

Shop Setup

I have never built an airplane before. I have worked quite a bit under IA supervision to make minor repairs to my own planes over the years. I have nominal mechanical skills. I hope to perfect my skills over the duration of this project.

My house is a basic ranch house with a walkout basement. The French doors are wide enough to accommodate moving parts inside. Most of the small components will be built in my heated basement. The plan is to finish the major components in the basement, then get the fuselage on the gear in my garage, and then finish wings and rigging in my hangar. Hopefully that will happen Spring 2006.

I had limited tools, no workshop and limited space to build. I've moved out some furniture, bought shelving, made a table, improved the lighting and built an square aluminum tube jig for the empennage construction.

So far not including the kit, I have spent upwards of \$5000 in tools, supplies and improvements for this build project. And I'm not done yet. You could probably complete construction with a lot less money, but be forewarned that you WILL spend a lot of money setting up and getting ready to build. And making the investment for tools will speed the process and make it much easier. Remember, if you never use the tools again, you can always make most of your money back by selling them on eBay!



Some of the items I purchased are: 2 Taylor rivet guns (2x,4x), Taylor air drill, dimple dies, Tatco hand squeezer, a gazillion clekos, micro stop drill bits, and lots of other aircraft aluminum construction stuff. Avery, Cleveland and Aircraft Spruce know me pretty well already, and I'll probably be on a first name basis with them before I'm done. (Actually I order almost everything on the web.)

Avery and Cleveland have builder kits already put together. Other builders recommended that I compare prices and contents of the kits. I ended up adding and deleting items from both companies. I still received the same discount because each total order was over \$500. That wasn't difficult to do.

I also bought a 10 inch drill press, a 9 inch band saw, a(another) 14.4 volt cordless drill, shears, clamps, a combo belt/disc sander, and a 30" 3-in-1 metal working machine. You don't need to have this stuff, but it sure speeds things up when you get right down to it. At least that's what I'm told.

I made an 8'x4' table out of 2"x4" and various plywood sheets for a top is my basic work surface. I found that a month after I built the table, it began to sag in the middle. I reversed the top cross members, put in a center leg and now I have a nice level surface to work with (until it warps again).



For building the Horizontal Stabilizer and the Vertical Fin (stabilizer), I purchased a 10 foot laminated beam from the lumber yard. It is the flattest straightest surface that would be dimensionally stable that I could come up with. You have to have a 9 foot surface to build the HS, so a 10 foot piece is more than adequate. \$35

My empennage jig was made out of 2"x2" aluminum tubing that is gusseted with 1/8 aluminum plating and 2 inch spaced 3 inch length 1/4 inch grade 5 bolts. The square tubing comes in 21 foot "sticks". It

was easy to make 9' wide horizontals, 8' uprights and use the excess to set 4' feet on the floor. I attached the top of the uprights to the joists above my drop ceiling in my basement. It cost me about \$150 for the materials to make this jig. After it had been erected for 6 months waiting for my kit, it had of course not moved a lick. So I know I have dimensional stability, which is important to keep twist out of your assemblies during construction.



A couple notes on tools along the way:

You need to buy a crowfoot wrench: 1 5/8 inch, 3/8 inch drive. Get one from SnapOn # FC52A. They are about \$33. You can even order one online, but you'll pay an extra \$9 in shipping! OUCH! The crowfoot is used to torque the titanium gear leg nuts. Gonna probably do that many times, and at annuals?! Another idea would be to buy online and get a GRIP JUMBO CROWFOOT WRENCH SET, which has 6 (not the 7 piece set). The whole set is about \$50 shipped to your door. They are, however, 1/2 inch drive, not 3/8.



I'm glad I got a right angle drill attachment. Get one! \$95

My cordless drill would never have kept up with the number of holes drilled. Get a big compressor and a high speed air driven drill. And lots of cobalt #30 and #40 drill bits. I have a cheapo Taylor air drill. I've used a Sioux, too. There's no comparison. You get what you pay for. Wish I would have bought the Sioux. Maybe Santa will bring me one!

I bought a cheap speed square, and didn't think I'd use it. But I have, several times. \$6

Get high quality small and medium tape measures, and a 4 foot metal ruler. You'll need to make many measurements down to 1/32! Also, a clear flexible plastic ruler (or two) is essential.

I have a digital level that has saved me time and a lot of headaches. About \$100! I think this is one of the BEST investments I've made. I have used this MANY times during this project. I would consider this a must. A very big time saver. And more accurate than it needs to be.



You can get a \$50 conduit bender from Harbor Freight, but a 3/4 conduit bender from the local DIY store will do the trick. About \$25 for just the foot. Or just use big screws and attach wooden blocks to a table and bend tubing between them. Cheap and effective.

Don't forget the string/twine and plum bobs. The digital level cannot completely replace these items. But almost.

A big bench vise comes in very handy, too.

I bought a pneumatic rivet squeezer from TheYard online. Most sell for about \$5-600. I bought mine with a 1.5 inch yoke for about \$325. You'll find a 2.5 yoke comes in very handy, too. In retrospect, I should have bought the hand squeezer that takes pneumatic squeezer yokes right off the bat. A bit more money, but more versatile.

