Falco Builders Letter

Above: Farmerville Face-Off, Kwiecinski vs Hansen

Building a Falco, Part II

This article appeared in the March 1988 issue of Pilot *magazine in England.*

"How's the airplane coming?" my friend asks. He too is a homebuilder, though he lives 3,000 miles away, in Los Angeles. I am sitting in rural New York, telephone in hand, staring out a window toward an elderly barn. Inside the barn is a half-finished Sequoia Falco aerobatic two-seater, a small spruce mosquito that has been abuilding for nearly three years now. Outside the barn, the second snowstorm of the season begins to build drifts. (Is the roof sagging? Will its old split-pole rafters, the bark of the 19th-century trees still in tatters upon them, last another winter? Is snow beginning to build on the barn floor in eddies and whispers wherever there's a chink in the rotting boards?)

"Aw, I'm sort of burned out on it right now," I tell him. "I haven't touched the thing in weeks."

"God, I can't bear to do that. I'd be afraid that if I ever stopped, I'd never start

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Devoe on de Falco

The world has turned over many times since I first looked at the Falco brochure in January of 1983. I had been widowed just a year before, and the future seemed to hold little of interest. Working with wood has great therapeutic value, and if you are building an aircraft with it your brain gets very active as well. In my shop, gathering dust, sat the tail feathers of a Barracuda, untouched for over two years. As I looked at what I had intended to hatch, I was not pleased.

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In This Issue:

Dead on Arrival: Porsche PFM

Now that there is a Turbo 260, are you going to offer a PFM Falco option? The speed advantage should be considerable. And, think about the sex appeal of "one of them red eye-talian jobs" with a Porsche engine up front. It should be fairly simple: add a 20 gallon tank in the tail to take care of weight and balance, stretch the cowling by two cylinder widths, modify the center console to eliminate the mixture and prop levers, run a flutter test at 300 knots and we should be home free. Assuming 12 gph and a 250 knot cruise, that would yield a range of about 1250 nm. If you can have the design work done by this summer, I'll wait and build the first one.

Howard Batt
Clearwater, Florida

Where is Don Meredith when you need him? Aw, HOW-ward!

We've all heard the old complaints that our aviation engines lack the sophistication and technology of today's automotive engines. Electronic ignition would be lighter and better than our old designed-for-Case-tractors magnetos. Electronic fuel injection would give us better fuel economy. Better cylinder head design would give us better efficiency and more power. If we could use stock, off-the-shelf, automotive parts, our engines would be cheaper. What if one of the exotic car manufacturers—maybe Porsche!—would build an aircraft engine. Just imagine what kind of engine we would have!

Now we know. And it's a disaster.

Because there is a direct relationship between the number of moving parts and reliability, the first cardinal rule of design is simplicity. Antoine de Saint Exupéry said it so well. "Perfection is finally attained not when there is no longer anything to add, but when there is no longer anything to take away." On this count, the Porsche aircraft engine is a stunning failure. The engine looks like it was de-

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Building a Falco

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again." My friend, a serious homebuilder, is crafting his own awesomely complex original design intended for outlandish speeds, altitudes and distances. If his project is the nouvelle cuisine of homebuilding, mine is Shake n' Bake. "I set myself a certain amount of work to do every day," he says, "and I feel I have to do it no matter what."

Perhaps that is for me the secret of enjoying airplane-building: don't take it seriously. The Falco must fit itself into my life, and if that means it must occasionally sleep in the barn, sawdusty and neglected, for weeks at a time, it's a far better fate than would be mine if I had to rearrange life to encompass what after all is only an airplane.

To have the Falco there, ready to be worked upon when I wish, out of sight and out of mind when I don't, is a delight. The studio in which I write—a chocolate-brown chunk on stilts, 12 feet on a side, one wall all glass—also frames the barn in its view. Often a paragraph goes nowhere until I have succumbed to that sight, put the writing aside in favor of gluing a rib, clamping a cornerblock, sanding a rough seam or drilling a fitting first. I come back to the keyboard renewed by 15 minutes of play.

When I was a boy, my father would delight in demonstrating a peculiar property of a domed passageway deep within Manhattan's Grand Central Station. On the special days when I'd be allowed to accompany him to the office, he'd stand facing one corner of that vaulted station chamber and, back to back, I would do the same diagonally across from him, perhaps 50 feet away. His whisper would carry clearly to my ears, slithering along the perfectly curved tiled ceiling while commuters trooped past and never heard it.

The Falco barn apparently contains something of the same architectural magic, though for no logical reason. The phenomenon was revealed by my mother-in-law, who with her conservative, reserved husband comes to visit us each summer for an extended stay. Grace and Irwin are wont to sit reading in our expansive living room, ceiling fan fluttering overhead, patio doors flung wide to the considerable lawn that lies between the house and the barn it faces while son-in-law pursues his deviant fascination with a plywood-covered structure that represents an investment that could easily have their daughter driving a Porsche.

"It's too bad Stephan hates working on that airplane so much," said Grace to my wife one day.

"Hates it? He loves it," Susan answered.

"Then why is he constantly cursing it, poor thing?"

From barn to house is perhaps 200 feet—a distance I had considered to be an ample buffer to allow me a construction technique known in our house as "shouting it into place." Other people trim, wheedle, cozen, slide or tap components together. I swear at them. Other people stop and reappraise or reapproach situations that frustrate them. I summon up the vilest curses to embarrass the bafflement into relenting. Other people sand, file and fit, then sand, file and fit some more. I voice the most unspeakable, anatomically impossible private terms as a cathartic substitute for repetitive effort. And somehow the open-doored barn was acting as a wretched sounding board focused, like that train-station tunnel of my youth, on a single spot. A spot where my in-laws sat to take their contemplative ease. How embarrassing.

Build a Falco and you learn at first hand that an airplane is a wing. A wing with seats atop it and primitive extensions to support engine and tail, but the wing is the heart of the matter. Appropriately, the Falco's wing spar is the single largest component of the aircraft—a tapered Brobdingnagian toothpick of spruce, bent elegantly in the middle and showing in every lamination, scarf joint and internal support (except for a solid centersection 8.5 inches deep and 4.25 thick, the spar is largely hollow) the craft of Falco wood-kits supplier Francis Dahlman.

From that spar proceeds the assembly of a trusswork of ribs and secondary spars that never fails to amuse those privileged to have seen the filmy ribs of production planes and of even such tough, externally braced designs as the Pitts. The Falco's wing is a phenomenally stout structure of thick, closely spaced ribs all bound together by a comparatively heavy plywood skin. If Dassault built business jets of wood, this is how they might do it.

A few Falco builders have first made a fuselage and then a wing, fitting them together, fuselage frames nesting nicely against the spars to which they glue. It is a superficially logical procedure but a delicate one: the spaces between spars (there are three in all) in the completed wing must match to the millimeter the position of the completed frames (the circular rings that determine the fuselage cross section) to which they glue, for this

The Falco Builders Letter is published 4 times a year by Sequoia Aircraft Corporation, 2000 Tomlynn Street, Richmond, Virginia 23230. 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.

is the airplane's Jesus joint—wing center-section clasping the cockpit area in, one hopes, a permanent embrace.

A more reassuring and ultimately far easier technique is to build the wing first, in a vertical jig, with the relevant fuselage frames an inextricable part of the structure from the outset. When the wing is complete and set horizontally upon temporary supports, you have the beginnings of a fuselage rising skeletally above it and can begin building the airplane's body fore and aft from that foundation.

What makes building the wing a tricky procedure is that it has a delicate twist from root to tip—a gentle, consistent rise of about half an inch along a span of some 10 feet. Simply gluing the ribs at right angles to the spar at their stations won't do. Instead, wing construction begins as a cat's-cradle of strings stretched to define the leading and trailing edges, and how accurately the minute measurements were made that locate the fixings of those strings becomes a question that will only be answered by flight. Have I built a 180-horsepower corkscrew, each wing warping through the air at a slightly different angle? Will I own a dog that trots along with its wing cocked a degree or two above the optimum?

The import of such questions is difficult to explain to the moderately curious, who ask questions but lose interest after learning that, "Oh, you're building a *kit*." (Left unsaid is, "I thought you said you were *building* an airplane, not just screwing together some parts.") Airplane homebuilding has become a matter of moderate interest in the general press hereabouts, since all its dimensions—dollars, people, number of aircraft—so greatly outweigh the equivalent statistics for what little remains of the lightplane industry. But this means the public has become aware largely of ultralights assembled with ordinary-household-tools technology and of what one friend calls "Tupperware airplanes"—composite homebuilts with all the style and grace of plastic kitchenware.

Interest in the Falco, however, draws interviewers from the Far East, and one Saturday, three small Japanese—writer, photographer and driver—and a statuesque gaijin interviewer arrive at our remote home. She—Consuelo, a six-plus-foot ex-tennis pro who charms us all immediately—does the actual taped interview, for the Falco is to be the subject of an article in a Japanese magazine intended for businessmen who want to learn English.

Subscribers get not only the magazine but a tape cassette of me pontificating about homebuilding. The Japanese seem baffled by my inability to remember how long I've been working on the airplane and my unwillingness to predict a completion date.

A more worrisome visitor was Sequoia Aircraft's Alfred Scott, the dear, obsessed, infinitely helpful man who is responsible for bringing the 1960s Frati Falco F.8L back to life as the much-improved 1980s Sequoia Falco. Scott had seen many a kit Falco under construction, and I imagined he would look upon the clumsiness of mine as an insult to his obsession. He approved, however, to my vast relief. Scott took pictures, seemed interested in some of the things I'd done and found fault only with my lumpy ailerons. Originally intended for fabric skinning, I had done mine in thin plywood, and the skin showed every rib-to-rib variation. Worse, despite what I'd thought was reasonable care, one was mounted a few millimeters out of line with its wing bay. I'd known it but needed the outside approbation to force me to relocate the hinge brackets—a considerable job, since it involves the shared flap-hinge brackets as well.

Still, one of the great delights of working with wood is the ease with which mistakes can be corrected—holes plugged and redrilled, shims glued in place where too much wood has been removed, surfaces built up with a few strips of thin plywood wherever needed.

Scott takes the Falco not only seriously but personally, and he is devastated when a newly completed kit Falco crashes and kills its builder and another pilot. The very first kit Falco to be completed had also crashed fatally, nearly two years earlier, which means something like 20 percent of the active Sequoia Falco fleet had destroyed itself and four people. A fatal flaw? Hardly, for both airplanes had stalled and crashed during desperate attempts to make deadstick landings after careless fuel exhaustion—the first airplane during an instrument approach, this one on takeoff. (In the more recent accident, the retired student-pilot builder and a young local pilot had landed the new Falco to refuel but found the FBO sold out. They'd guessed there was enough fuel remaining to try another airport. The engine proved them wrong on climb-out, and the builder's friend, in the left seat, apparently tried to turn back to the runway from an altitude of only 300 feet.)

If there is a "flaw," perhaps it's that the Falco is an airplane that by European standards is light and precise yet not untypical in its handling qualities. By docile, undemanding Beech/Cessna/Piper standards, however, it is sensitive, unstable, quirky. It has a stick. It stalls distinctly. It is entirely willing to spin. Whether Skyhawks or Cherokees in the same situations would have crashed as disastrously as did the Falcos, it's impossible to say.

