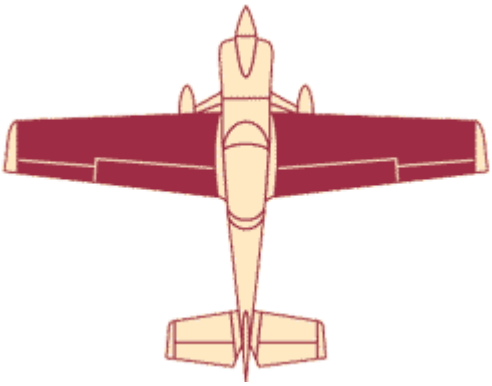


The Team Rocket quickbuild kit comes with factory jigged and skinned wings. The bulk of the tricky building, especially with the EVO taper wing, is done for you. Those EVO wings are compound curved and tapered. And the type of airfoil it is makes it more critical to get the dimensions just right.

I wanted a quick build. I didn't want to do all the complex jigging that accompanies the wing and fuselage. I was happy to spend the money to let the factory complete this difficult chore.

When my kit finally arrived, the EVO wings were supplied with the kit. The flaps and ailerons are part of the kit, but were still in development. They arrived about a year after my kit. That was over a year ago, so don't worry, the parts are readily available now.

The wings are a work of art. Regardless of whether you think the EVO tapered wing is right for your plane or not, you have to admire their beauty. And the construction work is excellent. Those Czechs know how to build airplanes!

The EVO wing has a laminated spar, similar to an RV kit. That gives you lots of strength and safety. One lamination fails, well, there's lots of others still to support you.

Each wing has a 26 gallon removable tank that should be able to be removed without TOO much fuss. It looks like you can unscrew them and pull them out from the front of the wing. But they do come pre-assembled and sealed with the caps and fuel level sensors installed.

IHere's an EVO wings sitting in my cheap ass rack. I was undecided whether to work with them standing up on the LE (Leading Edge) or work with them on their backs (top skin facing down). So I'm going to start with one oriented each way and see how it goes. Certainly leaving the wings upright in

the racks takes up a lot less room.

I finally sold my Super Decathlon to make room in the hangar for my Rocket. Before moving the fuselage out of my basement, I decided to go ahead and work on the EVO wings. I figured that during the week, I'd try to work in my basement, then on weekends try to work in my hangar. The only trouble is going to be having tools in both places. Guess I'll be carting some of them back and forth (a little tough by motorcycle), or buying duplicate tools.

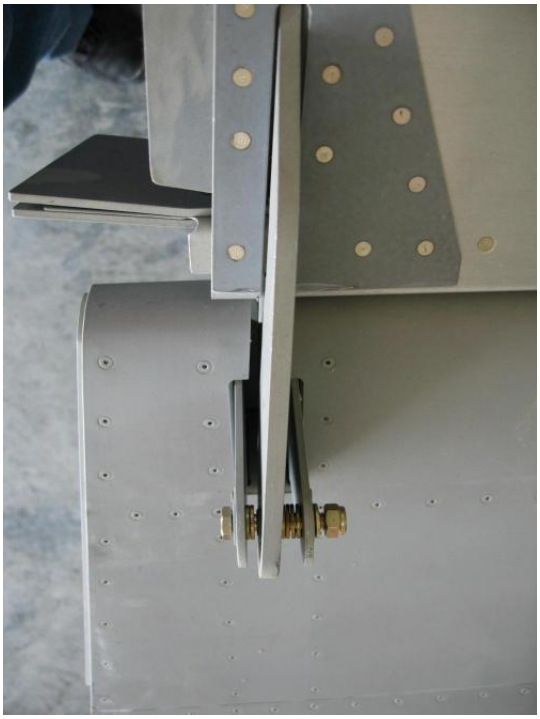
My EVO wings are the second set made by the factory in Prague. They already had the entire leading edges screwed down as well as the inpection hole doublers installed with nutplates. That probably saves me about and entire month of weekends of drilling, prepping and riveting in nutplates.

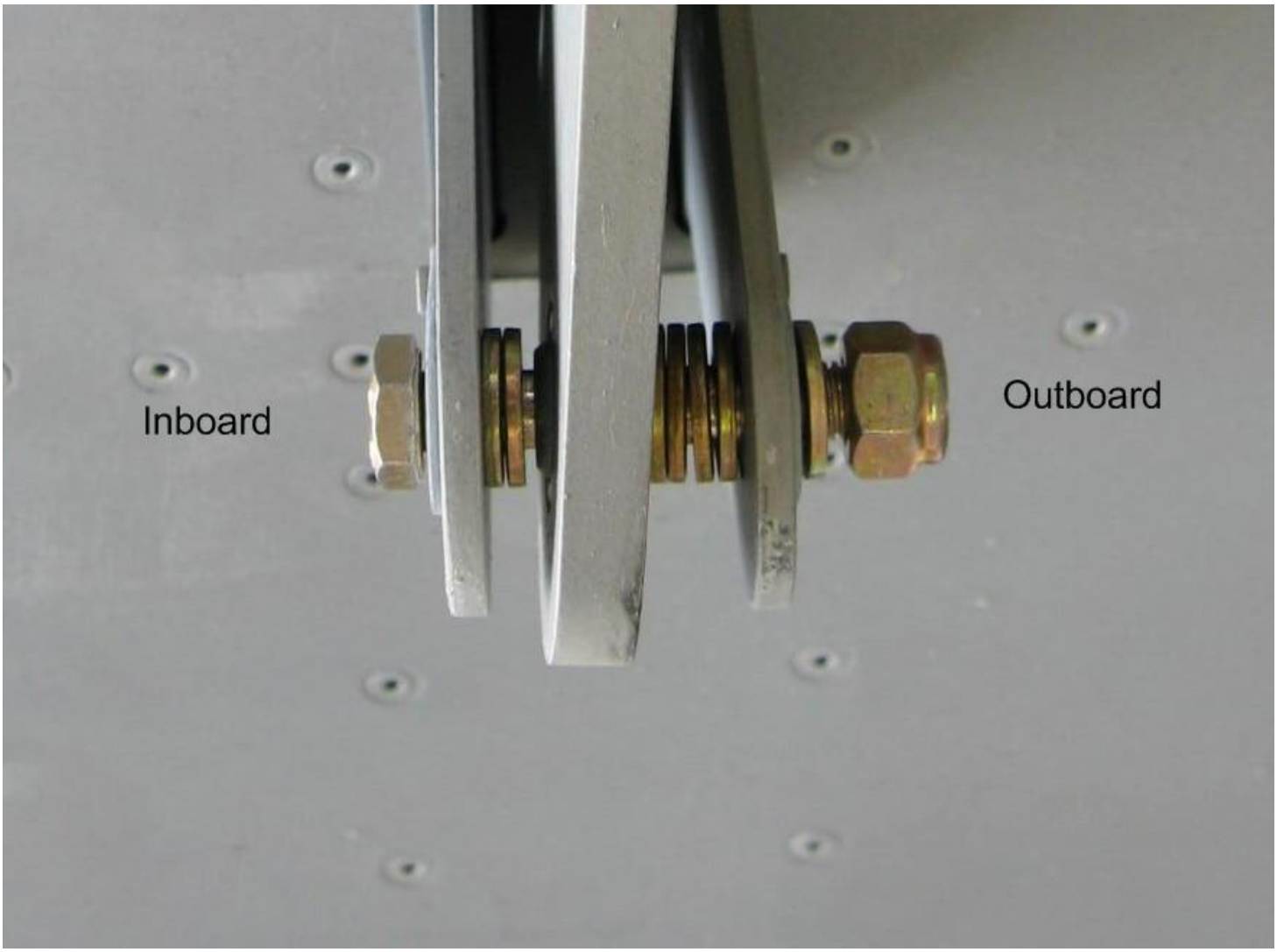
The manual tells you to start the wing project by reaming the spar holes first, then do the leading edge skins. I get to skip all the way to the flaps! Sweet.

Flaps and Flap Gap Seal Fairing

Evently Tom Martin got Mark to include a device in the plans to help you set the position of the flap trailing edges. The top skin of the wing has to be bent to the proper position based on the flaps being neutral in flight. So the goal is to have flush skins with neutral flaps with a flap faring closing the gap between the flaps and the spars. First thing I did was go ahead and bolt up a flap accoring to the

manual. There's a really cool technical drawing in the manual that shows you how the washers and bolts go in the flaps. Here's how they set up:



