

Falco Builders Letter



What's a Norwegian Falco doing at Oshkosh?

Oshkosh

Cats have a strange way of showing affection. They'll kill a rabbit, squirrel or bird and then arrange the choice pieces and organs in an ornate display at the doorstep of their most beloved human. To us it's disgusting, but the pieces are all carefully laid out, often in symmetrical arrangements of innards, guts and gristle. To the cat, they are offering a feast of the choicest parts, to us it's all something we'd rather not look at.

I thought about cats as I wandered among the show planes of Oshkosh. Here and there are displayed the innards and engine compartments of otherwise attractive airplanes. Who really wants to look at the aeronautical intestines, gizzards and craw of an airplane?

There was an SX-300 at Oshkosh that someone had spent 11,000 hours a-building, quite obviously salivating at the glories of winning the coveted Grand Champion award. It was an airplane whose only purpose was to win an award. The rocker arm covers were gold-plated. The inside of the cowling was painted to match the exterior and waxed to a high gloss. Every screw that could be polished was polished. The aluminum tubing for the instrumentation was

polished to such a high gloss that it appeared to be chrome-plated, and it was painfully obvious that the builder had invented parts just so they could be polished.

For example, all airplanes have the problem of how to get wires from the firewall to the alternator. All sensible builders just bundle the wires neatly and ty-wrap them in place. But not on this SX-300. Oh, no. They ran an aluminum tube along the inside of the cowling above the Camloc receptacles. Each end of the tube was flared—*nice touch, don'tcha think, judge, 'cause that way the ends of the tube won't cut*

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the wires, see—and then the entire tube and cable clamp assembly was polished—how 'bout that, judge, see all that polishin'? Eleven thousand hours of building, polishing and inventing parts to be polished. I wanted to bore-scope the tube to see if he had polished the inside.

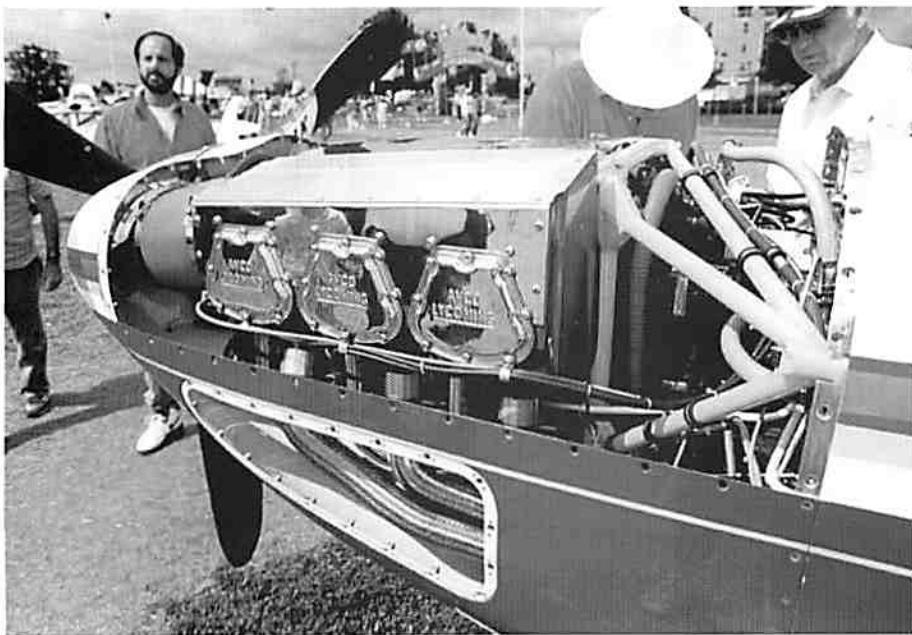
It was just like cats. All these pieces of airplanes that you'd rather not see laid out in an elaborate display. Some builders show up at Oshkosh so intent on winning The Big Prize that they bring along an entire Amway platoon to wax and polish the plane, which they stake out with flagged ropes, and erect stands to hold the photo albums. To fit in with this crowd, Lyndon Johnson should have put makeup on his belly before he showed the world his gall bladder incision.

Fanie Hendriks came all the way from South Africa to see the Oshkosh show, but more particularly he came to see a real Falco, something he'd only seen in photos and major parts of which occupied his workshop. He'd heard his friend Brian Nelson tell of flying in a Falco and seeing them at the Great Oyster Fly-In, but he'd never seen one in real life.

Thus, imagine the surprise of Fanie Hendriks wandering among the generic 'glass of Oshkosh and seeing a red Falco with Norwegian tail numbers touch down and taxi quietly into the grass. He knew immediately that Falco LN-LCA belonged to Bjoern Eriksen. He had hoped to see a Falco, but never Bjoern Eriksen's Falco. He lives in Norway, for goodness sakes.

It took Eriksen 24 hours of flight time to get from Bodoe, Norway, to Oshkosh, Wisconsin. He had installed a 45-gallon ferry tank in the right seat, there was an HF radio mounted at the base of the stick and a GPS sat atop the glareshield. Other than that, it was a perfectly stock Falco that was flawlessly and lovingly built.

There wasn't a single part that was polished for the sake of appealing to an airshow judge, and Eriksen had not invented a single component to fulfill a fancied lust of airshow judges for glitz and glitter. At one



Top: Gold-plated rocker arm covers and a cowling painted on the inside.

Center: Eriksen's Falco with 45-gallon ferry tank and GPS on top of the panel.

Bottom: All of the white striping on the Falco is vinyl tape.



point, I spied a judge going over the Falco, and I asked him if the ferry tank would count against the airplane in the judging standards. "Quite the opposite," he said. "It shows the airplane was flown here."

"I'm rather surprised to see you here," I told Eriksen when I first saw him. "That was the idea," he grinned, and later he admitted that this had been a long-planned trip concocted in deliberate secrecy from Dr. Ing. Alfredo Scoti. He had planned to come the year before but was unable to get vacation time from his company during the Oshkosh convention. There were some last-minute administrative problems as the FAA instituted a moratorium on bringing Experimental aircraft into the U.S. The EAA was very helpful and got the FAA to lift the moratorium for amateur-built aircraft. (The moratorium, which has since been lifted, was instituted because of the flood of inexpensive surplus Eastern-block jets being imported by warbird collectors.)

On arrival at Oshkosh, Bjoern called his wife Torill back in Norway and told her to get a ticket on KLM and that she could not miss the show. Torill was there when I saw them on Monday, and both of them were decked out in matching "Flight of the Falco" teeshirts with a map of the route of flight. Hmm. You'd have to make those teeshirts well in advance. Norwegians are a frugal lot—maybe Bjoern didn't want to squander the money on an airline ticket until he was safely across the Atlantic.

It was quite a long flight, over lots of water, but Bjoern said it was all routine, as the trip



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home later proved to be. The longest leg was from his home of Bodoe, which is above the Arctic Circle, to Iceland. That was 1,000 miles, and it took about six hours, if I recall correctly. With the GPS, Bjoern knew where he was at every moment and says he would never consider a flight like this without the GPS. He also had an HF radio with the antenna wire strung along the aft wing spar of the right wing, so communication was no more of a problem than navigation.

It didn't surprise anyone that Eriksen's Falco was in contention for an award. He had previously won the top award at the Wroughton Fly-In in England. Charles Gutzman, whose Falco had earlier won Reserve Grand Champion, circled Eriksen's Falco and said it was better than his plane. And a judge commented to me that it was the best Falco he had seen. In the end, if you haven't already heard, Bjoern Eriksen walked off with the Grand Champion (Plans-Built) award.

No airplane is without flaws, but in going over the Falco, there were only two things that I could point to and say, "See, that's not perfect." The aft third of the wing fillets were made of plywood, and if you sighted down the wing fillets at just the right angle, you could see that there was an area in which the ever-changing shape became a flat-wrapped section. And on the fairing around the bottom of the windshield, if you caught the reflection of the sun at just the right angle, you could see the weave of the fiberglass. That's how near perfect the airplane was.

The thing that 'said it all' to me was how the Dzus fasteners on the cowling doors worked. It's difficult to get these to work properly on a Falco, and they're normally tight and difficult to turn. But on Eriksen's Falco, they all turned easily, and every one was exactly the same. And when you looked in the engine compartment, it was spotless. I asked Eriksen if he had cleaned the engine compartment. He said he had not, that he had just flown across the Atlantic and parked the airplane. In looking at it closely, I could see that there was a very slight haze of carbon dust on the top of the induction filter that came from the exhaust line of the vacuum pump.

After he won the award, I asked Eriksen if he didn't stop in Canada and spend a day cleaning the airplane in preparation for Oshkosh. Nope, he said, he just flew across the ocean and landed at Oshkosh. Each morning, he went over the airplane with a soft cloth to remove any dust, but that was



Bjoern and Torill Eriksen with their Grand Champion Falco.

it. "But what about bugs on the leading edge?" I asked. "At ten thousand feet over the Atlantic, there *are* no bugs," he said.

Thus it was that Bjoern Eriksen, who built the Falco in a single-car garage in one of the more frozen climes of Europe, became the first international homebuilt to win the coveted Grand Champion award at Oshkosh, and the first to be built above the Arctic Circle. (The Swearingen ended up winning third place among kit-built aircraft.) Eriksen also set a record among Falco builders for the longest distance flown to get to Oshkosh.

Another unofficial Falco-builder record fell at Oshkosh, this one for flying the biggest airplane to Oshkosh. The previous record was held by Nick Tramantano, who flew a Flying Tigers DC-8 cargo plane to Oshkosh. Blake Jessen, however, has set a

record that will be quite difficult to beat when he arrived at Oshkosh flying a C-5A Galaxy. Blake gave Jack Amos, Cecil Rives and me a VIP tour of the machine, which is enormous beyond description. Blake used about 25,000 gallons of fuel for the one-way flight from Travis Air Force Base in California. Let's put that in perspective: his round-trip fuel consumption is enough for Bjoern Eriksen to fly from Norway to Oshkosh 160 times.

I arrived at Oshkosh by Falco, Cherokee and good fortune. Jack Amos and I left Richmond in the Corporate Disgrace on a flight that seems as ordinary as any other. About 45 minutes out, the engine suddenly went very rough. I quickly switched tanks, checked the mags, pulled carburetor heat on and then flicked through the four cylinders with the Alcor CHT/EGT. One cylinder was cold, and perhaps a second



Top: Blake Jessen and his lil' ol' C-5A. Center: The Corporate Disgrace weeps oil. Bottom: What happens when an exhaust valve is digested.

one as well. This was obviously not a problem that was going to clear up with some knob twiddling.

Only a minute or two before, we had crossed the Shenandoah Valley airport, at Harrisonburg, Virginia. We were at 8,000 feet and the weather was clear, so I turned back to the airport while Jack scurried about looking for the airport frequency.

