Aileron and flap braces - 05/11/2012 - 3h30

Category: 2.4. Main Wings
Published: Wednesday, 07 November 2012 18:36
Hits: 1653

Time for some work on the aileron braces and fairings.

As I had explained earlier, I had a problem with the straight alignment of the outboard aileron brackets.
I sent a mail to Vans support for this and got approval for 2 possible solutions.

1. Put a small shim between the angle leaning against the main wing spar and the main aileron bracket. Not a bad idea but enlarging the distance between the two brackets slightly.

2. Better idea is to use a new stock angle piece that is not pre-drilled (eventually wider on the spar side) and clamp the bracket in place and matchdrill the angle with the holes on the main spar.

In the end, I did none of them. After some clamping and hand-forming, I could put the aileron bracket in place so that it stood up as good as straight. I clamped the rib against it and then drilled the #30 holes in for the AD4 rivets in the web of the outboard rib.

After drilling, it looks like this. Almost perpendicular. It makes no sense looking at a millimeter precision because anyway, the aileron will be installed enclosing this bracket and you will adjust by using washers between the aileron brackets (aileron side) so there is a nice and thight fit.

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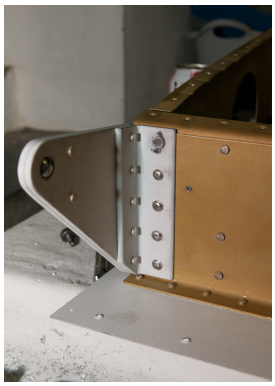
We started by shooting the outboard aileron bracket in place. We used the rivet gun but I found out that you can actually squeeze these so if you need to do this on your own project, use the squeezer here. I have a yoke with the nose slightly grinded down to the size of the die's head. It fits perfectly then.
On the flat AN426AD4, we used a flat die mounted on the c-frame extention bar and shot on this using the backrivet set. A bit of overkill as it can also be squeezed. But in the end, it worked and it's a new technique to remember if I ever have to rivet in thighter places.
The black in the picture on the rivet is not really something bad. It's just the aluminum making the white primer dirty. The bracket alignment after rivetting was still fine.



After that, we rivetted the outboard side of the aileron bracket using the rivet gun. Here again... you can actually use the squeezer on all of them by reaching through the lightning holes in the rib.
I can still not understand what went through our mind wanting to buck these.
The next lines will make clear why you should use the squeezer.

We fucked up, well... we didn't just fuck up. we fucked up big time !

While setting one of the rivets, my rivet gun shooting partner made a

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smilie on the side of the rivet that reached almost until the center of the manufactured head. There was no compromise on this, it had to come out again.
Additionaly, on the two bottom rivets, the web did not fit nicely against the bracket. Could put a nail between. Not good...
Up to this point, it was just a bad rivet that had to be drilled out... no big deal.

After this, a number of mistakes were done and wrong decisions were taken.
Read them, so you can avoid them on your own project.

Mistake 1 : never use a rivet removal tool for AN470 rivets when the manufactured head has been damaged. Why not ? The answer is quite simple: the whole idea of using this tool is making sure the drill will be centered on the tivet head, and as such will drill straight through the hole. If the head is deformed, the center is no longer the center and you will enlarge or 'oval' the hole.
Check !, we did it... So now we have an oval and enlarged hole.

Mistake 2 : once the rivet head is broken of, you normally put in a pin punch and give the shaft of the rivet a light tap with a hammer. If the rivet doesn't move with a light tap, drill a bit deeper and try again.
Our rivet didn't move at all... afterwards, the analysis is easy, since the rivet isn't drilled out straight, part of the rivet is still intact and it won't move, whatever you do.
We put in the pin punch and gave it a good blow with the hammer.
Big big big time NONO !
The web of the rib on the inside was seriously deformed by the rivet being forced out of the hole. The sides of the hole were forced out.
But even worse, there were 2 cracks in the holes.

This gave me cold sweat for a couple of minutes and we had - as usual - to re-find our calm and brain in order to take the right decisions.

Solution : after the ridiculous ideas like : 'oh no, I'll have to drill out the whole outboard rib and replace it', 'I'm doomed', 'Why me ?', ... , the calm returns and we decided to drill out for an AN5 rivet.

I first squeezed the deformed hole with the pneumatic squeezer and two flat dies so the web of the rib would be more or less flat again with the aileron bracket. This worked quite fine.

Then drilled out the hole for the AN5. This was not solving the problem yet. The crack was too deep and still visible and believe me,

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cracked aluminum on the outside rib is not a good idea.
Only option is to enlarged again to the next step to #12 for a AN6 rivet or a AN3 bolt.
The #12 hole makes that the minimum edge distance on the aileron bracket is not respected. Not much, but it's slightly below nominal value.
I do prefer being below on nominal edge distance over a crack in the web so we decided to drill to this size. On the web size, the edge distance is ok because it's in the middle of the rib web. This is also where the material is the thinnest. On the aileron bracket, the brace it very thick and I think the chances of rivet breaking out of the bracket is minimal at this gauge aluminum.

Fortunatly, this #12 size removed the crack from the hole in the web and made - after deburring - a nice smooth hole again.