Scott in no way avoids this reality. His builder's manual includes a remarkably complete chapter on cautious flight-testing, and he goes to great lengths to deter inexperienced builder-pilots from testing their own Falcos. He stands ready, in fact, to provide a Marine F-18 Hornet acceptance-test

pilot friend and Falco builder to do the initial flight for any Falco builder so disposed. It is an option I may someday at least consider.

One summer, I returned to the barn with a broken arm acquired during a tramp through the Maine woods in search of Nungesser's and Coli's lost transatlantic biplane, l'Oiseau Blanc. (But that's another story—one that approaches its culmination as inexorably and surely as does the Falco, though I suspect the mystery of the two Frenchmen will be solved before I fly.) The injury was infuriating, for it was perfect homebuilding weather, ideal gluing temperature, lovely days to shape an airplane. Two weeks before my next appointment with the doc, I took my favorite Tyzack backsaw to the cast. Free again to bend and staple, cut and fit, glue and sand.

A salient moment is reached when my Falco's completed wing is removed from the jig that has held it vertical and is gently rotated onto jacks so that it sits normally. Huge, broad, expansive, it fills the barn like a wooden stealth bomber—hey, not a bad idea—and now the inevitable comment becomes, "Very nice, but how are you going to get it out of the barn?" My theory—supported by some casual exercises with a graph-paper plot of the barn floor and a scale planform of the Falco—is that if I can figure out how to build it, I can figure out how to get it out the one door, across half an acre of hilly lawn, onto a flatbed trailer, down a driveway long and steep enough to be impassable for parts of each winter, onto a death-trap divided highway...oh hell, I can always Sikorsky it out.

The Falco's fuselage is built around an enormous, temporary central beam of 2x4s and ordinary plywood with small crosspieces screwed to it at each fore-and-aft station. The crosspieces support the circular fuselage frames. The entire fuselage takes shape in no time, for there are only four main longerons (plus a few subsidiary sticks) that tie the whole thing together. Soon, I am able to perform the homebuilder's rite of passage: sitting in what will be the cockpit making airplane noises and wiggling the stick. My daughter's male playmates invariably add the sound of machine guns as they key the little red microphone button atop the stick. She, more pacific and less acculturated to what one is "supposed to do" with airplanes, spends her imaginary flight time wearing a headset and arguing with ATC.

Ideally, the 2x4 keel should stay in place until the entire fuselage is skinned, the crosspieces ensuring that nothing shifts or warps as the structure grows. Instead, I grow impatient with the great pipe-frame bedstead that supports the keel and tire of explaining to people that no, the big piece of household lumber will not be part of the finished airplane.

Having seen the assymmetry and ironmongry of unclothed Ferraris, I content myself with thinking that the original Falcos were also built by Italians, and they fly just fine. I skin the upper half of the tailcone to provide a stiffening spine, and the imprisoned beam is sawn in half and withdrawn to become firewood. The fuselage remains as sturdy as a tip lorry.

Despite my refusal (or inability) to pursue the kind of perfection that leads some homebuilders to cosmetically finish and perfect internal structures that will never see daylight, one of the continuing miracles of the Falco is how perfectly everything *fits*, even after construction reaches stages where no amount of drilling-and-filling or gluing of shims can correct a thing. The cockpit floor has been built and the instrument panel is bolted in place, for example, and the unyielding aluminum center pedestal slips into place between panel and floor firmly, tightly, perfectly.

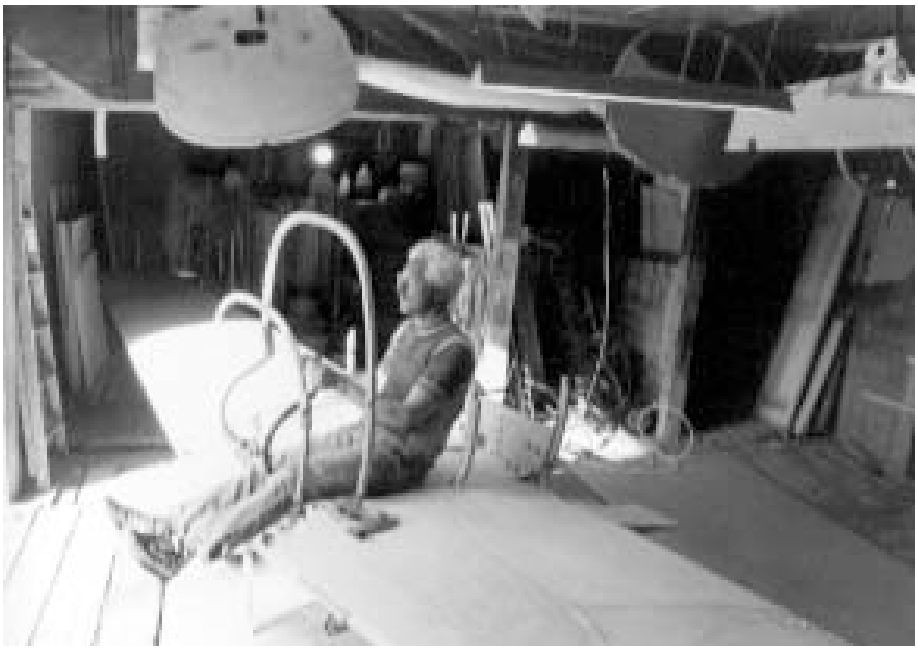
From firewall aft to the cockpit rear wall, a train of preformed fiberglass components that nest one into the next—nose-wheel-bay cover, trim-control cover, the entire between-the-seats central console and gear-motor cover—fit as perfectly as they would have in a factory.

The seats on their sliding tracks—my Christmas gift from my wife—fit into place with literally the one-millimeter thickness of the interior cockpit skin to spare.

I swing the landing gear up into its wells, lying on my back wondering how long it will take for my plight to be discovered if the airplane falls off its jacks, and everything nests like a hat in its box, just as it was intended to. Sometimes, I amaze myself.

Surprisingly, the only thing that doesn't fit perfectly is the rather expensive engine-mount framework (just over $1,000, including Lord mounts). It sits slightly spraddle-legged on the front face of frame one. If I align any one of the tube-steel framework's four mounting brackets with properly premarked bolt holes to be drilled through that bulkhead, the centroid of the four Lord mounts isn't at the airplane's centerline. If I align a plumb-bob from that centroid with the bulkhead centerpoint, each of the four mounting brackets is slightly askew. Scott later confides that kit components produced for Sequoia by subcontractors accustomed to common machine-shop standards were invariably faultless. The engine mounts, ordered from a highly regarded general-aviation specialist, showed the lowest quality of workmanship that Sequoia would come to accept. In fact, Scott has since found a new and assumedly better engine-mount supplier.

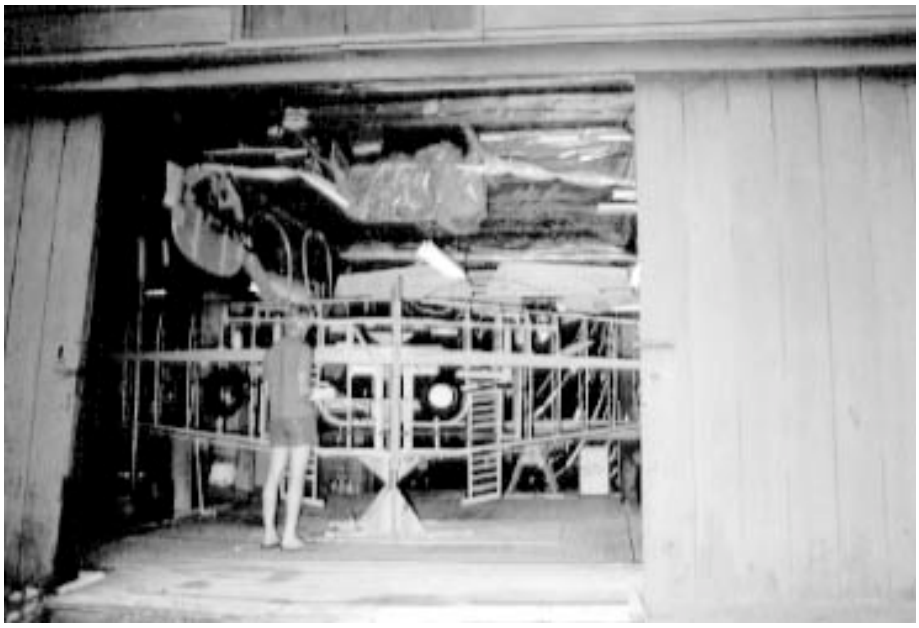
My Falco's engine will not be the standard 160-hp Lycoming but the maximum-allowable 180. The 12.5-percent greater horsepower will gain me perhaps only four percent more cruise—probably not even that, since I'll most likely fly it at a comfortable reduced-power setting—but



I'll be able to climb faster and fly higher. Strong climb and the highest possible ceiling are so much more useful for weather flying than are a few knots more speed, and I find the most fortuitous flight levels to be around 16,000 feet—relatively unpopulated, well above the highest haze layer and often affording a much better view of weather. I am scared of ice, terrified of embedded cells. A bonus is that a new prop for an IO-360 is some $1,200 less expensive than is an IO-320 propeller.

I spend hours, drive miles from metal fabricator to machine shop to construction-supply house, searching for stainless steel for the firewall. Fortunately, I don't find it, for somebody eventually points out that I am asking for 0.20-inch steel plate, a fifth of an inch thick, rather than .020-inch sheetmetal. Frankly, the firewall seems an oxymoron on a Falco, for the nosewheel bay forms a neat blast tube into the cockpit, capped only by a fiberglass cover. Fireproof the fiberglass with a stainless-steel insert? Why bother? Wherever the flames go, they eventually come to a formation of flying firewood.

As winter clutches upstate New York, Falco-building pauses awhile. Aerolite glue needs a temperature of 15°C. or more to properly cure. I've been able to attain it during the late autumn with the help of a kerosene stove, heat lamps and a cocoon of plastic sheeting, but if that continues, I'm sure to torch the Falco, firewall or not. (My homeowner's insurance is delighted to cover a cedar-shingled house full of woodstoves. They see no problems insuring an estate that only the most resourceful fire engines could reach in the wintertime. They're happy to guarantee me against a society of litigious callers begging to plummet from icy porches or be beaned by a forest-ful of rotten tree limbs. They worry not a whit about insuring an aging barn surrounded by topheavy trees. But there is one very specific exclusion: an airplane inside that barn.)



What's fun is that what once looked like misguided cabinetry now is unmistakeably an airplane, and first-time viewers are easily awed when I theatrically trundle open the barn doors. What's also fun is that I have outpaced the builder's manual. Now I'm chopping and gluing and bending on my own, doing what's necessary in ways that have finally become second nature. No longer am I a neophyte terrified to cut a piece of plywood without reading the step-by-step directions through three times, I'm a confident initiate with a bunch of well-thumbed plans.

Not that there isn't ample material to guide the builder, 15 Sequoia Falcos having already been completed, but Scott continually finicks and tunes his builder's manual and is only now getting to the chapters covering skinning and detailing of the fuselage. Is it worth the wait? Expensive as the Falco kit is, builders are getting an unspeakable bargain in terms of Scott-hours per airplane. A friend, an industrial-management consultant accustomed to dealing with nuclear powerplant installations and the like, looks at my Falco blueprints and says he's never seen any as clean yet detailed. One of my brothers, 20 years a Harvard-trained architect, says he can't draw as well (Scott is a self-taught draftsman). Furthermore, he says, his own design firm would lose money if it charged a client only $400 for the same quantity of blueprints and drawings.