I've always operated on the understanding that engines rarely fail without previous warning and that the vast majority of engine failures occur on a power change. So on those few occasions when I've had a problem, I always maintain altitude and fly over the airport, then reduce power and land. This is the approach I used here, and I throttled back only when I was safely within gliding range of the airport.

Other than the conversation with the airport unicom, the rough-running engine and the high approach speed I used, it was a normal landing, and we taxied by the airport fire truck with the engine stumbling irregularly. I had told them that I didn't need any emergency equipment standing by, but they just had to fire up the truck anyway. It was the biggest excitement the airport had seen for months, and you wouldn't want to spoil it all by being too cool.

Oil was streaming from the right rear cylinder, and we left the Falco in the care of the local FBO, Classic Air, while Jack and I continued on in a rented Cherokee 140. The Cherokee was a "hot" machine, with a new 160 hp engine and speed-mod wheel pants. My Lord, it was slow. On most of the trip, we rarely saw more than 90 knots groundspeed, and once or twice in a thermal actually saw 600 fpm on the rate-of-climb.

On our return, we learned that the Falco's engine had swallowed an exhaust valve and that the piston and cylinder were a complete mess. It took several weeks to get a new jug, but it's back in the air now.

How long it would have run is anyone's guess, but we were losing oil out of the cylinder and at some point the engine would have seized from lack of oil. Classic Air's Richard Kiser said we were only five minutes from becoming "a short-winged glider" when we landed. Everyone agrees that it could not have happened at a better place. Ahead of us were the Allegheny mountains where there's almost no place to land, and further on we would have crossed Lake Michigan. For a bit of bad luck, it certainly came at a lucky time.—Alfred Scott

The Glider

Part 4 of a Series

by Dr. Ing. Stelio Frati
translated by Maurizio Branzanti

This is the second installment of Chapter 3, in which Stelio Frati discusses the fundamental elements of aerodynamics.—Alfred Scott

Chapter 3 Elements of Aerodynamics

13. Charts

To aid in the understanding of aerodynamics, it is helpful to show the characteristics of an airfoil in orthogonal or polar charts. Since the coefficients C_L and C_d are always less than one, their values are multiplied by 100 in these charts.

Orthogonal Charts. In this type of chart, the coefficients C_L , C_d and E are functions of the angle of incidence α . On the vertical axis, we have the C_L , C_d and E coefficients, and the angle of incidence α is on the horizontal axis. Thus we have three curves relative to C_L , C_d , and E . To obtain the value of a coefficient at a certain angle of incidence, for instance $\alpha = 6$ degrees, you draw a vertical line from the incidence angle axis equal to the given value. And for all the points of intersection of this line with the three curves, you draw corresponding horizontal lines to determine the values for C_L , C_d and E .

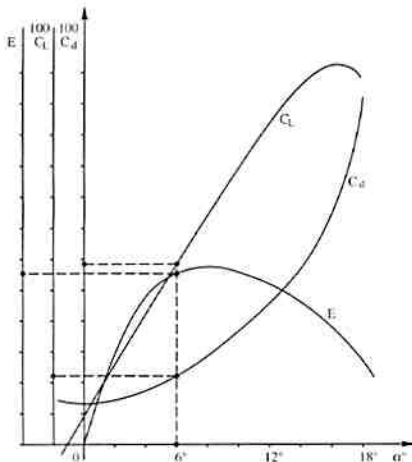


Figure 3-11

Polar Charts. In a polar chart, we have the value of C_d on the horizontal axis, and the value of C_L on the vertical axis. The values of C_L and C_d are given by a single curve called the polar profile, on which the angle of incidence alphas are marked.

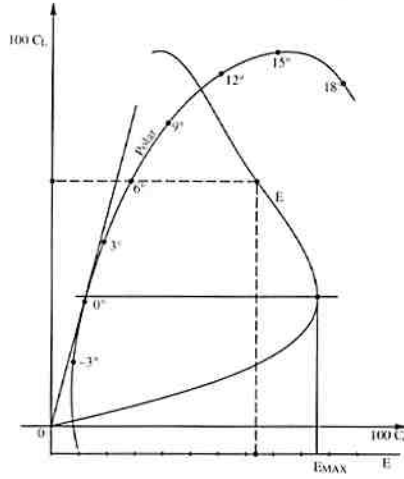


Figure 3-12

To determine these values for a certain incidence, for example $\alpha = 6$ degrees, on the point on the curve corresponding to that incidence you draw two lines, one vertical and one horizontal. The value of C_L and C_d are read on the proper corresponding axis.

A feature of the polar profile is that the point of tangency with a line drawn from the origin of the axes represents the angle of incidence of maximum efficiency.

The curve of the efficiency E relative to C_L is also shown in the polar chart. At a given angle of incidence, its value is obtained by drawing a horizontal line that will intersect the E curve. At this point of intersection a vertical line is drawn, and the value is read on the proper scale.

14. Moment of an Airfoil

To establish the position of the center of pressure, we first determine the moment of the aerodynamic force F with respect to a point on the airfoil. By convention, the leading edge is used. The moment and the coefficient of moment C_m are determined in a wind tunnel as was done for lift and drag.

The moment M is:

$$M = C_m \cdot \rho \cdot S \cdot V^2 \cdot c \quad [5]$$

where

- c = chord of the airfoil
- C_m = coefficient to be determined

Having found the value for M by various measurements in the wind tunnel, the coefficient C_m will be:

$$C_m = \frac{M}{\rho \cdot S \cdot V^2 \cdot c} \quad [6]$$

where M is measured in kgm and c in meters.

Having found the moment, we now establish the position of C.P.

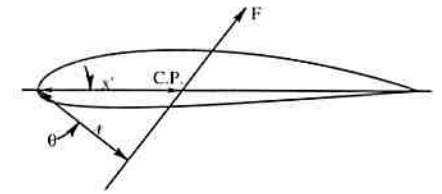


Figure 3-13

Let's consider the force F and its moment with respect to the leading edge. We can calculate the arm length x from F since

$$M = F \cdot x$$

then

$$x = \frac{M}{F}$$

The position of C.P. is given by x' which is equal to

$$x' = \frac{x}{\cos \theta}$$

For normal angles of incidence, angle θ is very small so we can substitute L and F , giving

$$x' = \frac{M}{L}$$

and substituting M and L we will have

$$x' = \frac{\rho \cdot S \cdot V^2 \cdot C_m \cdot c}{\rho \cdot S \cdot V^2 \cdot C_L} = \frac{C_m \cdot c}{C_L}$$

If we would like to express the position of C.P. in percent of the chord as it is usually expressed, then we have:

$$\frac{x'}{c} = \frac{C_m}{C_L} \quad [7]$$

In conclusion, we can say that the position of C.P. in percent of the chord for an airfoil at a given angle of incidence is given by the ratio between the coefficient of the moment C_m and the coefficient of lift C_L at that angle of incidence.

First Flight: John Shipler

Move over Larry Black, your record building time has been eclipsed by John Shipler, at least in terms of time from date of plans purchase to first flight. Here's a guy who bought the 13th set of plans we ever sent out. That was back in June 1979.

John had already built a 260 hp Skybolt, and he initially put the Falco project on hold until he sold the Skybolt. John didn't find any immediate takers for the Skybolt, so in October 1981 he began construction on the Falco. He ordered up the kits and started work. John always had high praise for the Falco plans and kits, and a steady stream of builders trekked out to his garage in Huntington Beach, California, to see the project.

John Shipler built the Falco in a cramped garage, and we used a photo of his Falco in our brochure to go with the line, "You can build it in your garage, but it wasn't designed in one." The Falco spent most of its construction time on a dolly, so John would wheel it around to make working space, and his wife Lucca would have to crawl under the wing to get to the washing machine.

While the whole project took about 12 years from start to finish, John actually worked on the Falco for six years. There were huge blocks of time in which he never touched the project. At times his work at the local Nissan dealership interfered with the project. John was an auto mechanic when he started the project, and he was subsequently promoted to service manager, and this required long hours at work. He also had some health problems, worried that he might never fly again, and John admits those were some fairly depressing years.

John built the Skybolt as a scratch-built airplane over a five-year period, and he worked almost every night and weekend on the project. "I was younger then", he says with good humor, and he estimates it took 6500 to 7000 hours to build the Skybolt.

With the Falco, John put in about six years of weekends. He never worked during the week, only on Saturday and Sunday. He made all of the wood components and that took a year. After the experience of making components for the Skybolt, John was an avowed kit-builder, and he had a simple philosophy that "if somebody makes it, you buy it."



Top: John Shipler fires up the engine on the day of the first flight.

At the time he was building, we were working on many details of the construction of the Falco, and refining things. As we came out with new drawings, John frequently found that he liked our designs better than what he had just finished, so he spent a lot of time going back and re-grooming things that he had already done. Like most Falco builders, John never kept track of the time the project took, but he says the Falco took about half the time of the Skybolt—he guesses about 3,000 to 3,500 hours.

Finally a couple of years ago, John 'retired' when the car dealership closed, and he got back to work on the Falco and finished it. John sold the biplane earlier this year to a guy in Oregon. He moved the Falco to a hangar at the Chino airport and finally on

June 20, Father's day, the Falco flew for the first time. The test pilot was Jerry Scott, a friend and an experienced pilot. Jerry flies an RV-6, which he calls "the Chevy pickup of the air". After flying the Falco for the first time, Jerry says "My airplane may be a Chevy pickup, but this Falco is a f—kin' DeVille!"

John Shipler agrees. The Falco now has 17 hours on the tach, and John says, "The Falco is an absolute dream to fly." The Falco flew hands-off from the first flight and has required not a single trim tab adjustment. There have been a few minor glitches. The tachometer froze up immediately and needed to be replaced. The fuel pressure gauge leaked internally, and John is putting another in the Falco.



"Other than those problems, it has been absolutely flawless," he says. The control surfaces are perfectly in trail, and John said that with the Skybolt he had to spend a lot of time getting things trimmed out.

John Shipler's Falco is the 36th Sequoia Falco to break ground. It has a 160 hp IO-320-B1A engine with constant-speed prop. He has two King KX-155 nav/coms, a King transponder and an Apollo 618 loran.

The loran, unfortunately, does not work. John used an internal antenna and primed the Falco with a duPont paint that has a lot of graphite in it. He thinks this is the source of the problem. I mentioned to him that Wendell Taylor and Dan Garn had a similar problem, they used the canopy frame as the loran antenna, and it worked fine.

The Falco has the Nustrini canopy, and John says he probably regrets using it. He has thinned the seat cushion down a little and is now fairly comfortable. He is 5'9.5" tall, and he finds it acceptable as it is now,

however he is thinking about cutting a pocket in the fiberglass seat.

The interior is finished in grey naugahyde and grey carpet, and with black naugahyde on the glareshield. The instrument panel is painted in the dark grey color we suggest. John says it looks much better than the production aircraft at the Chino airport. "There are a lot of Looky-Lou's out at the airport on Saturday. They can't believe it's a homebuilt airplane, and they can't believe it's made out of wood."

