# Falco Builders Letter

*Vivienne and Stuart Gane with the 39th Sequoia Falco.*

## My First Flight

by Stuart Gane

Little did I know it at the time, but September 7th would be remembered forever. It began with the routine preparations for a normal day, a rushed coffee, feed the dog, the last-minute dash around the house to find something, all done in less than 25 minutes from getting out of bed. Then into the car for the 17-mile drive to Cheltenham, slowing down for those secret places where the traffic police hide waiting to pounce on unsuspecting motorists who don't know where to look. Vivienne, my wife, has a very keen eye after a number of early morning meetings with the local traffic police. I think they are possibly on first-name terms now.

One advantage of having to spend time in a car is that you have an opportunity to let your imagination take you to alternative destinations or plan activities more exciting and novel than the mundane day that lies in wait for you. We live in the Cotswold Hills, some 600 feet above the river Severn flood plain where Cheltenham nestles against the eastern slope of the escarpment. Part of our journey takes us right to the edge the steep escarpment slope where, given the right weather, it is possible to see across the Severn plain, sometimes as far as the Welsh Black Mountains, a distance of 60 miles. In this part of England, with the prevailing winds blowing from the West, you can often see weather coming in for the day ahead.

Today was one of those clear days after a series of weather fronts had passed through. The atmosphere was clear and lots of blue sky as far as the eye could see. A great day for flying. My mind immediately switched from its normal soporific state to how I could find time away from school to get down to the airport to complete the high-speed taxi tests which had been delayed by almost two weeks of solid grey clag.

### *In This Issue:*



During school, an observant pupil might have enquired why Sir was looking out the window so frequently, but none did. Possibly they were too engrossed in thinking of what else they could be doing instead of wrestling with the mechanical problems of their current project.

As the last boy left the workshop, I telephoned Ralph Vincent to check if he was available. Ralph is the inspector for my Falco and the would-be test pilot. "Yeah, no problems. Come on down. We'll do the taxi runs", was the reply. Some fifteen minutes later I was in Ralph's hangar looking for a suitable place to park my bicycle (Stephan Wilkinson is not the only cyclist-cum-Falco jockey, although he does it in more style with all the proper gear and, of course, the hat). The Falco was quickly uncovered and pulled out of the hangar, with the pre-flight checks being carried out whilst Ralph telephoned the tower for clearance to carry out the taxi tests.

The tests went well. Ralph did two runs to check the aileron response. The Falco wanted to fly as we raced along the runway. You could feel the wheels were barely making contact as they bounded over small irregularities in the runway surface. My duty was to call out the airspeed as Ralph concentrated on keeping the aircraft in a straight line. Port wing lifted at 34 knots and then the starboard wing rose at 33 knots. "That's it. This bird wants to fly", said Ralph as he slowed the Falco down at the end of runway 27. "I am going to do the test flight. She feels just right." At that moment, I realized what all Falco builders surely dream of was for me about to become a reality.

The taxiing back to the pumps for fuel was made in silence. Ralph kept whatever thoughts he had to himself, whilst my mind was racing about trying to recall if there was anything that I should have done during the construction of the aircraft which would turn a momentous occasion into a disaster. Did I always mix the glue correctly? Was the temperature sufficiently warm in the garage during those long cold nights which I had left a heater on? What about the 'Jesus joint' where the spar joins frame

number 4. Did I use the correct technique for gluing? Will it take the weight of the aircraft when airborne? On and on my mind raced checking everything I could remember. Of course, everything had been checked before but this is a time of self-doubt. There is no going back once the aircraft is in the air. It is the ultimate test of one's craft skills to build an aeroplane and then to fly it, except that I was not going to be on this flight. God, I hope everything will be okay. What do I say, what will I do if it doesn't fly, or Ralph is hurt? And so my mind continued, conjuring up even more spectacular failures and disasters until we finally reached the pumps.

Once the canopy has been slid back, I climbed out conscious of the quiet reflective manner which had enveloped Ralph. I wished him the best of luck and walked away from the aircraft to leave Ralph to prepare for the test flight. I eventually stood some 50 yards away on the corner of the airport apron whilst Ralph busied himself in the cockpit. I had some very mixed feelings about what was due to take place. Some were rational whilst others were based purely on emotion. Although I would have loved to have been the first person to fly my Falco, I knew I was not sufficiently experienced. My flying has been limited to Cessna 152 and 172 types, besides Ralph was a very experienced pilot on many different types including the other Frati masterpiece, the SF.260.

Seven years after I purchased the plans, this was the day I had been working towards, the moment when all those countless hours of work would be put on the line. It was during 1985 that I purchased the Falco plans. I was attracted to the aircraft by a series of adverts in Pilot magazine. The Falco looked very sleek and appeared to possess the characteristics of a machine designed to move through air with speed and grace. Very different from the type of aircraft I had trained on which have about as much sex appeal as a Morris Minor car.

Having only a year before just completed building my house, I was looking for something to do which would be different and a schallenge. So, off went my cheque to Sequoia for their brochure. By the time I had read all the booklets in the information pack, I had decided that this was to be my next project. It was not a very rational approach because at that time the pound was almost at parity with the dollar, but that's what an attractive aeroplane like the Falco does to you. When the plans arrived, I was initially a bit overawed by them. There were so many sheets, all beautifully drawn and printed. I studied them on and off for about six weeks before finally purchasing some spruce.

I actually started work on January 1, 1986. From then on until 1990, I worked most evenings and weekends gradually becoming more and more involved in the project. By 1989, the Falco was becoming too big for the garage. In order to keep the project at home, where I could at least meet my wife twice a day to remind her that she was still married, the decision was taken to build an extension to the house to accommodate what she must have thought was on occasions a cuckoo, and which seemed to be taking over the house and our finances. Six months work provided a garage suitable for the Falco and later, when the plane has departed if we ever made it to the Big Time, space for four cars.

It seemed to me that as the Falco was going to be one of the most time-consuming projects I had ever undertaken, I needed to treat the construction of the aircraft as an end in itself. The flying would come as bonus at the end. Each rib or frame would have to be something to enjoy making for the pleasure of getting it right. What new skills I learned during the process and generous people I met who were willing to pass on their knowledge! There were times of frustration when the spruce would not bend sufficiently to take the profile of the leading edge on a rib without breaking into a multi-fiber expensive fly-whisk, and the great pleasure in discovering the joys of steam bending. I wonder what the neighbors thought as they passed the end of our drive and witnessed the clouds of steam and the gentle rumble of liquid emanating from the converted oil drum and wooden box long enough to cook any snake that might be kept at London Zoo. What annoyance and despair on discovering that all the hinges I had spent most of one winter making turned out to be made from metal of a lower specification than called for in the manual. They filled a 5-liter paint bucket when I disposed of them. I was so pleased with their faultless finish but it all came to nothing. I still have them now, and occasionally give the bucket a vicious kick. Not being able to face making them again, I purchased new ones from Sequoia. When I read in the Falco Builders Letter recently how somebody has had his total project destroyed by a flood not once but twice, I really appreciated in some small way what he must have felt seeing all his effort come to nothing. Take heart, it will be worth it.

Whilst the Falco gradually came together, I found it necessary to purchase various items of machinery which otherwise

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*Above: Inspector and test pilot, Ralph Vincent, and Stuart Gane.*

I would never have considered I needed, amongst the most useful being the bandsaw which, apart from cutting spruce, also proved capable of cutting other materials such as aluminum and fiberglass. Another machine which at the time was indespensible was the compressor and the pneumatic stapler. To use a pneumatic stapler is like having your own little machine gun. You can be in command of the situation with the plywood begging for mercy as it is forced to perform all sorts of unnatural acts. Seven years of working in a garage can do funny things to one's mind.

One major change was to raise the Nustrini canopy by 32mm. I did originally fit the canopy as per drawings but found that I had to bend my head to avoid hitting the plastic. This was fine for hangar flying but not something I thought I could cope with on a long flight. Even so, I was very reluctant to undo all that work. Eventually common sense took command. It did take some courage, I must say, to pull the thing apart. Raising the canopy and frame was easy but changing the dorsal fin and, worse, extending the canopy skirt took some three weeks full time work. The canopy is still close, but there is no need to bend one's head anymore. I'm glad I made the change.

As the Falco grew towards completion, I began to worry how it would be transported to Staverton airport. My mother-in-law asked if I was going to be able to take off using the driveway to the house? "Well, er, not exactly, Ma'am. The drive is not quite long enough." The drive in question being only 20 yards long. Eventually the problem was solved by using a 40-foot mobile-home transporter lorry.

In fact, it was not a problem at all. The Falco was split in two at frames number 8, and the front half still with the engine attached was towed down the drive with the ride-on lawn mower, and then winched onto the back of the lorry. The tail section was tucked in beside the front half of the Falco. It was all so easy in the end. Like a lot of problems, they are often only difficult in the mind. Before we left, I asked the driver not to go above 40 mph. He decided 25 mph was plenty fast enough and so we crawled our way to the airport. I think we must have caused one of the biggest tail-backs on the road to Cheltenham for years.

Once the Falco was safely installed in Ralph's hangar, I remember calling Sequoia for some part of other and telling Alfred I was nearly finished. "Another two

months", I said confidently. Alfred muttered something about taking another 6 months. Alfred was right (he always is). Word soon got around the airport that a Falco was about and quite a few folks came and had a look. If you are the owner of a Falco, it would be very difficult to fly incognito. Those six months at the airport included two months full-time work during the school holidays. During that time, I did the final hooking up of the engine and avionics, and just when I thought I could apply for a permit to fly, word came from Virginia that the flap system had to be modified. That was another two days with my head buried in the bowels of the plane. At last came the final inspection. I was told to increase the thickness of the washers wherever a split pin was not entirely positioned right down in the slot of the castellated nut. Otherwise, it was okay.

The paperwork was completed and sent off to the PFA for a permit to test fly. Approval was received in just over a week. Insurance was taken out, and then all that was needed was a time when Ralph was free and the weather was suitable. We waited. It seemed as though the weather would never behave itself.

