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Dear Falco Builders:

In our last letter, we mentioned that Aerolite and epoxy glues had a compatibility problem. This information was passed to us by Chiltern Sailplanes in England, who have been repairing a damaged production Falco. One of our builders, John Oliver, took particular interest in this comment as he had used both glues in his Falco. John contacted me, and we discussed the extent of my knowledge of the problem, which was extremely limited at that time. I contacted a number of companies, including Ciba-Geigy which makes Aerolite and Chem-Tech which makes T-88 epoxy. John is a retired duPont engineer, and his expertise was put to good use in this matter.

As you probably know, Aerolite is a urea-formaldehyde adhesive which is activated by a formic acid hardener. Most epoxies are subject to attack by acids, and special formulations are available which offer high resistance to acids. Chem-Tech's T-88 advertises good resistance to weak organic acids. It should also be understood that the catalyst in T-88 is alkaline, and the presence of any acid will keep the epoxy from hardening.

John Oliver had already run into this problem. Where the lower side longerons butt into the forward face of frame No. 9, John glued on a small corner block with Aerolite. After this was done, he glued on the longeron with T-88. The T-88 did not harden. This is to be expected, although at the time John did not know what was causing the problem.

This is the first part of the Aerolite/epoxy problem: the acid prevents the epoxy from hardening. John reports that a drop of Aerolite hardener in a freshly-made T-88 mix prevented the curing of the T-88. In a second test, an Aerolite joint was made and shortly thereafter an adjacent T-88 joint was made on the same spruce pieces. The T-88 joint failed to cure properly in 24 hours. John concludes that the greatest likelihood of producing unsatisfactory T-88 joints would occur when one or more of the following conditions pertain: (1) the T-88 joint is made after an Aerolite joint was completed on the same pieces of wood, (2) excess Aerolite hardener was used, and (3) the time lapse between making the Aerolite and T-88 joints was short. There seem to be no hard and fast rules on how close you can push these things. John ran series of tests using various combinations of resorcinol, Aerolite and T-88, simulating different types of joints. In only one test did the T-88 joint appear to be slightly weakened, but the joint was still acceptable.

The second aspect of this problem is the acid resistance of the epoxy. Chiltern reported that their experience had been largely with epoxy and fiberglass laminations, such as fairings. They reported that if you put the Aerolite hardener on a piece of fiberglass, the acid would completely eat away the resin in a matter of a few minutes. John Oliver dropped pieces of cured T-88 in liquid Aerolite hardener. In 24 hours, the T-88 softened and smaller pieces of T-88 disappeared completely. These conditions are much more severe than those which you would actually encounter in the construction of your airplane.

John did a series of tests in which he tried to duplicate the conditions used in his construction. While these are not scientifically conducted tests, they are, in John's and my opinion, fairly indicative of the relative joint strength. The types of failure were re-assuring. John's report is quite lengthy, and I will be happy to make a copy of it for any of you who request one, but I do not see the need to reproduce it here.

For your purposes, I think a few basic rules are appropriate. First, bear in mind the two ways that the Aerolite hardener can affect the epoxy joint: (1) preventing its cure and (2) attacking the epoxy. Any excess acid hardener will dissipate in time, both by soaking into the wood and by evaporation. The time between Aerolite and epoxy joints is important, you are sure to run into problems if the time is very short, and if the time is very long, the problems appear to be negligible -- but a conservative approach would be to avoid such joints. Also, remember that the relative position of one joint to another is important, for example, it is much more difficult for the acid to migrate through the multiple layers of phenolic glue in plywood than it is to migrate through a thin piece of spruce.

While John was running these tests, his Falco building came to a temporary halt. I mentioned to John that I had been trying to figure out a formula for the curved shape of the Falco's fuselage frames. I had been working on this for a few years. I never missed an opportunity to discuss the matter with engineers and mathematicians. Their usual reaction was "that looks easy", then after much thought "it's not as easy as it looks", and my would-be helper would disappear from the scene. John Oliver got together with his son, and they came up with a lengthy computer approximation program. While the result of the program was very accurate, it was unweildly to use. I took a chance and called Jim Petty, a Falco builder and engineer. To my surprise, Jim said he had worked it out last year! Even though we refer to the fuselage shape as an "ellipse", the shape is not a true ellipse. The formulas and a program for a Hewlett-Packard HP-11C programmable calculator are shown at the end of this builder letter. If you wish, you may use this method for plotting the shapes of the fuselage frames. For the drawings that I do here, I find this method far easier, and it will allow me to do things much quicker in the future. I'd be willing to venture a guess that this formula would have saved me 6 months work if I had known of it back in 1979. For me, the formula is a quantum jump.

Bill Wink asked that I sketch up my ideas for a wing assembly jig. I went to work on the problem and found that it was easier to work

things out more precisely. I have enclosed some of these ideas at the end of the builder letter. Please understand that this jig is a "quick and dirty" design and can certainly use some refinement. I would appreciate any suggestions for its improvement. Of the builders who have seen it, many have expressed surprise that the templates for wing stations No. 1 and 14 are not the shape of the airfoil. I do not think that this is necessary nor desirable, but it is important that you draw the "offset chord line" on the template so that you can always find the position of the chord line of the rib. I would also suggest that the bolt holes be drilled for the center fuselage frame support before cutting the slots for the fuselage frames. After the slots are cut, the plywood may weaken or warp due to the cutting, and if the bolt holes are drilled before, they will correct any warpage.

John Harns reported that he didn't like the thought of the sight of the threads and nuts for the eight bolts which hold the instrument panel in place, so he replaced the single-bolt channel-nuts with nut-plates and screws, painting the screw heads. When I was designing the installation, I spent a lot of time worrying about the appearance of the thing. I concluded that it was more important to have the bolts installed as we show them. You have to imagine installing and removing the instrument panel. Even with the radios removed, the instrument panel is reasonably heavy. If you have eight protruding studs to hang the panel on, it is much easier than trying to hold everything in place as you fumble for screws. It was my plan to make some black plastic cap-nuts which would screw on to the threads and cover up the threads, nut and washer. After I put it all together for the display panel, I was quite surprised at the appearance. If you paint the panel and install it in your Falco, you will be bothered by the sight of the things, but once you install all of the switches, circuit breakers, mic and phone jacks, you will realise that there is a lot of shiny metal on the instrument panel -- and the support bolts are no longer noticed. During the entire Oshkosh show, no one noticed or commented on the presence of the nuts, and I made a point of showing them to a lot of people. Even when people had the things pointed out to them, they dismissed them as nothing to worry about. So what I am saying is, don't worry about the appearance of the studs showing -- it's important to have them that way -- and if in the end you don't like the looks of them, make up some black plastic cap-nuts to cover them.

