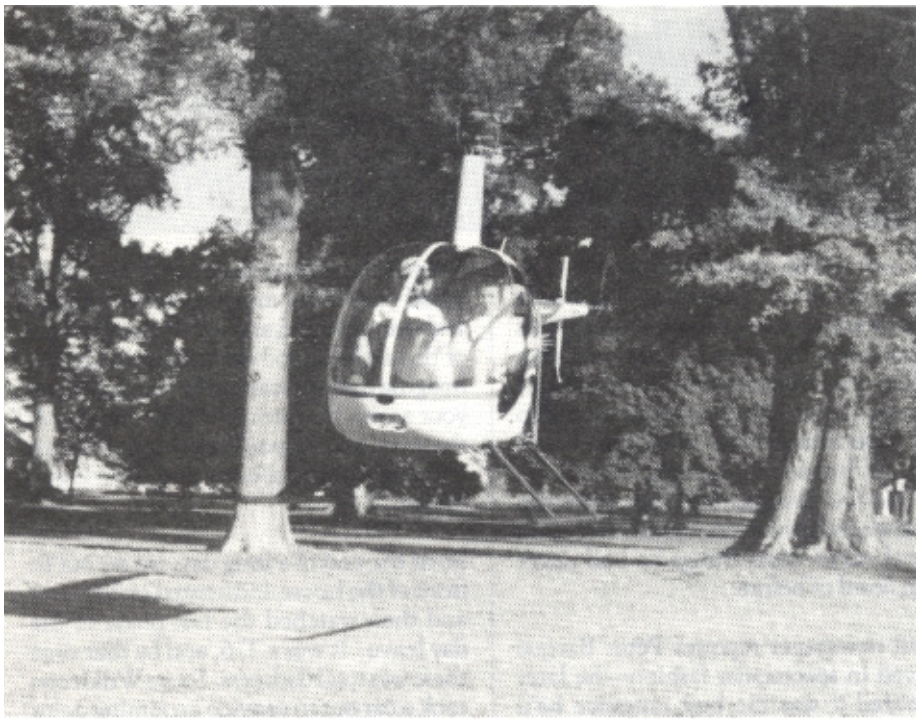
# Falco Builders Letter



***Only at the Great Oyster Fly-In can you get helicopter rides from your front yard.***

## Around the Falco Patch

You *really* missed it. This year's Great Oyster thing was possibly the best ever. After a couple of down years with bad weather, the first few days of November were a couple of left-over September days that got lost and finally showed up late—it was in the mid-seventies on the big Saturday.

This brought a huge crowd to the tiny town of Urbanna. Only 500 people live in the little village on the Rappahannock river and every year for the past 30-something, they've hosted the famous Oyster Festival which is like something you've never seen. Every fire engine in the eastern part of Virginia shows up for the parade in which they creep through the town with sirens screaming. Following close behind are an hour's parade worth of good-natured and often drunken Keedive shriners and sprinkled in between are the ugliest small-town beauty queens you're likely to see this side of the Urals.

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## Goings On at Sequoia Aircraft

Wood kits continue to dominate things. I've now finished all of the 'other' wing spar jigs and have turned them over to our man Darryl who does the assembly work in the evenings. He is finding that there's not much to it and the main problem is that it's so boring. It takes about 10 minutes to glue together an aileron/flap spar or aft wing spar. The forward wing spar is a bit more challenging because of the order in which things are glued together, but it still takes about the same length of time.

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### *In This Issue:*



## CAD Malarky

The surest way to spot a phony in the aircraft business these days is if the promoter is spouting a lot of CAD/CAM stuff at you. The hucksterism is so obvious that it's surprising that people, particularly the media, are taken in by this nonsense.

In a recent article, the erstwhile kit promoter, Ken Wheeler, described the design of the Wheeler Express. "I just laid out the curves on my CAD system and then sat back and let the CAD system finish the design." What arrogant nonsense. That's roughly equivalent to saying that you wrote the opening paragraph and then let your word processor finish a novel. And what enormous stupidity of the magazine that printed such trash.

The Prescott Pusher was a classic piece of CAD/CAM flimflammery. All the emphasis was on the McDonnell-Douglas CAD/CAM system, the ability to rotate the airplane on the screen, the ability to precisely determine the angles of the cuts of the steel tubing, the ability to take sections through the fuselage at any angle.... They were embracing technology, and everybody got warm fuzzies just thinking about it. And somewhere in all of that, people lost sight that Tom Prescott sat at the keyboard of his computer and designed one of the really terrible airplanes of modern times.

He used square tubing when he should have used round, and then had the audacity to claim that square tubing was superior. The whole thing was assembled with pop rivets, something no competent engineer would do. The airplane was so short-coupled that part of the vertical tail actually overlapped the wing. And the landing gear was so far aft that one writer told me he got it stuck on the ground on takeoff roll and couldn't even pull the nose up.

So let's clear up some of the nonsense about CAD. I can give you a relatively good perspective on the subject. I'm a self-taught draftsman, and I've done all of

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## Around the Falco Patch

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In an ordinary year, somewhere between 30 to 50 thousand people show up for this thing, but this year there were about 80,000. And across the "creek"—actually it's a sizeable harbor—our small band of airplane nuts had a wonderful time doing exactly what we wanted to and without any preconceived notions of what a 'fly-in' is supposed to be.

Al Eynon brought his SF.260 in from Ohio and pitched a tent in the yard. Steve Wilkinson and friend came in a 182 and were later joined by Mark Reichen who in an act of extraordinary generosity arrived in a Mooney filled with enough lobsters so that we were forced to eat two suppers.

Butch Harbold arrived in his 260 hp Chipmunk and spent much of the weekend tearing up the skies with his acrobatic routines. Terry and Mae Smith arrived by Falco, as did Jim DeAngelo—so in all we had three Falcos there and one SF.260. A couple of warbird types brought in an old Fairchild PT-something and a T-6. There were other Mooneys, Cessnas, Pipers, someone in an Avid Flyer.

Oshkosh it ain't, but *we've* got a bushel of oysters, and while others take their fly-in's seriously with organized events, formation flying and fastidious folderol, we dispense with all that foolishness and just park the planes, stroll over and have a few oysters, mill around and when the mood strikes go fire up one of the planes and go flying. Every day should be like that.

Happiest of all, though, was Brian Nelson. Brian is building a Falco in South Africa and was on his annual trip to the U.S. during the Great Oyster thing. He always stops by and picks up a few bits and pieces for his Falco, but he had never even seen a Falco until that weekend. So on Friday evening, I flew Brian down in my Falco and gave him a little intro into barrel rolls. If that wasn't enough, we fed him his first raw oysters, then took him into town where he had soft-shelled crabs and funnel cakes—two things he had never even *heard* of before.

Local newspaper reporter Peter Bacqué arrived in spectacular fashion—he later admitted it was the best entrance he'd ever made—by landing a Robinson R-22 helicopter in our front yard and scattered leaves all over our oysters. We established yet another world's first (National Aeronautics Association please note) by rushing him an oyster on the halfshell, which he downed before engine shutdown.

Then Peter took a number of us for rides out over the fields and above the town. There's something magical about lifting up off your lawn, moving across the road and over the field and up. It was like one of those childhood dreams in which you imagine that you can fly by just spreading your arms. You are only a few feet above the grass, and yet you float through the air and move about silently and effortlessly. Magic.

So at the end of a long day, we sat out in front of the house and feasted on lobsters, and then watched the last plane of the day leave. It was a T-6, and by that time there was total darkness. Steve Wilkinson took a car out to provide an aiming point for the takeoff and the old T-6 rumbled and groweled unseen in the night, and then finally bellowed somewhere along the runway and off over the river.

It turned and circled back for a low pass over the house and flitting through the trees you could see the blue flame of the exhaust. It was Tinkerbell, right there in our yard, flying through our trees, but her basso profundo voice was all wrong.

*—Alfred Scott*

***Al Eynon arrived in his SIAI-Marchetti SF.260.***

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

**Subscriptions**: $12.00 a year, $15.00 overseas. Available to Falco builders only.

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

## Goings On at Sequoia Aircraft

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For those of you who follow my jigging techniques with interest, about the only new-and-interesting thing is a variation I use with my cam-clamps. I now use a built-in caul block of UHMW between the cam-clamp and the wood. UHMW—'poor man's Teflon'—stands for ultra-high molecular weight polyethylene, and it's a relatively soft plastic that nothing sticks to.