On completion of the pre-flight checks, Ralph taxied the aircraft to the runway. At last, after what seemed an interminable wait, the Falco was given clearance to take off. I am not sure how to describe that moment as the airplane began to move. Slowly at first and then rapidly picking up speed, the nose lifted, and she was flying. It certainly was a mixture of elation and fear as the little Falco climbed away. Happiness that at long last I was witnessing something that had occupied both my conscious and subconscious for so long. Everything was out of my control now, and there was nothing I could do until the aircraft returned. I recall thinking about how I had planned to have Vivienne with me and one or two friends who had taken a keen interest in the project. But there I was,

***The raised device in the back of the canopy is the GPS antenna.***

standing alone at the corner of the customs building with nobody to share my thoughts, nobody to exchange the tremendous feeling of exhilaration. I did see a chap walking nonchalantly across the apron with his hands in his pockets towards me. I wanted to rush across and tell him that is my aircraft, I built it, this is its maiden flight, but he changed direction and walked behind the customs building.

Ralph flew the Falco for 30 minutes, returning to make a textbook landing. I need not have worried. She flew well but needed some trim on the right aileron and a trim tab on the rudder. Later that afternoon, Ralph and I went up together, and the Falco proved to be everything I had hoped for. It climbs like a bat out of hell. It is so positive in handling that if you want to bank left or right it seems only necessary to turn your eyeball in the chosen direction and around she goes.

Initially there was very little warning of the approach to the stall inspite of fitting stall strips, but with subsequent moving of the starboard strip higher up the leading edge there is now a very slight buffet before the left wing drops. I would guess the nose falls to about 30° in a full stall. Since the maiden flight, the Falco has flown another 4.5 hours including some basic aerobatic manoeuvres—all of which the aircraft performed impeccably, although it has proved very reluctant to spin to the right.

In level flight and without gear doors, it indicates 155 kts at 3,000' and 10°C. She climbs at 1400 fpm from takeoff, and the noise level is no problem. I am used to flying Cessnas without a headset so, in the Falco with a headset, the noise level is below what I have become accustomed to.

The Falco has a 160 hp Lycoming IO-320-B1A factory zero-timed engine (£10,000 including buying a core). The radio stack includes a Magellan 5000 GPS, KX155 nav/com, KR87 ADF, KT79 transponder and RST marker beacon. The interior has been upholstered in a light grey Connolly leather with two dark red flashes on the cockpit side walls, and the grey perforated leather to the seat cushions and back. The weight is 1,319 lbs with a CG at 64.9" empty but including engine oil.

The Falco has a white primer-filler paint which as been applied quite generously as I intend to fly it until everything has had a chance to settle down. As to the final colour, the current plan is to paint it Ferrari red with white stripes á la Hansen but that will depend on how tolerant the West Microlight filler which I have used is to high surface temperatures. We do occasionally get good weather in the UK, usually when I am at school and can't get away. I still feel withdrawal pangs every time I walk into the empty garage where it was built. I would do it all again if I could afford it and if Vivienne would let me.

# The Glider

## Part 5 of a Series

by Dr. Ing. Stelio Frati
translated by Maurizio Branzanti

15. Moment Equation and its Properties
The equation for the moment is represented by a polar chart as a function of the coefficient of lift. This curve is essentially a straight line until just before the maximum lift value is reached.

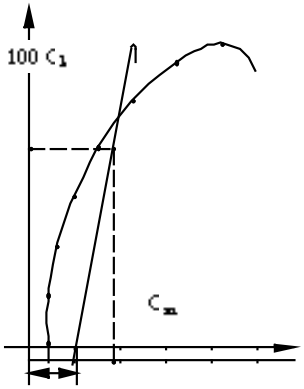



Fig. 3-14

The value of the coefficient of moment in relation to zero lift, $C_L = 0$, is of particular importance in determining the airfoil's stability. This intersection on the horizontal axis is called $C_{m0}$. The position of the center of pressure may be determined graphically in the polar chart by looking at the moment curve.

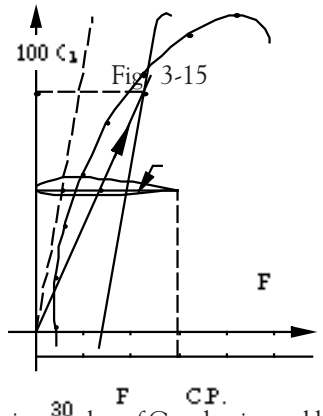



Fig. 3-15

For a given value of $C_L$, a horizontal line is drawb with its origin on the vertical axis and its length equal to the value of $C_m$, i.e. 100 $C_L$ = 30, 100 $C_m$ = 30. This line is called the reference chord.

To determine the position of the C.P. at a certain $C_L$ value, a horizontal line is drawn through the $C_L$ value in consideration, so that it will intersect the $C_m$ curve at a point A. The line drawn from the axis origin 0 and the new-found point A, or an extension of this line, will intersect the reference chord at a point that represents the center of pressure.

Stability Slope of an Airfoil. This graphic construction allows us to arrive at important conclusions about the stability of an airfoil. We can have three cases: (a) the moment curve intersects the horizontal axis to the right of the origin, (b) the curve coincides with the origin, or (c) the curve intersects the horizontal axis to the left of the origin.

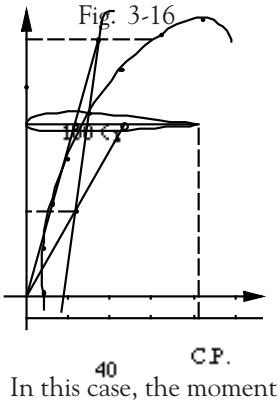



Fig. 3-16

Case A. In this case, the moment curve intersects the horizontal axis at a positive value of $C_{m0}$. Let's determine, using the previous procedure, the position of the C.P. for a value of low lift, where A is the position of equilibrium. Let's suppose that now we increase the incidence angle, thus increasing lift (point B on the moment curve). We'll notice that the C.P. moves forward, toward the leading edge. On the other hand, if the incidence is reduced, the C.P. will move aft towards the trailing edge.

Therefore, for an airfoil where $C_{m0}$ is positive, when a variation occurs, the center of pressure will move in a direction that helps to increase the variation. We then deduce that an airfoil with such characteristics is instable because any variations will be accentuated and moved further away from the position of original equilibrium.

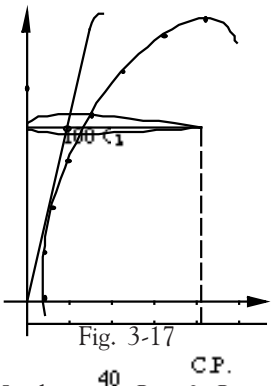



Fig. 3-17

Case B. In this case, $C_L = 0$, $C_{m0} = 0$, and the curve goes through the origin. From the chart we note that for any variation the position of C.P. does not move, and it coincides with the focus of the airfoil. An airfoil with this characteristic is said to have neutral stability.

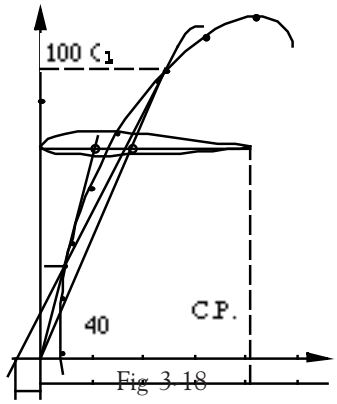



Fig. 3-18

Case C. Let's now consider the third condition. For zero lift, $C_{m0}$ is negative. The effect of the center of pressure is therefore opposite the one noticed in Case A. For an increase in incidence, the C.P. will move toward the trailing edge, and forward when the angle of incidence is reduced. In these conditions, the airfoil is stable.

All of the airfoils in use, however, are designed as in Case A—they are therefore instable. Airfoils that are unaffected by variations (Case B) are used in tail sections. Their profiles are biconvex and symmetric.

Flat surfaces are like Case C. These are stable, but obviously they are not used in wing construction, both because of the impossibility of obtaining structural strength and because of the low values of lift and efficiency. There are in existence some airfoils that follow the characteristics of these flat surfaces, and these are called autostable, but their use is limited to wing extremities.

The instability is at a maximum in concave/convex profiles with high degree of curvature, and it diminishes gradually through lesser degree of curvature in the biconvex asymmetric airfoils to, as we have seen, completely disappear in the symmetric biconvex profiles.

Thus, the measurement of instability of an airfoil is dependent on the movement of the C.P. with changes in the angle of incidence. In normal flight attitudes, the position of C.P. varies between 25-45% of the wing chord when normal wing airfoils are used, while for biconvex symmetric profiles found in the tail sections, the variation is 25%.

By studying the moment curve, we can thus rapidly establish the instability of an airfoil, and say that the closer to the origin the moment curve intersects the horizontal axis (small values of Cm0), the flatter the curve is, and the less the instability is.

## First Flight:
## Cecil Rives

The latest happy Falco builder to see his bird pop into the air is Cecil Rives, of Houston, Texas. The first flight took place on October 5 with the capable hands of Frank Strickler at the controls. Frank, as many of you know, imports SF.260s and is primarily responsible for the large numbers of Iron Falcos in the U.S.

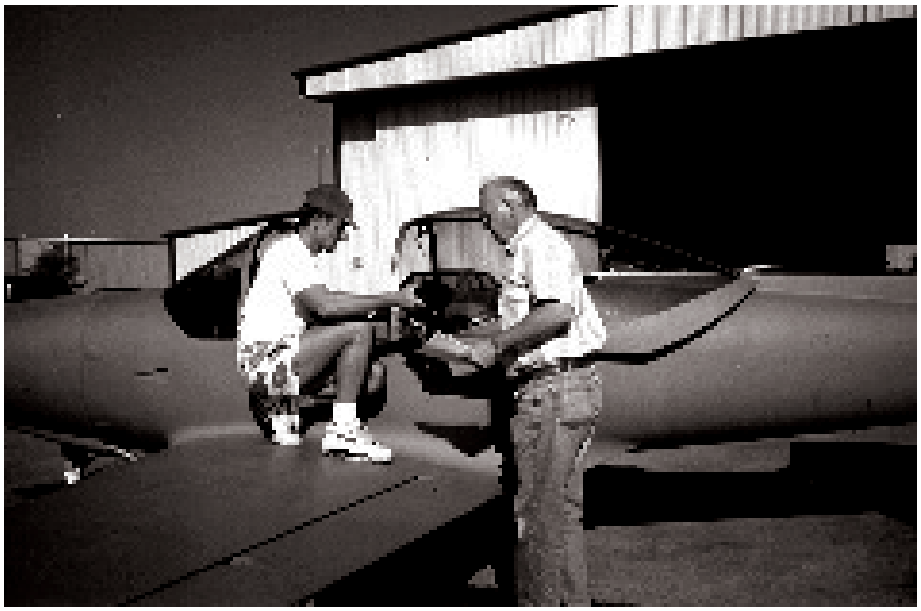
Frank put about 30 minutes on the plane and landed to report, "It's wonderful. The workmanship is exemplary. It runs great and flies better—absolutely a superb aircraft." Frank has been known to exaggerate, but after Cecil and two expert pilots have put 26 hours on the Falco, Cecil is prepared to believe that, in this case, Frank is 100% objective.

