

HORIZON II BUILDING LOG
PHIL SCOTT

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OSHKOSH 91 - Bought plans from Mike Fisher, \$350.00.

December 91 - Started ribs.

January 93 - Finished wing ribs. Started elevator.

February 93 - Finished elevator, started horizontal stabilizer.

March 29, 1993 - Finished putting gussets on one side of horizontal stabilizer.

March 30, 1993 - Glued gussets on other side of horizontal stabilizer.

March 31, 1993 - Took out staples and began sanding around gussets on horizontal stabilizer.

April 18, 1993 - Yesterday I cut up 1-1/4 X 1/4 pieces for rudder ribs.

Previously finished work on horizontal stabilizer. Should start rudder today.

April 24, 1993 - Today started gluing rudder spar and ribs with gussets.

April 25, 1993 - Continued gluing rudder ribs to spar.

May 4, 1993 - Took rudder off board last night...glued gussets on the reverse side today. Next will trim ribs down, put roundness into leading/trailing edges and put on some plywood gussets.

May 22, 1993 - Did nothing today, but in the past week took the staples out of the plywood gussets on the rudder. Should now be sanded down some. Picked up a grinding tool for the drill the other day that might be some help.

October 13, 1993 - No entries here for awhile, but the tail feathers are all finished, except for some rough spots and the concavity in the piece in front of the fin. All the wood, that is. A few hardware pieces have been constructed, for the wing. The spar pieces are mostly cut out, waiting for the trip to Apple Valley. In September I attended the Mike Fisher fly-in at Portsmouth OH, where all the celebrity and Horizon people got together. There were workshops in woodwork, covering, finishing and weight and balance. Lots of people to talk to about Horizons. Several others are building from scratch, most further along than I. One guy from Ohio is putting in a Subaru with direct drive. Heard a lot about Subaru's at Oshkosh, so I bought one there. Put down \$100, but haven't seen the engine yet. Mike F is pessimistic about all auto engines (he sells aircraft engines) but says they're OK if you want to tinker. With all the money required for an aircraft engine, I'm willing to tinker, I guess.

December 25, 1993 - In the past two months at John's, I've gotten the spars glued (caps and web) and most lately the main attach block. Things went together pretty smoothly and straight. Only hitch has been time...when to get it. Also did some work on hardware parts. Tried to bend a part (aileron hinge, I think) but did not figure out the bending allowance before cutting the part. I think the solution is to cut the part large all around, then bend, then trim to size.

October 22, 1994 - Through the winter I spent a few more sessions at John's and got most of both spars finished (reinforcements, etc). One is about done and the other needs reinforcements put on. Last month I rented Bob Reed's hangar with Mike McNeil (\$80/mo for both of us) and have now moved everything there. I bought a space heater at Sears, and also a band saw. Started setting that up last night. Have not yet gotten to do anything more with the spars yet, except set up the table and get a line of blocks down. Because of the rental commitment I think I will find more time this year, since I don't have to worry about John and Barb's schedule. I go to the airport after work and on weekends now. Hope the heat system works before it gets too cold. Also, during the summer Norm picked up the Subaru for me from up north. It came in pieces, and I will have to have it checked out at a shop. Got a few ideas in Oshkosh about Subaru's, but still have a lot to learn. Sounds like it might be

good to "profile" the camshaft to get most torque at about 4800 (or was it 4000) rpm. Also, port and polish the head. The idea is to make it easier for fuel to get in. Many mysteries remain, however.

Feb 4, 1995 - Quite a while since an entry. Have done a lot. Am now installed in Bob Reed's hangar with Mike MacNeil. Have got the room heated, a 16 foot table installed at a diagonal. The rear spar is together except for hardware. Front spars are also about done (the wood). Started to varnish the ribs. Have got 12 done so far. Next is to get the holes drilled and matched to the strut attach fittings, jury strut attach fittings and spar attach fittings, before putting the ribs and geodetics on. Otherwise it will be hard to get the holes right afterwards. Have talked to Dick Burns about the Subaru. He can check it over for me, and knows about building re-drives.

July 19, 1995 Bill Witt, technical counselor, came to check my progress. He was satisfied with what he saw: ribs glued onto one spar, holes drilled in spar, bushings installed, most fittings prepared for wings, fin and rudder construction.

Bill Witt, EAA Technical Counselor

July 22, 1995 - Since February the spars are done, and one wing has ribs and false ribs glued on. Major project to get it straight. Wing fittings seem to be straight and in the right place. Could not get 6061-t6 in the right dimension (angle) for the aileron and rib hinge pieces. Requires about 2" x 4.5" angle. I used a piece of 6063 rectangular tubing (1/8" thick) to make these pieces. Am not convinced they are strong enough, so I will look for the 6061.