The caul blocks distribute the load and allow you to clamp down hard without worrying about denting the wood. The main problem with these blocks is keeping them under control when the clamps are retracted. I came up with a little method of using springs to pull the blocks back. The blocks themselves are held down with screws and large washers, and the 'screw holes' in the blocks are 5/8"Ø to provide enough clearance around the screws for the movement of the blocks.

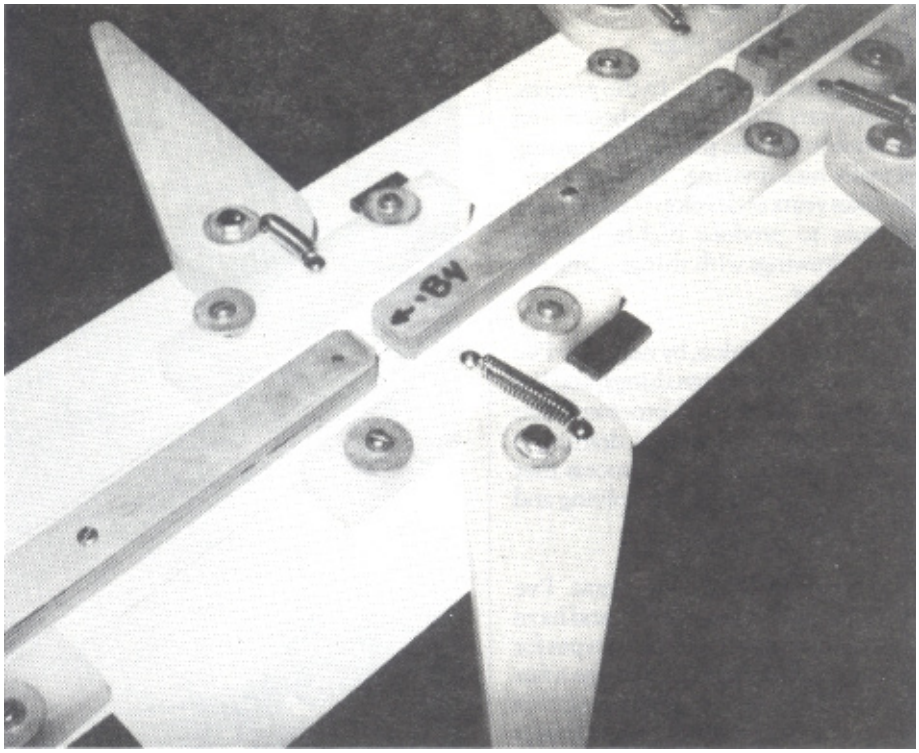
I also glue a little piece of plexiglas to the jig as a kick-straight. When the clamp is retracted, the caul block attempts to pivot with the clamp, which would be unacceptable if you want to be able to put things in the jig quickly. The plexiglas block stops the block from rotating and kicks it straight.

There's a fair amount of adjustment you have to do on tightening the screws and the bolt for the cam-clamp, but once you get everything working well, you turn the jig over and dribble some Loctite on the bolt to keep it from turning with the cam-clamp. The whole arrangement works so well, I've gone back and retrofited all of my jigs with this clamping method.

We have shipped the first batch of five wing spars, and we will begin assembling the next batch of main wing spars in January.

The first spar kit to be shipped by truck went to Howard and Marty Benham in Wichita. I designed a crate, and we put it all together, loaded it on the truck and crossed our fingers. A few nights later, I got a call at home from a very excited Howard Benham who had good news and bad news.

The bad news was that the trucking company had destroyed the crate, so badly in fact that the dispatcher told them that he didn't see any point in attempting to deliver the shipment—that the trucking company had destroyed the contents, and would they please come out to confirm that?



The crate was destroyed almost beyond recognition. Someone had run a fork-lift into it, and only a third of the crate had survived. A 3/8" bolt that clamped the spar to the crate wall was bent in a 45° angle.

But the good news is that the spar survived with hardly a scratch. Howard and Marty went over the spar with a 'fine-toothed comb' and could find only two tiny damaged areas. One was at the tip, where they were going to sand it to shape anyway, and the other was a small chipped area a couple of feet from the tip. They decided that the Benham Freight Line would provide transportation of the spar to their shop, and strapped it on top of their Bronco.

I am now well into the process of making the assembly jigs for the wing ribs. It's never a good idea to predict how long anything will take—twice as long as your wildest guess seems to be a good rule of thumb—but the work seems to be relatively straightforward. The only complication on the wing ribs is that many of the braces in the ribs are cut at four angles, but all that means is that you have to make more cutting jigs.

We now have a number of builders in Germany, and Cipriano Kritzinger has offered to translate the Falco construction manual. He has the same Macintosh computer that we use, so we're sending him the manual on disk.

You will note a change in our price list. Weldon Tool, the manufacturer of the fuel pump that we use, is no longer listed. Instead, we show the pump as something that we sell.

You can still buy the pump direct from Weldon, but they have bumped their one-to-three-piece price to an artificially high price of $570 at the request of some of their distributors. The distributors complained that customers would occasionally call Weldon and get a much lower price and felt that the distributors were cheating them. It's an age-old problem.

There are three big distributors who carry the pumps, and since they had toll-free order numbers, it looked like it would be best to just let Falco builders order direct from them. Unfortunately, the pumps that we've been buying for around $260 were quoted at $550-$675. We'd rather not get involved in the pumps, but the four-piece price is about $280, and if we carry them in inventory, we have to mark them up.

So we have decided to carry them. Our price of $325 means that we make about $40 on each one, but it also means you get a far better deal than you would at the hands of the distributors.—*Alfred Scott*

## CAD Malarky

*Continued from First Page*

the drawing for the Falco. In the process, I've spent years at the drawing board, and I take pride and some pleasure in turning out a really nice drawing. It's hard work, and it takes years to develop the skills and techniques to produce highly detailed isometric drawings with things going every-which-way.

In working on the Falco, by necessity I've had to learn how to design things, and I'm familiar with the mental processes that you go through. I know that drafting is only an incidental part of a process that consists primarily of problem-solving and decision-making.

I'm also familiar with CAD systems. I've started looking at them in 1984, and have used graphics software of various types for our construction manual. I've done a fair amount of 'beta' testing of new graphics software, and I use a CAD system that is extremely powerful yet which is light-years ahead of the competition in ease of use. I've been a beta tester on that software and am in frequent touch with the head of the software company and with the programmers. I've made a lot of suggestions that have gone into the program and have written a number of macros which add functions to the program.

I *like* CAD. It's one of the marvels of modern technology, but you need to understand what CAD is and what it is not. What it is good for and what it can't do. When to use it and when to use a pencil.

I think the biggest misconception is that because something is designed on CAD, it is somehow better. I have people come into my office and when they hear that I have a CAD system, they smile warmly, nod and approve. Then they point to the intricate engine/baffling/cowling layout drawings on my wall and feel reassured that I am embracing modern technology. That's when I explain that the drawings were done by hand.

CAD is just a drawing tool. What is important is the brainpower that goes into designing something, and it makes no difference if the designer used a pencil or a computer. And I've found that with CAD, you get lost in the details almost from the beginning. You lose a sense of the overall perspective of the design and a sense of proportion.

When I am designing, I like to sit with chin-in-hand and gaze for hours at the drawing, think, measure and scribble. That process of sitting with elbows on the drawing board and gazing over the drawing is where it all happens. Your eyes move over the design, and the mind wanders as you consider alternative methods of doing things. During this process, you find yourself in something of a trance. Routine daily activities and conversations become barely-noticed interruptions of a thinking process that will consume you completely. You struggle to appear attentive to conversations when your mind is really on the thing you're designing.

***The Corporate Disgrace screams by at the Great Oyster Fly-In.***

At some stage, the design starts to please you, and you pin it on the wall, and gaze at it while you work on other things. The rate at which sparks go off in your head slows down, and you begin to feel comfortable with the design. At some point you find that you can no longer find ways to improve the thing—it's as simple and elegant as you can make it—and you consider the design finished. Your mind rarely returns to the part. It's finished. It's done. It's right.

