

My FMX4 story
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Member EAA 292

Every older EAA member remembers the Sport Aviation cover from Oct, 1994. It showed a dramatic new airplane, from a well respected, professional aeronautical engineer named Barnaby Wainfan. The plane flew well, but eventually succumbed to an in-flight engine failure and some off-field landing damage. Repairs were complicated, and the plane never flew again



I have wanted to build a copy ever since I saw the initial article.

At the age of 65 I retired. I had been unable to get plans for the plane, nor to meet Barnaby, so I decided on a 5 year plan to reverse engineer the plane. In the interim I would build a kitplane of some sort, to establish some minimal building skills.

To start, I went back to the junior college for a year to get certified as a CNC machinist. I learned Master-cam, solid works, and G-code for industrial mills and lathes. And naturally, I joined the nearest EAA chapter. When I told them of my plans to build a plane with CNC, they referred me to a chapter member named Robert Haines. An engineer, he had built a CNC table out of plywood, and was using it to build a Thatcher single place airplane. His table was just what I was planning to need: to start, it had a bed big enough for a 4'x12' piece of aluminum sheet.

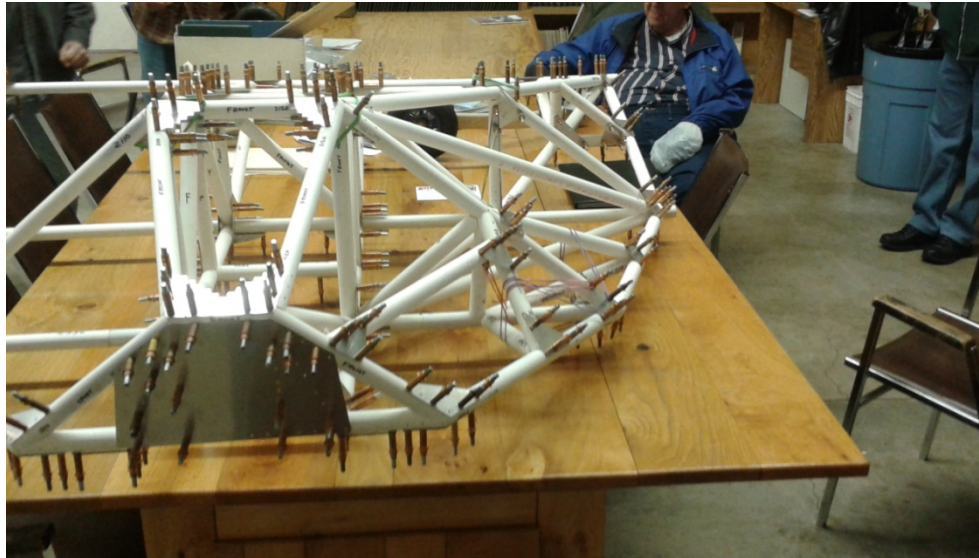
And then I told him of my desire to cut out the tubes, too, with carefully machined ends that would fit perfectly in complicated joints. He thought a second, then climbed over the table, retrieving an old cardboard box from some dark recess in his garage. He reached inside and pulled out a fist-sized thing that had wires protruding. "Here" he said, handing it to me. "That's a stepper motor. If you can figure out a way to attach that to the table, we can machine tubes." Sure enough, we could. Importantly, he

spent several weeks writing some sophisticated programs that let me generate the G-code automatically, from parameters regarding the tubes. Now it was just a matter of putting it all together for a full CNC building system.



Finally, fortunately, my tech advisor, Ernie Moreno, mentioned that he knew Barnaby Wainfan. So we arranged to meet him, and flew to Long Beach. Barnaby met us at the airport in a car with vortex generators epoxied to the rear roof line. A true aerodynamics guru! Ernie, Barnaby and I spent several hours going over the plane in the EAA hangar at the Compton Airport (with bullet holes in the wall facing the street). We got measurements, and Barnaby answered all our questions. Wow, with this kind of support, I skipped the kit plane and decided to go straight to the real thing, I would build a Facetmobile.

I started with a 1/3 scale model out of nominal 1" dia PVC. This allowed me to practice making the tubes properly abut, and to make sure the gussets fit properly. The tube and gusset holes were nominally 0.001" accurate. I quickly found that if the tubes didn't fit exactly, I had made a mistake somewhere. If it wasn't perfect, then it needed to be redone.