John Harns is now installing the electrical system for his Falco and reports that even his electrical-engineer-friends are amazed. Initially, John was a little taken a-back at the cost of the electrical kit. After trading a couple of letters, I got him to talk to Dave Aronson. Now that John has the kit, his attitude has changed considerably in his view of the thing. Incidently, you may recall that I had earlier mentioned that the design of the system took about 3000 hours. John thinks I didn't keep a good count and must have taken longer. I got a call the other day from an electrical engineer who is thinking of building a Falco. It just so happens that he was responsible for the entire electrical system in one of the new model Pontiacs. Even though it is just another car in a long series made by General Motors, you may be interested to know that the Pontiac's electrical system took about 2000 hours of design work.

I have been doing some thinking about the assembly of the control surfaces. The earliest builders built the control surfaces and then skinned them on the airplane. The control surfaces would tend to twist when the leading edge skins were glued on. This was a real problem with the ailerons and flaps, which have to line up with each other. I would guess that the first 8 or 10 sets of control surfaces were built this way and all were twisted. Later on, we suggested that builders skin the control surfaces in a jig which holds the assembly rigidly in place. Builders who have used this method have not encountered the problem of twisted control surfaces.

I have been mentally tinkering with a new method of building the control surfaces. I have talked to a number of builders about this method and all have thought that the method has merit. In fact, Joel Shankle likes the method so much that he is thinking of building a second set of ailerons just to see how it works! Here's what you do. First, install the hinges on the spars. Then install the leading edge ribs and leading edge capstrip. Next, sand the ribs, capstrips and spar to the final airfoil contour. At this point, you should trial fit (but not install) the trailing edge ribs. Now, put the spar down on a bench and skin the leading edge, from the aft face of the spar all the way around the leading edge to the aft face of the spar. Next, scarf the plywood skin for the trailing edge skins. You have the choice of making localized scarfs, or making the scarf continous from one end of the spar to the other. The continous scarf would require that you waste a lot of plywood for the trailing edge, but might be the easier method. Then, glue on the trailing edge ribs and trailing edge strip. The leading edge will be torsionally rigid once it is skinned. It should not have any twist in it, but even if there is a slight twist, you can sand the trailing edge ribs to compensate for this. In the case of the ailerons and flaps, you can mount them on the wing, clamp the spar in place so that it will not pivot on the hinge bolts, and support the trailing edge strip (which should be continous from wing station 1 to 14) with a long straight board or piece of metal. Once immobilized in this manner, the upper and lower trailing edge skins can be skinned, and you should be able to hold things straight during the skinning process.

As drawn, the heavier leading edge skin is shown extending back slightly aft of the aft face of the spars. I doubt that this is necessary for strength, but I intend to ask Mr. Frati about this shortly.

A couple of years ago, I was in California and saw Hal Engel's Falco project. I was quite surprised at the way in which he was assembling the control surfaces. What he did was to first glue the trailing edge ribs to the trailing edge strip. He did this with the leading edge ribs as well. When he went to glue the ribs to the spar, he glued the entire ribs-and-capstrip assembly at once. Hal mentioned that this was standard procedure with model airplane construction. I could never figure out why it was a good idea, and Hal said he couldn't see why you would do it any other way. I can't see any harm in the idea, and prehaps it has some merit. I can see that it might come in handy when you assemble the control surfaces as I have just outlined as it would allow for an easy job of trial-fitting the ribs in place.

With the elevators, the procedure would be to install the hinges, then install the two ellipse-like ribs on the trailing edge, at the center section. Skin this area, then install the leading edge ribs and proceed as with the other control surfaces.

I'd like to discuss epoxy glues and moisture protection of wood. Epoxy glues soften with heat, and they vary considerably from one epoxy to another. The epoxies used for bonding metal pieces together are special formulations designed for high service temperatures. Typically, if you want an epoxy that will retain its strength to 300°F, you would be provided with a formulation with a number of catalysts. The catalysts "kick off" at various temperatures. As a rule of thumb, the cure temperatures of such epoxies are 50°F above the service temperature, so the 300°F assembly would require curing at 350°F. Lately, a number of epoxies have been formulated for "post cure". With these epoxies, the glue is cured at room temperature and after it is cured, it is placed in an oven at high temperatures, thereby increasing the service temperature of the adhesive. These glues are a recent development and are not yet widely available. The epoxies normally used with wood are "room temperature cure" epoxies. Earlier builders may recall that when Bellanca was certifying the Eagle Ag-plane, they found that the specifications of most epoxies did not prove out under tests that they ran. There <u>are</u> reputable companies, and I am inclined to believe the literature of 3M. As you may know, adhesives and coatings are the principal business of 3M, and they show the shear strength of their room temperature cure epoxies at 300 to 500 psi at 180°F. Most room temperature cure epoxies must be cured at 70°F or above, just like resorcinol. There are a number of low temperature cure epoxies and T-88 is one. The normal expectation would be that the service temperatures of such a glue would be lower than that of a room temperature cure epoxy. The literature for T-88 lists the shear strength as 1000 psi at 180°F. The tests that Bellanca ran found that T-88 began to lose strength at about 125°F, had only 25% of its room temperature strength at 150°F and had a shear strength of 40 psi at 175°F. Bellanca eventually settled on H. B. Fuller FE-004 which would cure at room temperature and would retain 75% of its room temperature strength at 175°F.

The tests that Bellanca ran also revealed the startling discovery that epoxies were not durable in the presence of moisture. The mode of failure can be observed but to date is not completely understood. Epoxies are, of course, impervious to moisture, but wood joints made with epoxies are not. The best theory is that the wood swells and pulls itself apart. Most waterproof glues have some moisture in them, so they tend to raise the grain, giving you a joint with some internal stresses. Subsequent immersion in water does not affect these glues in the same way that it does the epoxies. The maple test blocks would pop apart of their own accord after only a couple of hours in water (the FAA tests required that the joints show no appreciable loss of strength after a 48 hour water-soak). The epoxies do not contain any moisture, so there are no internal stresses in the glue line. My thought is that the grain of the wood is raised when the wood is placed in the water, forcing the two pieces of wood apart. This makes sense, but the failure was in the glue line, and the wood under the glue was

found to be relatively dry. Another theory has it that one side of the block swells more than the inside, causing the wood block to "cup". Nobody knows why the epoxy joints fail, but it is now well-established that the problem is severe only with the very dense species and at very high moisture content (M.C.). All engineering data on aircraft wood is based on 15% M.C., which is higher than you will normally see, even in very hot humid climates. The epoxy problem only gets severe above 80% M.C. So, with spruce-to-spruce and spruce-to-birch plywood joints, I have no concern about the performance of epoxies in our aircraft.

My principal concerns about epoxies are about their performance at high temperatures. You might be surprised how hot things can get from the effects of sunlight. Some time ago, a soaring enthusiast did an experiment which he reported in the September 1975 issue of Soaring. He made a number of insulated foam boxes, painted each a different color, and placed a thermometer in each. The temperatures were recorded for each color paint. The temperature in the box went up with the ambient air temperature. Here are the peak surface temperatures recorded at an ambient temperature of 100°F: white 150°F, yellow and pink 158°F, light blue and aluminum 164°F, purple and blue 171°F, light green 178°F, orange and tan 185°F, red and green 205°F, brown 218°F and black 223°F. If you consider these temperatures and compare them to the temperature performance of epoxies, you should have some inkling as to why I have been cautious about recommending the use of epoxies. The Bellanca tests indicated a shear strength of T-88 of about 625 psi at 150° F, while spruce has a shear strength of 990 psi parallel to the grain.