When spring comes, I'll finish skinning the forward half of the fuselage—after remembering to install the two fuselage fuel tanks, one hopes—and will mount the sliding canopy. Then the airframe will be complete, standing on its own gear, and I will begin to determine the validity of the First Law of Homebuilding, "Firewall forward is half the work."

To this moment, my investment in the airplane totals $34,722.31, about $28,000 of it for kits and plans, the rest for materials (glue, varnish, plywood, sandpaper) and tools I didn't already own (air compressor, pneumatic staple gun, router bits, more clamps than I've ever seen outside a hardware store).

I still have some $10,100 in Falco kits to buy, plus an engine and avionics. Such an expenditure for the pieces alone of a two-seat wooden airplane of doubtful resale value cannot be rationalized.

One U.S. builder doesn't agree and is currently asking $150,000 for his admittedly outstanding, superfast, Ferrari-red kit-built Falco and has even consigned it to a dealer for resale, but I think the man is daft, joking or trying to start a Falco tulipmania. True, there has never been anything like the Sequoia Falco on the used-plane market, but nearly new Christen Eagles, another excellent kit-built design, generally sell for the value of the kit components at best. And a builder's liability when reselling a homemade airplane can best be protected, lawyers tell me, by neither making nor even implying the tiniest claim touting the airplane's condition, worthiness, performance, safety or suitability as anything other than a sump for the buyer's money. I doubt that a 160-hp airplane can be sold for the price of a nice house as is, where is, take it or leave it.

But I have decided that I needn't bother rationalizing my foolishness, for the project is priceless in the challenge and pleasure it affords. Nor is it entirely selfish. Said my wife recently, "You know, even if you turned that thing into firewood when you were finished, it would all have been worth it: our daughter is growing up realizing what enormous possibilities exist—making an airplane, things like that—and some people never get a chance to see that."

And who knows what pointless, expensive, unhealthy or even immoral hobbies I would pursue were it not for the Falco in the barn?—*Steve Wilkinson*

Notes From the Sideline

Susan Crandell is editor of special publications at American Express Publishing, formerly managing editor at Flying, a pilot and married to Steve Wilkinson. I asked Susan if she would like to write something about "Life with a Falco Builder." Then Steve wrote "Building a Falco, Part II" and stole her big line—but if you can't steal from your wife, who can you steal from?—Alfred Scott

When Alfred asked me to take a crack at recording some impressions and observations about my connection to the Falco that is taking shape in our barn, the first thing I realized was how little I'd examined the airplane's influence on our lives.

Right now Steve has the airplane about halfway to completion (at least that's what he says; to me, it looks far more finished than that). Yet other than marveling at the peculiar combination of artisan-caliber skill and mind-numbing grunt work that is required, I just hadn't thought about it very much.

Now, having been asked to plot the pluses and minuses of the project, I find that, for the most part, the Falco's creation has been a positive force in our household.

I'm sure I don't have to tell other Falco builders that Steve has spent a whole lot of time and quite a bit of money pursuing the project. But while I'm not particularly excited about owning and flying the Falco someday—we just sold an airplane that better suits our transportation requirements—I do not begrudge the Falco either the effort or expense it demands.

If Steve weren't out slapping plywood against spruce, he'd be engaged in some other equally demanding solitary pursuit. That's just the way he is. And I'd prefer to think he was spending that time away from me building an airplane than playing golf or manicuring the lawn.

In terms of money, Steve has been prudent enough about purchases that I've never felt we were buying seats for the airplane instead of a sofa for the house, or a Lycoming IO-360 in place of a European grand tour. I suspected at the start that I might come to resent the Falco's expense, but it hasn't worked out that way. Steve and I both work, our life is otherwise relatively unadorned, and I guess we've been lucky.

So I've really felt quite comfortable with the Falco on what I suspect are the traditional fronts of inter-spousal discord. Still, there is one significant difficulty with my role *vis a vis* the airplane.

People often refer rather generously to the Falco as "the airplane that you and Steve are building." Many are surprised to learn that my only role in the Falco project is that of occasional financier—treating Steve to the next kit or a specialty woodworking tool at a birthday or Christmas.

Clearly, many people could not imagine being so close to such a fascinating project and not jumping right in. And that is, in fact, the central problem with being silent partner in a Falco. You're subject to recurrent—and unbecoming—bouts of envy.

Don't misunderstand me. I have no desire to become a co-builder. The Falco asks skills I don't begin to possess. My learning curve would be so much steeper than Steve's that I have no wish to plot them side-by-side.

Nevertheless, I'm smart enough to know this: his willingness to undertake and—more important—to carry through on the building of a Falco puts Steve a light year or so beyond me in terms of courage, tenacity and heart.

Yes, sometimes that makes me glance barnward with envy. Yet Steve's eagerness to embrace this project (the phrase "magnificent obsession" comes to mind) is a quality of spirit that drew me to him in the first place. So while I'll admit to feeling envious of this marvelous focus his life has right now, I won't be petty enough to complain.

Besides, the Falco is the ultimate education experience for our daughter, Brook. Imagine watching an entire airplane take shape in back of your house, built by your father. Nobody's ever lectured her about the import of this experience. ("Now dear, you know when people want something and work hard, no matter how difficult, it can happen.") The Falco is simply there—an extraordinary undertaking that we pretty much take for granted day-to-day. I hope she'll take for granted that such things can occur.

So it's been more than okay so far. Curiously, as I figure it, the biggest negative of all is the airplane itself. Chosen as process rather than product—for its builder's-satisfaction quotient rather than its ultimate applicability as transportation for our three-member family—the Falco will make an instant move from the asset to the liability column once it's complete. But I'm far from worrying about that. Between us, I don't think Wilkinson has any idea of how to get it out of the barn.— *Susan Crandell*

Dead on Arrival: Porsche PFM

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signed by NASA. Wherever possible, the elegantly simple design was discarded in favor of adding features and 'engineering solutions' to problems that should have been avoided altogether. It appears that Porsche simply threw engineers at the project the way our government throws money at social ills.

The engine is geared, thus it has a propeller transmission while our Lycoming has none. There is a torsional damper and a cooling fan, while we have none. There are two cam shafts, while we only have one. There are two alternators, and the engine requires two complete electrical systems, including two batteries. There are six cylinders, and everyone knows you can produce a reliable 200 hp aero engine with 4 cylinders. The extra cylinders bring with them a full complement of additional components—valves, guides, pistons, piston pins, spark plugs, crankshaft bearings—and a less rigid crankshaft. The number of moving parts in the engine is difficult to comprehend. Maybe it's because Porsche already *had* a lot of parts.

The second cardinal rule of aircraft design is light weight. Again, the Porsche is a dismal failure. The engine is very heavy, but the engine weight alone is not the true measure. It's the weight of the entire installation that counts. In the case of the Mooney Porsche, the airplane is about *two hundred pounds* heavier than the Mooney 201. It would have been more, but Mooney removed the inner wheel well doors and used an exotic $14,000 Hartzell Kevlar prop to keep the weight down. Without such extreme measures, the weight increase would probably have been close to 250 lbs. (For comparision, our IO-320-B1A weighs 285 lbs.)

It is very important that an aircraft engine be compact and have a low frontal area. The Porsche fails again. Although it's a small displacement engine, the Porsche PFM is substantially bigger than the 200 hp Lycoming. Porsche seems to have no comprehension of this requirement. An induction system looms over the top, the gear transmission takes up a large amount of space in the front, overhead cams widen the engine beyond everyone's firewall width, and the exhaust system is right where the nose gear goes on most airplanes.

To be a success, an engine must be very reliable. At this point, it's too early to call. Porsche and Mooney speak very highly of the engine, but it gets 217 hp out of 193 cubic inches of displacement. That is the equivalent of getting 530 hp out of our 320-cubic-inch Lycoming. This power is attained through a higher compression ratio and higher engine speeds. History shows that geared engines, high compression ratios, high rpms, and complex mechanical design are not the hallmarks of 'bulletproof' engines.

The one absolutely horrible design feature is the fan cooling system. While it only uses a couple of horsepower to drive the fan, it totally destroys the exit velocity of the air. In normal installations, the engine acts as a radiator and the heat expansion of the air drives it out of the engine compartment. This thrust keeps the cooling drag to a minimum. One engineer estimates that the Porsche Mooney is losing 12-15 knots from the fan cooling.

Porsche claims that the engine is efficient, but this is statistical mumbo-jumbo. At best economy, Mooney's Lycoming and Continental engines are more efficient, but brake specific fuel consumption does not account for the extra drag of the cooling system and the bulbous cowling. These steal power from the installation. The faster the airplane, the greater the net power loss. The extra weight steals from the payload. What counts is moving payload efficiently. Watch the CAFE 400 for a true measure of the engine's efficiency.

It is now well understood that listening to customers and understanding their needs, desires and problems is of critical importance to the success of any commercial venture. In a Kendo blow of incompetence, arrogance and stupidity, Porsche did not talk to the major light aircraft companies before designing the engine. It's often been said that Porsche has forgotten more about engine design than aviation engine manufacturers ever knew. Porsche mistook a compliment for the truth and never bothered to find out the few things that Lycoming and Continental *did* know.

Had they asked, they would never have designed the silly three-point engine mounting system with one of the pickup points on top of the propeller gearbox. This makes for an awkward and complex engine mount, which on most singles also picks up the nose gear. It is difficult enough to design a tubular steel structure which will reach over the engine, but you must also provide some means of removing the engine. In the Mooney installation, the engine is trapped between the nose gear and the complex tubular structure which reaches out over the engine. You tilt the engine nose down and then take it straight forward. You can't use a block-and-tackle hoist, but Porsche has a special gizmo designed for that purpose.

Had they asked, Porsche would also have discovered the addiction to four engine mounting points—one more than you need to fly. If you lose one of the Porsche mounts, the engine is going to go bye-bye. (I have a friend who actually broke two of the four mounts on his Baron. On that airplane, the mounts are all on the bottom, so the engine continued to sit on the totally-cracked-through castings.)

The hope of a cheap engine made from stock automotive parts is dashed too. My engine friends have always said that by the time you do all of the things to an automotive engine to make it a good aircraft engine, you have redesigned the entire engine. Porsche apparently found the same thing. The engine has virtually no parts which are interchangeable with the automotive engine on which the design is based.

The engine has—techno-weenies squeal with delight!—electronic ignition. That's now a standard feature on all automobiles. By using solid state devices, all of the moving parts can be replaced with electronic devices. Once you have little silicon chips powering things, it's a natural to put the timing under the control of a microprocessor. These devices are remarkably small, and you often see photos of Oshkosh fruitcakes holding one of the tiny boxes next to a pair of magnetos while they decry the lack of progress in aviation.

Gosh, no one will deny that solid state ignition is a better system, but no one has yet offered such a system as a reliable stand-alone package like a magneto. They all depend on the aircraft electrical system. In the case of the Porsche, dual electronic ignition requires two complete electrical systems. The extra alternator, battery, associated wires, switches, connectors and circuit breakers weigh much more than a pair of magnetos.