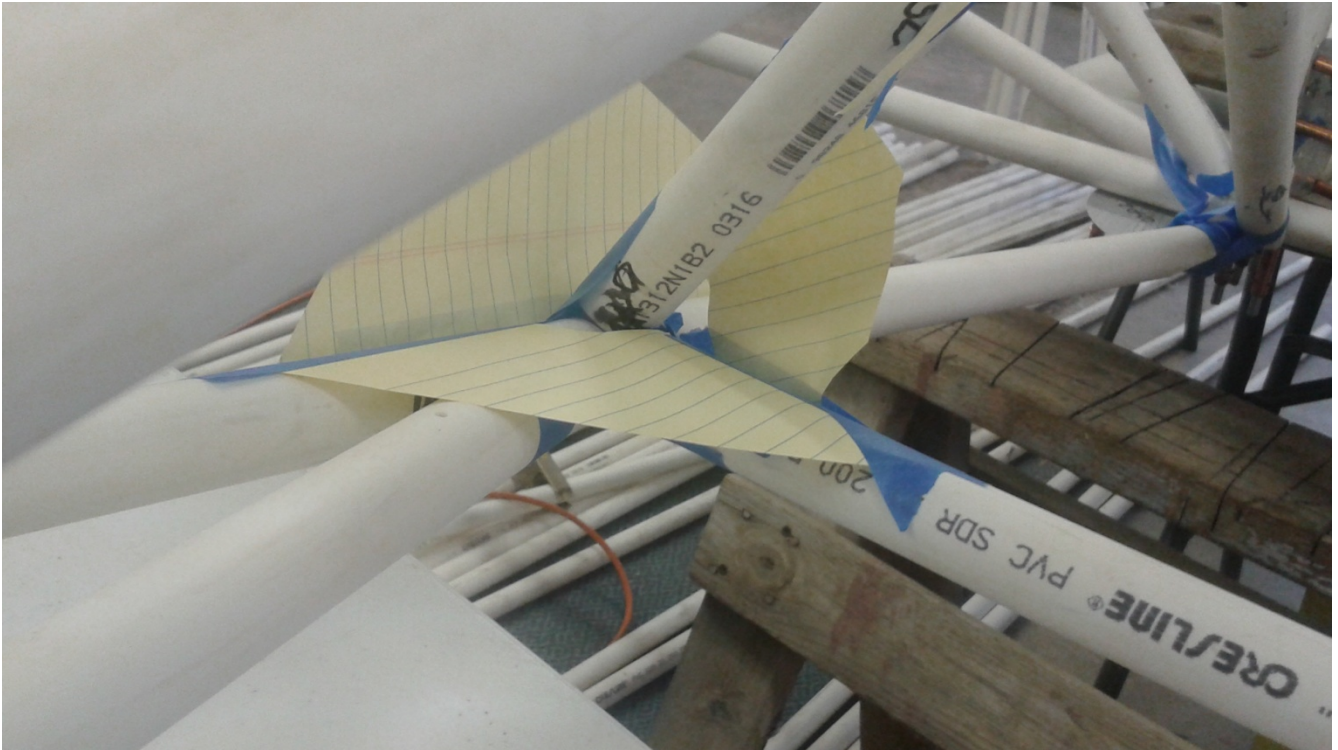
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Then it was time to scale up.



