Falco Builders Letter

Rex Hume and his 180 hp Falco.

First Flight: Rex Hume

The 22nd Sequoia Falco broke ground on June 27 from Grants Pass, Oregon. The proud builder and pilot is Rex Hume who built the plane over an eight-year span. Rex is an A&P mechanic, who already had 39 years of experience at that job when he bought the Falco plans in September 1980, and he had also rebuilt a lovely old Harlow PJC-2.

At that time he was living near San Diego, but he moved to Williams, Oregon, four years later and after doing much work on the airplane. Rex likes building things, and he built the plane from plans, although he bought this-and-that from us. The airplane has a 180 hp O-360-A1A with an aluminum cowling and lightweight B&C starter. The empty weight is 1,251 lbs with a CG of 63.5".

The cowling by itself is enough to make you stand in awe of Rex's handiwork. There are precious few people who can make aluminum take such bends. It's work that requires an incredible amount of skill with a hammer, working the alu-

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Stability vs. Trimmability

By Al Aitken

There is a need to discuss the Falco's trimmability and how it is affected by the stability and control of this wonderful airplane. I once heard a friend say the Falco was so stable that you seldom have to touch the trim. That seemed like a strange comment to me at the time, but it wasn't until I had the opportunity to fly Karl Hansen's beautiful red bird during Oshkosh '89 that I was moved to put my thoughts on paper and hopefully clear up a misconception.

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Around the Falco Patch

If you had to miss an Oshkosh, this was a good year. The weather on the opening weekend was terrible so the traffic was down dramatically. Luciano Nustrini wrote that he couldn't come because his daughter was getting married in early August. And then at the last minute, Carla Biella sent word from Italy that Mr. Frati had been confined to bed with a case of laryngitis and was prohibited by his doctor from travelling. Mr. Frati is now fine and back at work.

But once the weekend weather passed through, we had a good turnout of Falcos. Karl Hansen and Ray Purkiser flew in formation, and Ray felt very humbled by the experience. On the way they flew at altitude with the throttle wide open and set speed with rpm. Ray flew at 2500 rpm while Karl held 2000 to stay even. Karl didn't let him forget it either, and kept the radio active with chatter about the engine settings. Ray said he was going to have to go home and put nose gear doors on his Falco. "So the speed of Karl's airplane is not a myth?" I asked Ray, who shook his head, and said, "No, Karl's Falco really does move."

Karl had big plans for a mass arrival of Falcos from the West coast, but John Harns called to say that he couldn't make it because of a death in the family. And Jim Slaton developed some engine problems and had to bow out at the last minute.

Jim DeAngelo left his Falco at Appleton where I had the Corporate Disgrace. Jim is tired of people fondling his Falco, and the last time he tried to fly into Oshkosh he was refused permission to land—the airport was full. He had to fly back to Appleton and then thumb a ride to Oshkosh. "If anybody wants to see my Falco, tell them to go to the Appleton airport!"

Pawel and Mira Kwiecinski flew up from Chicago for two days of the show. Their

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Rex Hume

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minum over a wooden mold and stretching the aluminum by pounding it over a sandbag. This is the way many exotic Italian cars are built, and it's certainly within the ability of a lone craftsman, but very unusual to see. Rex says, with pride, that "the only fiberglass on the outside of the aircraft is the main gear wheel well doors." That's really rather remarkable when you look at the lovely shape and smooth curves on the bottom of the cowling and carburetor air scoop.

It's also unusual to see in a plans-built Falco such a faithful rendition of our instrument panel, throttle quadrant, glareshield, seats, etc. Many homebuilders branch off on their own when it comes to such things as the panel design, but Rex has plainly drilled every hole in the exact location called out on the drawing. The stick grips and throttle quadrant knobs are a light-colored wood coated with a clear finish.

The airplane is painted white. The instrument panel and interior is all light grey and is very simple and attractive. N660RH is equipped with a single King navcom, transponder and Apollo loran. Rex is certifying the airplane for night and instrument flying.

Rex reports that he trailered the Falco to the Grants Pass airport on May 5th, assembled all parts, did the weight and balance. This made Grants Pass airport the first airport in the world to have two homebuilt Falcos based there, since Ray Purkiser is also at the field. Rex and Ray are friends and on May 12th, Ray put Rex in the left seat of his Falco and Rex made his first takeoff and landing in 28 years. Rex has about 1,400 hours in Stinson Voyagers, Monocoupes, SNJs, Stearmans, Twin Beech, etc.

The FAA inspector arrived on June 12, and signed the plane off. Rex reports, "On June 19th, I was signed off on my bienniel flight review in a Cessna 172 after less than three hours dual. I made four high speed taxi runs up to about 55 knots in my Falco before the first flight a couple of days later. Everything went well with the first flight of 50 minutes, and Ray Purkiser flew chase for me on the first flight with a passenger and video camera. I didn't retract the gear until the second flight. The aircraft trues out at 205 mph at 6000 feet, 23"/2300 rpm. Climbs out at 1800-2000 ft per minute."

Rex now has over ten hours and thirteen flights on the airplane. Rex reports "The landings have proved to be the easiest part. The plane is so easy to land, and it jumps off the ground before I get full throttle if I don't watch it." Rex reports a number of minor teething problems with the plane. The nose gear wheel well doors have given him some difficulty. He said "the gear will not fully retract without popping the circuit breaker, so I took them off—will remake them later with a continuous piano hinge and a different spring."

"I still have to use the manual gear crank to down position to compress the springs. The motor does not coast. Will play with that later. I've had two engine problems. One was an oil leak at the O.D. of the crankshaft seal, so I removed the prop and seal, and sealed with Tite-Seal. Have two hours since, and it looks okay. The other problem is the oil pressure transmitter. It fluctuated from 70 psi down into the yellow band periodically after several minutes of flight. I installed a Stewart-Warner system as a backup and bled pressure hoses to the senders. It helped a great deal but still fluctuated occasionally."

The oil pressure transducer that we use is made by our instrument supplier, Rochester Instruments. Rochester makes the engine instrument clusters for Mooney, Piper, Beech, Cessna, and others. For years they used the inexpensive oil pressure sender that you still see sold through catalogs. This sender is a marine/automotive unit that has a rheostat connected to some sort of pressure device (diaphragm or Bourdon tube). Since the berylium copper wiper of the rheostat rarely moved—remember oil pressure rarely changes—the engine vibration would cause the wiper to cut through the thin copper wires of the coil. The wipers cut through the coils with such frequency that they usually didn't even last through the warranty period and Rochester said that they were tired of replacing the things. As a result, they made their own sender, which uses a potentiometer instead of a rheostat.

Rex's problem with the fluctuations in the oil pressure indications sounds like a loose electrical connection to me. I can't imagine what in the oil pressure transducer mechanism would create such a result. One thing you absolutely do not want to do is to hook up one of the rheostat-type senders to our instrument cluster. The resistances are dramatically different, and it will destroy the gauge.

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One thing that I would like to talk about here, as gently as I can and without being unduly critical. Rex said he was following our flight test guide "by the book" in his testing of the airplane. The flight test guide gives you an extremely complete check list for the final inspections and then a logical sequence for the testing of the airplane. These things, I think, dramatically reduce the risk of something going wrong on the first flight. I know that prior to the flight test guide, we had a very high incidence of problems which were discovered in the air—clogged fuel vents, governors that worked incorrectly, oil leaks, etc.—that should have been discovered before the wheels left the ground. The inspection procedure seems to have eliminated that sort of thing.

The flight test sequence of engine ground runs, taxi tests, controls effectiveness tests and flight tests also reduces the risk. But none of these things eliminates the risk of something going wrong; after all, it is a flight test of an airplane that has never flown before. One thing that was not at all "by the book" was who flew the plane.

It's not a widely publicized statistic, but each year roughly 10 to 20 percent of all fatalities in homebuilt aircraft occur on the very first flight. There are any number of things that cause problems—fuel system problems are very high on the list—and the pilot fails to successfully get the plane back on the runway. There is a very repeatible pattern to the fatalities—the builder does the first flight, and the builder let his flying skills get rusty during the course of building the plane.

I don't mean to jump on Rex; he's got a lot of time in some difficult airplanes; he read our manual and made his own decision. That's fine, but I hope that the success that we are having in reducing problems on flight testing does not lull anyone into complacency. We'd like to see the test pilot be someone who is extremely overqualified. Let's face it, if nothing goes wrong on the first flight, almost anyone can do it, but you should be prepared for the worst. So when the airplane proves to be barely controllable and suffers an electrical fire and engine failure on takeoff, we'd like to see the test pilot be someone who can put it back on the runway with aplomb. For most of us that pilot is someone else.—*Alfred Scott*

Rex Hume and Ray Purkiser taxi in after the first flight. The only place in the world that you can find two Sequoia Falcos based at the same field is at Grants Pass, Oregon.

First Flight:
John Oliver

Congratulations to John Oliver, whose Falco flew for the first time on September 12, thus becoming the 23rd Sequoia Falco to fly. The initial test flights were made by John's son, Paul, an Air Force F-16 pilot who has about 300 recent hours in a Pitts S2A. Part of Paul's job is to flight test F-16s after work has been performed on them, so Paul was ideally qualified to test the Falco, and John readily accepted Paul's offer to do the testing.

Paul took two weeks off from the Air Force and spent the time very methodically testing the aircraft. On the first day, he did about three or four high speed taxi tests and then flew it. He held it on the ground to 80 knots, to insure that he was well into the flight envelope, and then the plane jumped into the air. Paul kept the gear down and reported that the only problem was a very slightly heavy right wing that produced a 2°/second right roll rate.

Paul was very happy with the way it flew. On stalls, he reported "5 knots of tickle, then it rolls off hard left. The airplane talks to you just fine—'you're going to stall.'" Paul said that landings are a "piece of cake" and that ground handling is much easier than the Pitts.

The next day was gear test day and the gear would not retract electrically. Paul cranked the gear up by hand and reported that a power setting of 24/2400 gives 130+ knots indicated. The plane does not have fairings and gear doors installed at this time. There were a number of other little electrical problems—no CHT reading and the load-reading ammeter stopped working after takeoff. These are the types of little electrical glitches that most people experience. The landing gear problem has been traced to the pitot-pressure switch—either there is a loose connection or the switch is faulty—since they bypassed the switch with the jumper used for ground retraction tests and the gear retracted normally in flight.

The problem with the load-reading ammeter turned out to be a problem with something else. On the ground the battery was charging after starting and the load-reading ammeter showed a load of about 20 amps. Once in the air, the ammeter showed a slight discharge, the low voltage light came on, the load-reading ammeter showed no load, and the voltmeter showed about 12 volts. The problem is really with the charging circuit, and I thought it was probably with a loose field wire to the alternator.

Paul Oliver

I remember that Dave Aronson had a problem with his alternator field wire. The thing broke off on every flight, apparently from vibration, and Dave finally used a slightly heavier-gauge wire in hopes that it would not have the same harmonic frequency. Whatever the reason, the new wire worked nicely.

John reports that now with about four hours on the plane, they are still buffaloed by the alternator, which stops working at about 90 knots. They have checked all connections and find them tight. The alternator works perfectly on the ground, and he is beginning to suspect that the problem is in the alternator itself.

In anticipation that a wing would be heavy, John made an aileron trim tab so that it was about nine inches long and stuck out from the trailing edge by about an inch and a half. To correct for the slight wing-heaviness, he bent it about 20° and Paul was presented with a rude surprise when he next flew the plane, although he didn't have any difficulty in flying it. For those of you who don't know, you only have to bend an aileron trim tab the very slightest amount. These things are surprisingly powerful, and you only need two or three millimeters to get an effect. Twenty degrees from neutral is an enormous amount of trim.

At the time he bought the Falco plans in February 1980, John Oliver had retired from Du Pont where he had worked as an engineer. He worked on the aircraft on a steady schedule at home and then moved the project to the Wilmington, Delaware, airport where he finished the plane. John is one of our early builders and suffered through that period when we were eliminating errors from the drawings.

The Falco came in at 1,277 lbs empty with a 64.71" CG, with a 160 hp IO-320-B1A and constant-speed propeller. John tried to get a registration number that ended with his initials of JO, but the FAA won't use the letter O since it looks so much a zero. So when he saw he wasn't going to get anywhere with that, he asked them for the lowest available number that ended with a J and received N27J.

John was a relatively low-time pilot when he began work on the Falco, but he and his wife, Midge, have an Archer which they both fly regularly. As I was writing this, I called John to see if he had flown the Falco. He said he had just come back from his first flight in the plane. He said he finds it a "nice flying airplane—a real pleasure to fly" and also with the as-described light controls. Paul will be checking John out in the airplane during the rest of the week. For his part, John is very glad he had someone else do the flight testing, and says that "anybody who tries to test fly this plane who hasn't been flying this sort of plane has got rocks in his head."—*Alfred Scott*

First Flight:
Joel Shankle

"Thor! How many times do I have to tell you? Don't... eat... the SPRUCE!"

Thor is a large Doberman who for the past nine years has been Joel Shankle's constant companion while he builds his Falco. Thor is an impossibly gentle soul, and he has never understood why certain types of wood hold such importance for Joel. And for Joel this adds a degree of risk that one day he might come home to find that his dog ate his aileron.