I ended up buying a "Main Squeeze" from Cleveland. Geared action that takes less hand force, and it uses pneumatic yokes. Pricey, but my knuckles and elbows demanded relief. This is another item I wish I would have bought at the beginning. Although I have to admit, there are times when I have gone back and used my Tatco hand squeezer, too.

To go with the Main Squeeze (and the pneumatic squeezer), I bought a flat/thin nose yoke to get in to tight places. It does not take a die, just has a nicely finished flat surface to buck against. I also got a 2.5 inch yoke, and a "longeron" yoke to reach over the side of those darn flanges. That should reduce the number of rivets I have to drill out by quite a few.

When I bought the pneumatic squeezer, I also ordered a pneumatic cleko tool. Get one that the barrel swivels. I use the cleko pliers a lot, but when it comes down to unclekoing a large area, the pneumatic tool saves a bunch of time and carpal tunnel pain. \$75

Get several small bucking bars of several different shapes and be prepared to grind them to suit your purpose.

If you can find a large piece of smooth steel to use and a tabletop back riveting plate, it's money and effort well spent. Mine is about 1.5 x 2 feet by about 1/4 inch thick, and is much easier to hit than a little 4x10 inch plate. However, the little plate is handy, too, because it is quite easy to move to different locations. \$50

I've used my 4 inch side grinder many times. I don't have a pneumatic cut off or speed grinder, but it's on the short list.

A dremmel tool with lots of cut off wheels is VERY handy. The standard wheels cut aluminum (and human) skin much better than the "heavy duty" wheels. Buy a little container of each.

I finally bought a Scotchbrite wheel for my bench grinder. I cringed at the \$40 price tag, but I've used that thing so many times now, I don't see how I got along without it!

You'll need to do some welding. If you don't have a friend with a rig, you can get a MAPP gas setup to do some very basic stuff for about \$50. Plus you'll need goggles or a helmet.

I've purchased a 30 inch 3-in-1 sheet metal bending, rolling, brake. It has come in handy many times. I bought mine used but in better than new condition for \$300. Unfortunately the empennage skins need trimmed and are too large for my bending break, so I had to hand cut, make two passes or find a "friend" with a 48 inch break. I did the latter. But my little break has had LOTS of use. You can tell by the pile of scrap sitting behind it!



I bought a 2 ton foldable hoist. I also have two engine stands for a fuselage rotator. In retrospect, I only needed one. Since the 2 ton "cherry picker" takes up so much space, I decided to use it for fuselage support . \$100

I went ahead and bought a 4x rivet gun. The 2x is OK, but is really "buzzy" and does not hit very hard. In retrospect, I would skip it. You can learn to do the job with a 2, 3 and/or a 4x. I like the 4x because it makes fewer hits and doesn't seem very hard on my hands. Unfortunately, my back rivet set with the delrin sleeve does not work properly in it.

I bought an assortment set of countersink and regular "universal" hard rivets. It's good to have extra stock. Don't bother buying any soft rivets.

I bought a hardware kit from Aircraft Spruce. I thought at the time it was a bit pricey, but I have dipped into my "AN" supply many times. Searching through all of the Team Rocket bags for inventory is time consuming (and sometimes pointless), so labeled bins with lots of AN hardware is highly recommended.

After having to borrow tools to work on the Rudder, I decided to make another Cleveland Tool order. I needed a long reach yoke to get over the part of the rudder that is rolled. Also, I decided to get a flat/thin nosed yoke and a "longeron" yoke.

I've been using a Tatco squeezer and my clone pneumatic squeezer a bunch. I find that I can squeeze #3 rivets easily with the Tatco, but find it a bit cumbersome. And a big note: the yokes on the

Tatco are not interchangeable with the pneumatic squeezer. So depending on the job, you have to perhaps have two sets of various sized yokes.

I decided to try to bypass this problem by purchasing a new hand squeezer. I bought a "Main Squeeze" from Cleveland. It is a very light aluminum rig that takes pneumatic yokes. The mechanism is "geared" so that supposedly it only takes 35% of the effort to squeeze rivets. That's pretty much true, and the Squeeze is pretty nice to handle. But you have to be careful because there are instructions that come with it that make me think that there are warranty issues with the unit. In other words, I think several must get broken. And you cannot squeeze larger than a #4 rivet with it. Well, I've only used #5's so far when I screwed up a 4, and that was only a couple times, so that's not that big an issue.

I have to admit that so far, the Main Squeeze has turned out to be a great asset. I think my Tatco will end up on eBay by the time my F1 is complete, IF the Main Squeeze holds up.

Don't forget a good shop vac. Mine is getting quite a workout. I bought one of the high power, low profile jobs that mounts to a wall and has about a 20 foot hose on it. If I could rig a remote switch on it, I'd put it up in the ceiling or WAY out of the way.

Tools to leave out:

I bought a rivet drill/removal tool and have never used it. It's not that hard to stay centered on a rivet when you drill it out. And sometimes when I've had to drill out a rivet, the manufactured head is boogered and the removal drill is worthless.

Air powered shears. They chew the skin pretty badly and don't turn corners very well. I'd rather use hand shears or a dremel.

2x gun. Worthless. Harsh. Buzzy.