John says, "I've been pretty happy with the performance." The Falco indicates 145 knots at 2-3000 feet. He has a partial nose gear door, gear doors but no wheel well doors at this time. He has the 13-second gear motor and will probably put the full wheel well doors on this winter.

I asked John if he had any problem with the shock absorbers leaking, and he said they initially would go down in a day or so, but he used the tool we have here to hone the valve seat smooth, and then put a light grease on the seat when he installed the

valve. Since then it hasn't leaked or gone down in two months.

John is delighted with the handling of the Falco. He put stall strips on the plane and reports that he gets a good buffet before the stall. "The handling is better than I expected, even better than I could have imagined. It's a very stable airplane. I'm just completely impressed with the plane. I could not ever be more satisfied with the airplane." So far he's hasn't looped the Falco, but he has rolled it. "It's a piece of cake as long as you get the nose up."

Prior to seeing his own Falco fly and flying it himself, John Shipler had never even seen another Falco—and still hasn't. Once on a trip to Chicago, he and Lucea went one state out of the way to see Jim Slaton in McCall, only to find that Jim was off somewhere else that day. But now his bird is in the air, Lucea can get to the washing machine without crawling across the garage floor, and the only problem John Shipler sees with the Falco is "what do you build next?"

—Alfred Scott

First Flight: Dick Reichenbach

One thing that seems to be a constant about Falco builders with newly hatched birds is that they always express their Falco-hours in tenths of an hour. Old salts round it off to the nearest hundred, but when they're first getting to know the plane, it's always in tenths.

"20.4 hours" is how Dick Reichenbach answered my question about how much time he had on the Falco. Here's a guy who soloed at 17 when I was one year old, got his private ticket in 1944 and has flown about 30 different types since then, and he's talking in tenths of an hour. Hmm. How do you say 'spring chicken' in Italian; we need a new classification for this type of Falcoviator that talks in tenths.

Sequoia Falco number 37 took flight on July 31 at the hands of pilot/builder Dick Reichenbach of Bay City, Michigan. He had hoped to fly two days earlier so the flight would be on the 50th anniversary of his solo in a Taylorcraft in 1943, but bad weather prevented that. Nevertheless, the first flight was a thrill.

"I just opened the throttle, and she jumped off the ground. I over-controlled a little bit, but then I settled down. The controls are well-balanced, and it flies really great. It's a beautiful airplane. I can't believe I built it."

But let's go back a little. Dick Reichenbach bought the Falco plans in 1981 at a time when he was working as an industrial gas consultant with Consumers Power. He began working on the airplane slowly but didn't really get going hard on it until 1986, when he retired. He made all of the wood parts and bought the rest of the kits from Sequoia.

Dick is hardly lost in a workshop or around tools. During WWII, he worked on radar systems on the B-29, and both of his sons are heavily involved in SCCA amateur racing. They drive a Fiat X-19 and won the National Championship in 1991. Dick and Lil Reichenbach work as part of the crew and even bought a few tires so they could be listed at a sponsor. In return, the sons painted "Mom and Pop Falco Shop" on the car.

I asked Dick about building the Falco. "It was exacting work. It was time-consuming, and you have to be accurate, but I think it was a lot of fun to build." He makes no claim on being a fast builder, and



Top: Dick Reichenbach and FAA Inspector John Beeby.
Bottom: Lil and Dick celebrate after the first flight.

said "I like to take more time than some people. I'm happy I built it, but now that I'm flying it, I wish I had finished it sooner."

Falco N1593R has a 160 hp IO-320-B1A and came in at 1268 lbs empty with an empty-weight CG of 65.44". The airplane is painted white and has no interior or paint stripes at this time because Dick

wanted to work out all the bugs before getting to the final finishing stage. The instrument panel is fitted out with two Terra nav/coms, ADF, marker beacon, transponder with encoder and an Apollo 604 loran. Dick reports the loran works great and that he has an internal wire-up-the-tail antenna. Ditzler paints were used, with the DU35 grey primer under the pure white polyurethane enamel.

The initial problems have been minor and have been confined to instrumentation and wiring glitches. He had about four or five over-crimped connections that were open circuits. One of the digits on the clock-timer doesn't light. The alternator loadmeter doesn't show amps and the original manifold/fuel pressure gauge read backwards and was replaced by IFR. There was a problem with the oil pressure gauge that turned out to be an over-crimped ring terminal.

That's the extent of the mechanical problems. FAA inspector John Beeby arrived for the final inspection, spent about an hour going over the Falco and pronounced that "It looks more like a production airplane than anything I've seen."

Dick reports the Falco flies well and has no handling problems. The initial few flights were done with the gear down and revealed that the airplane was well trimmed out, but that he had to hold a little rudder above 100 knots. The Falco has stall strips, and Dick says he gets a definite buffet as a stall warning. At this point, he's only done approach to stalls, but it reveals no nasty tendencies so far and no wing drop.

When he raised the gear, the Falco developed a slightly heavy right wing, so he used Tony Chamberlin's trick of using a dowel for a trim tab. He used a 3/8" dowel, flattened on one side to 1/4" thick, and reports that it works well. Dick initially put it on with tape, then screws and will finally glue it on.

At this time, Dick is adding the gear doors and now has all doors on the plane except for the nose gear clamshell doors. All of the doors are working well, and he reports that the wheel well doors gave him about 10 knots or more. Dick has not yet attempted to get any accurate speed numbers, however this Falco seems to be quite clean since he reports seeing 160 knots indicated at 24"/2400.

I asked Dick about the noise level, and he said that it is about the same as his 172. He uses David Clark headsets and finds the airplane noise level to be comfortable. "I expected it to be noisier than it is."

The only problem Dick has with the Falco out with the local gentry out at the airport. "They keep knocking on it. They believe it's plastic, and people react with surprise when you tell them it's made of wood. They don't believe you can do that with wood and make it look good."

—Alfred Scott

Construction Notes

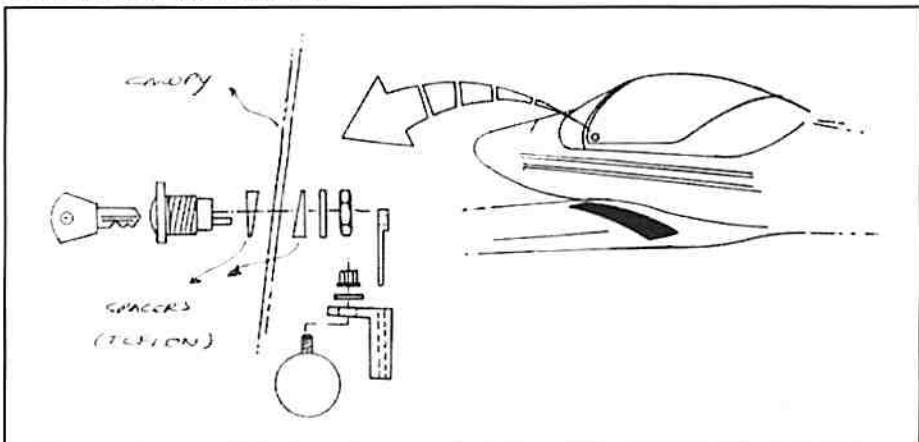
On his way from South Africa to Oshkosh, Fanie Hendriks stopped by. In talking about his project, he mentioned a clever method of temporarily clamping parts in place on the wood structure. The part might be an aileron hinge or one of the rudder pedal supports that go on the inside aft face of fuselage frame number one. These are difficult parts to clamp in place while you drill the holes.

Here is what Fanie does. He protects the wood by putting a broad piece of masking tape on the wood, and then he covers the base of the metal part with another piece of masking tape. He uses instant cyano-acrylate glue to glue the part in position, but because of the masking tape on both surfaces, what he is really doing is gluing the two pieces of masking tape together. This has good shear strength, and the part is held firmly in place, but it is still easy to break it loose by prying. Once the part is removed, the masking tape peels off the wood and the metal part easily.

Short of Ioran and GPS, one of the most interesting advances in aviation in recent years has been the lightweight starter. Bolt one of these babies on your engine, and you save eight pounds or so. It's hard to pass up, particularly if you are in the process of buying a starter.

There is, however, a minor problem with clearances. For all their light weight, these new starters tend to have solenoids and other parts which hit the oil cooler where it is installed in the Falco. George Barrett and I have worked on the design of the left front baffling to move the oil cooler to clear the Sky-Tec 'high-torque' starter that he has. I rebuilt the baffling and left it to George to finish up, but he changed his mind halfway through (ain't that just like a man?) and decided it should just be moved outboard, not outboard *and* aft.

Marcelo Bellodi's canopy lock.



At Oshkosh, I made a point to collect information about lightweight starters with the idea that we would come up with a new design for the oil cooler installation. There are three such starters on the market: B&C, Sky-Tec and Lycoming. They are all similar, though I've heard the Sky-Tec starters are the best of the bunch.

The old design Prestolite starter that has been used for years weighs 18 lbs, while Lycoming's new lightweight starter weighs 11.5 lbs. I have been told that it is difficult to install, requires shimming to get the installation correct and that there have been problems in the field with the starter.

The B&C starter weighs 10.25 lbs and is based on the starter used in the Nissan 280Z. The B&C starter is an excellent product and is made of all-new materials.

The Sky-Tec 'high-torque' starter also weighs 10.25 lbs and is based on the Nipondenso starter used in Toyota, Lexus and all other Japanese cars except Nissan, and this starter is also used in many Ford and Chrysler products. In making their 'high-torque' starters, Sky-Tec buys used starters and then remanufactures them to new-part standards, replacing contacts, plating some parts and then installs the components in a casting with addition components so that it will work on a Lycoming engine. This 'high-torque' starter has an excellent reputation and Sky-Tec's Tom Williams says that they have shipped 4000 of them, and the other day got their 19th one back on a warranty claim.

That's the good news. The bad news is that all of these lightweight starters hit the oil cooler in the Falco. Sky-Tec, however, is coming out with a new starter that is based on a new Ford permanent-magnet starter design which was first introduced in 1991 on the Lincoln Town Car and is now used on all Ford products. This starter

weighs 8 lbs, and it does not hit the oil cooler in the Falco. Cecil Rives has just installed one of the four pre-production prototypes in his Falco. He says it fits perfectly and is easier to install than the original Prestolite.