Joel Shankle first appeared on the Falco scene back in 1980, not long after we had started selling plans for the Falco. Joel flies for American Airlines and lives on a private grass strip in Culpeper, Virginia. It's one of those little out-of-the-way spots where airline pilots live, within commuting distance of a major airport. Houses, hangars and a grass strip—the necessities of life. Joel already had built a house and a hangar, in which he kept the old Ford tractor to mow the strip and "Darrel Stinson," an old Stinson Station Wagon that Joel uses for puttering around the countryside.

Joel started construction in October 1980 and made his first parts, the smallest fin and rudder ribs, sitting at the kitchen table. He even posed for a picture and Carolyn Shankle quietly slipped the photo from Joel's Falco album so that we could include it here. She sent along a note that said, "It doesn't seem possible that such a beautiful aircraft could begin with such a small, insignificant part. But just think, *nine* years later we're still friends and talking to each other and, of course, I'm mightily proud of Joel for his perserverance, his creative talents and above all his *patience*."

Throughout the first winter, Joel busied himself making wood parts in the basement and kitchen, and then in the spring he moved the Falco building operation down to the hangar. Son Mike made a giant sign—"Welcome to Falco Country, Completion Date 2000"—that hung prominently on the hangar wall. I was mystified at why Joel would make all of his wood parts when there were kits available, but Joel used to explain that he had always wanted to build an airplane, that he was only going to build one airplane in his life, and he wanted to make all of the parts.

That was also before I came to realize that

October 1980. Construction begins. September 1989. Still much to do.

people do not always build airplanes to get an airplane. For many it is a mountain to climb. Many times, I'd ask Joel why he didn't just whip together a little thing-a-ma-jig, stick it in there and get this trap in the air. Joel would say, "but this is a *project*!" as if finishing is not a goal. This guy is worse than Wilkinson when it comes to prolonging to the very end the process of building the Falco. And even as he broke ground for the first time this morning, I can report that the painting is not yet finished. The upholstery still has to be done. And then there are the avionics. These things could easily require another four or five years!

Joel's progress through the Falco almost exactly mirrors the progress I was making at this end. It seems that whenever I was working on some part of the design, Joel was into that part of the plane, too. He has been an enormous help to me and since he is the closest Falco to me—a 25-minute hop in my Falco—I've watched the construction from the beginning in the kitchen. And over the years, Joel has been a gracious host to innumerable Falco builders and builders-to-be.

One of the least desirable parts of flying for an airline is the time away from home. For Joel, a motel in a strange city became a place to plan his next step in the construction. While others watched television or read magazines, Joel would spend the time mentally stepping through the sequence of building the plane. It's a good thing we didn't have a construction manual available at that time. It would have taken all the fun out of it for Joel.

Joel installed a 160 hp IO-320-B1A engine and used a Nustrini canopy, even though he is 6' 5" tall—Joel's quick to add that he has long legs. Joel just liked the looks of the Nustrini canopy, and he came up with a scheme to lift the canopy an inch-and-a-half. This is the "high Nustrini" installation that Pawel Kwiecinski used, and it is very difficult to tell from a distance that there is anything different about the plane.

The Falco weighed in at 1160-1170 lbs in primer and the final inspection was on September 13. Joel decided that he didn't want to fly on the 13th, so he waited until the following day to fly the plane. One

problem that Joel had with the first flight was that his engine had fresh chrome cylinders. Chrome cylinders require a break-in procedure which doesn't mesh very well with the normal requirements of flight testing a homebuilt. You're supposed to start the engine a couple of times, run the engine until it gets warm, and then you are supposed to take off and fly the plane for a half-hour or so at a high power setting and with the cylinder temperatures very close to red line. If you don't do it that way, there is a possiblity that your engine will be an oil burner.

Joel managed to squeeze some high-speed taxi tests into the initial engine runs, and then on the first flight he just took off with the unusual mission of getting his engine hot. I should mention that Joel flew A4D Skyhawks in the Navy and flies regularly with American so he's completely qualified to handle the bird. There was a low overcast, and Joel found he needed to raise the gear. He just selected gear up, which worked nicely the first time, and then he watched as the airspeed climbed to 160 knots indicated.

The plane "goes like a bat," and for the next half hour, Joel screamed around the skies over the strip, and never strayed far from the field. How did he like it? "Oh, it'll run, boy, I'm telling you. That was the biggest problem—to keep it reined in." He reports that the airplane flies hands-off from the first—from the beginning it is in perfect trim.

There were a number of little glitches. The manifold pressure gauge didn't work. He had erratic readings on the front fuel tank gauge. And then when he brought it down for the first landing, just as he pulled the engine to idle over the fence, the engine quit. Joel isn't exactly sure when it happened because the prop continued to windmill and only after his wheels touched down did he see the propeller stop. He couldn't get it started again, and Joel thinks it was flooded, since it had been running rich at idle. He has since discovered that it was way too rich and has been flying it with the mixture leaned.

For the registration number, Joel tried to get "J03L" (get it?) but had to settle for N703L, although he may take liberties with the bottom of the seven. Joel says he actually fits under the canopy and finds it snug but liveable. Even if he didn't fit, I'm not sure Joel would change it—the canopy screws, he says, "almost made me lose my religion."—*Alfred Scott*

Aftermath: G-ROVI

G-ROVI, an Aviamilano Series II Falco, crashed on September 9 near Belfast, Northern Ireland, killing Brian McBride, the owner/pilot and his young son, Mark. They were about 4 miles from the airport at Newtownards, in level flight at 1200 feet over the sea when there was a loud noise, the tail section broke off, and the rest of the airplane spun/tumbled extremely violently into the sea with the engine "screaming." The wreckage was scattered over a 70-80 meter area. Brian McBride was found 40-50 meters from the wreckage; thirteen-year-old Mark McBride was not recovered.

The information I have to report on the wreckage comes from Andrew Brinkley who is very familiar with the Falco by virtue of maintaining G-ROVI and other production Falcos. In Belfast for Brian's funeral, Andrew had about 10 minutes to inspect the wreckage and will make a more complete examination in a few days. The evidence strongly suggests that the canopy came off by sliding aft, hit the tail and broke the entire tail section off in front of frame eleven.

There are deep grooves on the right aft top of the fuselage from the canopy. The top foot of the leading edge of the fin is missing. A slot is cut in the rudder a foot from the top. The elevator has a hole through it at station five. There is a two-inch hole on the top of the stabilizer.

There were a number of eyewitnesses, including one man who was watching the airplane at the time of the accident. The forward part of the fuselage and the wing arrived at the water largely in one piece but were shattered on impact. The ailerons and flaps were recovered, as was about 40% of the wing skin. A small piece of the main wing spar was found, just a 4-5" section at the center of the airplane. The two fuselage frames at station 8 were found still joined together with bolts but the frames were smashed. The elevator and rudder cables failed in tension. Andrew reports no sign of glue failure and that all of the breaks were in the wood.

Andrew Brinkley had installed a shoulder belt mount using our design as a guide. The shoulder belts did not fail but had pulled out a large section of fuselage. They have recovered various parts of the windshield and fragments of the canopy, but not the canopy frame. The windshield bow has been recovered in three pieces and the section with the hook is missing. The canopy tracks were found still bolted to the longerons below them, but the canopy tracks show no sign of distortion, indicating that the canopy was already gone when they broke from the fuselage.

At this time, the best explanation is that the aircraft struck a bird, which shattered the windshield, the force of the air drove the canopy straight back into the fin, and broke the tail section off. Some of the wreckage had been floating in the water for several days, and there is no direct evidence of a bird strike. The area is highly populated with seagulls; indeed, Brian had lost his windshield earlier this year when he hit a seagull. At the time he was flying about 90 knots in a wingover looking to the left when he heard a very loud noise and saw that a seagull had broken a large hole on the passenger's side, and the dead bird was in the passenger's seat. In level flight, Brian would have been going about 180 mph.

On the Falco, the windshield bow depends on the windshield for its strength. If the windshield was completely shattered, the bow would break off in an instant. With the windshield intact, the canopy is sucked forward by the lift created by the windshield, and it is difficult to move it back even when rolling out at 40 mph. And a bird strike at 180 mph is a terrible event that few windshields will tolerate. Pidgeons and seagulls weigh one to three pounds, and at the 90 kts that Brian earlier lost a windshield, a one-pound bird would have 354 ft/lbs of energy, while at 180 mph the energy would increase to 1,082 ft/lbs—one engineer equated that to dropping a brick on your car's windshield from an overpass while your car is going 60 mph (The energy in ft/lbs is: the speed in ft/sec squared, divided by 2, times the weight of bird in pounds and all that divided by 32.2.)

Triple those figures for a 3-lb bird, which at 180 mph has enough energy to lift 3,246 lbs a distance of a foot. Said another way, that's enough energy to lift a fully grossed-out Falco more than twenty inches. —*Alfred Scott*

Around the Falco Patch

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Falco looks as good as ever, except for the fairings on the wing and tail. When I drew the hinge fairings, I never dreamed that anyone would be doing tailslides in the Falco. Irek has been putting the Falco through its paces and all of the flat fairings have long since been peeled back.

Terry Smith arrived from Pennsylvania with his new 180 hp Falco. Because Mr. Frati was scheduled to come, they rushed to complete the painting in time for Oshkosh. The Falco is white with red and grey strips. Terry reports that it took him 3.5 hours to get home, averaging 192 knots groundspeed with a tailwind.

I think the real surprise to everyone was Steve Bachnak's Falco. Steve had always sneered at compulsive builders who polish parts and don't get on with the business of building an airplane, so everyone just assumed that Steve's Falco was, well, *average*. It sure isn't, in fact many Falco builders considered it the best-built Falco at Oshkosh. It is just a good honest airplane, with a relatively simple panel. It's very nicely built with hardly a flaw to be seen.

I flew up to Oshkosh with my nephew, Jimmy Stanley, whom you might remember from the story about Jimmy's Big Ride at the Great Oyster Fly-In a couple of years ago. This time, rather than wringing the airplane out over the farm, we settled down for a long cross-country, and I taught Jimmy the basics of how to fly the thing and then settled down to read the morning newspaper while Jimmy soldiered on. There were a few clouds around and to hone Jimmy's skills and to keep things from getting too boring, I said I wanted to see him slice that cloud up ahead with the left wing. It didn't take him long to get the hang of it and for the rest of the day clouds weren't safe with Jimmy in the sky. Jimmy's fourteen and with the sight of all of the airplanes at Oshkosh, Brenda and I had to put Jimmy on a ration book of the A-word. Everything was "awesome" including some rather pedestrian machines.

Steve Bachnak

Terry Smith and his newly painted Falco.

Hang around the Falco booth, and you'll see the whole spectrum of humanity. At one point, I found myself face-to-face with a guy who looked like a cross between Festus and Mongo, and as he explained his request in a deep southern accent he lowered his forehead, squinted his eyes and wobbled his head back and forth—the unmistakable good-old-boy body language of the real-friendly, Chuck Yeager approach. Looming over me, he explained that he was building a Lancair and wanted to buy our throttle quadrant for his plane. I explained that I was very sorry but because of all the liability problems with lawyers suing everyone, we only sold our parts to Falco builders. His eyes got squintier and his voice became even more friendly and understanding as he said that surely there wouldn't be a problem selling him these lil' ol' things. He mentioned he knew a Falco builder, and I told him the parts weren't terribly difficult to make and that he was perfectly welcome to make copies of the drawings and make the parts himself. After a couple more requests and apologies from me, he suddenly turned very sullen, said "Well, with your attitude, I'm not sure I want your parts on my airplane" and stormed off.

He reminded me in a way of the West Virginia farmer who came to see me a couple of years ago. He called ahead to make an appointment, and then spent a surprising amount of time talking about his cows before getting on the subject of the Falco. After going over all the drawings and giving him a tour of the warehouse, he said he really wanted to see the Falco. He didn't want to fly in it, just to see it. So we drove out to the airport, and I pulled back the hangar door.

Everyone reacts differently to the sight of a new machine. Some people stand back and study the lines. Others examine the plane up close and crawl under it to look at the gear, but this man in bib overalls did something I'd never seen before, and frankly, it seemed rather unnatural. He lunged at the plane and began to feel it all over. Almost as if he were blind, he ran his hands all over the fuselage, the wing, the tail, under the bottom.... It was rather embarrassing—what are you supposed to do when somebody feels your airplane? Look the other way?

This went on for about five minutes and then he stood up and said he had seen

enough, so we came back to the office, and being a rather formal man, in his way, he waited until we were seated across the desk before he talked business. He said that based on everything he had seen, he was very interested in the Falco and wanted to know if I knew of anyone who had a *used* set of drawings for sale.

Where was I? Oh, yes, Oshkosh. I always enjoy running into Frank Strickler, co-conspirator in the marketing of Frati aircraft. Frank is an excellent pilot with strongly held views about aircraft, and he's not shy about it. He very much dislikes the Glasair, which he says exhibits inertial coupling in a roll. He tells of how Bob Thalman, test pilot for the SX-300, used to give prospective purchasers a refreshingly frank opinion of the airplane, saying that the airplane flew well but still had a few things that needed to be done. He was told to stop saying that, and on refusal to do so, he just took his final paycheck and the company issued a press release that flight testing was complete. (For my part, I'm not so critical. Swearingen did more flight testing than anyone else that I'm aware of.)

