Falco Builders Letter

Marc Stamsta's Falco is the only production Falco flying in the U.S. with a normal FAA Type Certificate.

Factory Falco
Plywood Butterfly Reborn

by Budd Davisson

Reprinted with permission from the March 2005 issue of EAA's Vintage Airplane *magazine, and author Budd Davisson. Visit www.vintageaircraft.org for information on EAA's Vintage Aircraft Association, and www.airbum.com for more stuff than you can imagine from Budd Davisson.*

Sometimes it's difficult to decide which is most interesting: an airplane's erratic passage through history, the passion that an airplane engenders in an individual, a blow-by-blow accounting of a problematic restoration, or the thrill of slaying a paperwork dragon to get the airplane certificated. In the case of the Stamsta family Falco, the tales are so closely interwoven that the telling of one tale absolutely requires telling the others.

Marc Stamsta is the quintessential craftsman in that, without saying so in so many words, he feels his days are best invested when they end with something he has crafted with his own hands. His life story leads up to the restoration of one of only two factory-built Falcos on American shores and the only one that isn't in the experimental category. But we're getting ahead of ourselves.

Marc was born in Milwaukee and now lives on acreage behind the two-room, 1890 schoolhouse his parents converted to a house where he was raised. Right from the beginning it was obvious he'd look at life a little differently.

"My mother," he says, "is a fiber artist who works in weaving and paper. She even makes her own paper, and it's not unusual to see her wading around in vats of paper pulp. I guess that kind of hands-on creative thinking was part of my upbringing."

When Marc graduated from high school, he went to a technical college for two years for industrial engineering, but almost as soon as he graduated, he went his own way.

"I started making harnesses for carriages," he laughs. "In fact, we made a lot of very high end rigs for people like the Rockefellers and the Queen of England. I did that for 14 years."

While he was working leather, some part of his brain was becoming infected with the concept of flight.

"I don't know exactly when or why I decided I wanted to fly. It's just always been there. In fact, almost as soon as I started getting into aviation I discovered the Falco, and that's the first true airplane I ever actually wanted."

The Falco was, and is, a legendary design by Italian designer Stelio Frati. Stelio is renown for his ability to design aircraft that are works of art and that fly even better than they look, and they look great. The 150-hp, all-wood Falco has made inroads in the homebuilt market because of the efforts of Virginian Alfred Scott, whose Sequoia Aircraft re-worked, with Stelio's blessings, the plans for the Falco. Sequoia Aircraft now produces kits and drawings. (While Alfred did the actual pen and ink drawings from the Stelio-supplied copies, he'll be the first to tell you that well-known aeronautical engineer Dave Thurston is the man responsible for the actual redesign work on the Sequoia Falco series.)

At the time Marc discovered the Falco, he was just dipping his toes into aviation by starting out in ultralights.

"Since I was 19 I had been building wooden canoes and kayaks and had worked a lot in fiberglass. This morphed into a side business building dune buggies, and I traded a dune buggy for a weight-shift Quicksilver ultralight. I didn't know how to fly, but little by little I taught myself the basics and pretty soon was flying it quit a bit.

"In 1982 I decided to go for my private pilot license, so I did a bunch of self-studying and passed the written first time around. Then I went to Texas and in 14 days flew 40 hours and passed my checkride."

While Marc was courting aviation he

In This Issue:

Photo Courtesy EAA's Vintage Aircraft Association
Jim Koepnick/EAA

was also courting and eventually marrying his wife, Gail, and life began to change.

"We had two daughters, Maya and Tobie, and almost immediately we got a rude introduction into parenthood."

Most people go through life taking an enormous amount for granted and never truly get a handle on who they are or what they place value on. Marc and Gail, however, learned that early.

"Maya was a baby, and they discovered she had a brain tumor and wasn't likely to live. When someone tells you your daughter won't live another hour, instantly everything you had placed value on before dwindles to nothing. In a matter of seconds your priorities are totally rearranged. Believe me, if your kids are healthy, you don't have any problems.

"When you're waiting around an ICU with parents who have been told their children are likely to die, and you're one of them, your life gets very simple. You want her to live and nothing else matters.

"Maya lived past that hour. And the next one, and the next. She somehow hung on and survived the surgery that gave her a normal life. She's 12 years old now and calls herself my 'pilot girl.' My other daughter, Tobie, likes horses and spends more time with her mom and the horses, but Maya and I fly a lot. We love taking our little Cessna 120 out camping."

Having a family and all the associated medical expenses caused Marc to reprioritize life.

"I couldn't do this loose craftsman thing any more. I had to find a regular job that had medical insurance, so I started working with a CNC operation. I did that for six years and learned a lot that helped me in later years with airplanes."

His wife, Gail, has always been his strongest supporter, and when she got a solid job teaching school with all the benefits, Marc was instantly back making things with his hands.

"I sought out Bill Scheunemann at Scheunemann Aviation Products in Juneau, Wisconsin (www.woodwings.com). He builds wood wings, specifically wing kits for the One Design and Pitts Model 12. I guess because I knew what a gusset was, he hired me," Marc laughs. "Also, I knew how to run his three-axis CNC machines, so it was a good combination.

"Even better, I found that Bill not only loved the Falco but actually had a set of plans. We thought, 'Yeah, why not build one.'" So, he started putting the plans into CAD, and we actually had started making up fuselage jigs when he got a call from Gar Williams."

Gar Williams needs no introduction in these pages other than to say he's highly revered as a restorer of some exotic antique airplanes as well having interests in all fields of aviation.

"Gar said to Bill, 'I hear you have someone up there who would like to have a Falco; if you aren't too far along building yours, stop right now!' He was talking about me."

It turned out that Gar had the damaged airframe of a factory-built Falco, only the second one to be imported into the country in addition to the one Alfred Scott at Sequoia had. Gar was the latest in a long string of owners.

"This airplane is serial number 212, although there were only 75 built," says Marc, "and the Europeans really don't like to see them leave the country. They stopped building them in 1960, and they consider them national treasures.

"The original buyer of the airplane was an ex-Luftwaffe pilot who really loved the airplane and flew it 800 hours. I have some of his old tires, however, and he wore them right down to the cords before replacing them, and I think that's what caused his accident.

"In 1974 he landed and had a flat tire. The airplane has only one brake pedal that actuates both brakes at the same time. So, when he lost the tire, the airplane got sideways. The nose gear folded, which crushed the bottom of the cowling, and one of the mains punched a hole in the wing."

The airplane was definitely repairable, but apparently the German pilot didn't want to go that route. "He disassembled the airplane and bought another Falco almost immediately."

Enter Charlie Yates, who had learned to fly in a Falco in Luxembourg, and after returning to the states, got a call from a friend in Germany about the newly-wrecked Falco. Charlie bought it sight-unseen and had it shipped to him in New Jersey, where it sat in a barn for a decade. When Sequoia started marketing the Falco, Charlie started work on the Falco, but business activities left no time for the airplane, so he sold it. On the way to the next owner, the trucking company ran a forklift through much of the airplane, which did a lot of damage to the fuselage.

"When Gar got the airplane, he did a terrific job of rebuilding all the control surfaces and the gear doors, but he put the project on a shelf and let it sit for a while because of paperwork problems. Then he called me."

"The truth is I couldn't even begin to afford this airplane. I could barely afford my little Cessna 120. By this time I was managing a ski slope during the winter and doing stained glass and helping Bill Scheunemann during the summer, and the Falco was worth far more than I could come up with. Besides, I knew Gar had a check from a European for $60,000 just the

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way it was."

What Marc didn't know was that Gar really wanted to see the airplane fly again and wanted to see Marc Stamsta get it.

"It turned out that the other buyer was planning on parting the airplane out in Europe where he would make far more than the $60,000 he paid, and this really bothered Gar. He knew how badly I wanted the airplane, but I told him I'd never be able to afford it. Then he did something I couldn't believe.

"He knew how important it was for me to fly. I have to fly; it's as simple as that, and I had the 120 at the time. Gar said, 'If you sell your airplane you'll have the down payment, and I'll set up a payment schedule for the rest. Since I know how badly you want to fly, you'll have to finish the airplane to keep flying, and that's my guarantee that you'll finish it.' I absolutely couldn't believe Gar would do that for me, and I was very flattered that someone of his stature put that much stock in me."

Marc trucked the remains home and began doing an inventory of the damage and missing parts.

"The good news was that there was no rot," Marc says. "The airplane had been in dry storage all its life, but besides the original accident damage and shipping damage, a lot of stuff was gone or destroyed. Many parts of the airplane, like the dorsal fin and the fairings, are pretty fragile. They are made of laminated 1/32-inch veneer so it can't survive rough handling, and I had to make entirely new ones.

"Most of the major structure, like the fuselage longerons and wing spars, were in great shape, but the skins in many areas were split or broken. The bottom of the cowl and the nosebowl were badly crunched, and the windshield was broken although the canopy itself was still usable, although it was crazed in the corners.

"The interior was in shreds, and much of it was missing. The interior of a Falco is actually glued to the ultra-thin, 1/32 plywood that is glued to the inside of the fuselage as part of the structure, and most of that plywood was missing. The seat frames were there, and fortunately the rear seat and single belt were also there. Only a few Falcos were built with the child seat in the back that would accommodate a 66-pound child."

Marc's background in building canoes and kayaks became directly applicable in restoring the Falco.

"Many pieces, like the wing root fairings, were made the same way we'd make boats. You take two-inch wide strips of 1/32-inch veneer and glue them edge-to-edge at an angle over a form. Then, you glue another layer at an angle to the first

Photo Courtesy EAA's Vintage Aircraft Association
Jim Koepnick/EAA

Photo Courtesy
EAA's Vintage Aircraft Association
Jim Koepnick/EAA

layer. With that method you can make a plywood part of any shape and thickness. It sounds tedious but really isn't. When I was doing the wing fairings, I even scabbed in some of the original fairings in an effort at keeping the airplane original.

"I'm much more comfortable with wood than I am with metal, but this airplane forced me to learn a lot of new skills. The cowling, for instance, had me using a shot bag and English wheel, but I was able to save it all without using Bondo.

"I'd never worked Plexiglas, and the windshield turned out to be different than Sequoia's airplane in that it wasn't a flatwrap. It had a slight compound curve to it, so we made up a mold and heat-formed the Plexiglas over it. I had to do the same thing for the nav light lenses in the wingtips."

From the time when Marc first started speaking with Gar about the airplane, FAA paperwork was a major part of every conversation. The Falco, although theoretically certificated in the United States, was a victim of a classic Catch-22 situation.

"Part of the type certificate said the airplane had to be inspected by a representative of the FAA during construction to ensure that it conformed to the TC for it to be granted a standard airworthiness certificate in the U.S. The catch was that the type certificate wasn't issued until 1961, and the airplanes went out of production in 1960, so there was no way that requirement could be met.