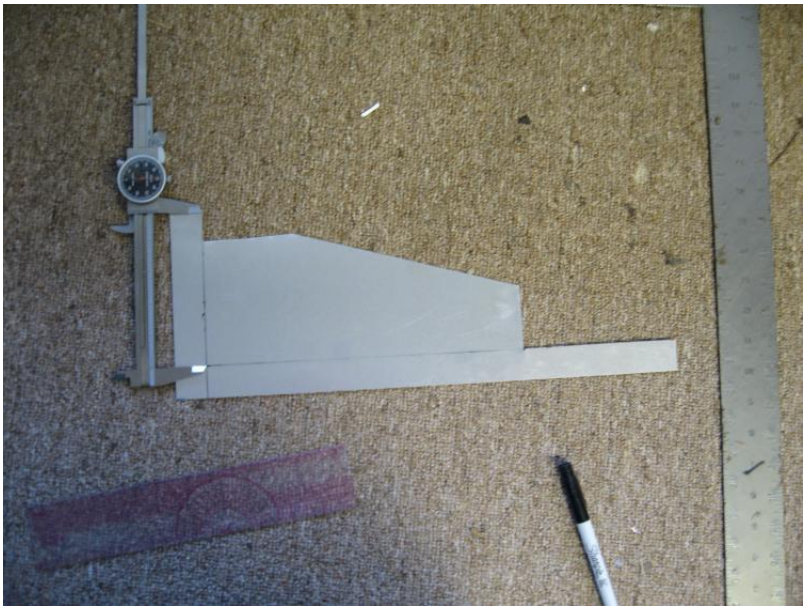


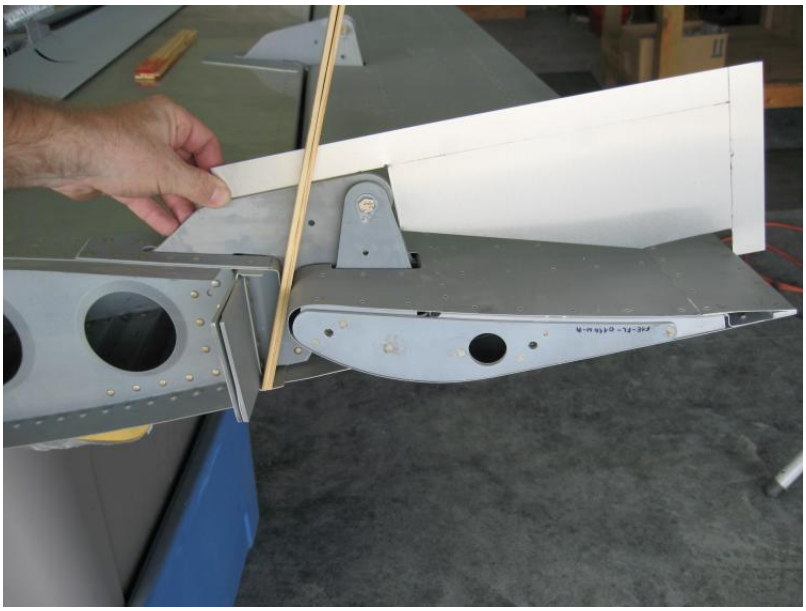
After setting up those 3 sets of 7/16 bolts (with 7 washers each), time to bend the skin and try to get it close to the proper position against the flap.

That's what you have to close. Now here's how far I got doing one flap skin by hand until my fingers hurt (I am a wussie):

That's better, but the flap is actually in positive diflection. It's over rotated upward (the wing is upside down as I am working on it). So the TE (trailing edge) actually needs to go up a little, and that makes the gap a little bigger. Doesn't look like much, but it is NOT easy to bend the skin.

Mark has a technical drawing of Tom Martin's flap TE jig (actually a measuring/positioning device) in the manual. I made mine out of some .025 that I had laying around. .032 or thicker would be better, the .025 is flimsy and makes getting a steady position on the gizmo to the TE a little tough. But it was less wastefull to use the .025, and I only have to use in on two flaps in one place each. I have no idea how we would have otherwise determined where the TE goes and where to set the flaps at neutral. The jig gizmo make it Easy. Thanks Tom!



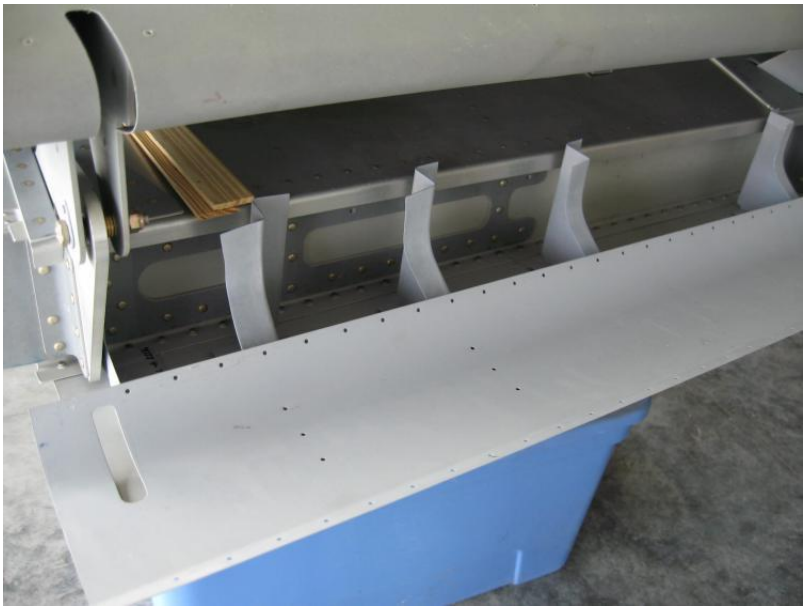


Tom recommends that you shoot for exactly this setting for the flap TE. Then, in service actually set the flap up against the top wing skin just a little more. IOW, if anything err to the postive side, but you really want it neutral to begin with. You have to get the flaps right to get the ailerons right, too!

The flap gap seal (fairing) goes in next. I think this thing is going to be a bitch. You have to work through the rear spar and make the ribs hold the fairing in place as well as pull the top skin down. Like rubbing your stomach, patting your head, and dancing a jig all at once. Even Tom Martin seemed to have a tough time with this part. I think he was the first one outside the factory to do it, though. Glad I wasn't breaking any ground here. I'd probably still be waiting for replacement parts.

I gathered up the 8 ribs and the side specific flap gap fairing and laid it all out. This is how it goes.. I think....

Some of the locations in the wing spar are pre-drilled, as are some of the rib locations in the fairing. Not enough to spoil it, mind you, but enough to get at least SOME of these parts properly located... although I think some serious "massaging" will be in order on this one.



Looks like the top of the ribs will have to be cut down a bit. Dunno yet if the top (really the bottom) of the ribs (as shown) go under the wing skin or just cut it off to clear. My motto is ASK TWICE, CUT ONCE. Where's Mark on a Sunday afternoon when you need him. Not answering emails, that's for sure! Well, time
to gather more info and get my hand held. I'm rusty from taking about 2 months off from building. It's going to be slow going with the wings for a while.

Those EVO flap gap seal ribs have to be cut down A LOT! The part under the lip on all SEVEN of them had to be cut anywhere from 1/4 inch to over 1/2 an inch! And on the 5 outboard ribs (not in front of the spar doubler) I cut about 1/4 inch off each of them at the base where it steps over the spar flange and rivets (under the top wing skin).

 It wasn't all that hard to trim them. And when you get the ribs to the correct length, they just set right in under the spar flange lip. I started to measure them and trim them scientifially. I rapidly decided to set the ribs down against the top skin and just mark where the top skin intersected the rib. Then I cut short of the line to make the rib slightly smaller. Even then, on a couple of them I went back and cut another 1/8 off after that.

One the right wing, I just put the ribs back to back agains the left ribs and cut them to match per Mark's recommendation. That worked well. The first set of ribs took about an hour and the second set took 20 minutes. And that's because I was using a dremel. If I had a band saw out there, I'd have been done with the whole mess in about an hour.

In the pic, the ribs are roughly wehere they belong. My wings are more complete than yours, so I have rivets to drill out, etc., where the wings coming out after the first batch are missing some doubler rivets and whatnot. Not that big a deal, really.
This was actually kind of fun!

 After setting the ribs in place, I started to trim the gap seal. You just cut the slots out to the edge and also trim the outboard end at the edge of the top skin that splits at the aileron. The gap seal is too long, and you have to cut about 1/2 inch off of it. I rough cut it and set it to place.

It sits in there pretty cool! Nice piece of work!

Now to see what happens when you raise the flaps (well, flip it down in this case....):

 The flap is at rest. It actually sits against the gap seal in the pic. As it sits, it is actually in POSITIVE deflection. Now, my top wing skin is NOT pulled down to meet the flap in neutral position yet. Mark Frederick is lending me a special flange tool to bend my skin. I tried to do it by hand and was afraid I would kink it. Plus I didn't have the hand strength or deep enough clamps to get onto the skin and spar flange. I asked Mark how I should proceed. He said he had a tool for it. OHKAY! I like the sound of that!

Man, it's just cool to stand back and look at this wing... even if it isn't finished, it's dirty from being in my T hangar for a year, and I don't know what the hell I'm doing. But Looking at this wing with the flap over the gap seal is really gratifying. I feel like I'm getting somewhere.

Now I AM doing the right wing at the same time. You can see it sitting vertically behind the left wing. I didn't put the flaps on that one yet. I'm waiting for the skin bending tool. In the mean time, though, I fitted the ribs, trimmed the gap seal and tried to keep pressing on while waiting for the UPS man.

These wings are SWEET!

Mark has the right answer for everything. Well, maybe not everything, but he certainly was helpfull when it came to getting the "flap skin" to lay better against the flap. "Mr. Brown" just brought a neat home made (looks to be, anyway) steel tool to aid in bending the flap skin and the spar flange it is attached to. Just hook this thing under the skin and tweak the flange/skin the direction you need it to go. Nice! Easy does it!

This tool was NOT the cat's ass that I thought it would be. In fact on the first skin, I got tired and frustrated trying to get the thing to work. I ended up kinking the skin. Oh, I can fix the skin all right, but I was VERY disheartened that I lipped it. And I also dented the middle area over the middle flap bracket. In order to bend the skin down enough (it evidently bowed up quite a lot when the wing was skinned), you have to bend the skin and spar flange down A LOT. And when I did, I got off the flange and bend the skin, and pulled the skin down and dented it over the flap bracket. Now I'll have to tap the dents from the bracket back down, and I'll have to fill the crease in the skin on the left wing. SUCKS to be me. I was able to roll some of the kink back out, but not all of it. Once the wing is painted, it will stand out like a sore thumb if it's not filled. Dammit.