Frank also tells of the time Thalman flew in the SF.260. Upon landing, Frank asked him, "Well, Bob, what do you think?" Thalman looked both ways to make sure no one was around and said quietly, "I wish our airplane flew like that."

Frank's latest report was on the Glasair III, which he had flown recently. He said the airplane is extremely fast, but he did not like the pitch control at all and that the control forces reverse above 240 knots indicated. I heard this from others as well, that the pitch control was a problem. There were some SF.260 pilots who deserted for the faster Glasair III, and the word among the SF.260 pilots is that there are a few regrets. Marty Jacobson sold his SF.260 and had a Glasair III built for him. He's now looking to sell it and buy an SF.260 again. The reason, basically, is that he rather go a little slower and have more fun flying. Speed isn't everything.

The other two are Jack and Cindy "Tip Tanks" Rouse, who in the past have owned a matched pair of SF.260s. Jack had a Glasair III built for him and has another under construction for Cindy. Cindy, who is by all reports much the better pilot, finally got her nerve up recently to tell Jack she really doesn't want the Glasair III.

Brazilian writer Fernando Almeida came by the booth. The man was visibly shaken and said, "My friend, I have just had a terrible experience." Fernando had just flown down to Fond du Lac in the Lancair 235 with the demonstration pilot whom he only knew as "Bob". Bob had about ten people lined up to give rides and then Fernando and Bob were going to fly back to Oshkosh. They landed at Fond du Lac, Fernando got out and the first man in line hopped in the Lancair. They taxied out and took off.

Fernando struck up a conversation with Patty Wagstaff, current U.S. woman's aerobatic champion, and they looked up to see the Lancair turning final for landing. It was not the normal approach, they were low, slow and turned steeply. Fernando could see the wings shutter, and then the plane stalled and went straight in. It was over in an instant.

We talked about whether there is a tendency to push to show off an airplane at Oshkosh. Fernando thought so. You want to show how fast the plane goes and how docile it is at low speed. At each evening airshow, you watch the world's best pilots routinely zip through impossible maneuvers, and as we stroll past the Bob Hoovers and Clint McHenrys I think we forget for a moment our own limitations. It isn't showing off, but rather a subtle erosion of caution.

Otto Oppliger, Lycoming vice president for sales and service, stopped by our booth. After I wrote my article on the Porsche engine a couple of years ago, I sent a copy to a friend at Lycoming figuring that it might cheer him up. It did to an extent I hadn't imagined—my friend called me up and talked for an hour-and-a-half about the engine and how this was the first thing they had seen that questioned the engine. Oppliger got his hands on the article, posted copies all over the factory, sent copies to all of their OEM customers, all distributors and even the president of Porsche. The Mooney sales manager called him back to say that he didn't really disagree with any of the points raised, but they had built the airplanes and his job was to sell the things. Oppliger ran into the president of Porsche at the Hanover Air Show, who was quite cheerful about the article and who said he found it "another interesting point of view". Porsche has since pulled out of the engine retrofit business, declaring that they are a car company.

We had a good builder's dinner with a diverse and interesting assortment of people. Fernando Almeida told of seeing a Frati aircraft, a Picchio, for the first time at the Paris Air Show a number of years ago, and how afterwards flying away in a Jodel, he was so preoccupied with thoughts of Frati that he lost his way. He found himself over a large elegant building in a forest, surrounded by many limosines. He circled the building a number of times and noted the unusual amount of activity below. He continued on his way and was arrested upon landing. The building was SHAPE—Supreme Headquarters, Allied Powers in Europe—and he learned that there had been some discussion about whether to shoot him down. They finally decided he meant no harm, and he was released.

Writer, test and ferry pilot Peter Lert gave an extended account of flying Homer Woodard's SF.260 from New Zealand to Greenland where the engine failed after takeoff. I hope someone publishes the account, which is quite something to hear. The bureaucracy of the New Zealand authorities. The beer-drinking tower controllers in Australia. Trying to purchase gasoline in impossibly remote Arab states. The thoughts that went through his mind after the engine stopped. "It's not mine, and it's insured." Whether to attempt a glide across the fjord, which was covered with a thin layer of ice—too thin to support the airplane but thick enough to create other "difficulties". How after looking down at the only possible landing spot, a boulder-strewn field, he mentally prepared himself for "a big disappointment". He was able to put it down safely between the boulders in the barren, blighted spot of earth, only to be instantly surrounded by twenty Inuits smoking cigarettes. Peter is married, and after this flight he's become more cautious. In the last year, Peter says he's turned down lots of ferries.

One of the people who came to Oshkosh was an Englishman who was on his way to see Jim Martin and to buy his Falco. Just two days before coming, Jim called to say he had sold the Falco. Joel Bottero, World Airlines captain and Falco builder, had taken one ride in the plane and wrote a check on the spot. The agreed price was $75,000 for the no-radio Falco and carries some intangible benefits for Jim, who's welcome to fly it any time he likes.

I had been trying to get Jim to turn the airplane over the Frank Strickler to sell, since I think airplanes are just like houses.

It's well-established that people who sell their own houses usually don't get full price. Jim didn't want to leave the Falco in someone else's hands, and everyone's happy, so who's to quarrel?

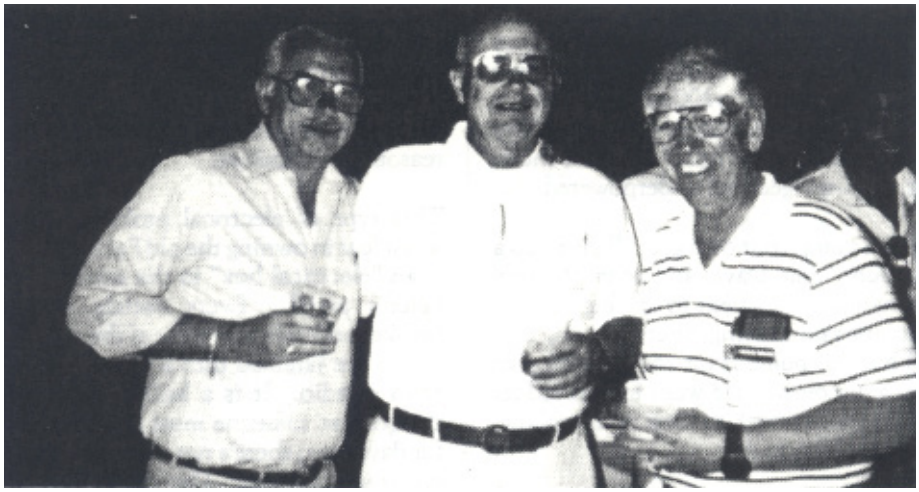
I left Oshkosh on Thursday with time to kill. I was supposed to meet Meredith and the girls in New Hampshire on Saturday evening. I stopped to see Gar Williams in Naperville, Illinois. Gar is finishing up a Sequoia 300 for Butch Harbold, and I hadn't seen the project in some time. The project was started by a man who slowly lost his eyesight as he built the plane so there have been a lot of mistakes to correct. It should be flying in relatively short order but for the recent discovery that one wing has two degrees more twist than the other. The next time you think you have problems, think about that.

I had planned to spend the night with Gar and Mary Alice Williams (not the news anchorwoman), but there was a big front moving in from the west, so I headed east with no particular plan in mind. On my flight to Naperville, I had noticed that the voltage was slowly dropping. The only reliable instrument I have for the electrical system is a digital voltmeter, and that is only marginally reliable because it always reads frightfully low. But at least it is consistent and for a 28-volt system, I normally see no more that 23 volts on the thing. But since it gives you the voltage in tenths of a volt, it is normally very active, frantically vacillating between, say, 22.6 and 22.7 volts.

But not on this flight. The voltmeter was unchanging, and every fifteen minutes or so would drop down another tenth of a volt. The obvious conclusion was that the generator was not working. I reduced the electrical load and after landing at Gar's, I looked for a broken generator belt. Everything looked fine. The airplane wouldn't crank over, so Gar propped the plane, and I headed east with the general plan to stop somewhere to get gas and the plane worked on.

The countryside east of Chicago is non-descript, and I found it difficult to precisely locate myself on the sectional. My radios, when I flipped them on, said I was north of where I wanted to be and with my voltage continuing to drop and an hour's fuel reserve, I decided to put it down at the first airport, which happened to be LaPorte, Indiana.

I taxied up to the gas pump, shut it down and then tried the starter to see if it would



Scenes from the builders dinner. Top: Bob Bready, Karl Hansen and Howard Benham. Center: Ray Purkiser and Nolan Hansen. Bottom: No ticki, no laundry—the cashier's desk was overstaffed by Kakee Scott, Sara Scott, Jon Aitken, Jimmy Stanley and Brenda Avery.

crank. Nothing. I fueled up and then turned a hopeful face toward Dave Potter, Maple City Aviation's sole mechanic who at the time was trying to fix the gas truck, fix supper for his son, pump gas, tow airplanes out of the hangar and generally make everyone happy, even though it was well after quitting time and plenty hot.

He put the Corporate Disgrace on the battery charger, while I removed the cowling. A Stinson Model 10 taxied up, needing gas. It was on its way back from Oshkosh and flown by a garrulous woman

and her silent husband. She only wanted ten gallons because she said the plane didn't climb well, and in fact had only managed to climb to 200 feet at the end of the 8000-foot runway at Oshkosh. The Model 10 was the "baby" Stinson, short, fat, high-winged and underpowered.

"If you pump your own gas, I'll give you a discount," said Dave, and when the tiny woman standing next to the big, clumsy airplane said nothing, he continued, "and if I have to pump it for you, I'll still give you a discount." He went for the ladder while I went over to look at the plane. Nothing else to do.

Then the Stinson wouldn't start. I got my pocket multi-tester and offered to help. The only thing worse than an Italian electrical system is no electrical system at all. The battery was down under the seat somewhere and try as I might, I could never see it. The master switch was something you felt for with your hand down in there, but I wasn't able to see that either. The starter switch was something you pressed your foot on. We determined the battery had some juice because the fuel gauges moved. We finally decided to just prop the plane and send them on their way.

With the shorter field, I tried to make a bet with the couple that they wouldn't make it, but collection became an issue. In fact, the plane took off rather quickly, but once it was in the air, it established itself serenely in nearly level flight. Once you get used to the 2000-foot service ceiling, I suppose it's a nice plane. At least you don't have to memorize a lot of airspeeds; stall, cruise, top, landing, approach and climb speeds are all the same.

As Dave tore the generator apart and discovered that all the necessary parts were present, he mentioned that a bunch of acrobatic pilots had taken over the field. Over at the hangar at the end of the field, there was a bunch of Pitts and an Extra 230. The pilots were practicing for the upcoming championship at Fond du Lac which was coming up in a few days. At such a deserted field, they could practice right over the hangars, and their coach/mechanic would talk to them on the radio about how they were doing. They were keeping a tab going on the fuel; in fact, I was there for two hours before Dave bothered to collect for my gas.

Their coach/mechanic wandered over and peered in the engine compartment. "*You* fix it!" said Dave, and I noticed that the guy kept looking at me in a strange way as we talked about the system. We determined that the voltage regulator was not getting any juice and that was the reason for the failure.

This type of electrical problem is my worst fear in owning the old Falco. There is an "electrical box" in the middle of a Falco's panel. Every switch, circuit breaker and indicator light of the original Falcos are jammed into a box no bigger than a radio. It is a brilliant piece of design that someone must have labored for days over; there's not one extra millimeter in this thing. The idea is wonderful; to remove the front tank, you lay this box on the floor. Unfortunately, that part of the design was not understood by everyone and over time as radios were added, the box became a rat's nest with wires running every which-a-way. Once some years ago, I was working over this thing and a tiny screw fell into the box and tinkled to the bottom. I spent an hour trying to find it and was never able to do so.

If our problem was in that box, there was no way we were ever going to figure out what was the matter. Then I remembered that I disconnected the landing light and had capped off the wire in the engine compartment. We decided to try a band-aid, hooking the landing light wire to the voltage regulator. It was easy to do, and we put the cowling back on and fired it up. Not only did it work, I have since found that the band-aid works better than the original system ever did. I'm now seeing 26 volts on the voltmeter, and I suspect it's all voltage drop to the bus, which also supplies power to the voltage regulator.

By this time it was nearly dark, and I decided these aerobatic types might be interesting. One of them had already offered me a ride into town, and they were all over at the hangar where the local flying club was hosting them for dinner. I'd been invited to join, so standing right next to the gas pump I changed into some clean cloths and wandered over.

They turned out to be a lively bunch. The coach/mechanic was Ron Cadby, who I'd met in Florida some years ago and actually had given him a ride in my Falco. Bob and Patty Wagstaff are from Anchorage, Alaska. Patty is lithe, lovely and athletic and Bob, a lawyer, wears the Alaskan uniform of non-conformity: beard and blue jeans. Rudy Pintiago is from Brazil, Ian Groom is an Englishman living in NYC, and Mike Goulian is from Boston where his family runs a large flight school at Hanscom Field.

Hang around such people, and you'll hear a lot of engine talk. Ian Groom had just had High Performance Engines overhaul his engine. They did a nice job on the engine, but he was miffed that they had not replaced the spark plugs. Patty voiced the opinion that the work at both High Performance and Firewall Foreward had slipped and that the best work was presently being done by Monty Barrett of Tulsa. (Barrett Performance Aircraft Inc, 2870B North Sheridan Road, Tulsa, OK 74115—telephone: 918-835-1089)

I was also interested to learn that because of the emergence of aircraft like the Extra 230, the Pitts is now "useless" for unlimited contest flying. The problem is that judging standards have changed. If you do a square loop, the radius at the turns at the top is now expected to match the radius at the bottom, and the Pitts can't do that.

