

Outbound Progress Report 7-11-17

Tank Install

The new 20 plus gallon fuel tank is underway. In a matter of weeks we should be getting the first article and placing a first run order. The tank fits like a glove into the root of the wing to maximize volume. An important design feature: Drill out a few rivets and you can remove the tank if needed. This became a welcome feature, as our test wing tanks ended up needing replaced, due to potential leaks.

There is a neat trick we used to install the root rib. Since it needs to slip between the outer skin and all of the tank supports, we created a space between them using a piece of .125" nylon cord. Once the root rib is installed, simply pull the cord out, install the rivets, and the install is complete.



Aileron and Flap Assembly

Pre-formed skins make for fast assembly. We were knocking them out right at 2 hours. The parts come well formed for a cleco and rivet assembly. It starts with riveting the hinge and action plates to some of the ribs, then cleco all the ribs in place on the skin, slide in the spar, double check the fit up, rivet all open holes, set the surface square and transfer drill the bottom skin leading edge to the spar.



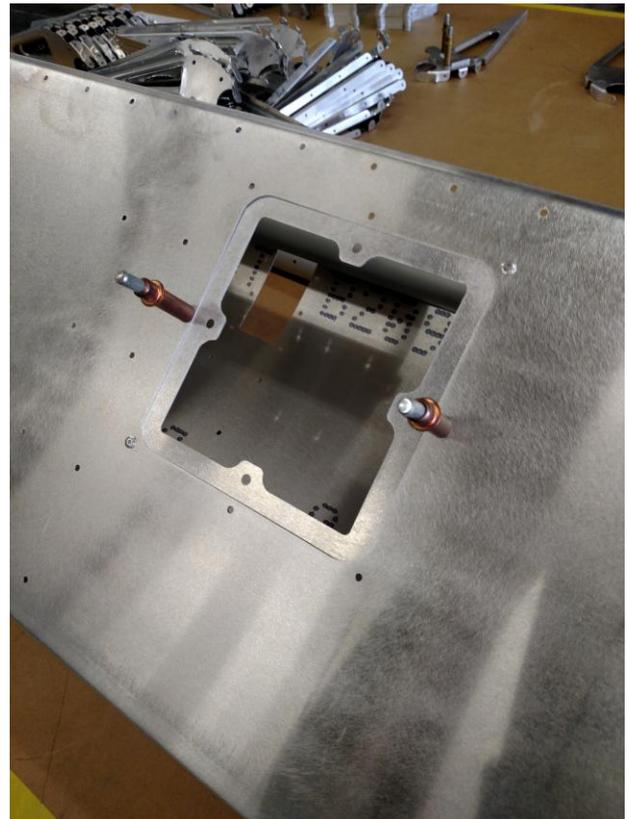
Aileron and Flap skins come formed to shape for smooth surfaces and fast assembly.



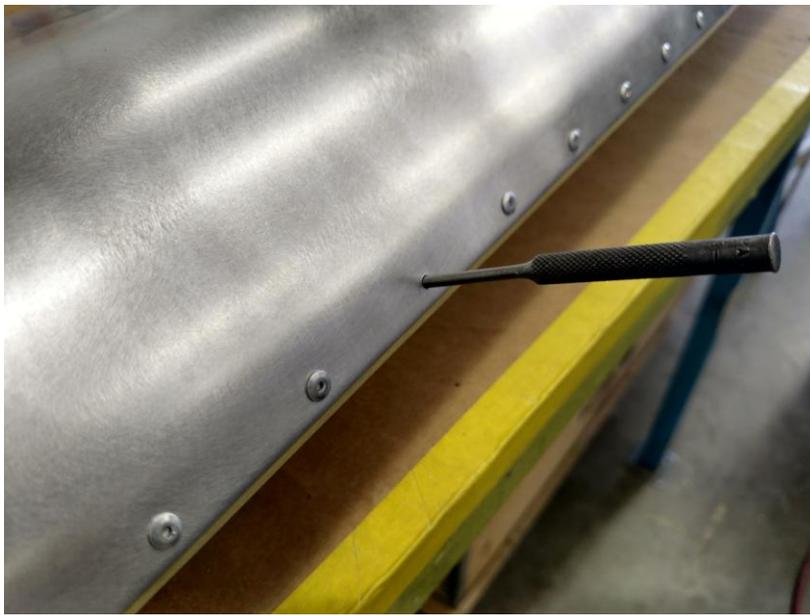


First step in aileron or flap assembly is to rivet hinges and action plates; these are where the push pull tube attaches to the ribs. The action ribs are .040 thick to withstand actuation forces, thus “action” ribs.

This is the prototype access hatch on the aileron, but this will give way to two smaller holes on either side of the action rib.



A vice grip with a couple scraps of stringer material make an excellent squeezer tool, if needed, to fine tune the skin fit to minimize pillow effect.



To help line up some holes a #30 punch works great.