Epoxies are also toxic. One Falco builder, a professional woodworker, told me that he attended a seminar where he heard a talk given by a chemical engineer from Dow Chemical. Regardless of what epoxy you use, the base resin is made by Dow, Reichold, Shell or Ciba-Giegy. There are lots of companies making the catalysts used with these resins but you will always be using the resins from one of these four companies, and the resins are relatively similar. This man from Dow said that every time you work with an epoxy, without regard as to who made it, you will be killing nerve cells in your body. Now you have billions of the things in your brain alone, but you should be aware of this little tidbit. If you work with epoxies without taking adequate precautions (protecting your hands and providing adequate ventilation so you don't breath the stuff) you will eventually become sensitized. There is no way to predict when this will happen, but it can be very sudden. People report that one day they were working with epoxy without any effect and the next day were hospitalized with third degree burns from contact with the glue. Tony Bingelis is mildly sensitized and reports that unmentionable parts start to itch when he uses epoxy. He is quite lucky. A. D. Spurlock, a Falco builder in Georgia, has become so sensitized to epoxy that he has to put on a thing like a space suit with a hose supplying air to the suit. That's dedication to epoxy! I recently heard from a potential Falco builder in Nashville whose father built a composite airplane. His father became sensitized and in addition to the usual burns, all of his hair fell out and never grew back. Some people have gotten permanent skin disorders similar to psoriasis and a similar condition on the inside of their lungs.

All this said, there are still many good things to say about epoxy glues. With the exception of Aerolite, they are the easiest glues that you could use. Like Aerolite, they have gap-filling capabilities and can provide for a good glue joint even when your work it unbelievably sloppy. It may be that epoxies are the best glues for some builders.

We are very fortunate to have a genuine expert on epoxies and fiberglass as a Falco builder. Jed Harrell has worked with fiberglass for over thirty years, formulating resins, selling resins and manufacturing parts for industry. I asked Jed what he thought of my comments on wood vs composites in our latest Falco Product Letter, and he said he agreed with the comments completely. Jed said that he would be reluctant to use any epoxy below 65° F, regardless of the claims of the manufacturer. He has used some T-88 and doesn't care for its lack of strength at higher temperatures. He has tried H. B. Fuller FE004 and doesn't care for the viscosity of the glue. It is relatively thick and difficult to spread and get a thin glue line. He is presently working with a formulation that has better temperature characterists but this is a special formulation which involves two catalysts, and he doesn't want to recommend this for homebuilders. Jed agrees completely that you have to be very wary of claims of people in the epoxy business and run your own tests. Jed's main concern about epoxies is the lack of strength at higher temperatures, but neither Jed nor I can cite a single example of a problem with a homebuilt airplane built of T-88 or any other epoxy. Jed plans to get some Penacolite resorcinol and try it.

In our last builders letter, I took a few licks at fiberglass, and I have a few more to get in. I read an article on the America's Cup race recently. One of the sailboats was not performing as expected so they pulled the boat from the water. On examination they found that the fiberglass hull had been pulled 18 inches out of shape by the tension of the stays. My brother has a Palmer Johnson "New York Forty". The sailboat is made of fiberglass, and they adjust the tension on the stays everytime they sail; in fact, the stays are hydraulic on his boat to make life easier on the captain of the boat with a flexible hull. A friend of mine sails on a recently-built WEST system wood sailboat. He said that they set the tension of the stays last June and have not had to make any adjustments since. One of our latest Falco builders, Mark Millbank, builds custom world class racing sailboats. They use only wood and are able to get a much lighter and stiffer structure than they would with fiberglass.

The reason for the revival of wood in the building of boats is entirely due to epoxy glues. The WEST System has been largely responsible for this. This system uses epoxy to glue all parts together and then the outside and inside of the boat are saturated and coated with a layer of epoxy. Wood boats were largely replaced by fiberglass boats for only one reason -- maintenance. With the new epoxy and wood boats, the maintenance problems have dissappeared.

Now, boats live in a different environment. The temperature problems we might encounter are not a problem for boats, which are always sitting in water. Wood boats have far more severe problems with moisture protection, and epoxy gives the boats the protection they need.

I suspect that we will come to see wood aircraft construction in a new light as more developments are made with epoxies and wood boats. In my view, the temperature problem with epoxy is just a problem waiting for a solution, if it is not already solved today. More importantly, the moisture protection offered by epoxies and polyurethanes may change the way we think about moisture protection. There may come a time when the use of a fabric covering over plywood and drain holes are no longer necessary.

To properly understand the principal of moisture protection of wood, you should understand that water vapor in the atmosphere and liquid water are two completely different things. If you fill a balloon with air, it will slowly deflate so that after a few days it is quite limp. The air in the balloon has passed through the rubber skin of the balloon. If you fill the same balloon with water, it will stay in and will not pass through the skin of the balloon. The same is true of the coating that you put on wood. A few layers of spar varnish will make a wood bowl completely leak-free and water can stand in the bowl for a few years without increasing the moisture content of the wood. On the other hand, the wood in the bowl will be constantly changing with changes in the relative humidity.

A few years ago the U.S. Forest Products Laboratory did a study on the moisture-excluding effectiveness of various coatings. In this test, blocks of Ponderosa Pine sapwood were initially conditioned at 30% relative humidity at 80°F, coated with the specified paint and then exposed to 90% relative humidity at 80°F. If the coating prevented any change in the moisture content of wood it was given a score of 100 for 100% effectiveness. The report's table is two pages and covers many variables, but I'll trim it down to size here for the effectiveness after 14 days of exposure.

Paraffin wax dip	95	Latex wall paint	
Clear shellac		one coat	0
one coat	3	two coats	0
two coats	20	three coats	0
three coats	42	Aluminum pigmented varnish	
Polyurethane varnish		one coat	41
(one component/oil modified)		two coats	77
one coat	2	three coats	84
two coats	23	Pigmented shellac	
three coats	44	one coat	44
Spar varnish		two coats	65
one coat	0	three coats	73
two coats	15	Epoxy paint (2 part)	
three coats	30	one coat	40
Nitrocellulose lacquer		two coats	78
one coat	1	three coats	83
two coats	8	Polyurethane paint (2 part)	
three coats	19	one coat	41
		two coats	61
		three coats	70

We know from all this is that there is no such thing as a coating that is totally effective at keeping out moisture vapor in the air. We know from experience that epoxy and polyurethane finishes are much more durable than other coatings. Spar varnish, shellac and paints tend to dry out and crack with age. From what is generally known today, it can be expected at a good film of epoxy or polyurethane will form a completely waterproof barrier for longer than most of us will live.

The ability of the coating to slow down the water vapor is important only from the standpoint of the expansion and contraction of the wood. All of you know that wood expands as it picks up moisture and contracts as it dries out. No matter what you do to your Falco, the wood will be forever changing its moisture content. This will cause the wing to change its shape very slightly. With the polyurethane and epoxy coatings you should have an exceptionally stable structure, and I doubt that you would ever notice any change in the wing's smoothness.