Ian Groom has owned all of the CAP series of airplanes, and I've always thought the CAP-10 and the Falco were very similar in handling. The next day, I took Ian for a short flight in the Falco, which he found completely different. At the time he flew it, Ian was thoroughly psyched up for his aerobatic routine, and he flew the Falco as though it were a Pitts. I have never seen anyone handle an airplane with so much activity. The stick was in constant motion as were the rudder pedals on take-off. Interestingly, Ian said he considered the barrel roll the most dangerous maneuver and that it was easy to get yourself killed doing one if you didn't have instruction.

I flew on east and stopped for fuel at Binghamton, New York. This place reeks of big corporate aviation. The buildings and hangars are huge, monolithic structures. There's is a big IBM facility there and the FBO must have succumbed to a super-salesman; the girl at the desk typed fuel request data into a mainframe terminal and to get fuel you had to fill out a lengthy form. I imagine that if I had landed *there* with my electrical problem, they'd have to re-write their database to accommodate a 1960 Aeromere Falco. I prefer little airports like LaPorte where you can land, get gas and go, and where the biggest problem you have is with the kid on the bicycle who won't stop asking questions.—*Alfred Scott*

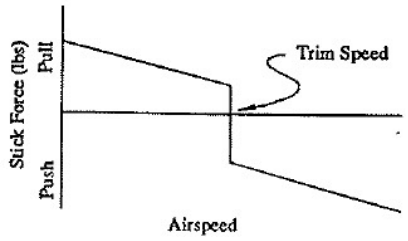
Stability vs Trimmability

Continued from First Page

As Karl and I approached Appleton's Outagamie Airport, we were instructed to report on left base for runway 21. At that point, we were cruising at 2,500 ft. MSL, clean at 165 KIAS. We were getting pretty close to a modified left base, so I reduced power and started downhill. The Falco does not slow readily, so I tried a few mild G turns to bleed the airspeed off. At 108 KIAS, I lowered the gear, and then it dawned on me that, in spite of a 57-knot airspeed decrease, the untrimmed stick force required was virtually unchanged. Things got pretty busy as Karl was talking to me, the tower was talking to another aircraft on long final and I was trying to get a word in to call my position past left base approaching short final! My attention had been diverted outside the aircraft for lineup and to look for the long final traffic when I glanced at the airspeed indicator and noticed we had slowed now to about 70 KIAS with still no significant change in stick force and no need to retrim. Why was that so?

First, a very brief review of stability and control: The stability of any airplane is its tendency to return to equilibrium when displaced. Controllability is a measure of the ease with which the pilot can displace it from equilibrium. An extremely stable airplane might be very hard to control depending on the level of controllability. An unstable airplane may be impossible to control regardless of controllability. The F/A-18 I used to fly was designed with very relaxed static longitudinal stability—almost neutral. The relaxed stability and very strong controllability make it a highly maneuverable fighter—the airplane would be extremely difficult to control without the digital flight control computers. Static longitudinal stability is normally indicated in terms of stick force versus airspeed measured about a trimmed point of equilibrium. A simple graph explains:

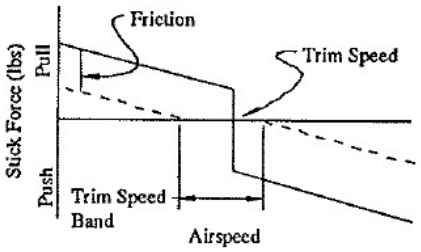
The important thing for most general aviation airplanes is that the slope of



the curve be positive (ie. to slow down, the pilot would increase pull force on the stick). The level of positive stability is indicated by the degree of the slope of the curve. Starting from a trimmed airspeed, a very stable airplane would require significantly more pull force on the stick; a more relaxed stability airplane, much less pull force.

Hold that thought for a moment while I present one more simple graph to make my final point on trimmability as affected by stability:

Even though the Falco has some of the smoothest and most nicely harmonized



controls flying, all airplanes have some friction in the control system. The friction must be overcome before the control surface will actually move and cause the airspeed to change. Plotting the friction effect on the graph above forms a hysteresis (see the dashed lines). The intersection of the hysteresis envelope with the zero stick force line spans what is known as the trim speed band. The trim speed band is a range of airspeeds in which the airplane is perfectly happy to fly with zero stick force required and no need to retrim. Now to the point—for a given amount of friction, the lower the slope of the curve (less positively stable) the wider the trim speed band. In other words, an airplane that requires very little trimming over a wide range of airspeeds may be indicative of a *less*, rather than more, positively stable airplane.

Why is this important to Falco builders and potential new Falco Test Pilots? I've flown four examples of Falcos now including three homebuilts and the Corporate Disgrace. All four exhibit similarly light stick forces and wide trim speed bands. In fact, I have never had to touch the trim wheel—Alfred wouldn't let me touch his. Although I do not have numerical data to support my opinion (give me 4 to 6 years to finish my Falco, and I'll provide the data), the Falco is obviously not a kid's toy. It's a pilot's machine.

In most general aviation aircraft, a primary cue for airspeed control, other than the airspeed indicator, is stick force. During an approach in a Piper Cherokee, for example, the pilot can use the push or pull force cues from the yoke to help judge airspeed. In the Falco, if you are trimmed for approach speed and don't pay close attention to your airspeed indicator, it would be very easy to get slow without realizing it. I personally like the Falco's apparent relaxed stability and silky smooth and harmonious controls; it feels more like the agile fighters that I'm used to. But the lack of stick force cues for airspeed control in the approach phase is a characteristic that should be kept in mind and compensated for.—*Al Aitken*

Al Aitken is a Marine Corps F-18 pilot and a graduate of the Patuxent River test pilot school. Now that he has fully developed his skills, his present assignment is flying a desk.—Alfred Scott

Goings On at Sequoia Aircraft

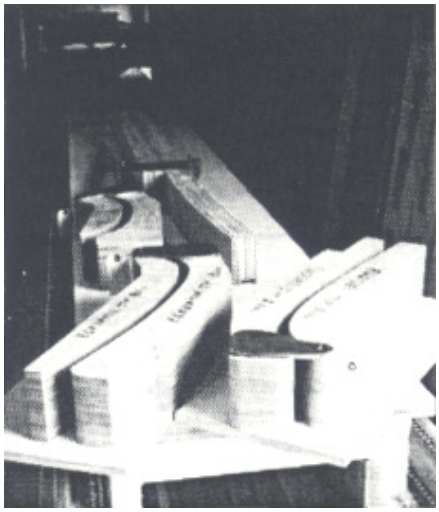
Slow, steady progress on the wood kits. I've made new jigs for the forward wing spar, aft wing spar, aileron/flap spar and all but one of the tail spars. I am just in the process of finishing up some jigs for the elevator and rudder tip laminations. None of this is particularly interesting. The spar jigs are all "inside" jigs; that is, the spars fit around blocks of wood which locate everything. The only tricky business was cutting the tapers accurately with the taper jig described in Tool Talk.

The elevator and rudder tip laminations are made on a jig that is pretty much like the one Francis Dahlman used, but Francis made one part at at time. We get the laminating strips in five-inch widths and with our new jig we can make five or six at one time. To make the jigs, I drew the shape of the parts on sanded acrylic, drilled a series of holes for dowel pins and then made a number of birch plywood parts on the inverted pin router. When you glue the pieces together, you use dowel pins in the holes to keep the parts aligned.

I find that I depend mainly on a few materials for making the jigs: baltic birch plywood (baltic is a trade name for Russian plywood made from technology forcibly extracted from the Fins after WWII), Formica, acrylic sheet, dowel pins, glue, screws, polyurethane varnish and hard mold wax.

The main wing spar laminating jigs are partially made, and it will be easy to finish them by the time the spruce arrives in a month or two. There are still other jigs that will be required, and I find that it is essential to spend a lot of time working on the design of the jigs so that you are very, very sure that you want to do things a certain way. It just doesn't seem to work at all to fly off half-cocked and make part of a jig and then try to figure out how to finish it.

It's rather strange. Even though the part itself may be designed in complete detail, you have to design a production process and then design the jigs to fit the process. The jigs are so critical to the accurate and simple assembly of the parts that it is essential that you spend the time necessary to make very certain that you have done it the best way. Most of the work is mental, and once you have worked out the design, the actual building of the jig is relatively simple.



Cutting schedules are critical. You work out the size of the plywood pieces needed for the tail group ribs and then you can cut all the pieces for fifty kits in a couple of hours. The only problem I have is that there is a lot of work involved in all of this. Like the Old 97, I'm always running be-hind time.

One little project that I have been working on at odd moments is doing some beta test work on a CAD program known as PowerDraw 3.0. Ever since I saw what word processing could do, I have longed to be able to draw on a computer and over the past 5 years, I've read more about computer-aided-draftings systems than I have about airplanes. Every time I found myself tracing an image, or drawing something repetitively, I've been overwhelmed with frustration.

Then I go in search of CAD systems. If you talk to a salesman or read a review, you'll be convinced you can do anything with their systems. Once about three years ago, I got a demonstration of a $60,000 system that I had pretty well decided to buy. The salesman ushered me into the demonstration room and introduced me to the nice lady who would demo the software—the salesman couldn't run the software he was selling. The lady started throwing circles up on the screen with blinding speed, but then I stopped her and asked her to do the simplest thing: make the portion of one circle where it crosses the other circle a hidden line. She couldn't do it.

A few months later, a competitor lugged a monster machine into my office, set the thing up and started to strut his stuff. I was curious how you would draw the Falco's fuselage curve. I showed him how the curve was developed, and I gave him some dimensions. He set the grid for millimeters and then started counting tickmarks on the screen with his fingers. It's difficult to know how to react in such situations.

And over the years I've watched as others have bought systems, and everyone talks about "six month payback" so I like to call six months after they have taken delivery. Invariably the learning curve is steep, and the benefit of the systems proves to be far more limited than was originally thought. I know of countless CAD systems that are purchased and then literally abandoned—indeed, the industry average is that 30% of all installations fail.

The problem with such systems is that you are expected to draw by typing. It's an absurd way to work. We use Macintoshes here and while they are nice, easy machines to use, there has not been much activity with CAD systems. Instead there have been a number of "draw" programs, that treat lines, rectangles, circles, ellipses, etc. as objects—things that you can push and shove around on the screen like they are sticks. It's a far better way to work with a drawing, but the programs have lacked the precision and control of a CAD system. The marriage of object-oriented drafting with CAD has been difficult and slow in coming.

I've done other beta testing for graphics software. It's interesting work, and I do it primarily to influence the design and operation of software I might use. It was amazing to make a suggestion that ended up in the software, albeit one year later.

Unfortunately, my blunt tongue got me in trouble. I was fired by the thin-skinned president of a huge company for a report of mine that he found "demoralizing and demeaning" to his employees. I had told them politely on two occasions that they were committing an unbelievable *faux pas* by referring to ellipses and elliptical arcs as "ovals" and "oval arcs". It had no effect so I decided to use the shock approach (which, incidently, *did* work). It was all terribly funny, and if I weren't pledged to secrecy I'd print the whole thing, but the fellow seems particulary offended by "kindergarten language" and "Kiddie CAD." I do this so often that I've developed a philosophy that if you are not making someone angry, you're being too ordinary—nothing to strive for, mind you, but it's a nice platitude to mumble to yourself when no one will talk to you.

Then Frank Christensen mentioned to

me that he had evaluated all of the CAD programs available on the Macintosh, including AutoCad and VersaCad and had found an obscure program that was vastly superior to all of them. It was developed by a tiny company in North Carolina, literally a computer store. Nobody told the owner that only big companies could do this sort of thing, so when they weren't selling computers, Bill Stanley and his son, Todd, started working on a program and were later joined by another programmer, Hoyle Fulbright. Todd and Hoyle do all the programming, and Bill and others figure out what it should do, write manuals and help their users with questions from time to time.

I had met these people before at a show and had given them some of my drawings on the Falco to use with the plotter driver they were selling. After warning them of my banishment from their huge competitor, I asked if they would be interested in me doing some beta test work. Unlike the other company, which had many people testing their software, Bill Stanley limits it to ten people who were expected to work hard. Frank Christensen was already signed on, so for the past six months, along with eight other people, Frank and I have beat upon these poor people unmercifully, and the amazing thing is that they like it.

When I first looked at the program, I found a gem in the rough. There was so much about the program that was wonderful and so many other parts that were ugly, horrible and non-instinctive. I had a lot of ideas of how things should be done that meshed with my passion for elegant simplicity. I sketched out some ideas and was surprised to see them appear in the software a week later.

So I kept sending ideas down there, and the more I sent the more got implemented in the software. The degree to which this whole preposterous thing evolved is reflected in the admission by Bill Stanley that they sometimes feel like they are designing the software just for me and how after months of me snarling at them about something, they'll finally put some new feature in the program with the war cry in the programming rooms that "*this* ought to make Alfred happy!" It did.