So after hammering the kinks out of the wing skin as much as I can, I went back to more spar flange bending. It ain't gonna be pretty. And actually, after cutting the ribs and drilling them to place, I think I was trying to bend the skin and flange WAY too much.

Making Mountains out of mole hills... yep. I was pretty worried about this flap fairing (gap seal) and all the ribs and what not. After working on it another 7 hours today, it's actually coming along fairly well. And simply. It's not going to be pretty, but it will be effective. I thought I was going to have to shim this and that and rework all the ribs. NOT SO! Just trim the tops so that the ribs drop in under the spar flanges (skin lip) and cut the bottom flange away from the spar flange rivets. Then line em up

with the predrilled holes in the fairing skin and drill 'em to the spar. That's what I did today. Now I feel like I'm getting somewhere!

My EVO wings came completey riveted from the factory. The plans say to rivet the flap fairing ribs that sit over the inboard spar doubler using the existing holes. Well, I had no holes. I had to drill out the rivets just to get the ribs to sit flush on the surface of the doubler. Then, especially with the first rib inboard, I had to reposition it and drill extra holes.

You can see in the first pic the line drawn up the doubler. That's the edge of the rib flange. The existing hole is the one with the hash marks drawn next to it right on the edge. I scooted the rib as far inboard as I could (actually right up against the next rivet head) and drilled new holes. I then cut back the rib flange, and I'll put the rivet that I drilled out back in the holes. Same situation on both wings.

Note the mark that I made around the rib flange that sits on the top wing skin (yes, Margaret, the wing IS upside down). Rather than jump through hoops and make a bunch of complicated measurements, I just traced a box around the rib, and sooner or later, I'll drill 3 holes for NAS rivets.

Before getting too far along, I decided to fit the flap fairing a little better, and then go ahead and drill the fairing up and match drill it to the bottom skin flange. The flap fairing was predrilled, but the wing skin flange was not. Fun little project with clekoes and drill bits.

I'm still working with the right wing on edge, and the left wing upside down.

To the left you can see the underside of the top wing skin marked for drilling and subsequent riveting of the wing skin to the flap faing ribs.

Once the ribs are trimmed and set into place, and the skin bent to "neutral", the bottom of the rib flange (actually the top that sits against the top wing skin bottom... did that make sense?), the wing skin sits VERY nicely against the rib flange. I hope that means I have the wing skin in about the right place.

Now I have to find the courage to drill the top wing skin. It's going to be tough. The flap fairing ribs are a funky shape, and the rivets have to be pneumatically riveted. Getting a bar against those rivets is going to be a little tough in the tapered TE of the ribs. I think I'll try to keep the rivets forward and closer to the spar where there's more room to buck them.

If you see how far off the rear spar flange causes the wing skin over the flaps WAY up in the air (at least on my EVO wings), you have to understand that the flange must have been puckered when the skin was riveted. You HAVE to bring the skin and the flange down. Having said that, you CAN trust that if you seat the ribs back agains the spar web, you WILL get the skin to come down to the ribs and end up in a nice "tension" against the flaps. IOW, the ribs are made very well and do make the parts fit together beautifully. Although the flap skin takes considerable man handling to get it to sit in place properly.

I did the right wing first. After mangling the wing skin down to position, I set the ribs in place and drilled them to the spar. No problem, they sit in there very nicely. Next, I outlined the rib flange on the underside of the top wing skin. The bucking bar for seating the hard rivets can't get too close to the tip end of the rib, nor should the rivets be placed too close to the joggle in the rib next to the spar flange. Therefore, I moved the outer rivets of the rib that go into the rib 1/2 inch toward the middle of the rib, marked the skin accordingly and drilled the skin with a #40 bit.

Next I set the ribs. The two inboard ribs get bucked with hard rivets agains the spar doubler, and the rest get AVEX pull rivets. I set the whole row of ribs to the wing spar. After the ribs were set to the spar, I machine countersunk each of the 3 skin holes into the ribs. Then I bucked them. Even so, I had a hard time bucking these 3-3.5 rivets, and actualy mauled the skin on the right wing in two places. Out of practice, I thought I was being careful. Now I'll have to do some putty work later... Bummer.

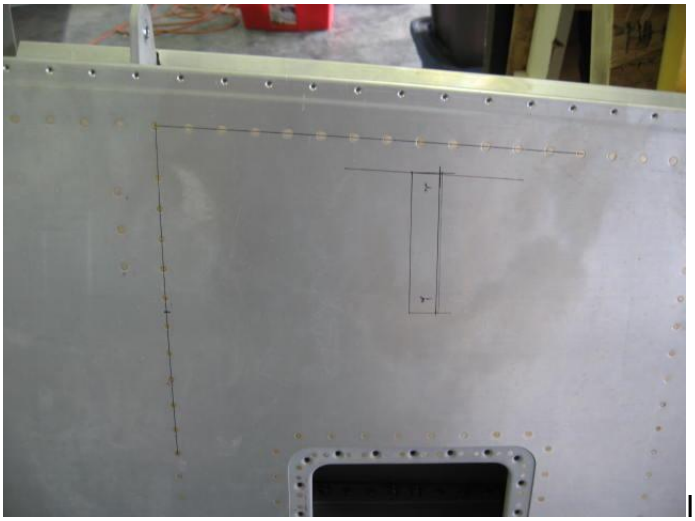
The flap fairing has to really be rolled a lot, and mostly in the tight turn of the ribs. It's not imparative to get it to sit perfect, but if you have already made your wing skin sit near where the flaps are at neutral position, you have to make the fairing sit passively. On the right wing, I had the fairing bent beautifully, so I started match drilling it, prepping it and then pop riveting it starting along the lower edge. You can't use clekoed in the fairing when you check the fit of the skin against the flaps, so it takes some faith to trust that you have everything shaped correctly. Which is why I went ahead and riveted everything together except the TE of the wing skin to the flap fairing ribs. That trailing edge is supposed to be dimpled, as is the flap fairing. I did NOT do this per plans, and I am going to countersink the skin instead.

Team Rocket makes the flap gap seal fairing pre-punched along the TE. After I riveted the ribs to place, I clamped a long piece of 1 inch angle along the edge of the fairing and the skin. That would keep it all flat and straight when I match drilled the skin to the flap fairing. I used very high speed and very light pressure on the drill bit on all these holes. Since I have already riveted everything together, getting in there to clean up bits of shavings is nearly impossible, so I clekoed every hole and tried to not displace the skin from the fairing while drilling. After that, I jumped in and machine coutersunk the skin and prepped for riveting. I tried to clamp the skin, but I couldn't get the squeezer around the angle, so I just started riveting from the middle out. The left wing skin stayed nice and straight... relatively. The right won't be so easy. It's not straight even after clamping and riveting to the flap fairing ribs. But at least the left side turned out OK.

The flap fairing for the right wing wasn't quite so simple. Since I had wanged the skin pretty badly trying to bend the skin and spar flange into submission, the wing skin had a noticeable wave in it. Clamping on the angles again when drilling the skin to the flap fairing definitely helped straighten out the wave. In fact, I kind of over did it on this side, and the skin is fairly straight but I would not call the skin's relationship to the flap as "tension", it is TIGHT. I can barely get the flap to neutral. I'll take it, though. I thought it might end up with a nasty gap, but it turned out fine. And pretty straight.

Aileron Push Tube Slot

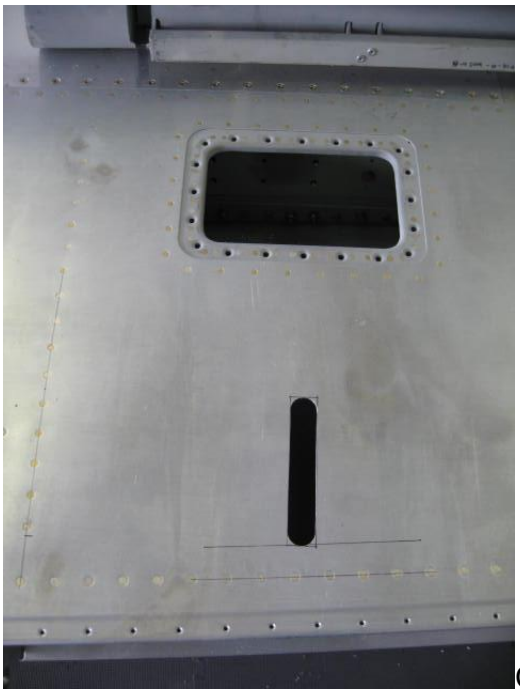
While waiting for the flap skin tool to arrive from Texas, I went ahead and pressed on to do other stuff. I have to cut the bottom skin for the aileron push tube. It's a pretty squirelly job. The plans aren't really bountiful for this one. Just a diagram. Ok, here's how I did it.

 I drew centerlines along the rivet lines in the area specified on the bottom of the skin at the inboard end of the aileron. Oddly enough, the slot is going to be nearly perfectly centered aft of that big square inspection panel. That will certainly make putting in the mechansim a bit easier.

From the trailing edge rivet line (along the spar) I measured up 27/32 and marked a parallel line. I used a right angle "square" ruler and laid it along the vertical rivet line (rib) and measured to a point from that line and marked a spot perpendicular to that rivet line that intersects the 27/32 parallel line at 6 31/32 from the vertical rivet line. That corner is the basis of a rectangle that you mark out, then drill and slot. Next I made another mark that was 7 1/32 from the vertical rivet row. That line goes SMACK DAB between the #5 and #6 rivet. That was a guess based on the diagram in the manual. It doesn't tell you how long the lines are, it just shows you where it goes. Fine. I can interpret drawings MUCH better than I used to. Building this Rocket has been quite a learning experience.