Magnetos may be old fashioned, but they are reliable devices. While the electronic ignition would be more reliable, the electrical systems will introduce a host of new failure modes for the ignition system. A better solution is the electronic magneto, in which the breakers are replaced by solid state devices. These work well,

and Bendix has been making them for oil pipeline pump motors for years. They aren't offered on aircraft because of the expense of certification and because the breakers in magnetos have been acceptably reliable.

The single power lever system is one of the more appealing features of the engine design. It greatly simplifies the operation of the engine since it changes the propeller speed with the throttle setting, and the mixture is set automatically. On the high-revving Porsche, the vibration level is very low, so this scheme works. You wouldn't want such as system on a Lycoming since you would prefer to set the prop for the lowest vibration level. Remember that the most efficient power setting for an engine depends on much more than the characteristics of the engine. The speed of the airplane, the drag characteristics, the propeller design are also part of the equation. If you want to cruise at maximum efficiency, you must be able to set the manifold pressure and propeller rpm yourself.

We seem to be suckers for "new technology". I have just returned from Disney World and Epcot Center, where there were many dilettante displays of new technologies which promise a "better life"—and yet a glance at the crowd would indicate that a more sensible diet and a bit of exercise would be of greater benefit.

I don't believe in sudden leaps in technology for the sake of technology. It just is not reasonable to adopt all of this new technology and expect it to work without trouble—after all, by redesigning virtually every part, Porsche has already stated that the automotive engine would not work. Take the Malibu engine as an example. It turns out that the problems that recently grounded the fleet were caused by a tiny change in the piston pin design and a change in thread lube on one step of the engine assembly.

The piston pins were of a new brass-plugged type whereas the old reliable pins had a solid aluminum center—who knows what the reason for the design change was, but this tiny improvement *wasn't*. For years Continental engines have been assembled with ordinary mineral oil as thread lube on the crankcase through-bolts, but they changed to castor oil because it doesn't show up in a black-light check for oil leakage. Unfortunately, the poor extreme-pressure lubrication of this oil caused the bolts to reach the final torque before the proper bearing pinch was attained. So an entire fleet of airplanes was grounded because of a slight change in the design of the piston pin and an oil change in one tiny step in the engine assembly.

This is a good time to take quiet notice that in competition aerobatics—aviation's most brutal test of technology—the hottest airplane today is the German Walter Extra 230. Although titanium, carbon fiber, Kevlar, and all of the exotic materials have been used in other airplanes, today's best is a modified Stephen's Acro—fabric covered steel tubing for the fuselage and wire-braced tail group, a wood wing and a Lycoming up front. The 230 hp engine is simply a ported-and-polished 200 hp IO-360. The propeller is a lightweight wooden Muhlbauer constant speed prop—less efficient than our Hartzell but the light weight is easier on the crankshaft in violent aerobatics.

Road & Track:

"The new chairman has a reputation as a no-nonsense finance man and may trim unprofitable projects, such as the 911-based aircraft engine.

"At this time, Porsche may do well to remember the words of the company's founder: 'Shoemaker, stick to your last'."

But the most important feature of the Extra 230 is the design of the wing. Construction of the wing is Polish pine—similar to spruce but denser and stronger—and covered with birch plywood. (The wing, but the way, is built by Sportavia at a price of $25,000 each). The symmetrical airfoil is a slightly squashed radius which extends back to about 10% of the chord and then extends in a perfectly straight line to the trailing edge, which is 15mm thick. The ailerons are about 60% of the wing span and in cross-section are essentially the same as the Falco's rudder, except that they are about 3mm higher than the surface of the wing, and the leading edge stands proud by about 10mm at full aileron deflection. The rate of roll is 320° per second. The airfoil was developed during WWII by the Luftwaffe in one of their zany experiments. It was never used on an airplane, since it's a lousy airfoil for anything but competition acrobatics and had escaped the notice of almost everyone.

The Malibu engine and the Extra 230 illustrate the more natural progression of progress—small incremental changes taken one at a time. If you want some technology, go buy a loran.

But what do you get with Porsche's Dilettante's Delight? Just take a cold, hard look at the Mooney Porsche. Even though the airplane has more power than the Mooney 201, it is five knots slower at altitude. The difference is apparently in the extra cooling drag of the fan-cooling system and bulbous cowling. And for this decrease in performance, you pay $100,000 more than a 201. (Mooney should have known better, but part of the high cost is attributable to the frightfully expensive engine instruments—for an engine that virtually renders instrumentation obsolete.) The plane is $12,000 more than the turbocharged, intercooled Mooney 252. This is progress? The plane simply demonstrates what wonderful aircraft the 201 and 252 are.

The Porsche engine, by the way, was originally rated at 200 hp, but the rated power was increased to 217 hp only after the dismal performance of the Mooney was evident. The essential problem with the Porsche engine, one expert told me, is that Porsche never understood the interface and interaction of engine, propeller and airframe. They thought delivering power to the propeller was enough.

The Porsche aero engine is the brainchild of Porsche chairman Peter Schutz, a dynamic man whose decision-making process might be described as "bold" or "reckless" depending on your point of view. Porsche has sunk a lot of money in this engine—I've heard estimates from 8 to 20 million—and it is now obvious that Porsche will never recoup its investment. As a result, Peter Schutz has recently been... well, the official version is that he resigned. My guess is that the project will be abandoned within the

year. Oh well, Porsche can at least be grateful it didn't put its money on the Starship!

Does this mean that aviation has lost its one best hope for new engine technology? Will we forever be condemned to yesterday's technology? Of course not. It was a Camelot engine, yet another example of a large corporation exercising monumental stupidity. Porsche learns most of what it knows of engine design from the millions it spends on racing. Porsche's public relations people can easily paint the picture that the aero engine was just such an experience and the lessons learned will be valuable for the company. Everyone will believe it, and they'll all go home happy.

It is a beautiful, well-made engine that does have its place. It's the great engine for a blimp or a SeaBee amphibian. And Roy Lopresti could stick a Porsche and a nose wheel on a Swift and never have to move the main landing gear!

What could Porsche have done instead? For the Falco, they could start with our four-cylinder Lycoming and then simplify and add lightness. Replace the heavy Prestolite starter with a lighter B&K starter—or better yet combine the alternator and starter into one device like they do on jets. Install a couple of lightweight electronic magnetos. Make the prop governor an integral part of the accessory case. (Since the engine already has an oil pump, why do you have to pump it again to operate the prop?) Optimize the combustion chamber. Balance the engine. Flow-balance the induction. Redesign the engine mounting system so the Lord mounts fit into rings in the engine, not in the engine mount. Put the oil pressure port in a more convenient location.

Our new Porsche IO-320-B1A would then put out 185 hp and weigh 15 to 20 lbs less. The engine would cost $25,000 to $30,000 new and almost all of us would say it was too expensive and go back to buying overhauled Lycomings, but airframe manufacturers would buy them—if anyone was still buying their airplanes. Porsche could have done these things. Instead it produced a heavy, complex, bulky engine which does not produce the power or efficiency to justify breaking all the cardinal rules of aircraft design. It's a pity.

My views are obviously in the minority. Sherman McCoy has a Porsche Mooney and loves it. Teterboro-to-Southampton is an easy commute of 30 minutes.

—Alfred Scott

Devoe on de Falco

continued from first page

The design was unsophisticated, it weighed 4-500 pounds more than the Falco, and there was no builder support program or parts source. But it was built of wood, and you know what can be trusted. I sent for the Falco brochure because a month earlier—forgive me, Alfred—I had looked at a Glasair under construction. The builder's shop was bereft of sawdust. No smell of freshly cut spruce. And after sitting upright as a USAF pilot for twenty-five years I was not about to go that prone.

My old friend of over forty years was not here to tell me I was crazy to start building *another* airplane, so with the somewhat bemused approval of my adult children—it will keep Dad off the streets—I sent for the Falco plans.

I visited Jim DeAngelo whose Falco, sleek and smooth in a coat of grey primer, was pretty well hatched. Over lunch we talked about airplanes and life. We solved few of life's problems, but as we talked, the relative complexity of the design seemed to fade as Jim talked about Frati's beautiful bird in that little restaurant in central Connecticut. And it was springtime. Time to begin, again.

My "beginnings" were not all that disciplined. Until May of 1987, my progress was a bit erratic. The tail feathers were built and skinned, and the ribs were finished off, cut and varnished. Much time was spent with a young woman who is now my wife, and more time yet refurbishing my home for the lady I married in late 1985. When spring arrived Gwen and I bought a new Airstream trailer and saw most of the Maritime Provinces in the course of 1986. I finally had to remind her that I had to get back to work on "our transportation problem" which, in our house, translates into work on the Falco.

I had not been entirely idle on the wind machine, but most of the time seemed to deal with the future aspects of construction—thoughts and musings about instruments, avionics and final paint. I sent Jim DeAngelo a few pictures of my activities, and he said "Your problem is that your shop is too neat. Remember, John, if you ain't got it, you can't paint it."

Remembering that there wasn't all that much runway left I retired from my teaching job of the last dozen years partly because I was no longer enjoying it—I'd sooner deal with an engine fire at 22,000 feet than a smart-mouthed kid—and partly because I wanted to take some time to smell the roses, or in my case, Sitka sawdust. I ordered the spar.

Most of us have little familiarity with P/N 205-1 until The Big Box arrives; then we come to know it intimately. We cruise from one end to the other and back around the other side, sharpened pencil in hand, making all those soon-to-be-precious marks upon it. It cost $180.00 to ship it to coastal New Hampshire, and I took a moment to admire my good judgement to have the monster delivered in the spring. A foot or more of snow on the ground would have complicated things, for once the crate was on the

lawn it seemed best to open it and get the contents into the 'hangar' one piece at a time. The price becomes somewhat less awesome once the box is, not without difficulty, opened. I once again admired the handiwork of Francis Dahlman.

The main spar itself weighs only 55 pounds, and Gwen could carry it to the factory. Not many sixteen-wheelers have been up the country road on which I live, and there was no way the driver was going to be able to back in the driveway. Anxious to preclude its delivery merely onto the asphalt behind his truck, I tried to elicit some help from the driver.

Did he know what was in the crate? "I just haul the stuff, buddy, I don't ask questions. Here, you can use this dolly." Gwen said plaintively, "Gee, I didn't imagine an airplane wing was *that* long!"

That did it. The driver not only helped, but spent another half hour poking around the shop—"I didn't know people built airplanes"—looking at tail feathers and wing ribs. I purchased the fuselage frames and the longeron kit for the same delivery, and these came in two additional crates. All were very well packed, and the contents were a joy to behold. If Aerolite glue has any gap-filling qualities, you could never prove it by anything in the boxes I opened. I was tempted to varnish frame No. 1 and hang it on the living room wall.

I worked on the main wing spar and the other spars and the flaps/aileron. I ordered the fuselage metal kit. I ordered the controls kit. I ordered the landing gear kit. I ordered the flaps kit. In due course they all arrived, and the vertical jig went up. All

wing ribs were glued in place, the landing gear has been painted and installed. The aileron controls are in. The leading edge is on and most of the antennae are in place. Some float sanding has begun. Can skinning the wing be far behind?