The best designers have coldly, and often cruely, analytical minds. Their job is to weigh the relative merits of two alternatives, and it's imperative that you never give the slightest favoritism to your own ideas. You must be willing to throw weeks of work in the trash when a better idea comes along. The worst designers cling to their own ideas and are more fascinated by the tools of their trade then by the things that they are designing.

I asked Dave Thurston about his experience. Dave has been doing some work for a company in Houston and while Dave cranks out finished drawings with his pencil, they have wasted $150,000 playing with a 'powerful' CAD system and have literally nothing to show for it. Dave Thurston is completely wedded to his pencil and has no desire to ever own such a system.

Stelio Frati got a CAD computer for his office a few years ago, and I was curious how he had adapted to it. Frati works in an unusual way, working out the overall dimensions on paper and then building the parts. Drawings are produced only after the parts are made and serve as a record of what they have done. Frati is a pencil-and-slide-rule man, and rarely even uses an electronic calculator. He scribbles on a piece of paper at his desk, and on occasion they use the computers at the local university for finite element analysis for the design of a complex part.

Frati's drawing are done by a number of draftsmen, led by Carlo Maccabruni, who has been with Frati since the SF.260. Maccabruni works for Frati on the weekends, and during the week works on a large CAD/CAM system at another company. When they first installed that system, Maccabruni was

very excited about it, but after a few years he told Mr. Frati that he prefers to design with his own system, the "Mac-Man"—as in Maccabruni-Mano (*mano* is Italian for hand). Like Thurston, Frati and Maccabruni are devotees of the pencil, the drafting pen, the ruler and the circle template.

One of the problems with CAD is that much of the industry is dominated by people who know a great deal about CAD but very little about drawing. The programmers, the managers of software companies, writers, industry pundits, CAD consultants, managers of CAD departments are almost entirely composed of people who can compare specs and features *ad infinitum*, but who couldn't draw our isometric Falco cowling installation drawing with a pen if their life depended on it. Most have little comprehension of what it means to sit at a drawing board and draw, and very few actually understand the mental processes of designing. Instead they sell systems based on arrogant claims that border on fraud. A friend told me, "I learn something every day that my CAD system won't do."

The head of the company whose CAD system I use—and who *has* spent years sitting at a drawing board—agrees that the industry is perhaps 15 to 20 years away from creating a system that is as natural an extension of a designer's thoughts as a pencil on paper. He concentrates his efforts on the things that the system *is* useful for, and makes none of the usual outrageous claims.

CAD is most successful when the user is allowed to make the purchasing decisions and the decisions of when to use it. I'm a passionate devotee of both CAD *and* the pencil, but the important thing to remember is that CAD is just another tool—phenomenally useful in some circumstances, and a frightful impediment in others.

The key word in CAD is *repetition*. It generally takes longer to draw things on a computer, but if you have to use it repetitively, CAD is a truly wonderful invention. It's a benefit to you, the Falco builder, mainly in that it makes it possible for me to generate a whole series of drawings that show how the wing is assembled. There's no way I could do that manually.

The other useful thing about CAD is that you can use it as a central database for the geometry and dimensions of the design. This makes it possible for the product to be brought to the market faster, sometimes more cheaply, and with accurately designed parts. The Malibu is an example where CAD was used effectively. So was the Stealth bomber, where there never was a prototype. They just made all the parts and knew from the beginning that they would all fit together.

It's also possible to do that without CAD, indeed most of the parts I designed for the Falco were never built as prototypes—and that includes the cowling and baffling. I knew from the beginning that they were dimensionally correct. It isn't particularly hard to do with something as relatively simple as the Falco; you just have to check everything very thoroughly.

The CAM part of CAD/CAM is simply a programming convenience for the machinist. By making parts on computer-controlled machines, as we have always done, you get an accurate, repeatable part. There's no magic in that, everybody does it that way, but I can't imagine why a customer would care if the machinist used a programming aid to make his life simpler.

I've also seen examples where well-intentioned people get lost in the details of the CAD system and lose an overall sense of a design. I think the SwiftFury is an example of that. Roy LoPresti told me he gave Stuart Millar a budget of $50,000 for computers and eventually spent $500,000. They leased for $20,000 some software from Lockheed that permitted them to move the wing and reduce the pressure drag of the airplane by 20% (pressure drag is actually a relatively small part of total drag) but then had to clamp 20 pounds of lead on the engine mount of the 180 hp SwiftFury to keep it in balance.

All of us who visited the LoPresti skunkworks were surprised by the number of people concentrated around the computers in the office and how few were out in the shop. For a tiny fraction of the man-hours that those Italians spent resurrecting an old American design, this American modernized an old Italian design. And at the same time that the LoPrestis modified the Swift, Frati's shop of equal size designed and built from scratch the Penguino and *also* produced a second retractable-gear version. With slide rules, pencils, and drawings with cat paw prints all over them.

Years ago, an aspiring writer sent a manuscript to Truman Capote who commented, "That's not writing, that's typing." And when I see someone working on their CAD machine, I mumble to myself, "That's not designing, that's drafting."

What really counts in a design is the brains, skill and experience of the designer, and a passion for simplicity and elegance in design. The tools mean very little. So the next time you hear someone spouting a lot of CAD/CAM talk, you can be sure he's just a promoter.

*—Alfred Scott*

***Quality control inspector at Benham Falco Company.***

## Construction Notes

Owners of production Falcos take note: The brakes on my Falco gave out some time ago and when we put it through the last annual inspection, I asked the mechanics to fix the problem. At first, I thought the problem was with a leak in the system, but it turned out that the rubber seals in the master cylinder had become completely destroyed, apparently by solvents.

The Series III Falcos used an automotive master cylinder for the brakes, and this aluminum forging is located under the cockpit floor. The seals were rectangular in cross-section, and we had no idea where to get any. Rather than fight with that problem, I decided to redesign the thing for standard O-rings.

This turned out to be a relatively simple matter. The aluminum cylinder has a 1.00"ID. I took the brass piston and redesigned it for standard 1/8" by 1.00"OD O-rings and designed the grooves to the depths specified in the standard O-ring design guides. Our machine shop had the thing made in an hour, and then I found that we needed to spend another hour adjusting things.

The original design is an astonishingly simple design with no valve in it. The piston has two O-rings, and when the piston is completely 'retracted', the position of the O-ring is such that it just barely passes the port from the brake reservoir, so fluid leaks in to replenish the system. Once you press on the pedal, a rod shoves the piston past the port and the system is sealed. I found that in my first attempt at reverse-engineering this part, the O-ring did not pass the port at all. This was easily solved by sanding on the end of the brass piston until the port opened.

The second problem was that the O-rings introduced more friction into the system than the return spring could accommodate. You could push the cylinder down all right, but the spring would not push it back. Back to the machine shop I went, and the machinist put the piston back on the lathe and took a few thousandths out of the bottom of the O-ring grooves until the piston would move freely enough for the spring to work.

Now I have a system that doesn't depend on weird, God-knows-where-you-get-them seals, and the really good news is that the brakes on the airplane are suddenly very powerful. I had always thought that the weak brakes on my old Falco were something to do with the brakes themselves, but I can now push on the pedal, and the airplane actually stops right-now. This is something of a luxury considering that I had been flying it for a full year with literally no brakes at all.


***Marcello Bellodi's Falco takes shape. When is he going to skin that thing?***

Steve Wilkinson reported an unusual problem with his landing gear motor. In running the gear up and down with the plane on jacks, the landing gear motor would bring the gear up almost all the way, and then the gear would stop moving while the motor continued to run. He asked if there is a clutch in the system, and I assured him there was no such thing. But then I remembered how the gearbox is assembled, and I realized what his problem was.

Our gearbox is something that I designed after studying how the original Falco system was made—it was a surplus bomber flap gearmotor that had been kludged into a landing gear motor—and also by using drawings of Frati's current motor arrangement. I had also taken apart a number of electric hand drills to see how they are made.