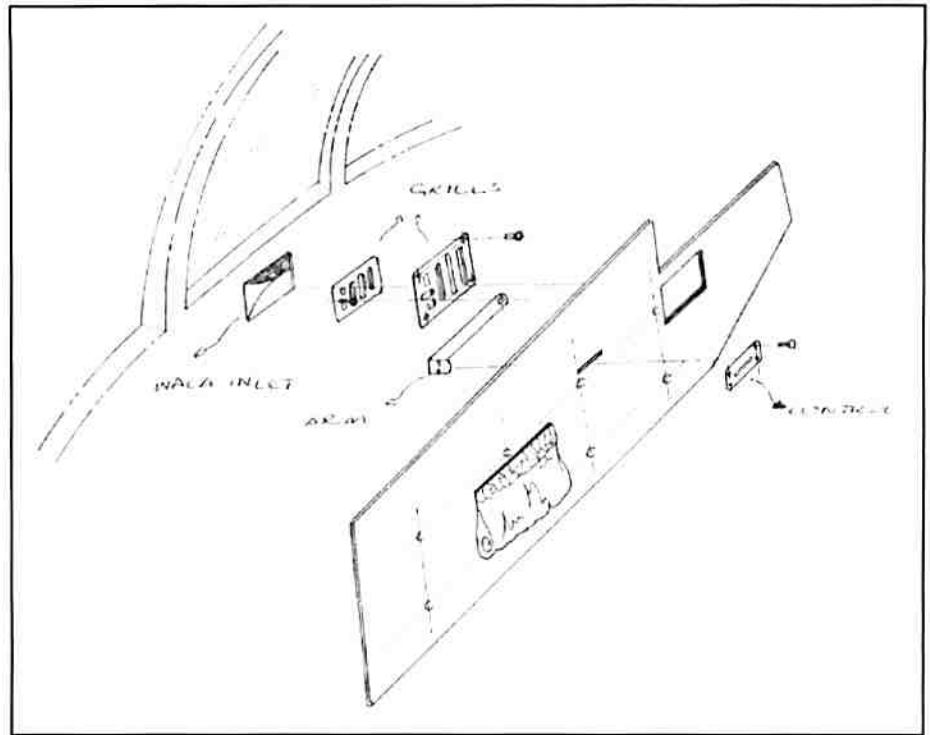
Cecil called back in a few days to report that the solenoid of the new starter interferes with the housing for the landing light. The solenoid projects about one inch into the housing and Cecil cut a chunk out of it that's about three inches long. His initial plans are to get the airplane into the air without a landing light and worry about it all later.

Sky-Tec says the new starter will be in production in a few weeks however the interference problem is not happy news to them. Tom Williams says they can move the solenoid but it will require a new casting pattern which is a \$6000 expense. At this time, he wants to get a number of these starters into the field and find out what other interference problems they might have. Williams says it will be at least six months before a new version will be out, but that he will probably have made a decision well before that time.

Except for this interference problem, it appears that the answer for Falco builders is to go with this new permanent magnet starter from Sky-Tec. If you can afford to wait six months, then I'd suggest waiting until you see how the solenoid position issue is resolved, and it's my guess that this problem will be a common one and will force the issue on Sky-Tec. The starter sells for \$499.00 and is available from Sky-Tec Manufacturing, 3106 Cypresswood Blvd, Winter Haven, Florida 33884. Telephone: (800) 476-7896 or (813) 324-7979. Fax: (813) 324-8521. Tom Williams begs that you call or fax, and he mumbled something about not liking to write letters. There are two starter model numbers, the P/N 122-12PM or P/N 149-12PM. More than likely, you will need the '149' model. The '122' and '149' numbers refer to the number of teeth on the ring gear on your engine.

All of these lightweight starters have solenoids on them and many people assume that this means the starters do not require a starter relay. Not so, the solenoids on these starters pull nearly 30 amps and are used in place of the 'Bendix' device on a starter. The solenoids drive the starter's gear into the ring gear of the engine. You still must have a starter relay.

Sky-Tec also sells the Concord sealed re-combinant-gas battery. This is a sealed 25



Marcelo Bellodi's fresh air vent.

amp, 12 volt battery that is suitable for use in aerobatic aircraft. The battery sells for about \$120.00. Tom Williams said the battery would have about the same 4-5 year life span as a Sears battery and would last about as long as a normal aircraft battery—possibly a little longer because the plates can't warp. Tom Williams spits at Gel-Cells and says that if you get two years out of a Gel-Cell, you're lucky. That's something I've heard from many other people.

Cecil Rives is finishing up his Falco and hopes to have it in the air in a few weeks. In doing the upholstery, he made a mistake that he would like to warn others about. He covered the glareshield and the area immediately in front of it with one piece of leather. This means that the glareshield cannot be removed separately, which makes it very difficult to remove the fuel tank.

Gary Jacob faxed that he was confused by the fuel system drawing and that he didn't understand what the hose (P/N 740-18) is going to and that it terminates with P/N 740-15. On this drawing, there are two installations shown on the same sheet. If you use the header tank, you screw P/N 740-15 into the bottom of the fuel tank, instead of the AN912-8D. And Gary, as you see this, you will doubtless perform the classic gesture of bouncing heel of hand off forehead—which, incidentally, is why Italians have flat foreheads.

Gary also says he's not sure where to install the washers when mounting the engine mount supports to the firewall. There are

metal fittings on both sides, and asks where you put the washers—under the nut or bolt head. Washers are used to protect the underlying metal from the scraping action of turning a nut, thus washers are always installed under the nut unless otherwise specified.

By the way, when I first started to learn about aircraft fasteners, I was surprised to find that there were a number of specialized bolts and screws that were absolutely identical—most of them internal-wrenching bolts/screws. I became puzzled about the difference between a bolt and a screw, and it comes down to this: a bolt is a fastener that is prevented from turning while a nut is screwed onto it, while a screw is a fastener that is turned when it is installed. That's it, and you will find identical heads, shanks and threaded portions on both.

When you install the radio racks in the instrument panel, the normal method is to use screws and 'tric-nuts' in the flange on the back of the instrument panel. I've always heard of these things being called generically 'tric-nuts' by everyone in the business, but the other day at our local hardware store I saw that the proper brand name is 'Thread-Sert', made by Creative Engineering, of Taunton, Mass. These little babies are an expanding aluminum nut. You drill an oversized hole and then put the Thread-Sert in place and tighten up with a supplied socket-head cap screw and an Allen wrench. The two-piece aluminum nut expands, fills the hole tightly and becomes permanently installed.

Garry Wilburn asks when is the right time to balance the controls and to make the measurement. He assumes the weights as specified are in the final finished form, but might it not be instructive to make a preliminary balance test to see how things are coming out? Typically builders weigh things before painting and then there is a final weighing before the first flight. The final weighing is mandatory, of course.

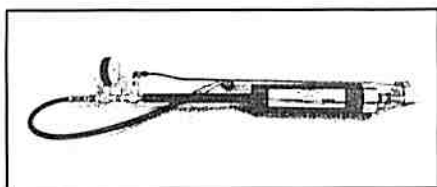
Martin Steinwender of Germany asks about using Ciba Araldit epoxy and whether it would be good for wood protection. Also, he had read about not closing all wooden surfaces completely otherwise it cannot breath.

I am not familiar with the Ciba Araldit epoxy, but I will simply mention that some epoxies are very thin and are intended for moisture-protection coatings (West System epoxies are of this type) and other epoxies are thicker and are intended for gluing. Epoxies are excellent for moisture protection, however if the resins are thick, they can add a lot of weight to the airplane, and that is obviously something that you do not want to do.

On the question about not closing the wood surfaces so that it cannot breath, this is something you need to use your judgement on, and it will depend on the volume of the air space within and the area of the plywood. Large areas should have small vent holes so that air can escape, while smaller areas don't need to be vented because the volume within is so small.

Keep in mind that all wood is porous and even when you have a solid piece of spruce, you have air trapped in the spruce. It does not have to all get out.

Gary Montgomery and others have asked about using the Shadin Miniflo in place of the now-discontinued Silver Fuelgard. Cecil Rives has been down that road. The



Here's the 12X strut pump that Stelio Wilkinson uses. Hooked to an air bottle or air compressor, you hand-pump it to deliver 12 times the pressure of your source. It's available for \$329.00 from Bogert Aviation, Rt. 1, Box 1676, Presser, WA 99350. Telephone: (800) 627-8088, (509) 786-4004 or fax (509) 786-4300.

Shadin Miniflo is essentially identical to the Silver Fuelgard in terms of instrument hole cutout, but it's dramatically different in length. If you try to install it where the Fuelgard is shown in the drawing, the connector plug hits the fuel tank strap. Cecil says it might work if you put it where the OAT is, but even then it is probably too long. Shadin, however, is coming out with a new version that is only 4.5" long and promises to be in production in the next 3 to 4 weeks. When they do, Cecil will be trading his too-long Miniflo in for the shorter one.

Gary Montgomery also asked about the smoke system, if a system might be set up by putting a small tank in the luggage compartment, and whether this would include the pump and/or needle valve as required for a complete smoke system. He doesn't know how much oil is fed to the exhaust per minute and how it is pumped there. It's been years since I first looked at the smoke system, and I remember very little of this except that I did provide the smoke system with a 3/8" line, same as the fuel system. I also remember that you typically use a 7 psi fuel pump mounted with the tank on the right seat. That's the limit of my knowledge, but if you are going to install such a system, you might want to quiz some air show pilots about how and what they do.

Glyn Russell asks about how to attach the plastic tube to the pitot tube. The pitot tube that we used in the past was made by Cessna and had a plastic fitting bonded in place. That model is no longer available, and the pitot tube that we use now has a tube coming out of the top of the thing. We ask them to supply it with just the plain copper tube so you can shove the plastic tube over the copper tube. If there's a fitting on the end of the copper tube, then just cut it off.

At this time, many of you have installed the reinforcement for the flap actuator. Everyone who has done it reports an astonishing improvement in the stiffness of the system. Getting to the actuator is a problem with finished aircraft, but some builders have reached the actuator by simply cutting out the vertical walls of the wheel well, that is, the section aft of frame 5. After the repair is made, they just glued in a new plywood wall.

I also want to remind everyone on the importance of using washerhead screws which bear on the plywood skin of the fuselage. This is dramatically stronger than countersinking screws into the spruce, and I've only recently learned that in the case of

Falco G-MRCI the screws had actually pulled loose prior to the flap flutter incident. A couple of weeks before the incident, the owner and a friend were taxiing out for takeoff. They lowered the flaps but then noticed that the flaps had not lowered at all. They taxied back, inspected the system and found that the screws had pulled loose from the wood. Instead of the flaps lowering, the actuator had climbed up the actuator screw. The owner replaced the screws and also installed a stiffening aluminum plate.

On many airplanes, the flap system has an up-stop such that when the flaps are completely raised, they lock into position by bumping into a solid part of the airframe. Larry Black pointed out that this is possible on the Falco as well, and he's got a good idea. Many of you, in an effort to reduce the drag of the airplane, seal the gap at the inboard end of the flap. There are two ways of doing this. One is to screw a piece of aluminum sheet metal to the bottom of the flap so that it overlaps the gap and hits the bottom of the wing.

A similar method is to build a little spruce lip/extension on the inboard end of the flap and then glue a similar and matching strip of spruce on the wing so that when the flap comes up, these two pieces of spruce hit and seal the gap. There's certainly nothing wrong with this type of sealing, and Larry points out that this sort of overlapping integral seal will also serve as an up-stop on the flaps so that when the flaps are fully raised, the spruce seals contact each other and give additional rigidity to the flaps.

