Flaps Matchdrilling - 12/11/2012 - 12h

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After many hours of deburring, it's finally matchdrilling time again for both flaps.

You start by attaching the ribs to the flap spar and attaching the bottom skin plate to the ribs.
One of the ribs is slightly bend for about 6 degrees so it rib to spar flange will need to be slightly bend as well.
Pay attention to the orientation when attaching the ribs but it's hard to make mistakes because the prepunched holes won't line up if you invert them.

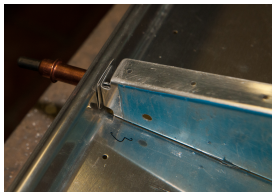
Then matchdrill first the ribs to the spar to #30.



I made some spacers out of 0.025 stock material to insert between the end of the inner ribs and the rear spar (if you can call it that way) and the bottom skin.



The spacers were required in my case because the rear flange tab of the rib was too far from the rear spar. Then matchdrill through the skin spar through the spacer in the rib.



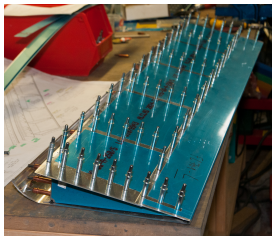


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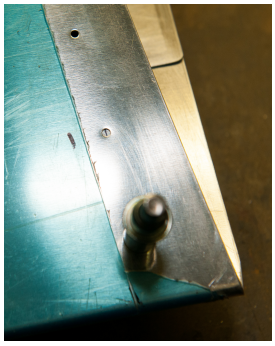
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Then installed the top skin over the bottom skin. Matchdrill all the inner rib holes for the bottom skin and the side ribs. on the bottom skin only.



2 spacers need to be made for each flap that go between the outer ribs and the top skin on the bottom side of the flap. This keeps the skin at the same distance at the end of the flap and compensates for the overlap of the two skins.
The dimensions are not critical to thousands of an inch. You'll see that if you fabricate it to the dimensions given as per the plans, the spacer is shorter than the open length under the skin. But the edge distance is fine and I guess every bit of weight saving counts.

I drew a line on the space and pre-drilled the first hole, you can see the line through the hole in the picture below.Just matchdrill when the line is centered and you have a guaranteed perfect alignment



spacer before installing.

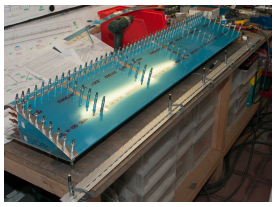


Then I matchdrilled the rest of the flap. Top side, first the inner ribs, then the outer ribs, then the top line along the spar. Then turned the flap and drilled the rest at the side ribs and the joining

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line along the af then end where the two skins meet.

Missing part was the bottom line along the spar. This is the place where the piano hinge has to be installed.
I cut the required length + 0.5 inch of the stock hinge to be on the safe side.
Marked the 3/16 min edge distance line at various points and used the other hinge and clamped to be able to draw a straight line.







The manual and plan state that you need to vary the distance of the piano hinge according to the height of the aileron. In other words. By installing the hinge pin, you need to make sure that the flap and aileron aft edge align when installed on the wing...

But .... How to know that ???

Only one way to find out: install the flap temporarily to the wing and try it out.

To align, you need to put the aileron in the neutral position. How do you know what the neutral positions is ? well... you need to make a new tool for this...
And that's why sometimes, trying something turns out to be a full afternoon work.

To put the aileron in the neutral position, you need a straight and stiff piece of material. I used an aluminum angle that extends far enough to reach passed the aileron aft edge.
First mark the center of a flange, and drill a #12 hole. bolt the angle to the side rib of the main wing and then (after marking the center again), matchdrill through the tooling hole at the end of the outboard rib.

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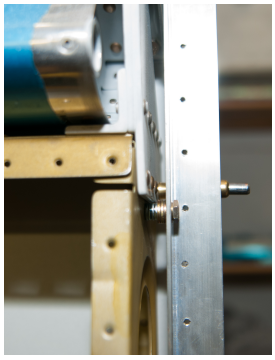
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Now that you have both holes, use a marker to draw a line that connect the both extremes of the holes. You can also use a laser to make the alignment and draw the line. That will be even more precise.
I will do that for the final mating, but for this test, this is sufficient.

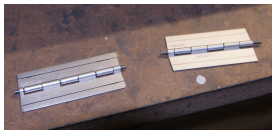


You will have to use some washers as spacers to clear the angle from the aileron bracket. Some small spacers help passing.



From the cut-offs of the long piano hinge, I cut two short sections for tryout.

Draw the 3/16 minimal edge distance lines on the hinges. The minimal edge distance is real critical here. The flaps take high loads during takeoff and landing.

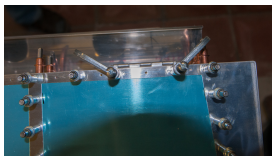


what I wanted to do is try an aligned drilling of the hinge on the flap side and then see how much I'm short on the top side later so that I can adjust if needed when I do the real drilling.

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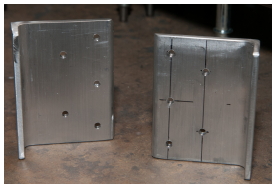


Move the aileron in the neutral position and keep it in place with some duct tape (what else... ?)

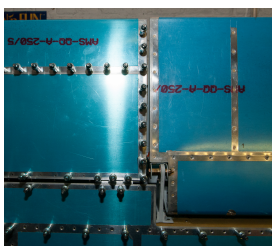
Pay attention to the two lines on the angle in the image. The trailing edge of the aileron shouldbe between these lines.