"Alfred Scott had run up against this with his airplane, and put the airplane in Experimental—Exhibition category. Gar was convinced I could get it into standard category, and that became one of my goals; I wanted to have the only Falco in

history with a standard U.S. airworthiness certificate.

"In a lot of ways I was tremendously lucky to be doing this where I was because some key FAA people were located in my area. One of them worked for the local FSDO and was part of my ski patrol on the ski slopes I was managing. I was talking about my airplane problem with him, and he said, 'You need to be talking with Bill Coppernoll. I'll mention it to him.'

"One of the problems in taking this kind of project to the FAA," Marc says, "is that there is no real reason for them to want to help you with it. The attitude in some places, especially after 9/11, is that the world really doesn't need a certified, 200-mph, Italian two-place airplane, and to a certain extent, you can see their logic.

"I called Bill Coppernoll in the Milwaukee FSDO, and he was already familiar with my problem because of my ski patrol contact. Fortunately, Bill's primary FAA job is certifying foreign aircraft that come into the U.S. for commercial purposes. For instance, he's worked on aircraft like the Shorts Skyvan. So, we were talking about an area with which he was really familiar."

It's seldom a private airplane owner with a severe certification problem like Marc's who stumbles on the right person at the FAA at the right time, but this was clearly the case with Bill Coppernoll.

"He came up to look at the airplane, and as he walked past it, he reached out and petted it. It was at that exact moment that I knew I stood a chance of making this work. He looked at me and said, 'Why isn't this a certified airplane?' and I explained the problem. He then said, 'This is why you pay your taxes, to get guys like me to work these things out.

"Bill said there had been a subtle change in the foreign type certification process, and in the case of the Falco, if I could prove beyond a shadow of a doubt that the airplane conformed exactly to the type certificate, as it was originally issued in 1961, then he'd be able to certify it in Utility category."

Marc smiles as he remembers, "Bill got this serious look on his face and said, 'If you do exactly as I say, it'll work out, but if you give up and try to go experimental, I'll fight you every inch of the way. You just have to be patient.' He wanted this to work as much as I did."

Marc's challenge at that point was to come up with the proper Italian paperwork that documented his airplane's construction and the type certificate to which it was certified.

"I had to find the Operations and

Marc Stamsta and his Falco.

Maintenance manual and have it translated, but when I tried that, it turned out that the translators didn't know anything about technical stuff and wouldn't certify that it was correct, so I had to find an engineer who translated it and notarized it as being correct. Then I had to do the same thing with the Pilot's Operating Handbook, only it was in German. Then I had to find paperwork that tracked the airplane's exportation to Germany and then from Germany to here.

"Bill's attitude was, 'If the airplane was being built today, I'd be the FAA rep inspecting it for the type certificate, and all I would be asking was whether it conformed to everything mentioned in the type certificate.'

"As it happens, my airplane was custom built for the German owner with a fixed-pitch prop, while the type certificate calls for a Hartzell constant-speed prop mounted on a [Lycoming] O-320-A1A, so I had to modify my airplane to that configuration."

"While I was going through this, I had any number of experienced people tell me it couldn't be done, but because of Bill Coppernoll's direction and the help of a lot of other people, we made it work. Along the way I met some really interesting people, and it was exciting to be talking to Italy one day, Germany the next, and working with the translators.

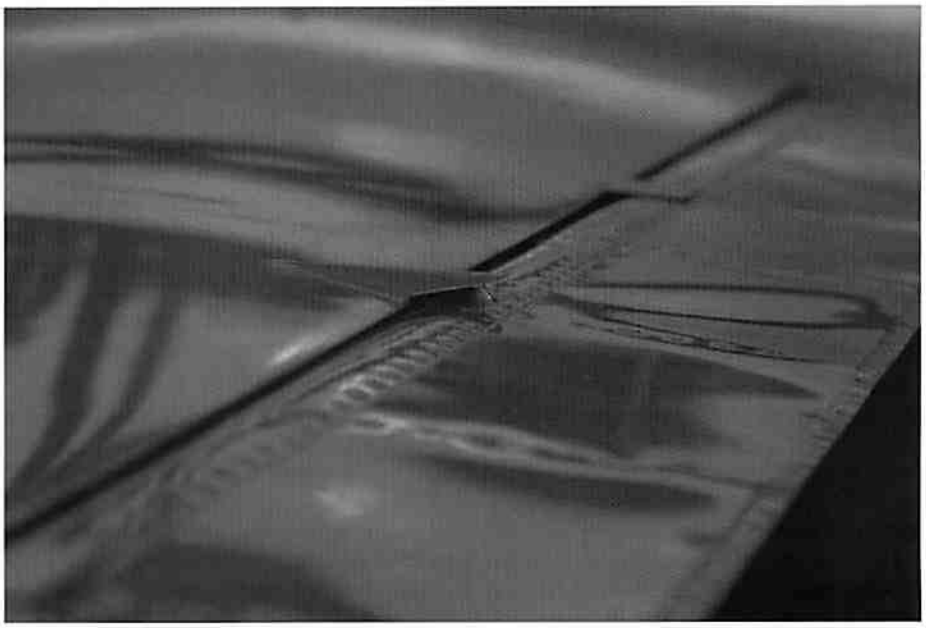
"Along the way I came to really appreciate our own government. We may complain about how slowly they handle paperwork, but compared to many foreign governments, they are extremely efficient and lightning quick. Gar had tackled part of this before I got the airplane, and he actually had to go to Europe to get some of the documents because the people over there just weren't helping."

It would be logical to ask why Marc was willing to invest nearly a year of his time on the paperwork alone, when putting it in Exhibition category would have been so much easier and would not have affected his flying one bit.

He says, "It was a challenge. Here we were working on a one-of-a-kind project, and how often do you get a chance to be involved in something like that?"

Of course, the fact that it was a one-of-a-kind certified airplane caused other problems.

"When I needed an IA to do the final inspection, I had a little difficulty because whom do you ask to inspect an airplane when they've never seen one like it before? Again, I was lucky because Paul Anderson, a local IA, had worked with Bill Coppernoll on some foreign certifications



and knew exactly what he'd be looking for. Besides, it's a simple airplane."

So now that it's flying, what are his thoughts?

"First, I can't believe I actually own this airplane. It's a Ferrari. It handles like a dream. But, with the flaps down it could be a 150 on landing, and it's so smooth in the air. There is simply nothing like it.

"A side thought on this is that flying a Falco was always a dream of my CFI, Caris Fryatt, who is extremely sick right now, so in some ways, we've accomplished his dream as well as mine, and that makes me feel good.

"Unfortunately, I've priced myself out of the Falco market. I'm flying an airplane that is worth so much that it is no longer carefree aviating because I have to think about what it is worth. The responsible thing to do for my family is to sell it, and I probably will, but I love this airplane so much. I can just sit and look at it, and it's almost as much fun as actually flying it.

"One side benefit of getting the airplane certified is that now it will last forever regardless of what happens to it. As long as that dataplate exists, the airplane exists. What has been built once, can be built again, but without that certified dataplate you have no starting point."

Like we said, the story of any airplane restoration always has its personal side, but this one is a little more personal than most.

A Great Road to Travel

by Duane Root

When I first wrote this article, the next day an email appeared from Alfred. Kudos on my article—well, not quite. He said it was "way, way, way too short". I may have even left out a "way". So maybe I should start out with a little history both about myself and this project.

I have been flying since 1974, and I flew commercially about 10 of those years. A few years as a corporate pilot, and a few in the airlines. I have been fortunate to fly aircraft ranging from J-3 Cub to the Boeing 727. That time of my life had me flying and traveling all over the U.S. I finally settled in Boulder, Colorado.

Sometime in the 1970s I had seen some photos and read about the Falco. It was like the bite of a vampire. It took a while, but it was in my blood, impossible to forget. Years passed, kids, career changes, but always she lurked in my psyche. Finally, I succumbed. January 2000 I ordered my plans. Just like a moth to the flame, there was no escape.

I worked faithfully—some might say obsessively—on it for what would take five years. It's hard looking back and remembering the details of those early years. Starting in a one-car garage, it's amazing to think the fuselage was completed in that small space.

We were forced to acquire a larger home as the Falco continued to grow. At different intervals I would receive those large packages from Sequoia. I was like a kid at Christmas—or is it a junkie awaiting the next fix?

On May 6, 2005, I flew N444PK, Falco #1364 on her maiden flight. As I sit in the hangar admiring this beautiful bird, how do I express in words the exhilaration and wonder of that moment? My expectations were high, but I was rewarded far greater than I could have expected.

Incredible! I will leave it at that. She was an absolute joy. Upon liftoff I was rewarded with a true thoroughbred. What a delight! She flew beautifully and had it not been for a rough-running engine I would have stayed up until she ran out of gas! So maybe it worked out for the best.

Stable in flight, she flew hands off, straight as an arrow, wings level, ball centered. It just doesn't get any better! Approach and landing were dead on, and I felt one with the Falco.

So where do I start on the thank-you's? Five years of building, my wonderful wife, Mary, has to get most of them. When you live with one who is possessed, you've gotta be something special, and she is. My son, Keenan, did a job on the wiring that certainly deserves a hardy " job well done!". To Dennis Tracy, a great friend and a true artist with the paint gun, he placed the crowning touch on what is truly a work of art. Alfred, you were always there to lend an ear and advice that I so desperately needed. I guess with me you can now say you've heard it all.

There was no shortage of adversity, and fortunately there were great periods of satisfaction to keep the project moving along. I truly can reminisce fondly about the wonderful times and great people that I have met along the way.

The Falco website has been more than an information stop. It has become family, no different than getting an email from a family member. When you read the stories from past builders, there is a kinship that exists. When they say that this enterprise is a life-changing and life-shaping undertaking, well, I can only say "ditto"!

Finally, to Dr. Stelio Frati, my love and admiration for the man also defies words. It was a pleasure and honor meeting with him some months back, and I only wish he could have been there at lift-off. But in so many ways he most certainly was. Bravo Dr. Frati and mille grazie!

When Mary and I went to Italy last year, we certainly did not plan on the Falco taking center stage on that trip. But after a few trips to Europe, that one will always be remembered as our visit to Dr. Frati. It is like many of the memorable moments that this wonderful project has brought into our lives.

This has been a wondrous achievement and like an actor at Oscar time, I could go on and on with the tributes, but suffice it to say, it takes a lot of dedicated and great people to make this dream come true. This is an elite and glorious club, and I am proud to be the newest member. To all of you, my deepest thanks.

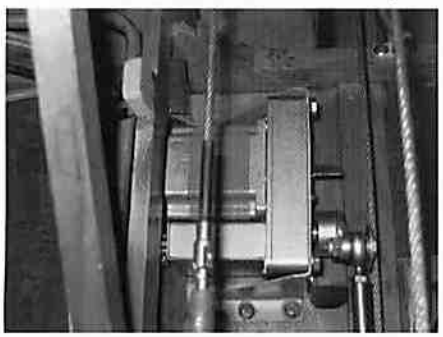
The conclusion? There is none! It is a journey that never ends. It has reached a new point, and for those of you who may be starting out, it is a great road to travel!