Fanie Hendriks reported a problem with the A-600-2-4 fitting that screws into the top of the header tank. He initially reported that it had the 'wrong threads', but it turned out to be shallow threads cut into the fitting on the header tank. He opened them up by simply screwing in a similar fitting that apparently had slightly smaller threads, but if you have this problem, you can just use a 1/4" NPT tap. For those of you who are overseas, spelled out that means "one quarter inch national pipe threads".

In looking this up for Fanie, I was surprised to learn that we have not been shipping the 5/16" diameter steel ball that is supposed to be in the vent of the header tank. Brenda didn't know about this, but we're getting some in and will be happy to ship them to any of you who are missing them. The ball becomes a check valve when the airplane turns upside down. It seals the opening of the A-600-2-4 fitting and prevents fuel from running out.



Marcelo Bellodi polishes the Brazilian air.

At Oshkosh, Cecil Rives saw a booth for Bruce's Custom Covers of Sunnyvale, California. They make fabric canopy covers. Cecil ordered one for his Falco, but since they didn't have a pattern for the Falco, the company used Larry Black's nearby Falco to make a pattern. Cecil said the canopy cover is very well done and cost \$235.00. If you'd like your own, contact Bruce's Custom Covers at 800-777-6405.

It's just possible that Cecil is getting a bit over-compulsive on this one, but he asked me to pass on you to that when the autopilot cable clamps are tightened, the clamp bolts should be tightened to 55 ± 5 inch/lbs. At least that is the information the autopilot company passed on to him when he called about this. Also they said the bridle cable tension should be $17 \text{ lbs} \pm 2$ lbs, which is an engineering-terminology way of saying that you need to remove slop from the cable or the autopilot will hunt.

Note from the latest revision list that the elevator and rudder trailing edge ribs may now be made of 6mm solid spruce as an option. With our inverted pin router, it's much easier to make them this way. This means that these ribs will be the same thickness as the elevator and rudder leading edge ribs and follow the same method of construction used in the flaps and ailerons. Mr. Frati, of course, has approved this change, and I have weighed a stack of completed ribs of each type and the two methods of construction are essentially identical in terms of weight. I suspect that the solid ribs will use less varnish and may end up being lighter by a tiny amount.

Steve Wilkinson writes: "My main-gear shock struts continue to leak down slowly, one somewhat faster than the other, and never to the point where I'm dragging gear doors or anything. It's simply a matter of pumping them back up with my handy strut-pump every two or three months. I

do wipe them clean and spray them with WD40 frequently, as you recommend.

"I mentioned this to Karl Hansen the other day, in a letter, and he replied that he had the same problem. I don't know if he's ever told you this, or how legitimate it is, but he thinks the problem is in the threading of the air fitting into the top of the barrel—that the drilling and tapping of that hole wasn't done micrometrically perfectly perpendicular to the barrel itself. So the air fitting doesn't seat perfectly flat. He recommends reaming those threads out a bit so that there's just enough thread-play for the fitting to seat perfectly flat.

"He points out that if the leakage were through the O-rings, there would be fluid leakage, and he doesn't have any. I don't either—not a bit. There's only the barest film of oil on the shiny part of the struts, barely enough to pick up dust, so I think the O-ring part of the mechanism is working just fine. (I think you'd also have fluid leakage if it were through a microscopic pinhole leak in the strut itself, wouldn't you?) Anyway, I think he may be right in that the problem is air leaking out of the struts independently of the oil."

Like you and Karl, I suspect that this very slow leakage is at the valve, but I don't agree on the analysis. We know that the surface finish of the metal that the O-ring seals against must be very smooth, and we have a little tool that we have sent to many builders to smooth this out with valve grinding paste. I've always heard that it's a good idea to put a light grease on the O-ring before you screw the valve into the strut, and I suspect that very slow leakage is less likely to happen if some grease is there. Finally, I called Schrader, the manufacturer of the valves and asked if they had any suggestions. An engineer said it sounded to him like the swivel nut was not tight enough. You have to loosen this nut to

put pressure into the valve, and when you are through the swivel nut should be tightened to at least 60 inch/lbs. (He also mentioned that the valve core should be tightened to 3-5 inch/lbs if you want that bit of trivia in your brain.) I suspect that the answer to the very slow leaks is more than likely to be caused by one of these things.

On the other hand, Cecil Rives has also had very slow leaks with both of his struts, and finally brought one home and put it in a sink full of water for the night. In the morning, he noticed that there was a series of tiny bubbles around the joint between the P/N 553 oleo cylinder and P/N 554 oleo nut. Cecil wrapped some Teflon tape on the threads of the nut and reports that the leaks have stopped.

I doubt, however, that the Teflon tape will prove to be a long-term solution, because if the O-ring is leaking it will continue to leak until enough pressure builds up to overpower the Teflon tape. O-rings typically leak because they are abused, as in the case of being cut on threads in the assembly process. The surface finish of the mating surface is also important. I've checked some cylinders we have here and the surface finish appears to be very smooth, but if you have a problem you can smooth it out with a ScotchBrite pad or very fine emery paper.

I find it curious that it is leaking air when you would expect that oil would leak for this location. I know that one of our earliest builders reported that he had a problem with a leak in this place until he completely filled the cylinder with oil and then screwed the oleo nut in place.

It's also possible that the O-ring is not being squeezed enough. I have double-checked the tolerances of the O-ring grooves, and it appears that the groove may be slightly too deep. In checking the tolerances against my O-ring manual, it appears that the ideal groove would be $1.519 \text{ } \varnothing$, $+.000 \text{ } ^{-.002}$ with a groove width of $.146 \text{ } ^{+.010 \text{ } ^{-.000}}$. There's ample room for a new groove if any of you have a lathe and want to experiment.

A far cheaper and easier way of trying to get more rubber squeezed in there would be to go to a larger cross-section O-ring and stretch a smaller diameter O-ring in place. I've experimented with various O-rings, and I find that a MS28775-215 O-ring looks about right. We'll get some of these into the hands of builders who are having very slow leaks and see if it stops the problem.—*Alfred Scott*

Swing-Wing Falco

By Jonas Dovydenas

The weather was so bad this past winter, I rarely flew the Falco. The one time I went out in January, I had to taxi between fifteen-foot-high piles of airport snow to get to a heavily sanded, icy runway. Before the winter was over, we were to get 130 inches of snowfall. The problem became what to do with myself and the Falco.

One day, I came across a promotional package from the Cirrus people and was tempted to begin building again, but a simple calculation showed that the time required to complete would use up 39.5% of my remaining lifespan, assuming I lived that long. So, instead, I chased the racoons out of my attic, repainted the hangar floor for the third time, and put a couple more stick-on bullet holes on the Falco. This got me through a week of February.

Then my friend Gandanauskas called from Kalushubov, in the Trans-Caucasus, to tell me his whole department was out of work. The Computing & Research section where Gando worked was downsizing because of the demise of communism. "It's all Reagan's fault," he said. "We were in the middle of some interesting work with plasma flow in an environment of a hundred million degrees and ten million bars pressure when the Party went belly up, just like that. Now I can't even pretend to work for my pretend pay. Can you get me a green card?"

I told him green cards take forever to get, but an idea occurred to me. Back when I first told him I was thinking of building a Falco, his only words were "I know all about your project. Do it, you won't be sorry." A year later I ran into him in Moscow and asked him during a walk. "So explain how you knew about the Falco." "Well, aerodynamics is a hobby of mine. I helped a glider shop with some airfoil designs. I never told you before, but once, in a vault in Cheliyabinsk I came across a set of Falco plans and a technical analysis. Don't ask how we got them, we had everything. There was a stack of books in the same vault all written by this guy Bingelis. Sounds vaguely Lithuanian. Do you know him? Anyway, every time someone would send one of these books, the KGB would steal from the post office and lock it up. But getting back to my story, I read all the reports on all the homebuilts, and the Falco is in a class by itself."

All I could say was, "That's what I'm hearing from everybody I talk to."



With 20.6 degrees of wing angle, Jonas's Falco will outrun every Falco in existence.

That was six years ago, now I was asking him, "Could the Falco be improved?" There was a long pause on the line. "Ah, that's a really interesting questions. I can look into it. Give me a week." As it happened, he called back in three days.

This is how the swing-wing Falco modification was born. "Look," he said, "my friends and I ran the numbers in our heads over four bottles of Polish vodka. Just for fun, we started with the SGDE [single governing differential equation]. I remembered the main design points and dimensions, and each of us made three or four totally wild, even improbable assumptions for modification. Then all of us ran through three or four iterations. That alone took care of two bottles. We couldn't believe it. That Frati's some genius. Just under his design lurks a real monster. We looked at more than ten parameters, but in the end all we did was change four coefficients, normalized the Pandtl equation for non-elliptical distribution, threw out some third derivatives and made sure the resulting solutions weren't somehow squirrely. To our surprise, most of the problem factors and numerical clutter dropped out, and 20.6 degrees of wing angle popped out."

"Oh, that's good," I said.

"If you want to go all the way, swing the wings and swap your prop set-up for an 800-lb-thrust APO unit. You will go supersonic without even feeling anything in the stick, that's how well designed the Falco is. Of course, you'd have to re-balance the control surfaces, beef up the flap actuator brackets and a few other things, but those are just shop problems. If you keep the prop, you will see a 65% increase in speed in cruise."

Good ol' Gando, I'm thinking, he's still drunk.

"Look, it boils down to this: I need 565,000 rubles so I can pay off the machine shop guys. The only way the numbers work is if the hardware is made out of titanium. Anything else adds too much weight." I asked him how much that was in dollars. "Uh, let me think, that's about \$127." I told him the high cost was not going to deter me from going ahead. "Okay, give me a couple of days."

"To our surprise, most of the problem factors and numerical clutter dropped out, and 20.6 degrees of wing angle popped out."

I waited two days to call Gando. "It was a piece of cake!" he said (actually in Lithuanian he said a "slurp of sour cream" but the idea's the same). "I told the guys in the machine shop I'd give them two extra bottles and a smoked ham from my parents's farm. They did it overnight! I'm giving the package to a driver today. We're sending er, ah, some interesting metals to North Korea by boat from Klaipeda. The driver's my buddy, he'll give it to UPS, two-day air delivery, COD, okay? By the way, send me some BIC throwaway razors. I can get 5000 rubles apiece for them here,

and you know, there's still no toilet paper here, so I'm losing a lot of blood shaving with our so-called safety razors."

The package came, and I have to tell you, it was impressive. A set of five virgin mylars, and copies on good paper. A hundred some pages of instructions and data, albeit in Lithuanian. Every part vacuum-packed, dated and bagged in heavy Russian plastic, with little bags of desiccant. Builder's heaven.