Then a couple of weeks ago, a very distraught Bill Stanley called me. He was obviously at the end of his emotional ropes and was calling me to ask "a favor" of me. It took a while for it to sink in what the "favor" was: he wanted me to stop sending in ideas for adding features to the program—or at least put them on a separate piece of paper. With his small staff, he didn't have the ability to separate bug reports from new ideas. Everything was getting through to the programmers who'd much rather work on creative new ideas than fix bugs. With the shipping date only weeks away, bug fixes were the first priority.

Most of us buy programs and use them as they come out of the box. Even though most software companies are committed to listening to their customers, very few of us can point to anything on the screen and say "I suggested they do that." I find it astonishing that I could have had such an influence on the design and operation of this system, and I'm sure all the other testers can say the same thing. My influence has been on the design of the dialog boxes, the documentation and some features related to how curves are handled. Frank Christensen has been influencial on the operation of the dimensioning tools.

After Oshkosh, I was in New Hampshire for a week's vacation and with time to kill on the way home, Kevin Baranski-Walker and I went down to Boston to a big show where PowerDraw was being displayed. I was primarily interested in seeing what Kevin thought of it—Kevin works for Digital Equipment in their 3D graphics department as a programming manager. He's familiar with all of the micro and mainframe CAD systems. I was surprised to learn that mainframe systems have drawing tools that are inferior to their micro bretheren; their features have mostly to do with allowing multiple designers to work on a single design. As in word processing and spreadsheets, the best features are found in the micro systems. Kevin was very taken with PowerDraw and planned to order a copy.

So how good is this program? As best I can tell, it has all the features of the best programs plus a lot more the others don't have and yet is stunningly easy to use. Parts of it are so slick a walrus would fall down. It's all most people will ever need, and I use it for production drawings for the wood kits to work out cutting schedules for spruce and plywood. Will I be using PowerDraw for our drawings here? In some cases I will, but unfortunately not for all drawings because I need some capabilities with curves that presently aren't in the program. The things I need are high on Bill Stanley's list for the next version. As a dyed-in-the-wool CAD cynic, my judgment is that PowerDraw 3.0 is a wonderful program and the only CAD program I've seen worth considering—although compared to what it might become, it's still in its puberty.

If you don't see much about it in the computer press, remember that magazines the world over cater to their big advertisers. All writers hate it but can do little to stop it. When he was editor of *Car & Driver*, Steve Wilkinson was called on the carpet by an irate Ziff-Davis executive. Steve had done a road test on the very first Datsun F-10, "a particulary ugly and ill-advised attempt at a front-wheel-drive economy/sporting coupe that had all the right parts but they didn't work together very well. Datsun had bought a full-spread four-color ad to announce the arrival of this piece of excrement in the same issue in which my road test appeared." "How can you say *this* on this page," said Senior Vice-President Brad Briggs pointing to the article, "when you say *this* on this page?" pointing to the advertisement. "But what about the reader?" asked Steve. "F(*bleep*) the reader, it's the advertiser who pays the bills!" Steve says he had always suspected that was their attitude, but had never heard it spelled out in such graphic detail before.

In the same vein, the latest Ziff-Davis *MacUser* "Lab Report" on CAD systems arrives at the conclusion that the winner is (surprise!) the very ordinary product of their largest advertiser. They employ the tortured logic of limiting consideration to products based on advertising and distribution, and then turn over the testing to students. No kidding, *students!* What do students know about drawing? That's like a student pilot doing a flight test of an airplane.

In addition to the full program, there's a $25.00 demo disk—a full working program with saving turned off—which will be out in a couple of months. Just send a note with your Visa/Mastercard number and a request to send the demo when available. Engineered Software, 615 Guilford-Jamestown Rd., Greensboro, NC 27419. Telephone: 919-299-4843.

If I got a little long-winded on this, my apologies, but this is where my mind has been a lot lately. This *does* relate to the Falco since I have a number of long-term projects for which I'll need this—isometric views for the construction manual, an illustrated parts manual, a giant cutaway drawing of the Falco, etc.—*Alfred Scott*

Construction Notes

Just in case any of you get this same idea, here's an idea that didn't work from Steve Wilkinson:

Any easy way to sunshade a Falco canopy, in the style of the two productions airplanes in the forground of the photo in your old full-spread promo piece (the Falcos parked in a row on a fied somewhere in Europe) is to buy the largest sheet of Opti-Cling sunshade material available from Luverne Products, 1200 Birch St., Brandon, SD 57005. Telephone (602) 582-7200 or 800-533-5328.

They advertise 22"x17" sheets, designed to stick up on the side windows of typical Cessnas and Pipers, for $11.95. Fortuitously, the largest sheet they have—54"x24"—seems to be just about exactly right for the "roof" of a Falco and only costs $30.00. The stuff clings tenaciously, and the only problem seems to be that depending on how carefully you put in in place, tiny air bubbles can get trapped under it. I suppose with a certain amount of effort they can be made to migrate to the edges and be dispelled, but at $30 I'm not going to worry a lot about it.

(*Then a month later*) Please disregard my earlier "advice" about buying that tinted-plastic sunshade material for use on the inside of the bubble canopy. I now have my $30 piece, and there are two problems with it: (1) It really doesn't want to take the compound-curved concave shape of the canopy interior without wrinkling, and (2) it's impossible to get all the little between-canopy-and-sheet bubbles out of a piece that large—you end with what looks like a freshman Puerto Rican pimp's attempt to tint the windows of his Camaro.

I think the piece will work fine for about a 2'x2' overhead square, atop the pilot, but that wasn't what I had in mind.

A question: on the belly of the airplane, wedge-shaped wooden "ramps" are glued laterally to the wing spar to carry the belly skin over the bottom-most side and center longerons. The two bottom-most side longerons are 20mm thick, and the center longeron is 15mm thick. The obvious choice is to sand the ramps, and the side longerons, down by 5mm—flush with the thickness of the center longeron—or build up the center longeron with a 5mm longitudinal ramp in that area so that everything is flush with the existing ramps and side longerons. Which way is preferred?—*Steve Wilkinson*

The 20x20 stringers should be sanded down to match the rest. The stringers are used as a gluing strip to form the wheel well door hinge "corner" between the bottom fuselage/wing skin and the side wall of the wheel well door. If no wheel well doors are going to be installed, the stringers serve to support the laminated ring for the "open air" installation. And in either installation, they serve a useful function in the event of an embarrassing slide on the runway.

The production Falcos all had canopies made of three pieces and the dark piece in the middle was bonded to the clear side pieces. The SF.260 canopies are still made this way and if you'd like to adapt one to your Falco, you can order one of these $7,000 puppies through Fox 51 (who are not to blame for the cost). I've been flying under this canopy for years, and I don't care for it. It takes a second for your eyes to adjust to the change in brightness and as a result, the canopy might as well be opaque during aerobatics and quick-scans of the sky. I prefer a tennis hat with the metal button at the top removed (if you don't, turbulence can be very painful).

But if you are really worried about overheating on a hot day, I'd recommend making a cloth sunshade with some thin wooden battens to hold it in place. You can stuff it away somewhere and pop it into position when you need it. John Harns does this and it works well. The shade clips over the center tube so that it will not move around, and when he wants to do a little acro or when it's cloudy, John just pushes the thing back.

Jim Slaton has had continuing problems with his gear doors and the gear retraction system. He got everything adjusted so that it worked perfectly when the airplane is on jacks, but once he got it in the air, the system would start to act up on him. The gear would retract all right, but the circuit breaker would pop with just a turn or two left left.

The first thing that anyone starts to blame is the gear motor. It's a logical conclusion: the motor's too small, or the gear ratio needs changing. I asked Jim to watch the load-reading ammeter to see how many amps the gear motor was pulling. The motor that we use has a no load speed of 5350 rpm at 2.7 amps, pulls 61 amps with a locked rotor pulling 172 oz/in, and an operational speed is considered 4260 rpm at 35 oz/in torque at 14.6 amps. All those figures are for 12 volts, and there is a linear relationship between voltage and speed, and voltage and stall torque.

What all this comes down to is that if the motor pulls less that 10 amps to raise the landing gear, the motor is barely being strained. Our motor turns 7.031 turns for every turn of the screwjack, and it takes 100 turns of the screwjacks to raise the landing gear. For those of you who know how to construct a power curve from this data, you can see that if our gear comes up in around 7 to 8 seconds, the motor is correctly geared and it barely working.

This is what Jim Slaton reported and that the current draw of the motor during the retraction was hardly worth mentioning, rising slowly to peak around 7 amps or so, but then the amps would spike and the circuit breaker would pop. Folks, the motor and gear ratio is fine. It has to be something else.

Jim also reported a number of other things that didn't add up to me. He reported that if he cranked the gear up the last turn and then reset the circuit breaker, the breaker would immediately pop again. I concluded from this that his up limit switch was not closing. The strange thing was that it all worked perfectly on the ground, but not in the air.

We don't use a gear up light in the Falco, but it's quite easy to hook up a wire to the NO (normally open) terminal of the up limit switch, run this switch to an indicator light and ground the light. Wired this way, the indicator light would immediately indicate when the up limit switch is closed.

This is where I left Jim before Oshkosh (which seems to take a month out of things). I talked to Jim the other day, and he reports that the problems have all be straightened out. Jim said the up limit switch was closing properly, and that the problem was something to do with the adjustment of the linkage to the main gear wheel well doors. I can't explain why the circuit breaker continued to pop when the gear was cranked fully up if the up limit switch was closed. It makes no sense to me at all.

I can also report another perplexing problem that Pawel Kwiecinski has had with his propeller governor. Pawel and Irek have been doing a lot of inverted

flying with the Falco, in fact, they are the only ones to ever have flown the Falco inverted for any length of time.

The propeller that we use is a standard, non-aerobatic propeller. This means that it uses oil pressure to increase pitch. This is the standard type of propeller used on single-engine aircraft because it is the lightest. The only difficulty with this type of prop is that when you do aerobatics, you may experience a momentary oil pressure loss—in that case the propeller goes to flat pitch, and the engine overspeeds.

Aerobatic propellers have counterweights on the blades and use oil pressure to decrease pitch. Any momentary oil pressure loss causes the engine to go to a high pitch and the engine slows down. Aerobatic propellers are heavier and the counterweights prevent the use of the nice looking spinner that we have.

Pawel reported that his engine would overspeed after 15 seconds of inverted flight. Pawel heard that Woodward Governor made special type of governor that uses an accumulator. We decided to switch to that system and see what it would do.

The way a governor works is that it takes oil from the back of the engine, pumps it to a higher pressure and then regulates this pressure. The regulated-pressure oil is fed to the propeller through a tube that passes below the cylinders on the right side of the engine. The tube puts oil in the front of the engine and is directed to the propeller. The important thing to remember is that the governor takes pressurized oil from the oil galleries of the engine. The oil is picked up at the bottom of the sump, goes to the oil pump that then sends the oil under pressure to various parts of the engine that need lubrication.

If this supply of pressurized oil is interrupted, the governor is unable to supply oil pressure to the propeller. The accumulator is plumbed so that it is between the engine and the governor's oil pump. During normal operation, the accumulator fills with oil and if there is an interruption in the flow of oil, the accumulator pushes oil to the governor, which doesn't care where the oil comes from.

The accumulator is a cylinder about two inches in diameter and twelve inches long. You mount it on the firewall with a hose to the governor. Inside the accumulator is a piston, and you pump about 100 psi of air into the end. It is this pressurized air on the other side of the piston that supplies the pressure. When the engine is not running, the air pushes the piston to the far end of the accumulator and all oil is pushed from the accumulator. When the engine is running, the oil pressure of the engine is greater than the pressure in the accumulator, so oil flows into the cylinder.

The first problem that we encountered was that the governor supplied by Woodward has a different housing than the one we normally use. Our governor has a head with a number of screws on it, which we use to mount the governor bracket. The type Pawel received did not have the screws. We inquired of Woodward if they could just supply us with the same type of housing.

This turned out to be one of those absurdities that only makes sense when you rely of government approvals for insuring safety. To provide for the installation of the accumulator, Woodward drills and taps the housing of the governor. There is no difficulty at all in drilling our standard governor since the housing are internally identical and only have the slightest differences on the outside.

Unfortunately, this hole in the governor is what is known as an Engineering Change Order, for which Woodward has a minimun charge of $1800.00. The reason is simple, any changes must be in accordance with certification requirements, so they have to do a new drawing, define an inspection procedure, make changes to the operation and service manuals, mail all these to their distributors, etc. Woodward is embarrassed by all of this, but sees no way out. They readily admit that a homebuilder can drill his own hole and adapt the present governor—but you should be careful to make sure all chips are cleaned out. This certainly calls for the governor to be taken apart, drilled, cleaned and then re-assembled.

So Pawel kept the governor and made a clamp to go around the governor housing. This provided the screw holes for the governor control bracket. I have a copy of his drawing and CNC milling machine program should you need a copy.

Pawel reported that the accumulator increases the inverted time from 15 seconds to one minute and 15 seconds before the engine overspeeds. That is enough for him, since they don't normally fly inverted for any extended periods of time.

Now we get to the part that makes no sense. With his inverted oil system and accumulator, Pawel should be able to fly inverted until the fuel is exhausted. The symptoms that Pawel describe exactly fit those of an inverted oil system that is not functioning properly. You would expect that when going to inverted, there would be a short interruption in oil, but once inverted the inverted oil system should pick up oil again. Pawel insists that his oil pressure gauge reads normally throughout the inverted flight, but this makes no sense at all to me.