Got most of the AL I need from Dillsburg PA. Some different sized channel for the rear spar hinge is yet needed.

Next step is to install compression struts in wing, and geodetic.

September 6, 1995 - Compression struts and the top layer of geodetic are installed. At Oshkosh I found a few bolts (AN) for spares. Also found that Wicks has the right size angle AL for the aileron and Flap hinges (previous entry). I ordered these, the AL came, and the hinges are made. Also found some odd size tubing that will be needed (6061). Also sanded the AL fittings with 400 paper, cleaned with paint thinner, and sprayed with zinc chromate (also found at OSH). Assembled and attached three pulleys inside the wing. Figure they have to go in before putting on the second side of geodetic. Three more pulleys attach to the rear spar, but they can probably go in after the top geodetic. I need to order 2" pulleys for this location. Today I turned the wing over and put strings across to check straightness. Looks pretty good. The wing needs to be held straight while the second (bottom) layer of geodetic is put on. That will be the straightness for good after that. ☐ **October 30, 1995** - All geodetic is installed on the right wing (the only one so far). Nose ribs, false spars and nose spar are also installed. Am getting ready to put on the trailing edge, and to make the trailing edge ribs. Sunday I started on forms for bending the leading edge plywood. I plan on putting in two landing lights. I bought two halogen lights at KMart for this purpose. They are 12 volt and 55 amp each.

Nov 19, 1995 - Got the trailing edge on, and trailing edge ribs. Started putting on the leading edge plywood (1/16). Have got the first piece glued. Spots are picked out for the landing lights, near the middle of each wing. Also made the wingtip bow, and glued it on. Was a bit tricky, but it is straight.

March 12, 1996 - The first wing is finished and hanging on the wall. The second is now begun, with the ribs glued on, the pulleys made and installed, and I am in the process of cutting the geodetic strips. The second wing is going faster because I can refer to the first one instead of staring for hours at the plans to be sure I got it right. If I didn't get the first one right, at least the second one will be just the same. I do, however, still check the plans for details and measurements, just to be sure.

August 12, 1996 - A long time since an entry has been made. The second wing is now finished. At OSH this year I talked to Mike F about the wing tanks. He agrees that fiberglass tanks in the first bay of each wing would work, and give more capacity than the four gallon aluminum tanks he makes. I am convinced that AL tanks will leak sooner or later, especially when TIG welded like his. My tanks will hold almost 7 gallons each. One cubic foot is 7.48 gal. I will have to leave space for the spar fittings on one end, and the pulleys on the other. The bay is roughly 5 inches by 12 inches by 2 feet long. That is close to a cubic foot. Have now removed the geodetic from this bay on the left wing, and put in 1/16" ply on the lower bay surface. The ply will substitute for the geodetic, providing stiffness for the bay. I'll put fiberglass and vinylester resin on the inside. Mike suggested leaving a removable opening so I could go in and fix leaks if they would appear after all was said and done. FRP can have pinhole leaks. A KR-2 guy told me to use vinylester (resists alcohol, should I get any in the system), and to put on two coats of resin on the glass to take care of pinholes.

Sept. 7, 1996 - In the past month I have built the first fuel tank bay. Used 1/16 ply as planned, birch for the top and bottom (replacing the geodetic) and mahogany for the sides. The joints are reinforced along the edges inside with 1/4" pieces of spruce or pine. Making all these shapes was tedious, as they have to fit just right. The two sides are the shape of the ribs, and are glued directly to them along the caps, and vertically to the two outermost reading vertical pieces on the rib. The front and back sides of the tank are inset to create spaces for the pulleys and the spar attach fittings, so the fittings could be replaced without destroying the fuel tank. The position of one of the bolts will have to be reversed (turned around) so I could get the bolt out if I had to. All the nuts have to be inside the first bay. That will make tightening more difficult, since I didn't leave more than about an inch of space in front of the nut area.

I have also been varnishing the completed parts of the wings. The first quart of varnish I bought was spar varnish. This last quart was regular interior polyurethane semi gloss. It seems to be lighter weight and dries quicker. I think a generous coating of the thinner varnish will be sufficient to prevent rot from moisture. It will not have the covering power of the spar varnish, though. In the long run, the plane will be in a hangar most of the time, so I don't think this is a problem. At OSH, Mike's son indicated that the fabric may not stick to spar varnish as well as to regular polyurethane. So polyurethane it is.