Indeed, Cecil has been on a real high ever since the Falco's first flight, and he keeps saying things like, "I can't believe I built it". After the first flight by Frank Strickler, the flight testing was turned over to Jim Pohoski, a Delta Airlines pilot and F-16 instructor in the Texas Air National Guard, and Sam Kliewer, ATP, CFI and air traffic controller at Houston Center.

Jim Pohoski flutter-tested the Falco to 213 knots and pulled it through 6-g turns, then performed loops, rolls, stalls, spins, Immelmans, chandelles, lazy eights and Cuban eights. He reported a stall speed of 57 kts clean, and 51 kts with 20° of flaps and gear down. A complete roll takes about 5 seconds at 130 kts, so that's about 70° per second.

Everyone raves about the handling of the Falco, but the speeds have been exceptional, despite the fact that the 180 hp IO-360-B1E has 2,040 hours on it. Several pilots have said they've never felt a smoother engine/airframe combination. In level flight at 2500', Jim Pohoski reported 163 knots indicated at '25 squared' and 173 kts at full power. The really remarkable thing is that those speeds are for a standard-canopy Falco that's painted in primer and which doesn't have any gear doors, control hinge fairings or any of the other 'go-fast' additions that Karl Hansen and others have used. Perhaps all this is due to the slick air they have in Texas.

Sam Kliewer conducted speed and altitude tests in late October. He recorded data at one-thousand-foot intervals from 1500' to 17,500'. Sam reported that the Falco was still climbing at 500 fpm at 100 knots indicated at 17,500'. The best airspeed was




***Center: Jim Pohoski (left) and Cecil Rives.***
***Above: Cecil after his first flight in the Falco.***

178 knots true at 2500' with 20.7/2500 and 12° C.

Cecil is now in the process of installing gear doors, control hinge fairings, stiffening the engine baffling seals, closing up the gap between spinner and cowling, and sealing off the starter ring from the upper deck engine cooling air. His first speed run with these installed produced 165 KIAS at 6500', 13° C, full throttle and 2650 rpm. That works out to 184 kts (212 mph) true airspeed.

Cecil began construction on the Falco in September 1988 and did most of the construction in his two-car garage at home. Cecil is a petroleum geologist and, with the slump in the oil business, that's a subject he'd rather not talk about. However, the slack times at the office did provide ample opportunity to work on the Falco, and for much of that time Cecil worked on the Falco full time, and he used all of the kits available.

In June 1993, he moved the Falco to a hangar at the Hooks Airport for final assembly. In this hangar, there are about 12 RV-4 and RV-6 projects, and all this draws a considerable amount of traffic consisting of other pilots, homebuilders, weekend sightseers and other assorted airport riff-raff. Cecil reports that most assume the Falco is either aluminum or composite. "Their reactions vary from shock to total disbelief when told that it is built of spruce and plywood. One guy wanted to know if it was 1/4" or 1/2" plywood!"

The constant attention can, at times, be annoying, and Cecil reported that one guy kept hanging over him forcing Cecil to finally just take a walk down the runway in hopes the man would leave. He did. On the other hand, he still admits it's tremendously gratifying to hear people say, over and over, "Wow, what a beautiful airplane!"—considering it's still only in olive drab primer. "The Falco is truly a classic design", says Cecil.

"Now that the required 25 hours have been flown off and others have flown in the Falco, the universal opinion is that of Frank Strickler's after the first flight: 'It is, simply, a superb airplane'. My opinion is that it is far more than I hoped for or expected, but I guess I've never met a Falco I didn't like. It is a delight to fly as other builders have said about their Falcos, but you really have to experience that for yourself.

"To other builders who have not completed their Falco, I would like to say that the effort, time, frustrations, blood, sweat and tears that go into the construction of a Falco are well worth it. And the feeling that you get when your creation takes off into the wild blue for the first time is just indescribable. In my opinion, if you follow the plans closely you don't have to worry about a great flying Falco.

"Last, I can only echo Alfred with regard to the first flight and test phase: If you're not a current, high-time pilot in an aircraft similar to the Falco, try to find someone, as I did, to do it for you. Believe me, it shouldn't be hard to do. I could have had six more test pilots with no trouble.

"Like Larry Black, I built my Falco in an attached garage and like Larry I would be remiss if I didn't acknowledge my wife's patience and understanding during the construction phase. The dust is incredible. Karen earned the 'K' in N63KC."

Cecil's Falco came in at 1,305 lbs empty. The panel includes two KX-165, one with glideslope, KT-79A transponder, and Northstar 600 GPS. Cecil is in love with the GPS and has the antenna installed under the windshield directly in front of the magnetic compass. He says it works perfectly there.

The interior is fitted out with light grey leather on the seats and side panels, dark Navy blue leather on the glareshield and turtledeck, and with a light grey cut pile carpet on the floor and baggage area. Now with the required time flown off and with all of the speed mods installed, the next step will be to get the plane painted.

Congratulations, Cecil, on getting Sequoia Falco number 38 into the air. Many happy landings.—*Alfred Scott*

## U.S.S. Kitty Hawk

Come with me on a visit aboard the aircraft carrier Kitty Hawk. I went aboard with two editors from Air & Space magazine, partly for the tour and partly to help with photography and words on an upcoming article. Pat Trenner, Caroline Sheen, and I joined up in San Diego on a December Saturday evening, and we had a few drinks on the patio out in front of the grand old Hotel Del Coronado, famous among other things as the set of the movie Some Like It Hot.

Built by Chinese labor in the 1880's of wood, the 'Hotel Del' was in full splendor with its red-tiled Victorian roofline draped in Christmas lights. The dining room is a huge mahogany-arched chamber that makes you think that the Chinese workmen were more likely shipwrights than carpenters. A basement full of shops bustled with Christmas shoppers wandering among tourist-art shops and displays of famous visitors from Teddy Roosevelt, Truman, Chiang Kai-shek, to our own modern-day joggin' pres and his biddy.

I've rarely seen two women so excited at the prospect of the following day. Pat and Caroline could barely contain themselves, and the next morning both admitted to being so wired that neither had slept a wink. After breakfast, we caught a taxi out to the North Island base for the tedious hurry-up-and-wait pace of the military that I hadn't experienced since the late sixties when I was in the Marine Corps in Morocco.

We arrived, signed in, and then waited a couple of hours for the twin-engined Grumman COD transport to take us out to the carrier, presently forty miles off San Diego and conducting carrier qualification flight training for a new batch of pilots. This was Sunday morning, yet a steady stream of helicopters arrived, loaded and departed, while turbine aircraft from jet fighters to prop transports whined loudly out on the ramp in endless runups before taxiing out to the runway. Clumps of black-uniformed young sailors with close-cropped haircuts moved about like sheep while officers and chief petty officers in tan uniforms leaned on the wire fence, gazed out at the aircraft, and let the time pass.

As the departure drew near, we were issued our gear for the flight—an outfit that later turned out to be the standard, required apparel for all on deck. The canvas jacket is a complete water survival suit, containing a self-inflating life jacket, with multiple pockets, whistle and a pouch of colored powder to sprinkle in the water so rescue

aircraft might spot you among the waves. The 'cranial' is a semi-helmet, with two hard plastic sections, integral noise-protection cups for your ears, and goggles for your eyes. As we would later learn, the deck of a carrier is no place for unprotected eyes or ears.

We trundled out to the ungainly-looking COD (Carrier Onboard Delivery), a hugely overpowered folding-wing mini-transport that shuttles mail, parts and people out to the carrier, and climbed into our seats.

One look at the innards of the COD is convincing proof that this is an all-business, just-get-em-there operation. The seats are immensely strong, riveted metal affairs that are jammed tightly into the dimly-lit cabin, all facing aft. Wires, cables and tubing are clearly visible above, and the sidewalls are covered with Velcro-attached padding. As we get a safety briefing about how to exit the aircraft through two tiny ceiling hatches in the event of ditching at sea, I wonder how many of us would get out before this twenty-ton Grumman Iron Works creation sank straight to the bottom. How any future warbird collector could romanticize this machine is beyond me, but I suppose the same could be said of literally all warbirds.

The engines whine up and thus begins another endless Navy engine runup. The COD's sole cabin crewmember closes the three-piece aft cargo door and then crawls up on it to inspect the latches. After perhaps ten minutes of furious engine-running, we finally taxi out and take off. The cockpit is dark for there are only two tiny windows for the seats directly behind me.

*Top: Caroline Sheen and Pat Trenner. Above: Our first look from the COD.*

By straining, I can just barely see out of one window and my only reward is the sight of the ocean below.

In twenty minutes we begin circling, and by now essentially everyone on board has dozed off. The approach to landing on the carrier begins with an unmistakable sudden sharp bank and then a hard pull in the turn. The movements of the airplane become increasingly jerky as our unseen, anonymous pilot makes quick, sharp corrections to the controls and engine power. A bell goes off, and a red light proclaiming "PREPARE FOR ARRESTED LDG" comes on. In the seat behind me, Caroline Sheen—who slept not a minute the night before—is fast asleep. We hit her leg, and her eyes pop open and roll about.