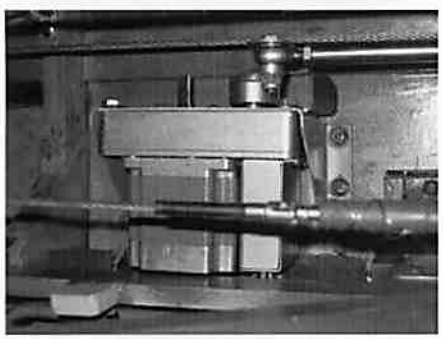
Autopilot Installation

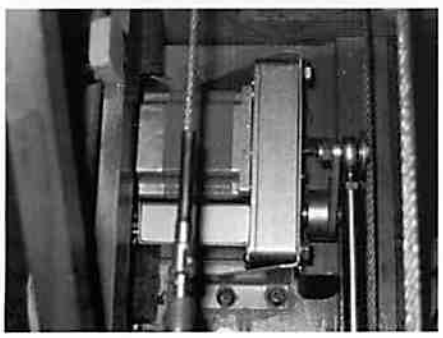
by Drew Done

When I had the grand total of 300 hours VFR experience, including around 50 in the Falco, I stupidly got caught up in a serious bout of must-get-home-itis. To add to the pressure, I had one of our kids onboard. This scenario finally put us above heavy cloud with failing light. Thank God for the GPS and the fact that we live on the coast—I was able to set us up inland from our town with a heading out to sea. This obviously got any potential mountains out of the way. After letting down through about 3000' of thick cloud I admitted to my son that it was the first time and the last time that I had flown in that situation. Right then I convinced myself to put in an autopilot and also get some instruction in instrument flying.

Over the coming months I did heaps of research into various units both by reading any article I could lay my hand on as well as searching the net. In fact, Falco builder David Carroll has info on a Trutrak AP in his entry in the Falco Workshop at www.SeqAir.com. The net probably was the best source of info, for it not only lets you read the manufacturers' claims, it also gives plenty of homebuilders' thoughts and experiences with different brands. A friend of mine had fitted a Navaid A/P into his RV6 and was fairly happy with it. Since this was my first bit of info, and it was positive, I admit I leaned that way. When lots of articles started appearing on the web by people pulling out Navaids and putting in Trutrak in all different types of homebuilts, I decided to look much deeper.







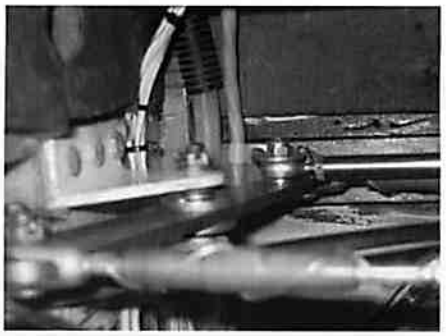
There is no doubt in my mind that the Trutrak range of auto pilots is by far the best affordable unit available on the market today. They have a large range depending on the size of your cheque book. The top of the range are definitely out of my reach. Their website (www.trutrakap.com) will detail all of the units available far better than I could ever do.

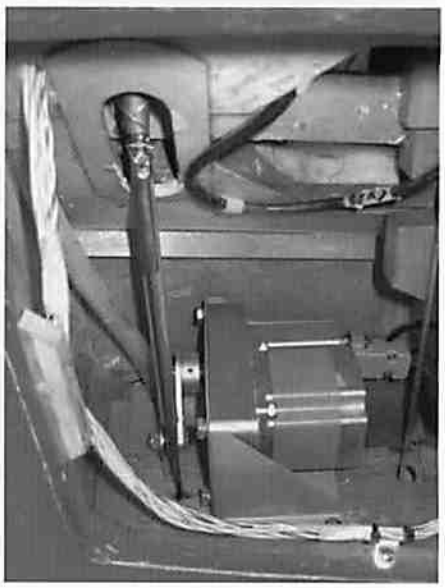
The model that we ended up putting in was the Digiflight 11 VS which basically means it is capable of being a wing leveller with altitude hold as well having the ability to dial in a rate of climb or descent in multiples of 100 feet per minute. The unit will track to a GPS heading or flight plan better than I can hold by hand, or if you want it will track to a heading from its internal source of magnetic information.

As soon as you turn it on the Trutrak will be in the lateral mode, and it will be synchronized to the direction being flown. The main knob is used to dial the heading in that you want and presto the Falco just gently rolls over to pick up this heading. The amount of roll, as well as other parameters can be adjusted to your liking in the set-up stage.

What is even easier is to bring up on the GPS the town or flight plan that you want and as soon as you press "go to" the autopilot takes over. If the GPS was already showing an active waypoint but you were flying by hand and let your concentration slip a little and had drifted off course a bit, let's say three miles off to the left, (O.K. I daydream whilst I fly) and then you engage the AP with the GPS info, the Falco will roll to the right and track towards the original line from where the GPS was activated to the town, pick up this line and then roll onto that heading with a bit of overshoot each time it intersects the line.

I was surprised the first few times we did this for we expected it just to fly direct to the town from the point of activation. It's obvious when you re-read the book and think about it all, but a surprise all the same. Again all this is available on their web site.





The installation of the Trutrak was relatively easy, but the manual assumed that I knew more than I actually did. Because there hasn't been heaps sold to Falco owners as yet, as compared to RVs, the info is not aircraft specific nor is the kit that is supplied. The kit comprised of the panel-mounted unit itself, one aileron servo, one pitch servo, two push rods of different lengths, two mounting brackets, two travel limit mechanical stops to stop over-centre lock up of the push rods, and four rod-end bearings, but is very shy in the supply of nuts and bolts. These you have to measure and supply yourself.

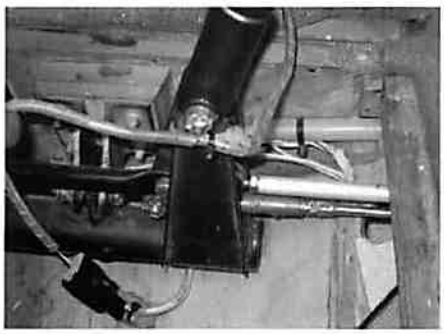
The aileron servo was probably the hardest to mount. The blocks in the drawings for the Century I autopilot are useless for the Trutrak, so I decided to mount it on the inside face of the #1 rib. To be safe I fitted a 10 mm thick piece of spruce to the rib with a little blocking around the edges. A total overkill to be sure but better safe than sorry.

Obviously from this the servo brackets are mounted onto this spruce doubler. The push rod enters the fuselage through the provided hole as in the drawings, and connects onto the control stick joining arm (P/N 718) by welding on a small extension plate of the same 4130 material. This plate is drilled to accept a 3/16 AN bolt

to capture the rod end bearing on the end of the pushrod. Penny washers were used on the outside of the bearing in case of a bearing failure and collapse. The length of the extension was just long enough to keep the bolt/bearing out of fouling trouble at full throw. I had to run a couple of extra wires to the servo as well. The mounting of the servo in the wing was fiddly and time-consuming but relatively simple.

The pitch servo was mounted on a doubler plate in the belly next to the negative bus bar. The pushrod provided wasn't long enough mainly because of where my fuel drain for the rear tank is placed. The fuel tanks and lines in DJD are our own construction, so probably vary a little to the ones supplied in the Falco kits.

The pushrod bearing is connected to the bell crank directly with a 3/16 AN bolt and penny washers like in the aileron. I drilled through the bellcrank in situ and deburred the hole on both sides. The hole is above the elevator cable hole and the pushrod lies parallel to the cable. The wiring was easy - just make sure that the loom is secure enough and far enough away to not foul the cables in any travel position. All the wire connections are soldered into tiny holes. Years ago when my eyesight was heaps better, this job wouldn't have been a problem but today it is much harder to do.



With the help of a wire-holding jig and a magnifying glass it all worked out okay.

When installing both servos the control surfaces have to be in the neutral position as well as the servo arms being perpendicular to the pushrods. This ensures that the servo has plenty of travel in both directions and won't go anywhere near over-centre.

There are both pitot and static lines to install as well. These should be installed as near the altimeter as practical. The only problem with this job is pulling the panel out once again. When I was near the end of building our Falco and was removing the panel, I foolishly stated that this would be the very last time I would ever have to take it out. Ha Ha, 10 times later I'm not game to make such a bold statement again. Speaking of pulling the panel out, both servos have the option to be reversed in direction by swapping wire positions. The roll servo is easy as you can just reverse the wires at 4 and 5. (Soldered connections) The pitch servo uses pin Nos 1 and 2 by installing or removing a jumper between these pins at the back of the AP unit itself. I figured that I didn't particularly want to pull the panel out again if I hadn't worked out the directions properly, so I installed a long wire jumper. This wire loop was long enough to be accessible when everything was back in place.

Once everything is in place, it's obviously time to turn it all on and see what happens. Well, when I hit the power I thought all hell had broken loose; the rear servo was moving and making a terrible noise. The servo arm was moving in jerky movements and then forcing itself back towards neutral and starting all over again.

To make a real long story short, what was happening is exactly what is supposed to happen, but not explained clearly enough (at least not for me) in the installation manual. What was happening was the AP is trying to hold the aircraft straight and level and the elevator is sitting there in a nose dive configuration so it instantly tries to raise the nose but the elevator is too heavy for the clutch in the servo so it slips back to the neutral position and then starts again. We tried various things like supporting the elevator, levelling the waterline and holding the stick back. In fact, any and everything that we could think of. All to no avail.

On the suggestion of our supplier, we pulled out the aileron servo (which was behaving) and swapped to see the reaction. The aileron servo did exactly the same thing whilst the pitch servo was perfect in the aileron position. The long and the short of all this ramble is the elevator is too heavy whilst on the ground and no matter what torque you set on the AP unit, it will still slip badly, but as soon as you are in the air all the load is aerodynamically carried, and it is perfect. As long as you are 110% sure that the AP disconnects on demand, the easiest thing is to just go and fly to test it out.

As mentioned earlier flying with the Trutrak is very easy, either in the GPS mode or in the synchronized magnetic mode. The only problem that I have found with the unit, and this showed up when I was showing off to Stephen Friend, that when I turned it on it gave a heading about 30 degrees off our actual. I'm sure this is the operator's fault, not the units.

When the unit is turned on whilst in flight, the knob has to be held in for at least 10 seconds to initialize the gyros. The first few times we turned it on in flight, I just pressed the knob in to start and didn't hold it in. If the unit is turned on whilst on the ground at start-up the initializing happens there and gives true readings. Even though we have only flown through pretend cloud, it sure is a strange feeling sitting there with your arms folded just watching the plane fly itself on an extremely stable descent path to a distant point.