In addition to the coating you put on the wood, you should also consider the special problem of protecting the wood under fittings. Whenever there is rot in a wood aircraft, it is nearly always under a fitting. The reason is that the small gap between the wood and the fitting can trap water. If the wood is adequately protected, this does no harm. If the wood is not well protected or if the varnish develops a crack, the water will work its way into the wood.

There are many things that you can put under fittings. Many builders just bed the fitting down in the coating that they are using on the wood. Since the coating hardens (at least around the edges), it will be subject to cracking and the fitting will be effectively glued in place. This may not be convenient, particularily if you ever want to remove the fitting. Ideally, the fitting should be bedded down in a sealant that will not harden. I have a number of candidates to suggest.

The first thing that comes to everyone's mind is silicone rubber compound. This is an excellent sealant, and it remains flexible. The stuff is also a fairly good adhesive so if you ever want to remove the fitting, it would require some effort. There is one other factor to consider, and that is the compatibility problems of silicone and paint. If there is any silicone on the surface you are to paint, you will have a problem, as anyone who has refinished furniture or painted a car can attest. The problem is usually caused by the use of silicone waxes and polishes, and the surface must be carefully cleaned. There are a number of additives for paint ("fish-eye eliminators") which are designed to alleviate the problem. I've been told by one builder that using silicone rubber compound on an airplane or car prior to painting can create some problem. According to the reports, just the fumes of the sealant are enough to deposit small amounts of silicone on the surface. I don't know if this is really true or not. Since there are other materials which offer the same kind of moisture protection and without the unwanted adhesion, I would stay away from silicone rubber compound for this purpose.

There is a material known as zinc chromate paste. This is similar to the zinc chromate primer that is used on metal parts but this

paste does not harden. This material is commonly used between lap joints of seaplane floats to seal and prevent corrosion. It is made by H. B. Fuller and sold in paint stores as "Fullers Compound" and by Randolph as their No. 801 Seam Paste which is sold by Aircraft Spruce and Specialty and many others.

Permatex Form-A-Gasket No. 2 hardens to a pliable film and is suitable for semi-permanent assemblies. Permatex Aviation Form-A-Gasket No. 3 is a non-hardening sealant and would be an excellent candidate for this purpose.

3M makes a long list of sealants. No. 612 Scotch-Seal industrial sealant is a non-hardening, non-shrinkage putty that remains permanently plastic. It is unaffected by age, weathering, water, fuel, oil and many other chemicals and conditions. The sealant is a heavy black putty of polysulfide rubber. It does not contain any solvents, which would be important in sealing the windshield (remember, solvents can cause crazing in acrylics). Cleanup is with No. 3 Scotch-grip solvent, which is a ketone. I suspect that MEK might also work. While this sealant is a good choice in terms of its specifications, the principal problem is that the sealant is a very stiff paste, about like chewing gum.

3M's No. 1202-T Weatherban Sealant Tape is a tape version of No. 612 sealant, but with a scrim cloth in the middle. This might be a good choice for the windshield, and in fact it is the standard material used on automobile windshields. I would suggest a thickness of 1/32" or 1/16" and a width of 1/2" or 3/4".

Our local 3M representative recommends No. 5200 Scotch-Seal Marine Bedding Sealant as the best choice. This is a moisture-cure urethane rubber (available in tan, mahogany or white) with no solvents. Applied with a caulking gun, it cures to form a rubbery, extremely strong, waterproof seal. It is non-shrinking and offers exceptional resistance to weathering. It is used in the manufacture, maintenance and repair of wooden boats. Non-shrinking, it has good adhesion to wood. This last property is the only thing that bothers me. This stuff is a more powerful adhesive than silicone rubber compound. This might be the best choice for such things as around the edge of the firewall.

Other 3M sealants have aromatic solvents which might soften the coating on the wood. You might try one of the following No. 101 Weatherban Sealant (a polysulfide sealant with 98% solids, i.e. relatively little solvent), No. 202 Weatherban Sealant (a synthetic elastomer with 76% solids) or No. 404 Weatherban Sealant (a synthetic elastomer with 75% solids), all of which are sold in caulking gun tubes. For the name of a distributor near you, write Adhesives, Coatings and Sealers Division/3M, 223-6NE 3M Center, St. Paul, Minnesota 55144.

Bear in mind that the joint between the stainless steel firewall and frame No. 1 is an area that should receive a sealant. This will be subject to the greatest exposure to moisture. The joint between the tail section and the fuselage center section should also be protected. Here you have a choice of covering the seam with a fabric

layer. On the original production Falcos this was not done, and it is much less noticable than you might imagine. I suspect that many of you will want to cover the seam for the sake of appearance. You should consider whether you want to paint your Falco in your shop before you move it to the airport and whether it will require the removal of the tail section. Also, you may at some time want to take the tail section off, and this could involve more work than you might imagine in repainting. The type of paint that you use would make a big difference on the work involved as some, such as polyurethanes, are not readily "touched up".

Having read all of the above, you now know more about the moisture protection of wood than most "experts". The sealing of the wood is a laborious chore, and the efforts made during the production of wood aircraft vary widely. The original production Falcos were varnished on the inside with a brush, but no sealants were used under fittings and no problems have been reported. The CAP-10 aircraft have a spray application of an aluminized paint or varnish with no sealants under fittings, and I have heard of no problems with those aircraft. The Bellanca Viking wing was given a single dip in a thinned Glidden sealer, and no sealants were used under fittings. From the standpoint of production efficiency, this is hard to beat, but it must be clear to all of you that this is not the ultimate in moisture protection. When you consider the large number of Vikings, earlier Bellancas and their Champion line, the incidence of problems has been relatively small. For reasons that can only be attributed to human nature, some things tend to terrify people more than others. We all know that aircraft accidents make bigger headlines than automobile accidents. By the same token, failure of a wing from wood rot seems to strike more terror than failure of a metal wing due to corrosion. There was a recent case of a 1971 Bellanca Viking which crashed as a result of the in-flight failure of a wing. The rot occurred under the wing attachment fittings.

Published reports have played up the fact that the airplane was always hangared. I am frequently asked if it is necessary to hangar a Falco. My reply is that it is desirable to hangar a Falco for the same reason that metal airplanes are hangared, to keep the sun from damaging the plexiglass and the paint. It is also desirable to keep the airplane out of rain and from collecting dew in the morning. A free circulation of air is also desirable to speed the evaporation of any moisture that may have collected in the airplane. If the Bellanca Viking was flown in rain and the moisture worked its way down to the wing attachment fittings through the joints in the wing fairings, it will make relatively little difference where the airplane was stored. In my opinion the greatest single cause of wood rot in aircraft is ignorance of the subject by the owners and operators of the aircraft. If you understand the nature of the problem you can take measures to eliminate any risk by providing the proper protection and by inspection.