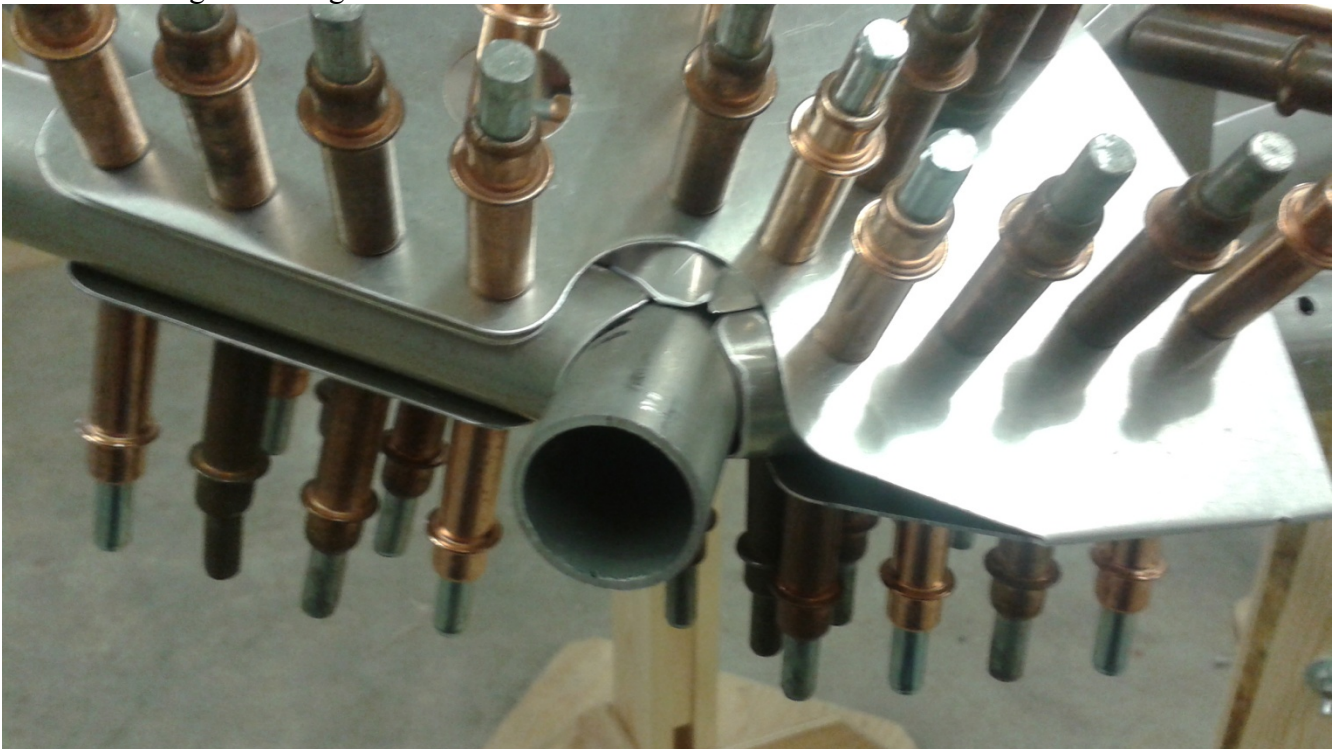
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And time to make better designs for the gussets.



4/1/14

Then the final gusset design in metal:



Notice here that the tubes properly fishmouth into each other. This makes a really neat connection. The flat edges of the gussets were later rounded over to properly abut the tubes.

Then take a break and do control surfaces:

5/23/2014



Finally, it was time for the real deal.

Tubes, 8/30/14. This is a complete set of tubes for the plane. After a year of computer programming the G-code with Robert Haines' programs, cutting the tubes only took 2 days.



Gussets, 8/11/14. This happens to be the gussets for the control surfaces cut from a full sheet of aluminum. The gussets for the plane itself were cut from aluminum sheets in a period of 3 days. The hardest part was keeping them properly labeled after they were cut out. They all look the same!

