Aileron bending and matchdrilling - 07/10/2012 - 8h

Category: 2.6. Ailerons
Published: Monday, 08 October 2012 09:08
Hits: 1731

The skins were primed, the stiffeners rivetted. It's time to start the bending and matchdrilling process of the ailerons. I decided to work on both at the same time.

First I broke out the good old empennage bending brake and installed it on the workbench.

The aileron skins have to be bend so that when the spar is installed, the skins nearly touch the spar without force. The aileron bend radius at the trailing edge needs to be between 3/32 and 1/8 inch.

This is quite important as the radius of bend will influence the flight characteristics of the plane.

A tight trailing edge gives you better flutter margin but does increase the stick forces slightly. A smaller radius trailing edge will result in a stiffer control feel, a larger radius in a lighter feel. That is true for rudders and elevators too.

An RV with a heavy stick forces is still lighter than the majority of aircraft out there.

I used a dowel of 5mm inserted in the aileron trailing edge to ensure this radius. However, the bending was only possible in the beginning with this dowel. I had to remove it to make the final bend because otherwise, you just can't oversqueeze the skin at the end.

I didn't manage to make the skin touch the spar, it's just not possible to push the skin with stiffeners on deep enough to close them that much. If you would do, you would probably deform the trailing edge and worse, close down the radius too much.

I have to measure, but I think I ended up somewhere around 3/32. The side rib inserts nicely so I'm quite happy with the result. No bulges or bumps.

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The next step is the matchdrilling of the reinforcement plates on the aileron spar.

I stared for a long time on the plans on how to drill these and how the orientation needs to be.

It's actually quite simple once you know. The holes on the spars are pre-punched. The inboard side of the aileron is always where the nutplate will be installed (see picture below for hole layout)

The comes the question of orientation which determines then which one of the spars is the left one, and which one is the right one. And what is top and bottom.

You can measure with an angle finder. Put the spar on the flange on a table and measure the angle. The Bottom side is bent 95°, the top side is bent to 98°. So the top flange goes down sharper then the bottom one.

I then found out that there is an easier way to identify it. The bottom right drawing on DWG13A on the plans show a little note saying "Closely spaced holes identify bottom flange". And indeed, you find 3 holes in the middle of the bottom flange which are close to eachother. Another example of wanting to go to fast without studying the plans in detail upfront.

Started on the outboard side

Then clamp the reinforcement plates on the front side of the aileron spar. The 2 3/4 inch long side lays flush against the inboard/outboard edge of the spar. So longest side standing up.

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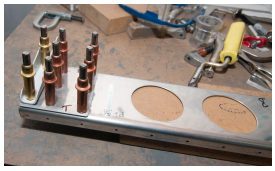
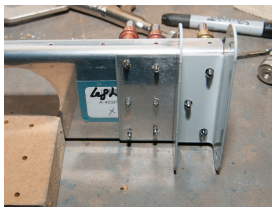
Drilled the #30 holes. Some will just hold rivets that attach the plate, the inner ones will also connect the nose rib. The outer ones are #40 in the middle and 2 large#12 holesthat will holdAN3 bolts that fix the aileron attach brackets

Aileron attach brackets clecoed on. Notice that the #40 holes are only in rib, spar and reinforcement plate, not through to the bracket.



On the inboard side, you do the same, the bracket here is wider and hold 3 AN3 bolt. this is where the aileron is actually pushed via the aileron bellcrank from the stick in the cockpit.



The middle AN3 bold is tightened without a nut. It is installed using a nuplate that sits on the other side of the spar. The hole idea here is that you have no more access to that nut once the side ribs are on. The nutplate sits inside the aileron behind that side rib.

Then clamped and clecoed the side rib on and matchdrilled the inner

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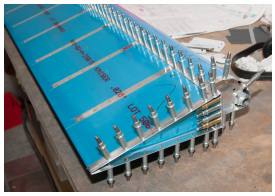
#40 holes with a long 14" drill.

Then inverted the spar and used the #12 holes from the back to matchdrill the hole in the top rib flange.
I first center pointed the rib flange with the #12 drill very lightly. Then used a #40 and #30 drill to enlarge the hole. And finally drilled through the flange with #12.

In the end, this procedure of up drilling gave me nice round drill holes. I never drill #12 right away in thin skin material.

Clecoed on the nose ribs and matchdrilled them also to the spar.

Then, you install the trailing edge skin and nose skin and insert the counterbalance pipe. This is a kind of long water pipe in galvanised steel that serves as counterweight for the aileron.



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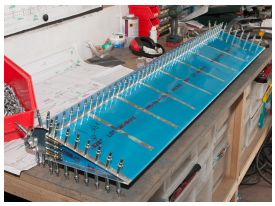
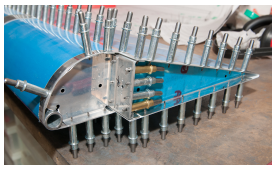


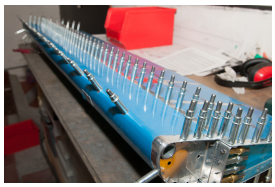
Side shot of the inboard side on the right aileron.The countersink pipe is nice and flush with the nose skin.



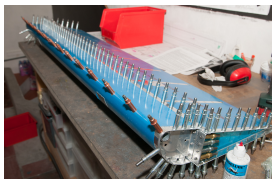
The counterbalance pipe needs to be match drilled with the skin. Since this involves manual drilling in steel, I used the updrilling technique again to ensure nice round holes.

The pipe is installed with CS4-4 pop rivets so you need #30 drill.

I made an initial drilling with #40 to have the first holes small.



Then updrilled to #30. The updrilling goes very easy and smooth once that pilot hole is already there and again ensures nice round holes in skin and pipe.



Matchdrilled all skin to side and nose rib and spar flange.

The nose rib needs some minor fluting to match the nose skin and then you clamp the nose rib flanges on the skin and drill the undrilled two additional holes

The final matchdrilling is on the bottom side of the aileron spar. The bottom skins and spar are also attached with CS4-4 pop rivets. Same procedure here as with the pipe.

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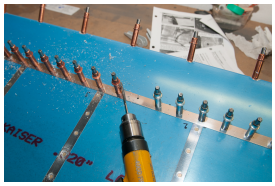
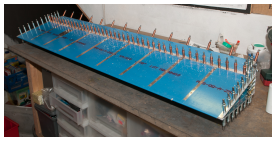
First drilled with a #32 to enlarge the hole. Then used a second drill with a #30 reamer installed to enlarge the hole to #30. It gives perfect holes all the time.



Fully matchdrilled, ready for deburring and dimpling



But that will be for the next day. Now it's my kids birthday party.

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