E \cdot \sqrt{C_L}$ is at a maximum value. This is because

$$E = \frac{C_L}{C_d}$$

thus

$$E \cdot \sqrt{C_L} = \frac{C_L}{C_d} \cdot \sqrt{C_L} = \frac{C_L^{3/2}}{C_d}$$

In other words, the velocity of descent will be at its lowest when the factor

$$C_L^{3/2}/C_d$$

is at its maximum. This is called the power factor, since the power required to maintain horizontal flight at any given attitude is inversely proportional to it.

29. Top Speed in a Dive

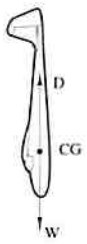


Figure 5-4

In the flight attitude shown above, the aerodynamic force F is in the direction of the trajectory since $C_L = 0$. Thus F is directly in line with D and equals the weight W. The equations are $W = D$ and $L = 0$, thus

$$W = C_d \cdot \rho \cdot S_w \cdot V^2$$

The velocity on the trajectory coincides with the velocity of descent V_y, so $\varphi = 90°$, $\cos\varphi = 0$, and $\sin\varphi = 1$, therefore

$$V_y = V \cdot \sin\varphi = V$$

$$V = \sqrt{\frac{W}{S_w} \cdot \frac{1}{\rho} \cdot \frac{1}{C_{do}}} \qquad [22]$$

where C_{do} is the coefficient of drag at zero lift.

This top speed is important for safety considerations of the airplane's structure. Aerodynamic brakes have been used, if the top speed reaches a value that can compromise the glider's structural strength.

Construction Notes

In the process of tweaking his Falco, Jim Petty has had a consistent problem with the landing gear circuit breaker popping on gear retraction. This doesn't happen on the ground, and by a process of elimination, Jim has come up with a very good theory about what is causing the problem. He thinks that at low speeds and full take-off power, the swirl of air around the airplane causes the nose gear tire to turn as it retracts, the tire hits the screwjack and the system jambs.

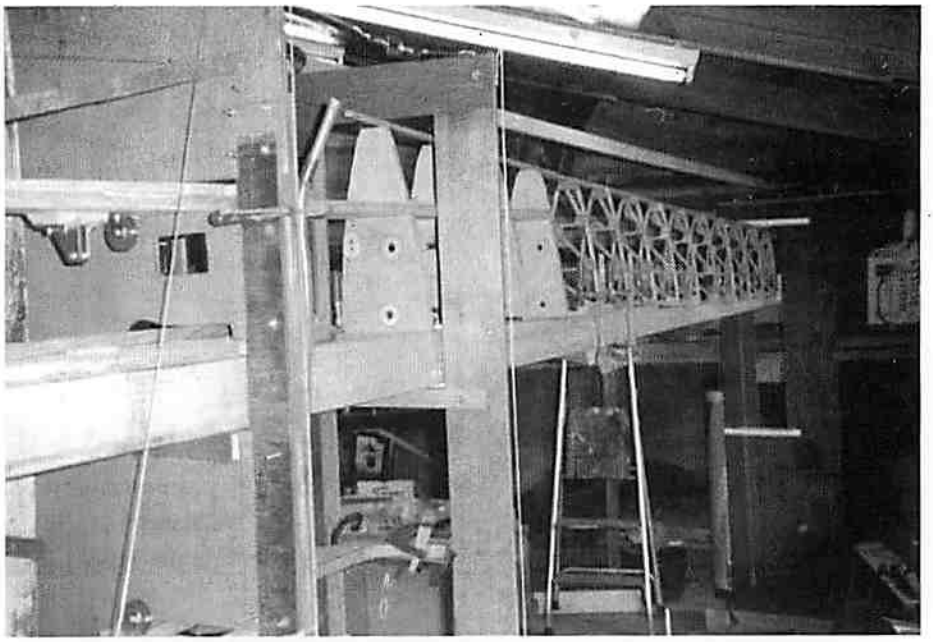
As further proof, he has found that if the circuit breaker pops, once in level flight if he extends the gear part way and then retracts it again, it will jamb, but if he extends it fully (which causes the gear to straighten up with the rudder pedals) and then retracts it, it does not jamb. In recreating the problem on jacks, he finds that the system jambs with only a single turn left on the screwjack. Additionally, Jim says his nose gear swivels freely since he did not tighten the nut at the top of the trunnion.

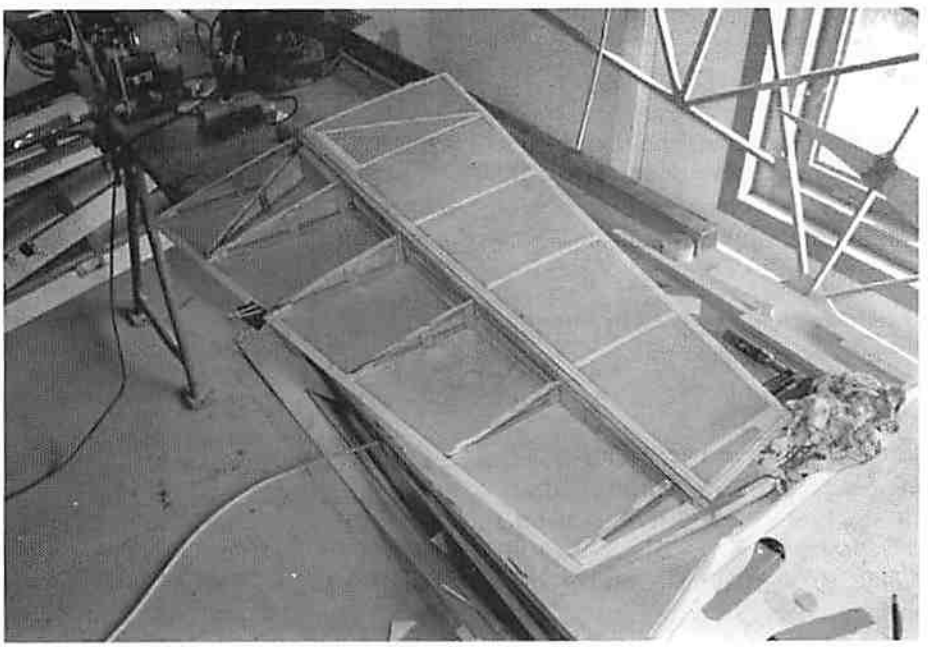
I've been hearing about circuit breakers popping on Falcos for years, but it has always been a sporatic problem, and we have never be able to isolate the reason. For the first time, I think we can now understand what is happening and thus take corrective actions.