Falcos Downunder 2005

by George Richards

The idea of a Falco fly-in with three Falcos may seem a bit strange from an American perspective, but when you consider the rarity of the breed and the expanse of the Australian territory, it is really quite an achievement. And I attest to the fact we have a lot of fun. I'm sure we carry on in the same manner that all Falcophiles do when gathered in a flock. And like all meets, there is at least one moment where a couple of people are lying on their back under someone's Falco discussing or viewing the gear with photographic evidence. Its great fun, and I for one look forward to them.

This year's event was organised by Drew and Judy Done, and it was held at their home base airport of Merimbula on the Sapphire coast of Australia. I confess to it being the first time I'd ever really considered where Merimbula might be, or what it would be like. So when I ordered the plane tickets (my Falco wasn't ready for such a big outing, and I didn't have the time either), it was a bit like heading into uncharted territory for an ignorant Kiwi like myself. What we found was that Drew and Judy live in an idyllic little seaside resort that we certainly look forward to visiting again.

Our arrival was a bit late, due to a work stuff up, arriving Saturday morning. Most of the others had arrived Friday at some time earlier and spent the night out at a seafood restaurant re-acquainting themselves. As our Metroliner taxied in, we could see the Falcos in the corner of the field being readied for the day's activities. I was suddenly in a hurry to get out! Judy Done and Juliet Ferguson were our greeting party, and they showed us to our rental car pick-up point and bags.

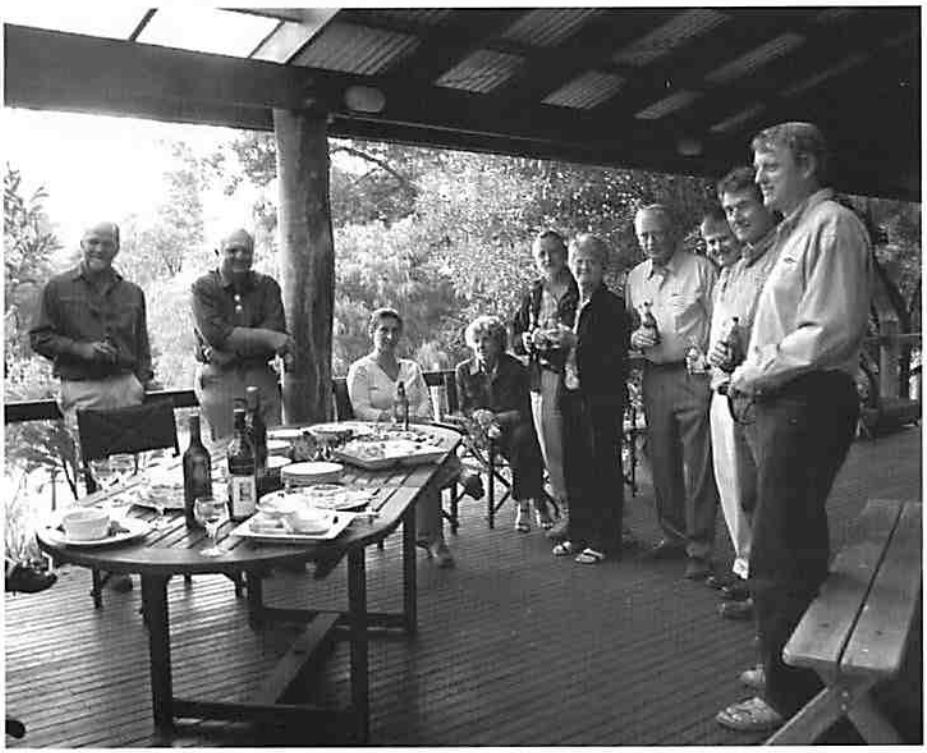
After picking up our rental car—which was adorned with the largest damn spider I'd ever seen—we headed down to a little room that was arranged for the get-together to meet the rest of the gang. You couldn't really miss the fact that this meeting room was intended for Falco types. Both entrance doors had the "Nine Intoxicating Flavours" posters on them and inside were various magazines with Falco references and Drew's plan set, info pack and photo construction log. I haven't got to the bottom of who that young guy in the photos was yet though.

Outside on the flightline, the group had gathered, and I guess you could say the fly-in had begun. The Falcos of Done, Ferguson and Friend were in the process of being lined up on the hardstand and milling around watching their arrival was the balance of the group. Present were Drew and Judy Done, Ian and Juliet Ferguson, Steven and Annie Friend, Neil and Gwyn Aitkenhead, Rob Phillis, Garry and Brenda O'Leary and (myself) George and Vicki Richards. Let the aeroplane talk begin!

Falcos of Ferguson, Done, and Friend.

The rest of the morning was spent on Falco talk while the girls visited a local country art gallery with Judy. Lunch time rolled around pretty quickly and so with the arrival of the girls back from their tour we all headed off for a casual lunch at the local golf club. Despite the beautiful course with lush green fairways nobody seemed keen to dump the Falco group in favour of a quick nine holes—I certainly wouldn't, but that is an article in itself—so after lunch it was back to the airport for the whole group.

Air-to-air photography was the plan for the afternoon so it had been arranged for a local chap with a 206 to take the photographers, one of whom being Juliet Ferguson, while the three Falcos carried out a succession of formation passes. The 206 owner very kindly advised he would remove his door, since he felt that if he didn't, the Falcos might not be able to keep up! I was lucky enough to score a ride with Ian who flew in the slot, while



Top: Ian Ferguson explores the shore. Above: Australians with an excuse to drink

Steven flew lead with Garry, and Drew flew wing with Rob.

The day was a little bumpy which made for some fairly high concentration levels on all concerned and after only about six orbits of the 206, the photographer felt sure he had got at least one photo! I think Juliet managed to get more shots. They certainly had their work cut out trying to snap three Falcos racing by in formation with not a lot of warning and all those bumps. I thought it was huge fun although the pilots complained of overwork and underpay. Even the girls, who had gone for a walk, got a kick out of the formation flying when we overflew them on the way back to the airport.

After arrival back at Merimbula, the aircraft were put to bed, and everyone went their own separate ways to get ready for dinner.

Five PM rolled around, and we all met up at Drew and Judy's house for a tour of their plant nursery business. Now I must confess to being absolutely ignorant when it comes to gardens and plants and things, but I found the whole deal very interesting. It's funny how things change significantly when they are done on a large scale. It seems growing plants is no exception. I also must say that I was surprised to see such a large, well organised set-up in the middle of the bush. All in all very educational and interesting.

After the tour we all headed back to Drew and Judy's house for drinks and dinner. For a spot to live in they really have found a piece of paradise. The house is built from mud brick with redwood beams and slate floors in a very timeless design. It certainly fits very tastefully into its surroundings in the Australian Gum trees. I could certainly see myself being very comfortable there, although I'm sure Judy would have something to say about that.

Drew and Judy had arranged for professional caterers to cater the event, and they supplied a feast fit for a king. All involved had a very pleasant evening of good food, good company, good conversation and fun. Drew and Judy certainly went the extra mile and showed how good the Aussies are at hospitality by inviting us all into their home and destroying the peace.

The next morning day dawned a picture perfect day. Some of the girls went off horse riding and the rest met mid-morning at the airport meeting room to discuss the days activities over a cup of coffee.

The girls got back around eleven, and all the planes were readied for the day's trip to Frog's Hollow.

"Frogs" is a country grass airfield about 10 min flying time away, where Drew and Judy fly to every Sunday to meet up with friends, talk planes and eat lunch. It has become such an institution that the local commuter airline crew fly out to Frog's Hollow—in a 206, not their Saab!—during a long turn around they have in Merimbula. Once again the local Aussies showed great hospitality in making us all feel very welcome and supplying us with a very tasty barbecue lunch.

Everyone enjoyed themselves and all too soon it was time to wave goodbye to Stephen and Annie Friend and then make our own way back to Merimbula. On the way back, there was a little more formation flying and some good photo opportunities, particularly when Drew and Rob formated on the Cherokee 6 that Vicki, Gary and I were passengers in.

For an end to the event the remaining team spent a pleasant evening in a local seafood restaurant with much time spent on where and when the next fly-in would be.

It was over all too soon, but I can say that I had the best time I have had in a while. Thanks to Drew and Judy for organising such a fun event. I can't wait until the next one.

Construction Notes

On behalf of James Tseliki, Claudine Bloom asks "A company here is prepared to service the oleos for the Falco. We have given them a copy of the drawing, but they need to know whether the struts must be refilled with fluid with the valve uppermost or upside down. They said that some aeroplanes (i.e. the Ralley) struts need to be refilled with the valve upside down."

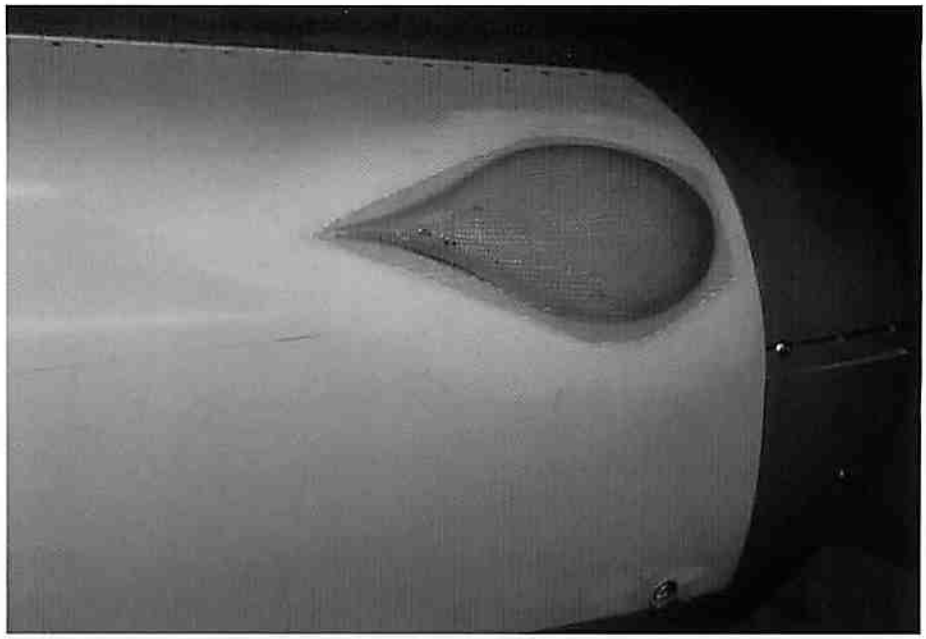
Valve uppermost. Normally, they are serviced in place with the airplane on jacks. To fill the struts, remove the valve core and put a plastic hose over the valve and the other end of the hose in a can of hydraulic fluid. Then exercise the strut by collapsing and extending it. This will push air out and draw fluid into the strut. When the strut is filled, air will cease to come out of the hose in the bottom of the can. Then, collapse the strut by pulling the wheel fully up. With the strut fully collapsed, remove the hose. There is a metering tube inside the strut which traps the right amount of air. Then extend the strut, replace the valve core and fill it with nitrogen.