Between work on the drawings for the cowling and the engine baffling, I managed to put in some time for a series of drawings that I have done for the fuselage. At some point I will integrate these drawings into the Falco plans, and they make for interesting viewing as they show the front face and aft face of each fuselage frame with all

equipment installed. As a result of doing these drawings, I have come up with a couple of revisions. These changes (see Revision Supplement) are not essential, but if you are in a position to make these changes, you will find the assembly and installation of the aircraft somewhat easier. Two things are accomplished here. First, the main battery wires are quite large and stiff. On the original production Falcos, these wires were routed up and over the nose gear bay cover to the aft face of frame No. 1, then outboard to the triangular openings in the frame. It is much easier if you can route the wires under the floor on the pilot's side. This requires that holes be drilled through the forward wing spar, and frames No. 2 and 3. To clear the control stick torque tube, the holes must be angled at 15° "nose up" so that the wires will dive down below the control stick torque tube. The holes in frame No. 2 are positioned so that the wires will take a nice even bend. These holes are too high for a "lowered floor", and for those installations the holes may be lowered.

The second change is for the installation of the rudder cable pulley brackets. These pulley brackets are installed with the bracket on the inboard side of the pulley. This places the channel-nut squarely in the middle of the nose gear bay walls, requiring that you build the walls around them. Several years ago, when I was working on the detailing of this area, I considered that it might be easier to install the brackets on the outboard side of the pulleys. I did not do this for a couple of reasons. First, the frames and forward spars did not have solid wood in them to allow for this possibility. Secondly, I have always cautioned builders not to make changes. This airplane has a way of biting you when you make a change, and while I could not see any obvious interference problems, I was worried that such problems might arise. Now that I know the design better, I know that there is no harm in doing this, but to do this change you will have to install solid wood in the area under the brackets for frame No. 3 and the forward wing spar. For those of you that are too far along to make this change, I think you will be safe if you provide the holes for the wires. This is one of those seemingly-unimportant little things that will make the final wiring much easier.

From time to time, I am asked by builders about incorporating some little design idea picked up from an article in Sport Aviation or another magazine about homebuilt airplanes. When you first become acquainted with homebuilt aircraft, you can be swept away with the enthusiasm of the articles. After visiting Oshkosh, you will begin to find that a lot of the airplanes are not as wonderful as they seemed in the articles. In fact, I have trouble understanding how grown men can actually spend the time and money involved to build lots of the things you see, and then be proud of it!

You need to develop the ability to read behind the over-enthusiastic report to actually comprehend the facts. As you might have noticed by now, the builders are all made out to be heros, which to an extent they are. In many cases, however, the airplanes have some of the most God-awful design details. A few examples come to mind: the articles on the Grand Champion Midget Mustang at Oshkosh '83, the Beachner V-8 Special and Lyle Powell's Glasair. Each of these articles

covers aircraft that have some good points, but at the same time you find some of the most hilariously ridiculous features and accounts, all presented in an admiring manner. For example, the Midget Mustang was an exceptional aircraft from the standpoint of finish. The airplane was designed for an engine fully half the size installed. The cabin heat duct was taken off the aft engine baffle -- an absolute no-no since the cockpit will fill with smoke if you have an engine fire. The airplane has a retractable antenna, which adds something like six pounds! The Beachner V-8 Special is a two place airplane with about the same wing area as the Falco and retractable landing gear. Designed by a "fire agate miner", this airplane has an engine that is much heavier than the Falco's, yet it is but a fraction of the weight of the Falco. Can this airplane really be a +6, -3g acrobatic airplane like the Falco? How is this accomplished with a basic structure that is 400 to 500 pounds lighter? If this is true, then the Falco surely has 400 to 500 pounds of structure that is not needed. And what of the engine? The spark plugs must be changed at nearly every stop if avgas is used. Of course, the engine is single-ignition, and there is no accessory pad for a vacuum system. The radiator was a tight fit, and even though the designer is selling plans for the plane, he doesn't even know what sort of radiator he used. As for Lyle Powell's Glasair, I know Lyle and he is a very nice man. But the account of him continually ripping the airplane apart and re-designing things had me in stitches. The funniest part was when Lyle (an eye doctor) re-designed the aft wing spar and sent it off for approval by the Glasair's designer (a dentist by training). And yet, there are other articles about designers and airplanes of genuine merit: the Starlite and the Sorrell Hyperlight, to name a couple. Look at the time taken to carefully design each and every feature of the Starlite; this is an exceptional piece of design. All you have to do is to look at the Hyperlight and see that quality components are used (the flying wires, for example). The best design work is usually very simple, and the simplicity takes a long, long time. What I am saying is, learn to separate the wheat from the chaff.

It's not too early to be making you plans for Oshkosh. We will have our Falco booth at the usual spot. I will give a forum on the Falco on Tuesday, July 31 at 11:45 AM to 1:00 PM in forum tent 4. That night we will have our Falco builders dinner at Martini's restaurant at the Midway Motor Lodge at Appleton beginning at 8:00. Martini's has asked us to let them know how many people are coming, so I would appreciate it if you would let me know who and how many are coming. They will be able to handle additional people who arrive unannounced at the last minute, but we need to let them know how many to expect.

In his last letter, Mr. Frati indicated that there is some possibility that he may come to Oshkosh this year. He plans to let me know when and if these plans are finalized.

We will be moving our offices on or about May 15 to 2000 Tomlynn Street, Richmond, Virginia 23230. You should send mail to this address until we notify you of the move and even so, we will have mail forwarded. As those of you who have seen our office, the "great halls of Sequoia Aircraft" are somewhat less than ideal for our purposes. A friend of mine and I bought this building about 12 years ago. While

we've never put it on the market, we always were able to tell people inquiring about its purchase what we'd like to receive for it. Finally someone took us up on the price, and we have since made a most pleasant trip to the bank. Our new office is in an office-warehouse center. Our offices are being built to our plans now and will be a welcome change for us.

During the last three months, I have finalized the design of the cowling. In all, the cowling took about six months of work and resulted in 36 large sheets. These will be condensed to installation details as soon as I have the time. The first cowling (for Dave Aronson) should be done in about 9 weeks, and we should be able to ship cowlings in about 12 to 14 weels. Also, I am well into the engine baffling. The baffling has been a real chore, largely due to the manufacturing process we will be using. It's a little difficult to describe, but the way the baffling is designed, it's very difficult to assemble unless some measures are taken. The parts will be stack-machined on CNC milling machines and then formed. Because of the accuracy possible with these computer controlled machines, we will be drilling all holes in the sheet metal. This way, the assembly and installation is nothing more than a cleco-and-rivet operation. I am still a little undecided on the way the parts will be supplied in the kits. Earlier I had thought that I would let the builder do the riveting, but a lot of our builders do not have the equipment and skills to do this. While I don't want to commit to it, I may just put them all together myself. I think I can probably assemble the baffling for fifty airplanes in my shop in the same length of time some builders might take to do one.

We are also in the process of making a skirt fairing for the Nustrini canopy. This is nearly done, but I want to work out the details of the access door for the aft fuel tank before commiting to production tooling. I have also done some preliminary work on the many access panels for the Falco. I can't say when that will be finished.