I will give you a full report of the shop work in a separate article, if you think anyone's interested. But it was a snap, really. Gando had figured 46 hours. I did it in 152. Not bad, huh? The hardest part was putting the Sawzall to the spar, but there was a jig included in the kit. Gando knew my hands would be shaking.

After cutting the wing and replacing the existing gearbox with Gando's titanium box and wing-pin, I was ready for flight tests. I wanted to use Al Aitken again, but he was on a trip for the airlines, and I couldn't wait.

After a standard climb-out to 7,000 feet, I leveled out at 100 knots and pulled up the wing-pin lever. This engaged gears and activated a microswitch. Slowly backing off the throttle, I saw the airspeed go up as the wings went back. When the gears clunked into automatic lock, I was 8 knots shy of Vne with 19 inches of manifold pressure and 2300 rpm. Gando's numbers were very close. I said to myself, that's good enough for me. Fuel burn was 8.1 gallons. Roll response was spectacular, even a little touchy. There seemed to be a good deal of noise in the cockpit from the high speed. Otherwise it was the same familiar Falco. I was elated but needed to change my shirt and other clothing.

Turning back to the airport, the swing-wing Falco just would not slow down to pattern speed. Keeping my eyes on the CHT numbers, I made three turns around Pittsfield to enter the pattern. Cycling the gearbox in the wing-pin mode got the wings straight again, re-cycling in the landing mode got the gear down. I was limp with the thrill of it as I drove home from the airport.

If there's any interest out there for this modification, I'd like to hear about it. Gando's still out of work, and Polish vodka has not yet been replaced by a gold-backed ruble. And if any of you out there have a BIC distributorship, you're in luck—Gando's ready to deal.

Goings On at Sequoia Aircraft

We have spent the summer gluing the fuselage frame laminations, and we now have industrial quantities of these laminations. About a week ago, we finished the last gluing operation, and I have been hard at work making up a machine to slice the things.

Whenever you make a jig or machine, you spend a fair amount of time with your fingers crossed as you wait to see how it works. The laminating process went well, and as is so often the case, the most-feared operation turned out to be the easiest. Most of our laminations were made inside a mold, and we pulled the pieces in place and then clamped a series of shaped blocks on the inside. I think in the process of making these jigs, we used about of ton of Baltic birch plywood.

The frames that we worried about the most were the smaller ones toward the rear of the airplane. The bends were so tight, we couldn't pull the laminations into place without breaking them, so we made an 'outside' jig with a welded steel bar gadget to pull the laminating strips around the tight bend. It worked spectacularly well, and when it was over, we all looked at each other and wished we had used this type of jig for more parts.

The fuselage frame laminations are made from six-inch-wide strips of wood, so we get five or six pieces out of each lamination. I had a vague plan of cutting them oversized and then after gluing all the pieces together, we'd send them through a wide-belt sander. This is how Francis Dahlman used

to do it, and he made two pieces in each lamination.

I finally decided to 'bite the bullet', and we made a special machine just to slice the fuselage frames. We bought a Delta shaper and then modified it to accept a saw blade. This involved reworking one spindle, making an entirely new one, and changing the pulley ratio to bring the shaft speed down to motor speed.

There's a long spindle that let's us run the blade at 5 to 6 inches above the table top, and another for cutting down low. The entire thing runs inside a sturdy plywood box. There's a support bearing at the top for the long spindle, and a dust collector pulls the sawdust out.

The device works beautifully, and all of our worries about that long spindle vibrating all over the place have proved to be groundless. The thing runs very smoothly, and the whole thing is very rigid.

We have a large extension table so we can push the pieces through. Since the laminations are made in jigs mounted on Formica-covered plywood, the glue forms a flat bottom. We do a clean-up cut on the top, then flip the piece over and clean off the glue on the bottom. Then we do a final cut in the high position to get down to clean wood. Finally, we put on the low spindle and slice up the parts.

The pieces come out absolutely perfect and flat on the first cut. We have a Lexan splitter that runs in the sawcut, and this keeps the upper piece from riding down on the blade. The process of sawing up all of these pieces is slow, boring work, but it's nearly over now. By the time you get this news-



letter, the process will all be finished.

The next operation will be to set up this machine to scarf the laminating strips with a precision cut, and begin putting the fuselage frames together. Gearing up for each operation is painfully slow, but it goes quickly once you get an operation underway.

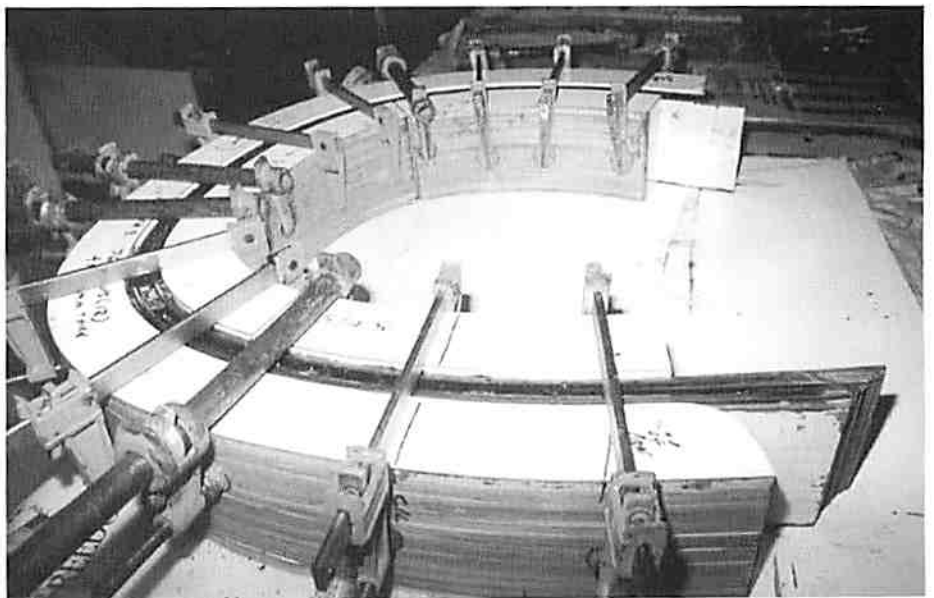
With these laminations, we're finding the same 'spring-in' problem that Trimcraft had. As best I can figure it, the resorcinol glue contracts when it dries, and this causes a slight change in curvature. For those parts that are assembled as part of a complete ring, it's no problem at all because you simply bow the part out slightly and glue it into position. The diagonal frames at station 2 and 6 will probably need some additional wood glued on at assembly time. This is a minor point of aggravation with which all finished-and-flying Falco builders are familiar.

Steve Wilkinson was in England recently working on a story for *Air & Space* on Capt. Glen Stewart (the idea for this article actually came from reading our March "Sawdust"). While there he visited with Stuart Gane, whose Falco project is so stunningly perfect that Steve actually called me from England to report on it.

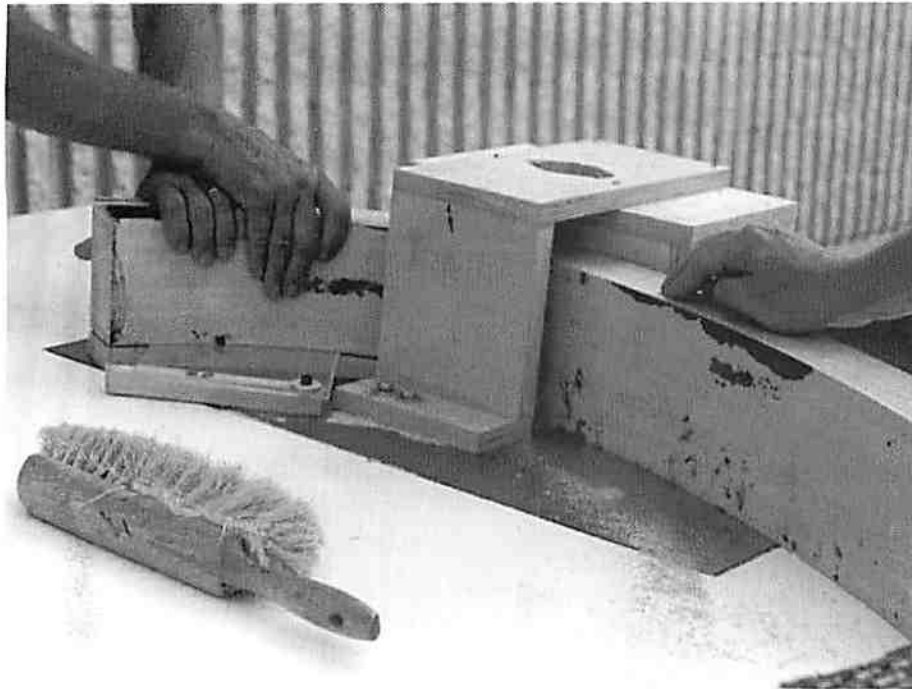
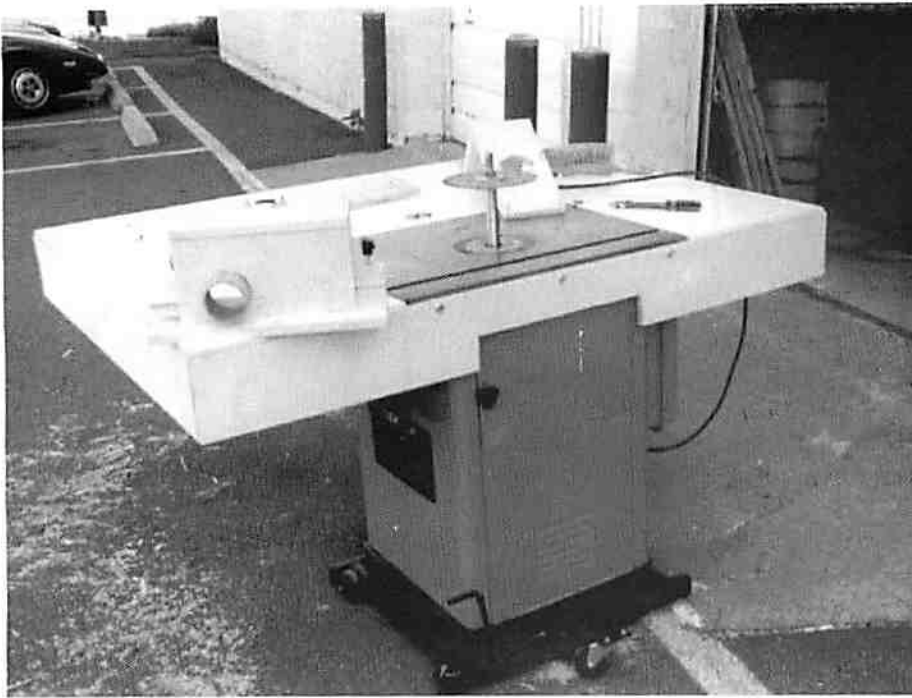
While there, Steve also learned some additional information about the flap flutter incident we reported in our last issue. It seems that about two weeks before the flutter incident, the owner of the plane and a friend were taxiing out for takeoff. They lowered the flaps. The flap motor ran, but they noticed that the flaps did not move. They taxied back to investigate.