They all use the same method of making change gears. A length of pinion wire—dunno why they call it wire because it's a 5/8"Ø shaft machined with gear teeth on its entire length—is machined down for 1/4" shafts for needle bearings and there's a shoulder turned on the gear and then a larger gear is pressed onto that shoulder.

It all works because it's a tight interference fit, and the pressure is enough to keep the outer gear from turning on the inner gear's shoulder. On Steve's system, the fit was not tight enough and one of the gears was slipping.

There's an easy fix for this. All you do is drill a 1/8"Ø hole at the junction of the two gears and parallel to the axis of the gear shaft. This means that half of the hole is in the outer gear and half in the shoulder of the inner gear. You then tap in a 1/8"Ø dowel pin and put it back together. The dowel pin prevents the gears from spinning any more. This type of thing is called a 'dutch pin' and you can use a setscrew instead of a dowel pin.

It's unlikely any of you will have this problem, but if the symptoms of this little malaise show up in your Falco, that's what the problem is. If you need a dowel pin, just let us know.

George Barrett discovered a minor omission in the construction manual. We fail to tell you to install the aileron pulley brackets on wing rib No. 2 before you install the rib in the airplane. So in Chapter 24, somewhere after Figure 5 and before wing rib No. 2 is installed, make a note to install the pulley brackets on the wing rib. Once the wing rib is installed, it's difficult to install the brackets, even with an angle drill.

Gary Wilburn asks if anyone has tried using Hydrocote Exterior Polyshield varnish on their Falco. It's sold by Highland Hardware who sell it for general woodworking applications. The Hydrocote finishes are unusual in that they are water-based polyurethanes. They have an interior polyurethane and the exterior-rated Polyshield.

Gary spoke to Highland Hardware and asked about the finishes. They said the


***Home for Brazilian Marcello Bellodi's Falco.***

varnish has water-exclusion qualities that are equal to or better than conventional polyurethanes but didn't know enough about the application on aircraft to make a recommendation.

I'm always suspicious of new miracle finishes that are not used by professionals. Lacquer-type finishes harden by vaporization of the solvents. Enamels harden by a molecular change in the resins in the paint that cause them to become a solid material. Epoxies and polyurethanes work by the chemical reaction of two completely different resins which react chemically to each other and which then form a complex solid molecular structure by cross-linking of the molecules. The entire film surface consists of interwoven spiderwebs of cross-linked molecules.

So whenever I hear about one-part epoxy or polyurethane finishes, I wonder if I'm being sold a bill of goods. If there are two highly reactive resins in the paint, how do they know when to 'get married'? I've heard of such paints as moisture-cure polyurethanes that don't react until moisture in the air gets to them, and when someone explains to me that *that* is the way the finish works, I can understand it.

But when I buy a can of Minwax polyurethane varnish or shake-and-spray cans of epoxy paint, I have this strong suspicion that all I'm getting is a normal paint with some ground-up polyurethane or epoxy powder sifted into the paint. I can't believe that there is any cross-linking taking place at the time the finish is hardening or that I'll get the extremely durable film that these finishes are famous for.

Until someone explains to you that cross-linking takes place when you spread the stuff, I think you're safe assuming you have polyurethane-powder-filled paint in the can and that the polyurethane did its crosslinking at the paint factory.

From looking at the sales literature, the primary advantages that I can see about the Hydrocote finish is that it is very thin, easily applied, easy to use and cleans up easily with water. Until I saw some data on the finish, I would assume that it has no special moisture-exclusion capabilities over other similar one-part polyurethanes.

There's a standard moisture-exclusion test developed by the Forest Products laboratory (described at the bottom of page 9-2 of our construction manual) that's not the easiest thing for one of you do but if the paint manufacturer is making moisture-exclusion claims, they should be able to supply test data—if they can't they're talking through their hat.

A quick-and-dirty test that you can do that'll tell you *something* is to coat one side of 12"-square pieces of thin birch plywood with a number of finishes—West System, spar varnish, latex paint, Minwax polyurethane, and your new 'experimental' finish. Lay these on a carpeted floor, finish side up, and put moist paper towels on top of each piece. Observe which of the pieces of plywood curls up and which lays flat.

It's not much of a test but it will show you the relative values of each type of finish, and you'll quickly be able to sort out the worst and best.

One thing I've always liked about West System is that the Gougeon Brothers company has a testing laboratory, publishes test data and explains how their finishes work. Everyone knows that there are only three manufacturers worldwide for the base epoxy resins (Dow, Shell and Reichold, if memory serves) so everyone buys from them and mixes their own brew. There's considerable technology in the recipe and anyone who can't back up claims with data should be considered to have a certain proportion of snake-oil in the recipe.

Gougeon Brothers explains that their secret is in the reactive diluents—a strange but correct word that simply means that the thinners don't evaporate. Thinners that evaporate leave a porous film with tiny pinholes, while the West System's thinners 'get married' with the resins. This is almost exclusively the reason why West System epoxies are so good for moisture protection.

The fall 1990 issue of Gougeon Brothers' *Boatbuilder* shows the results of some tests that they ran on the moisture exclusion effectiveness of West System 105/205 as compared with other finishes, and remarkably enough they also offer a free booklet, *Moisture Exclusion Effectiveness*, on how to test coatings for moisture exclusion. Write Gougeon Brothers, Inc., Dept 91, P.O. Box 908, Bay City, MI 48707.

We have had a little procurement boo-boo on P/N 775 elevator trim tab control arm. The last batch of fifty or so parts was made as drawn, not opposite-hand as noted in a revision. If they are made opposite-hand as intended, the flange that is screwed to the bottom of the elevator trim tab is inboard and mounts on the solid spruce rib that's 25mm wide, and that's why we changed it to an opposite-hand part.

As originally designed, the flange was outboard which worked fine on the wood elevator tab, which was made of solid spruce with a couple of lightening holes. We changed to the current construction of spar, ribs and trailing edge strip because it's lighter and easier to make. To use the current batch of parts, you'll need to glue in another block of wood outboard of the 25mm-wide rib at the inboard end. The weight penalty is negligible, and it's crazy to throw a couple thousand dollars worth of parts away because of the minor inconvenience of installing an extra block of wood.

Joel Shankle discovered a little problem with his fuel gauges. They work fine,

but when you cut on the panel lights, the needles move very slightly and show less fuel. The problem was traced to a marginal ground between the engine instrument cluster's case and the instrument panel. Because of the paint on the instrument panel, there is an incomplete contact between the mounting screws and the panel. If you ground the case of the instrument cluster with a wire, the problem disappears, so that's what we think all of you should do.

We switched some time ago to a new type of fuel selector valve. John Oliver recently changed to the new valve and made a little adaptor block so that he could use the old mounting holes. I've got the drawing if anyone needs it.

By the way, John Oliver discovered when he installed his canopy, that brad-point bits work very well with Plexiglas. Using scrap pieces, he drilled a large number of holes to see if the drills would cause a crack to start, and found the bits work just fine thank you. I've used them as well, and have never had a problem.

At the Great Oyster Fly-In, SF.260 owner Al Eynon noticed that the upper roller bolt on the aft side canopy roller mount was loose on Jim DeAngelo's Falco. He mentioned that there had been a few problems with the bolt ovalizing the hole in the aluminum casting on the SF.260s, and you had to watch the bolt to make sure it wasn't loose. With the SF.260s, the problem eventually manifests itself when the canopy frame jumps out of the rollers and a fairly large gap shows up that you can put your hand through.

I've had this happen on my Falco, but for a different reason. The upper roller was not rolling, and by opening and closing the canopy, I simply wore the thing away. We finally noticed it on the way back from Oshkosh, and the canopy had popped out. I quickly put a new roller back in when I got home. Like the SF.260, the failure seems to be minor but not something you should ignore.

Marcel Morrien reports that he didn't use C-clamps to clamp the fuselage frame in the fuselage assembly jig. Instead, he made his own "integral" clamps by using a few blocks of wood and a screw—see sketch to the right. He was almost embarrassed to mention it because it was so simple, but then again there are a lot of us that didn't think of it.

Has anyone tried to use a biscuit joiner as a scarfing jig for plywood? I wouldn't run out and buy one for that purpose, but it seems like it might work and would be relatively easy to set at the correct angle.