Some observations: For the most part, follow the manual. It provides a sequence that, in my experience, rarely lets you down. Some of the approaches were not to my liking, but again the *sequence* outlined will save you frustration. I found that the jig required a few modifications to accommodate, among other things, the tube at the bottom of the control stick. I found a 2-3mm sag in the main wing spar when it rested on the station 1 and 14 templates—brace it until you have the leading edge ribs and the leading edge strip glued in place. The hole size called out for the coax cable is a bit tight.

An additional string indicating the location of the wing rib chord line should be stretched at the forward face of the aft wing spar. The one located at the trailing edge of the flaps will help with the flaps/aileron, but it is not of that much use when installing the wing ribs. The angled cut for the aft wing spar where it meets the frame can be neatly done on a radial arm saw (see page 16). Some of the wing ribs take a bit more sanding than you might suppose to get the chord line where it belongs. A lot of the bolts provided are longer than need be. Jim DeAngelo is very helpful, as are Bob Bready, Steve Wilkinson, Alfred Scott and Brenda Avery.

There are no longer *pieces* of an airplane scattered about my 'hangar' to amuse my friends and relatives. The 24x34-foot area is nearly filled with Falco. To the most-answered question, yes, I believe it *will* go out the 8' 3" door. Even my non-pilot, recent-MBA-recipient son is impressed and asks, "Dad, if that is the landing gear, where is the one for takeoff located?" So *that* is why the Brits call it the undercarriage!

It has been a productive year. Work will continue in preparaton for skinning, and then I will give some attention to the remaining fuselage frames. I dare not skin in the heated shop, but spring, open doors and moderate humidity are not far away. Then I can take Falco 832 out of its climb and let it assume a position more conducive to sitting in the cockpit and planning the first takeoff—with work in between, Jim!—*John Brooks Devoe*

Goings On at Sequoia Aircraft

Continued from First Page

Not much to report. For the past month or two much of my time has been taken up with a project that is so weird I even surprised myself. Fact is, I can hardly explain how it happened. As you know, I have been working on a computer program for aircraft performance testing. As part of that, I developed an arcane method of high resolution plotting on the printer we use. At some point, it began to dawn on me that it might be something that others might want as well, so I really got to work on it.

I don't have any dreams of millions on this. Mainly, I'm just curious if this thing will have a market. It may turn out that the world will yawn, and if it does it's okay with me—I just did it for myself. The program and its documentation is very nearly finished now, and I hope to get back to work on Falco stuff shortly.

For those of you who might be interested in knowing about this arcania, the software is called Desktop Plotter. It is a compiled Turbo Pascal unit that makes it very easy to plot in PostScript on the Apple Laserwriter. You can also create an Adobe Illustrator document, so the image is easily edited with that program. It is a very specialized tool for programmers and companies that need to create repetitive charts that can be used in electronic publishing.

I have had a lot of complaints about slow delivery of instruments from Instruments and Flight Research. Some of the instruments are shipped without any appreciable delay, while others never seem to arrive. Pawel Kwiecinski spent more on telephone calls with IFR than he did on his artificial horizon, and even though he ordered his instruments a year ago, IFR has not delivered an accelerometer or encoding altimeter. Jim Martin reports a similar series of telephone calls, each of which brought a promise which wasn't kept. Shortly after flying his Falco, Karl Hansen's horizon stopped working. There was a loose piece rattling in the case so it was returned for warranty repair. It took at least three months before Karl even got an acknowledgement and a repair estimate of $180.00. After letters and phone calls we finally got it straightened out and the instrument was repaired and shipped a couple of months later. As a reason for the delay, they emit the Battle Cry of Inept Management: "You can't get good help."

I've been frustrated with IFR for a long time. In looking back at my correspondence, I note that I have been pleading with them to stock instruments and give our builders prompt delivery. They are nice people, but they seem fairly well set in their ways. Although I have repeatedly asked them to give me price increases before we mail our builder letter, they always seem to send them in a week after the letter is mailed. In December, virtually as Brenda was stuffing the envelopes with your last builder letter, I received a note from IFR advising of a price increase for the accelerometer—an instrument they haven't delivered in a year, nor which they seem prepared to deliver now.

The sloppiness seems almost deliberate, but that can't be possible since the things they do deliberately, they do not do as well.

From what I can tell, IFR's encoding altimeter is a figment of their imagination. I am removing it from the price list until I hear that they actually have the thing in stock. I have no idea what the story on the accelerometer is. It is made by A.I.D./R.C. Allen and all they have to do is to put a slightly customized dial on it. The other instruments that IFR manufacturers or sells seem to dribble in within three months after your order is placed and have all been fine in terms of quality. Delivery and broken promises on delivery times are the main problems.

I'm reluctant to make a change, but after the December price increase, I decided it was time to look for an alternate instrument supplier. Earlier I had been approached by Croydon Kemp, president of Mitchell Aircraft Instruments of Milwaukee, about supplying our instruments.

While IFR is an instrument manufacturer, Mitchell is a distributor for the largest instrument manufacturers—A.I.D./R.C. Allen, United Instruments, Sigma-Tek, etc.—who only sell through distributors. (Mitchell does manufacture tachometers and clocks.) They have an 800 number for ordering. They make a point to stock a lot of product so that the instrument is shipped on the day the order is received. They base their business on top quality products, top quality repair and prompt service. They charge manufacturer's suggested list prices with no apologies. It is obviously a successful formula because they are a rapidly growing company and are now one of the top 15 instrument shops in the country in terms of sales volume.

By the time you get this, they should have all the dials made up for the Falco instruments. Croydon Kemp is shooting for same day shipment for all Falco instruments by keeping at least one in stock at all times, and in the event they are temporarily sold out, he promises shipment within ten days.

One of the reasons that I was attracted to IFR in the first place was their artificial horizon. This was a design which originated at Aerosonic and was later bought by IFR. It has a big rubber "cushion cone" suspension. I've had one for years in my Falco, and it's taken a lot of abuse. My friend Parke Smith has one in his CAP10, and it has worked well. We've had no trouble with them in the Falcos.

The artificial horizon that Mitchell offers is made by R.C. Allen, and I asked Croydon Kemp to explain the difference between the two. He said that in order to meet the TSO requirements, the rubber had to be so hard that you might as well not have it at all. He also made the point that IFR has always had lower prices than A.I.D./R.C. Allen, United Instruments and Sigma-Tek but that none of the major manufacturers use them, most probably because of the unreliable service. He said his artificial horizon will take the same abuse and that if you do a lot of acrobatics you can expect a slightly shorter life from either instrument, say 1800 hours instead of 2000 hours.

We are listing both a turn and bank and turn coordinator for those of you who have a preference. I prefer the turn and bank with the old needle and ball. The turn coordinator has a horizon-like display which in practice has proved to be confusing. It looks so much like an artificial horizon that pilots regularly misinterpret the instrument, which in a turn tilts the opposite direction from the artificial horizon.

We will continue to list both instrument suppliers on our price list and will leave it to you to choose the supplier you prefer. I would welcome letters reporting on products, service, etc. that you receive from either company for our Mailbox section.

One of our builders asked me the other day if he should install an encoding altimeter or a remote encoder. I asked Croydon Kemp for his recommendation. He said, by all means, you should use a remote encoder. For one thing, the combination of a standard altimeter and remote encoder is cheaper than an encoding antimeter. The maintenance costs are less. You also have two instruments on board, so if your altimeter were to fail in IFR conditions,

you could always get the controller to tell you what your altitude is.

Without any warning, RST has stopped making the antenna kits that they have made for the Falco and some other aircraft. We will start making these kits and hope to have the antenna kits on the shelf in about a month. We will be offering the materials kit only, and frankly I think that's all anyone ever needed in the first place.

I am also removing RST's intercom from the price list. We worked with RST to coordinate the installation of this intercom with our electrical kit. John Rawlings ordered one, built it and now finds it is impossible to integrate into our panel because the design of the intercom has been changed.

We have added the induction scoops and funnel to Kit No. 817-2. These parts have been a real bear for builders to make and I have worked with Joel Shankle to make the tooling. Joel started the job off by fitting things to his airplane and then I finished up by converting those to a finished mold. Even using a mold, they are very labor-intensive parts to make. For those of you installing the Silver Fuelgard, we now have the extra Aeroquip fittings in stock to modify the Lycoming injector-to-spider hose.

I am presently making molds for the main gear doors. Jerry Walker sent me his doors, and I am pulling molds from those. I hope to have those added to the kits in the next several months. I am looking for a guinea-pig to test these on before we make them in quantity.

I hope, at long last, to ship the exhaust port horns to those of you who have the cowlings. Karl Hansen has these installed in his Falco and while we never got a precise number on the speed increase, I do feel they give us some speed. I also hope to make a lot of the wing and tail hinge fairings soon. These little parts are simple to make once you have the tooling, and I want to keep the cost down by making all of them at one layup.

Above: Wendell Taylor and Dan Garn have painted their Falco with stripes. It has spent most of the winter on jacks while they work out problems with the induction system. Wendell and Dan are helping Jack Butler finish his SX-300, which they expect will be the first kit-built SX-300 to fly.

In our last builder letter, I listed the various "advanced builder memos" that we have available. I should mention that I have changed "Chapter 45 Engines" to add some information on the injector for the 180 hp IO-360-B1E. The throttle arm on the injector must be reversed to match the setup of the IO-320-B1A. It's all in the revised Chapter 45, so if this applies to you, please request a copy.

We now have three Falco builders who have installed their engine breather lines so they dump into the exhaust pipe. I think Ed Swearingen was the first to do this on the SX-300. The idea is to vaporize any oil rather than let it get on the bottom of the airplane. Like an airshow smoke system, the oil doesn't burn because there is no oxygen in the exhaust. Wendell Taylor and Dan Garn did this on their Falco. John Harns was next and now Pawel Kwiecinski has done it. Pawel welded a three-inch length of 3/4" stainless tubing to the exhaust pipe, at a 35° angle to the tailpipe. With such a short length, I worry about the line burning, but Pawel says it hasn't yet.

I'm cautious about adopting a new idea, particularly when it is in such a critical and delicate area as the engine installation, but this idea intrigues the devil out of me. Since the idea is attributed to Ed Swearingen, I called him to ask if he had any warnings or comments. Funny, he hardly remembered it or exactly what he had done. They have been through three different exhaust systems on the SX-300, and he thinks that the one that people have copied was one in which the breather line entered the exhaust tailpipe and turned downstream and was cut off at the tailpipe end.

This tailpipe was rectangular in cross-section and the end of the breather line was positioned directly in the middle of the tailpipe. Ed said he carried the breather tube all the way back to preclude the exhaust feeding back into the crankcase and that was his only warning. You want to insure that the exhaust does not pressurize the crankcase. That could blow out the crankshaft oil seal. With a constant speed prop, that seal containes pressurized oil, so the engine oil would quickly dump overboard.

(This is what happened to Max Conrad's Picchio at Greenland. Conrad said he always wondered how long a Lycoming would run without oil. He got seven minutes before shutting it down.)

Speaking of Swearingen, they just set two new speed records with the SX-300. By going 313 mph, that is the first time any aircraft has broken 300 mph on 300 hp. That is the equivalent of getting 253 mph out of a 160 hp Falco. Swearingen has discontinued kit sales of the SX-300, which I am sorry to see. Swearingen and Christen are the only other kit manufacturers that I really respect. Although you hear a lot of chatter from Poberezny Inc. about innovation in homebuilding, I've only seen two kit designs that were truly elegant designs, the Starlite and the SX-300.