By far, the simplest solution is to tighten the nut at the top of the trunnion so that there is a moderate amount of friction in the steering action. That involves no additional parts, and no additional weight. The extra friction is not something you would ever notice while taxiing because you have an enormous amount of power in your feet.

Second, because of the pattern of the popping circuit breakers in the landing gear system, we should all develop a certain amount of paranoia for this and check the circuit breakers before extending the gear, or confirm that the landing gear has been extended when you select gear down. Perry Burholm recently had precisely this problem and landed with gear up because he did not notice that the circuit breaker had popped on retraction.

Perry thinks his problem was related to the gear-up limit switch and says that the mechanism that he devised to kick the gear straight (see page 11, 12/94 FBL) will work even if the landing gear is turned fully left or right before retraction.



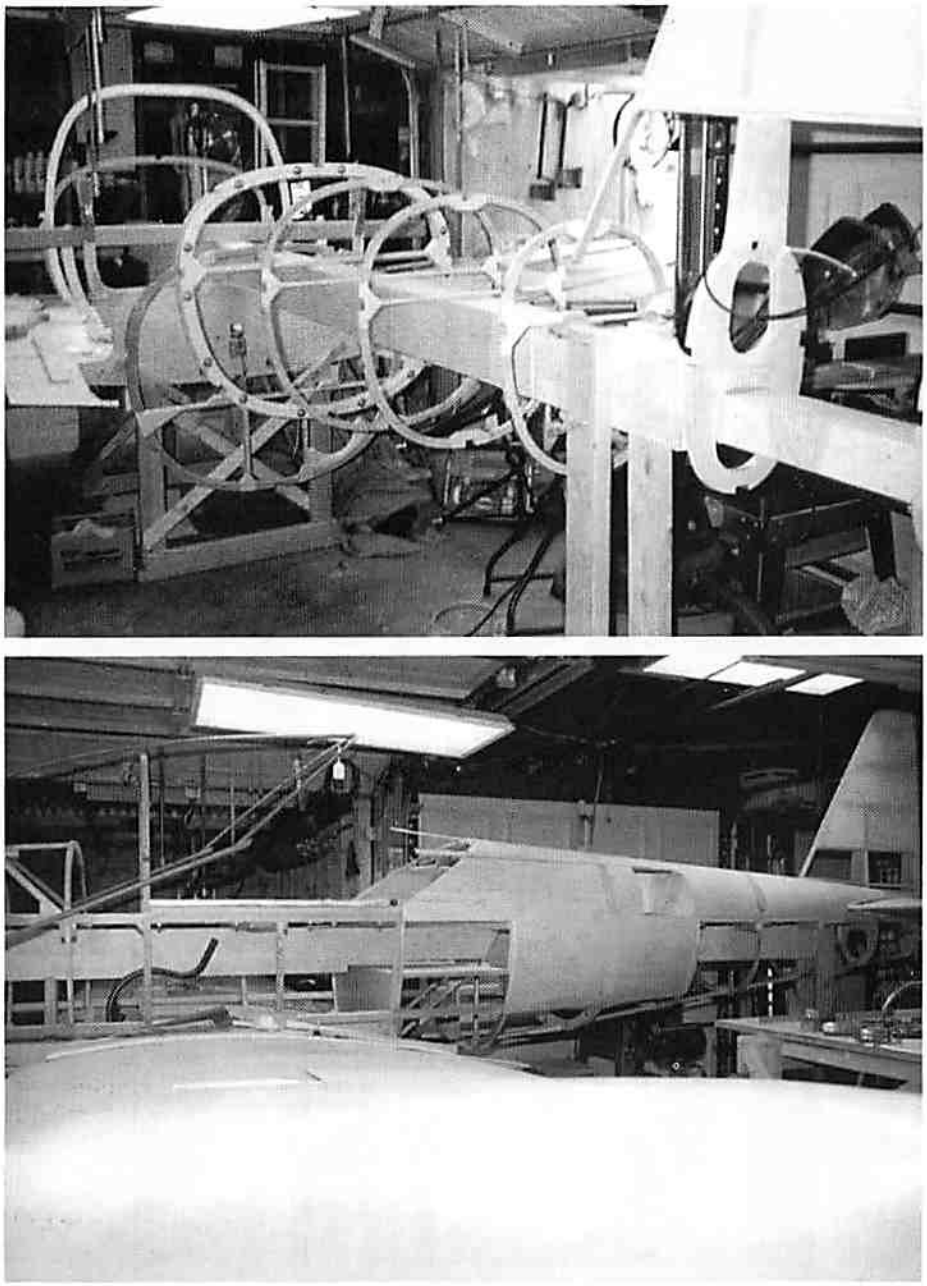


International spruce. Top: Richard Marks' wing takes shape in England. Above: Fedrigo Gilbert's rudder ready for closing in France.

Since developing this theory, Jim has since confirmed that the nose wheel tire is jambing because he is able to retract the gear without difficulty if he kicks the gear straight first.