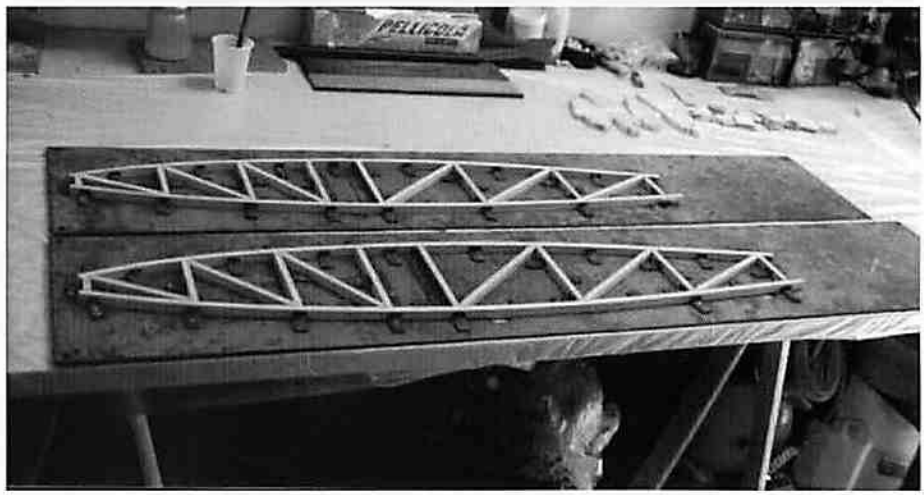
Dave Nixon asked about the tail light strobe fairing, and what material it is made of. The fairing could be made out of aluminum or fiberglass. I've always thought of it as a fiberglass part, but if you're talented in forming aluminum, have at it. It's just a fairling.

Dave also mentions that Whelen has a change in part numbers, and that they don't make the A500-14 nave and strobe light any more. He says that the new part number appears to be A555A and then specify 14 volts.

Angus Buchanan sent a note explaining that he could not understand the exhaust port framing, and he has searched the Falco Skunkworks and Hangar on our website for photographs that explain it. So, I knocked out a simple set of drawings which show how all of the pieces fit together. It's shown here, and we will add this to the Skunkworks.

A builder we'll just call 'Charlie' who has just had a serious episode in the hospital asks, "With the advent of the Sport-Pilot category, is the any possibility that the Falco can be operated under this new rule? It might be the answer for some builder-pilots denied medicals up to now to continue to operate their aircraft. Just wondering if there has been any thought given to this and, if so, in what direction might it be accomplished."





Top: David Carroll's speed bumps.
Above: Luigi Aldini used the wing rib jigs for the production Falcos.

From what I understand, the Falco is too heavy and fast for that category.

I'm not flying anymore, but I spent 20 years or more with a very laid-back attitude towards the regs. It was a rare moment when I was entirely legal when you consider the requirements for annual inspections of the airplane, biennial flight reviews, or keeping my medical certificate up to date. I've never felt any obligation to be entirely compliant with the government. I just viewed them like a crazy aunt that you couldn't completely ignore, but it is always best to not draw attention to yourself.

Building the Falco is a journey, and the journey is the reward as much as finishing the final machine. Let's say you are right, you work on the Falco, get it flying and then sell it because you don't have a medical. If you do that, you'll live longer and be happier while you are doing all of this, and you'll get a great sense of satisfaction from building the plane. It sure beats playing shuffleboard.—*Alfred*

Many thanks for your refreshing thoughts! I completely agree with your philosophy, and I believe that I shall continue on my Falco construction project despite a recent stay in the hospital. While they were repairing [my problem], they found that all else was in good shape. I feel that I could safely and confidently operate the Falco; although it is probable that I would never qualify again for a 2nd or 3rd Class FAA Medical.

A builder once said that hours spent in building the Falco are not deducted from your allotted time on the earth, but are added to it. Construction of the Falco itself is therapeutic, so I will continue with the treatment. And just between you and me, I have every intention of flying it one of these days—screw the bureaucracy and their medicals!—*Charlie*

'Charlie' also asks, "Is the electrical components kit compatible with a future conversion to a glass panel type of installation we hear so much about these days? While I do not yet need the electrical kit, I have been contemplating placing an order for one, just so I have it and can look it over and become familiar with it and its installation details well before I am ready to use it. I guess that what I am concerned about is some requirement down the road that may be called for should I want to get high-tech when I am ready to install avionics and be faced with a major compatibility problem when what I have installed won't work with the new generation of equipment. More specifically, for the moment: do you foresee any major problem in the future if I purchase the Sequoia Falco electrical kit now and then later (who knows when) get the bug to convert the conventional panel over to the new?"

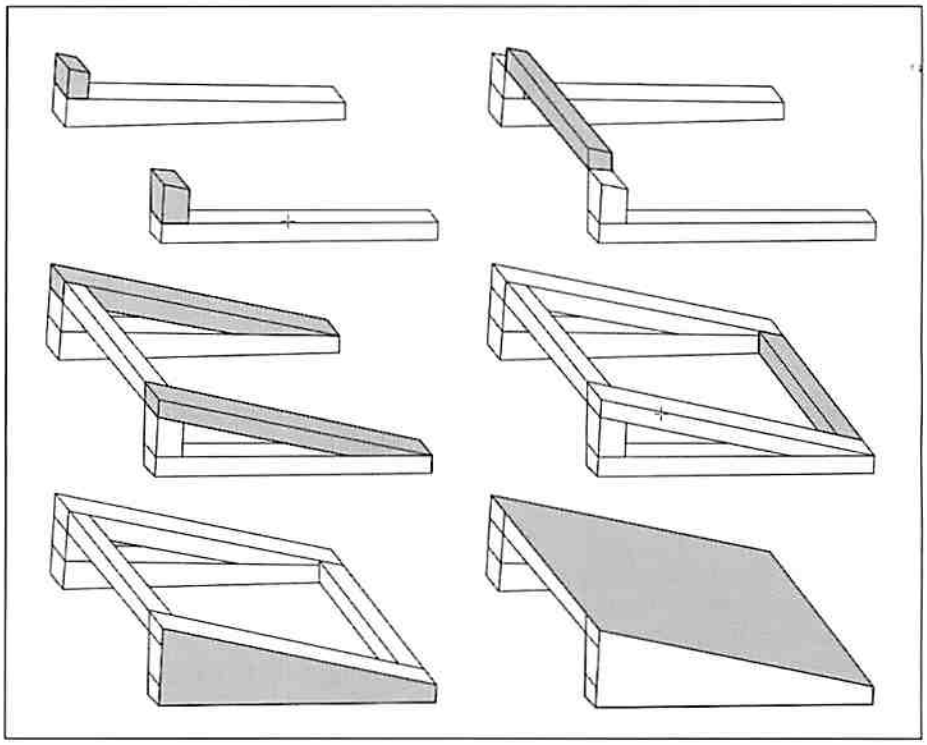
On the electrical kit, it is 'avionics neutral' except that it provides for circuit breakers for a full IFR installation. Today, you need much less equipment and the equipment draws much less power. The conflicts will all be in the instrumentation and avionics. For example, does the glass cockpit attempt to handle oil pressure, oil temperature, amps, fuel quantity, RPM, etc.?

At this point, we have one or two Falco builders who are installing these things. I always want to be the last person on my block to adopt a new technology, and it only makes sense to change things when the industry has settled on a standard installation, much as they have done for the current generation of instrumentation and avionics.—*Alfred*

Marcel Morriën asks, "I'm still building, someday the bird will fly. Before that I have to do a lot of crimping on electrical terminals. Is there any news on crimping tools since you wrote about them in the instruction manual of the electrical kit? The there-mentioned instruments seem relatively unknown and may be replaced by more modern designs."

As far as I know, there are no different crimping tools available, but you can always consult AMP catalogues, which is where we got all of our part numbers.—*Alfred*

Ryan Vaughan asks, "I've been preparing to glue the fuselage frame laminations soon. I'm planning on using Penacolite glue for this process. My question is about the actual gluing sequence. After I trial-fit all the laminations and scarfs without glue and I'm ready to actually glue, I was planning on laying in the outer lamination loosely held to the female jig by bar clamps followed by applying glue to the next lamination and inserting it next to the previous lamination, again held by loosened clamps. Then repeat until all laminations are in and tighten all the clamps while ensuring scarfs and laminations are aligned and flat. And doing all this before the closed assembly time for penacolite glue expires."



Step-by-step illustration of the exhaust port framing.

I question this technique as there will be a lot of glue squeeze-out between clamping stages. I would not do this at all. I don't like the idea of clamping, then releasing the pressure, moving things and then clamping again.—*Alfred*

Is there another method that might make this process less messy or more simplified? Perhaps for the smaller laminations I could stack and glue all the laminations first before insertion into the jig, but for the large frames this seems daunting. Any tips would be appreciated.—*Ryan*

The only method we have used and which I would recommend is that you put glue on all of the laminations, stack them up and then get them into the form all at once and then clamp everything. However, this can be very difficult since the wood can crack rather easily. On the smallest frames, we used a male form and pulled the laminations around the form, and this worked very well.—*Alfred*

From David Carroll: I am installing a Lycoming IO-360, and the cowl requires blisters (beauty-bumps I call them). I have fabricated the blisters to provide adequate clearance for the front cylinders but I may need them to be larger. I have de-hydrator plugs installed in place of spark plugs, the clearance for the plugs is fine. Now, with spark plugs installed with the spark plug wire installed I'm short on clearance, oops! Are there special spark plugs that extend out from the cylinder a shorter distance than normal plugs? Or, do the 90-degree fittings on the spark-plug wires solve this (there is approximately 1/2" clearance between the end of the spark-plug and the inside of the cowl door) though pictures of the 90-degree fittings don't show any savings in space."

As far as I know, all of the standard spark plugs are the same length, however Jonas Dovydenas has installed a Unison(?) ignition system, and he says the electronic ignition uses a shorter spark plug. I asked him to write an article about it for the next FBL, but I haven't seen it yet and at press time he was heading back to Afghanistan again for more photography. Everyone has a different idea of what a vacation should be.—*Alfred*

Angus Buchanan said that the framing of the exhaust port totally confused and befuddled him. In fact, he was so confused by it, he had difficulty even phrasing the question and said "I can't do the eye gymnastics" to make any sense of it. So, I banged out a little sketch of how the pieces go together.