The diagram in the plans tell you that the slot will be 25/32 wide. Ok. Of course I don't have ANY rulers marked in 32nds, so this is exactly approximate. Heck, I'm drawing a straight line using a steel square on a curved surface with one hand. And I can proudly say I got it perfect. Almost. Anyway, you draw a line parallel to the one you make between the 6 31/32 and 7 1/32 marks, mark the cross lines and VIOLA! You have a nice rectangle almost perfectly centered aft of the inspection cover.

I forgot to take my BIG step drill bit to the airport, so I came home to update my website. Note that the aileron push tube slot is ready to drill and dremel.

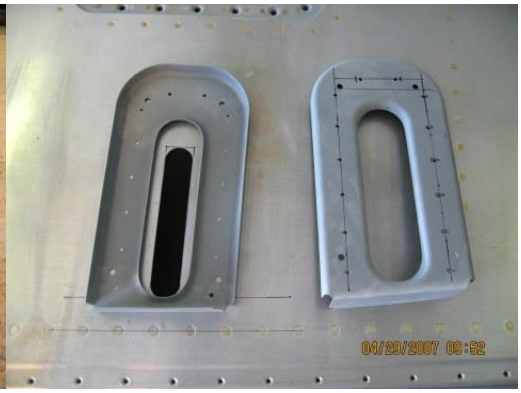
 Oh, that was fun. A hand file and a dollar's worth of fiberglass reinforced dremel cut off wheels. I did learn one thing: the cut off wheels last longer if you don't drop the Dremel on the floor. DOH!

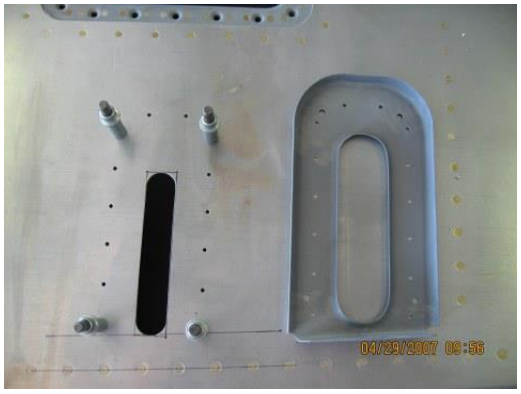
Ready for reinforcements, SIR!

(as in... I need Mark to send me the doubler for these push tube slots.

Mark finally sent me the slot doublers and I put them to use. They are side specific, one left and one right. The only forming you have to do is to ben the flange. There isn't much instruction for locating these. I guessed. I bent the flanges on the doublers parallel to the wing spar, and made them actually clear the wing spar a bit. I suppose if I was really anal, I could have made the flanges on the doublers sit flush against the spar, then riveted them to the spar. I don't think that is what is intended, and in fact I may end up trimming the flanges so that they clear the rivets for the flap gap seal fairing ribs.

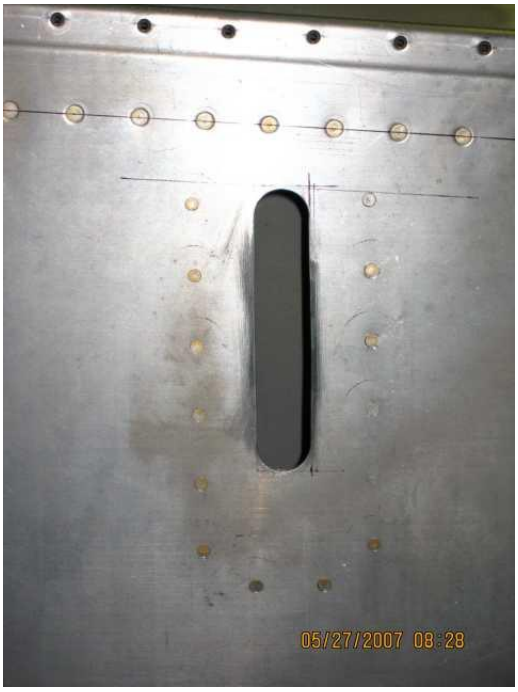
The parts are mirror images of each other, so I decided to measure one, mark it for drilling and then match drill both doublers together face to face. That way I could use the right doubler as a template (face down) to match drill the left wing skin, and the left doubler for the right wing. It worked beautifully.

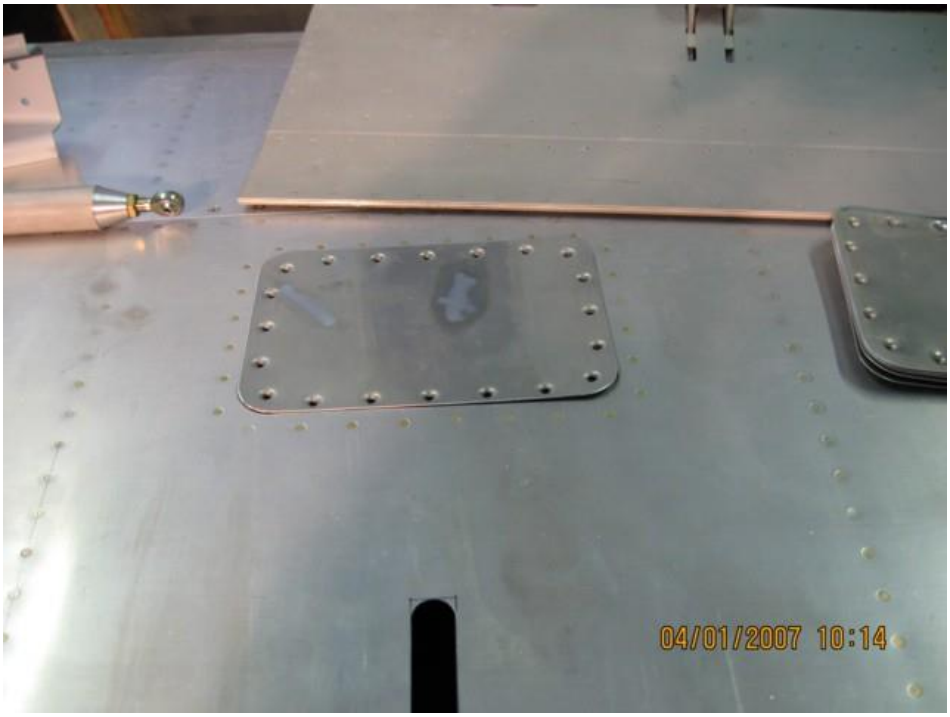




Now all that's left to do is countersink the skin and drive in the NAS rivets. I'll leave that until later. I don't think these doublers will get in the way too much, but I think I'll put in the flap gap seal ribs first, not that it makes THAT much difference.

Before I started riveting the wing skin over the flap gap seal fairing and ribs, I practiced on riveting the aileron push tube doubler. Good thing these are on the bottom, because I mangled the skin on the first one pretty badly. I haven't bucked rivets for about a year, and it showed. Literally. Fortunately, the second doubler went much better and ended up quite nice.





Inspection Holes & Covers

Wow, now this was a fun little project. For those of you new EVO owners, you probably have to put the doublers down and rivet those puppies in. Not me. Mine were already there. Now I hope that doesn't confict with the 51% rule, but I'm glad they are done. All I had to do was drill up, dress and dimple the cover plates. Easy? Well, yes... but... I screwed two of them up.

I aligned all the prepunched holes AND the outer edges (they actually come packaged that way) in the six cover plates. I took them to my scotchbrite wheel and cleaned up the edges. You can actually do this with them all clekoed together if you want. That's how I did it. And I drilled them cleckoed together as well.

Next, I dressed them and dimpled the cover plates one plate at a time. I dimpled the first one upside down. The holes ended up NOT matching the doubler in the wing without a bunch of overlap around the perimeter of the hole. IOW, the plate didn't sit in the recess, it overlapped on one end. Scratch one. The second mistake plate is serviceable, I'll use it as a spare. But I let the plate slip on the dimple die and the male die bit a hole offcenter. I was able to dimple it and make it look right. The screw will probably hide the defect. Just the same, I bought a couple replacement cover plates from Mark to do it right. Now, hopefully, I'll have one spare cover plate.

***So to reiterate - these plates are all drilled the same, but they are NOT univeral. They DO NOT orient the same way in every inspection hole and may need to be reversed or inverted or both BEFOR DIMPLING to fit a specific hole. On my ship it seems the inboard holes are NOT oriented the same as the two outboard holes.