Jim and I are going to put some think-time into the design of a mechanism that will straighten the nose gear on retraction. There are a couple of obvious methods of solving this problem, but I am inherently suspicious of complicated mechanisms. Bob Bready solved this by riveting two straps of stainless steel to the bottom inside of the cowling. There strips are about .75" wide and are made of the same material as the firewall. Bob bent the straps back onto themselves to make a vee-shaped spring. When the landing gear is retracted, the nose gear rocker arms hit these springs and kick the nose gear straight.

Stelio Wilkinson faxes, "If anybody out there is scrupulously following my how-to-do-an-annual summary—poor fools—here is one more item that I have discovered properly should be done at an annual. I understand that this ultimately is discretionary, but Bendix recommends that at least every 100 hours, the fuel strainer in the Bendix RSA fuel-injection body be removed, washed in solvent (MEK, typically), blow-dried and replaced. I assume that virtually all of us have fuel-injected engines with Bendix fuel servos mounted. The fuel screen is accessed on the side of the RSA opposite from the throttle linkage, down low, next to the pivot point of



Bob Brantley's fuselage takes form in Santa Barbara.

the mixture linkage.

Steve Wilkinson has been trying out fuel totalizers that interface with GPS and loran for an upcoming *Aviation Consumer* article. He has bought a Shadin Microflo-L and borrowed a similar unit, the FP-5L, from Electronics International. The Shadin device has been the unit of choice for Falco builders.

Steve's basic conclusion is that the Electronics International unit is a fine alternative to the Shadin despite its "kit-plane" appearance and reputation. It's considerably cheaper, at least superficially is of higher quality, and appears to be better thought-out. The Shadin still offers the advantages of readouts in tenths of gallon (most of the EI unit's are in whole gallons) and of the two readouts at all times (fuel flow and fuel remaining, for example) to the EI's one. Installation of each is pretty easy, he says.

Also from Steve: "Another nice little addition I've made to the airplane is a 'custom duct' that fits between the air filter and the throttle-body inlet. Since that juncture has to be removed every time you take the cowl off to change the oil, after a while the stock SCAT (or whatever it is) tubing begins to unravel, and you have that awkward situation of trying to get the sproinging, Slinky-like wire onto the inlet and under the hose clamp, etc. It's a pain in the ass. But there's a guy out in Pendleton, Oregon, who makes 'custom ducts,' which are simply SCEET tubing (the high-quality, rubberlike orange ducting) onto which he vulcanizes permanent ends, once you've told him exactly what length and diameter you want. It's not cheap—a 10" length 3" in diameter cost me $35 (a little over $30 for the duct and the balance for shipping)—but it's very classy and solves a problem."

"His name is Tom Franke, the company is Custom Duct (they have a little ad in *Sport Aviation*), and his phone/fax is (503) 276-4588. He works as an A&P during the day, so you leave a message and he'll call you back in the evening or morning. Unfortunately, he doesn't take credit cards—check or COD only. For the specific application I outlined above, I would suggest a 9" length rather than the 10" I got. The heavy-duty SCEET tubing is not as flexible as SCAT, so it's a bit of a push to get the full 10" into place once you've got the lower cowling on."

Stephen Friend said that his mechanic noticed that his ignition switch was not hooked up correctly, with the result that the right magneto is not grounded when the starter is activated. In our wiring diagram, we show that the R terminal is grounded when the switch is in the 'start' position, however I had always assumed that this was an internal link. Apparently it is not.

The diagram for the switch shows eight terminals, while the switch actually has nine. There is an extra, unmarked terminal beside the R terminal that is grounded in the 'start' position. In addition, I note that the package for the switch includes a two-hole link that is apparently provided for this purpose. In checking the switches we have on the shelf, it is apparent that the R terminal is not grounded in the 'start' position and therefore must be linked to the adjacent, unmarked terminal to operate as it should.

Stephen Friend also mentioned that the problem with his artificial horizon was that he bought it in 1992 but didn't fly it until 1995. IFR's warranty for the instrument is one year from the date on the back of the instrument, and they point out that gyros should be put on a 'scorsby' every six months until you are ready to fly the airplane. They say that any aircraft shop will have a scorsby. What happens to the gyros if you let them sit too long in one position is that the oil on the bearings drips to the bottom of the bearing. When this happens, the balls in the top of the bearing dry out.

Bending the Wing Leading Edge Skins

by Bob Brantley

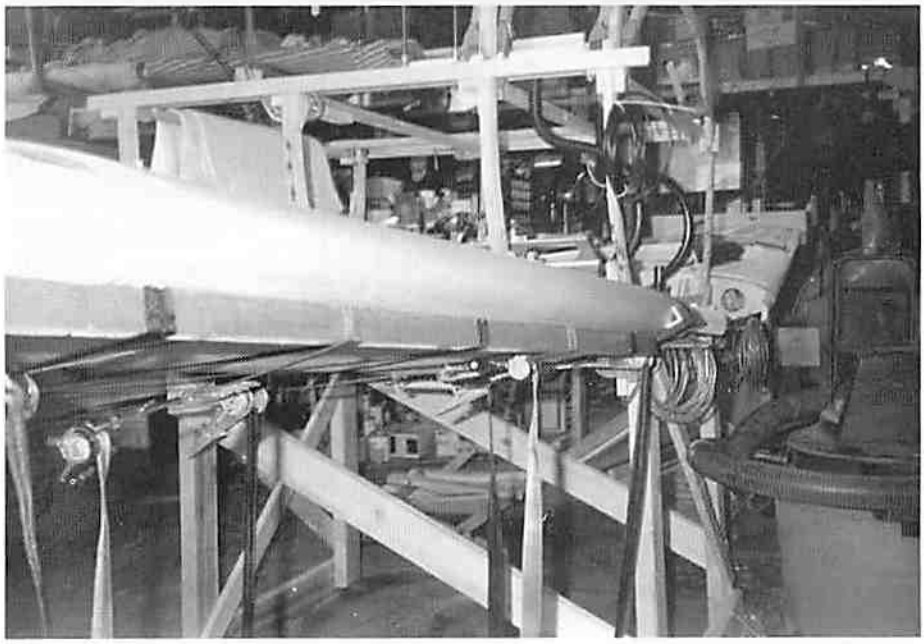
When I skinned the top of the wing panels, I departed from the system described in the construction manual. I had such good luck with skinning the stabilizer and vertical tail with the method used by Craig Bransfield that I felt it should also be used on the wing.