The jerky ride and throttle-jockeying continues with increasing roughness, and we all brace ourselves for the landing, which comes suddenly and with a thump as the COD careens onto the deck and pitches down. We are slammed into our seat backs with a sudden, stunningly strong force that no carnival ride could ever hope to equal, and in a few short gut-straining seconds we have reached a complete stop. We all breath out slowly and realize that we've done it.

The plane turns sharply, rolls a short distance, wheels about again, and then the engines spool down as the aft cargo door clanks open, and we peer out of the dark chamber at our first glimpse of the carrier. We are so close to the edge that we can scarcely see the deck at all. There's the ocean sliding by below, but we can hardly see that either because our full view is blocked by two jet fighters with wheels right at the deck's edge—a surreal, impossible close-up of a part of a nose, an engine intake, two underwing tanks, and pieces of wing. Which tanks and wing belong to which airplane is difficult to tell because the images overlap each other, yet they are arranged side-by-side. So close, so impossibly close.

A band of goggled, helmeted, life-jacketed men appear and stream into the COD to retrieve us, while others lean tight-lipped into the wind. We pile out of the COD and glance around quickly at the deck. There are people everywhere, with jackets of wild colors. Some are standing with legs firmly apart, while others carry tie-down chains. There's a low, yellow boxlike machine with four black tires. Among them, an F-18 is bellowing like a bull in a castrating pen. Above the jet blast fence, we can see the airplane jerk and move away from us suddenly, pitch up and then hang in the air as the deck is clouded with steam. Men mill around among the steam, the jet blast fence lowers, the F-18 climbs away and another moves into takeoff position.

Thus it is on the deck of a carrier, where the preposterous is routine, the impossible is executed with precision, and it all takes place amid a swarm of men who but for the helmets and goggles might easily be mistaken for a spring college riot. How these men—whom any New York cop would immediately arrest for mayhem—manage and coordinate their activities is infinitely more fascinating than the astonishing machinery that dominates this tiny landscape.

They are organized by teams, each easily identified by jackets of green, yellow, white, tan, or red. Team leaders have radios built into their headsets and are directed by other men in the steel-and-glass Matterhorn that looms over the deck. 'Spotters' move the airplanes around the deck and their activities both on deck and on the hangar deck below are coordinated by a room of men sitting around a double-decked table littered with flat Christmas-cookie models of each aircraft. Names like neck, hell hole, throat and fantail are used to describe locations on the deck and hangar, and they use brightly-painted hex nuts placed on each model to indicate which plane needs refueling, arming, or maintenance.

To live on a carrier is to be married inextricably to a machine. Every compartment and passageway has a tangle of wires, pipes,

valves and ductwork along the ceiling and walls. There are endless fire drills—remember, you're sitting atop four million gallons of fuel and an enormous supply of rockets and bombs.

At least once a day, the ship goes to 'general quarters'—full wartime battle alert conditions in which all of the water-tight compartments are sealed, sailors don full firefighting gear, and everyone stands by for the worst. While inarguably necessary, such exercises contrast sharply with the action on deck where there's teamwork and hustle that any football coach would appreciate. In the fire drills, there's the unmistakeable look of I'd-rather-be-doing-something-else in every pair of eyes. Executive Officer Robert Taylor explains that young men come into the Navy as teenagers, and if nothing else at least learn discipline during their tour and return to society as adults.

When I was in the military in the late sixties, all of the services were filled with a special breed of bland, unimaginative, just-doing-my-job "lifers" who were mainly interested in 'three hots and a cot' and a pension. With the cutbacks in the military, those guys are all gone, and there's fierce competition for officer promotion. The result is a dramatically improved quality of people in the military.

I saw active, motivated men at every level who were interested in what they were doing and made no secret of it. Bill 'Bear' Pickavance, who commands the ship, thinks he's got the best job in naval aviation, but I also met a mechanic on the night shift who proudly showed me around the hangar deck and who said "I wouldn't trade my job for anything." Indeed, the invitations from men we met to "come see what I do" became something of a problem.

On a carrier, there's so much to see that it would take weeks to cover it all, and men report that even after months on board, they occasionally find themselves in a part of the ship they've never seen before, and engine-room mechanics may go months without a sight of daylight. The statistics are astonishing. There's a crew of 5,000, payroll sixty-three million dollars a year. Telephones: 2,400. Seven dining rooms, four doctors, 65 hospital beds, five dentists, two barber shops, four stores, and two lawyers. There's a jet engine repair shop, composite repair shop, machine shop, bakery, printing press and photographic lab. Whenever you think you have heard the last impossible statistic about the Kitty Hawk, you hear yet another—that,

for instance, they make their own eyeglass lenses.

Scattered below the flight deck are all sorts of machinery rooms supporting the flight operations. Each arresting cable has its own arresting gear engine room immediately below deck. The operator dials in the weight of the landing aircraft so that the airplane will be stopped in the correct distance. When an aircraft catches the arresting cable, all hell breaks loose in this room, as the two-inch steel cable streams out and courses though the array of pulleys that drive an enormous hydraulic piston.

There are so many critical interdependencies between pilot and ship's crew that the traditional military chain of command, and dependence on orders gives way to a very high degree of teamwork and cooperation that's more akin to modern corporate management. Bear Pickavance, for example, has much more in common with the best business managers than any military stereotype, and he is the sort of man who would rise to the top in any profession. He talks easily and comfortably with strangers, yet his eyeglass-spinning and ring-twiddling reveals an intensity he's working hard to suppress. The ultimate approval, however, comes from the crew, and comments like "He's a good skipper" come easily and unprodded from a number of deck hands.

Pickavance jogs four miles a day on the deck in a Nike running outfit. "Just like Slick Willy!" I say to a couple of officers and men, to see what sort of reaction I'd get. Privately, one-on-one, the enlisted men would snort and laugh conspiratorially with me, but the officers wouldn't touch it.

After his morning jog, Pickavance stopped

*Top: Bear Pickavance a-jogging. Above: Deck hand with a morale problem.*

by for a talk, and he spoke about the dramatic improvement in the safety of carrier operations that had come about in the last ten years. He attributed this primarily to the equipment: the use of twin-engined jet aircraft and the improvements in cockpit controls and displays.

Reliable as they are, jet engines still can have problems. He talked about flying the single-engine A-7 Corsair, which developed an engine problem when they were first introduced. The engines had a tendency to explode one mile out. The manufacturer quickly addressed the problem, but it took time to get the new engines into the fleet. In the interim, they would hook the aircraft to the catapult, the deck crew would clear out, the pilot would run the engine at full throttle for two minutes, and if it didn't explode, they would fly the airplane. The F-14 had some engine problems as well, but with a spare engine you could always get back to the ship.

He is particularly proud of the controls of the F-18, which he helped design. The flight controls and instrument panel displays dramatically reduce the pilot workload on approach. The heads-up-display has become the primary flight instrument, and the pilot can move whatever gauges he wishes to this display. The flight control inputs are all processed and interpreted by a computer, so if you slam the stick full right, you're telling the computer to roll right, and the computer then figures out which controls it will use for this purpose depending on the airspeed and strain on the wing. Full right stick could produce differential movements of the aileron, flap, rudder or stabilator.

In fact, the standard takeoff procedure for the F-18 is for the pilot to completely let go of the stick and grasp the windshield bow instead. At near-stall speeds, the computer does not respond well and if the pilot attempts to make a correction, he will just make things worse. So they just let the computer fly the plane until it's established in a climb.

As we talk to Bear Pickavance, flight operations have been suspended and all on deck are busy with training exercises. A hundred men rush to rig the arresting net, a huge nylon strap affair that's used when a plane can't land using an arresting cable. It takes them three minutes. A crew of six men races to assemble the MOVLAS, a standby apparatus for the landing light 'meatball', and they do it all in "one plus thirteen seconds" intones the supervising officer. (MOVLAS stands for "mobile landing, um, er, something system"—part of the role of any military is to murder the language with acronyms like this.)

Others practice putting out a make-believe fire in an engine-less derelict F-14, then they pretend it has landed with a collapsed landing gear, and they rush out a crane to lift the aircraft and move it a short distance.

The training session ends with a FOD walkdown, a ritual performed several times a day. That stands for Foreign Object Detection, and it's vital to the operation of jet engines that all debris be removed from the deck. These engines will suck up anything that's on the deck and little pieces of metal can destroy an engine. The previous night, an A-6 had a 'FODed' engine removed, however it turned out to be an over-reaction. This morning a small band of red-faced men had to troop up to the captain's bridge to "explain" the situation to Pickavance.

When flight operations are underway, the deck of a carrier becomes one of the most dangerous places on the face of the earth, yet the safety record is superb. With the deck crew, we moved among the taxiing aircraft and stood beside the catapult as fighters and bombers rocketed past us.

The noise is indescribably loud, and even though your ears are well-protected, you can feel the vibrations all through your body. Short unprotected exposure to this noise level can permanently damage your hearing, and even high up among the antennas over the captain's bridge it's frightfully loud. Later while lounging in the public affairs office, a deck safety officer stormed in and cursed our host Rob

Newill. "I'm really pissed at you! You've got two women up on the upper deck without double hearing protection. I've got twenty-five years, man." As the safety officer stomped out, you realize that the Navy takes safety seriously.

For takeoff, the pilot is guided by the deck crew so the dual nose wheels exactly straddle the catapult slot. A man crawls under the jet and attaches the aircraft to the catapult. He moves with the agility of a lynx, the strength of a college wrestler, and the grace of a ballerina as he installs the holdback bar, arches forward with dramatic hand signals to move the aircraft slightly forward, kicks a bar into the catapult shoe, then runs a tight hook pattern forward and clear of the plane.

All of this takes place within a few feet of the jet engine intakes. Mike McCamish, the air wing commander who has been flying off carriers for 22 years, and the personification of the quick-reflexed, supremely confident fighter pilot, admits he's frightened by the thought of working among the planes. Every year or two, a man will make a wrong move and get sucked up by an engine. Some brace themselves against the intake vanes until the engine is shut down, some lose fingers to the engine, and others die.