August 31, 1997 - Can't believe it has been so long since a log entry. The two wing tank bays have been finished, but plans to glass them in have stalled, due to cold weather last fall and various problems this summer. Instead I have started the fuselage, with the wings being stored hanging on the wall. The two fuselage sides are glued, and now the fuselage is being put together. It lays sideways on the table, with the bottom side facing the window, and the top side over toward the heater. I have spent a lot of time this summer just getting it straight. At present I am in the process of fitting the inner floor and the

cross pieces, before any gluing. The fuselage sides were constructed over the winter, and the setting up process began in the spring.

Sept 1997 to November 2002

In November we moved to Wisconsin. No progress on the plane for about a year, as I had to build a shop first before I could move the plane to WI. The shop was 30x30, plenty of room with a 16 foot table in the center. During the time we were in Wisconsin, I made some progress on the fuselage, putting in the rest of the cross pieces, the firewall, many gussets and the supports for the engine mount bolts. All this was wood work. I did not get as far as installing any interior appointments. After we moved back to the Twin Cities in Dec of 2001, I moved the project back to Crystal airport in a much less inviting space, somewhat less room than I had in the Wisconsin shop, and not heated. In the summer of 2002 I started to work on the wing mounting hardware, which is principally a hinge on the rear spar. The hinge connects the rear spar carry-through with the rear spar. I discovered that the position of the front spar carry through will depend on the position of the rear spar carry-through, so I've held up on that project until I get further with the rest of the fuselage.

At present I'm making aluminum parts of the control system.

March 21 2004

During the last summer (2003) I got the top of the fuselage up, consisting of the wing roots and front and rear spar carry-throughs. The trick of getting the spar attachment hardware in the right position was to create a jig from each wing, which measured the distance from each wing's front to rear spar attach point. I transferred the distance via the jig, from the rear spar attach on the upper fuselage piece to locate the position of the front spar attach. If all goes well (or went well) the wing fittings will mate to the spar carry through when the time comes to attach the wings.

This month I have been working on the ailerons in the basement, since the hangar is too cold to work in right now. At this point the aileron frameworks are complete. I have yet to place on them the hinges/horns, and then cover them in 1/32 plywood, per plans.

January 26, 2006

During the summer of 2005 I built the front and back seats and also some of the control hardware.

The aileron and flap frameworks are now put together, and today I started applying the 1/32 ply skin to one of the ailerons. Previously this week I attached the fittings to the ailerons and flaps. These fittings will attach to the aileron and flap hinges on the airplane, and also to the control hardware.

May 18, 2006

The flaps and ailerons are now finished. One of the flaps had a bulge, so I cut out part of the top skin and replaced it with a repair that is level with the rest of the flap. The flaps and ailerons fit into the hinges on the wing, however they do not flex quite right, owing to the fact that the hinge fittings were made before the flaps and ailerons, so the hinges will have to be re-built

to fit. Today I hope to finish varnishing the flaps and ailerons with the epoxy varnish. This needs to be done when the temperature is above 70.

During this time I continued work on the control hardware: front and rear sticks and torque tube along with the attachment fittings. These are all aluminum tubes and plates, connected with AN bolts.



September 4, 2006

In June or so I finished the flap and aileron installation. Had to re-build the hinges to get the right amount of travel. Still not satisfied with the right wing hinges, may have to do them over again. Last week I got the sticks connected and fitted to the front seat. Purchased the resin and glass for the gas tanks. Today I worked on getting the left wing tank ready for glassing. I bought the fittings for the tanks this summer at Oshkosh through Wicks.

January 11, 2007

Over the summer I worked mostly on the fuel tanks. Construction was with vinylester resin and E glass, lining the wooden "boxes" that would comprise the fuel tanks. I also installed baffles, and glassed them in. The tanks are painted inside with a sealing compound (PS-870-A-2) - polysulfide, MS rated. The problem remaining is that both tanks have a leak at the top. I'll need to wait for warmer weather to remedy the problem.



Fuel tank enclosure after glassing, prior to installation of the tank top.



The control sticks are now in place and functional, though not yet connected to the flaps and ailerons. The tail is now in place and the linkage to the elevator has been made.





December 12, 2010

Over three years since the last entry. I have been busy with many things, plus the airplane. At this point the fuselage is finished and covered, with one coat of the paint applied.

Some revisions I have made: The FG tanks just did not work so I went to aluminum. Two tanks in the wings and one smaller header tank. Plumbing is in using steel braided tubing with AN fittings. I installed a retractable pitot tube in the left wing, leading edge. When

retracted, only about an inch shows. It extends to five or six inches. Seat belts are in. they are a bit heavy, got them from JC Whitney -- four point attachment.