After all of the bottom wing skins were glued in place, I removed the wing from the vertical position and placed it in the horizontal position—making sure to level it in both directions and jig in the proper amount of wing washout. I glued two-by-fours to the cement garage floor with construction adhesive, and attached the jigs to these with drywall screws to prevent any movement of the jigs after the alignment was made.

The plywood skins were cut to proper width and a 3/4"x1" piece ripped from 1"x6" fir was glued to the front edge of the top side of the skin.

Five elongated holes were cut to correspond to the wing rib spacing to allow the passing of the webbing from web-style hold-down clamps. These clamps have a ratchet that will pull up the nylon webbing tight and are used as tie-downs for pickup trucks. I found them in my local hardware store, and they have been invaluable for odd clamping jobs.

The skin was glued and clamped, except right at the leading edge of the wing. After the glue had dried, I removed the tack strips from the leading portion of the rib area and installed the web clamps around the front of the skin, over the 3/4"x1" board, and around a stout 2x4 across the rear of the wing jig and fuselage jig.



Top: Steaming the leading edge.
Above: Pulling the plywood around the leading edge strip.

Using a wet towel and steam iron, I proceeded to steam the leading edge of the skin until it started to bend around the leading edge of the wing. Once the skin starts to become pliable, start tightening the web clamps to apply pressure and continue until the skin wraps completely around the leading edge. It took me about an hour to steam the 2.5mm inboard skins and 40 minutes on the thinner 2mm outboard skins. The number of plies of the wood can make a big difference in the amount of time it takes to steam the bend in the plywood.

You need to let the skins dry completely for two or three days before it will hold the rounded shape of the leading edge. To glue the skins, just remove the clamping pressure, pry back the skin, force glue between the skin and the leading edge strip, and reapply the clamping pressure. I used a 2" paint brush and epoxy glue for this operation just in case there were any gaps to be filled. After the glue has dried, remove the web clamps and use a razor saw to remove that portion of the extra wing skin with the 3/4"x1" board attached, and sand to blend to the bottom skin.

One nice thing about this method is that the bending jig is the wing frame. That is already made, and since you bend the skin around the piece that it is glued to, the fit is perfect.

Goings On at Sequoia Aircraft

I'm happy to report that the fuselage frames, which have been backordered for much too long, are now finished and shipping. Francis Dahlman always said he felt sorry for the people who took over the wood kit production, and insofar as that allows me to feel sorry for myself, I'm inclined to agree. But his methods were all based on craftsmanship—fitting each part carefully to the next.

We do exactly the opposite, cutting each part on a jig so that every part is exactly the same and so craftsmanship will play no part. The only problem is that laying out all of the assembly and cutting jigs has taken an enormous amount of time, but once done the work proceeds very quickly.

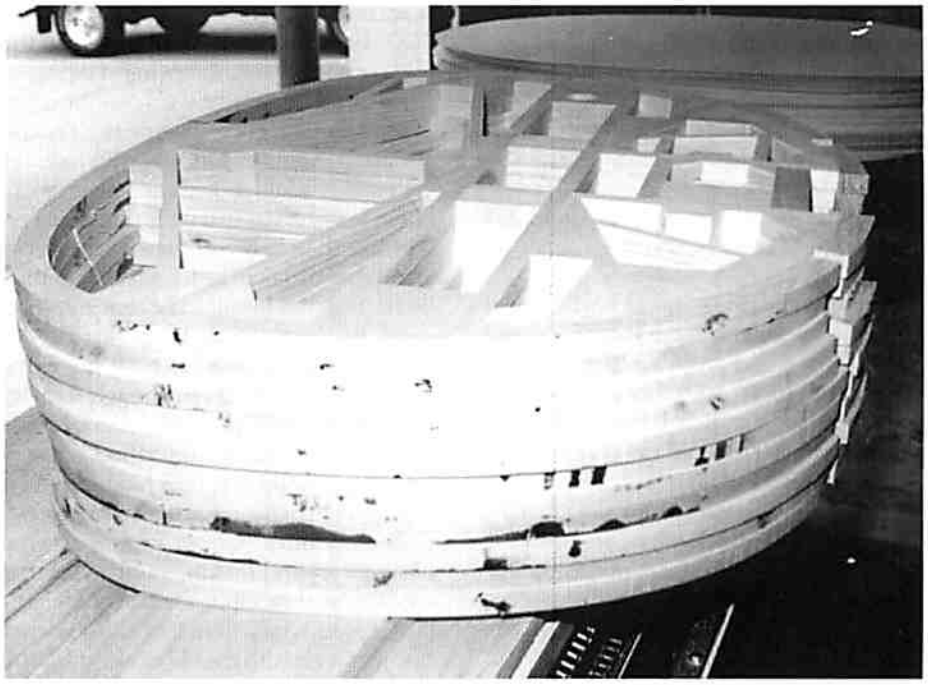
On frame 1, for example, Francis used to spend eight hours cutting, fitting and gluing in place the interior framework. It takes us 30 minutes. He fit each part into the laminated frame, we do not. Instead, we assemble the entire interior framework as a single assembly that's too big to fit in the lamination, then we have a cutting jig that we use to cut the interior assembly to fit in the lamination. All this happens on the inverted pin router.