To me, brilliance in design is simplicity, and the Starlite is a model for all to copy. The SX-300 is elegantly simple too. I am particularly fond of elegantly simple widgets, and we have a lot of them in the Falco. The SX-300 has a number of little design

features that only a nut like me would notice—the induction system and the method of safetying the aileron torque tube are two that come to mind. My first reaction when I saw the plane in 1984 was that they had under-priced the kit, and I think that is the reason homebuilding has lost this class act.

Some of you have asked what I think of the Graflite, the carbon fiber Falco clone. First, I'm not offended. Not at all. What offends me is amateurism in design—doctors, dentists, interior decorators and farmers holding themselves forward as aircraft designers. To design an airplane well requires three things, aeronautical engineering, mechanical engineering and—above all—years of experience in both. Stelio Frati, Dave Thurston, Ed Swearingen, John Thorpe, and Chris Heinz have what it takes to design an airplane. We are producing a generation of specialized engineers who aren't capable of overall aircraft design. Committee-designed aircraft are the norm, and the pathetic "Venture" demonstrates that some engineers actually need the restraints of a committee to design a good airplane.

Over the years, the design that Frati laid down in 1955 has been developed and emulated by him and others into a surprising number of variations: the four-place Nibbio and Picchio, the SF.260 (normally aspirated, turbo-charged and turboprop), the Brazilian Esqualo and Neiva T-25. Now we have a carbon-fiber variant produced, I'm delighted to see, by two young engineers who know their materials.

Carbon fiber is superior to almost all other materials. With it you can build a structure that is lighter than wood, aluminum, steel tubing and all of the normal structural materials. It is expensive, but even if you are not bothered by that, it is a difficult material to use and the fabrication of carbon fiber parts should only be done in a qualified shop. I had always wondered what a carbon fiber Falco would be like.

The approach that Steve Kotula and Brian Lundy took is essentially correct. Because the airplane would be lighter in carbon fiber, the wing and tail areas should be reduced slightly—which they did. The integral wing tanks gives them a slight weight savings. The winglets are silly, and I'll wager them a round of beers at the Road Kill Inn that the airplane will be faster if they sawed the things off. The silly boys spent their money on a Hoffmann prop and now regret it.

Their empty weight of 989 lbs would be 1,024 lbs with a Hartzell prop. The Graflite has a no-frills panel, no upholstery and a fanatically light paint job. This is similar to Buzz Glade's Falco which weighed 1,065 lbs with a fixed pitch prop. Now with a constant-speed prop installed, Buzz has a steel-hubbed counterweighted prop which is 25 lbs heavier than our 50 lb aluminum-hubbed prop. Although Buzz picked up about 100 lbs with the change, with our prop it would have been 75. That would put his empty weight at 1,140 lbs. Figured that way, the weight savings of building from carbon fiber is about 120 lbs.

The performance is not dramatically different from our Falcos. At 165 knots indicated at 6,500 feet, it cruises well and that makes it faster than some Falcos and slower than others. The climb is slightly better than our Falcos.

Somehow in the shape of things, they lost the Falco's flair—someone called it "the Falco with pimples." It is still a good-looking airplane and better than most 'glass planes. I can never understand why so many fiberglass planes are so un-lovely when they have the capability to put everything to shame. The Glasair actually has a squared-off firewall that betrays its KR2 heritage. Only the Lancair and the European motorgliders have managed to construct an appealing shape.

You can forget about seeing the Graflite as a kit. It takes serious money to set up in production, and this is not an easy business. But, Steve Kotula and Brian Lundy, you are always welcome at the Road Kill Inn. And I'm glad it was you that built a carbon fiber Falco and not me.

I have two design features I want to add to the Falco, both of which I hope to do in the next six months. One is very minor, the other not. The minor modification is an alternate vacuum system for those of you who are going to fly hard IFR. The system that I want to use will use manifold pressure at the alternate vacuum source. It is a fairly simple system to design and install. As I see it, the best thing to do is to drill and tap the 45° elbow of the induction system. This is the casting that bolts to the back of the sump and to which the injector is bolted. There is a special valve that you will need, but other than that, it's mainly hoses and fittings. Since we don't have to bother with the expense of certification like everyone else, it should be much less expensive than the ones sold for production aircraft. I would guess the cost will be between $100.00 and $150.00. I would appreciate hearing from any builder who is interested in this.

The more complicated modification is the addition of some really long range tanks. We have a number of builders who have expressed interest in trans-atlantic tanks. I have thought about this for a long time and have reached the conclusion that the best way to accomplish this would be to install underwing tanks at wing station 4. My plan is to design almost-flush fittings, similar to our jack pad fittings, that will go on the bottom of the wing. The tanks would bolt to these, and we would install quick-disconnect fittings on the fuel lines. If it is done right, it should add no more than a couple of pounds to the basic weight of the plane.

Most of the time, the tanks would not be installed, so the only noticable difference would be the little holes on the bottom of the wing. For a long trip, you would bolt the tanks onto the wing and go. I think the best way to handle the fuel system is to use transfer pumps and pump fuel into the front tank. Anyway, that's the way I see it now. Let me know if you are interested in such a system.

—Alfred Scott

Carbon Fiber

Grumman did it with composites—high-tech blends of plastic and tiny carbon strands, a kind of ultimate fiberglass. But how composites behave under pressure and over time is still a bit of a mystery. Aluminum absorbs stresses: it bends, groans, cracks, and finally fails if pushed too far. Composite structures are imperturbable until their ultimate limit is reached—then they fail totally. "Composites don't have the ability to absorb energy, take load gradually and gracefully the way sheet metal does," says David Thurston, a consulting aeronautical engineer who has worked with composites as well as aluminum.

"We had a tiny delamination inside a wheel well," Rogers Smith recalls. "You could hardly see it—just a thin line. Grumman said, 'Aw we'll just shoot some glue in there,' but some university expert looked at it and said, 'This could be disastrous.' I wondered, was I suddenly going to be flying around in a cloud of filaments? We were down for a month deciding how to fix it, because this is unfamiliar technology."

From "X-29" by Stephan Wilkinson
April 1988 Air & Space

Construction Notes

"Of the four seat-track sets included with the seats-and-equipment kit that Susan bought me for Christmas—whatta wife!—I was able to mix-and-match two sets (one seat's worth) into free-sliding units. The other two sets were virtually immovable. After spending an hour banging and prying away at one of the lower tracks—the track within which the piece attached to the seat bottom slides—I gave up trying to widen it slightly. They're too tough.

"What did work, however, was a liberal dose of Permatex valve-grinding compound—it's a fairly coarse paste, comes in a tube, available in any good auto-parts store—and slowly working the sliders back and forth until they freed up. The valve-grinding compound cuts the necessary clearance surprisingly quickly if you clamp the bottom track in a vise and grab one of the welded studs of the upper track in Vise-Grip pliers (suitably cushioned with inserts of plywood, naturally, to avoid ruining the threads) and work the track back and forth in increasing increments."—*Steve Wilkinson*

Steve Wilkinson and I have been trading notes on the method of skinning the fuselage side panels. These 2.5mm plywood skins have a slight compound bend that never ceases to frighten builders, but it is also remarkable that most builders don't remember much about putting the skins on. The production Falcos were built by wetting the plywood pieces and clamping them in place. After the plywood was dry, the now-curved plywood pieces were glued in place in the normal fashion.

The problem with this method was that the bend in the plywood was rarely smooth. You could see each fuselage frame very clearly. Larry Black developed a bending fixture that a number of builders have used with success. It is a lattice-work of wood and the plywood is held in place with a frame with canvas stapled over it. (We published a drawing of this years ago in a builder letter and can send you a copy if you are interested.)

A lot of builders have simply installed the skins dry. This seems to be the easiest and fastest method. Jim DeAngelo said that these skins were actually the easiest skins to install on the entire airplane. When they are installed dry, the plywood takes a beautiful, seamless bend. You apply the glue and then staple the devil out of it, working your way from the center out so that you don't create a large "bubble" to work out.

All of the builders who had installed the skins dry, however, did so before the wing was skinned. This made it easy to staple the plywood to the bottom side longeron. When you build the wing according to our construction manual, the wing is already skinned when you skin the fuselage. The one complication is that it is difficult to shoot staples into the bottom side longeron.

The safe approach is to prebend the skin with Larry Black's jig and then glue it in place. If you want to install the skin dry, the approach would be exactly the same as all of the other builders, except that you can't get that staple gun in there onto the bottom side longeron. You can, however, lay the staple gun on its side and shoot in a lot of "one legged" staples, where one leg is completely buried and the other is not. There's really nothing wrong with that at all, although it looks messy. Steve did it a slightly different way, but let me put him on the phone to explain it.

"Taking to heart your advice that wetting and prebending those panels in place leads to possible concavity of the inter-frame areas as the panels dry—and refusing to waste time making the fussy wood-and-canvas jig for preshaping the panels in a compound-curved male/female mold—I therefore am installing the panels dry and muscling them into place, as other builder successfully have. What I'm finding, however, is that it's easier to glue each panel in three steps—possible two—rather than trying to glue, clamp and staple everything all at once. When I do the latter, I find that by the time I reach the end of fastening one area, another has consequently begun to bulge and lift, or I end up with 95 percent of everything neatly glued and stapled, but I have a bulge or crimp that's simply too big to get rid of.

"So I first glue each panel to the bottom side longeron and let it dry, then glue the panel to the vertical frame(s) that runs up its center, then finally glue the remaining longeron/frame joints. (I'm using 50"x50" plywood sheets, so I can only span three or four frames per panel.)

"This way, the panel doesn't squirm and buckle uncontrollably enough to put me into my usual oh-God-the-glue's-setting-and-I-just-stapled-my-thumb condition. Steps one and two could doubtless be combined by anybody slightly more competent than I am.

"I also think that temporarily clamping the entire upper part of the panel wherever possible along the dry, unglued joints before gluing the bottom-side-longeron joint helps to establish a "set" to the plywood that begins to create the compound curve that the panel will ultimately accept. In other words, that first glued joint is actually slightly bowed under the resultant pressure rather than the straight joint it would be if you just glued the plywood to the longeron in the simple curve it would most easily accept.

"Finally, it's important to start at the bottom joint and work up; that way, glue and hardener can be applied from the top downward during steps two and three, running down into the decreasing-gap areas that would otherwise be inaccessible if you were stuffing glue in from below the fuselage."—*Steve Wilkinson*

Steve is using Aerolite, so if you are using a slower-setting glue you could do all of this at once. I do believe that not clamping the whole sheet into its final position when you glue to the bottom side longeron is an invitation to disaster. The only thing that I see about this technique that is questionable is the very slight possiblity that there would be small areas of unglued wood where the glue was not completely stuffed down to meet the previous joint. I think that would be more of a theoretical concern than a practical one. Lordy, if the Falco had that small a margin of safety, we'd better all go home.

Elsewhere in this builder letter there's an article by John Devoe on his experiences. In case you miss it, he makes a point that bears repeating. John found that when he was installing the aft wing ribs to the spar, the alignment string at the trailing edge of the ailerons and flaps was inconvenient to use. Others have used it, but you have to clamp a straightedge to the rib. John simply used an extra alignment string at the forward face of the aft wing spar. He located the string by using the 200mm offset line.