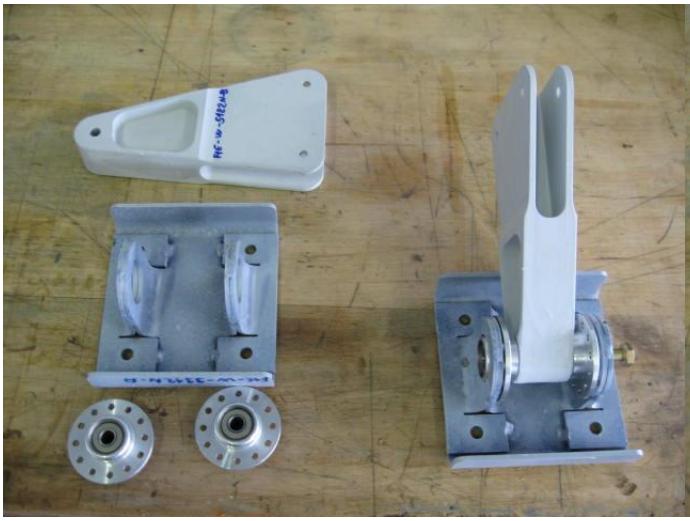
EVO Aileron Push Tube Mechanism

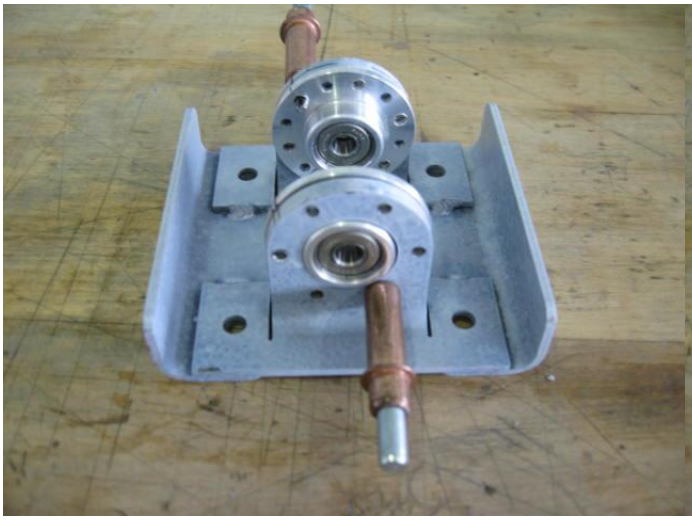
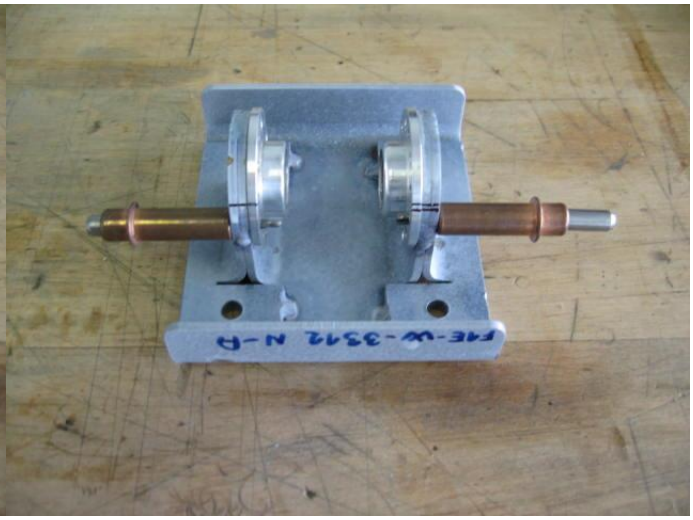
The EVO wing has a pretty cool little mechanism that operates the ailerons. When I got my wings, they still hadn't completely figured it out. I'm pretty impressed with the simple and elegant way that the mechanism goes in the wing.

First step: gather up the parts. My NEW work bench in my hangar (thanks BRUCE!) is now covered with parts. Almost no room to work. Which means I have a lot of parts yet to install. Man, the pivot brackets that hold the bearings for the push tubes are SERIOUSLY beefy.

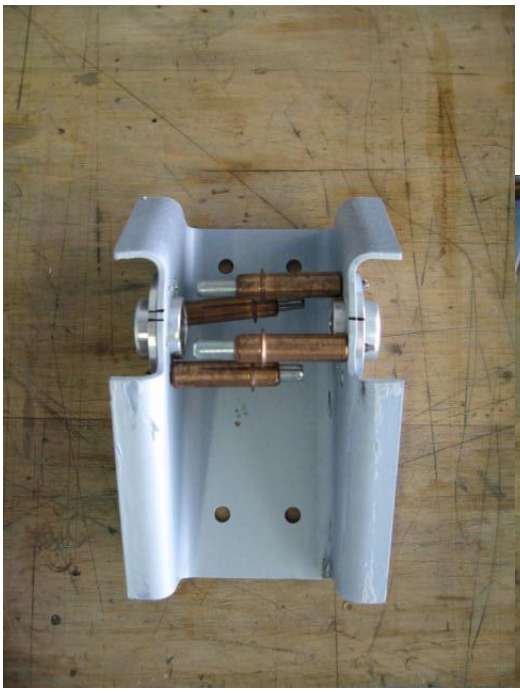
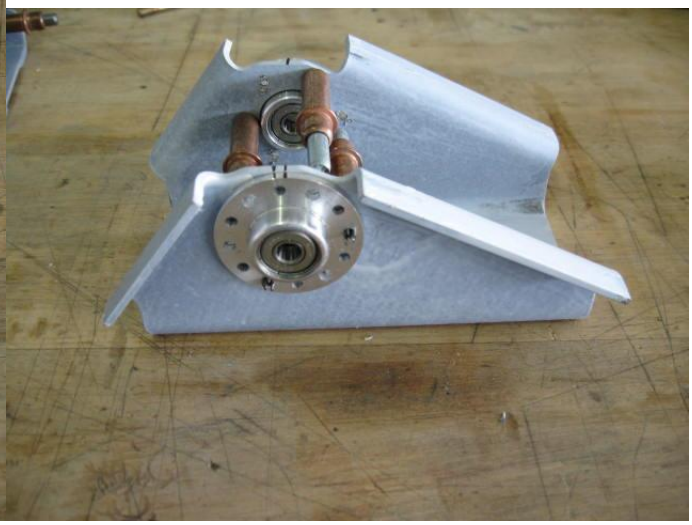
There is a pivot bracket/bearing that intercepts a short aluminum push tube, and that bracket goes inside the first inspection bay. The aileron bellcrank bracket goes in the third inspection bay. Both brackets bolt right into the spar... and the nuts are already built into the wing. COOL! Less work. They are behind the gas tank, so it would be a MAJOR to get to them. Thanks to the CZECHS for putting those in. So. I just follow the drawings and instructions in the manual, and off we go!

First, let's make a pivot bracket/bearing. Simple. Hold a bearing on the outside of the bracket, match drill a hole, cleko it, then match drill the every others. I actually drilled them 1/8, then went #30 after I put the bearing on the inside of the bracket where it belongs. I arranged the bearing rivet holes so that they were as easy to squeeze as possible. The bearing is held by a double wall of heavy aluminum, so it took #8 rivets to hold the parts together.



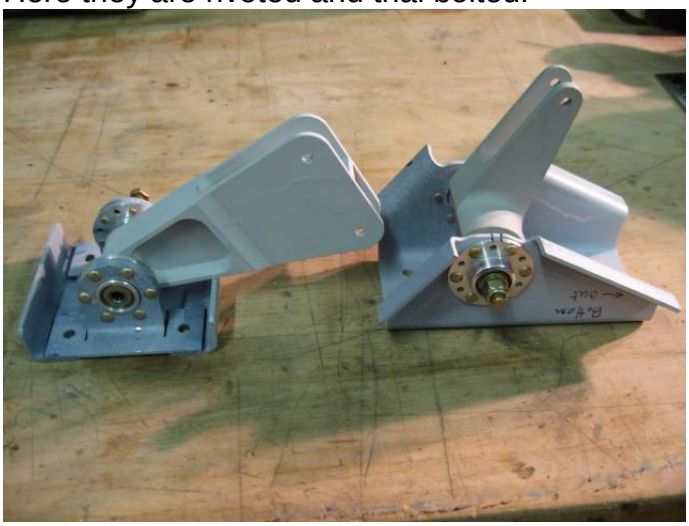



Then I put the aileron bell crank bracket together:

This was more or less like the pivot bracket, except easier to drill, rivet, dress and assemble. Nice that the bearings stay on the outside.

Here they are riveted and trial bolted:



And of course you need a pair for each wing: (I'm still playing with my new camera...)

The manual sez that you are supposed to use THREE washers on each side of the aileron bellcrank to hold it in the bearing. There is NO WAY IN HELL that the parts supplied are going to fit like that. I think they were saying 6 total washers way back when the were using BARE billet parts, not seriously thick primered parts. I could only install FIVE washers total between the bearings as provided. I only had room for the tip of my dental explorer to go in there.... much thinner than a washer... by HALF. On the pivot bracket/bearing it says to use 1 on 1 side and 2 on the other. Now THAT gap is a lot bigger than on the bell crank.

I have some "stock" AN washers that are thinner than the ones provided, so I used a combination of different sized washers to take up the slop in the hardware on the aileron bell crank. I wanted to mate this stuff as flat against the bearings as possible. YouI definitely want to close that slop, which is why the pic above shows the pivot unbolted. If you just tighten the bolts to take up the slop, you'd bend the brackets slightly and the bracket would not sit flush on the bearing. That could cause the bearing to fail. Not good.

The Evo Aileron push tubes are simple to assemble. They are relatively thin walled aluminum tubes that you cut to length, then grind end caps to rivet and JBWeld into the ends. The caps are threaded

and you put rod end bearings in there. Nice. I had to use a dremel drum on the inside of the tubing and on the outside of the caps to get them to fit. That will also help Mr. JB hold them better. They are still tight, even without gluing.

Mark F. recommends not trimming the tubes and final assembling at least one end on each tube until you are ready to finalize the wings. The measurements in the plans seem rather exact, but as we know, the real world ain't always as planned.

I laid the brackets and all the tubes on the wings roughly where they are supposed to go. It looked so cool, I quit for the day, and forgot to take a picture of it. Hard to believe, I know. Maybe tomorrow....

Here's the orientation of the left wing aileron push tube and push rod bell crank brackets:

Note that inboard is to your left and outboard is to your right. Both brackets are bolted to the rear wing spar in approximately their present positions. Also note that when you install these, it makes good sense to put the nylock nut on the bottom of the AN bolt. Which means when you install them (from the bottom through the inspection holes), you will actually want the nut facing you. Not only will that help keep the bolt from falling out of the bracket, but it makes inspecting the nut easier.