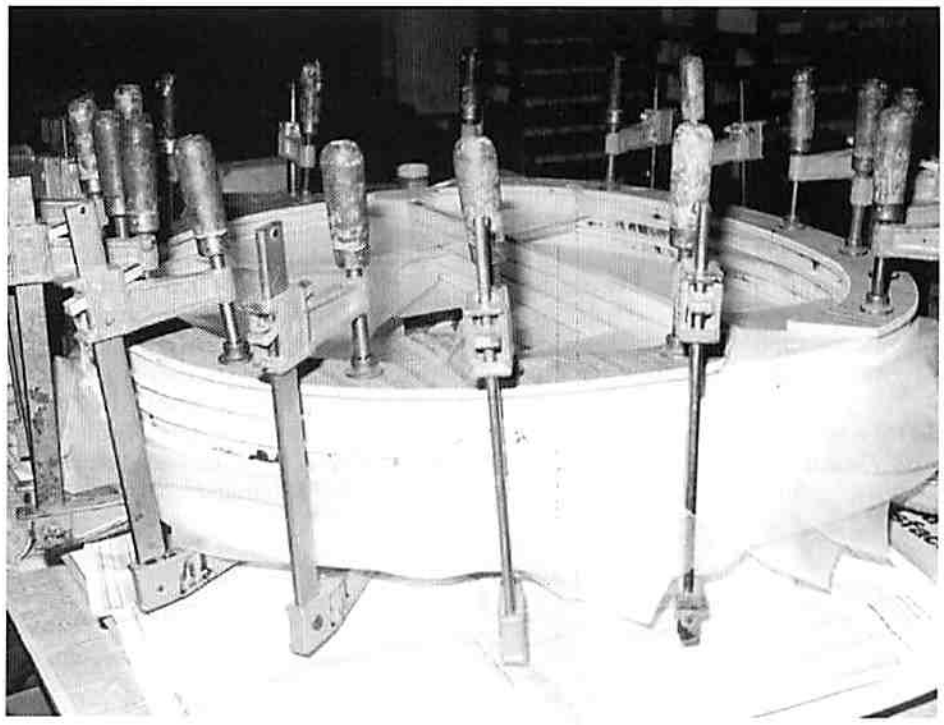
Then we have a separate jig to glue the lamination to this inside piece, and once we have a batch of ten or so, we take them to a woodworking shop where they're sent through a wide-belt sander and reduced to the finished thickness of 20mm.

The other frames are all rather straightforward except for frames 7 and 8. Because these are covered with plywood at the scarf joint that joins the identical left-right pairs, the scarf must be done accurately not only in slope but also position. This requires that we put the parts on the assembly jig, mark the overlap and trim down the scarf with an electric planer in a sloped trough-like jig.

In any event, the long delay is now over. I, for one, am very happy to have this behind me. I hate holding people up and this has been a very unhappy experience for me. I thank all of you for putting up with me and for your patience. Now all we have to do is produce another batch of wing spars!

—*Alfred Scott*





Top: A stack of fuselage frame No. 1 sanded and ready for shipment. Center: The plywood for frame No. 8 is glued on in a stack of five parts. Right: Herbert Müller's Falco looks as good as always.

If They Could See Me Now

by Stephan Wilkinson
Artwork by Richard Thompson

This article first appeared in the April 1995 issue of Air & Space *magazine.*

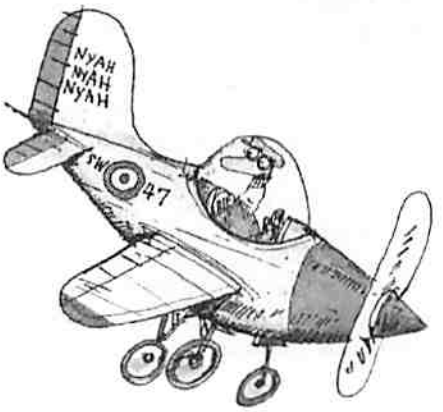
One glorious morning in 1945, when I was nine, our teachers at Yorktown Central School in suburban Westchester, New York, trooped all 300 of us out onto the grubby playground behind our single red-brick buiding. There we stood among the vicious iron jungle gyms and tooth-cracking swings—bewildered kindergartners, acne-plagued high schoolers, nose-picking fourth graders—with faces upturned like tiny white flowers while a navy blue Grumman F6F cavorted above in the bright April sky.

I have no idea who the pilot was. An alumnus, I suppose, though it could have been a student's father or even a young ex-teacher gone to war. For all I know it was part of a recruiting drive, though what the Navy would want with hormonally challenged high schoolers I can't imagine. But I remember the Hellcat chuttering back and forth, almost certainly doing nothing more dramatic than a couple of enormous egg-shaped loops and a few rolls, its R-2800 engine barking out the surprisingly truck-like sound of a big, slow-turning Pratt & Whitney radial.

This was no Bob Hoover demo, with the belly nearly brushing the ground and polished wings flicking through precise eight-point rolls. This was just a new ensign with 2,000 horsepower in his left hand and the reins of a worn-out, slab-winged old steed in his right. I'm sure he was breaking every aerobatics-over-a-crowd rule the Federal Aviation Administration—which didn't yet exist—would someday come up with, but at least he was in a navy that let its pilots take their fighters home for the weekend if the trip could be logged as a training flight. Boy, did I want to be that ensign.

I never was. Decades later, all my flying involved civil airplanes, though some of them were fast and powerful enough to give me an entirely unjustified sense of pride. I remember one clear morning coasting down the approach toward Westchester County Airport in a Westwind business jet and looking out the cockpit window at that same Yorktown Heights playground, which from that altitude was a tiny rectangle with the old cinder track still circling it.