The Glider

Part 23 of a Series

by Dr. Ing. Stelio Frati
translated by Maurizio Branzanti

Chapter 9
Applied Loads and Structural Design

56. Wing Stress Analysis.

Let us again consider the wing and analyze what we have called the second phase of the design of the supporting structures, that is, the calculation of the structural stresses considering the architecture itself.

In this design phase, we enter a field of engineering that deals directly with construction. Since it is evident that we cannot discuss this topic in great length, or even assume that the reader will have complete knowledge of this discipline, we will discuss a simple and practical method of calculation.

1) Load distribution at maximum lift. The load on the half-wing

$$n = (Q - Q_a)$$

is distributed on the wing according to the area, and thus proportionally to the chord of the wing. In practice, the rounding of the wing tip is not considered, therefore the calculated area is slightly greater than the actual wing area. It is acceptable to do this, since we use worse-than-actual load conditions, because the center of the wing area will be located farther outboard.

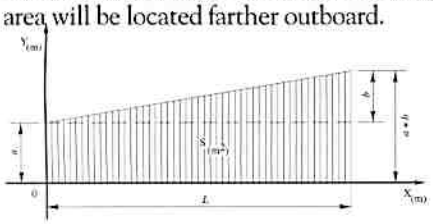


Figure 9-3

The drawing that shows the wing area also represents the load distribution on it. Since the stresses increase from the extremities to the center, the distances are counted starting from the wing tip where the origin of the x and y axis is placed.

If a is the minimum chord, (a + b) is the maximum chord at the wing root, and L is the wing half-span, the intensity of the loads corresponding to these chords will be

On the minimum chord:
$C_1 = a * P/S$ *(kg/m)*
On the maximum chord:
$C_2 = (a + b) * P/S$ *(kg/m)*

Where *P* is the load on half-wing and *S* is the half-wing area.

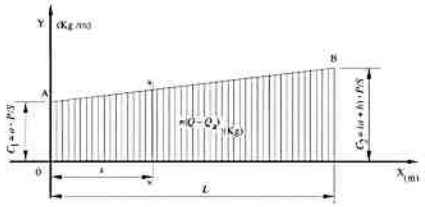


Figure 9-4

Example. Let us suppose that the wing of a glider has a minimum chord of $a = 0.5$ *m.*; half-span $L = 8$ *m.*; maximum chord $(a+b) = 1.5$ *m.*; total weight $Q = 300$ *Kg.*; wing weight $Q_a = 100$ *Kg.*; $n = 3.5$; half-wing area $S = 8\ m^2$.

The load for the half-wing will be

$$n * (Q\text{-}Q_a) = 3.5\ (300\text{-}100) = 700\ kg.$$

The load for the minimum and maximum chord will be

$$C_1 = a * P/S = 0.5 * 700/8 = 43.75\ kg/m$$
$$C_2 = (a+b) * P/S = 1.5 * 700/8 = 131.25\ kg/m$$

In the wing schematic, the chords in an appropriate scale represent the ordinates y of the load diagram.

Cantilever Wing. Shear stress. Bending moment. Let us consider first a tapered wing without external means of support. In a generic section S of the wing, the shear stress is none other than the sum of all the loads outside this section, while the bending moment is given by the product of this outside load and the distance d of the center of gravity of the section.

To determine these shear stresses and bending moments in the various sections of the wing, we may use two methods: analytic and graphic.

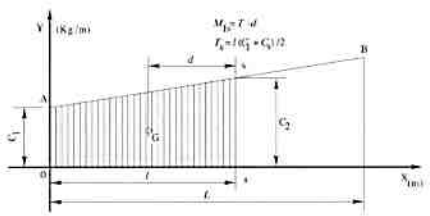


Figure 9-5

Analytic method for a tapered cantilever wing. The shear and bending loads are calculated by integrating the load once and then a second time. This gives us the relation that ties the load distribution to the wing span.

From Figure 9-4, we get the equation of the line AB that represents the load distribution

$$y = \left(\frac{C_2 - C_1}{L}\right)x + C_1 \quad [28]$$

for every value of x distance of the section to the tip, we get the value of load y.

Integrating this function will give us the one for shear stress

$$T_x = \frac{C_2 - C_1}{L} \cdot \frac{x^2}{2} + C_1 x \quad [29]$$

and integrated one more time will give us the function of the bending moment

$$M_{fx} = \frac{C_2 - C_1}{L} \cdot \frac{x^3}{6} + C_1 \frac{x^2}{2} \quad [30]$$

In these equations C_1, C_2, and L are known values, and for every value of x we get the values for T and M_f.

Example. Let us consider the wing from the previous example and obtain C_1 and C_2, let's round off the values to

$C_1 = 44\ kg/m$
$C_2 = 131\ kg/m$
$L = 8\ m$

Let's suppose we want to obtain the values of T and M_f at a distance from the tip of $x = 4$ *m.*

$$T_x = \frac{C_2 - C_1}{L} \cdot \frac{x^2}{2} + C_1 x = \left(\frac{131 - 44}{8}\right) \cdot \frac{16}{2} + 44 \cdot 4 =$$

$$= \frac{87}{8} \cdot 8 + 176 = 263 kg$$

$$M_f = \frac{C_2 - C_1}{L} \cdot \frac{x^3}{6} + C_1 \frac{x^2}{2} = \left(\frac{131 - 44}{8}\right) \cdot \frac{64}{6} + 44 \cdot \frac{16}{2} =$$

$$= \frac{87}{8} \cdot 10.7 + 352 = 468 kgm$$

By repeating the calculation for the other values of x we obtain the shear loads and bending moments of the various sections of the wing.

In practice T and M_f are calculated for the location of wing ribs.

Rectangular cantilever wing. In the case of a rectangular wing, we will have a load diagram with a line parallel to the x axis as shown in Figure 9-6, so $C_1 = C_2 = C$.

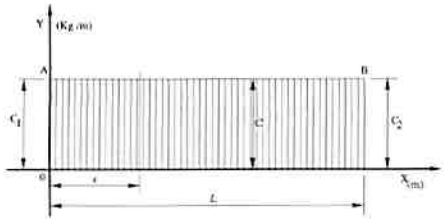


Figure 9-6

Therefore the load equation is $y = C$, thus the load is constant.

And with $C_2 - C_1 = 0$ the shear equation will be

$$T_x = C \cdot x \quad [31]$$

And for the bending moment

$$M_f = C \cdot \frac{x^2}{2} \quad [32]$$

Thus, the calculations for T and M_f are rather simple for a rectangular wing.

Rectangular-tapered cantilever wing. Finally, let us consider a wing with a rectangular center section and an outboard section tapered to the wing tip. See loading diagram in Figure 9-7.

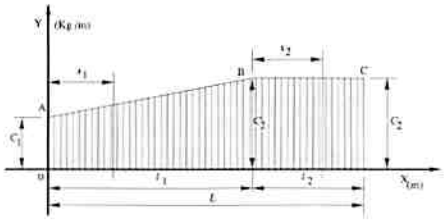


Figure 9-7

The shear equation for the tapered portion from the wing tip to Section B, as we have seen in equation 29 is

$$T_{x1} = \frac{C_2 - C_1}{l_1} \cdot \frac{x_1^2}{2} + C_1 x_1$$

Where x_1 may vary from zero to l_1

$$0 < x_1 < l_1$$

For the rectangular portion from B to C, the shear is given by the summation of the maximum in B that is equivalent to

$$T_B = \left(\frac{C_2 - C_1}{l_1}\right) \cdot \frac{l_1^2}{2} + C_1 l_1$$

or

$$T_B = (C_2 - C_1) \cdot \frac{l_1}{2} + C_1 l_1$$

with the resultant of the rectangular portion starting from B that is equal to equation 31

$$T_{x2} = C_2 \cdot x_2$$

Where x_2 is taken starting from B and may vary from zero to l_2

$$0 < x_2 < l_2$$

Therefore in a generic section between B and C shear is equivalent to

$$T_{x2} = T_B + C_2 \cdot x_2$$

To represent a wing of this type, we use a diagram as shown in Figure 9-8 where the line is parabolic from 0 to the B section and linear from the B section to the fuselage.

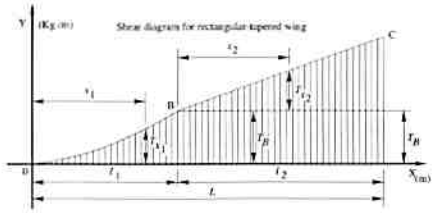


Figure 9-8

For the bending moment also, the two sections are considered separately. For the tapered portion from the tip to section B it is the same as we have previously seen in equation 30

$$M_{fx1} = \frac{C_2 - C_1}{l_1} \cdot \frac{x_1^3}{6} + C_1 \cdot \frac{x_1^2}{2}$$

For the rectangular section from B to C the moment is equal to the product of the load in the tapered section and the distance d from the center of gravity G for the generic section s under consideration as shown in Figure 9-9 and adding the moment of the rectangular section originating at B that is

$$M_{fx2} = \left(\frac{C_2 - C_1}{l_1}\right) \cdot \frac{x_1^3}{6} + C_1 \cdot \frac{x_1^2}{2}$$

The distance of the center of gravity G from the B section may be found either with a simple graphic method, or with the ratio between the bending moment and the shear in B.

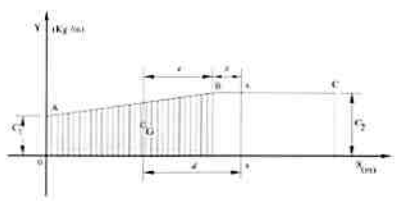


Figure 9-9

Calling this distance e, we have

$$e = \frac{M_{fB}}{T_B}$$

Finally, it follows that the bending moment equation in the rectangular section is

$$M_{fx} = T_B(e + x_2) + C_2 \cdot \frac{x_2^2}{2}$$

Where T_B is the shear stress at B, and $(e + x_2)$ is the distance of the center of gravity of the load on the tapered section we are considering.

Here also, the diagram of the total moment may be considered as the summation of the one given by the load in the tapered section (R), with the one given by the rectangular section (S) in Figure 9-10.

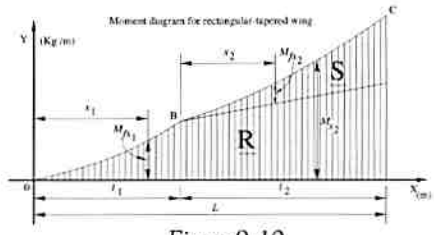


Figure 9-10

The resulting line is parabolic (cubic parabola) from 0 to B, linear from B to D, and again parabolic from D to C.

Example. Let us consider a wing of this type, a rectangular section followed by a linearly tapered section.

Let it be:

$C_1 = 40\ kg/m.$
$C_2 = 130\ Kg/m$
$l_1 = 4m$
$l_2 = 5m$

We want to determine T and M in a section s at $7m$ from the tip.

We will have therefore $x_2 = 3m$.