All the control surfaces are now covered with the Stewart system, and most of them are painted. I used Behr primer and water based enamel, glossy. I am rolling the paint on with a foam roller, works pretty well. Was able to work in Ed's hangar this winter to get the fuselage done. Wings won't be covered till I figure out the lighting problem.



March 22, 2011

The control surfaces are now covered and painted. Fuselage is covered and painted. The wings are covered, rib stitched and most of the finishing tapes are on. I have just installed the first nav light. I figured out that I could install the lights, which are LED auto lights (1156). I have two red lights and one white light on the left wing. Lights will be covered with the plastic

lenses I shaped from flat plexiglass sheets last summer. Mylar sheets have been cut and taped to provide a template for the rear window.



July 9, 2011

All the covering and painting is now complete. The plane is now registered and has the numbers on the side in large print: N428AP. This past week I installed the tubing for the brakes and filled the reservoir, pumping out the bubbles by pushing the fluid from the brakes to the reservoir with an oil pump. Pretty messy project, in all. Last week I re-installed the tail pieces and got new springs for the tail wheel installed. Now waiting for the engine to get ready. Dick says he has started it.

February 5, 2012

Since the last entry I purchased a VW radiator from Carlburg Radiator in Richfield. The radiator is installed underneath the front of the fuselage just below and behind the firewall. An AL shroud holds the radiator and the 1/8" orange rubber sealer which guides the airflow going through the radiator fins.

I finally got the brake lines free of bubbles. Had to lift the tail to get the bubbles out of the master cylinder on the left side.

The engine and motor mount are now in the hangar. At this point I need to size the mounting bolts and find them as well. Dick says grade 5 bolts are the same quality as AN.

The instruments are also in the panel now, though not connected. Wiring is yet to be done. Transponder and altitude encoder is installed next to the back seat, transponder antenna is installed facing downwards behind the back seat, two screws holding the antenna ground to two pieces of pine glued to the bottom stringers. Instrument complement so far is compass, airspeed, altimeter, EGT/Tach, oil pressure, oil temp, water temp, voltmeter. There is an ignition switch not yet installed. Battery is procured but not installed.

September 16, 2012

Wiring is now complete. Also installed a water pressure gauge. Then engine is now mounted. This past month I constructed the cowl out of 2024-t3 Aluminum. It will be attached to the firewall rim with 10-32 screws and locking nutplates. The top of the cowl will have two hinged doors for engine access. Still waiting for the mufflers and pipes to come, then we'll try to start the engine. Have a

new battery installed under the rear seat, which has proven able to spin the motor. Now have water in the radiator and oil in the engine. The major work of the spring and summer was in completing the panel and wiring the various components.

October 7, 2012

The cowl is now installed and the engine compartment doors are installed with Dzus type screws. The two doors on top are connected with an aluminum hinge. Full removal of the cowl will require removal of the prop, which is an inconvenience, but I did it this way to avoid a much more complex cowl construction. Next step will be to form a mold for the nose bowl. I plan to do this with strips of Aluminum between two wooden forms.



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July 12 2014

The past almost two years have been taken up with engine problems and completion of the cowl. The first major engine problem had to do with the block plugs coming loose, resulting in the mixture of the water and oil when the engine was first started. Apparently I had left plain water in the radiator too long so it froze and broke the plugs loose. The engine had to be torn down to fix this problem. After that was fixed, I had to get the carb and timing adjusted to get the engine to start and run, which it did. However after 10 minutes run time the engine made a knocking sound, and right now it is back in the shop.

Along the way I needed to install a new and more robust throttle cable. I also discovered that my tachometer was not compatible to the engine ignition system. I acquired a Tiny Tach which seems to work well enough, and which also keeps a record of engine time.



May 17, 2015

Since last entry I have moved the airplane to a new hangar at Flying Cloud airport. The knocking sound i the engine turned out to be a damaged crankshaft, which had to be re-ground. Dick Burns did this work. After reassembly of engine and plane, next problem was to get the engine to start reliably. At this time the engine starts readily and runs smoothly, but rpms are still less than 4000. Problem could be the





mixture, not rich enough at full throttle, or possibly the exhaust system length. Prop angle is set to 13 degrees, which is recommended by the manufacturer (Warp Drive).

June 16, 2015

The engine is now behaving better. I shaved a bit off the carburetor needle, which enriches the mixture at full throttle. Also fixed the throttle control so it opens up to full throttle. The throttle cable had been flexing, inhibiting control. Also was able to hook up the alternator properly so the battery is now being charged. Today I started

to re-install the cowling. The next step will be to do the weight and balance.