I left my ratchet and the proper socket at home, so I didn't get to install the mechanism in the wing now that the flap fairing and aileron slot doubler are installed. I might be moving right along if I wasn't in transition with half the tools and plane still in my basement and half in the hangar....

The aileron push tube mechanism was not all that tough to install, but it cost me some skin and bruises. It's just tough to get a socket or wrench in there. This is where having a wide variety of tools comes in really handy.

The spars are already prepared for the brackets to be bolted with the provided AN4 hardware. On this particular bracket, "the CZ Boys" did a pretty crappy job of welding the two base plates together and the predrilled holes were quite offset. I had to ream them with a dremel stone just to get the bolts through the base.

This is the left wing aileron bell crank bolted to the aft side of the forward spar. Note that outboard is to your right. The long arm is for the long outer push tube, and the short arm (pointed right) goes closer to the skin and points outboard. That short arm is for the aileron push rod.

Note that I made sure that the nut on the assy bolt faces downward (you're looking at the bottom of the wing). Not that the bolt could come all the way out. You HAVE to install the bolt and nut before bolting the bracket assy to the spar.

The long push tube is really NOT supposed to be cut to length until you install the entire mechanism and perhaps the wing on the plane. Mark told me this AFTER I had already cut the tubes per plans to length. Oh well, no since crying over spilled milk.

I didn't rivet the bearing end caps into the tubes until I test fit the tube with the aileron mechanism set to the neutral position.

The middle inspection hole is empty for the most part. The pivot is in the inboard hole and the bell crank is in the outboard hole (to your right).

You can see how the outer (long) tube will go between the aileron mechanism assys. Yes, you have to put this tube into the wing from the inboard end with the wing off the ship.

The end cap with the threaded bearing is drilled and riveted to the tube with AVEX structural pull type rivets. Of course I used some JB Weld on the mating parts before riveting them together.

The inner aileron push tube is also cut to length already, but it won't be used until the wing is ready to go on the ship.

Here's some pics of the aileron bell crank and pivot in approximate various positions:

Full down: Neutral:

NOTE: The bolt that you use on the bell crank to attach the aileron push rod HAS TO BE INSTALLED UPSIDE DOWN! In my installation, I didn't even use a washer on the head of the bolt

for fear of interference of the bolt with the bracket body as the aileron swings through. Sorry, I should have taken a close up picture of that potential interference.

Although the outer aileron push tube construction is complete, I'm not ready to finalize the installation at this point. Some of the bolts are torqued and will stay uin place, but I will probably have to unthread the tube from the bearings (from the inboard, pivot end) and adjust the travel and final neutral position. For now, the aileron mechanism is as complete as I can get it until the wing is installed.

Aileron Attachment

Nothing earth shattering here. Except a couple notes from Mark that aren't presently in the plans. First major point is to only pin in the two outer hinges on the ailern. Leave the center hing unhooked. Don't know why, but that's the word from The Boss. The other question I had was about the large amount of space between the aileron bracket and the wing bracket. Mark sez just use washers on the bolts as spacers.

In the factory assembled Evo aileron, there are nutplates already fabbed behind the aileron brackets. So all you have to do is figure out how many washers you need and bolt them up. Simple.

There are only two brackets used on the aileron even though there are accommodations for three... don't use the middle brackets.

The outboard bracket gets two washers on the inboard side and four on the outboard side:

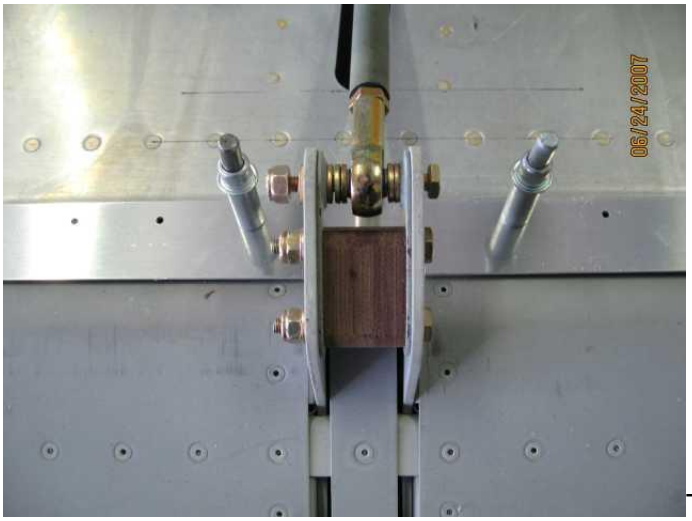
The inner bracket gets three washers inboard and 5 washers outboard:

The difference in one or two washers in the wrong order can make a difference in how much travel the aileron gets. The ailerons don't move nearly as much as you might thing. I'm used to seeing the big barn door ailerons on my Decathlon swinging massively. In comparison, these ailerons appear to move half as much.

Here's a couple pics showing how far the ailerons move stop to stop (without any push tube mechanism to restrict operation):

Max Aileron UP deflection:

Aileron Max Down deflection:



The aileron push rod comes as a kit. You get a steel tube and two threaded rod ends. Since I don't weld, I was able to coax one of my patients to weld them for me. Thanks!

Mark said the tube should be cut to EXACTLY 12 inches long. Well, I think the tubing should have been more like 11 5/8 long (or maybe even a little less). As it is, the push rod is at the very minumum length when the aileron is full down. The rod end bearing contacts the bracket base inside the wing. So I have NO room for adjustment on the aileron pus rod.

Moment of truth. Did I cut the push tube slot correctly??? Yep. Put the proper amount of washers on the AN3 bolt and the rod goes full travel without contacting the skin. SWEET!

Aileron Gap Seal

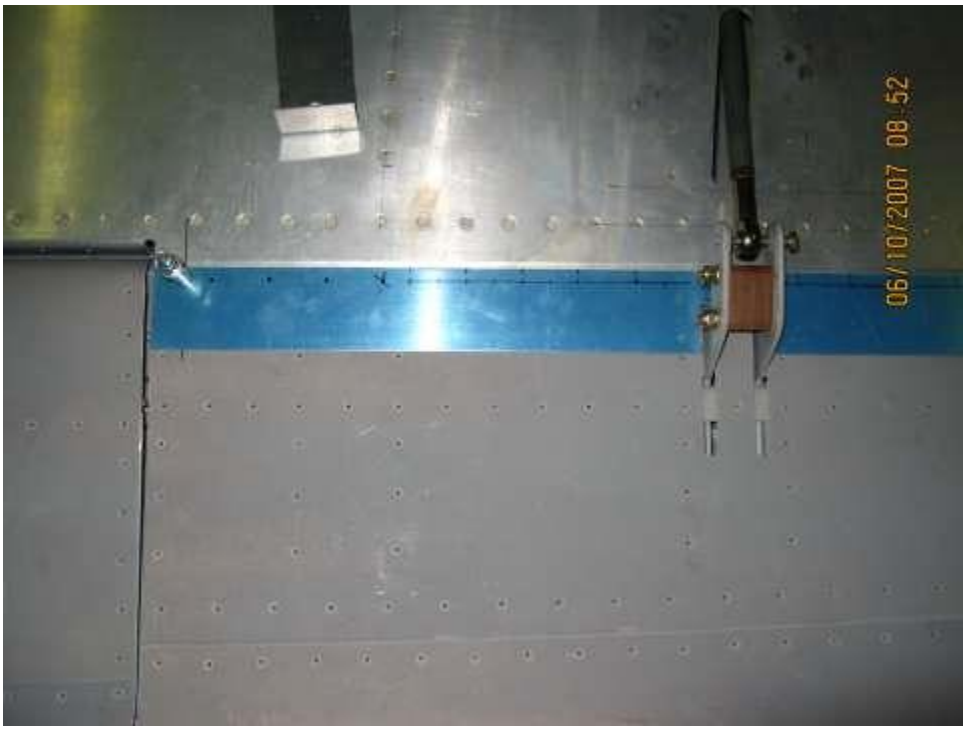
Some of the EVO parts weren't in full production when I got my kit. Those parts took a year to get to me. Had I not been SCREWED by an engine builder, this may have been a big issue, but since I wasn't finishing really fast, the wait was not a big deal. And when I was missing the parts once I got around to assembling the Evo wings, Mark sent me the parts, no hassle, no questions, no worries. Fast and easy. Very nice.

I was missing the aileron gap seals. I wasn't even sure there WERE any gap seals (nothing in the manual about them), but the wing skins are predrilled and dimpled along the wing trailing edge where the ailerons attach. Mark is good about that. If it's something really simple, it's not usually in the manual. Guess I'm flying by the seat of my pants on that one. At any rate, the parts should be here by the end of the week (takes UPS about 5 days to get here from Texas).

The aileron gap seals are just strips of what appears to be .032 aluminum about 1 inch wide. There is a little joggle in the wing skins from the factory on the EVO wings. I thought I was supposed to use all those predrilled, predimpled holes. Nyet. Evidently there has been so much change along the way that only two of the factory holes are used to attach the aileron gap seals. And you don't need to use every hole anyway.

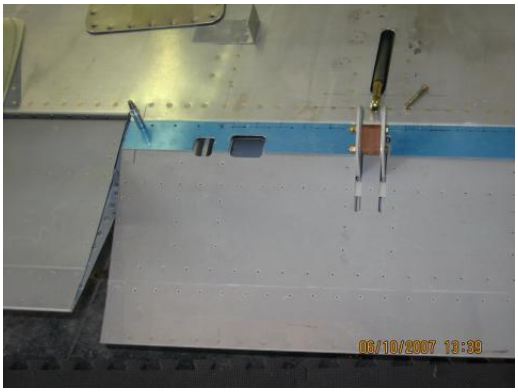
The plan from Mark is to match drill the end holes, then space a new hole inbetween every other predrilled hole on the ship. Then you just countersink the new holes on the gap seal and squeeze hard rivets. Oh, and since the TE of the wing skin is not only pre-drilled and dimpled, but also folded with about a 240 degree bend, squeezing rivets requires a special offset squeezer set. Or I suppose I could just take a dremel and cut the bend off the skin.