John also found that it was much easier to install the wires in the plastic tubing conduit by sprinkling them first with talcum powder. Thus lubricated, they pushed through the tubing very easily.

The Environmental Protection Agency is cracking down hard on metal plating companies, particularly on cadmium plating. You may be told by your platers that the EPA has required them to use zinc plating now in its place. Don't believe it. What is happening is that the EPA is requiring the plating companies to

clean the liquids that they discharge. In the case of cadmium plating, this requires million-dollar equipment. The result is that only the largest companies are still in the cadmium plating business.

(In Fort Worth, the EPA actually poured concrete into the drains of one of the largest platers because of the presence of cadmium plating effluent in the sewer system. It turned out to be the fault of another smaller company in the next block, so the EPA has to dig it all out.)

You really do have to use cadmium plating. The reason is that cadmium is very close to aluminum on the electrolytic scale. Zinc would just cause problems. I should explain that zinc chromate primer uses the properties of the electrolytic scale to a different purpose. Zinc has a corrosion death-wish, so when corrosion is going to occur, it happens to zinc first, and not to the other metals that are around. Zinc protects by volunteering to die. That's why we use it in paint and why boat owners attach pieces of zinc to their hulls.

John Kerosotas ran into an unusual problem by following our construction manual to the letter. Somewhere in the manual, I say to glue the phenolic upper elevator stop to the top of the stabilizer spar (see Sheet D3). Apparently everyone else has waited until later to do this. John found that when he did this, the phenolic block became trapped in the slot in the main fin spar, and he couldn't get the stabilizer out of the fin assembly. He is able to move things around enough to glue things in place, so it's not a complete disaster, but this little block keys things in place in a way that never occurred to me. I guess you'd better wait to install the elevator stop until you glue the stabilizer in place.

Terry Smith is installing a 180 hp IO-360-B1E. Apparently on this engine, the fuel pump to injector hose assembly is a -6 size, and Terry already had a 7" Aeroquip 303 hose assembly made up in the -4 size. If you need one, please contact Terry at 415 River Street, Forty Fort, PA 18704. Telephone: (717) 288-6288 home or 287-4912 office. The hose is fine for an IO-320-B1A, and it cost Terry $35.00.

Now that everyone is using the aluminum inserts for the screws for access panels, we have a new problem—how to insure that the screws don't rattle out. My suggestion is to dip the threads of the screws in silicone rubber compound before you install them. The rubber hardens enough to keep the screws flying in the same formation with your plane, but you can still get them out with ease. My friend Parke Smith had nothing but trouble with the spinner screws on his CAP10 until he tried silicone rubber.

—Alfred Scott

Ben Burgoyne: "Last year I couldn't even spell Falco Builder. Now I are one."

Tool Talk

The other day I went to a woodworking show at our local convention center. A young friend later asked me if I had seen the Zyliss vise demonstation. He had been blown away with the demo and was hot to buy one.

If you have ever seen one of the demonstrations, you can understand the appeal. For five minutes you watch the man with the microphone do more things with the Swiss-made vise than you can imagine. One year at Oshkosh, the Zyliss vise man had the booth across the way from us, and I thought I had the whole razzle-dazzle routine memorized. I bought one and proudly brought my new find home.

I don't think I've every bought a more worthless tool, and for reasons I don't understand, I really don't hold it against anyone. I keep thinking that surely, this must be my fault. Every time I reach for the gizmo, I can't remember how that fast-fingered man did it. I literally saw the man clamp one of every conceivable shape and length, but I can never seem to be able to do any of these things. My brother fell prey to the display and bought me one from Christmas. Now I have two, but this one is a "Profi-King Plus" with gadgets that turn your electric hand drill into a drill press, and disk sander. The other day, a friend stopped by to help glue up an extension table for my table saw. As always, the table was just an inch too wide for all of my clamps, so I reached for my trusty Zyliss and a two-by-four to make a bar clamp.

For the next ten minutes, I found myself engaged in a silly exercise which have made Woody Allen envious. We twisted and turned the vise every which way until we finally got it to hold on to one corner. Just long enough for me to grab a hammer and some nails.

I have since made a careful study of the manual for the Zyliss vice. It seems to me that if you have a work table of precisely the right thickness, it might make a reasonable lightweight vise for holding a piece of wood, but otherwise I don't see much use for the thing. A big cast-iron vise is a much better vise, and if you need a clamp, buy one. There are a hundred clamps which are more useful than this.

Also at the show I picked up a set of "cool blocks" for my bandsaw. I'd seen them advertised in woodworking catalogues. Mainly I was just curious what the fuss was all about.

My Rockwell bandsaw has four steel guide blocks which keep the saw blade in position. The blocks are held in place with set screws. The "cool blocks" are replacements for the steel guides, and they are made of graphite impregnated phenolic. The benefits of the blocks are supposed to be that you can adjust the guides closer to the blades so there will be less wobble to the blades and so the blades will run cooler.

Actually, I had never noticed the temperature of my blades, so I can't tell you if they do any good. After spending $10.00 on these blocks, I have felt compelled to follow the precise instructions of bringing the blocks down snug on a piece of paper against the blade. This way I have very little side-to-side wobble in the blade, but I can't really say if it's any better than before.

If you find yourself laying awake at night wondering if you have been running your bandsaw blades at too high a temperature, I think these little blocks are just the thing for you. But otherwise, I'd say hold on to your money.—*Alfred Scott*

Brenda's Corner

Now that spring has arrived, can Oshkosh be far behind? It's not too early to start making your plans. We already have had requests for half the rooms we have reserved at the Paper Valley Hotel in Appleton. We have reservations from July 27 to August 5, and we could probably get additional rooms after July 31 if we need them. If you would like to stay there let me know as soon as possible.

If you are coming to Oshkosh you really must plan to attend the Falco builder dinner on August 2. You may find this hard to believe, but there are Falco builders who come to Oshkosh for one reason — the Falco builder dinner. Where else could you be entertained by Frank Strickler, Tony Bingelis, Luciano Nustrini and of course Alfred Scott all for the price of a prime rib dinner. Families and friends are always welcome and if you need transportation from Oshkosh to Appleton and back, we'll even try to arrange a ride for you. When you consider all of this, what excuse could you possibly have for not coming and joining in an evening of Falcos, friendship and fun?

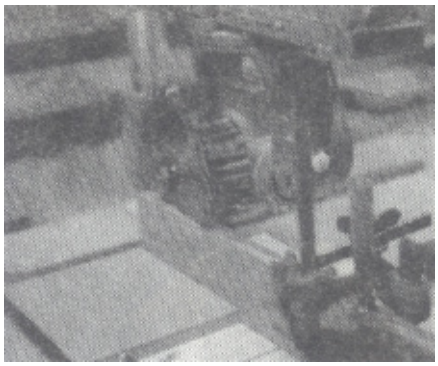
Recently we made a large shipment of kits to a Falco builder in Italy. When the shipment arrived in Milan there was a package missing, plus a couple of the boxes had been damaged and pieces were missing. The builder immediately wrote to us concerning his problem.

We will always do anything possible to help you with any problem you may have with a shipment received from us, but the *first* thing you should do is contact the carrier, or in this case the forwarding agent and report the damaged boxes and the missing pieces. When a shipment leaves our door we no longer have control over it, and it is up to you to initiate the action for a claim.

Also, you should always let us know if you require special packaging to your order. Normally when we are sending a large shipment by sea, we have a wooden crate made. In this case, the shipment was handled by a forwarding agent, so we sent everything to them in cardboard boxes to be packed in a container. That did not protect the boxes from a wild and crazy forklift operator.

Since we get mail from all over the world, we have always made it a practice to save the stamps. In the past we would give them to the tenants in the apartment building Alfred owned and then in the last couple of years, Sara and Kakee decided to try out stamp collecting. They have both said, "Thanks, but no thanks" to any future donations so I have a bag full of stamps. If any of you are interested drop me a line. I will send them out on a first-come first-serve basis.

I will leave you with a question I was asked on the telephone this week. "Is the Falco a helicopter or a hydroplane?"— *Brenda Avery*



Sawdust

• Despite instructions to destroy all material for the advertisement featuring Richard Brown, the advertising director at *Flying* did it again and ran the ad in the April issue. Our apologies to everyone.

• Luciano Nustrini called the other day and said he plans to come to Oshkosh this year. Heinz Wallerkowski is still planning to fly his Falco from Germany in early July and will attend the Oshkosh convention. Thanks to ferry tanks, his Falco has a 2050 nm range.

• Bill Nattress, who for five years has worked with Neville Langrick on their Falco, suffered a stroke and heart attack recently and is presently confined to a wheelchair and unable to speak. Neville hopes to fly the plane soon and that Bill will be well enough to see the first flight. Best wishes to Bill for a speedy recovery.

• Virginia's 1988 do-nothing legislature declared the Urbanna Oyster Festival to be the official Oyster Festival of the State of Virginia. The measure to declare the Chesapeake Deadrise the state boat failed. No mention has been made of the Great Oyster Fly-In—we're offended.

• You can now reach Sequoia Aircraft on CompuServe at 71121,2204 although we don't check our electronic mailbox very frequently and still prefer letters on paper.

• Declaring that 1988 is the Year of the Screw-Off, Karl and Shirley Hansen are descending on the East coast by camper in April. Watch for Karl or Frank Strickler to show up at Sun 'N Fun with the red and white Coke machine.

• Buzz Glade, who is now flying with a 160 hp engine and constant speed propeller, says "You should tell everyone to forget about using a fixed-pitch propeller on the Falco. It's a whole new airplane with the constant speed prop."

• Watch the July issue of *Town and Country* for the latest in children's fashions modeled by Sara Scott, Katherine Scott and friends.

• Look for Irek Mikolajczyk to fly Pawel Kwiecinski's Falco in the airshow circuit starting in July. By mistake, Irek recently pulled +7.5 and –4 Gs—easy boys, the Falco can be broken. Pawel is thinking of having a second Falco built in Poland by Adam Slodowy and then flying the plane across the Atlantic. Flap seals and hinge fairings are now installed and increased the top speed by 5 knots indicated. Full throttle gets 170 knots indicated, but wheel well doors and nose gear doors are not yet installed.

• Since Sequoia Aircraft has been offering the Falco, *Sport Aviation* has put the Glasair on the cover at least three times, but never the Falco. By strange twist of fate, the "Graflite", a Falco *clone*, made the latest cover. Draw your own conclusions.

• Moved. He couldn't stand retirement in northern Idaho, so Larry Black is now back in San Jose and managing the company he used to own. Larry's nearly completed Falco was once again trailered to the new location. He got lots of comments on the way, most of them from people who reported seeing a VariEze who thought "it looked just like a P-51."

• Movin'—Now with full gear doors installed, Jim DeAngelo decided to see "what'll she do" and clocked his Falco at 190 knots indicated at 1500 feet, 29"/2600 at 2° C.

• Nigel Moll reports the turboprop 320 hp SF.260TP indicates 190 knots at 94 percent power at 7,000 feet. See the April issue of *Flying*. The range is about two hours, thanks to the FAA's silly 61-knot stall speed limit.