The jet blast fence comes up. An F-14 thunders to full power, then explodes the air with afterburners. The catapult officer crouches to one side and exchanges hand signals with the pilot, who salutes when he's ready. On the final wave-off, the fighter jerks suddenly forward, its nose bobbing quickly and screeches forward in a howling blur. The catapult is extremely short, and in less than four-and-a-half fuselage lengths the F-14 is hurled to 170 mph. The catapult shoe hits a stop, sending a tremor that can be felt throughout the ship. The F-14 climbs out, the blast fence comes down, and mountains of steam waft over the deck and obscure the men who guide the next airplane to the catapult.

Perched high on the aft superstructure, the 'air boss' runs the control tower of this air field. His tiny glass office, like all compartments in the ship, is filled with an impossible quantity of men packed together like newborn puppies in a shoe box. "Personal space" is not a phrase heard round this ship.

They bring the aircraft in with astonishing precision. An airplane crashes into the deck, hooks a cable and bellows at full power (in case of a bolter) against the cable

as it comes to a stop, often one fuselage length from the end of the deck. The hook is raised, the cable falls free, and begins to rewind into the deck. Men use solid metal push-brooms to guide the cable. The aircraft turns, taxies clear of the landing area and in a few seconds another aircraft hurtles onto the deck.

The final phase of the landing is controlled by the LSO—landing signal officer—who inhabits a small patch of metal to the side of the landing area. In front of him a television monitor gives a bore-sight view of the aircraft on approach, complete with crosshairs that match the gyro-stabilized glide slope. "You're right, above glide slope," he radios to the pilot in clipped phrases, and the plane gets closer he adds "Deck coming up. Deck going down".

At night it's a dramatic experience to huddle in the cold wind and watch this spectacle. The television monitor glows red against the dark Pacific, and in it you can see the fuselage and wings of jet approaching, yet against the night sky only the winking lights of the plane are visible. As it slides toward the deck, the LSO clears the plane to land with a final "Fly the ball". The fighter comes into full view, shrieks by so close you feel you could leap up and touch the wing, crashes into the deck and bellows to full takeoff power as the cable snags it to a stop. Occasionally, the hook misses all the cables, and the fighter arcs back into the night.

To our right, somewhere in the dark there's a canvas safety net that we can dive into should the airplane careen our way. In the moment that's quiet enough so I can scream into the man's ear and be heard, I ask, "Is this work or sport?"

"A little of both!" laughed the sailor.

From the flight deck to the innards of the ship is only a short distance. Bounce down a few steps, duck through a metal door, and you've suddenly moved into the quiet steel honeycomb world of passageways, oval cutouts in bulkheads that you hurtle over, and occasionally tiny holes that you must crawl through. Wherever you go, you're never alone. There's always someone else there, too, passing the other way, waiting for someone, busily hurrying along or working on something. The inferno of the deck is far away and forgotten.

We had dinner with the officers, and they lined up a long banquet table with white tablecloths in a large dining room with an acoustic-tile ceiling and paintings on the wall. You could be in any office building in the world and not tell the difference. A Marine captain sat across from me and was so competitive with the Navy officers that he never exhaled lest his physique deflate. I took a devilish delight in watching their polite discomfort as I told a story about how, years ago, I had concocted a monstrous lie for a fellow Marine caught sleeping on post (see "Corporal Goldberg", page 14) and how it had succeeded in getting him off. It's a terribly funny story that never fails to amuse people, but it was also a bit like telling a group of U.S. Attorneys about a bank robbery you pulled off in a foreign country. The Marine exhaled long enough to say, "I can tell when my men are lying to me."

"Yeah, that's when their lips are moving", said the Navy supply officer to his side.

Lance Theby, one of our enthusiastic guides on the ship, talked about his life in port. He's in a softball league, and it's very competitive because there are a lot of retired professional baseball players in the league. One of the pitchers is an old pro. "Boy, I hope when I'm 56 I can still pitch a softball!", said Lance, as I swallowed hard and tried not to count the years to that decrepit age.

Later that night, we visited with the commander of the group to which our carrier belonged. Admiral Dennis Blair, a thin, soft-spoken Rhodes scholar, talked about the dramatic changes that the Navy was making in response to the collapse of the Soviet Union. Of the delicate management balance of how long you could keep men at sea, away from their families, and still keep them in the Navy. Of the need to maintain salaries and housing allowances at a sufficient level to keep qualified motivated people in the service.

As he talked, a black-and-white television connected to the ship's closed-circuit system played out the violent drama on deck. In the comfortable, carpeted quarters, it all had the impersonal, remote feeling of a movie. Yet directly above we could also hear the slap, scrape and thump of the aircraft, and you realize that it's all happening within scant feet of where we were sitting.

The next day it came our turn to pile back into the COD and wait our turn to be catapulted off the ship. This time I had a window seat. We jerkily taxied out, and I soon found myself peering over the catwalk down to the ocean below. Since you're facing aft, you brace your legs on the seat in front of you, cross your arms tightly across your chest and lean forward.

The engines rev up to takeoff power, and you know that the moment is near. You wait, breath uneasily, and wait some more. There is no warning. You are looking at your feet and the floor below you when the cat-shot begins. You know what is happening, but there is a complete sensory shutdown. The force that's hit you is so enormous, so otherworldly and so foreign that all mental processes collapse. True, you can hear a scraping sound below you, but this wild, black-hole force that's got hold of you is otherwise silent. It ends suddenly with a loud THUNK, and the airplane is flying as normally as if you had just awakened on a routine flight. We all sit up, look around at each other and blink.

In twenty minutes, we've landed back at North Island. Less than an hour after the catapult shot off the Kitty Hawk, I'm back at the hotel, a mansion that once belonged to a wealthy sugar importer. In three hours, I'm going to meet friends for dinner. I'm exhausted. I run a hot tub, soak for two hours, and think about all I have seen.

—Alfred Scott

# Corporal Goldberg

When I was stationed with the Marine Corps in the late 1960's, our job was to guard a Navy radio transmission station in a cork forest on the coast of Morocco. That was before satellites, and our base was a radio link between the Mediterranean fleet and the Pentagon. While the war in Vietnam raged on, our job was an ordeal in boredom.

I was one of the lucky guys who were part of the guard dog squad. During the day, the antenna field was guarded by a man high up in a radio tower over the central radio compound. If a Moroccan wandered into our area to steal copper wire, he could call the sergeant, who would drive out in a truck.

The Moroccans rarely did this, and never at night because that's when the dog patrols were out. A few years before, one particularly crazy Marine had turned his dog loose on a Moroccan, nearly killing the poor man. It required a personal apology from President Kennedy, but it served our purposes well because the Moroccans thought all of the dog handlers were crazy. We did our best to maintain the image by chasing them with our German shepherds into the forest.

While our receiving station sixty miles away suffered enormous losses from pilferage at night, we had none at all. No Moroccan would ever consider sneaking into our base at night. In fact, the dog handlers were never doing their job. We would pair up and spend the night talking or sleeping. When the sergeant came out for his hourly check, we had a warning system of whistles that would send us scurrying back to our individual posts, each being a pie-slice of the round field.

One of the dog handlers was Corporal Goldberg, a hard-working, energetic man who had just returned from Vietnam. Everyone liked Goldberg, but one morning we woke and the awful news of the night before raced through the barracks. Goldberg had been caught sleeping on post—the ultimate, worst offense any Marine could commit. You were guaranteed six months in the brig and then a dishonorable discharge.

One of the first things any soldier, sailor or Marine learns is that when your ass is in the crack like this, you lie. You prevaricate, fabricate and dissemble. Only the stupidest and most foolish soldier will fess up to a hanging crime and take the punishment. I had once been caught sitting down in the post high up in the tower reading a book. But the sergeant was never able to find the book (which I hurled over the radio building as he climbed the ladder) and really couldn't tell from directly below if I was sitting or squatting. It was a problem of "leg cramps", I later told the captain, and I was just doing knee-bends to relieve them.

So I went up to see Goldberg, who was just rolling out of the bunk, miserable and frightened. "What happened?", I asked. "They caught me sleeping on post", said Goldberg who recounted the sad tale. He had been posted at midnight, sat down on a rock at the posting station, and fell asleep. He woke up in the headlights of the sergeant's truck. There were two witnesses, the sergeant and the company driver. Not only was Goldberg asleep, but his dog was asleep as well. To make matters worse, the spot where he was found was across the road from his post, so he was also off his post, another serious offense.

It didn't help that the sergeant was one of those sick types who actually liked burning people. In 18 years in the service, he had never risen above E5 sergeant, and was so hated that a few months later one of our bunkmates fixed bayonet and tried to run the sergeant through as he lay in his bed. Two men caught the Marine and grabbed him within three feet of stabbing the sergeant.

"Well, what did you say to them?", I asked. Goldberg exploded at me in frustration. "Are you kidding? They caught me! They had their headlights on me!" I persisted. "Look Goldberg, did you actually admit you were asleep?" After some more arguing about the absurdity of all this, Goldberg finally admitted that no, he had said nothing.

Goldberg was too frightened to think, so I concocted a story for him and coached him on how important it was to keep a straight face and tell the story as if he believed it with all his heart. It was either that or six months in the brig. By the time breakfast was over, Goldberg had developed a religious fervor for the story.

It was then time to appear before the captain, who was a great guy and who had also served in Vietnam. The staff was assembled, and the sergeant made his report, describing in detail all he had seen. The company driver confirmed it all. Then it was Goldberg's turn to stand before the captain's desk. Goldberg said that he had not been feeling well the previous day, and after he was on post he began to feel so sick that he tried to call in to be relieved. His radio didn't work, so he began walking to the central building (to have the Marine at the gate call in for him on the telephone—the standard procedure in the event of a radio failure), and the next thing he knew the headlights were in his face. He had no idea how he had gotten there.

The sergeant came completely unglued and began to sputter all over himself in protest. The captain silenced him, and said that a doctor would have to look at Goldberg before they could proceed. Two minutes later, Goldberg was back in the barracks all excited and telling me about the session in the captain's office when someone said that there was a telephone call for Goldberg. It was the captain calling from his office only 50 feet away, but he didn't identify himself. "Goldberg, that's the best story I've ever heard! You stick with it." Then he hung up.

Before he could see a Navy doctor at mainside, Goldberg had to see the chief petty officer who dispensed pills and tended to minor complaints. The old chief filled out a medical form drenched with disbelief and sent Goldberg on his way.