I have designed a flush jacking pad for the wing. This is an aluminum fitting which is epoxied into a wood block mounted on the aft face of the wing spar. The fitting will accept an eyebolt for tie-downs and a fitting to match the jack. John Rawlings, a Falco builder and McDonald-Douglas engineer is doing some tests on the on the installation to see if it will take the sideways snatch loads of heavy gusts. I should have this finalized by the next builders letter, but any of you who are at a stage of construction so that you need the drawing now should drop me a note. I have also worked on a tail tie-down ring. While it will work, I've not yet figured out if you will be able to get your hand in to get the nuts on the screws!

Over the next few months I will be spending nearly all of my time finishing up the final details so that we can get Dave Aronson, Syd Jenson and a few others in the air. For the most part, I am doing drawings that are not finished to extent that our drawings normally are, so the final drawings will follow on later after the rush is over.

Francis Dahlman at Trimcraft has been up to his ears with work on the wing spars. Francis says that it boggles his mind that a homebuilder can make the thing. The thing that Francis finds difficult is sanding the spar caps and then sanding the forward and aft faces on the spar for plywood. This is not that much different from sanding a floor flat by hand. Francis is in the process of making travelling overhead drum sander mounted on tracks which will allow him to sand the faces to a precise flat surface. This should be finished in about two weeks and will allow him to turn your wing spar orders out more quickly.

In our construction manual, we mention the magazine Fine Woodworking. I have been getting this magazine for some time, and I can't say enough good things about it. I force myself to read every article since I have found that there is something worthwhile in each. If you don't get the magazine, I would like to suggest you try it for a year. A one year's subscription is $16.00 ($20.00 in other countries). The address: Fine Woodworking, Subscription Department, The Taunton Press, 52 Church Hill Road, P. O. Box 355, Newtown, CT 06470.

Several times each day, we are contacted by prospective builders who ask for the names of Falco builders that they may contact to talk about the project before they commit themselves to the project. We usually supply the names of four or five Falco builders. I think that this sort of contact is a very good idea for anyone thinking of building an airplane, but it can be a problem for Falco builders. It may help you to know how we handle this. First, we will not supply the name of a Falco builder unless the person has purchased and read our brochures. Jim DeAngelo, for one, has gotten pretty tired of people walking into his shop, saying "The Falco is made of wood?" and then taking up a couple of hours asking the most basic questions. Secondly, we generally do not supply the address of the builder, only the telephone number, to discourage letters with a lot of questions. Also, we try to match the prospective builder with our Falco builders. For example, if the prospective builder plans to use all of the kits, we only give him names of builders who are building that way, and prospective "scratch builders" are directed to similar Falco builders. If you are contacted by someone who does not have our brochures, I would suggest you not waste your valuable building time chatting with this type.

Beginning with this letter, we will have a "Tool Talk" section. While we've had relatively little to say about such things, I think it would be a good idea to feature the various tools that you use to build your airplane. I'd like to ask that builders pass on their comments on what they have, what was good and what was bad, and other comments that might be useful.

Sincerely,
SEQUOIA AIRCRAFT CORPORATION

Alfred P. Scott
President

TOOL TALK

Many Falco builders have purchased pneumatic staplers to speed up the woodwork. Jim Petty has a Paslode Model PI-W30 stapler which uses 30 gauge (about .024" by .032" wire) staples of 1/2" wide and 3/8" or 1/2" in length. It is available with a safety interlock, which Jim didn't order as it might get in the way. The stapler cost $132.00, and Jim comments that he finds the stapler indispensible and only wishes that someone made a machine to take them out as quickly as this one puts them in! Bill Wink purchased a similar unit, a Senco J½ stapler using B04, B06 and B08 staples. These staples are of .030" by .0215" wire and are 1/4", 3/8" and 1/2" in length. The stapler cost $134.00 and is available from Senco Products, Inc. Look for their listing in your phone directory white plages or contact Senco Products, Inc., 8485 Broadwell Road, Cincinnati, Ohio 45244. Telephone: (800) 243-8160 or in Connecticutt (800) 842-0225.

One technique that you can use is to put a strip of cotton webbing under the nailing strip. This used to be standard practice with the production of wood aircraft and allowed you to "zip" the nailing strip off the airplane. Dacron finishing tape might work as well.

Karl Hansen reports that he has found that Disston "Abraders" are very handy for sanding spruce and plywood. These come in a variety of shapes and sizes. They are strips of metal coated with carbide grit, and they work like a file or rasp. I seem to recall that John Shipler had a sander which he was in love with. How about the make and model, John?

Builders will have to decide what tools are best suited for them. You will find that with tools you get exactly what you pay for, and I have heard numerous reports of people who bought inexpensive tools and later traded up to something that suited them. On the other hand, you only need something that will do the job, and you should consider if the tool is only to be used for the Falco project or if you want it as a permanent addition to your workshop.

With band saws you have a wide range of choices. At the bottom end, Black and Decker makes a variable speed 12" band saw which sells locally for $120.00. I would like to know if any of you have tried this and can comment on it. You can get a bandsaw from Sears, and Sears tools have a reputation of being inferior to such tools as Rockwell. A Rockwell 14" bandsaw lists for $866.00 and can be had on sale for $669.00 from Bratton Machinery, P. O. Box 20408, Tallahassee, Fla. 32316, telephone (904) 222-4842 or (800) 874-8160 -- catalogue $3.00. For a more complete shop, you would want to get one of the Rockwell bandsaws which are good for both metal and wood.

Black and Decker also makes a little 8" table saw which sells for $90.00 locally. This might be a handy little thing to have for small pieces, but I doubt that it would keep up with a bigger saw. Quality-conscious craftsmen normally have a Rockwell Uni-saw, or a Powermatic 10" Model 66 with a Beisemeyer Model 50 fence which lists for $2,239.00 and is on sale for $1,799.00 at Bratton Machinery.

The cheapest type of drill press is the Black and Decker 3/8" drill press which sells for $70.00. I have a variable speed Rockwell with a table raiser. I also have a Rockwell 6" belt/12" disc sander, which I find a very handy thing to have around.

I doubt that many Falco builders would actually need a table saw, and I think that a radial arm saw would be a better choice. Sears and Rockwell make such saws, but I am not familiar with them. Please let me have your comments on radial arm saws and the attachments that you use.

When you go to install the canopy, you will have to drill the canopy frame for the No. 4 sheet metal screws. The screws are very hard to run into the hole for the first time as they have to push metal to make the threads. One method is to chuck up on a screw with a tap chuck. This gives you much more leverage than a screwdriver. I have heard that you can buy sheet metal screw taps which work just like machine screw taps by cutting into the metal. So far I have been unable to find such a tool. If any of you can find such a thing, please let me know.

ROLL CALL

Please send in your progress report on a separate piece of paper and not as part of a letter as these entries go into a separate file. Please give your name and builder number.