I couldn't help but think that down there somewhere were all the one-time football players who used to make fun of me. "Collie-face" was one of the appellations that mocked my bookish phiz. Another athlete whacked me on that playground in front of my very temporary girlfriend, Marilyn Mincher, who had briefly adopted me as a toy because we'd appeared together in the high school play. Tony Lombardi resented that mightily, for Marilyn was captain of the cheerleaders and he the obese center of our farmboy football team. (I even got thumped big-time by Myra Tompkins, a tough girl on the schoolbus. You can bet word of *that* got around fast.)



I hoped they were all beer-bellied 7-11 clerks and washed-out supermarket cashiers reduced to watching "Geraldo" reruns as their window on the world, and I wished they could see me whistling over their heads in the left seat of a shiny executive toy that had more digits in its price tag than a phone call to France. (Of course, I didn't own it.) But they'd never know, and the fantasy remained just that.

Until a few months ago. Don't tell the FAA, but I buzzed the 40th reunion of my prep school graduating class. My airplane rattled the windows of Trinity-Pawling School, forced a time-out in the big homecoming-weekend football game, and figured prominently in the weekend's dinner-table conversation. This time, I made sure that Harris Lydon, the Class of '54's slickest dude, best drummer, and most accomplished ladies' man, knew that I was coming.

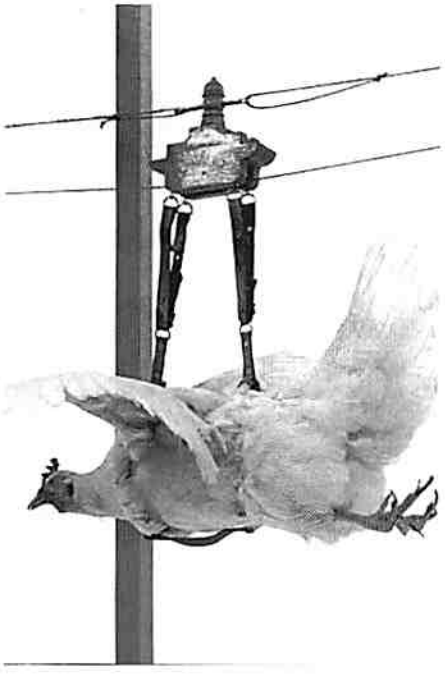
So when the little red and gray mock P-51 came out of the sun—don't they always come out of the sun?—and swept the length of the gridiron, leaving behind it the Merlin-like whistle characteristic of a Falco F.8L flat-out at 220 mph, Hare-Babe was able to yell, "Do you know who that is up there? That's Wilkie! *Steve Wilkinson!*"

"I'll be damned," muttered my old Latin teacher, his spine curved from age. ("He can hardly look at anything but the ground anyway," Lydon later told me, "but he looked up that time.")

Why isn't he here at the reunion if he can fly over it? some of my classmates might have asked. But I'm not much of a reunion guy. As Iris Dements sings, "Let the mystery be." If all they know of me now is that brief shining moment when the fighter-like airplane I'd built with my own hands stood on a wingtip in the sun, with me looking down at all the faces upturned like tiny flowers, that's enough. It may not be every pilot's lifelong fantasy, but it certainly was mine.

Sawdust

• Bored with Falco building and want to take on new challenges? Then order a copy of "The Teach Your Chicken to Fly Training Manual" from Ten Speed Press, P. O. Box 7123, Berkeley, California 94707. It begins with the 'history' of a group of visionary Californians who, during the period of 1940 to 1953, took sympathy on the plight of flightless chickens and decided to do something about it. They formed The Society for Rights for Inferior Birds, and invented an exercise machine to teach chickens how to fly. A complete Construction, Instruction and Training Manual was issued with each machine, complete with engineering drawings for the chickens as well as the exercise machines. The birds were supported in a leather harness, and suspended in flight attitude from a wire while they are wheeled back and forth. Below them cutouts of cities, trees and farms so the chickens will know what they will see when flying. There's an entire chapter on the pyschology involved and the use of audio-visual material so the chicken can hear the sounds of flapping wings and see other birds flying to the side. There's even a painting of Sigmund Freud with a chicken, indicating his interest in these birds which gave rise to the now widely used term "Freudian Chic." As with anything from California, there's instruction on how to massage the wing muscles of your chicken.



A training flight for Gregory Peck, the 'first aviator' to graduate.

• From *Airlines Magazine*: "The average pilot, despite the sometimes swaggering exterior, is very much capable of such feelings as love, affection, intimacy and caring. These feeling just don't involve anybody else."

From California—home of the VariEze, LongEze and Quickie—comes the new 'EZ' method of separating the tail cone from your Falco. Bob Brantley demonstrates.

• Top Gun and Bottom Gun. To our erudite list of readers, the Falco Builders Letter now adds actor Tom Cruise, since the original 'Top Gun' pilot now flies an SF.260 in his spare time. Cruise is originally from Louisville, as is George Barrett (hereinafter known as 'Bottom Gun'), whose sister-in-law is Tom's aunt. We just want Tom to know that he's welcome around these parts.

• Tired of high prices from Sequoia Aircraft? Rejoice, now there's a second source on engine mounts. Aircraft Spruce now lists Falco engine mounts in their catalogue, each made to order and without hardware or Lord mounts. There is, um, just this one little problem—their price is 24% *higher* then our normal kit price! If you want to buy the engine mount alone, please let us know.

• At the annual PFA Cranfield bash, Stuart Gane's Falco made its debut in finished form (there in primer paint last year) and scooped the Best Plans-Built Aircraft (effectively Grand Champion) award and the *Pilot* Trophy *Concours d'Elegance* (*Pilot* actually plays no part in the judging of that). Oh, what a beauty! Red with white trim, like the Norwegian one, with a surface finish you could easily use as a shaving mirror.—*Mike Jerram*

• Frati to Oshkosh! As we go to press, we've just heard from Mr. Frati that he is coming to Oshkosh for the Falco's 40th birthday party and also for the introduction of the Penguino/Sprint aircraft being introduced to the U.S. market by the Loprestis.