They found that the flap actuator supports had pulled loose from the bottom of the airplane, and instead of the flaps lowering, the actuator *climbed* the actuator screw. I'll say it again: the countersunk screws pulled completely out of the spruce block. Now if there's anybody out there who still thinks that using countersunk screws is acceptable or as strong as putting the washerhead screws on the outside of the plane, I'll ask you to think again and consider what happened in this case. There's a huge difference in strength between a washerhead screw bearing on birch plywood and a countersunk screw bearing on spruce.

Just prior to Oshkosh, I received word from Tony Chamberlin in Australia that the CAA test pilots had failed the Falco. The Australians have the most severe testing procedure for the first-of-type, and the air-



Top: Adrian Amos and Bill Motley clamp the laminating strips in the jig.
Center: A typical fuselage frame laminating jig.
Bottom: A partial view of the stacks of laminations.



*Top: Our modified shaper with the tall spindle and saw blade in place.
Bottom: Pushing a frame through the slicing machine. The splitter is on the far side.*

plane must meet FAR Part 23 handling qualities requirements.

The Falco passed all of the normal stability and handling tests. The test pilot found that the stick force gradient was on the low end of the range considered acceptable, but it was acceptable. The problem they encountered was with a phenomenon known as 'aileron snatch' in the clean, power-off stall.

In this test, the power was reduced the idle, and the stick was pulled back slowly. The test pilot was careful not to restrain the stick from sideways movements. A buffet

set in at 65 kias, and then at 62 kias, the control stick suddenly moved left by about 1.5". The left aileron, of course, moves up, and it moves before the stall has occurred; instead, it causes the stall. The left wing drops sharply, and it put the Falco into a knife-edge flight or a spin.

As it turns out, Dean Hall had noticed a sharp left break in the stall when slightly cross-controlled, and he mentioned it to me. He wasn't sure if it was something that needed to be corrected or whether all airplanes behaved like this when cross-controlled.

I talked to Dave Thurston about this, and also sent a fax to Mr. Frati. Thurston said the problem was a minor one and was curable. Thurston said that the left wing stalling first is to be expected due to the rotation of the propeller, and that even though the power is 'off' the effect is still there and sometimes worse because the pulses come in slower intervals. Thurston urged that they tuft-test the wing, find out what was happening to the flow over the wing and check the rig of the wing.

Mr. Frati thought the problem was "mainly due to imperfect construction of the wing tip leading edge" and that the best solution is to modify the lower part of the wing leading edge with a larger-radius.

We already know that the Zuccoli Falco, like many others, required an aileron trim tab. A small amount of out-of-rig can have a large difference in the lift that a wing produces. These aileron trim tabs are surprisingly powerful and can make up for a large difference in wing lift. In the case of this Falco, they were happy with the airplane and did not share the CAA's concern, so they fixed it in the easiest and fastest way possible. They added a trim tab to the right wing that allowed them to pass the test and be done with it.

I'd be curious to know if any other Falcos have this characteristic. If you run any tests, be aware that the airplane might go into a spin, so you'll want plenty of altitude and should be prepared for spin recovery.

While at Oshkosh, I talked to Falco builder Ian Ferguson, who once owned an 'A-model' SF.260. Ian said his SF.260 had the same aileron snatch problem on the left wing. Some years ago, he flew the SF.260 from Australia to Italy to have some required work done on it, and while there he mentioned the stalling problem. The SIAI Marchetti people took the left aileron off the airplane, and then an older gentleman came out of the factory and delivered a healthy blow to the hinge brackets with a hammer. The factory people said he was the only one that they allowed to do this, and Ian said it cured the problem!

We now have three Falcos that are 'almost ready to fly'. Stuart Gane, in England, is finishing up the last few things. Allan Hall in Vista, California, has already done high-speed taxi tests. Cecil Rives's Falco lifted off unintentionally the other day on a high-speed taxi test, and he should have his Falco in the air before you get this newsletter.

—Alfred Scott

Sawdust

- Guido Zuccoli reports that the Australian authorities have completed the 'first of type' approval process on the Falco and the Falco is now an approved design for construction in Australia. Unlike some other kitplanes, the Falco has no restrictions imposed on it because of stability problems. There was only one 'glitch' in the flight testing, as the pilot found Falco VH-LZF had a problem with 'aileron snatch' in the clean power-off stall tests, probably caused by a slight error in wing twist and which was cured by the addition of a stall strip on the right wing.

- 'Ferrari' no more. Now the Falco is the 'Alfa of the air', according to "Flight of the Falco", an article by our own Steve Wilkinson in the Summer 1993 issue of *Il Quadrifoglio*, a glossy quarterly published by Alfa-Romeo. There's a nice touch in the article as Steve mentions that Don Black, chief engineer for Alfa-Romeo in the U.S., gave me invaluable assistance by interpreting the original Italian drawings with their arcane dimensioning, tolerancing and material specifications.

- Watch the pages of *Flying*, *Sport Aviation*, *Kitplanes*, *Air & Space* and others for a series of new Falco advertisements created by Jack Amos, who re-designed our Falco brochure a few years ago. While these ads are the same 1/6th page size as our previous black-and-white ads, they seem dramatically bigger due to the spectacular color photographs of Karl Hansen's Falco and the exceptional design of the ads. With the recent advances in desktop publishing, these ads are done entirely on the computer. This technology makes small color advertisements suddenly a practical thing, and we were successful in persuading three major magazines to change their policies about accepting color ads of this size.

- Three times and you're out. John Rawlings seems to have attracted more bad luck than any other Falco builder. John lives in St. Charles, Missouri, right down on the big river, and his Falco project was nearly destroyed in 1986 when a flood submerged the airplane. All of the wood parts were ruined, and it took him two years to recover from the flood. Now it has all happened again. His project was at the Creve Coeur airport, and even though he had the Falco suspended 14 feet from the floor with pulleys and ropes, the water rose even higher. The Falco spent seven and a half weeks under water, and John found it on the floor with 16 inches of incredibly dense mud covering and filling everything. John has finally given up on the airport but not



Ride 'em, Cowboy. The latest techniques in test piloting are demonstrated by Mike Melville on the first flight of the Rutan Raptor/Talon unmanned aerial vehicle. The 66-ft wingspan Raptor/Talon is powered by a Rotax 912 with two-stage turbochargers and is expected to operate at 65,000 to 70,000 feet. This is the second recent Rutan design with the engine on the front, tail on the rear and completely without canards. Gee, if he keeps this up, we'll have to ship him off to Mr. Frati for styling lessons. Consulting engineers to this project are using our Benchmark performance testing software to model the behavior of the Raptor/Talon aircraft at very high altitudes.

the Falco. He's moving the project to a warehouse on high ground. John is a retired McDonnell Douglas tool maker, and as he talked about getting the project rolling again, I asked, "John, how old are you?" "I'm going to make it," he said. "I'm going to fly that son-of-a-bitch when I'm ninety-four."

- FAA wakes up to GPS. FAA Administrator Joe Del Balzo recently said that pilots will soon be able to use GPS as a secondary means of navigation and that it could be approved as a primary navigation source for commercial and general aviation within two years. This is a dramatic and welcome reversal of policy, and it comes as all of aviation is embracing GPS with a passion. It was only two years ago that Sony introduced its hand-held GPS. Last year, three companies had hand-held GPS units with an aviation database. This year at Oshkosh, there were several hand-held GPS models with moving map displays.

- These hostile shores. Why customs would be interested in FAA-business pa-

perwork is beyond me, but for the lack of a signature on an otherwise perfectly filled-out Form 337 for the temporary installation of a ferry tank in a TB-20 Trinidad, aviation writer and ferry pilot Peter Lert was detained for the day, then placed in the Penobscot County Jail overnight, had the airplane seized, along with all of his personal equipment, records and passport. At one point, Lert was being threatened with a maximum penalty of \$250,000 and/or up to three years in prison. He had to hire two attorneys to get him out of the predicament. In the end, he was fined heavily after paying tens of thousands of dollars in legal fees. The irony is that Lert's parents emigrated from Germany in the 1930s largely to escape a society in which arbitrary and unreasonable prosecution was becoming commonplace.

- The world-renown Oyster Fly-In and Gathering of Stelio Frati aircraft will take place on November 6 at the Rosegill Farm Airstrip. A finer way to spend a Saturday in November has not been discovered and any Falco owner east of the Mississippi who does not attend risks being ostracized and having his tires slashed.

Italian Jobs

by Mike Jerram

Mike Jerram is deputy editor of *Pilot* magazine in England, European correspondent of *Flying* and a long-time fan of Stelio Frati. Here are his reports from the Paris and Moscow air shows. In March, we reported that Mr. Frati was associated with the proposed ATTA 3000 derivative of the Jet Squalus. Mr. Frati has since advised us that he is not associated with the project. We regret the error, but then we make so very few!

PARIS—They bore his unmistakable signature. Other people may design airplanes, but Stelio Frati styles them. His latest creations, which made their public debuts at Paris, showed that the maestro has lost none of his flair for sculpting truly beautiful flying machines, except, perhaps, that with lines as racy and archetypically Italian as a Ferrari's, they should have been painted red.

Milan-based General Avia, of which Signor Frati is technical director, exhibited three prototypes of his F.22 Pinguino two-seat light training and touring aircraft, descendants of a long line of svelte Frati designs which have included the Rondone, Sparviero, Trento jet, Falco, Nibbio, Picchio, the highly successful SIAI-Marchetti SF.260 civil/military trainer and the Jet Squalus, which may yet emerge as a JPATS contender in a cooperative deal between Belgian manufacturer Promavia and Russia's MIG.

The F.22 Pinguino (as a flightless bird Penguin seems an inappropriate name for such an obviously raring-to-fly airplane) is available in four versions, one prototype of each of which has been built by General Avia. The F.22A and F.22B are fixed-gear models with 116 hp or 160 hp Textron Lycoming O-235/O-320 engines. Italian certification of these was obtained in May, and FAA approval to FAR 23 Pt 36 is pending.

The F.22R Sprint has an essentially similar airframe but with retractable landing gear and a 160 hp O-320-D1A engine driving a constant-speed propeller, while the F.22C Sprint, first flown in May, is the 178-knot top-of-the-range model with a 180 hp O-360-A1A. Certification of the Sprints is expected before year's end. Current list prices for the first batch of each model are: F.22A \$95,000; F.22B \$108,200; F.22R \$127,600 and F.22C \$149,500.

Frati is now working on a four-seat 200 hp derivative, the F.200 Airone (Heron)

which is expected to make its first flight before the end of the year. It will be Frati's second Heron; the first was a one-off Pasotti F.6 Airone light twin, powered by a pair of Continental C.90s, which was built in 1954.