When we ship the main wing spar, we have already drilled all the holes for the landing gear fittings through the spruce but not through the plywood. Before we glue the plywood on, we tap short dowels into the bolt holes to keep the glue from running down into the holes. This means that you must ream the holes out, and then when you glue the remaining plywood on the spar you should repeat the process. Thus, as part of the kit, we enclose a supply of dowels.

This business of drilling the main wing spar for the landing gear fittings is proving to be a popular thing with our builders. Our jig to do this came in at about $2500, but it allows us to drill the holes in 5 minutes, and the holes are a perfect fit with the landing gear. This relieves Falco builders from one of the most dreaded tasks in building the airplane, and as that task passes into history it's worth remembering that some years ago Tony Bingelis—not trusting the dimensions on the drawing—actually waited until the wing was completed up to the point of skinning before he drilled these holes. I've never figured out how he did that.

We're in the process of making new jigs for the wing ribs, and as I was laying out the jigs, I found myself rebelling at the thought of making the ribs as originally designed. Certain parts of the ribs seem needlessly complicated and with some very minor changes we can dramatically reduce the parts count of the pieces that go into the ribs, with no decrease in strength and negligible increase in weight.

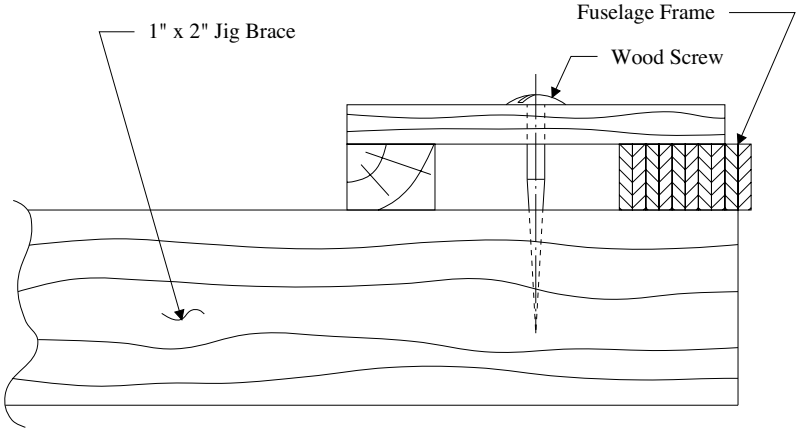
At this point, I am in-process on the design changes, but I can describe them fairly easily. On ribs 1, 2 and 14, I want to make the trailing edge part of the rib (aft of the aft wing spar) of solid spruce. That's the way the aileron and flap ribs are made, and we can make them very accurately and quickly on our inverted pin router.

On ribs 1, 2, 3 and 4, I want to make the leading edge part of the rib (forward of the forward wing spar) out of solid spruce, probably including a lightening hole large enough so that it would leave about 25mm of 'meat' at the thinnest points. This will eliminate not only a silly number of parts, but also the difficulty of bending the capstrips at the leading edge.

On ribs 1, 2, 3 and 4, on the ribs between the forward wing spar and main wing spar, I'm pondering the idea of eliminating the plywood gussets and instead using a piece of plywood over both inboard and outboard faces. It would be stronger, a tiny bit heavier, and much more sensible from a production standpoint.

Finally, on rib No. 1, I'm thinking about using a single piece of solid spruce for the upper spine of the rib. This would extend from the main wing spar to the aft wing spar, and would be a good part to profile on the inverted pin router. There would also be a minor change in the framing around the opening for the flap torque tube. I'm thinking of using a single vertical brace there and allowing a little more clearance with the flap torque tube, which is presently rather tight.

Over the years we've had occasional problems with the fuel tanks, and these problems came in several catagories which are not related to each other. The very




Marcel Morrien's clamping method for jigging the fuselage

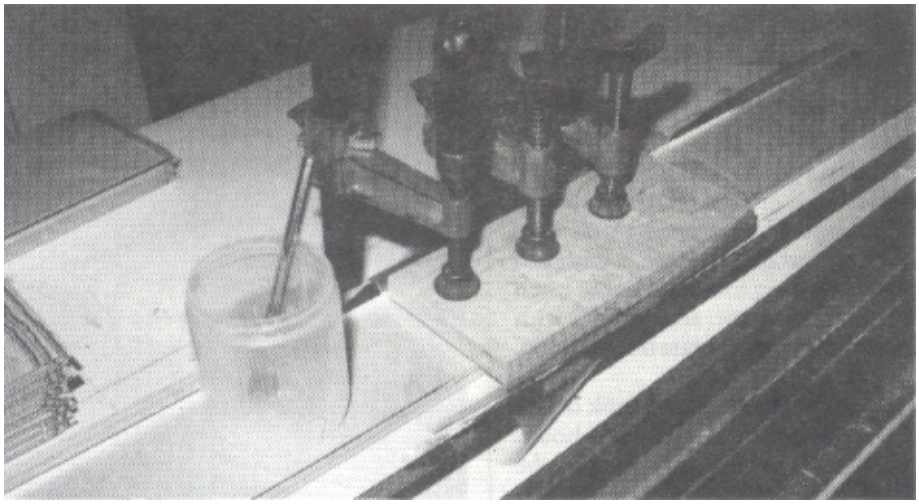
first tanks were not properly leak-checked, and there were a number that were shipped with tiny pinhole leaks. The shop making the tanks thought you could just submerge the tank in water and look for bubbles, but that won't catch the really tiny pinholes. The only way to check for those is to pump air into the tank to a pressure of about 2 psi and then brush soapy water over the welds.

We also found that it was necessary to use filler rod on the seam welds. You would think that simply melting the flanges together would be sufficient, but it isn't.

With those identifiable problems fixed, I thought we had heard the last of problems with the fuel tanks, but three of the Falcos have developed leaks in the fuel tanks. Jim DeAngelo had a slight leak develop in his front tank, and he pulled it out and had it re-welded. Since then, he has had no problems. And a couple of years ago, Pawel Kwiecinski developed a slow leak in his front tank, had to pull the tank and re-weld it.

And then recently John Oliver developed a leak in his front tank. The leak was in the weld along the bottom front left face of the tank, just outboard of the support strap. John was concerned about this and asked me to conduct an engineering review of the design of the tank.

I agreed to do this, but didn't know how. I remembered talking to Herb Andersen at Pitts some years ago and hearing him mention something about slosh and vibration tests, so I gave him a call. As chief engineer at Christen Industries, I thought he might know something about aluminum fuel tanks.



***This is how we scarf together plywood pieces for the various spars. The same jig is also used for joining wing spar laminations.***

Herb said that they have never had any problems with the tanks for the Pitts, Christen Eagle or Christen Husky, but that years ago when he was general manager at Mooney, they had a problem with the wing tanks in the wood-wing Mooneys.

With the Mooney, they were having very occasional problems with leaks in the field. Nothing serious, just an occasional airplane would develop a tiny leak in a weld. They decided to put the tanks through the slosh and vibration test.

This is a torture-test for tanks, and what you do is support the tank as it is mounted in the airplane, fill it two-thirds full with water, vibrate it at a frequency that's 90% of the maximum continuous rated power speed of the engine for a minimum displacement of 1/32" and then you rock the tank 15° each way, left wing down-right wing down, at a rate of 16 to 20 times a minute. In other words, you rock the tank to slosh the water around as you shake the tank to introduce a vibration into the water, and the tank must survive this for 25 hours.

