01/12/2018 - Redrill upper engine mounts to fuselage - 4H

Category: 3.1. Firewall
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Time to get back to some serious business. You may recall that some time back, I had some head scratching moments when I discovered that my engine mounts had insufficient edge distance on the steel engine mound brackets. (WD-602-L and WD-602-R).

You can read all about it in a previous post : [link][title][/link]

I discovered after drilling the rivets out and checking the mounts that the edge distance on the upper tab were dramatically small. Also, the last hole was nearly on the back side of the engine mount because I didn't respace the last 4 holes on the end of the engine mounts. Reason for that was that I measured the holes on F-695 fwd fuselage gussets without too much thinking of the hole pattern on the engine mounts. I made even spacing and matchdrilled that on the longerons. Only afterward, I drilled the engine mounts leading to this bad result. At first I thought that my longeron center line positioning was very much off but found out that it actually wasn't too bad. They were a slight to the outbord side but not all that much to give poor results. So after a lot of brain cracking think work, I finally found out what happened. The engine mount tabs are only welded together at the base for an inch or so and further on are independent from eachother. So you can slide one tab over the other in either direction. When I clamped the tabs to the longeron, I had first clamped the bottom tab lateral and vertical, which means that the lower tab now rests inside the vertiex of the longeron angle. When I clamped the upper tab, all that was left was the space next to the lower tab butting against the lower tab. That means there was hardly any space left when I drilled. At least that explained the reasons why.

I reordered new engine mounts and clamped them firmly, paying attention that the upper tab would now nest fully in the longeron vertex. Then I used the sharpie pen to draw contours through the holes. I got very close to edge distance this time which felt much better already but to ensure myself, I sent the following questions to Vans support:

In picture enginemount-3 I made picture of the mount and the distances measure from the outer (left) side of the leg to the assumed center of the rivet hole. 2D should give 0.250 edge distance but as you see, I'm on all holes too short. I started figuring out why this is and found out that the holes drilled in the longeron are all a little too much towards the inside of the longeron (outboard). I made measurements there as well and you see those on picture enginemount-1. (center of hole to inside edge of longeron) I'm not sure what I should do now. I could gently file away and round the upper tab of the WD-602 a bit, that might give me some thousands but even then, I'm not going to be

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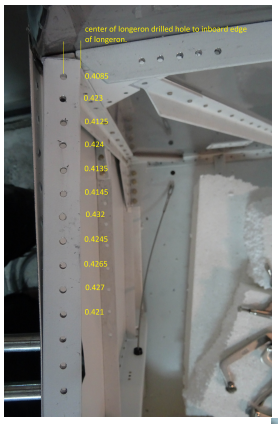
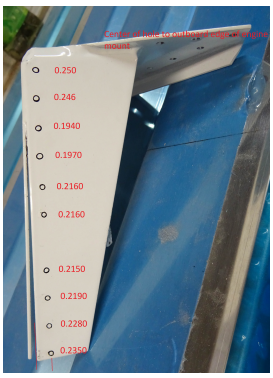
reaching the 2D edge distance. Are these measurements ok to continue with ?





The answer of Sterling was in Van's style, short and clear (16/08/2018) :

Picture three with the estimated ED measurements looks perfectly acceptable to me. A steel part can accept shorter than standard 2D and still be structurally sound. Clamp, drill, deburr, rivet and build on!

Later he responded another question on radiusing with:

I would not say it is necessary to radius the edge of the part to be able to nest further into the longerons. If would like to do this it can be done if you wish but would not be required. The welds do only

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extend up a short distance from the firewall.

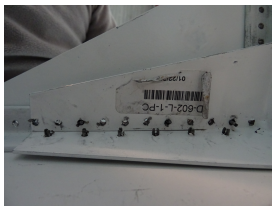
So with this confirmation in my pocket, I took all courage and started reclamping and drilling the mounts to the longeron and firewall again.

I first filed away a slight bit of the outboard side of the upper tab so that it would nest even nicer in the longeron vertex. Then clecoed and started clamping to get the best possbile nesting.

Well, you could say that I exagerated and that i clamped the hell out of it. Here's some pictures

As you can see in the image below, this is what you are looking for.

I drilled all #30 and checked the inside, looks indeed much much better than the first time.



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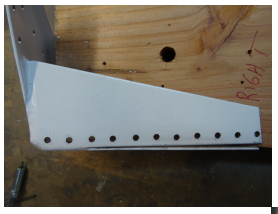
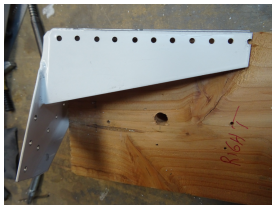
So I did the same on the passenger side and clamped away.

I removed both mounts and checked with the caliper for edge distance. Both edge distance reading were very good and even better than predicted on the mail to Sterling.
Pilot side:



As you can also notice, even though the lower tab is mounted below, you still have sufficient edge distance here.
Passenger side:



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As you can also see, the last holes on the upper tab are not acceptable. There's no way I can solve that without drastic measures by replacing the longeron.
That off course is a total no no...
Then the next solution popped in my mind : I could also cut off the bad hole, and weld a small tab of steel behind this. Welded steel is as strong as the original and if I would add a tab of about an inch, I would cover an additional 2 holes.
I still have the old engine mounts so the base material is found for the welding. Now I just need to find a welder who can do accurate TIG welding.

To confirm my story, I asked Sterling for his opinion:

... However, I still have my problem that my last drilled hole was on the end of the mount because I didn't adjust the spacing on the last 4 when I initially drilled the longerons.No way to replace the longerons so my new idea is to TIG weld some steel on the end of the engine mount tab so that at least I can redrill the hole in the same location and not be at the edge anymore. Does this seem like a good idea to you, and if yes, is there something special I need to know before I start doing this. I will ask a professional welder who's specialized in TIG welding to do this for me.

His response:

the holes all look good with the acceptation of the one on the end of course. Tig welding on a small tab will be perfectly acceptable. These parts are 4130 steel and the typical welding rod used is "ER70S-2".

I also presented this issue to the technical advisor from the Belgian aviation authoroties and he confirmed me also that it is a good solution. He just suggested me to make a nice detailed drawing of the solution and to present that again to Vans to get the offical confirmation on that.

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