Calendar of Events

Oshkosh '95. Spend a week with the sexiest 40-year-old on the planet. Be sure to attend the Fortieth Birthday Party for the Falco. Expect a massive turnout—Marcello Bellodi is going to bring his Falco from Brazil, and Stelio Frati is coming. The EAA is reserving parking for Falcos, but you must arrive early. Falco Builder's Dinner is at 7:00 on Friday, July 28 at Martine's Restaurant at the Midway Motor Lodge in Appleton, Wisconsin. Contact: Susan Stinnett at Sequoia Aircraft.

West Coast Falco Fly-In. September 7-10 at Coeur d'Alene, Idaho. Contact: Larry and Ann Black, (408) 378-4857 or at 3945 Bucknall Road, Campbell, CA 95008.

The Great Oyster Fly-In and Gathering of Stelio Frati Airplanes. November 4 at Rosegill Airstrip, Urbanna. Contact: Dr. Ing. Alfredo Scoti at Sequoia Aircraft.

Susan's Corner

Oshkosh is almost upon us, and I, for one, am ready. I've been told that it will be a baptism by fire, but I'm still ready. You know what they say—"No guts, no glory!"

We expect 15-20 Falcos will be flying in, and for those of you that are flying, upon arrival, the EAA parking folks will direct you to our parking area on the flight line.

We have filled all 20 rooms at the Paper Valley Hotel and Mr. Frati will be joining us, so we should have a crowd. For anyone that needs to find me (or Alfred), the Paper Valley is at 333 W. College Avenue in Appleton, telephone 414-733-8000.

The dinners are all planned for around 8:00 p.m. Wednesday night will be at Victoria's, which is on College Avenue, just a couple of blocks from the hotel. Thursday night we'll be at the infamous "Road Kill Inn" (Dick & Joan's), which is at 220 N. Lyndale Street, which runs off of College Ave. Friday night for the big dinner, we'll be at Martine's Restaurant at the Midway Motor Lodge at Appleton. We'll get started at 7:00 with our private bar and dinner will be at 8:30.

I imagine by now everyone knows that we're not doing anything 'formal' this year—no booth or anything like that. Our plan is to see the show and mill around—swap lies and trade wives, as Alfred so eloquently puts it. I expect that with the number of flyers, builders and Mr. Frati in attendance, there will be no lack for good conversation.

And for other news, we have full sets of fuselage frames at long last, and have been shipping out those that were backordered. I know Alfred appreciates everyone's patience while this project has been underway.

We're starting to prepare to begin more main wing spars, as the last five of those are now gone.

It's been a busy spring and early summer, but that's always a nice problem to have. Alfred and I both, have been 'hand over fist' with projects on our "to do" lists, but it keeps him off the streets and me out of the Bingo halls, so who's to complain.

That's all for now—see you at Oshkosh.

—*Susan Stinnett*

The Falco turns 40. Where were you on June 15, 1955, when the Falco first flew? Eisenhower was president, and a 36-year-old Stelio Frati had just designed one of the greatest single-engine airplanes of all time.

Mailbox

I feel compelled to comment on Mr. Glyn Russell's statements in the March '95 newsletter regarding glues used in wood aircraft construction. Mr. Russell's statements about T-88 are without merit. He states that the use of T-88 disallows painting the aircraft any color other than white. Mr. Russell bases this statement on what appears to be a very unscientific test, which, frankly speaking, resulted in erroneous assessments of the performance of T-88.

Were Mr. Russell's test block(s) constructed as specified in the Falco builders manual? Did he make multiple test blocks and conduct other tests (cold, normal, wet, dry) with the same glue batch? Did he mix the T-88 properly? Mr. Russell did not indicate anything about multiple tests, yet he informs other builders of his expertise based on one test with his wife's oven, and draws his own conclusions and recommendations.

I have discussed T-88 and its performance with the manufacturer, System Three. Additionally, I have conducted my own tests, and am familiar with 'all wood' aircraft built using T-88 as the primary bonding agent. T-88, notably, is a superior epoxy system which has been in use over 20 years with no known failures due to heat (from the sun). While it no doubt is a good idea to keep surface temperatures low with white paint, it is not a necessary requirement when using T-88. Falco builders take note: wood is a superior insulator of heat. If you measured the skin temperature on Karl Hansen's beautiful bright red Falco in the hot California sun, you would note that it is very warm, upwards of 130+ degrees. Hot indeed. However, if you measured the skin temperature inside the wing (the wheel well, for example), you would note quite a difference. The approximate inside skin temperature would be far less than 100°F—about 85°F. This change in temperature is a tremendous advantage to the builder wishing to use a darker color in the paint.

It is interesting to note that the Falco camp leans towards Aerolite as their glue of choice, or so it seems. One of the components of Aerolite is, of course, water, which, during the bonding process, evaporates. This in turn causes localized 'hard' spots due to increased grain density caused by shrinkage of the wood at the joint. This by no means compromises the integrity of the bond, but rather is visable (cosmetically) even with the very best of paint jobs. Understand, however, that Aerolite is a good glue and definitely has its place, but it appears to be inferior to the available ep-

oxy systems (and Aerolite, as you know, is incompatible with epoxy, thereby increasing the complexity of the job.)

Indeed, all the glue systems available have their strong suits; their performance varies with the application. While my intent here is not to further this controversy, but to point out that one should be very thorough in one's investigation of glue performance before disseminating data to the building community. After all, wouldn't you be disappointed to learn that your beautiful white Falco, which you have been flying could have been even more impressive painted red (which you desired in the first place) with no impact on structural integrity?