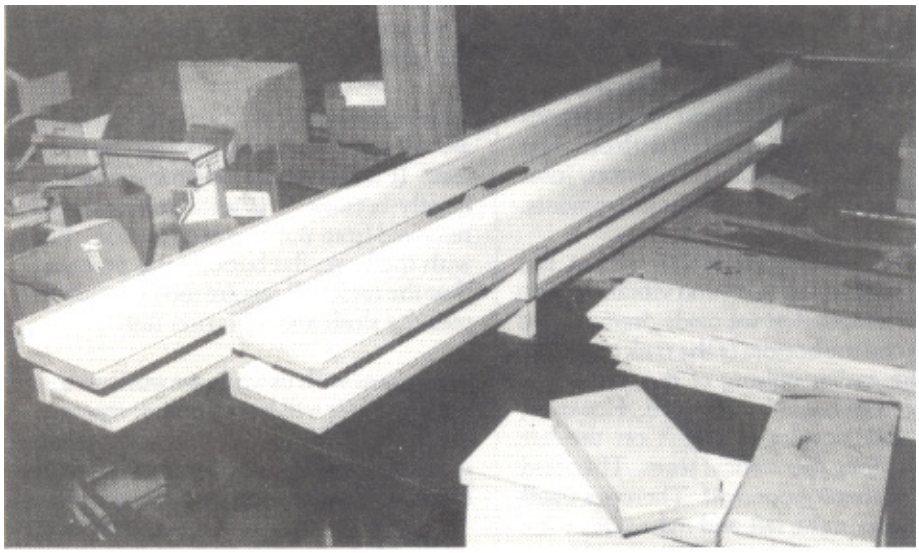
Herb will never forget what happened. The same tanks that had given only occasional problems in the field failed the test in *three minutes*. It didn't just develop a little tiny leak—the entire end of the tank fell out, onto the floor. Herb said it was an astonishing thing to see. They ended up putting a couple of small aluminum angles on the tank ends to kill the vibration, and the tanks passed the test and have never given problems again.

Herb said it made him a believer in the slosh and vibration test. He said if you get a tank to go 25 hours in this test, you'll never have a problem. He said that tank design was something that you couldn't engineer on paper. All you could do was design the tank as experience dictated and then test it. It was all cut-and-try to solve the problems you found.

I talked to Dave Thurston, who confirmed it. He said that tank design was a black art and that in his fifty years of aircraft design, he had never known anyone who got a tank design right the first time. You always had to test the tank and fix the problems you found.

John Oliver, who is an engineer, had already analyzed the problem and had zeroed in on the flat panels of the tank bottom, the loads imposed by the support straps on the welds, and on the weld design of the tanks. As the leak had occured just outboard of the support strap, he concluded that the loads imposed on the welds by the strap probably contributed to the failure.

***The scarfing jigs used for plywood and spruce are Formica-covered birch plywood and have a fence along one edge.***



He came up with a way of strengthening that part of the tank by welding a round aluminum bar on the tank.

The tank was put back in the shop where the welds were ground off, the tank was rewelded, and the reinforcing rods were installed. In the meantime, I designed and built a testing fixture of Baltic birch plywood, a gearmotor, and a motor with an eccentric arm to generate the vibration.

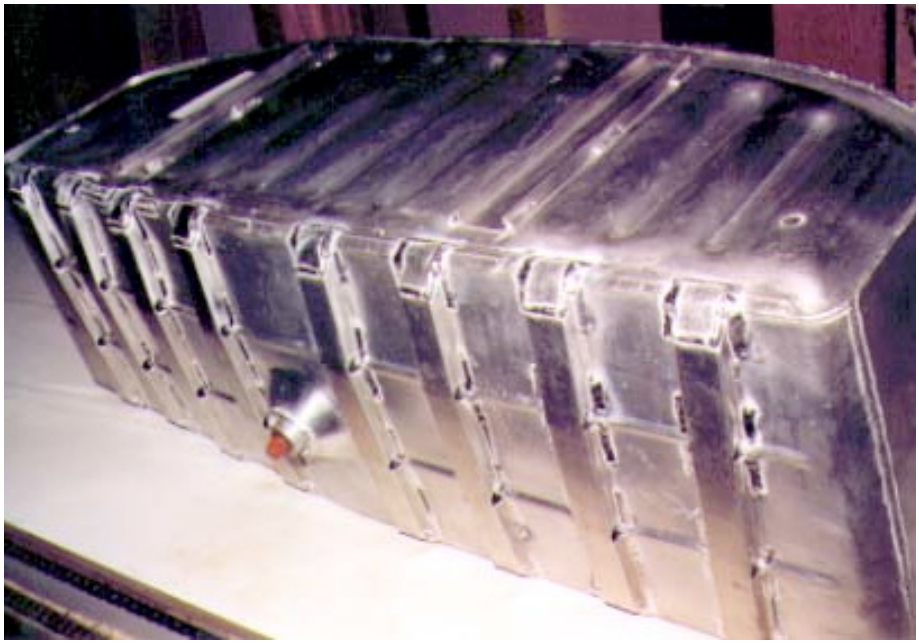
We tested the tank, and the tank developed a leak after approximately 4 hours. During the test, the flat bottom of the tank was vibrating noticeably and this is what we all suspected would happen, because it's always the flat parts of tanks that give you the problem. When a flat panel vibrates, it fatigues the weld, and the weld will fail.

The other part of the tank that was vibrating noticeably was the right front face of the tank—right in front of the radio stack cutout. This only occured when the 'right wing' was down, but there was a noticeable increase in noise, and you could see and hear the panel vibrating. An architect friend who saw it said he thought the vibration was caused by the shorter distance between the forward face of the tank and the radio stack. The leak that developed was—as you might guess—directly below this area along the seam weld with the tank bottom.

There was also a barely audible musical sound to the tank. As it rocked to the right, you could hear an 'underwater', steel-band-like sound. There were three notes, in quick succession, and not unexpectedly there was a chordal tonic-dominant-tonic relationship between the rising-frequency notes.

We all want to see this problem corrected, but let's put this in perspective. If we hadn't done the test and had never discovered the problem, what we would probably have is an occasional problem with the tanks. Every year or two, a Falco tank would develop a problem and the tank would be removed and rewelded. It would be considered a maintenance problem—one of those things that the plane has a problem with.

Also when the failures occur, they are hairline fatigue failures in the welds, and they do not result in catastrophic failures. An engineer friend of mine said that at the company that he once worked they had seen a similar problem with a sprayer they made. It had a motor and a square-shaped



***The fuel tank has been reinforced on the bottom with hat-section channels and with a U-channel on the forward face.***

tank, and all of the machines developed leaks in the tanks within twenty hours or so. There were about fifty of these machines, and the leaks developed like clockwork in all of the tanks. But in every case the failure was the same—just a little hairline fatigue failure in the weld that leaked fuel very slowly.

I want to develop a fix for the problem that is field-installable. The obvious task was to stiffen the flat bottom and also the right front of the tank. The right front of the tank proved to be a simple matter of welding on a U-channel of aluminum that would fit around the wooden support on frame No. 1, and we also did this on the left side as a matter of course.

To stiffen the bottom, we installed eight hat-section channels, and a tab of aluminum that wrapped around the seam weld and also the reinforcing rod, which was extended to the center of the tank. All of this is perhaps a bit of over-kill, but I want this problem solved. The methods were worked out in concert with our shop and presented to Dave Thurston, John Oliver and Stelio Frati for their comments.

With these changes made, we put the tank back in the slosh and vibration test. The changes that we made dramatically stiffened the bottom of the tank and none of the earlier pulsing of the bottom or right front could be observed. However, the tank developed a leak on the left front, along the vertical seam. This weld had not been ground off. There is a small flat area on the left and right side of the tank, and those areas were pulsing slightly. The pulsing did not have nearly as much displacement as the other two areas had before, but the panel was moving.

The vertical seam weld had not been ground off and rewelded between tests, so it's reasonable to consider that the failure occured after six hours of testing, although the tank must pass with a full 25 hours of testing.

As I write this, the tank is back in the shop for rewelding and for installing a brace on the tank ends. This is a difficult problem and one that takes much longer to solve than any of us would like. When we have the problem worked out, we will be in direct touch with all of you who have these tanks.

In the meantime, you should be aware of the problem, and you should inspect the tanks often for leaks along the welds with the tank bottom.

When we finish with the front fuel tank, we will put the aft tank through the same test. It has given us no problem so far, largely because it is well insulated and removed from the engine vibration. But with the large, flat bottom, it is probable that the tank will require modification to pass the slosh and vibration test.

Please bear with us while we work on this problem. We will have another report in the next builder letter and a complete report along with drawings and fixes will be available when the problem is solved.