I think what is happening is that once he goes inverted, the engine oil pressure drops to zero and the accumulator supplies a minute of oil to the governor. I think Pawel has no pressure at all when the engine is inverted.

I have talked about this to Lycoming representatives, Al Hadaway of High Performance Engines and aerobatic pilot Clint McHenry. All agree that the description makes no sense and that it sounds like the inverted oil system is not functioning correctly. Clint was interested to know if it made any difference if you rolled to the right or left, pointing out that the interruption occurs at knife-edge and that competition aerobatic pilots set things up so that they can maintain oil pressure in knife-edge flight to one side.

I have talked to Pawel about this, and he says that he understands what we are saying and is as confused as the rest of us. He doesn't have any answers and plans to investigate the matter.

With a number of Falcos now flying with lorans, we could use some reports on what antennas work. I remember that Wendell Taylor and Dan Garn found the antenna up the tail didn't work for them and that they used the canopy frame which worked well. Terry Smith, on the other hand, has the antenna up the tail and says it works fine for him.

Jonas Dovydenas got tired of hearing all the conflicting advice about loran antennas and decided to build all of them and test them. He bought a Northstar M1. Northstar publishes instructions for making two antennas. One is made of coaxial wire and very specific lengths are required. A second antenna is a plain piece of wire, about 19" long and suspended from insulators, that is

intended for use on the outside of the airplane. Jonas also built antenna of plain wire up the tail that RST suggested to us. The Northstar loran has a signal/noise indicator on it. Jonas tested the antennas in his shop and also out in the driveway. They all worked well in the driveway and less well in the shop. Jonas got the best results from the long wire up the tail, second best from the 19" plain wire and the worst results from the fancy coaxial antenna especially designed for use inside composite airplanes. That's technology for you.

Terry Smith has had a problem with noise in his electrical system. He has an Apollo 612A which he bought specifically because it was IFR approved and then found that you can't use it for IFR if you don't use the Apollo external antenna. He did have a problem with the warning light coming on. The Apollo people suggested using a 3-5000 microfarad, 50-75 volt computer-grade capacitor mounted on the alternator. Terry did this and says it cleared up the problem with the warning light.

Terry still has a noise problem with the electrical system which causes his ADF needle to swing way off course. The latest suspect is the ignition harness, but nothing is proved yet.

Terry was also having some problems with the landing gear system and the doors. He finally traced his problem to the nose gear turning during retraction so that it hit the screwjack. Terry made a guide from wire and nylon tubing that prevents the tire from hitting the screwjack.

Over the years, I heard a lot of people worry themselves sick about this, and I've always told people not to worry about it because I've always thought that this was one of those things that is theoretically possible but so unlikely that it would never happen. Most Falcos have the nut tightened down enough on the nose gear so that it does not rotate easily in the trunnion. I think this is the desirable condition and even though it might be stiff to turn in your hands, you exert a lot of force with your feet and would never notice this when you steer the plane.

With some friction in the system, the nose gear does not turn as it is retracted, thus the only way you can jam the gear is to take off, push full left rudder (an incredibly violent maneuver) and then retract the gear. As a practical matter, you'll have a little right rudder when you select gear up. I think the solution to all of this is simply to tighten the nut on the top of the nose gear until it's a little stiff. Then don't worry about it.

In our brake system drawing, which is an incredibly rough sketch that we supply with our kit pending completion of a finished drawing, I show the nylon line to the brake reservoir pushed over the metal tube that comes with the reservoir. When I did this, I was thinking about using polyethylene tubing, which is thin-walled and flexible enough to go over the metal tube. Nylon tubing is thicker skinned and too stiff to go over the tube. Steve Wilkinson found that you could easily make it work by removing the steel tube, sliding the nut and tapered gasket over the nylon line and just eliminate the steel tubing entirely. I have no idea why I didn't think of that.

Steve somehow got under the impression that the brake lines were supposed to go through some of the holes in the "garbage bracket"—no, no, no. This bracket came into existance because with the throttle quadrant, we needed a support for the engine control cables. The only logical way to do this is with a bracket mounted on top of the nose gear bay cover. I can get very passionate about simplicity in design, and to my way of thinking there is no better way to achieve simplicity than to have one part serve multiple purposes. As anyone who has completed his Falco can tell you, there is an enormous confusion of control cables, wires, hoses and tubing in this area.

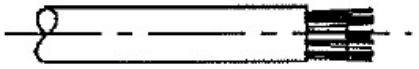
Because our instrument panel is removable, I also made provisions for mounting the vacuum regulator, pitot and static fittings on this bracket. Since they are installed in the bracket, they stay put when you remove the instrument panel. On the little tab that is bent so that it is vertical in the airplane and faces directly aft, we provide a number of holes. These holes are intended for you to ty-wrap wiring to the bracket so that they will not rub against the engine control cables. In addition, on the sides of the bracket, we have other holes intended for ty-wrapping brakes lines, wiring and anything else that might be loose. These holes are just there to be used if you want them.

Jim Petty reports that a model train paint, Floquil "Reefer Gray", is a beautiful slate-gray paint for the instrument panel. Their sealer, however, is not so good. It turned Jim's panel yellow, although it dried clear in his tests.—*Alfred Scott*

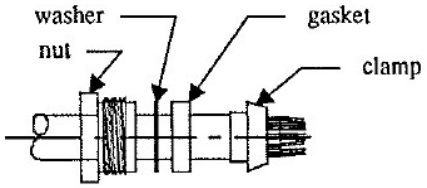
BNC Assembly

Here's how you install the BNC connectors for the antenna coaxial cable.

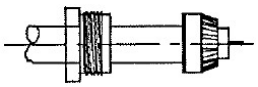
1. Strip the outer cable insulation for a length of 9/32" (7.1mm).



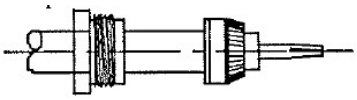
2. Fray the shielding braid and strip the inner insulation 3/32" (2.4mm). Tin the center conductor; that is, coat the conductor with solder to make the delicate job of soldering the contact easier.



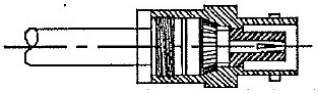
3. Pinch the shielding tight around the wire and slide the nut, washer, gasket and clamp over the braid. The inner shoulder of the clamp should fit squarely against the end of the outer cable insulation. Watch out, because the clamps supplied with the male and female connectors are different. Just install the clamp with the counterbored side toward the wire.



4. Comb the shielding out and fold back smoothly over the clamp. Trim off any excess shielding that extends past the clamp.



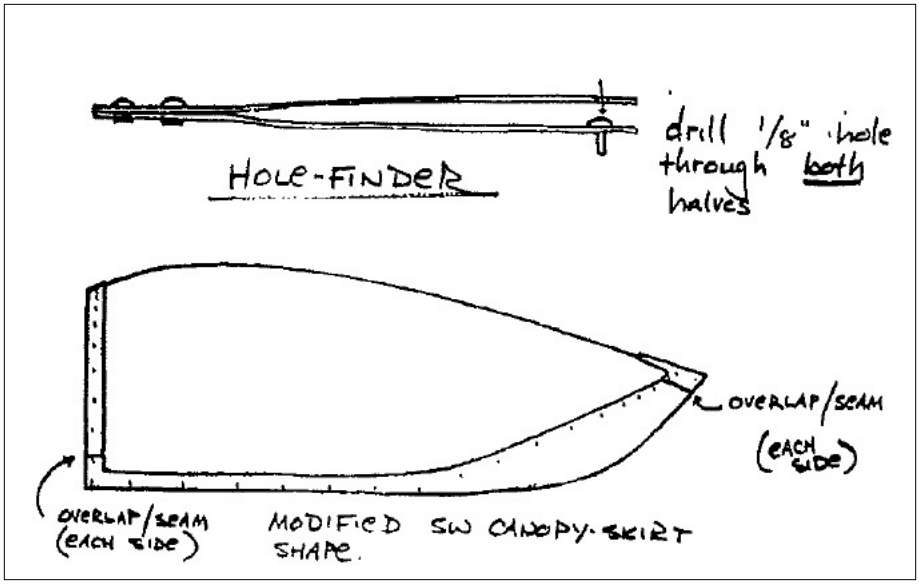
5. Slip the (male or female) contact in place, butt against the inner insulation and solder. The contact has a tiny hole drilled in it for soldering. Turn the contact so that this hole is on the top, hold the soldering gun under the contact, and feed solder into the hole. Remove excess solder from the outside of the contact. Be sure the internal insulation is not heated excessively and swollen so as to prevent the insulation from entering the connector body.



6. Push the assembly into the body as far is it will go. Slide the nut into the body and screw into place with a wrench until tight. For this operation, hold the cable and shell rigid and rotate the nut.

Metalwork Without Tears: Making the Windshield Surround and Canopy Skirt for an UnNustrini-ed Falco

By Stephan Wilkinson



If I'd ever had any doubts about making an airplane of wood, they disappeared during my tussle with the pool-table-size expanse of aluminum from which I cut the canopy sheetmetal for my airplane. Yes, I could have done it of fiberglass, but I find that stuff even messier and more recalcitrant than metal. Fiberglass is fine in small doses—hinge fairings, for one—but me, I would have ended up like the Tar Baby had I tried a component as big as a canopy skirt.

Still, the aluminum bit, sliced, skewered, splintered and attacked me in every way as I flailed away at it atop the picnic table (where it could best reflect the July sun back at my skinny chest). Get yourself a set of good leather work gloves for the job, the longest-bladed pair of high-quality tinsnips you can find (for the "first cut"), and the best possible set of left- and right-curving aviation shears with which to do the final trimming.

A primary principle of sheetmetal-working is that you don't cut the aluminum along the trim lines, you cut out the basic shape with the snips leaving a quarter-inch or so of excess (less if you're able to, but never try to make the first cut exactly on the trim line). Then you go to work with the aviation shears, trimming away the final curlicue of aluminum to achieve the trim line with little effort and minimal dimpling of the edge. And never make a cut that results in the jaws of the shears or snips closing completely, else you'll put a noticeable dimple in the edge you're cutting. I've been told, by the way, that there's a hand tool of some sort that will smooth out edge-dimpling in aluminum (a pair of spring-loaded rollers or balls that you run along the edge), but I haven't bothered to look for one.

The first thing you might discover as you set about building your non-Nustrini canopy skirt is that there's a considerable gap between the sides of the fuselage turtledeck and the aft/lower edge of the canopy skirt if you build the skirt according to the plans, as a relatively narrow strip of aluminum all the way around the canopy. If you assign clock positions to the fuselage cross section at about frame #7, the gap is biggest at the 10:30 and 1:30 positions. Maybe I've done something terribly wrong in building the fuselage, but Jonas Dovydenas recently mentioned that his airplane presents the identical situation.

The second thing you may find is that when you built the filler door for the rear fuel tank, you didn't take into account how far aft the canopy skirt extends. Depending on how generous you were in choosing a size for that door—I erred by about 15mm—you may have to trim one side of the canopy skirt to allow that door to be opened (with the canopy slid full forward, of course). Or modify both sides if you opt for symmetry.

All of this will become apparent as you make a pattern for the canopy skirt. You do this by going to an art-supply or stationery store and buying some large sheets of flexible posterboard or cardboard of some sort and fabricating a cardboard canopy skirt/surround. Make a pattern by using ample cardboard to allow trimming to a final size; don't try to "make" the exact outline of the skirt/surround as you go (except perhaps at the straight bottom edge of the canopy at each side of the cockpit).

Hold the cardboard in place using the same screws that are being used to hold the canopy to the canopy frame. Securely tape together all overlaps and junctures between various sheets and pieces of the cardboard, and make sure everything is absolutely flat against the canopy before you start marking it for trimming: you want to end up with a pattern that, when removed from all the curves of the canopy, lies flat—be careful not to unwittingly build any compound curves into the pattern, because the aluminum you'll be cutting is unyieldingly flat.

A confession: I have fabricated my can-

Due to fly shortly is Perry Burholm, who has never Nustrinied anything.

opy skirt/surround of four separate pieces of aluminum, for material economy as well as ease of fitting and manufacture. One piece arches up, over and around the front edge of the canopy itself. Two assumedly identical but mirror-image pieces form the lower edge and aft skirt of the canopy, one on each side. And a fourth small piece connects the two skirt-sides at the aftmost point of the canopy, also forming the small cutout through which the dorsal-fin slider tube passes. Skilled builders are welcome to make an entire one-piece canopy surround out of a single huge sheet of aluminum, wasting 95 percent of the metal but achieving an elegant component. But if there's the slightest slip betwixt pattern and metal, somewhere it ain't gonna fit. Me, I went for simplicity and correctability at the cost of some overlapping joints here and there.

The windshield surround is easy enough to make in a single piece, if you mount and trim the cardboard carefully, since it's hard—but not impossible—for compound curving and warpage to sneak into the pattern.