Michael Traud
Gold River, California

My goodness, glues sometimes take on religious qualities. I thought the thermoplastic characteristics of T-88 and other epoxies were well-understood and accepted. Glyn simply was confirming what had been shown in other tests and was doing it for his own understanding of the situation.—Scoti

After making all of my brackets for the Falco it appears I have enough material left for one more plane. If you know of someone else going this route, please give them my name as a source. I have all extrusions in the plane except seat tracks. My office number is (713) 937-2554.

Kirk Jensen
Houston, Texas

I saw a little note that someone said you do not need an 'annual' because it is not really the same as an annual. I guess you could say I have a 'yeah, but' to that. Operating limits do require an annual compliance inspection to be done either by an A&P, the original builder with a repairman's certificate, or by an FAA Certified Repair Station. At the very beginning of Part 43, it says that this part does not apply to experimental aircraft, but your operating limitations tells you that the annual compliance inspection has to be done using Part 43, Subpart D as a guide.

So we come into the back door to Part 43, Subpart D only for the annual. Subpart D has exactly the same requirements for an annual inspection of an Amateur-Built or a type-certified aircraft. It would be a mistake for the owner of an amateur-built aircraft to think they did not need an 'annual', even though it is called an annual compliance inspection.

We have been fortunate in receiving several sets of Falco plans here from builders who did not quite make it—they are still among the best in the industry.

Ben Owen
EAA, Oshkosh
Wisconsin

Top: Dave McMurray's Falco at Lakeland, where it won Best Wood Aircraft. Above: John Devoe takes to the air on June 22. "It's a Falco... light as an autumn leaf upon the water... a filly, not a stallion... goes where you point it, lands where you put it. An absolute delight to fly solo."

In July 1994, I wrote to Sequoia requesting information on the Falco, which you kindly dispatched quite quickly. You supplied the names of two other New Zealand builders, and it transpired that Syd Jensen wished to sell his Falco.

After making initial contact with Syd, I arranged to pass through Taupo and to take the Falco for a trial flight. Needless to say, this was a thoroughly enjoyable experience. After a certain amount of discussions over price, we came to an agreement, and in mid-March the aircraft (ZK-TBD) was relocated from Taupo to Rangiora, an airfield 25 miles north of Christchurch in the South Island of New Zealand.

I am very pleased with the Falco, which is a delightful aircraft to fly. I had the preconceived notion before I flew it that it might be 'hot' and not suitable for a low-hour pilot. However, it is very difficult to find any fault with the Falco at all, and it is the most pleasant aircraft to fly, very docile and without vices that I can find. I now have the pleasure of knowing that I can take to the air at any time the weather and considerations allow and enjoy the experience of this lovely aircraft. The Falco is very much a pilot's aircraft and a real credit to both its

designer, Mr. Frati, and its builder, Mr. Jensen. I thought you may like to know that a Falco has changed between careful hands!

Graham Hodge
Christchurch
New Zealand

I am enclosing some pictures of the North Alabama Rollover Party which we had on June 10. Family, church friends and neighbors came in and helped me with the rollover project, which did not turn out to be as big of a job as I had anticipated. I had been dreading it for several weeks, but my fears of dropping the airplane and breaking something permanently were in vain. We had a cookout after the rollover which was enjoyed by all.

I had an exasperating problem in trying to get the crimping tools for the electrical system. I talked to George Barrett who was very helpful in giving me information about the AMP tool numbers and also the AMP customer service number. I called AMP and got the numbers for their local distributors in Huntsville, Alabama. After calls to two of them, I learned that they could order the tools for me. Cash in advance and 8-to-10 week lead time. I called AMP back and asked them to look into their computer and see if they had a distributor who is large enough to have the tools on the shelf. In a moment they gave me the name of Newark Electronics and told me the quantity they had in stock. Ain't computers wonderful? I called Newark and placed an order. They were extremely courteous, took my credit card, shipped by UPS, and I had the tools in two days. What a relief to get past this nuisance!

I wanted to share this information in the FBL so that builders in the future will not have this problem and waste valuable time searching for these tools. Much better building than searching. Here are the numbers: AMP customer service: (717) 987-7777. Newark Electronics: (800) 367-3573. AMP part numbers: 169400 and 169404.

Glyn Russell
Hartselle
Alabama

I have been making good progress over the last several months and thought it was time to give you a project report. To date, the fuselage tailcone has been cut off from the cockpit and wing. The canopy frame is fitted with only the dorsal fin and hardware to be finished after the tail section is re-installed. The motor mount, firewall and motor mount angle braces are all fitted. The nose gear and main landing gear is installed with the retraction motor in final position. The inverted fuel tank is installed, and I have started to fit the rear fuel tank. The battery box is completed but I still need to fit the door. The cockpit floors are installed. I will be working on the seats and the instrument panel when those kits arrive. I must say that the light at the end of the tunnel is now visible even though it's a very faint glimmer.

Bob Brantley
Santa Barbara
California

Top: Glyn Russell's rollover party.
Above: Clive Garrard, David Nowill, Gordon Blunt and friends turn their Falco over.

David Nowill, Gordon Blunt and I have been working on our Falco for almost four years now, making all parts if at all possible—mostly for the fun of it. We've now come to the end of the manual, sawn the tail off and trial hung the engine. Two weeks ago we rounded up eight fellow Leicestershire Aero Club members and put the fuselage into its first half loop.

We all know what the first question any non-builders ask is, but the second one we always had was "How are you going to get it out of here?" This was especially true before we stood the tail on end, in the corner of the workshop. However, I had drawn the shop and aeroplane to scale and checked that we could wriggle it out—but there's nothing like doing it for real!

Clive Garrard
Leicestershire
England