*—Alfred Scott*

# Builder Letter Index

compiled by Steve Wilkinson

Alfred: Here's a complete builder-letter index for all the issues from March 1984 through September 1990. I've tried to index everything of practical interest to anybody building or flying a Falco and have left out stuff that's not relevant to either of those two acts. For example, none of your stuff on Gonzales or other wood-kit production procedures is included. I've also not bothered to index stuff that the passage of time has made totally irrelevant—for example if you wrote in 1986 about a kit-parts change that has by now long since come on stream.

A few of the items have multiple entries because they fell into several indexable categories, but 99 percent of them are listed only once. I tried to index everything by what seemed to me the most logical look-up references, so some of them are straightforward ("elevator jigging," "electrical-system noise," etc.) and others are inverted ("airfoil, importance of smoothness," etc.)

Anybody who wants to go wild requesting Xeroxes of everything listed in any category they're interested in should be warned that some of the references indexed are quite brief—maybe specifically important to this builder or that one, but they may get a full article on the history of Aerolite in one newsletter and a two-sentence reference to it in another.

—*Steve Wilkinson*

Abby Pratt / Berkshire Eagle Staff

## Ready for takeoff

**Jonas Dovydenas of Lenox, center, yesterday unveiled at a party in his back yard the airplane he has been building for the past five years. He built the single-engine, 310-horsepower plane from a Falco kit and plans to begin flying it next month, after it has been painted. With Dovydenas are Lisa M. Berkel and David W. Berkel, the town police chief, whose jacket identifies him as an ace flight mechanic. Model plane held by Dovydenas was a gift from a friend.**

## Sawdust

• Perhaps the funniest catalog ever written is from JerryCo, whose catalog of surplus and unsold gizmos and trinkets runs the gamut from bizarre to weird. There is a toilet-training kit for little boys which consists of little duckies and froggies that you float in the bowl and which dissolve when 'hit'. The kiddie version is sold out, but they still have a few of an 'adult' version with something *other* than duckies and froggies.

The latest from JerryCo is a fly powered airplane, described as "A little kit with some light paper, rather like cigarette papers, a stick, rather like a toothpick, and extensive, detailed, but very simple instructions. When you have followed the instructions, you will have two little airplanes, to each of which you will have attached one (or, for extra speed, two) live house files. The fly provides the motive power, and they really do work. Judy thinks ill of this product, and so may you unless you are about 10 or 12 years old, in which case you will absolutely love it." Get 'em while they last, they're P/N 88695 Fly Powered Airplane at $3.95 each from JerryCo, 601 Linden Place, Evanston, IL 60202. Telephone: (708) 475-8440.

• Media Watch. Spectacular article on the Falco in the September 1990 issue of *JP4 Aeronautica*. Dang if I know what it says because it's all in Italian, but there are some great shots of Karl Hansen's and Jim DeAngelo's Falcos. Steve Wilkinson's article on building a Falco appeared in the November/December 1990 issue of *Business Week Assets* magazine. There's a raving review of the Falco—"The Flying Ferrair" [*sic*]—by John Conrad in the December 1990 issue of *Sport Pilot Hot Kits and Homebuilts*. And there's a big article on Frati and his new Penquino in the October 1990 *Flug Revue* in Germany.

• It always pays to enclose a note. Pity the Wilkinsons of Sussex, England, who received a package from their relatives in Australia. Thinking it was a present of herbs, they mixed it into their traditional Christmas pudding, ate half of it and put the rest in the fridge. A few days later, a note arrived from Auntie Shiela saying that Uncle Eric had died and had they received his ashes for burial in Britain?

• Good Books. The best book on the care and feeding of your engine has always been *Aircraft Engine Operating Guide* by Kas Thomas, and a new revised version is due out any day now. Kas is editor of *Light Plane Maintenance* which—in addition to being highly informative on all the greasy-finger details of taking care of your bird—is written in a delightfully saucy up-your-pitot-tube style.

Now there's another book out that rivals it in scope: *Sky Ranch Engineering Manual* by John Schwaner, who discusses engines from the perspective of a shop which overhauls the things. It's nearly 300 pages of technical details laced with a lifetime of experience. Get yours for $19.95 plus $2.50 shipping from Sacramento Sky Ranch, Inc., 6622 Freeport Blvd., Sacramento, CA 95822. Telephone: (916) 421-7672.

• Good Grief. NASA's Galileo spacecraft zoomed past Earth on Dec. 8 in a slingshot encounter to send the sophisticated craft on its way to Jupiter. As it passed, it took pictures of Earth from 593 miles above the southwest Atlantic Ocean. "It will be the first time the Earth has been viewed from this perspective. I expect it will give us a greater appreciation of this place," said NASA's project manager—thus proving that you can rationalize anything. What about using a boat?

• Penguinia, or How The World's Only Piston-Engined Turbine Almost Came To Be. Did you know that Paul MacCready's Gossamer Condor was originally called the Gossamer Penquin? His team wouldn't stand for it, saying that the penguin can't fly, sits on its tail, swims underwater and is short and stubby. MacCready caved in, but not Stelio Frati who named his trainer the Penguino. I always liked the name—so what if a penguin can't fly, neither can mustangs, warthogs, tigers, or cobras—but Frati caught a lot of grief on the name.

His latest version, with 160 hp and constant-speed prop, flew the other day, and Frati had picked a nice name, the Italian word for whirlwind, to replace Penguino. Unfortunately that word is *túrbine*, which is 'turbine' to all of us who don't know spaghetti from linguini. Can you imagine the problems with gasboys who pump jet fuel into Turbo Arrows when they see a Turbine taxi up to the pump?

Despite advice from every English-speaking friend that the name was a disaster, the Frati team stuck with the name insisting that everyone would see the difference between túrbine and turbine. I thought they were making a terrible mistake, that people would make jokes about the name and would conclude that Frati and his team were silly people—which they most certainly are *not*—so I persisted and finally persuaded them to abandon the name. Thus it was that two or three days after the F.22R Túrbine had flown, it was renamed the F.22R Sprint, which I think is a fine name—don't you?

• 'Scaled Aluminum' Shuts Down. LoPresti Piper ceased operations the other day—'temporarily' until an investor is found, but it's most likely permanent. I've always liked the LoPrestis, and it's sad to see this happen. But it always seemed inevitable because nobody could figure out how they could build the SwiftFury for such a low price. Give him credit for one thing—one of Roy's stated design objectives was to develop better handling than Frati's SF.260, and by all accounts he succeeded at that.

• Holy Rotting Fiberglass! According to the latest issue of *Aviation Week*, General Dynamics has discovered that under certain conditions, their highest-tech composite will actually corrode. The corrosion was first discovered in March when an engineer could not find a glass jar to test a sample of the composite material in a water/fuel mix, used a tin can instead and was surprised to find several days later that the resin had dissolved.

The resin, bismaleimide, is a type of polyimide used only on the most advanced military machines so we don't have to worry. The conditions for such decomposition now appear to be: a conductive fiber like carbon fiber, in contact with a metal, in an electrolyte solution, with oxygen present and stagnant conditions at the water interface to prevent dissipation. Higher temperatures speed the process in which the materials form a battery that creates hydroxyl ions which collect on the surface of the composite, form a highly basic solution and which dissolves the resins from the material.

• Engines Galore. As we go to press, we got a call from an engine overhauler who says he's knee-deep in engine cores of every type that he picked up overseas. The engines are available overhauled to new limits from Nick Carter Aviation Supply, an experienced engine overhauler who is also a Lycoming and Continental distributor. Contact Bob Carter at Nick Carter Aviation Supply, 2116 West G Street, Elizabethon, TN 37643. Telephone: (800) 251-7050 or (615) 542-2032. Fax: (615) 542-2633.