Once you have all the cardboard in place, mark your trim lines on it, remove it from the canopy, and cut the pattern to shape. The entire forward part of my canopy surround is of the same width-dimensions as the plans call out, but at the point where the actual "skirt" begins, aft of the cockpit side rails, the surround widens in a smooth curve to a maximum width of about 6.5 inches, then tapers back gently to stock width at the point where it reaches the area of the slider tube. It's a curve I arrived at pretty much freehand, by sketching trim lines on the cardboard and stepping back and resketching, and I finally froze it by calling in an artist friend who looked, mused, tilted his head, hummed a bit and rationalized the whole thing by muttering something about how it "echoed the curve of the top of the canopy bulge." Hey, I like it.

There's still a gap between the skirt and the fuselage skin at those 10:30 and 1:30 positions—call it a Cockpit Environmental System Ventilation Extractor Outlet, assuming there's a negative-pressure area back there—but that gap is both decreased and made less apparent by the more downward/aftward extent of the skirt. The only way to entirely eliminate the gap would be to compound-curve the aluminum of the skirt to not only extend aft but curve slightly inward as it goes. Or make it of fiberglass. I'm sure there are plenty of you out there who could do either, but I'm not one of them.

My artist friend had not only blessed my curve but given me most of a 12x4-foot roll of .020" 2024-T3 aluminum he had left over in his hangar. (Yes, artists fly too). Unfortunately, that's too thin, as light and malleable as it otherwise is. The primary purpose of the canopy surround is to act as one big, continuous "washer" for the canopy screws, and .020", even if it's free, just won't hack it.

(I think you'll find you need discrete washers under the hold-down screws anyway, incidentally. I did—both because I ended up filing holes slightly oblong here and there to refine the fit of the skirt/surround and because removing and replacing the canopy screws enough times to get the job done inevitably chews up the soft aluminum if there isn't a real washer to take the strain.)

When I realized that the .020 was much too light, I bought a 4x8' sheet of .040" 3003 aluminum—an ordinary but amply strong kind of general-construction aluminum—from a local metal-supply shop. They didn't carry 2024, a type of no use in their business, but since the canopy metal is nonstructural, the 3003 works just fine, and it saved me "aircraft-quality" prices and trucking charges from an aviation supplier. A 4x8-foot sheet—the standard configuration—is plenty for windshield and canopy both, as long as you don't want to make the canopy framework of a single continuous piece. You'll obviously want to make all your cardboard patterns first and then locate them on the 4x8 sheet in a way that affords ample unbroken area for each.

The biggest lesson I learned from experience is that no matter how carefully you mark and make the screwholes through the cardboard pattern, you should forget about transferring those holes as drilling points to the aluminum. No matter how carefully you think you've done it, you'll find the screwholes you've drilled and the holes through the Plexiglas and canopy frame increasingly diverging as you go. Use the cardboard pattern only to determine the outlines of the metal.

The secret is to use a "hole-finder"—a device well-known to people who build things like Thorps but a revelation to me. You can make one yourself in a few minutes from the same aluminum you're using for the canopy. It's essentially a big pair of tweezers with a rivet stuck through the end of one blade and a matching hole drilled through the end of the other blade. You slip the hole-finder over the aluminum, the blade with the rivet below the metal and the blade with the hole in it on the visible side of the sheet. Move it around so the rivet slips into the hidden screwhole you want to match, and when it does, the visible hole through the hole-finder blade marks the spot to drill. Do this hole-by-hole, in situ, as you mount the canopy surround—marking, drilling and fastening the aluminum to the canopy before you establish the next hole.

Finally, I broke a cardinal rule of Plexiglas work by stripping from the plastic all of the protective adhesive paper before I started any canopy fabrication. It's my feeling, however, that either you leave the paper 100 percent in place—which makes it difficult to trim the edges of the Plexiglas visually as you fit it to the frame and the airplane—or you take it completely off: the damage caused by trash and grit that inevitably get trapped all around the edge where you've torn the margin of the protective paper off in order to see so you can trim can be worse than what happens during careful construction procedures.

I've gotten a few scratches on the canopy and windshield here and there, but they polish away surprisingly easily with the finest wet sandpaper grades and a final buffing with one of the commercial kits such as Micro-Mesh or Poly-Sand.

Have fun, and be glad you didn't have to build the whole airplane out of such obstinate, sharp, unyielding and ugly stuff.—*Steve Wilkinson*

The Italians, like Stelio Wilkinson, built the canopy skirt of a soft aluminum—definitely not 2024-T3—and put joints at the same logical places. All of you who are do not have the Nustrinified canopy will find that the gap is there on the sides. The Italians formed the aluminum at the gap so that it tucked back in close to the fuselage. The air pressure at the sides is slightly negative. I just throw my maps up against the canopy rail and the suction keeps them in place.

You should explain to Oshkosh nitpickers that this slight gap is an intentional part of the design; that air is extracted from the cockpit in a boundary layer that allows the fuselage to curve inward for minimum wetted area while maintaining laminar flow over the aft fuselage upperbody; that Falcos without this slight gap don't fly as fast; that you have a bridge you'd like to sell them.—Scoti

Tool Talk

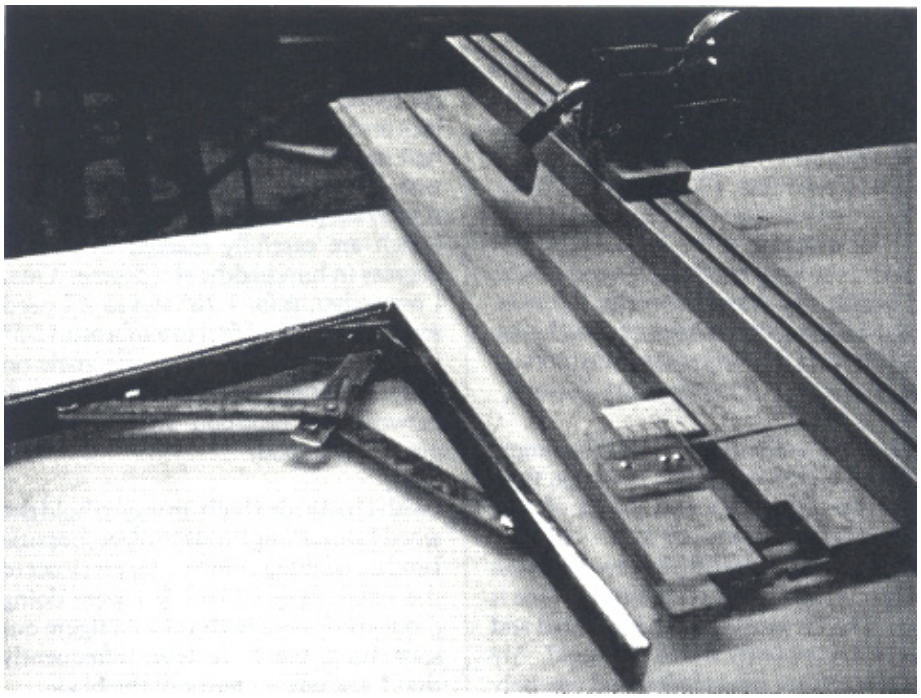
John Devoe reports that he has found a type of Sandvik sander wonderful for float sanding. The Sandvik "system" is a rather hard rubber block shaped to fit in your hand and the base is roughly three by five inches. With this comes a supply of metal sanding plates, which are thin sheets of steel punched with sharp pins so that the raised metal makes an abrasive surface—a perfect sliding board for Jim and Tammy. These plates are already coated with adhesive so you can just stick them on the rubber block and go to work.

Since they were already sticky, John just stuck a bunch of them end-to-end on a smooth board and used it for float sanding. He said it worked well and that the plates cut spruce just as well as the D. G. Products carbide grit sheets but which do not have their own adhesive.

Gary Smith bought a Porter-Cable abrasive planer the other day and says it does a beautiful job with taking small amounts of spruce off the main wing spar and other places where he needs to get the shape of the structure just right for the skinning.

For more agressive removal of wood, Stephan Friend sent along an offering from the *Australian Woodworker* magazine of a unique device which I think Steve thought might appeal more to my warped sense of humor than to any of you. The device is called the Arbortech Woodcarver, and it's round piece of steel that mounts on an angle grinder. It's roughly four inches in diameter and much like a saw blade, except that the teeth are exact copies of the teeth found on a chain saw. It's handy for polishing fiberglass airplanes, carving totem poles, removing pavement, or just a massacree. You can get this lethal device from Arbortech Pty, Forrest Street, Nannup, Western Australia 6275 for fifty Australian dollars.

Dean Malstrom sent me a couple of sanding respirators that he has been using and which he likes. They are 3M Cat. No. 8654, Auto Part No. 3201 Sanding Respirator. These respirators are inexpensive paper face masks, but they are superior to the many other masks I have seen. The masks are made of multiple layers of paper and give excellent filtration of the air. There are two rubber straps which hold the mask on your face with real authority, and a ductile metal band is bonded in place so that you can insure a good fit at your nose. These masks are great for working in dusty environments and when you don't feel like breaking out the big rubber masks that you need for painting.



The Spur angle bracket along with Ingeniere Scoti's super accurate angle guide.

Gadget freaks might be interested in knowing about a new type of folding shelf bracket that was designed in Spain a couple of years ago and which is only just now being marketed in the U.S. The Draftsman's Bracket is a heavy-duty, chrome-plated steel bracket which is designed for mounting a draftsman's table to a wall. In the extended position, the shelf is held at 90° to the wall, and you can fold the shelf down by triggering a little pull-release mechanism. The two-position brackets are either open or closed. There are also a couple of four-position brackets which are intended for lowering a drawing board to a comfortable angle.

These brackets are exceptionally well built, hinged with pins and snap rings instead of the usual tubular rivets. It's also a beautiful piece of design work, certainly better thought-out than many aircraft retraction systems I've seen.

I'm interested in these brackets because I have an Excalibur fence on my table saw. It's one great fence, but it has a rail on the far side, and it's difficult to mount an outfeed extension table. I'm using two of these brackets to support an outfeed table and then I slide a filler strip in the gap. The brackets come in three sizes, nominally 15, 11 and 8 inches and two largest sizes support 176 lbs while the 8-inch size supports 55 lbs. The part numbers are 7154, 7152, 7114, 7112 and 7082—the middle two digits indicate the nominal inch size, the last digit is the number of positions.

These shelf brackets are imported in the U.S. by Spur Hardware, One Dunham St, Winchester, MA 01890 who sell only through distributors, but you can call them at 1-800-666-SPUR for the name of a dealer in your area. The dealer in Richmond was such an idiot—who first denied carrying the line, then put me on hold for five minutes before informing me they only had the 4-position model in stock—that I called back for the name of a mail-order outfit. I got my P/N 7152 brackets for $15.00 each from The Source in northern Virginia—703-644-5460 or 800-452-9999. You will probably also see these things showing up in various catalogs soon since all the mail order companies are taking a look at the things.

Even if you don't need them for your table saw, I can see that they would be useful for various purposes in a cramped shop. Spur seemed particularly concerned that they not be used where small children might crawl underneath them.

You may not have a need to cut a piece of wood at an angle of 0.296°, but I needed to make a lot of such absurdly high-precision angled cuts to make the jigs for the various wing and tail spars. I use blocks of 3/4" baltic birch plywood which are cut precisely so that they fit within the spars. These blocks locate the cross pieces and the spar caps at the same time. The wood

has to be cut very accurately.

I make the jig board of 3/4" baltic birch plywood, cover it with white Formica and then I draw the spar on the Formica in ink, right on my drawing board using my drafting machine. (For the longer spars, I mounted a plotter pen on Gonzales and let the machine draw the centerline.) Then I cut long tapered plywood blocks to match the drawing on the Formica, mount them with screws and dowel pins, and then cut the long pieces into individual sections to fit between the stations.

The angle guide is an elegantly simple affair that took me longer to design than to make. There are two pieces of 3/4" baltic birch plywood cut to 3" x 30" and hinged at one end with a heavy-duty brass hinge. The hinge was important since it had to be no wider than the plywood and yet had to be fairly strong and rigid. My local hardware store clerk found precisely the right hinge, a fancy brass hinge used for reproduction desks.

I glued a piece of acrylic to each side of one of the pieces of plywood. These two pieces squeeze slightly on the other plywood piece and thus hold everything together. The angle is set by a quarter-inch jack-bolt, which I threaded full length, mounted in a T-nut. There's an acrylic wear plate for the jack-bolt. (I use a lot of acrylic in making jigs and fixtures. If you scuff-sand it, you can draw on it. It's easily cut on a bandsaw and sanded to final shape, and it is hard enough that it will withstand a reasonable amount of wear. It's also painfully cheap; I get mine by raiding the waste bin of our local plastics-supply company.)

I drew the indicator with our CAD system, using the radial duplicate feature, and glued the printed indicator to the acrylic. The cursor is another piece of acrylic that is mounted over the indicator and which is scribed and black-inked—which, by the way, is the way everyone makes a cursor. A spring hooked over two screws on the end holds the moveable part firmly against the jack-bolt.

I assembled the whole thing and zeroed the cursor on the indicator, and then did a couple of final clean-up cuts against the fence to insure that both faces were parallel. On the side that runs against the fence when cutting an angle, I actually cut right up until I was sawing the acrylic, so that I would have a hard, durable edge. Finally, I glued a push-block on the end.

The indicator is graduated in tenths of a degree and the device has proved to be astonishingly accurate. In more than half the cases, the initial angle setting is correct and needs no fine-tuning. I'm limited to about 5° on the indicator, and I wish I had more. I get around this limitation by keeping a few spare tapered blocks which are carefully marked with their degrees in hundredths of a degree. One, I remember, is for 1.76° and so if I need something around 6°, I just subtract 1.76° from the desired angle, set the angle on the cursor, then insert the tapered block between the jack-bolt and the hinged piece of plywood.