649. James Peate. Tail ribs complete. Fuselage frames progressing. Should be starting to jig the fuselage soon. I am using a Western Aircraft Supplies kit and the material is very good. I find that my progress is steady but fairly slow, and of course, not having done much woodwork for some years is not helpful; however, I am improving and that in itself is a source of satisfaction. I am lucky in one way, at the moment, in that I live only a few miles from Elstree airfield, and therefore I can look at Peter Hunter's Falco fairly often.

714. Paul Ryan. All tail (rudder and elevator) ribs done. Need suitable work area. Moving to house this year.

715. Robert D. Dell. The Falco has waited patiently for one year now, whilst all members of the group moved house and settled in. I envisage recommencing building work in the spring of 1984, now that the house has been made habitable. The workshop is the next priority.

718. Ralph McWhinnie. My Falco project is proceeding slowly and hopefully our .75¢ Canadian dollar will improve which will speed up my assembly time.

719. Barry Mowforth. Tail cone complete, wing spars complete, front section of fuselage 75% complete. Almost ready to attach main spar into fuselage. Intend building its wing in the vertical plane, i.e. rotating its fuselage and main spar 90° to stand its fuselage on end.

720. William McKaig. Basic fabrication of vertical and horizontal tail complete. Hardware (hinges, control horns, etc.) essentially complete.

Ready to begin skinning. Looking for space to begin fuselage fabrication. All kits excellent.

728. William Roerig. Things are going according to my long range plans quite well. Not much in the line of visible progress but a good portion of the equipment items that are just as important -- and I'm having a ball. I am pleased with all of the drawings so far. Also -- I'm glad I'm not rushing into larger construction because the evolution of the Falco, Alfred P. Scott style, is just great!!

737. Chris Barnes. All ribs for tail, all spars for vertical tail and a few wing ribs complete. Problems: not had much time so far, just moved house and new workshop to be built. Although I have started construction, I have not yet got very far. However I am rather proud of what I have done! As you know there are now 2 Falcos in England, and it was good to see these and Dr. Slazenger's together at Cranfield in July. I took quite a few photos! I also managed to persuade Peter Hunter to give me a ride in G-FALC earlier on, and as you have said many times, the handling was a revelation, much more akin to the big jets I fly professionally than the normal light aircraft.

769. Gord Cook. Construction begun December 82 on jigs and March 83 for parts. Spars ribs complete and inspected. Fuselage frames complete, ready for inspection. Problems: Money! Any suggestions? (Legal, of course). There have been no major problems to date. The plans are easy to read and having a Falco builder (George Neuman) close by has been a great help. After having built the spars, ribs and fuselage frames I can say that the kit prices are very reasonably priced. I'm glad I built my own -- the experience has been great -- but if I built another Falco I would buy the kits.

772. Per Burholm. 900 hours down the project road I thought it time for me to let you know where I am. I purchase all my spruce and plywood from Trimcraft Aero, and found quality and service good, although I had to wait 10 weeks for my main spar wood material. I guess Sitka spruce is in short supply. To date, I have made and completed all wood parts except the main wing spar. Fuselage 3/4 skinned, out of the jig and "cut" in half. Tail feathers skinned and installed on fuselage. Rudder and elevator completed. Fuel tanks installed, instrument panel and equipment temporarily fitted. I have also temporarily installed foot pedals and stick, and things seem to fit very well, and so does the canopy. At the present time I am working on details inside the cockpit, and as soon as weather turns a little warmer I plan to start the main wing spar. I am working strictly alone in my two car garage, which may prove to be too small as this project progresses. I appreciate your prompt service and your candid help over the telephone.

805. Karl and Steve Hansen. Fuselage and tail assembly, bare bones, ready for shaping (sanding) and skinning. Plywood and wing ribs shipped a week ago. Will skin 2.5mm sides of fuselage and some of tail cone to stiffen fuselage alignment, then will cover tail surface and separate fuselage at frame No. 8. Will not complete skinning of fuselage until all difficult hardware is installed. Expect wing spars about the first of year, meanwhile hope to set up the wing jig as you described possibly

with some variations. Will have one edge of the plywood pieces the wing reference line for that station with the spar positions and chord line set. Don't have the dimensions worked out for the plywood pieces but hope to set them up so I can invert the spars after I have the leading edge on without additional set up.

MAILBOX

Following receipt of plans from you in October 1982, progress on my Falco project has been slow. I am currently working in Saudi Arabia on a year's contract with a local company of consultant engineers. To date, I have built all the tail ribs (in Saudi!) with spruce supplied cut to size from Brian Fox in Doncaster, which I hand carried to Jeddah with me. I had to cut the plywood in U.K. before travelling. These parts are now in U.K. after my leave, at which time I brought wing rib and tail spar materials to Jeddah. (There must be an easier way!)

A few statistics -- my total time spent on the project to date is 220 hours of which 150 hours were spent on tail rib construction, including plotting airfoils, etc. Finally, I'd like to say thanks for the project which I am enjoying immensely. I am sure that I will equally enjoy flying my own Falco when it is finished. Keep up the good work with the newsletters which are always eagerly read and all the best to you for 1984.

Martin Bennett

Well as you said, I'm impressed!! The wiring kit is really outstanding. The manual is well written, your work? -- Well done. I can understand why you wouldn't release the wiring diagrams.

John Harns

Please find enclosed an order for several kits along with a check for same. I plan to purchase the balance as funds become available.

There's no doubt about it, the Falco is the "Ferrari" of the air. The latest ad makes "Falco Fever" for me. I really enjoy the news letters. I welcome any photos and articles, etc. Keep up the outstanding job. When I started the project I didn't expect it to be so refined or costly. But it's well worth it.

I enjoy the woodwork and find it gets easier as you gain experience. The wing spar should be complete in the next 30 days making it a 10 week project. Not bad for 2 hours every other night and 10-12 hours on a week-end.

My plans are to stay in the basement and complete the tail group, instrument panel, fit and drill wing spar, landing gear, etc. Then go for final assembly in the garage.

Jim Kennedy

Falco building here in the U.K. is going very well. At least 12 aircraft are well on the way and our little Falco Club has been useful to maintain an informal contact between ourselves, if only to gather around the bar periodically -- a dreadful British habit.

We are, of course, fortunate to have two Falcos, G-FALC and G-VEGL, to crawl all over. Both Peter Hunter and the owners of G-VEGL

show considerable patience. At our PFA rally three Falcos were parked up -- the other being Mike Slazenger's, now on the Irish register and sporting a new paint job. You might be interested in Peter Hunter's Falco. He has a Tipsy Nipper, a V.W. engined aerobatic single seater with tremendous performance that lives under the wing of my Piper Cub. The airstrip we use is, to say the least, very bumpy and only 450 yards long which Peter can operate out of quite safely with two people on board. This reinforces your comments that 160 hp and a constant speed prop is the ideal combination for the Falco. Daft though it may seem, I see Peter and G-FALC nearly every week, but I've yet to have a ride which is silly since he gets his tailwheel time in my aircraft!