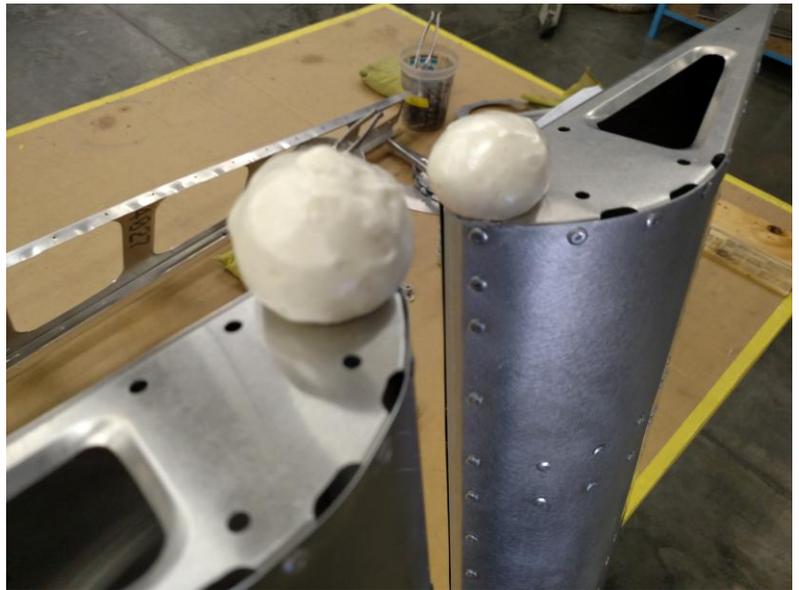
A flat table and some ballast bags is all that is needed to assure a square and true control surface.

Balancing the ailerons requires them to be pinned to the hinges on the wing, then pulling down with a fish scale and to take a reading. Unpainted you want to go to at least 100% of what you pull on the scale. Details about this will be outlined in the tech manual, since painting adds weight.



Adding a mixture of epoxy coated lead shot into the leading edge spar of the aileron provides a neat way to ballast. Prior to the install of the lead we injected spray foam at least 6" into the tube.

Once the lead shot is in place we sealed it with more spray foam.



Ailerons are set vertical, to let the epoxy and foam cure.

Wing Tips

The Joy of working ABS becomes apparent as you build up the wing tips. The material is light, strong, long-lasting and easy to work. Our prototype tips were pretty rough, but made useable by using scraps of ABS and ABS or PVC cement. The tips need the install of an inner rib that has 6 nut plates coming through the end rib. This method makes for a clean tip install and was pretty simple. We assembled the tips, taped them to the end of the wing, reached inside with a small 90-degree drill and transferred drilled the hole, off of the rib and into the tip. Remove the tip, install the nut plates, and bolt in place. You can make an ABS repair putty by mixing grindings with the PVC prep solvent. This sticky goo works great to repair or correct any flaws in the tip. Body putty and auto paints also stick really well to ABS.



Wing tip internal rib trimmed and ready to install. The metal strips are set to hold the rib stable for best match to the wing rib. Production rib will have webs to omit this step.



The glue sets fast, only a few strips of tape are needed to hold things in place.



The finish tip fits up nice and sleek



Wing Painting Jigs tie into the wing tip attach bolts. You will want to make a similar device. Being able to pivot the wing makes it easy to paint like a pro.

Installing the Wings on the Raven

It went fairly smooth. The skylight was able to conform to the slightly different airfoil of the metal wing. The wing cuffs were also recycled.



Aft wing spar fitting and special inner flap hinge. The hinge had to be shaped to allow the door to fully open. The fancy fitting has compliance fore and aft to allow for any slight variations in wing positions.

Shelly has skinny arms, so we volunteered her to fish out the pitot static lines. We “predicted” we could install after skinning.



Flight testing of Wings

Flight tests show the wing to perform as well as expected. The ailerons are nice and light, with a brisk roll rate. Roll coupling test show adverse yaw is less than a Raven with the stock wing. I expect it to be even less on the Outbound due to the longer tail moment.

Performance of the Outbound wing on the Raven is very respectable. A Rotax powered Outbound should be a very practical plane with good performance numbers. At 1340 gross on 100 plus degree days it still averages 800 FPM to 1000' AGL. Further testing showed a service ceiling of 15,900 at a gross of 1400. A 100 HP Rotax powered Raven or Outbound should top out around 14,000 at 1500 gross.

Stalls are gentle, with a noticeable burble prior to the break, and a light release and no power gets the wing flying in an instant.

The flaps are easy to deploy, even above Vfe. Flaps reduce the stall speed a good 8 or more MPH.

Rolls are smooth, with a rate of 112 degrees per second. Loops are with plenty of airspeed over the top to keep wings level. Speed build out of the loop is higher than the stock Raven wing, as should be expected. $\frac{1}{4}$ and $\frac{1}{2}$ turn spins show rotation halted at 30 degrees or less. More spin work will follow.

I flew the wing into the same places I have taken the standard Raven wing and it performs very similar in take off and landing distances, guessing about 25 to 50 more feet required. The wing flies close to the stock Raven wing, accurate comparisons can only happen when we have a chance to fly against a stock Raven. The intent is to validate the wing for use on the S-21, and from how well it flies with only 100 HP it should be a hoot with the Titan 340. Thanks, more to come! RJS