Next picture isn't really in sequence but I also drilled the attach reinforcement brackets as per the plans



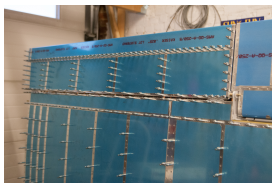
Back to the flap alignment, after the drilling of the second hinge to the rear spar of the wing, looking at min edge distance, I got to the result in the picture below.
I could see that I still needed another millimeter to be able to align to the flap so it means that I should extend the position of the hinge on the flap also by a mm (or at least as far as I can).



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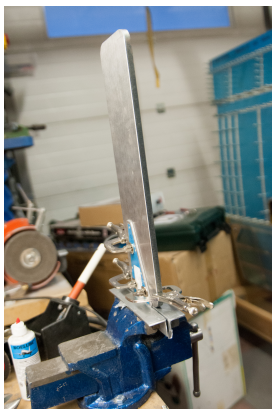
actually, the flap and aileron in place make a cool image.



The plans call for bending the side reinforcement angle at 6.7°. How much ???? yes, 6.7°
I don't know how other people do this, but bending to .7° close is not really my cup of tea.
I made a cardboard mock up with 6.7° and tried to match the bend as close as possible to this.

I first tried my Harbor Freight mini bending brake but soon found out that this fat piece of aluminum is too stiff for light material like that.

Instead, I drew a line at the distance where the bend should come, clamped it in a vise and backed it up by my backrivetting plate.



You need a lot of force to make the bend. Be carefull not to overbend. In the end, 6.7° looks like in the picture below.

It's really eyeballing because I had to give it a little tap back when I installed it to mate both parts together. So the 6.7° is a calculation from the Autocad from Vans but in reality it's making sure the parts fit together well.

So don't overbend in the start, just match them first and then bend some more if needed.

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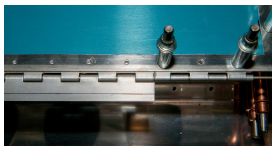


another shot at the wing



Then it was time to transfer my findings of the hinge to the real drilling work.

To check, I first attached the test hinge to the hinge pin of the final hinge and clecoed it in place.
Then checked the alignment looking at the min edge distance line through the holes.
I found out that I can win some more space but definitly not a full millimeter.

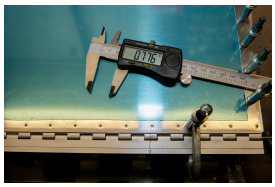


I decided to go some extra spacing but to keep on the safe side to ensure min edge distance was guaranteed.
When measure with the end of the caliper, I ended up with 0.776 from flap skin edge to other side of the hinge (see arrows on hinge in picture)
I measured to make sure that the distance is the same over the entire length and checked every inch again if the distance was still ok while drilling.
Make sure the second part of the hinge stays installed during drilling because it ensures the hinge stays straight.

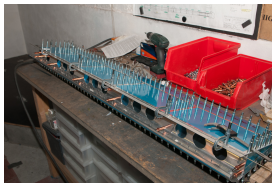
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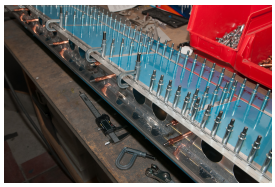
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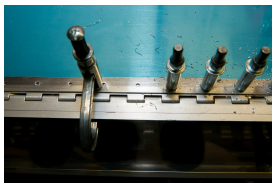
Hinge tempo installed



Hinge drilling one by one.

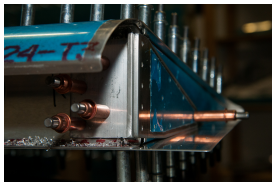


check out the min edge distance line through the prepunched holes



When finished, edge distance was more then sufficient and hinge is perfectly straight. Hinge also moves freely without friction.

Then it was time to drill the reinforcement of the inboard corner.
First matchdrillthe F706-A angle aligning the edge with the edge of the spar.
Then position the F-706B against the rib. If your bend was perfect, the ends will mate perfectly. Mine were close but I needed to give it some adjustment to get to the picture below.
There needs to be a thight match between the angle and the part that lays flat on the rib.

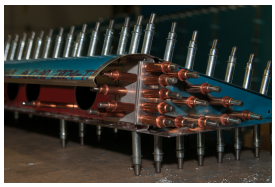


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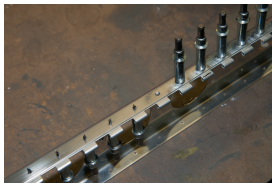
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Matchdrill the side



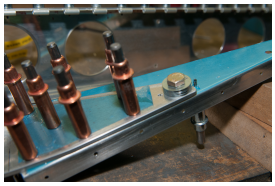
Matchdrilling is now done. Next step was deburring the holes and countersinking the bottom side of the flap spar.
You countersink with the hinge in place to allow the pilot of the countersink to grip.
The skin will be dimpled. The skin fits in the countersinks in the spar and the hinge will just have the holes drilled in them.



Another job is to enlarge the hole where the flap actuator fits through. These are AN4 bolts and need to be drilled to 1/4 inch. Do this step wise with different size drills.



Then drill the nutplate on. I used a AN4 bolt and some AN4 washers to keep the nutplate in place.
One side just drills through rib, the other leg through rib and F706-B. You need to countersink the F-706B on the outside (of the inboard rib).



More work on the left flap next session.

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