I told Goldberg he should stick to the story no matter what, and when he got to the hospital, he was shown into the Navy doctor's office. All of the doctors were basically civilians doing their residency in the military, and they had great sympathy for the Marines, who they thought were treated badly. After he was shown in, Goldberg sat as the doctor read the chief's report—that Goldberg had been caught sleeping on post, claims this, claims that. The doctor, who had not said a word, got out of his chair and quietly closed the door.

"What happened?", he asked.

Goldberg completely broke down. "Doc, they've got me by the balls!"

"It's okay", said the doctor. "What did you tell them?"

Goldberg then told him the whole yarn about feeling bad and waking to find headlights in his face. "That's a good story", said the doctor, and he then sat down and filled out a medical report that this syndrome of dizziness and fainting spells had been noticed several times in the past year in Morocco, that it did not require any medication, and so on. He filled an entire page with medical baloney, signed it and sent Goldberg on his way with a smile.

Two weeks later, Goldberg was promoted to sergeant, same rank as the man who caught him. Except for the sergeant, nobody wanted to burn Goldberg, and everyone on the base knew I had made up the story for Goldberg. From that time on, I noticed that the officers treated me with a very slight sense of humor and appreciation.

*—Alfred Scott*

## Construction Notes

In the last FBL, we discussed the problem a few builders where having with the O-ring in the main gear shock absorber strut, and the possibility of using an MS28775-215 O-ring. Since then, Allan Hall, has tried this O-ring and reports that the leaking problems have disappeared.

From an article in Light Plane Maintenance, Steve Wilkinson learned that a GE H7604 halogen bulb is a direct interchange for the conventional GE landing light bulb we use, and that owners of many other light planes have switched without "no diminution in lighting effectiveness" and claim fewer problems with broken filaments.

Landing light bulbs are rather notorious for failing just when you need them. Some people swear that putting the bulb in with the filament vertical will solve the problem, but Steve says that the landing light in his Falco has never worked when he needed it.

Steve reports, "The halogen landing light bulb is available in any good automotive-parts store, since they're commonly used by people who affect those big light-bars atop their pseudo-offroad pickup trucks. They're made by a number of manufacturers and all bear the same GE part number, H7604. Retail price is $34, typical parts-store discount price is $20. The terminals on the back of the bulb are identical to the ones on the back of the standard incandescent bulb. The halogen bulb does have a conventional-looking filament, inside a bulb-within-a-bulb, but apparently it's beefier than the one in the incandescent bulb. The bulb is rated at 10,000 candlepower and has an operating life of 100 hours—lit, I assume."

Steve Tweedt reports that in setting up his Falco shop, he bought a number of drill presses. He went through several brands, all made in Taiwan, and returned every one because of the wobble and free play in the arbor. One of them would wobble as much as .020". Steve finally bought a drill press made in Canada by General, and he is delighted with it.

After the flap flutter incident reported in our last FBL, Matt Clark got his Falco back in the air with all of the modifications done in October. After flying G-MRCI for 1.5 hours, he had another incident of flap flutter. Matt was flying the airplane at 2,000' in perfectly smooth air and indicating 150 mph when the right flap fluttered and disintegrated. Matt said the airplane experienced moderate to severe vibration for about two seconds.

The flap hinge at the outboard end was sheared off, and the flap broke in two, roughly mid-span for the flap. The inboard end of the flap stayed with the airplane, trailing at 45° down and aft. He landed the airplane without further incident.

Matt Clark reports that all modifications had been installed and that the system was very rigid, and the flaps were no longer reflexed. However, he said that in the process of balancing the right flap, they had to add a substantial amount of weight to the leading edge with the result that the right flap was roughly twice as heavy as the newly built left flap.

After the incident, the remaining part of the flap was shipped to Francis Donaldson, chief engineer with the Popular Flying Association, which is similar to the EAA but which also licenses homebuilt aircraft. Donaldson reported:

1. There is roughly 1mm thick filler all over the outside surface beneath the paint at the point which is now exposed in cross-section.

2. The flap leading edge was covered with two layers of 1mm plywood instead of the single layer of 2mm plywood shown in the drawings. At the point where the flap broke, the inner layer of plywood was feathered off as if meant to be spliced at this point, but the glue on the feathered area had obviously never been in contact with the matching part. Also, the two plywood skins were not glued tightly together; there was a void between them. The net result, he thinks, is that there must have been a weakness in the plywood skin which encouraged failure at this point.

3. At the break, the 15x15 leading edge spruce strip had been drilled through and a slug of lead glued into the hole. The effect of this was that the leading edge member was effectively cut through at this point—another weak point that would encourage a failure at that point.

4. There were no drain holes in the flap, and the vent holes drilled in the ribs were blocked with varnish. He pointed out that this raises the possibility that the skins may have opened up in flight or that there might have been water in the flap, however there was no sign of either problem.

In mulling this over, Donaldson and I have reached similar conclusions. The two flutter incidents are probably the same mode of failure. They come within two flying hours of each other, and the logical remedies of stiffening up the system, eliminating the free play and balancing the flaps obviously did not help this aircraft. We can see that this latest flutter incident occurred at a substantially lower speed (150 vs 208 mph indicated), and we also know that because of the balancing this flap was substantially heavier than it was before.

The distance between the flap hinge supports is substantially greater than for any other control on the Falco. As anyone familar with musical instruments knows, increasing the length of a guitar string lowers the note, and the heavier the string the lower the note. The same is true of any control surface on an airplane, and it's apparent this flap failed in bending. We know that the flap which fluttered in April was exceptionally heavy due to the amount of filler used on the airplane, and the addition of the balancing weights to the right flap made it even heavier still.

Donaldson and I both think that a heavy overall weight of the flap, regardless of any balancing, can bring it into an area where it at risk of flutter, and that the addition of balancing weight to the leading edge may be counter-productive in that it could lower the resonant frequency of the flap. Francis Donaldson says, "I had come to a similar conclusion that the relatively long span between the hinges on the flap might be causing a problem with the flaps failing in a flutter mode essentially in bending, and that by adding significant weight to the flap in the middle this may lower the bending-mode frequency and lower the flutter speed."

Francis Donaldson and I had quite different views on the role of the filler material used on the control surfaces. Donaldson said, "I find it hard to believe that a layer of filler this thick could add as much weight to the flap as this one seems to have done." I found it easy to believe.

The Falco has been turned over to Andrew Brinkley, England's premier Falco specialist, for repairs. On receipt of the control surfaces, Andrew found all of them out of balance to an astonishing degree. At station 11, the ailerons weighed 40.5 oz. (right) and 35 oz. (left) vs a balancing spec of 18.5±2 oz. The rudder weighed 45 oz. at station 2 (without nav/strobe light which adds 5 oz.), vs a balancing spec of 24±3 oz. The elevator weighed 74.5 oz. vs a balancing spec of 39±6 oz. The right aileron and rudder contained electric trim motors (Mac trim systems).

I asked Charles Gutzman, who built the Falco, about this. Charles said he balanced the control surfaces before painting, but not after painting. "I couldn't imagine that paint would make that much difference, but apparently it did."

(As it happened, George Barrett called the other day and reported some numbers on his Falco. This ailerons balanced to 16/16.5 oz. before fiberglass/painting and ended up at 20.5 oz. each. Similar weights for the rudder were 24 oz. before and 35 oz. after.)

The fundamental lesson that we can take from these two flap flutter incidents is this: if you make the flaps heavy, they can flutter in a bending mode, even if balanced. It would be wonderful if we could know with some precision what the 'break point' weight is, but we don't and probably will never know this. We know that flaps built with a normal amount of paint have a 38-year history of trouble-free operation.

Second, if you must add weight to balance the flap, it would be best to add the weight near the ends of the flap where it will not lower the bending-mode frequency. Flutter specialists generally want a balancing weight evenly distributed along the leading edge, but this clearly is a different situation.

Third, drilling a series of holes in the leading edge strip is probably the wrong way to add weight because it creates a weak point in the structure.

Finally, be aware that the rigidity of the flap in bending comes not only from the spar but also from the plywood skin. A poor scarf joint will create a weak point in the flap, make it much less rigid and more susceptible to an incident of flutter.

Thus, it appears that we have discovered a new way to screw up in a Falco, and we all now have another reason to build a light aircraft. Dave Thurston and Stelio Frati each have over 50 years of experience in aircraft design, and both engineers say they have never heard of a case of flap flutter before. Yet in this airplane, we have seen two flap flutter incidents within two flying hours. It is very clear that these conditions can be duplicated in any Falco with identical results.

I've noticed that there is a considerable difference in weight from one builder to another on the control surfaces. With the all-plywood skinning method, some builders curse us because we should have told them that they were going to need to add three pounds to the leading edge, while others say that they didn't have to add any weight. I think very few Falco builders are aware of how much weight they can add to the control surfaces by generous applications of varnishes to the inside or fillers and paints to the outside. Primer/surfacers like Awlgrip are mixtures of industrial talc and epoxy, and they are very heavy.

George Barrett found that his ailerons and flaps added only about 4 oz. to the trailing edge balance point when he added the fiberglass cloth, epoxy and paint, however on the rudder the trailing-edge weight went from 24 oz to 35 oz. George says he cannot account for the large increase in weight to the rudder. The weight penalty for trailing edge weight can be surprisingly large. In this case, George had to add 40 oz. in balancing weights to offset the 10-11 oz. overweight.

To do this, George made three lead balance weights. Two of these were flat weights that are glued and screwed to the leading edge rudder ribs at the upper hinge opening. These weights were shaped like the leading edge ribs—indeed, he just used the finished rudder to form the casting sand—but the weights are tapered so that they are thicker in the front. These weights, which weighed 8 oz. each, were installed with screws and 3M epoxy left over from the cowling kit.

George also made an internal weight for the lower leading edge section of the rudder. He cut a hole in the rib so he could reach in to the area above the diagonal rib, then made a wooden mold of the inside of the rudder. The casting sand would not retain the shape required to make a groove for the leading edge strip, so George put a 9x9 stick in the mold before pouring the lead. This lower weight was 24 oz. and George installed it with 3M epoxy and four AN525-10 washerhead screws and nuts.