General Avia has hitherto concentrated on design, engineering and prototype manufacture, but is now beginning a pre-series production batch of Pinguinos, and hopes to build 100 in 1994. Managing director Maurizio Ruggiero concedes that half that total is a more realistic goal. General Avia has signed a cooperation agreement with the German manufacturer Rhein Flugzeugbau whereby the Monchengladbach company becomes sole distributor and product supporter for the F.22 series in Austria, Denmark, Finland, Germany, Netherlands, Norway, Sweden and Switzerland.

Alas, artists must always suffer for their art, and both Dott. Ing. Frati and his airplane became victims of the appalling air show weather. The maestro returned to Milan with a cold and sore throat induced by Paris's downpours ("To work, of course, always to work!" sighed his assistant Carla Bielli, with just a hint of exasperation), while the statically displayed Sprint F.22C was bent (slightly) out of shape by a wayward hospitality chalet roof torn off in the gales.

MOSCOW—Among many bizarre and unusual things seen at the Moscow Aerospace 93 show earlier this month, perhaps the most surprising was a Procaer F.15F Delfino, the two-seat all-metal derivative of Stelio Frati's Picchio which he engineered at General Avia in the late 1970s. Save for cheatlines in the colors of the Italian and Russian flags, and a European Community crest on the fin, it was unmarked.

Unfortunately the Russian mechanics who were taking it apart (this was the last day of the show, and it appeared to have been roaded in) had no English, but from what we could exchange in sign language, it seems they were telling me the airplane is to be built in Russia.

I checked with Carla Bielli at General Avia, and she says that this may well be the case. Procaer has licensed the 300 hp F.15E and the 200 hp F.15F to one Pavini Rosati in Italy, and he in turn is negotiating with a Russian company (Sokol at Nizhny Novgorod) for the airplanes to be manufactured there. It seems the 1968 prototype F.15E I-PROM is also in Russia.

Brenda's Corner

We have been trying to get the flap correction kit out since the first of July. Everything is here with the exception of one bolt which has been promised in "two weeks" since the 27th of July.

A telephone call to the salesman this morning did nothing to convince me that the bolt will be arriving anytime soon—"Gee, we still haven't shipped that bolt. Let me check into it and get right back to you."

Finding some of the hardware we use in the Falco kits has become a real headache, although I try to think of it as a challenge. The company (Airfasco) we are trying to get the missing bolt from was our major hardware supplier years ago. We ordered everything from them—bolts, screws, nuts, washers, clamps, etc. Their delivery time became slower and slower. You would call about backordered items and get promises of delivery that were never kept. We stopped using them.

Alfred talked with some of the purchasing agents for Mooney, Schweizer, Christen, etc. We got some information on other companies and started using a company in Texas. Their prices were good, delivery time excellent, and they would go out and find whatever you needed. But then they went out of business for some reason.

Since then we have sort of jumped around buying some here and some there. We haven't been able to find one company who could supply us with the assortment of hardware we need. When Alfred was trying to find the close-tolerance bolts for the flap kit, he talked with the people at Airfasco. They convinced him they had changed their ways, and he decided we should give them another try. It looks like they are slipping back into their old bad habits.

If any of you know of a company who might be able to fulfill our needs, let us know. Jerry Walker suggested Freeman Aviation in Georgia as a good source. I gave them a call, and they never responded back. One thing I have learned is that if Alfred says it is as common to find as hens' teeth, then I'm on the way to a wild goose chase.

—Brenda Avery

Mailbox

My fuselage frames are all finished except for closing. All empennage ribs are completed by my son David. All tail group spars are complete, and the rudder and elevator are complete except for the final closing skin. I will start the fin and stabilizer next month for sure. The wing spar materials are on hand, and David is working on the wing ribs now so they will be done ahead of need.

I read with considerable interest the flap flutter story and your analysis thereto. I greatly appreciate your willingness to take the time and effort to communicate all of the details of this. Of course, it's only like the thoroughness which you appear to do in all things, to which I and all other builders have become accustomed.

Garry Wilburn
Clarksville, Virginia

I received yesterday the big box containing the construction manual and the construction drawings. Studying the material, our family became very happy and undoubtedly we have a new deal on really doing something important. Our two years of searching for a good airplane was surely not a waste of time. We can confess to you: We looked at least at a hundred types of homebuilt plans from all around the world. Falco F.8L is the most suitable and has light years of advances.

Frederico M. Wiendl
Piracicasa, S.P.
Brazil

I'm enjoying the serialization of Frati's textbook on gliders and aerodynamics. It is interesting to discover that Frati apparently believes the old aviator's tale that



Norwegian Wood.

wings keep a plane in the air by suction. Although the lift vector looks like a cable on an Otis, it is only an abstraction. The things that lift an airplane is the force of the air encountering the underside of the plane, from some angle below. The airplane pushes down on the air, the air pushes up on the airplane. If the force of the air equals the weight of the airplane, the plane stays up. It is not the sucking but the blowing that gets us up and away.

Jonas Dovydenas
Lenox, Massachusetts

How Lithuanians get off at all is a mystery to everyone, however we're forwarding this note to Frati to make sure he gets it right on his next airplane.—Scoti

Thanks for the promotional stuff for the Cal-Aero Expo. It was a real eye-catcher at our workshop. I was surprised how many people were familiar with the Falco. It's funny the reactions you get when you tell people you are building a Falco. You are either given instant credibility and respect, or people think you are out of your mind, but everyone agrees it is a beautiful airplane—even the composite guys.

Cal-Aero Expo was an OK show, but the attendance wasn't what they expected (10,000 people vs an expectation of 20,000). The workshops were first-rate. They had demonstrations of woodworking, sheet metal work, composites, fabric covering and welding, where I succeeded in burning all the hair off my left arm while reaching for another piece of rod. It's amazing how fast hair burns!

Our woodworking booth demonstrated laminating (Falco 'open-air' wheel well rings) and the construction of a Falco rudder spar. We also had a fuselage bulkhead and wing rib on display as well as a scarfing jig and some plywood samples that I had soaked and bent around a sharp radius.

Rick Fitzwater
Van Nuys, California

Yesterday I flew in a 182 that had Bose noise-cancelling head-sets, and the experience was awesome—remarkable. Have you actually tried them in an airplane? They're worth every penny of the \$1,000 they cost, and I'm going to get at least one set for the Falco, as soon as I can afford it.

The reason I mention it is that if I were you, I'd immediately add the wiring option—I understand it's quite simple, with a very small behind-the-panel, or in-the-sidewall, electronic module—to the Falco plans. I'd do it as an alternative to the cur-

rent jacks and urge people to seriously consider installing these as part of the airplane.

As I see it, you have a choice: crawl around with a dBmeter, seal and pad and soundproof and add pounds here and there in an unsuccessful attempt to quiet the airplane... or buy a set of Boses and be done with it. Particularly for the low-frequency rumble that is trumpeted by the tailcone (as I understand it), these things are the total, and I mean total, solution. With these things on, it's like being in your living room. (And mind you, I was flying in a 182 with the pilot's window off, doing air-to-air photography.)

You couldn't do your builders a bigger favor than urging them to install these things as original built-in equipment. I'd put these things way ahead of Shadin fuel-flow transducers or fancy electrical-diagnostics gauges.

Steve Wilkinson
Cornwall-on-Hudson
New York

The 1993 West Coast Falco Fly-In has come and gone. Fly-In #5 is scheduled for the weekend after Labor Day 1994, hosted by the McMurrays of Eureka, California. They plan to hold the meeting at Sunriver, Oregon—a super resort area. The plan is to have the weekend start on Thursday as we have been having too much fun for only three days. You can be sure that next year will be a super meeting with super amenities. Plan on bringing your whole family as we will be meeting in one of the most beautiful places in the nation.

This year we had the use of the new EAA hangar, with our Falcos parked in a group directly in front. We also had the use of their electricity which was handy as I parked our 26' trailer alongside the hangar, and we had our own airconditioned lounge complete with bathroom and fridge.

Unfortunately, we only had six Falcos on hand. Jim and Judy Slaton had a conflict in schedule caused by family concerns. Larry Wholers couldn't come as Edna was not feeling good enough to make the trip, and he wouldn't leave her. John Shipler only had 13 hours on his bird. Both Dovydenas and Wilkinson had conflicts, and with the sour weather back east I had some qualms about asking anyone back there to come. Cecil Rives in Texas just got his engine so he had other fish to fry. We had about 14 phone calls and letters from gracious people that would have liked to come and still had 35 here to share stories with. It was a great time.

You are right about this building of Falcos being a people business. As a group, they are real special and neat people. We had three VCR's working during the meetings and flying. We got some good pictures, Craig Bransfield has volunteered to collate them and make us one tape.

From noon on Friday we had aircraft coming, Falcos, a couple of singles, and a couple of twins. We saw to it that everyone who wanted rides got them. On Saturday morning, after a good breakfast, we decided to join the Swifts at their annual fly-in at Jackson, California. They had about 40 planes there. John Harns, Larry Black and I gave them a little formation runway pass, then landed along with the others of our group and fraternized for a while. Ray Purkiser put us up to it as he used to be a Swift jockey.

We only had one incident and at Auburn one of the group go on the brakes a bit too hard on a lift in the runway and with the flaps down. He wore the tire down to the air. Since he had a Rosenhan tire and brake, the best we could do was a special order for Wednesday. Fortunately, Frank Spysma came to the rescue and had a wheel assembly from his airplane sent to the Modesto Airport, and 1-1/2 hours later when had the wheel and tire ready to put on. That's a real sacrifice.

While the guys were breakfasting and flying Saturday, the ladies took some transport and went to Nevada City and Grass Valley. I don't think that they missed us a bit. Both are Gold Rush towns and are loaded with history and sentiment. They also have shops and the cars came back a bit more loaded than they went. Saturday evening we all gathered for a first class dinner of prime rib, salmon, or Cordon Blue.

Tim Shaw gave us a well-received slide show about the SR.71 Blackbird. We came away with a good idea of what went on with that program, an amazing project. He had previously survived 62 missions flying F.4C's in Vietnam. That's a bunch of them. He even had more missions than our President.

We saw them off in the morning after a breakfast get-together. Sorry to see them go but it'll be better next year, you can count on it. Don't forget Sunriver, Oregon, in '94, same time.

*Karl M. Hansen
Roseville, California*

As advised, the CAA chief test pilot, Keith Englesman has approved the stall charac-



Falcos of Pawel Kwiecinski, Marcelo Bellodi and Bjoern Eriksen.

teristics of the Falco, which we had modified by adding an 8" stall strip to the right wing centered about the aileron pushrod station. The result has been to have the right wing stalling immediately before the left wing, which alleviated the sudden left wing drop with the original wing configuration.

The Certification in the Aerobatic Cat-

egory will be issued concurrently with the normal C. of A. and will be based entirely on the R.A.I documentation.

The Falco is still surprising us by its performance and handling characteristics, besides continuing to collect awards at flying conventions.

*Guido Zuccoli
Toowoomba, Australia*