I wish I had a nice built-in way to hold the wood I am cutting firmly in place, because I end up working with my fingers closer to the blade than I like. If I were doing production work with this, I'd figure out something, but I use it so infrequently that I just rely on terror of the blade.

Except for the screws for the hinge, cursor and springs, the entire affair is held together with Zap-A-Gap cyanoacrylate glue. My initial efforts to use this glue were unsuccessful, but after I learned how to use the accelerator, I have become addicted to the stuff. It seems absurd to have an accelerator for an "instant" glue, but the simple fact is that Zap-A-Gap takes minutes, not seconds, to harden. The accelerator, called by the silly name of Zip Kicker, comes in a little spritzer bottle. You put the glue where you want it and then fog the slightest amount of accelerator to the other side. Bring the two pieces together and wait about five seconds—that's it. If you want to position things, then apply the glue, bring the two parts together and then fog some accelerator on the glue line. If you have enough glue applied, there will be a little fillet which will harden and then you should leave the assembly alone for some time.

Don't use this glue on your airplane. It's pretty strong, but you don't get solid film at the glue line, and it's relatively easy to break two pieces apart. But for making jigs and temporary holding fixtures when you want to glue a block of wood, metal or acrylic in place *now*, there is nothing to equal it. If you need an odd-shaped standing stick, you can fog some accelerator on some sandpaper, put the glue on a flat stick of wood, bring the two together, zip around the stick with a knife to trim the paper off flush and start sanding—within 60 seconds or less from start to finish.

—*Alfred Scott*

Brenda's Corner

It was good seeing so many of you at Oshkosh this year. Oshkosh really does make the summer fly by fast. Many of you have probably heard my story about how every year I have to find someone new to drive out with me. No one has ever made the trip twice with the exception of my husband R. T.. Now his excuse is he can't be away from the office for two weeks, so he flies in sometime during the week to drive home with me. This year my niece, Kim Williams, rode with me. Kim is a sophomore at Virginia Tech (THE University in the Commonwealth of Virginia).

I was trying to describe to her how passionate some people are about coming to Oshkosh and related it to R. T.'s passion for Virginia Tech. That put everything into prospective. The first thing she saw at Oshkosh was an 80-foot mock-up of the National Aerospace Plane (the "Tokyo Express") at the NASA display, and it had Virginia Tech painted on its tail. It had been built by the engineering students at Tech for NASA and the U. S. Department of Defence. She didn't care if she didn't see another plane at Oshkosh. The trip had been worthwhile.

For all you bargain hunters out there, we still have a few of the landing gear motor housing castings (just casting, not machined). Also, we do have the landing gear motor housing without bearings installed. Plus, there is an upper drag strut which is not quite up to our standards but could easily be machined a little. And then, for any of you who would like to have a little fun with a torch, we have a Dynafocal Type I engine mount which needs to have two tubes added to the bottom of it.

Remember that Hartzell increases their prices each year and to get the current price, you should order around the first part of October. Their price is based on shipping date not order date and the shipping date is usually about 12 weeks after they receive our purchase order.

As always, please let me know if I can assist you in anyway.—*Brenda Avery*

Sawdust

• It's the nearest thing aviation has to a snuffer movie. Now you can have your own copy of Aviation Week's video of the 1989 Paris Air Show, a 60-minute film showing the huge Antonov An-225 carrying the Soviet space orbiter on its back, the Sukhoi Su-27 fighter, the Mi-28 attack helicopter (Afghan resistance fighters weren't invited to demo their Stingers), the French Rafale and Mirage 2000, China's F-82 fighter, the Piaggio Avanti, the SR-71 Blackbird, and of course the star of the show, the lovely and exciting MiG-29, demonstrating the never-before-seen Mumblety-peg Maneuver. It's all yours for just $49.95 from Sporty's Pilot Shop, Clermont Airport, Batavia, Ohio 45103 or call 1-800-LIFTOFF.

• Falco "builder" Klaus Bodentien is actually restoring a wrecked German Falco. The previous owner took off with an empty tank selected. The engine sputtered and stopped immediately after lift-off, and the pilot had no choice but to put it in the trees. At the time of the accident, there were three men and a large sheepdog on board, all of whom survived with some injuries. Klaus reports that the pilot always flew with his dog and often with as many as four men as well.

• SF.260's can sometimes be a bargain. Pity the British gentleman who mentioned to his friends that he was thinking of buying an SF.260 for his son. His two friends, Desmond Norman and James Tseliki, explained that the SF.260 was much too expensive, and that they could design and build him an airplane for less.

Thus began the Firecracker design, which eventually consumed about six million of their collective dollars. In the end, the Firecracker came to naught simply because military contracts are sometimes awarded for political considerations. Britian felt indebted to Brazil for its assistance during the Falklands thing and government-owned Shorts already had an agreement to built the Tucano.

• Carrying the fire. Decades ago as a result of an argument with *AOPA Pilot* editor Max Karant, Richard Collins vowed never to rejoin the AOPA. Collins became a writer for *Flying*, and he rose to become the editor. Two years ago he left to become editor of *AOPA Pilot*, which post he recently quit. Through it all, Collins refused to join the AOPA.

Tony Bingelis's Falco is for sale due to medical problems and high cost of fish, chicken and oat bran diet. Nustrini canopy, KX175B nav-com, King transponder with encoder, intercom, nose gear doors, lacquer paint, strobes, 160 hp IO-320-B1A with 1460 hours and 125 hours on airframe. $47,500.00 and available only to approved purchasers—not just anyone. Tony Bingelis, 8509 Greenflint Lane, Austin, TX 78759. (512) 345-1537.

• At Oshkosh, Fernando Almeida let slip a remarkable bit of news. He mentioned that Stelio Frati's book on aircraft design was considered the "bible" in Brazil, and that it had been used as a guide for a number of aircraft designed there. The book is *L'Aliante*, which translates, I think, to "the flying machine." It seems that Frati published the book in Italy back in the '50s when he was professor. We're hoping to get a copy, and Maurizio Branzanti has offered to translate it.

• Here's an EAA/Oshkosh statistic you don't see published: the EAA Board of Trustees does not know—and is not permitted to know—how much Paul and Tom Poberezny are paid, and financial information that is presented to the board is very basic. Only in the last few years has there been a compensation committee, appointed by Paul and approved by the rest of the board, that is privy to this information. That's irony for you—the IRS requires that all non-profit organizations file a statement with the IRS with basic financial information, including the compensation of the top five executives, and a copy of this form must be given to anyone who requests it. It is called IRS Form 990, and if you would like a copy you should write the EAA. I don't care how much Paul and Tom make—I hope they are well paid—but I do care that the Board of Trustees know and approve. If you consider Paul and Tom as lobbyests for a trade association, they are probably a bargain by Washington standards. This is a simple matter of business ethics—a board of trustees should have complete access to financial information, and when something like this happens you have to wonder why.

• The Great Oyster Fly-In will take place on November 4 at Rosegill Farm, Urbanna, Virginia, and although Pawel Kwiecinski has twice bravely tried, he has never been able to get past West Virginia. So far no homebuilt Falco has made the event, but this year should break the jinx. Please do your part, since Dr. Ing. Scoti has threatened to commit *hari-kiri* with his removeable control stick if no Falco shows. The Oyster Festival parade begins at 12:00 noon, and it's best to arrive by ten o'clock.

• The self-styled Fortunate Few meet at Farmerville, Lousiana, on October 13, 14 & 15 for a weekend of guns, armadillo chili, women, airplanes, snake-catching and anything else you think is fun. These guys fly SF.260s, and even though they tend to regard Falcos as SF.260s in drag, we're invited as long as we don't wear dresses. Contact Homer Woodard at (318) 263-8482.

• The Falco Club in Italy is celebrating its 10th anniversary with a meeting at Grosseto on October 6, 7 and 8. A race is planned from Grosseto around the islands of the Arcipelago Toscano. Luciano Nustrini and Stelio Frati will be there and all Falco owners and crazypeople are invited to attend. Contact Giulio Boschi, Viale Piemonte 55, 58043 Castiglione Della Pescaia, Italy.

• Engine/prop combination for sale. 160 hp Lycoming O-320-D1D with Hartzell constant-speed propeller. 155 hours since new. $16,500.00. Can be flown in owner's Mustang II before buying. Bill Whitney, 18521 94 Ave NE, Bothell, WA 98011. (206) 481-9507.

Mailbox

I had a meeting 3 months ago in Milan with Frati, and we planned to meet you in Oshkosh this August as I promised you last year. But now I have difficulty to maintain my promise: in the second week of August my elder daughter Francesca will be married. I try to shift the marriage in July or at the end of August, but it is impossible because the fiancè of Francesca is a teacher and they have planned to go to Europe for the honeymoon during the school holidays.

My Falco is still well, but to fly often it is a big problem for me because of the distance between my house and the airport. For this reason I fly only a few hours per year, and I am very sorry for me and for it; when I fly and I scramble in the air with ERNA, we are very happy and everytime we remember the beautiful adventure passed together. Yes, because I consider ERNA as a person.

Luciano Nustrini
Auckland, New Zealand

I really enjoyed the trip back to Oshkosh, the biggest kick is seeing the other Falco builders and comparing notes with them. It was good seeing your family again too, it brought back memories of gracious hospitality. We left Sioux Falls at 9:30 AM, spent about 1:45 at Casper for lunch and about the same at Ogden, Utah, and got into Sacto at about 7 PM. We had headwinds all the way but fooled them going out of Sioux Falls by flying about 1000' most of the way to the Black Hills, then climbed to about 8,500' the rest of the way into Casper.

An idea of what the nose gear strut door does for drag: I left the link loose on it so it could trail and flew the airplane. I lost at least 5 KIAS. The cooling drag can be something else. Purkiser didn't have his strut covers on, or the wheel well doors either. The difference was 24.7 gallons versus 18.4 gallons on the leg from Ogden to Rapid City. We were both flying at 9,500' and full throttle. Ray was at 2,500 rpm and I kept reducing rpm from 2300 at first down to 2,000 rpm. I tried to pull it down to 1900 but it didn't want to stay there—even at that we were about 15 minutes ahead at Rapid City. The doors do make a difference.

While I had the cowling off, I checked for chafing spots from the engine. I found that the prop hub has been rubbing on the bottom of the big hole on the cowling, probably from the 4-4.5 g's on some of the maneuvers. Also some of the new baffling I put on shows from the rub spots that the engine pulls ahead about 3/16", so my spinner is getting more clearance than I planned. Also, the alternator bracket has been rubbing some on the landing light tube and the retaining ring for the light. I am relieving the bracket a bit.

Karl Hansen
Roseville, California

My #1 cylinder had a bad intake valve guide which I discovered in time to get it fixed for Oshkosh. Two days before I was to leave, I checked the compression to be sure it was broken in so I could change to multigrade oil for the trip. While checking it, I also checked the others, and I found #3 down to 35 lbs. I took the valve cover off to try to stake the valve in case there was some carbon holding it open and found that I could wiggle the exhaust valve stem about 15 or 20 thousandths of an inch. When I removed the cylinder and took the valve out, the guide fell out with it.

I called High Performance to see if they had another cylinder built up that they could send me overnight but all the brass was already at Oshkosh and the woman in the office could not find anything to send. I had no choice but cancelling out. It was a big disappointment as I had really worked hard the last few months to get it just the way I wanted it to look.

Of course, High Performance feels very badly also. They say that they used to send their head work out to another shop which is no longer in business. Al Hadaway there has been very nice and cooperative and is upset also. He insisted that I send all the cylinders back, except #1, which they had already re-worked, so that they could re-do them in their shop, even though #2 and #4 were holding 78 lbs pressure.

Jim Slaton
Hemet, California

We finally received our spruce from Western Aircraft Supplies in Canada. It was quite badly damaged, and we are in the process of filing a claim with the freight company. It was not a happy business transaction, as there is also a discrepancy between the amount we paid in advance and what his invoice showed (to his favor, I might add). I hope other builders have better luck with this company.

Marty Benham
Wichita, Kansas

Western Aircraft's Jean Peters reports that lately the trucking companies have been causing more damage than he has seen in the past. This is an irritation for everyone, to the customer who has file the claim, and to Jean who has to produce an itemized price list for every stick. Jean Peters fell behind in his orders this summer because his garage burned last winter, and he took time off from work to rebuild it. So far as I am aware, everyone is happy with the quality of the spruce and accuracy of cutting.

The spruce supply situation is easing up. Western Aircraft has a good supply of the best looking spruce Jean Peters says he's ever received. We've bought spruce for our kits from Western Aircraft and also from a wholesaler in Washington who last year processed a million board feet of spruce. Isn't it funny how we complain that the Japanese don't buy any of our goods, and then when they buy all the spruce, we don't like that either?—Alfred Scott

All ribs completed. Main spar 90% completed. Forward wing spar and tail spars completed. Fuselage rings 50% completed. Some metal parts in progress. Divorce 100% completed! Now I can get some real work done.

John LaNoue
Novato,California

Frati's latest, the F.22 Penguino with the F.20 Condor and F.1300 Jet Squalus.