Mark sends the gaps seal for the EVO in precut strips. They are just a scoshe longer than the ailerons. One each for top and bottom. I just happen to still be working on the bottom of the wings, so I started with the hard part.



I set the gap seal strips in place. First thing you notice is that the armature for the aileron push rod is in the way. So I lined up the strip with the inboard edge of the aileron, marked and cut the strip. You have to cut back into the gap seal strip about 3/4 of the way. I wanted to be sure that I had full travel of the aileron without the gap seal interfering. Next I set the strip into the skin joggle and tried carefully not to put the strip up on the slope of the joggle. I marked the bottom edge of the joggle at the ends and in the middle. Next I marked the location of the inboard prepunched hole and match drilled that in the strip. For the outboard edge, I ended up makeing a new hole about half way between the prepunched hole and the edge of the skin.

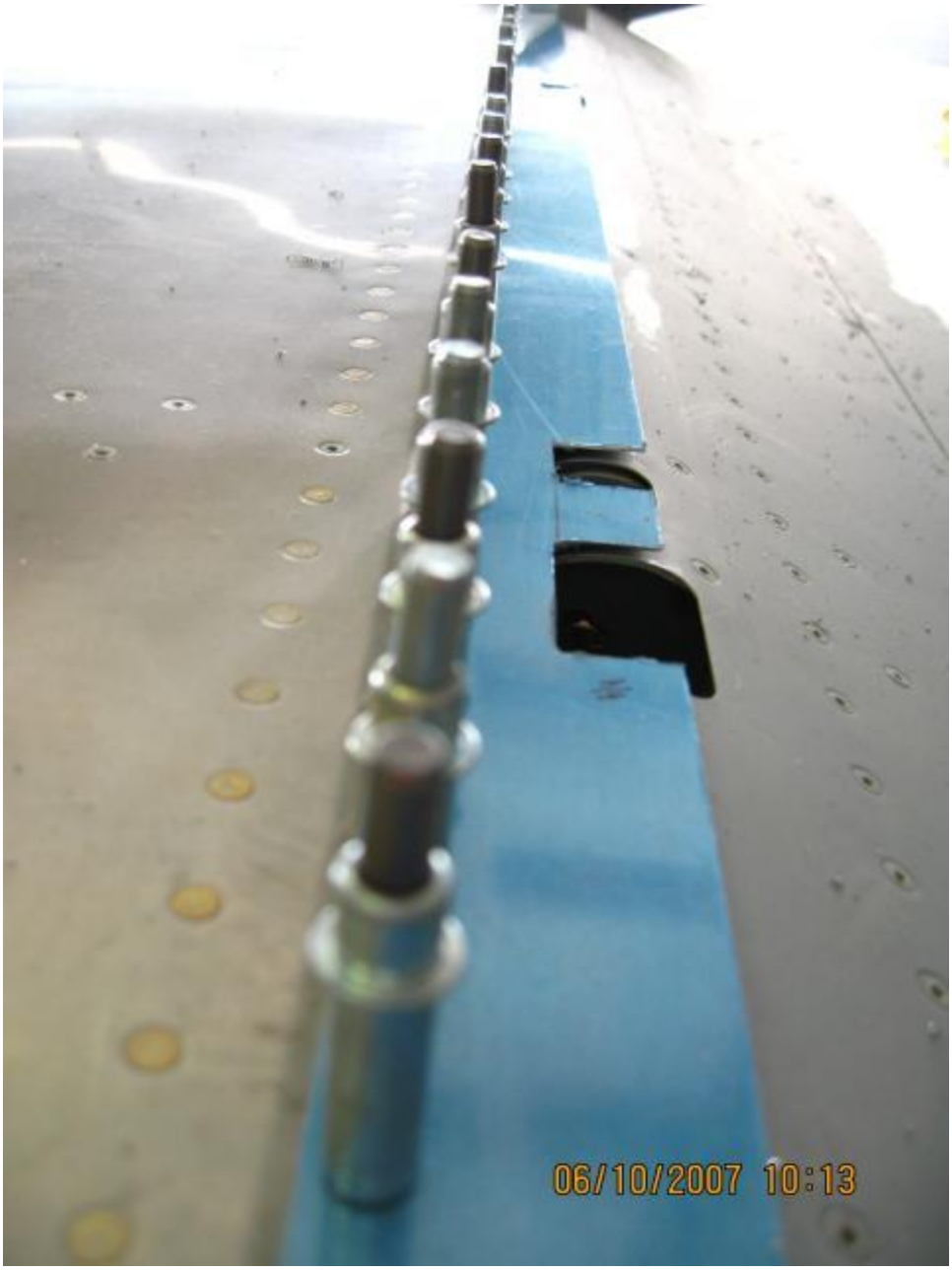
With a cleko only in the end hole, I marked all the interference locations and then rotated the strip down and marked the existing holes. Mark Frederick wants us to re-drill inbetween the existing prepunched holes and use the new holes (without dimples). I measured the existing holes and thought they were a bit too much on the curve of the edge of the skin, so I located the new holes 1/2 inch from the edge of the strip. This puts the new holes on a slightly more flat footing, and still with enough edge distance. I clekoed the other end and marked the rest of the hole locations and x'd out the places where you can't put in a rivet. I also skipped the rivet under the aileron arm. Mark and I talked about only using every other hole (my idea), but I since decided to use EVERY hole except where something would prevent you from squeezing a rivet.



At the same time, I marked the holes in the ailerons where the hinge bolts are located. You have to open the slot enough to be able to remove the ailerons for service. By the time I'm done, I may end up cutting the gap strip way back and the gap seal slots may not look quite so big. Keep in mind that whenever I need to remove the aileron in the future, I'll have to rotate the aileron full up to get to the hing bolt slot.

After marking all the existing stuff, I went back and drew a line on the strip at 1/2 inch and then measured 1/2 the distance between the holes. That came out to 1 3/16. Then I just drilled and clekoed, trying to keep the strip flat against the skin. Easy peasy.

The other bottom gap seal can just be match drilled to the first one! No sense in going to all that marking trouble if you don't have to!



The tricky part with the gap seal is figuring out how far back to cut it. If you leave it long, when you go full aileron IN toward the gap seal the gap seal at the very least rides up the skin. At the very worst, it could block the aileron's full travel. I think if I just put some teflon or UHMW tape under the edge, I could leave these strips as is and then just rivet them on. However, I think it would be best to trim them back to the minumum TE necessary.

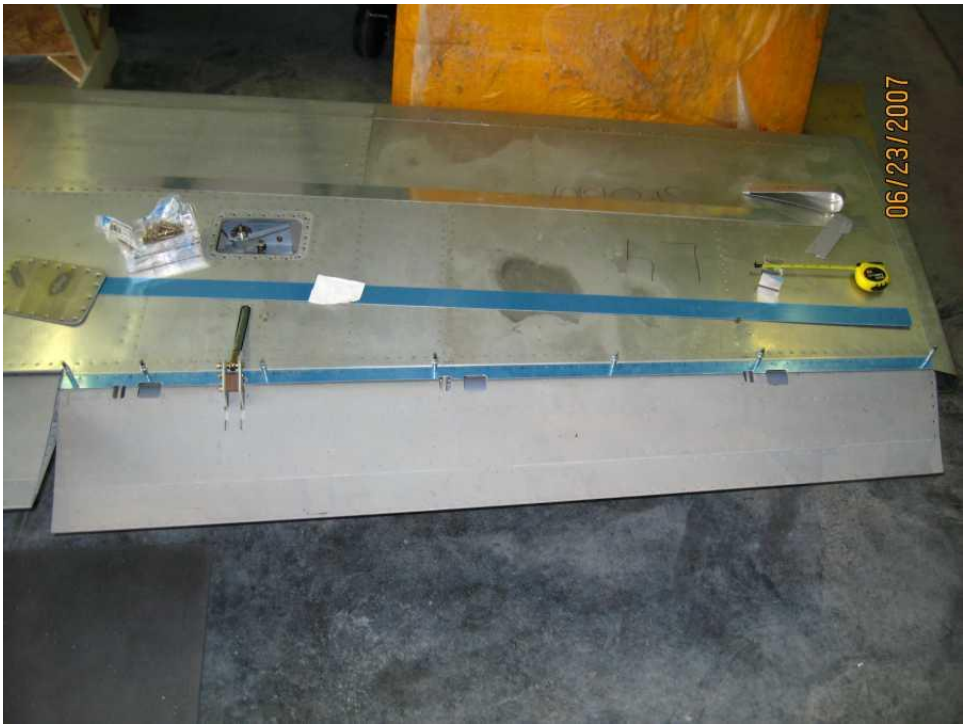
At the other end of the spectrum, if you cut them too short, air would get through and it defeats the purpose of the gap seal. Also I suppose if wind forces were not in your favor, the gap seal could bind against the radius of the LE of the aileron (the curved part at the front that rotates).

Mark said that on Ol' 84 they cut the gap seal short and then used a plastic tape to ride against the aileron.

My idea is just to cut the gap seal strip just aft of the aileron radius tangent. In the pic to the left you can sort of see the rounded radius of the hinge slot ion the aileron. Then the blue covered gap seal sticks out aft of that tangent as the aileron turns downward. If I push the gap seal slightly downward, I woud leave a little extra material ("cut it proud") and then use tape on the bottom side of the seal against the aileron.