It was most unfortunate that G-VEGL was damaged, but it is well on the way to becoming airborne. I know the guy repairing it quite well and have had the opportunity to crawl all over it in its dismantled state. The fabric covered control surfaces show no sign of rib stitching, again to reinforce your comment that it is not necessary.

I hope I have been instrumental in persuading several people into building the Falco, not that they need much of a push, since it is one of the best homebuilts (and investments) one can make.

Talking about building time, I find that providing you adopt (like sex) the attitude of a little and often, progress is surprisingly quick. Doncaster Sailplanes provides a superb service supplying the wood beautifully machined, and with the clarity of your plans (which surprises many people) it is really a relatively simple aircraft to build. We have one guy who builds his bits in Saudi Arabia and carts them home for assembly. That's dedication for you.

My own progress has reached the stage of the wing spars. The fuselage, tail, control surfaces and wing ribs are all complete. I found rigging the fuselage on your jig very straight forward but have left the sheeting until later to allow for wing rigging and fitting of the internal hardware.

Seasons greetings and let 1984 be the year of the Falco.

Jack Anziani

Firstly a very belated thank you to you and Meredith for your warm hospitality during my visit to you in November. It was very kind of you to spare me so much of your time especially following your tragic weekend in Charlottesville.

It was very interesting to see how Sequoia operates and just walking around your storerooms was a Falco builders dream. I was most impressed with your own skills and enthusiasm for the project, which is very reassuring for builders who are investing reasonably large sums of money in their aircraft. You certainly have gained a disciple as far as I am concerned.

Mike and I have been beavering away hard since my return to the U.K. putting some of the tips I picked up whilst with you into practice. The most valuable one of all was the trick with the plastic tube filled with water. This alone must have made my trip to the U.S.A. worthwhile in terms of time saved lining everything up. You really must publish this one in your next newsletter! We now have the fuselage glued to the main and forward spars and all the forward ribs are glued in place -- wing building seems a fairly fast operation. We followed your instructions in your last newsletter using templates at stations 1 and 14 picking up the leading edge chord line with fishing line and the

whole system worked well.

Peter D. G. Grist

(Thanks to Peter Grist for the kind words. The "tragic weekend" refers to a house party we had at a family place, during which three boy scout leaders died of asphyxiation from a heating stove in their tent. The scout troop was using the top of our mountain, and it fell my lot to handle the calls to their family. I thought everyone knew about water levels; you use a 1/2" clear plastic tube filled with water. Add a little ink for color, some dishwasher detergent to break down the surface tension and some alcohol to keep out slimy growths. Water seeks its own level, so to level the wing spars or the fuselage, you match them to the level of the water. This is the method used to install the supports for dropped ceilings in building construction. Alfred Scott)

QUESTIONS & ANSWERS

Q: Do you have any ideas for a canopy lock?

A: Still pondering on that one. The production Falcos had a lock installed on the canopy track on the pilot's side. The canopy frame had a slot cut in the bottom of it. When you turned the lock the tang of the lock rotated up into this slot. The lock on our Falco was broken so we had it repaired at moderate expense but great trouble for the locksmith. The lock worked, but the tumbler pins took forced-opening loads in shear and one such tug by someone dashed the lock. The arrangement is worthless and not worth duplicating. I've thought of and heard proposed a number of schemes, none of which appeal to me a great deal. One would be to put a padlock through the dorsal fin. Another would be to install some sort of weird-headed screw, such as an allen head cap screw or some of those automotive screws which require a special screwdriver and keep a part of a screwdriver on your key chain. These would be put in the same place as our worthless lock. With our Falco, I have adopted an optimistic/fatalistic view: if someone want to really get into the Falco, he is going to do just that, so why not leave it open so the canopy is not destroyed. At the same time, I cover the canopy up with the canvas cover and hope that everyone will assume that it is tightly locked. Brilliant ideas for a canopy lock for the Falco are solicited!

Q: The heads of the screws for the canopy tracks are too large for the slot in the canopy track. Should I spread the track or grind down the screw heads?

A: Neither. Grind out a radius in the top of the canopy track flange to clear the diameter of the head of the screw.

Q: I am installing the Whelen nav and strobe light system. Do the wires for these go the the aft face of frame No. 6? Can you send me a sketch for the accessory shelf suggested for that area?

A: These wires are routed to the aft face of frame No. 6. I have come to the opinion that an accessory shelf may not be necessary. While I do not have the exact installation location of all electrical equipment worked out yet, I think all, or almost all, can be installed directly on the aft face of frame No. 6. I would do noting in the way of additional woodwork at this time.

Q: I am enclosing some information on Dave Blanton's Ford conversion kit. What is your opinion re: its use in the Falco?

A: I think the engine is a piece of junk. For the same money you can buy a totally run-out Lycoming, with low compression, worn bearings, and burning oil and still have a much better engine.

Q: Should drain holes be drilled through the plywood web in the main wing spar? How many drain holes should be drilled in the bottom of the wing, fuselage and stabilizer skins, and what size are the drain holes?

A: It is not necessary to drill any drain holes in the spar, but it is a good idea to drill small (1/8" dia) holes in the blocking to allow trapped air to escape during a climb to altitude. This would be true throughout the aircraft. On the production Falcos, drain holes were drilled every other rib. On the wing they were drilled only in front of the aft spar, but most builders are doing it in front of the main spar as well, which I think is advisable. You should drill a reasonable number of holes to allow accumulated water to drain. In the fuselage you might cheat since you will be able to look inside and mop up any moisture. Also, consider the storage you will give your Falco (hangared or not) and that most water will be evaporated by air circulation. If you were to do a good job of sealing the wood with epoxy or polyurethane, I think you could get by with fewer or prehaps no drain holes. You may be interested to know that Luciano Nustrini has none on his Falco, which is normally hangared but was once submerged during a flood. Drain holes are normally 1/4" diameter. I would advise using seaplane grommets (Aircraft Spruce or Wicks Aircraft will have them).

Q: P/N 770 forward mount bushing does not fit inside P/N 767 forward mount. Should I send one back? Which one?

A: The bushings for the landing gear are a "press fit". This is true of the larger main bushing as well. It should be pressed into place. You should be able to tap it in with a hammer and a block of wood, but be sure that it goes in straight.

Q: I am concerned about the landing gear retract gear box that is mounted on the main wing spar. Seems as though the top two mounting bolts should not go through the top cap of the spar.

A: Yeah, I know. Everybody worries about that, but it is part of the design and is accounted for in the design. The holes go through the upper spar cap. Spruce is much stronger in tension than it is in compression, and this is the reason that the upper spar cap is larger. The bolts can take the same compression as the spruce. If it makes you feel any better, put the bolts in with epoxy to completely fill the holes.

Q: I've heard that Aeroquip 601 hose is subject to aging and must be replaced often. Will we be using this on the Falco?

A: Aeroquip 601 is a neoprene hose in a woven steel jacket and is the industry standard for fuel and oil lines in the engine compartment. The neoprene is attacked by ozone and should be replaced every three years or so (from date of manufacture). We will be using Aeroquip 666 hose, which is visually identical but with a Teflon hose, which is vastly superior and the same price.