Jim Slaton reports that at 700 hours on his Falco, he had a problem with the nose gear rocker arm on the top of the nose gear strut. The hole for the bolt became ovalized, and he cured the problem by using a 5/16" bolt. John Harns had the same problem at the same number of hours on his Falco, and he used the same fix. They both think the wall thickness of the tubing for the rocker arm is too thin.

At Oshkosh, Bjoern Eriksen—who everyone knows is meticulous—pointed a stern finger at the nose gear retraction system and told me that the use of steel bolts in the aluminum drag struts was a bad idea, that it would wear with time and would cause problems. I asked Jim Slaton, who now has about 900 hours on his Falco, to take a look at this. Jim reported that there was quite a bit of slop in the nose gear linkages, but that the holes were not egg-shaped. He had a local machinist install thin-walled steel or bronze bushings. While this doesn't worry me greatly, this is something we should all watch.—*Alfred Scott*

## Golden Silence

*by Stephan Wilkinson*

There are two things you can do to your airplane—one cheap, the other expensive—that will do more to make it smooth and quiet than all the soundproofing material it might be able to lift. The first is balancing the prop (the cheap one), and the second is buying a Bose active-noise-reduction headset (at $1,000 apiece, expensive).

Having a propeller tuned using a Chadwick-Helmuth electronic balancer costs about $150, and the difference it made on my Falco was perceptible on the first post-balancing flight. The engine ran with nearly the same smoothness of a BMW six, even though it's a 180-hp Lycoming with four ashtray-size pistons each displacing 1,500cc—the equivalent of four Honda Civic engines in very close formation. And this was an airplane that already was in a good state of balance, according to the technician who did the job.

The balancing process is simple. It requires uncowling at least the top half of the engine, and bolting a small transducer to the crankcase centerline at the front. When the engine is run at 2,000 rpm, that transducer senses the vigor, in Gs, with which the entire engine is moving longitudinally off its centerline. A strobe-light gun fired at the prop disk determines the location of the out-of-balance node.

A powerplant in perfect balance will give a reading of zero (equivalent to one G). a reading of .2 is considered "acceptable." The Falco came in at .3 before balancing, and many typical lightplanes are enough out of balance that readings as high as .8 aren't unusual. A powerplant that reads 1.2 or higher is so out of balance that simply adding counterweights to the prop spinner or the starter ring-gear flywheel won't solve the problem. Either the prop must be removed and balanced independently or there's an internal engine problem.

My mechanic was able to get the Falco down to a reading of .05—nearly perfect—with a single lucky guess as to exactly where 26 grams of balance weight should be bolted to the flywheel. "This is the easiest job I've ever done," he laughed. "You can sometimes spend three hours trying to find the sweet spot."

I flew the airplane immediately, and even the minute buzz that had always been perceptible through the stick had disappeared. Prop balancers say the biggest benefits of the process are the elimination of cowling cracks, wire breakages, landing light filament failures, accessory-mounting cracks, exhaust manifold splits, leaky oil coolers and the like, and I believe them. Ancillary benefits are stroboscopic verification of engine speed, so you can check your tachometer accuracy, and early detection of certain internal engine faults. At $150 for all this, prop balancing may be general aviation's last true bargain.

It's hard to call Bose headsets a bargain, since it'll take about $4,000 to fully equip a four-seater. Other companies are marketing active-noise-reduction headsets for discounted prices of as little as $340 to $850 apiece. (Bose sells only factory-direct, no discounts.) Since Bose is basically a stereo electronics-and-speakers manufacturer, the suspicion lingers that there is less than the usual relationship between price and quality, for the hi-fi industry is one in which product "improvements" sometimes are hyped by extreme prices rather than by perceptible improvements.

But I have one friend who bought a cheaper ANR unit and finds the improvement in sound quality dubious enough that he no longer bothers with the fuss of plugging the power unit into the cigarette lighter; he simply uses them as conventional noise-attenuating earphones. And another friend, who flies a Mooney, owns an avionics shop and sells Bose's competitors, admitted when he saw my new Bose headset, "Yeah, they're the ones to buy, if you can afford them. They're the best." Strong—if informal—recommendations.

If you'd like to be the first on the block to have one, you might try contacting the factory at Bose Corporation, The Mountain, Framingham, Massachusetts 01701. The fax number of 508 872-8928 or you can call 800-637-8781, an infuriating toll-free voicemail recorded exchange.

Unless you fly a Mooney, do not order the coiled-cord model; it's too short and tightly coiled to work at conventional headset-to-panel distances. Your other choice is a free-standing or built-in electronic-interface unit. The former plugs into a cigarette lighter and can be carried from airplane to airplane. The latter can be mounted on or under the instrument panel, or on a cockpit sidewall, and hardwired to the airplane's audio system. It's much neater, but limits your Bose headset to use only in that airplane.

I'd initially tried a Bose headset in a Cessna 205, and the improvement in quietude was incredible. There's no mistaking the difference, either, for the ANR portion of the Bose is powered by the interface unit and can be switched on and off. With the power off, the Bose is an excellent conventional noise-attenuating headset. Turn the power on, however, and low-frequency noise is immediately canceled out, swallowed up, sucked away, magically eliminated.

Interestingly, in the Falco the effect is not quite so extreme, even though the Falco's cockpit is a louder environment than is any Cessna's. Most of the engine, exhaust and propeller noise—all low-frequency—are eliminated by the Bose, but what's left is the higher-frequency noise of fast-moving airflow over the big canopy, something that apparently is not much of a factor in a plodding old Cessna 205. The result is a moderate sibilance, a hiss, very much like the sound you'd experience in a Learjet cockpit. I'm not complaining; it makes my little Italian stallion feel even faster.

## Brenda's Corner

Over the years we have been extremely lenient in our response to builders who call and say they are missing a part from a shipment. We normally will ship the missing part out with few questions asked.

In the past six months, there have been some instances when a builder will call and say he is missing a part or parts from a kit he received three or four years ago. The standard story is the kit really wasn't checked that well when it arrived, they may have misplaced the part, but they really don't think they got it. And will we be kind enough to send another one and maybe not bill them or give them a break on the price? Come on, we're nice but we're not that nice.

Please inventory your kits as soon as possible after they arrive. If something is not there, let us know and we will do our best to correct the situation. After a reasonable amount of time, we will consider the order correct and if a part is found missing after that we will invoice you for the part.

Doris Kennedy says she is not in the monogramming business, but she now has a machine and is willing to monogram Falcos on jackets and shirts. We have a price list. Let us know if you would like a copy. Alfred was the recipient of one of Doris's jackets. It's good looking and a vast improvement over the windbreakers we have. She can even monogram the Great Bird of Falco on the back..—*Brenda Avery*

***Nose well door art seen at the Great Oyster Fly-In, where lousy weather kept many away. For the first time ever, Falcos (three) outnumbered all other types (two), but we had a great all-day party.***

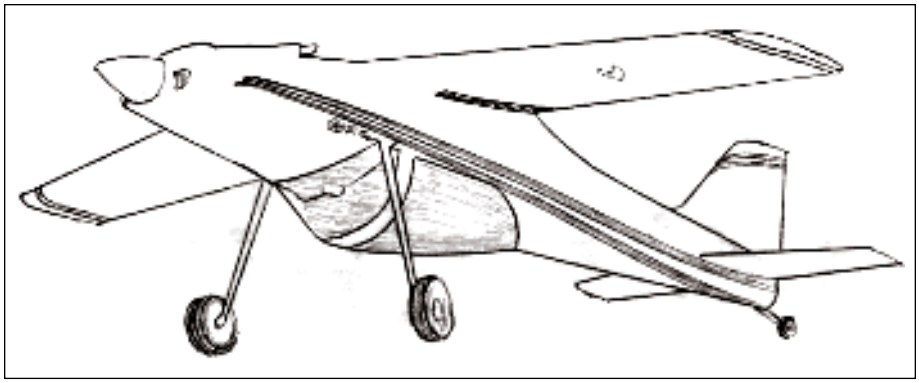
## Sawdust

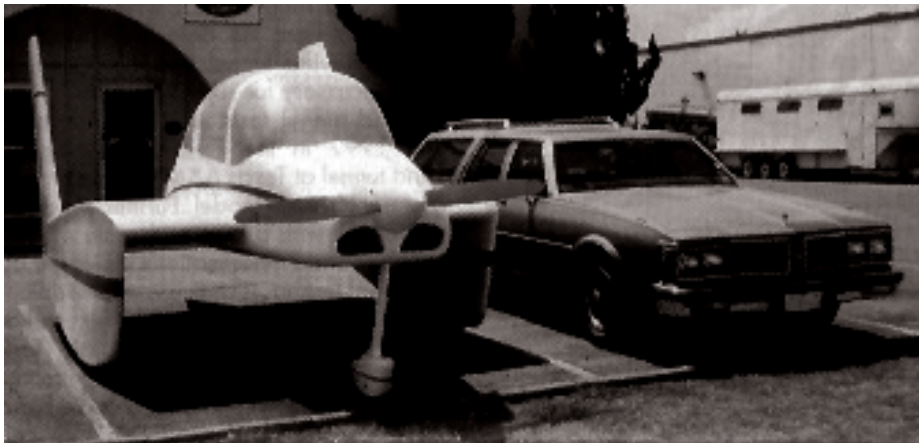
• A piddling matter. Pity Lt. Col. Don Snelgrove who lost control of his F-16 jet fighter over the no-fly zone in northern Iraq in September. On a four-hour mission, Snelgrove tried to use the regulation plastic container and dehydrated sponge, popularly knows as a 'piddle pack'. After he took off his lap belt, it caught between the seat and the sidestick, sending the plane into a spin. The pilot struggled to regain control of the plane and finally bailed out of the $12-million fighter at 2,000 feet. Rules for the use of 'comfort stations' in the fighters have now been amended: lapstraps are loosened, not unfastened.

• Now shipping. We got a breathless call for a Falco builder in California the other day, "This swing-wing Falco. Is that for real?" Yes indeedy, and watch for a reprint of the article in the April issue of *Kitplanes*.