The problem is now that I need to be able to squeeze or shoot an AN6 rivet. Squeezing, forget it, the power required is too high for the kind of pneumatic squeezer we use.
Shooting ? I never did that before so will need to test on some scrap pieces first. I also don't have such a rivet set.

Another option is to use an AN3 bolt. This would work but I think a rivet will be structurally stronger so I'll investigate the AN6 shooting in the near future. For now, the hole will remain open to remind me for the next weeks about the stupidities one can do.

After replacing also the bottom rivet and drilling it out more carefully, I managed to remove the gap between web and bracket.

You see the AN6 rivet on the picture below as the second rivet on the bottom-left.

This is the hole after being enlarged to #12. No more cracks, but it has turned out as a monster-size hole.

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Other side on the aileron bracket side.

How to overcome what we went through:

Tip 1: Always put the manufactured head on the side with the thinnest material. In this case, the manufactured head would have been better on the inside against the outboard rib web.It's better for the shape of the thin material after forming the rivet head.

Tip 2: I know you cowboys like your guns, but put it aside and squeezer those aileron bracket rivets. To make sure you got it, I'll say it again..., Use the rivet squeezer !

Tip 3: If a rivet won't come out with a light tap, or if the material on the shop formed side is very thin, drill through the rivet and use small pliers to remove it from the manufactured head side. This gives the least risk on deforming the material.

Tip 4: if you make a mistake like this. STOP working ! Emotion is overwhelming. Let it rest for a bit and get back to it when you had the time to calm down and think rationally again.

After all this emotion, we stopped work for this session. We actually should have stopped right away.

In the next work session, Installed the flap brace (first picture) and the aileron fairing (second picture).

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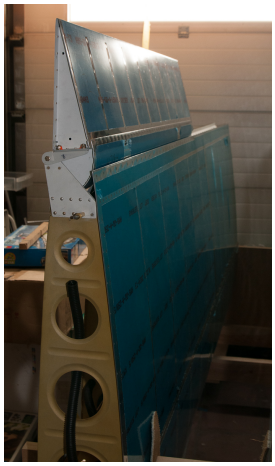
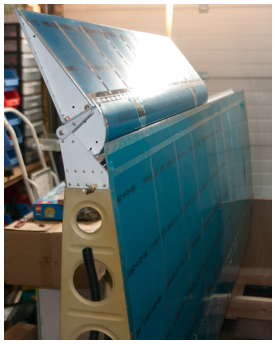
When the right wing braces were completely on, I drilled the steel aileron brackets on the aileron to #12 and temporarily installed the aileronon the wing using an AN3-10 and AN3-14 bolt with a temporary castle nut.

The aileron on the wing looks really cool. It's a nice reward after going through the misery of the last days.



Aileron tilted down in the lifting, left turn position.



Aileron up, in the right turn position.

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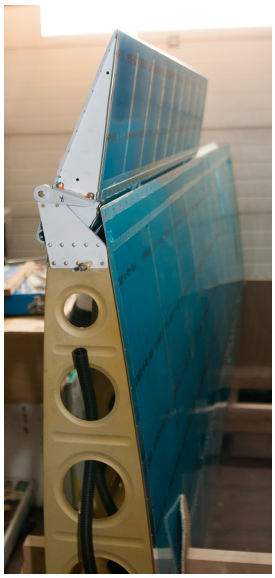
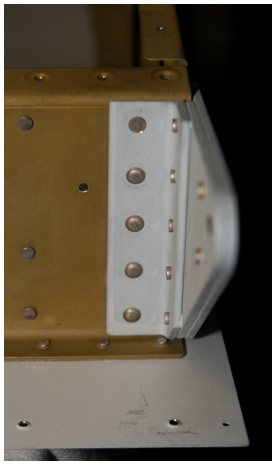
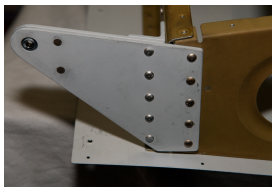


Nothing touches the main wing. The aileron moves freely in the brackets. Later on, I will have to install the aileron stop on the outboard aileron bracket. But this can only be done on final installation.

On the left wing, I started with a fresh mood and with the knowledge of what I learned from the right wing.

Squeezed the outboard aileron bracket.





Could have squeezed also the middle wing aileron bracket but we shot them with the gun. The right side has some smilies in the surrounding

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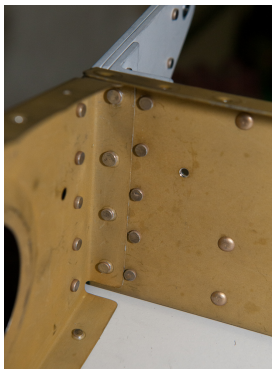
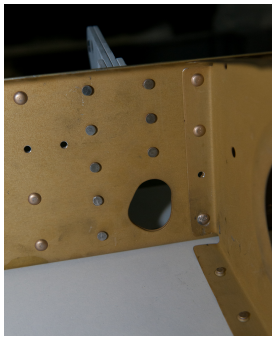
metal. Esthetically not so nice but acceptable

Rivet heads on the outboard side by using the squeezer



And rivet heads on the middle bracket



Installed the aileron fairing with the squeezer. This time installed the manufactured heads on the fairing (thin) side. The result looks much nicer.

Finalizing the aileron fairing and flap braces next session.

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