So the plan is to leave the gap seal slightly long, then use UHMW tape along the TE. Hopefully as the aileron is in service, the extra 1/16 or so of the gap seal won't bind the aileron when it deflects against it.

Mark F. and Tom Martin suggest that the gap seal is NOT supposed to touch anything. So I cut it back some more. Turns out that the taper is about 1 1/8 inch at the inboard end and just under 1 inch (about 7/8) at the other. Yes, the gap seal tapers as does everything else on these wings!



Note that there is a gap between the gap seal and the aileron until the aileron is in full deflection toward the seal. At that point it barely touches the aileron surface. I may have to trim it back even a little more to add some mylar or other flexible seal materia.

Mark suggests that the airlow should be sealed between the wing and the aileron on the bottom. The top gap seal should just be a nice metal edge. On the bottom, away from UV rays and most of the elements,, it's desirable to stick something to the gap seal and have it ride on the surface of the aileron. That way it stops the airlflow from top to bottom.

The gap seal gap (without flex material) can be seen in a pic down in the aileron tip portion of this page.

At the inboard (thick) end of the aileron, the surface of the round LE of the aileron actually protrudes beyond the skin of the wing. It was necessary to not only trim the aileron gap seal to size, but I had to bend the skin upwards away from the aileron to compensate. The aileron is a beautiful piece of work, but there is a slight discrepancy at both ends. No biggy, aluminum bends pretty easily!

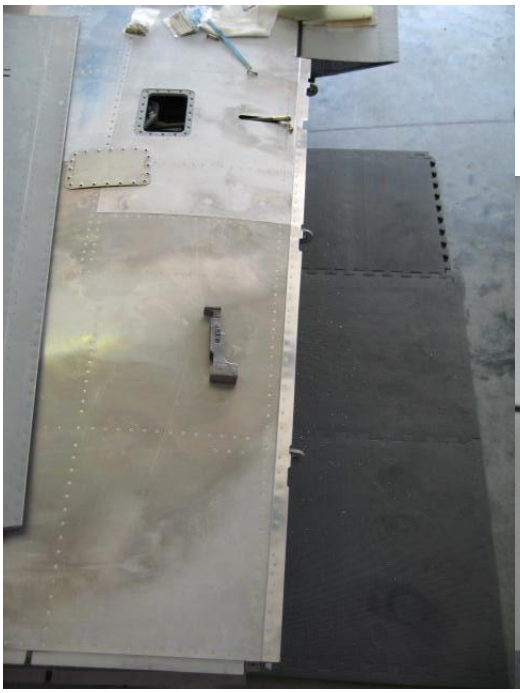
Off with the blue protective film!

After a little fun with the ol' countersink bit gizmo in the drill, I was ready to rviet the gap seal to place. 3-3.5 rivets is all you need, but it takes a special rivet set. The wing skins have about a 1/2 inch bend in them at the trailing edge. This evidently was supposed to get something special as a gap seal, but that never materialized. So you get to work around not only the predrilled and dimpled holes, but you have to rivet BEHIND the bend in the skin. Good reason to drill those gap seal holes as far forward on the aluminum strip as possible.

I intended to take a picture of the offset set that Mark provided, but I broke it after about 30 rivets. Sucks to be me. Now I have a half riveted bottom gap seal and no way to finish it. I sent an email to Mark begging him to send me another set. I'll try not to screw this one up. In fact, to make it easier to work on this part of the project, I may just take a dremel and cut off the "flange" bent in the TE of the wing skins at the ailerons. Would rather leave the bends as is, but at this rate if I break a set every 30 rivets, it'll take me three months to finish the gap seals.!

After breaking the rivet set, another builder posted his elaborately constructed bucking bar. I decided to follow in his footsteps. Being simple minded, I just took a 4 inch grinder to my #670 bucking bar and made the foot fit in the wing sking bend, and gound out the back of the bar to allow me to get on the rivet at the correct angle.

Finished!

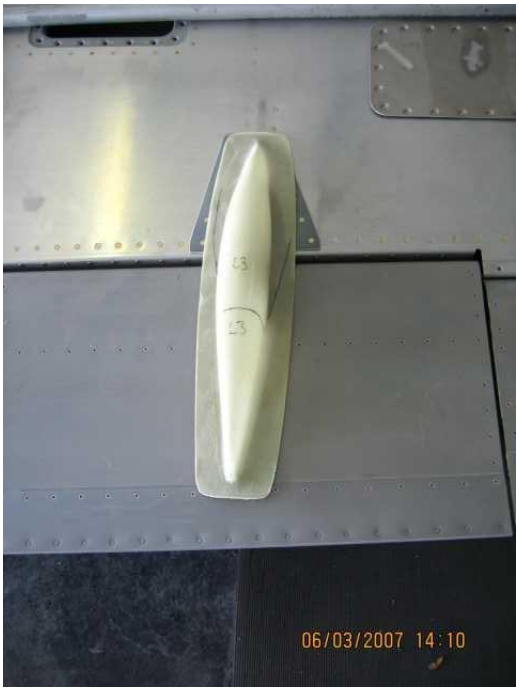


Flap Bracket Fairings

Tom Martin gave me some great direction with the flap bracket fairings. He recommended to get the positioning right for installation, cut only one of them right on the scribed line molded into the fiberglass. He said to then just tape that fairing pair to the flap and wing to determine the positioning of the fairing to ensure good clean, close separation of the parts in operation. He also stated that the Goop adhesive was plenty strong and that he only used a couple pop rivets to help hold the fairings in place.

When you shine a light through the fairing, you can see the bolt through the bracket/bearings pretty well. I was hoping that Mark or someone else would just be able to give a dimension from the cut line to position that bolt. Well, it's not that tough, but perhaps not that easy, either. Mark did say that the fairings only had about 1/8 inch variation in position to get the proper operation in service.

Here's where the fairings "want to sit". We'll see how close that position is after I cut the first fairing. Before I do that, I'm going to add some micro or some flox to the bottom of these fairings to level them out. Of course I don't know where they are supposed to locate, so it's just a guess. They do sit fairly flat on the flap and skin when the flaps are in the neutral position. But it's a good idea to beef them up and fill in the gap. I'll probably be liberal with adhesive when I install them too. That depends on how far off my positioning guesstimate is and how "flexible" positioning the fairings is going to be.



I took the end cap to my dental office and fired up the compressor. I was going to try using a coping saw, but I decided to stick to what I know. A nice turbine turning about 100K rpm and a tapered diamond bur (drill bit) made relatively easy work of cutting the fiberglass. Once cut, I used a hand file and a dremel drum to smooth the edges. These babies are going to need some delicate positioning and then some refinishing to get them smooth, functional and looking good. I need to get these done, at least ready to rivet, before flipping the wings over and getting ready to install them on the ship. Got to do as much on the bottom before installation as I can. I hate working on my back.

The pic above shows the approximate position of the fairing halves. When there is a bright light behind the fairing, you can see the locations of the bolts. If you cut the fairings closely along the scribe line, theoretically you should be able to position ALL 6 of the fairings based on the first one. Mark doesn't provide that information. I have this feeling that it's going to take a while to position and shape wash one of these.

I have the front of the faring clamped down. On the others, I'll have to tape down the front, then position and tape the rear part of the fairing. At that point, my plan is to drill at least 4 holes in each fairing half. These fairings are supposed to be glued AND pop riveted. I may not do the final attach until after I'm flying. Even then, I may just add a pair at a time to make sure that the fairings don't induce some sort of turing tendency. Even so, it's going to be a little tough to get them oriented with each other AND the airflow over the wings.

Wow, that's pretty cool! And it *only* took me about 2 hours to get them to that point.

Turns out that measureing the radius of the bolt doesn't work. All three fairings on each wing are different. However, I CAN say that there is some uniformity on where they position. On my ship, the tip of the LE of each of the two OUTBOARD fairings comes right to the tip end of the hinge bracket. You can actually see that on the middle bracket in the right picture above. The INBOARD fairing actually sits off the front of the bracket a little bit. But the place to START placing these fairings is to put the nose of the fairing (not the forward edge of the frlange) at the LE of the hinge brackets.

I used a straight edge to draw two lines from the sides of the flap hinge. Then I drew a centerline mark on each of the flap bracket fairings. That at least allowed me to locate the tip of the fairings with the airflow.

The bolts holding the flap to the hinge are barely narrower than the bracket fairing. You have very little room to

wiggle the fairing from side to side. Depending on which side you put the nut on, the nut side is wider, so you would want the fairing nearly in contact with the nut side of the bolt. That will make aligning the fairing with the airflow a little simpler. To verify the positioning of the fairings, I used one of the uncut aileron gap seals laid along side of the fairings aligned with the wing rivets (NOT the flap rivets). That was a visual confirmation of the positioning. You could even measure from this if you were really anal.

After I broke my offset rivet set, I put the squeezer aside and gathered up a couple of these fairings. For the next couple hours I listened to NPR and filed and sanded and filed and sanded. Getting the cut contours of these farings to look good and sit right is tedious. Not hard, just time consuming. Good work to do while chatting. One of my hangar neighbors stopped by and said hello. He described his F-16 flight from a week or so ago. Nice to be chairman of the airport board and an ex jet jock. Cool to hear about it from someone who walks the walk and talks the talk.

Pretty soon I'm going to #40 drill these babies to position. I'll do the forward half first, then re-align (double check) the aft half and drill those to positing. Then I'm going to retrim the flanges and probably level out the micro on the bottoms. More tweaking will come down the road, and final gluing and riveting probably will happen after first flight.