• Cheap trainers. Stelio Wilkinson reports: As you may know, the USAF has chosen the British Slingsby two-seater as its new flight-screening aircraft, the mission that used to be fulfilled by modified Cessna Skyhawks ("Mescaleros," they called them). The mission basically is to let potential pilot candidates fly around so you can find out early if they're prone to barf or are terrified of stalls, etc. The Slingsbys will be assembled by Northrop and called the Slingsby/Northrop T-3As, thereby making them "American airplanes." The thing looks like an incredibly awkward Falco with fixed gear and a 260-hp Lycoming. What is most interesting, however, is that the government has ordered 113 (potential maximum order) of these turkeys, which will be entering line service next month, at a price that works out to $486,725 apiece. Granted, that probably includes some spares and support, but what we're talking about here is a two-place, fixed-gear, utterly conventional airplane with an off-the-shelf 260-hp Lycoming engine. Sheesh.

• Winged that thang. The ultralight pilot was cruising along the mountain ridges in West Virginia when he decided to explore a valley that went way up into the hills. As he neared the end of the valley, a mountain man and his wife saw the craft skimming over the hills. "Great God, Bess! Look at that thing a-coming." The man grabbed his shotgun and went running down the mountain after it. His wife heard two shots, and then the man ran back up to the cabin, all excited. "What was it? Did you get it?", she asked. "Well, I don't know what it is, and I didn't get it, but I did make it drop that man it was carrying."





***Top: The taildragger F.8TD Falco achieves 97.8% parts compatibility with the Sequoia Falco F.8L and will begin production in Azerbaidzhan in July. Above: According to Aviation Week, the Sky Car will be powered by either a 475-hp automobile racing engine or two turboprop engines.***

• According to an FAA review of accidents, while other classes of general aviation aircraft have experienced dramatic improvements in the number of accidents and accident rates, the number of homebuilt accidents rose 25% in 1992, and a much higher share of homebuilt accidents are fatal—32.6% vs 18.8% for the rest of general aviation. The review concludes that although the majority of homebuilt aircraft pilots have good safety records, lower time pilots and pilots with little or no experience in homebuilt aircraft had significantly more accidents. Also, 14% of homebuilt accidents occurred on the pilot's first flight in the aircraft and 5% on the second flight. In all, 24% of the accidents occurred during the takeoff or landing phases due to inadvertent stalls, rolls or veering off the runway. Inflight breakups and structural failures accounted for 6% of the accidents. In short, 40 to 50% of the accidents in homebuilt aircraft seem to indicate a lack of familiarity with the flight characteristics of the aircraft, and this is a much higher rate than for other classes of general aviation aircraft.

The review identified apparent airworthiness problems in 16% of the accidents. Most of these were related to the builder/pilot making modifications to the aircraft. Seven percent of homebuilt accidents were simply from running out of fuel, while another 5% involved contaminated fuel or blocked fuel lines due to poor maintenance or inappropriate parts. Sixteen percent of homebuilt accidents are directly related to obvious airworthiness issues. The report concludes that everyone involved in aviation should attempt to reach people new to homebuilt aircraft with a somewhat aggressive but not very complex message: learn the characteristics of your aircraft, and recognize that meeting design specifications is critical.

• Where are the military Frati's? Steve Wilkinson compiled the following list of countries that operate Iron Falcos (SF.260s). In ascending order of number owned, they are: Brunei (2), Uganda (2), Bolivia (3), Chad (3), Dubai (5), Haiti (5), Nicaragua (5), Burundi (7), Ireland (7), Zambia (8), Zaire (9), Burkina Faso (11), Ecuador (12), Ethiopia (12), Thailand (12), Sri Lanka (17), Singapore (26), Zimbabwe (30), Philippines (35+), Belgium (36), Italy (38), Turkey (40), and finally Libya (190). Thus the world's leading Frati enthusiast is Mumaar Quadaffi, who owns more SF.260s than Frank Strickler has ever seen. Because he's so wild about these machines, we've decided to send a personal invitation to Col. Quadaffi for the next Oyster Fly-In and ask him to bring his favorite Frati.

## Mailbox

Your story on 'aileron snatch' interested me. Every three years I have to test fly G-FALC as part of its certificate of airworthiness renewal. Stalls and spins are included. So far, I have not noticed the aileron snatch you reported but there is definitely a tendency for the machine to drop a wing into knife-edge when stalled from a 'clean' configuration. Immediate incipient spin recovery must then be initiated to stop a spin developing, and it all happens very quickly.

This behavior occurs only when the slip ball is not perfectly centered. The ailerons must be absolutely neutral and progressive rudder pressure fed in to keep the ball in the middle as speed decays down to the stall. It is well worth being prepared for this when stalling a Falco for the first time.

Remember, G-FALC is a 34-year-old production model and might have developed some vices as it grew older.

*Peter Hunter*
*London, England*

Tony Bingelis toured the deVaux Aeroplane Factory in August, Howard and Marty Benham in October. None of them did any work on N644F during their stay. The enclosed photographs depict the emergence of my Falco from its bomb-protected revetment.

The engine should have departed Orlando, Florida, today from Don George. As you may recall this was the source Karl Hansen used, and he is happy with what he got. Cost for rebuild and the core (he supplied), $14,000 plus shipping for the IO-320-B1A. I figure I am 75% complete with 50% to go.

*John Brooks Devoe*
*Stratham, New Hampshire*

The avionics technician who installed my Bose system pinpointed my long-standing severe static-system leak, which turned out to be in the altimeter—the latest chapter in my epic of having bought lousy instruments. He said the instrument was at least 30 years old and obviously junk. He ordered me a new-manufacture unit and said to throw the old one out, that it wasn't even worth anything as a core to exchange.

One problem I've had for some time is a badly lagging manifold-pressure gauge. It's accurate enough, but sometimes it takes 10 or 20 seconds to respond to gross throttle movement, especially at high power settings.


***Top: John and Gwen Devoe with Howard and Marty Benham. Above: John Devoe's take-it-out-and-turn-it-over party. USAF stands for United Sequoia Aircraft Factory, Stratham Branch.***

The problem is that the slight amount of oil that collects inside the manifold-pressure line over time. Every time I remove the panel, I blow out the line, by mouth, and can tell that there's a small amount of some kind of moisture that has collected in there. My mechanic tells me this is not an uncommon problem, and that the solution is to drill a #50 hole in the bottom of the manifold-pressure line at some low point—not necessarily the lowest—somewhere near the cylinder head. This allows the oil to drain out and doesn't affect the manifold-pressure reading.

I'm going to do so, but the problem—if anybody else has this situation—is that it requires splicing a short length of copper tubing into the Aeroquip line that we use between the engine and the firewall, since you can't drill such a hole into the rubber of the Aeroquip itself.

*Stephan Wilkinson*
*Cornwall-on-Hudson, NY*

Why not just drill the hole in the bent-tube end of the Aeroquip line?—Scoti

I put the strobe cables, navigation light wires, pitot heat wires and 1/4" poly tubing for the pitot in the starboard wing before I received the electrical kit. When this arrived, I drew the correct wires up the PVC outer.

The other day, while connecting up the pitot pressure line, I noticed that the pitot poly tubing was partially cut through at

both ends of the outer. I must assume this was caused by a friction burn while I was drawing the electrical wires.

I am left in the joyous position of having to try drawing a new piece of pitot tube up a rather tight outer tube, something I am not looking forward to. If this is not successful, I will have to take all the wiring out and try again from scratch. Alternatively try a smaller bore pitot tube, be it 6mm OD or less.

The modification of the flap motor support bracket and torque tube support bracket calls for AN525 washer head screws. I have found that the tightening, horsing up, these screws, particularly in awkward situations, is difficult, not being able to put enough pressure on the screw to hold it against the nut while it is tightened. I have used AN3-5A and -6A bolts where I could hold the bolt head much more easily. I had to cut the threaded length of the AN3-5A's for the torque tube bracket to get them in, bolt head to the inside. With the nut inside, I would have had the bolt on one side interfering with the bolt on the other.

*Charles Wagner*
*Glasgow, Scotland*

On the lightweight starter, for those unable to wait for a fittable Sky-Tec, Sport Aviation of March 1991 has detailed building instructions for what appears to be a suitable starter replacement using Toyota/Nippon Denso parts.

Incidently, I mentioned a while ago that the Shadin clearance problems can be cured with an AMP DB9S 1DC right-angle plug.

*Stephen Friend*
*Breadalbane, Australia*

Falco 906 flew for the first time today, October 7, 1993. Test pilot Ralph Vincent was very satisfied with the high speed tests for aileron response and taxiing. So he checked the aeroplane once again before taking it for its maiden flight. Everything went well. Ralph was delighted with the handling.

This afternoon Ralph took me for my first ever ride in a Falco. It is everything I expected from hearing other builder's experiences. After waiting seven years for this day, I was not disappointed. A wonderful day. Thank you for all your help and for making such a marvellous aeroplane available for people like me.

*Stuart Gane*
*Northleach, England*

***Top: Santa arrives by Falco at the Dovydenas household.***
***Above: Steve Wilkinson and Susan Crandell on a bike trip to Nova Scotia.***

Regarding the question from Martin Steinwender of Germany about Ciba Geigy Araldite. This epoxy is excellent and is commonly used in South Africa. Of course, the specific system is important—AW106 and 953U are the two relevant components in a 50/50 ratio by volume. Neither I nor Fanie Hendriks have ever had a glue failure, even on oak/walnut test blocks of shear and peel types.

Before starting the Falco, I had structurally completed a KR2 which was subsequently completed and flown about four years. Two years ago, the owner suffered carburetor ice, which resulted in a forced landing, wing tip strike, cartwheel, and totalled airframe. The wreck was rigorously examined and not one glue failure existed.

Use heaters if necessary to keep the curing temperature above 20°C. Glue lines must, of course, be thin, say 0.3mm max.

Your article on the SX-300 trophy hunter was hilarious.

*Brian Nelson*
*Randburg, South Africa*

For the last three years, I've made very slow progress as I have built a new house around the Falco. The house is finished now. The fuselage woodwork is 80% finished, only skinning remains for the wing.

*Bartholomeus W. Van Steyn*
*Lelystad, Netherlands*