• Col. Fernando Tellez reports that the Chilean Air Force Falco now has 50 hours and is being flown with some frequency. The Falco was grounded for a long time with a cracked exhaust.

Mailbox

You're pretty hard on my airplane. I think next time I'll pick a pilot that watches his airspeed more carefully—remember, you were flying left seat.

Honestly, I enjoyed Farmerville more than Oshkosh. Guess I'm just a country boy at heart. What beautiful friendship, food, flying and fun. Real Southern Hospitality. Maybe we'll get to your "Oyster Bite" one of these years. It's sure not much farther than Farmerville, Lousiana. It sounds like the same general type of bash they had in Farmerville, except of course in Farmerville they only split balloons, not oysters, with their props. What did you say the "red line" is? All I was doing was staying on Gary's wing.

Karl Hansen
Roseville, California

Can't believe it's been over a year already since I received my plans. After reading all the letters I feel like I know the family. This will be the year I start on my "Pasta Pursuit" no matter what.

Joel Bottero
Almeda, California

I've looked over the drawing and construction manual for a few days now, and I can't begin to tell you how excited I am with what you have done. As an engineer, I work with blueprints every day, and I've seen construction drawings for quite a few aircraft, but the Falco set is superior in quality to any set I've ever seen before. I was going to wait until spring to begin building, but after seeing the plans, there's no way I can wait that long.

We all know how hard, and time-consuming, it is to go the extra mile. Judging from this package that's exactly what you've done. And though I'm sure you've heard it before, it bears repeating. Your efforts really are appreciated.

Chris Knowlton
Southern Pines, North Carolina

My introduction to home construction has been the main spar, having purchased the fuselage and tail from an earlier constructor. Well, the task isn't proving to be that difficult, it really is a state of mind. Time spent gazing at the plans is time well spent, especially if you can talk it through with a competent friend.

My greatest ally has been the local technical college where they are delighted to have granddad build his Falco. Mind you, I have more space at home and certainly no other pupils, but the facilities at the college are just wonderful, their bench circular saw, sanding machine, etc. I started at a local joinery shop where my friend cut four 3x12's into 10x100's. After careful selection, I transfered this to the college. I spent the first days making a scarfing box for the saw so that every joint is perfect. I next made some very simple jigs to lay the timber ends for gluing and clamping. Mind you, I have rather monopolised their workshop. My unworked material is in their store, drying lengths are over cupboards and finished twenty-seven-foot laminations are stored in the rafters!

Next, to the sheet metal workshop where I've just started cutting out the petrol tanks. It's all so surprising the interest and cooperation, and I've discussed the undercarriage with some of the Top Brass, and they are quite keen to 'have-a-go' alongside me. There are colleges up and down the country, certainly in the U.K with millions of pounds worth of machinery often standing idle. So fellas get cracking, see what you can come up with and please write to me.

Syd Clifford
Whitley,Wilts, England

At this time, all empennage ribs and spars have been constructed and the rudder is assembled except for the laminated tip bows and required hardware. Progress has slowed up considerably, due in part to my inexperience and a strong desire to avoid making expensive sawdust. I have not encountered any major problems, although there were a few moments. As construction becomes less obvious, progress slows.

I would like to take this opportunity to endorse the excellent job done by Jean Peters on cutting the wood kits for the Falco. All component spruce is labeled and even the trailing-edge strips are cut to the required taper.

To date the most difficult job has been bending the gluing strips for the vertical fin spars and in particular, P/N 410-12 which represents an almost impossible curve. I had to redo the main vertical fin spar because I cut the taper on one of the spar booms on the wrong face—one of the hazards of working late into the night. Mr. Peters had replacement spruce here within days and the booms had been cut, although the spar has not been reassembled as yet.

Dan Martinelli
Montrose, B.C.,Canada

With an hour to spare in Manhattan the other day, I stopped by a bookstore that specializes in aviation books—nice thing about The Big City, we have not one but two such stores (R. Gordon and Skybooks). Wellsir, there was a new softcover entitled something like Airplane Building for the First-Time Homebuilder. Certainly targeted me nicely. Not only that, it was about wooden-airplane homebuilding, since the author claims to have built—or was building—a Corsair WAR replica.

Picked it up and flipped to the chapter on gluing, which always interests me—I still find it hard to accept airplanes put together with sticky stuff—and got some fascinating insights. The author compared three kinds of glue—casein, resorcinol and epoxy, as I remember—and in a variety of categories and properties rated them "good, better and best," in that order, quoting a variety of Forest Products Laboratory research.

Taking his own advice, he of course employed epoxy—a remarkable glue called "Aerolite," according to him. He spoke authoritatively of the wonders of "Aerolite epoxy," though he did warn that the stuff "takes the skin off your hands as though it were gloves." Remarkable. Sorry I can't be any more specific about the title, but the bozo's name or any further pearls before swine, but I put the book down as though it were going to take the skin off my hands as though it were gloves. It's published by Tab Books, of Summit, Pennsylvania, though—that I will remember, in case they ever publish anything else.

Stephan Wilkinson
Cornwall-on-Hudson, New York

No further than last update but will resume building soon. Builders Letter excellent! Always a delight to find in the post. Keep up the good work.

S. C. Hendricks
Standerton, South Africa

I was very sorry that I could not make it to Meppershall during your England trip and did not meet you. However I was glad to be able to leave I-ROVI there so that all four Falcos in the U.K. were together, and enjoyed reading your comments in the "September Letter."

I have been competing in the season's air races this year but unfortunately Falcos seem to scare the handicappers and despite averaging 197 mph on a circuit and quite often being the fastest aircraft, my best placing was seventh. Having just read the "December Letter" I feel that I must read your "S-P-E-E-D" memo and would also appreciate some information on your nose gear doors hopefully to get

averages above 200 mph.

Brian McBride
Belfast, Ireland

Building is getting under way again after two years break due to pressures of work. I do wish that you would not keep inserting imperial dimensions into metric drawings. I see that you still not not use credit cards. It would cost £5($9) extra just to get a $15 bank draft—enclosed $15.00 cash.

J. B. Mowforth
Goole, East Yorkshire
England

We do in fact accept Visa and Mastercard. Please always include the expiration date. We apologize for the aggravation over the "checks on U.S. banks" thing but banks charge $15.00 to cash an overseas check.—*Alfred Scott*

At last I'm going to start construction of my Falco. I'm waiting on the tail group, and I'm doing the fuel tanks. Yesterday I thought that probably I'm the youngest Falco builder. Actually I'm 21 years old, and I hope I will finish it when I will still be the youngest builder. In order to go on with the construction of my Falco, I'm going to sell my Jaguar.

Andrea Luca Tremolada
Milan, Italy

The really depressing thing about this is that when I first contacted Stelio Frati about the Falco, Andrea Tremolada was ten years old.—Alfred Scott

As my construction advances, I feel more and more that there is no way back in this Falco project. The construction is becoming more and more interesting. It is great to see the plane taking shape. It is exciting to see the first flight not so far, and after all, I cannot throw so much money (I have spend nearly $18,000.00) through the window.

As I work together with a guy that does not read or speak in English, I have to translate all of the Construction Manual. In chapter 23, you frequently use the word "oleo" (page 23-26), and I am somewhat confused about this word. Could you help me with this?

Marcelo Bellodi
Jaboticabal, Brazil

I think the word "oleo" comes from "air-oil." It refers to the air-oil shock absorbers for the main gear and the nose gear. Whenever you see the word, just change it to "air-oil shock absorber".

—*Alfred Scott*

Progress on the restoration of my Aeromere Falco has been slowed by the demand for my time in the restoration of customer's airplanes. Had hoped to have the Falco done by Summer '88 so my daughter could use it to get her Commercial/Instrument rating. Seeing our lack of progress, I bought a Bonanza to use until the F.8L is finished. This winter should see more evening hours for the Falco. Keep 'em flyin'.

Gar Williams
Naperville, Illinois

I have not lost interest in the Falco. It is still a prime interest in my life, but it will not be built speedily... to say the least. The truck wreck put me behind by eight months. I truly expect to be underway again within a year.

Glynn Acree
Roswell, Georgia

Glynn Acree nearly died in a freak hydroplaning accident last year.—*Alfred Scott*

I flew my CAP10 out to Palm Springs from Detroit. 15.4 hours to do so and had a ball doing it. I now have 52 hours log time in this thing, with about 9 hours of hole boring (aerobatics). My comment regarding the King HSI—my panel is all electric as are all CAP10s—I was assured by the avionics people that the HSI wouldn't tumble and would not be harmed by negative Gs. I have had up to +4.5 and –2.5 Gs on the meter so far. Several times. Certainly not Pitts type Gs, but as much as my old bod wants. The negatives were actually the result of a botched hammerhead resulting in an inverted tail slide (fun—gulp!) and a couple of sloppy half rolls from a loop. The Northstar loran is functioned thru the HSI, and the HSI is slaved. It has all worked perfectly to this date.

I have a 'money-back' guarantee on the AIM horizon and the HSI if they are damaged by negative Gs, so at least for me, this panel is superb.

I shall be returning to Detroit next week and should resume some long-delayed cutting and gluing on the Falco. The CAP is enormous fun to fly, and but further wets my appetite for the time when I may perform in a vehicle of my own handiwork.

I flew the HSI and internal CDI of the Northstar every moment. I did not use the VOR system. Absolutely amazing instrument, that loran. I lost the signal 23 miles east of Albuquerque and regained it 18 miles west of same. So much for the gap! But, you must use the top side antenna, not a bottom installation, to get this kind of performance. My CAP has the loran antenna installed in the fin leading edge, instead of the comms. I have two short whip antennas on the turtledeck for the King 155 and 197. Everything works super as you see it, with range more than ample on all avionics.

Bill Wink
Palm Springs, Detroit
and near golf balls

We have had a very busy last six months of 1987. We had a little girl born to us on July 14. Jim was hired in August by Delta Airlines and started training with them in September. He was officially out of the Air Force in October. After his training, we moved to Metaire, Lousiana, just outside of New Orleans in November. We hope to get based in Salt Lake City in early spring.

Jim is very happy working with Delta. It is a very good company. We feel luck to have been hired by them.

Right now the Falco is still in Rapid City. We plan to move it to Salt Lake in early summer. We hope to do a lot more flying in it.

Sharon, Jim, Jeremy
and Sara Shaw
Metairie, Lousiana

Slight change of plans. Find the Shaws at 1515 Lexington Drive, Sandy, UT 84092 after March 3. When Dave Bowen flies, and it should be soon, that will make three Falcos in Salt Lake City.—*Alfred Scott*

Work on #982 is coming along slow but steady. I have the elevator ready to cover and the stabilizer ready for assembly. All the tail spars are complete. The rudder and fin ribs will probably come along faster than the elevator and stabilizer ribs. The learning curve is working. My jigs are getting less complicated but still maintain blueprint requirements. Plywood for tail skins is on order from Wicks Aircraft. All considered, I'm happy with the progress made in 1987 and so far in 1988.

Gougeon Brother's products are fantastic—easy to work with, no objectionable smell—sands well. Just ventilate, cover your skin and keep it off your clothes.

Charles Cross, Jr.
Walled Lake, Michigan

She who must be obeyed has locked me in the bedroom till it's been completed—the bedroom, that is! Falco soon!

Bob Dell
Melton Mowbray
England

(Censored)—Alfred Scott