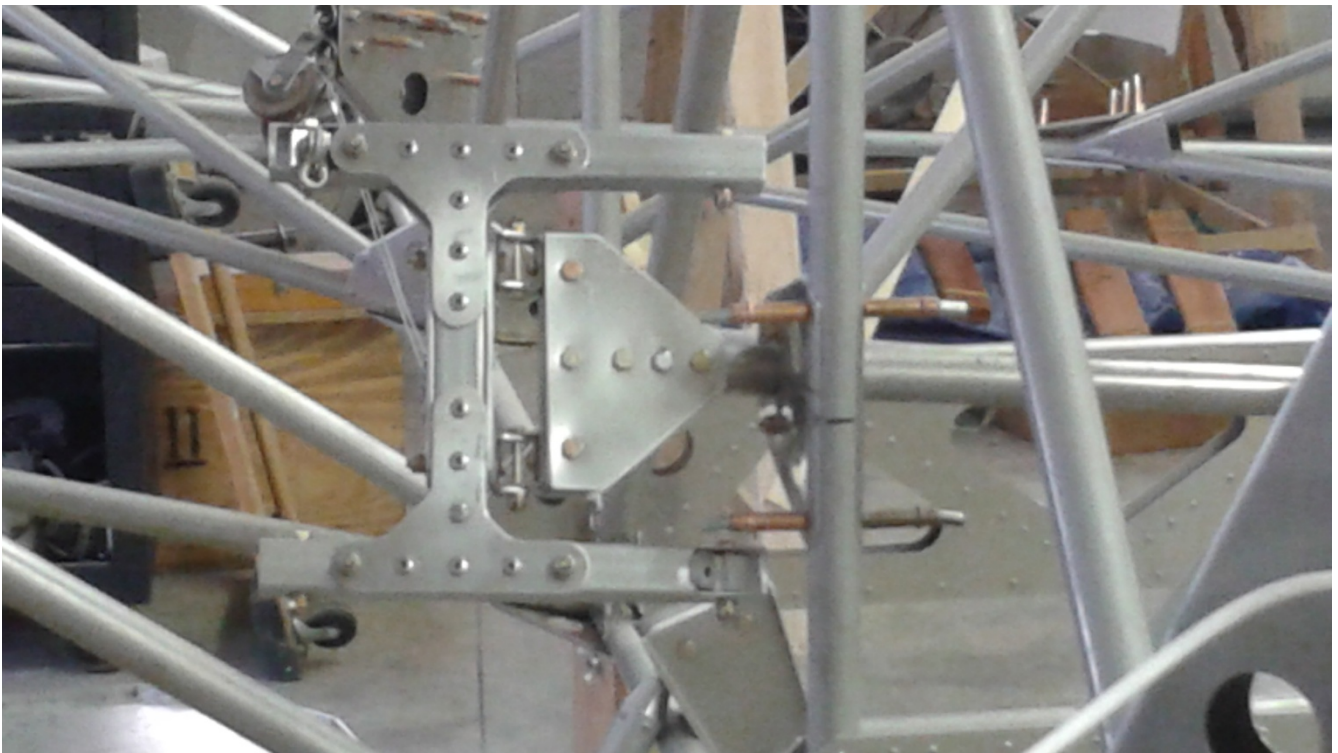


Since then lots of building. The landing gear structure was designed, laser cut at a local shop, and welded by Dave Smith of the local EAA 292. The landing gear is by Tracy O'Brien in Chehalis, WA, custom designed from an RV template.

Looking back at photos with dates, it seems like there was a gap in construction, but this was due to my inexperience as a builder. At an early stage I made a decision to “clean up” the location of a single tube end that I felt was inelegant. This later necessitated changing the location of the control system, and a cascading series of minor changes to make everything fit.

The control system took a long time. This is the final, single mixer that combines elevator and aileron inputs to the elevons. Clean, neat, smooth.

12/09/16



The mixer rotates about the longitudinal torque tube for aileron input, while rotating about the vertical axis for elevator input.

The engine mount was laser cut from steel, and recently powder coated before installation. Note how clean the front end appears, with the extruded aluminum front strut in place. The engine is presently on the test stand in the corner of the room.



And, finally, the structure as of 02/02/2017:



This is really a project of the entire EAA 292, being constructed in the build section of our hangar. Ernie, my tech advisor is building a DH2 next to my Facetmobile, and a glider is being built in the corner of the room. (To accommodate all the building here, the hangar build area is being expanded by 65' later this spring!) Vincent Homer has a new mill and lathe across the street, Henry Bartles has world class composite advice and supplies several hangars away. The EAA chapter president is a professor of Mechanical Engineering at the local University. At every step I have all the necessary advice and equipment to make this plane a tribute to Barnaby's vision.

Upcoming: Finish the final floor pan so that the rigging can be completed; make a gas tank, while learning how messy pro-seal really can be; finalize plans for panel instruments; electrical; covering; and flight test. The first 95% is done, now comes the second 95%.

I have had lots of enquiries about the plane, and am sorry that I haven't found the time to respond to them all. I will keep this section updated on the EAA 292 web site for interested builders. Along the wall in some of these pictures, you can see other vertical stabilizers, from an additional 5 planes that I am committed to build from the plans when my plane is finalized and test flown. After that I will leave

any future plans to Barnaby and the rest of the local EAA 292 community. Throughout, Barnaby has been available to answer my questions and to offer advice.