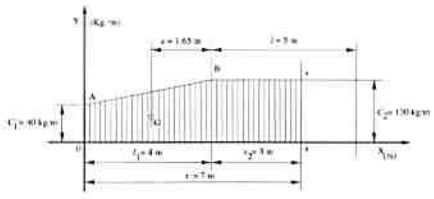


Figure 9-11

For shear at section B, the maximum value for the tapered section will be

$$T_B = \left(\frac{C_2 - C_1}{l_1}\right) \cdot \frac{l_1^2}{2} + C_1 l_1 =$$

$$= \frac{130 - 40}{4} \cdot \frac{4^2}{2} + 40 \cdot 4 = 340kg$$

The shear in this section s will be

$$T_s = T_B + C_2 x_2 = 340 + 130.3 = 730kg$$

Let us determine now M_f. In Section B it is equal to

$$M_{fB} = \left(\frac{C_2 - C_1}{l_1}\right) \cdot \frac{l_1^3}{6} + \frac{C_1 l_1^2}{2} =$$

$$= \frac{130 - 40}{4} \cdot \frac{4^3}{6} + \frac{40 \cdot 4^2}{2} = 560kgm$$

The distance e of the center of gravity of the load on the tapered section is

$$e = \frac{M_{fB}}{T_B} = \frac{560}{340} = 1.65m$$

The bending moment in the section s is therefore

$$M_{fs} = T_B(e + x_2) + C_2 \frac{x_2^2}{2} =$$

$$= 340(1.65 + 3) + 130 \frac{3^2}{2} = 2165kgm$$

We have seen how the shear stresses and moment in a tapered wing are calculated analytically. Let us now continue with a graphic procedure.

Graphic method. The stress determination of T and M_f are based on a graphic integration. In this method, the function of load is expressed graphically by a curve that when integrated one or two times will give us the diagrams of shear and bending moment.

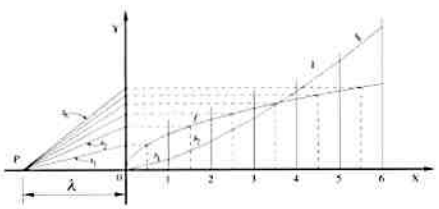


Figure 9-12

Generally to complete a diagram where l as an example is the line that determines it, we divide this in many parallel strips that are perpendicular to the x axis. We trace the middle of these strips, their intersection with the line l are projected horizontally to the y axis. We then take a point P at will on the x axis, and we connect this point with each of the projections on the y axis.

We will have a number of lines with various angles all originating from P. The distance of P from the vertical axis where the projected points of l were traced is called the polar distance, and it is indicated with the letter λ.

Starting from the axis origin O, we trace segments parallel to the lines $s_1, s_2 \ldots s_n$ that will intersect the vertical lines in points $1, 2 \ldots n$. The resulting segmented line I is the integral line we were looking for.

To read the diagram we need to establish the scale for the y axis. This is obtained by the product of the value of the x axis by the ordinate values of line I and the distance of polar λ.

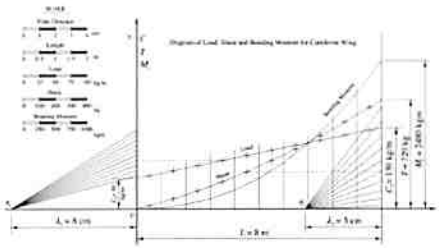


Figure 9-13

Example. Let's construct a graphic diagram of shear and moment. Let's use a convenient scale for the shear loads of a cantilever wing as shown in Figure 9-13

1 cm = 0.5 m for the dimensions on the x axis
1 cm = 25 kg/m for the loads on the y axis

In relation to the wing's ribs, from the smallest one to the largest one, and with a linear variation in between them, the load is

$C_1 = 50\ kg/m$
$C_2 = 130\ kg/m$

The half-wing span is $L = 8m$. Taking P_1 at a distance from y axis

$\lambda_1 = 8\ cm$

we divide the loading diagram into ten strips, and as we have seen, we obtain the shear diagram.

We need now to establish the scale in order to read the diagram. This is given by the product of the loading scale, the length scale and the polar distance λ_1. Thus the shear scale is

$1\ cm = 25 * 0.5 * 8 = 100\ kg$

In the diagram the maximum value of T is given as $7.2\ cm$, therefore

$T = 7.2 * 100 = 720\ kg$

To verify this, let's determine the total load on the half-wing, that is, the maximum shear. The average load intensity is

$$\frac{C_1 + C_2}{2} = \frac{50 + 130}{2} = 90kg/m$$

This multiplied by the span L gives us the total load of

$P = 90 * 8 = 720\ kg$

Exactly coinciding with the value found graphically.

Using the same procedure, we now integrate the shear diagram plotting a polar distance $\lambda_2 = 5\ cm$ to the right of the diagram, so not to interfere with the previous lines. The resulting new diagram will be the one for the bending moment.

The scale is given by the product of the shear with the length and the polar distance λ_2. Thus, the moment scale is

$1\ cm = 100 * 0.5 * 5 = 250\ kgm$

From the diagram we obtain the maximum value of the bending moment as

$M_f = 9.85 * 250 = 2460\ kgm$

The advantages of the graphic method over the analytic one are several.

First of all, with the graphic integration method we can derive to the diagrams of shear much faster than we can analytically and also the procedure is not complicated by the various shapes of wing being considered, that is for the distribution of loads it is not always possible to analytically establish an equation that represents the distribution of the load itself.

The precision of the graphic method may be inferior to the analytic one, but with the graphic method is impossible to commit the gross errors are often easily made analytically. Also for greater safety, all analytically-found values should be reported graphically in order to check their validity.

In the graphic method, it is advisable to operate with a small scale in order to obtain maximum precision. In practice 1/10 used for the lengths, and the loads and shears diagrams are divided in many strips.

John Kahrs

by Stephan Wilkinson

Cornwall, New York, where I live, is a small, insular town. Slightly beyond the highest bathtub ring washed up by bustling Manhattan commuters, just beyond the dismaying tide of bedroom communities, we're a town of New York City cops and firemen who can't afford to live in suburbia, a couple of famous Army officers because we're only five miles from West Point, and a whole lot of locals for whom "going to the City" means a trip to Poughkeepsie. (Popeye Doyle threatened the bad guys in The French Connection by asking them if they picked their feet in Poughkeepsie. I never did know what he meant.) The sole local of note, actor Armand Assante, grew up and went to school here. I've only been to the Assante family manse as a volunteer ambulance driver; Armand's mother is frail.

But I met Carl Ludwig almost 25 years ago, here in Cornwall, and he had just finished writing much of the software that made possible the filming of the world's first fully computer-animated feature, Tron. Nobody then knew what "computer animation" was, least of all me, but Carl and I hit it off immediately. He had a nicely restored Beech T-34 in Air Force trainer colors, as well as an early-1970s lightweight Porsche 911E that he'd owned since it was new. Our interests—airplanes and Porsches—neatly dovetailed.

Carl went on, a couple of decades later, to buy and reassemble for flight a two-seat Czech L-39 Albatros jet trainer. It is today perhaps the nicest L-39 in the country, painted in the rare camouflage colors of the Royal Thai Air Force, which operated L-39s as fighter-bombers. I gave Carl some minor help in putting the L-39 back together and got to fly it a bit, but one of the nicest things Carl ever did for me was to say, "You know, you ought to meet your young neighbor John Kahrs. He's a sailplane pilot, but he's fascinated by the thought of someday building a kitplane."

Ludwig had by that time moved to nearby Westchester County, but he had hired John Kahrs to come work at his boutique film-animation firm, Blue Sky Studios. (Blue Sky did the fantastic film Ice Age, another milestone of computer animation, thanks in large part to Ludwig's code.) John and I simultaneously looked each other up, and it turned out that he and our daughter Brook had gone to Cornwall High School if not together at least only 11 years apart. Brook is today 26, John Kahrs 37.

Kahrs had no idea what a Falco was, but I took him flying in N747SW one day, we became friends and mutual admirers (I'm proud to say), and today, John is a Falco builder at least in part because of that simple fun flight over the Hudson River Valley.

But that is only the superficial part of the story. As is true of so many Falco builders, Kahrs is an enormously but quietly talented person whose accomplishments should make people in Cornwall say, "Oh, yes, Armand Assante and John Kahrs are both from my town." But of course they don't, because they aren't even aware that John Kahrs is one of the most highly regarded and talented animators (most likely soon to be a director as well) of computer-animated films.

Kahrs has been doing animation since he was a teenager, in those days with flip-page moving-image booklets he laboriously drew. Sad to say, Cornwall High School, more interested in students who grew up coloring inside the lines, never appreciated what a talent they had among their students. Kahrs wasn't very happy there.

But he is now. Have you seen Pixar Studio's The Incredibles? It's a comic-book story but probably the most technologically advanced animated feature ever filmed. Kahrs was a lead character-development animator on that very successful film, and if you go to Blockbuster and rent the DVD, you'll see John interviewed on the added-attractions disk. And in the film, pay attention to "the Learjet sequence"—you'll know it when you see it—because it's a major sequence that John animated and of which he is particularly proud.

Such reticence is characteristic of many Falco builders. Alfred Scott recently commented, "I never knew that Joel Shankle was an Olympic silver medalist until somebody told me." Pixar, founded by Apple's Steve Jobs, is arguably the world's most imaginative and creative film-animation studio. A couple of years ago, at a party in Big Sur, I met John Lasseter, the animation genius who is essentially Pixar's creative director.

"I know a guy who works for you," I said to Lasseter. "John Kahrs," thinking Lasseter might politely pretend to recall the name.

I might as well have said I was Steve Jobs' brother-in-law. "Ohmygod, John is the best," Lasseter said. "What a talent!"

John was solely a sailplane pilot when I let him fly my Falco, and he today admits that he was baffled by my insisting that he use right rudder on climbout. Whatever for? Today, he's on the verge of getting his single-engine rating and has meanwhile become an increasingly serious sailplane pilot. He owns and flies a German-designed, Czech-built, carbon-fiber Discus CS—a generation ago the Porsche Carrera GT of sailplanes—and at one point traveled to the factory in the Czech Republic to watch it being built.

Kahrs is a little embarrassed to admit that he's still working on the tail surfaces of his Falco, a task recently made even more challenging by the fact that a bunch of lumber fell onto it from the rafters of his workshop and crushed the stabilizer spar. "It sometimes seems like everyone else is finished. They're all done building their Falcos. They're flying," John says today. "I think I'm the only guy still working on the tail, and I just wish there was one other builder who was in my position."

People! Help this man. I know you're out there, you of the barely skinned elevator. You who still unroll the plans on the living-room floor nightly but are still debating the next step. You who (like me) built the $1.98 trim-tab control wheel kit and figured that you were halfway to flight. C'mon builders, John Kahrs needs to know he's not alone.