## Brenda's Corner

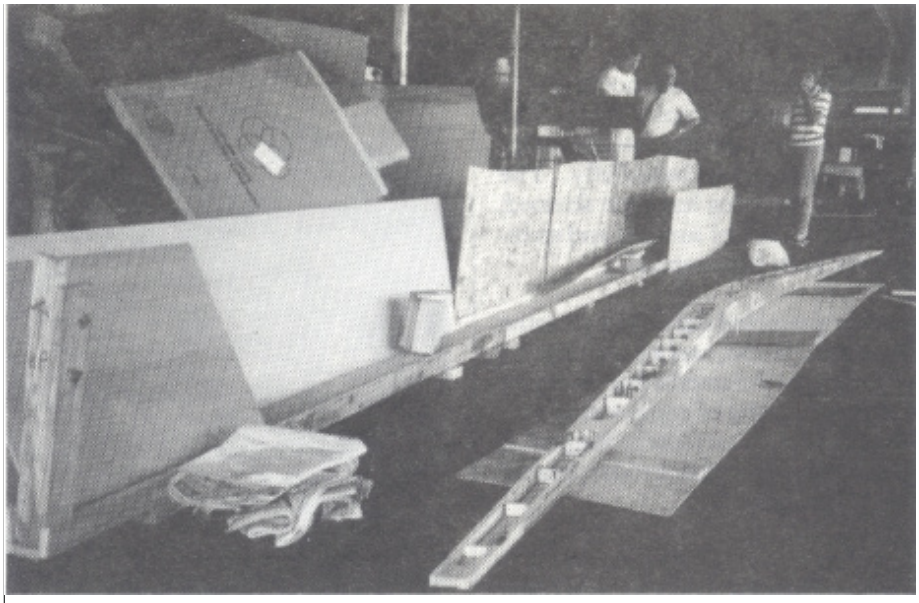
This fall we finally shipped the first five main wing spars (actually four since George Barrett picked his up). Getting them on their way was quite an experience. The first one was sent to Howard and Marty Benham, and it almost was demolished by Roadway. The crate arrived in shambles, but by some miracle the spar was not damaged. The next one went to Cecil Rives in Houston. The truck that arrived to pick it up was too small, so they had to radio for a bigger truck. The driver was not a happy camper when he saw what we needed to get out of the warehouse, but with some help from our neighbors next door we managed to get it loaded. We told the driver we had another one to ship that week, and he said to be sure to ship it on Thursday because that was his day off. The next one went to Dr. Nicholas Broussard in Oregon. By this time we had some experience, and it went rather smoothly. The last one was shipped to Marcel Morrien in Holland. Mr. Morrien usually wants everything sent by air freight, so we telephoned Burlington to get an estimate on the freight charges. You're not going to believe this—$7,000!!!! It went by ocean freight.

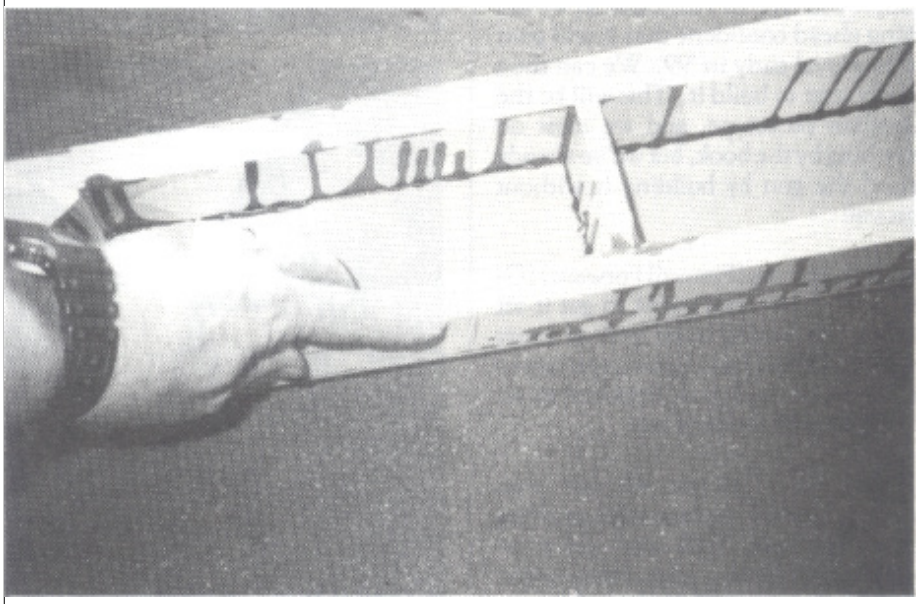
Sad news for the people of Germany. The U.S. Postal System does not recognize the unification of their country. Recently, I took a set of plans to the post office to send to a builder in Germany and a major crisis occured because the labels did not have East or West Germany on them. Of course, I shouldn't have been surprised. Only a few months ago, this same clerk wanted to know what country Great Britain was in.

Other than some of the wood kits, we are in good shape on all the kits. For the past six months or so, I have been in the process of restocking the electrical kit. It has been a mind-boggling task. Not only are the parts expensive, the delivery time on a lot of things are six months and more. You try to get all the parts in for one sub-kit, package it and put it on the shelf before ordering the parts for another. The only problem is that there are always a few items backordered so you're putting incomplete sub-kits on the shelf. The thing that really amazes me is how Alfred ever started from square one and put it all together in the first place.

We have a belated Christmas present for you. Gary Smith brought us a huge box of plastic jars that are perfect gluing cups. They are rejected and unused Afro-Sheen jars—see photo on page 9. If you would like some included with your next kit shipment, drop me a note. We don't want to be the only ones filling up the landfills.

*—Brenda Avery*





***How not to treat a Falco spar. Top: The Benham's spar crate was destroyed enroute to Wichita. Center: The worst damage to the spar was a tiny splinter. Bottom: Marty celebrates the spar's arrival.***

## Mailbox

Pleased to advise that we are now working full time on Guido Zuccoli's Falco. The wing is horizontal and the fuselage structure is going together beautifully. The underside of the wing has been skinned, and all of the control surfaces and stabilizers have been float-sanded.

I have just assembled the nose leg/engine mount combination, and we continue to be impressed by the standard of manufacture and machining of components supplied in what we think must be the pick of the kit aeroplanes available today. Maybe we are a little biased!

Unfortunately, our CAA does not see it that way, and the Falco has yet to become an approved type in Australia, so we are forging ahead confident that it will gain type approval early in '99. We can then *officially* start to build it. This will be the Australian prototype, and we must do everything by the book, but we've already jumped the gun by building it without approval!

The Dick Demars (Firewall Forward) IO-360 looks great—can't wait to get it set up. We are getting more excited every day—Guido is already planning a trip to the Ferrari dealership in Brisbane to select the correct shade of red!

Our hats are off to you all; this is an excellent aircraft package with untiring product back-up. Will send you some photos soon. Cheers from down under. Merry Christmas to all at Sequoia!

*Tony Chamberlin*
*Toowoomba*
*Queensland*
*Australia*

*On the approval process, it might help to remember Capt. Frank Strickler's Rule No. 7—forgiveness is easier to get than permission. On the paint shade, Lu Matthews, designer of the Falco paint schemes, color-matched the Ferrari red color long ago. It is Imron 5027, and the second of the San Marino/Monza paint schemes in Appendix C is the scheme that Karl Hansen used, although Karl used a more orangy Ditzler red to match his son's Alfa Romeo.*

*Lu Matthews emphasizes that what makes an 'all red' paint scheme of a Hansen Falco or Ferrari work is really an interplay of colors dominated by red. Red by itself is boring, and it comes alive only when you contrast it with black, white and tiny spots of yellow. Lu recommends a yellow background for the Sequoia logo next to the Falco name. This is what Karl did, and it really works. It's one of those tiny things that people don't even notice but which makes the red stand out.*

*—Alfred Scott*

***Two interior shots. Top: Jim Slaton's Falco panel features dual nav-com, transponder and loran. Bottom: Jim Slaton's Falco has a leather interior with shearling sheepskin seat covers.***

Work progresses fairly rapidly. The spar has been sealed and all fittings attached. The bottom has been planed to the trim line and tomorrow we drill the holes for the external tank fittings and glue the fuselage frame to the front of the spar.

Ed Merkel from Boeing is putting the finishing touches on the load analysis and drawing the attach fittings for the external tanks.

So far all of the dimensions on the main spar have come out to the millimeter. We did have to ream out the landing gear holes due to glue overflow and epoxy buildup.

*Howard and Marty Benham*
*Wichita*
*Kansas*

*Ed Merkel is an engineer at Boeing and the designer of the all-metal Merkel Mark II biplane. Ed has done a complete load analysis and drawings for external fuel tanks for the Benhams, who plan to fly their Falco to Australia and back when it's finished.*

*—Alfred Scott*