Doug Henson finally got his Falco painted, it's yeller, all right.

Susan's Corner

Oshkosh 2005! It's almost here and plans are well underway. We've booked all 15 of our rooms at the Paper Valley Hotel, and I'm in the midst of putting our big Falco Builder Dinner together. I expect that the whole week will be nothing short of fantastic.

Those of you that have rooms reserved, and have not been in touch with me, please call or e-mail me ASAP with your arrival and departure dates. I'll also need a credit card number with the expiration date for the hotel, as they need to charge the first half of the cost of your room NOW and the balance of your room on July 1st.

Tickets for the Thursday night Builder Dinner are on sale now, so please call ASAP and make your reservations. I'll need a credit card number for that, too. Your dinner ticket will give you a great memento from the 50th Birthday Party because these are pretty classy dinner tickets! I do need to know how many will be attending and what your choice for dinner will be, so do call me now. This year the choices for the Thursday night dinner will be shrimp scampi over angel hair pasta, herb roasted chicken or thin sliced beef sirloin.

Tickets in advance will be $30 per person and are all-inclusive. Any tickets that need to be purchased at the door will be $35. I'm sure that you can all understand that with this size of a function, they must have a guaranteed number of dinners and only plan on about 5% extra, so it really is important that I get an accurate number for dinner. Dinner will be at the same restaurant as before, although they have changed the name again and it's now Emiliano's Italian Cuisine, but it's still at the Best Western, Midway Hotel on College Avenue in Appleton. There will be a cash bar from 7:00 to 8:30 with a nice assortment of hors d'oeuvres and munchies and dinner will be at 8:30, complete with a big birthday cake for dessert.

The last few months here at Sequoia have been pretty busy. We've had a lot of new builders as well as several builders that are picking up speed on their projects, so we've had kits going out the door left and right!

Right now my focus is pretty much all on the rooms and dinner for Oshkosh, so that's all the news from here for now and hopefully I'll see lots of you there!—*Susan Fleming* (Oh yea...I got married!)

Calendar of Events

Oshkosh 2005. Plan now to attend the 50th Birthday Party for the Falco.

West Coast Falco Fly-In. Sept. 9-11, 2005 at Lake California Airpark, near Redding. Contact: Larry and Ann Black (530) 347-1753 email falcoab@yahoo.com or John and Pat Harns (208) 245-4600 email pjharns@icehouse.net

World's Only Oyster Fly-In and Gathering of Stelio Frati Airplanes. November 5, 2005 at Rosegill Farm Airstrip. Contact: Dr. Ing. Alfredo Scoti (804) 353-1713, email: alfred@seqair.com

Mailbox

I've started to fly I-BARO again, and I use it as my personal means of transportation between Milan and Florence. It cuts my commuting time in half—45 minutes versus 2.5 hours by car and driving like crazy. Unfortunately the weather over the Appenino is not always pleasant and sometime I have had to use the car. My office in Florence is right across the runway, and I can see aircraft landing and take off all day long so you can imagine how I suffer if I go there by car.

This summer I've planned a nice vacation across Europe up to the Canary Islands with BARO.

Enclosed are some pictures taken last Sunday on an airstrip close to Arezzo. My friends drove there and it took 4:45 by car and Falco time 1:20. I had some headwinds along the route.

I'm not very happy with speed. I'm trying now to keep out it very clean. I'm seeing 188 knots indicated at 2500 feet, full power and 27/2700. It was slighlty faster few years ago. I'm out of rigging a little bit with the flaps not perfectly aligned, and I do not have the front door installed and the main doors are not tightly closed.

Also I've not sealed properly the canopy. At 8500 feet and 21/2400 it trues out 181 knots. The best altitude range is between 7500 and 8500, or at least this is my impression.

I've searched old FBL, and I'm looking for some comparative numbers to see if my Falco is slow or fast compared to other 180 hp Falcos.

One of my close friend has been with his SF 260 to see Cipriano's Falco, and he tells me it's really impressive.

I'm trying to organize a reunion with him and on the first weekend that the weather is OK over the Alps and Cipriano is available. I'll fly down there to fly formation with him and shoot some pics.

Andrea Tremolada
Milan, Italy

Andrea is now marketing manager for Ferragamo, which is based in Florence.

My Falco will be on the cover of the October Fliegermagazin in Germany. A month ago we made plenty of pictures over the "Bodensee". On one picture the main wheel well doors and the clamshell doors are not completely closed. I fixed this problem in the meantime. It caused some vibration above 130 KIAS. I completed the break-in of my engine and can now start with the performance testing.

Andrea Tremolada and Cipriano Kritzinger and their Falcos have yet to meet.

Until now I did some airspeed calibration using the GPS and three-leg method. At 5,500 ft pressure altitude at 8°C OAT and 158 KIAS TAS was 172.5 KT. The speed error was less than one knot. There are still some improvements possible like fully closed wheel well doors. Anyway speed isn't everything it's the handling qualities which are really impressive. Longitudinal stability is acceptable, it may be a factor with a low time pilot. But as we know it is always a trade-off between maneuverability and stability. I think the Falco exactly where a perfect plane should be. I also solved the manifold pressure fluctuation by installing an orifice about three feet away from the indicator. Now the MP is stable.

The Falco is great fun I never regret having spent that much time for building it. People are fascinated about this plane.

Cipriano Kritzinger
Wegberg, Germany

Thanks for your kind email and for notifying the other builders. At this stage things are going well although the chemoherapy does not have much entertainment value. I have a 65% chance of total remission so feel very confident at this stage. To put it all in perspective, during the time that I've been building the Falco I've had a malignant melanoma removed, contracted a severe case of psittocosis requiring hospitalisation, been attacked by a cow and hospitalised (no recollection of this event, but the witnesses thought I'd been killed at the time). So I figure this will have to be better than your average bowel cancer to get me. I've also had some pretty amazing adventures during this time as well.

One think this has brought out to me is the amazing support I have from friends and family throughout the world. Also, the very close 'family' of the Falco fraternity let's me know how luck I am to have met so many great people.

I will be in contact again shortly to order some more kits—I'm determined to complete the project. (If all else fails, Lynette Zuccoli has offered Aerotech's services to complete it.) My son, who is in training to be a military pilot is trying to lay claim to the Falco when it is fin-

ished—regardless of my state of health. He claims only a professionally trained pilot deserves such a beautiful airplane. I think he's joking, but I'm keeping the gun loaded just in case.

Graeme Lean
Landsboro, Queensland
Australia
gdlean@excite.com

In January, we heard from a Falco builder who had visited with Graeme that he was very ill, and we passed the word on to all of the Australian Falco gang. They were all wonderful and contacted Graeme to offer their support and comfort.—Alfred Scott

Take a look at this photo!. On Monday, the 9th of May 2005 with George Richards on board ZK-SMR and myself on board ZK-TBD took off in formation from Ardmore Airport and flew around "chasing" each other around the Hauraky Gulf in Auckland for the first (of many) formation flight of the two yellow Falcos!

It was a flight to remember as we had been waiting for a long long time for this moment!

Unfortunately, due to business reasons I will not be able to attend the 50th birthday of the Falco at Oshkosh. Have fun and say hi to all I know and I don't!

Giovanni Nustrini
Papakura, New Zealand

After 10 years I decided I was sick of flying with a perpetual Quasimodo look. A while ago you said you applauded the idea and would look forward to selling me a new canopy! This I still can't rule out but no cracks so far. I have flown with it only once but the difference is astounding—I can use normal headsets now and don't think I have compromised the canopy other than the appearance! I have photos of the procedure and some spares in clear and smoke but would understand if you were less than impressed.

Looking forward to Oshkosh even if I have to get there the long way—Aus-GB-USA-GB-Aus.

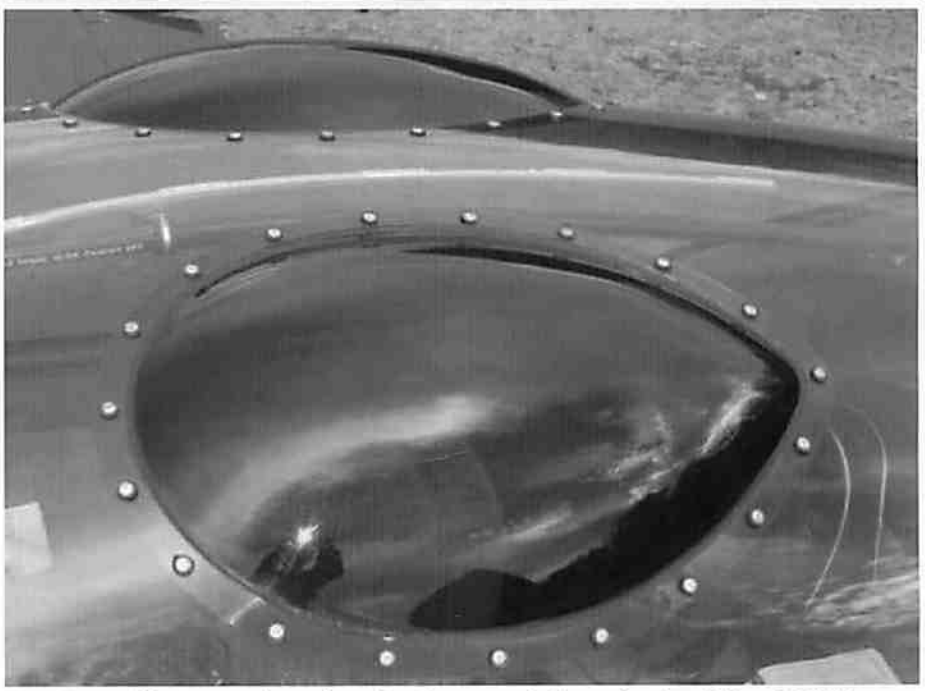
Stephen Friend
Breadalbane, NSW, Australia

The canopy bubbles are certainly interesting. I think they need a name. 'Speed bumps' is too obvious. They remind me of the side pods on a PBY Catalina, so maybe they are 'Nustrini Catalinas'?—Dr. Ing Alfredo Scoti

I'll be there at the 50th celebration, and attending with me will be Paul Montgomery. He is my brother-in-law and has attended the last couple of celebrations with me. He and I flew the Falco on a tour through Canada and Alaska last summer. Not many people up there have seen a Falco, and it caused quite a bit of interest in the northland.

Paul has now become my PIC since I have been diagnosed with Parkinson's Disease and that plus the medication I'm taking are disqualifying factors for the FAA. Paul is a good pilot, and I feel very fortunate to have him pilot the Falco so we can still go flying. We attended Sun and Fun last weekend as the only Falco on the field (at least that I could find).

Glyn Russell
Hartselle, Alabama



Top: Luigi Aldini is nearly ready to fly. Center and above: Stephen Friend did this to his Nustrini canopy after enduring ten years of the canopy doing the equivalent to him.