

Putting the Faux Elevator to Fuselage Fairing in on the Canard/Instrument Cover.

Dave's approach to putting a Canard/Instrument cover all the way to the Canopy leaves an area he has modified through the years and finally brought completely into the Canard/Instrument cover. It is easier to do with no eccentric elevator tube fittings to deal with, but we carried it out on my

Dave's original approach was to essentially make the fuselage wider at the elevator where high pressure air gets dumped onto the knees of the pilot through the hole that has to accommodate the swinging elevator tube. Some people filled that hole with foam (tempting rain intrusion and control freezing), others put a flat composite disk on the inside of the fuselage to attempt to block the air coming in. The best such study was the installation of the eccentrics which Dave just incorporated into my Berkut – and he had already modified the Canard/Instrument cover on several airplanes so that the cover slides down close over the fuselage where he used to have 3 flat head screws which actually allowed a friend to mis-believe that his canard bolts were installed through takeoff and flight – something we all regret – the guy died when he added Gs to the canard and it came off in flight. We should all check our canard bolts after any work up front in our planes. The Berkut method of removing the canard to get the wonderful access to all the avionics up front makes the canard bolt checking all the more important. We guess that on a Long EZ or Cozy (with a separate Instrument cover installed with hinge pins) if you forget the canard bolts, the canard will depart the aircraft before you reach rotation – embarrassing and exciting, but not likely fatal. So, before the eccentric approach, Dave made a kind of fixed elevator section about 1.75" wide where the elevator used to nearly rub the fuselage – it had the effect of limiting the air going in the canard tube holes. After the fatal accident where canard bolts were forgotten, he removed the need of 3 screws on the canard/instrument cover attachment of his original plans and drooped the instrument part of the cover down the outer fuselage sides. That meant moving the faux elevator onto that closely attached Instrument cover. Dave doesn't need the pins Rutan and Puffer put in their designs at the aft end of the canard space to fix the canard's rear end. He simply builds up a bed on which the canard goes, the canard bolts hold the canard down on that bed. With that background, let's talk about the installation of eccentrics and then the faux elevator included on the Canard/Instrument cover, which is part of the canard you remove. As an aside, rather than attach the pitch servo somewhere downstream, Dave now mounts a pitch servo (for autopilot) directly in line with the elevator inboard weight levers, so that the pitch servo is always attached when the canard is removed also. I've seen electric pitch trim servos in many different locations – I'm not sure of his latest view in that regard.

I don't know if all this works on the GU canards, but the geometry is very different for the Roncz Canard I am describing below.

Where to get eccentrics?

Dave used his friend Stevie to machine eccentrics to his specifications. They are not just 3 drums machined from the same piece of aluminum, there are dimensions for the inside diameter of the elevator tubes outside the fuselage, dimensions for the inside diameter of the steel tube that goes from the left fuselage side to the cross-fuselage tube, there is also a small hole to accommodate the elevator hinge pin that also helps you orient things as you install them. I've heard that the Cozy Girrrls make eccentrics too. I'm hearing that Mehran Salamat has the capability to make them too.

Preparing the elevator tubes and eccentrics.

The canard tube is suspended from multiple standoff pieces.

I describe the eccentrics as having 3 drums, the drum to insert in the actual elevator tube, the center drum that rotates in a circular hole in the fuselage and the inner drum that goes into the elevator tube section inside the fuselage, which on the right is basically the belcrank upon which the counterweight goes, and on the left side is a tube that is notched for a the canard mounted hinge pin standoff.

With the eccentrics in hand, you lay the eccentrics above the fuselage side and figure out where you will be installing the eccentrics to fit with the center drum – identify where the center of the center drum will be on the fuselage – and transfer that point to the elevator tubes with the canard turned over. Dave had done this installation fairly recently, so this went pretty fast. On our installation, the eccentric and the available elevator tubes were too long – we trimmed the elevators as shown below, then we found that the eccentric would be too long unless trimmed



1. Left Elevator, cut off.



2. Right Elevator, cut off.

You have no choice as to the room on the right side – as the belcrank for the right side interior elevator weight is the limiting factor. On the other side there is a steel reinforcement around the elevator tube that itself goes across cockpit from the left elevator to the left belcrank and elevator weight – and you should not cut off that steel reinforcement – but instead remove the outboard rivets and remove the cut off outboard elevator tube. Insert the eccentric into the steel reinforcement tube – cutting off the inboard barrel just as you have cut off the outboard barrel so that the middle barrel is lined up on the correct point on the canard to match the center of the fuselage where the inside barrel will be located.



3. The remainder of the internal elevator tube with the steel reinforcement, rivets removed and hinge pin inserted.

Now the Long EZ and Cozy will have a different fuselage side location because they are not rounded like the Berkut – which puts the eccentric further outboard related to the longerons.



4. Sorry for the focus. I didn't measure the parts cut off the outboard barrels of the eccentric (note the section cut in the eccentric outer barrel for the hinge pin, but you need to confirm your own measurements).

Lining up the elevators and drilling the tubes and eccentrics.

The hinge pin helps you line up one connection to one eccentric so the eccentric will be in the right orientation for installation vis-à-vis the canard,



5. The eccentric cut and inserted in the Steel reinforcement.

If you pin that left elevator to the outboard cap with a clamp – streamlined as in cruise:



6. The left elevator clamped.

Then you clamp the right elevator you will then be able to align the two inboard elevator weights and belcranks, clamp the tube around the right eccentric.



6.

7. Fixing the right elevator on the eccentric.

With a long drill you can drill and pin the elevator tubes to the outboard barrels of the eccentrics and inboard eccentrics, be sure to use a drill bit that allows no slop for a #10 bolt. In our case, we had to turn one of the outboard eccentrics on the lathe to fit the particular elevator tube it fit inside the associated tube.

Preparing the ends of the Longerons aft of the elevator tubes.

You have built saddles over the top longeron and joined the canard/instrument cover to it. With the canard off, the top longeron is again in view. Our top longerons ended in a kind of rough open U shape, the U pointed down. If you cut them off at 90 degrees, it would make the removal of the canard and elevator very difficult if not impossible. You need to sand the face of the top longeron U shape back to an angle of about 70 degrees, leaning aft. You sand both sides with a long sanding bar so the top longerons retreat at about the same distance from the position of the elevator tubes.



8. Top left longeron sanded back, filled with micro and 1 ply of 4 ounce BID stuck to the aluminum plate held in place by a stick to the nose.

This shows the top longerons cut back about 70 degrees, the metal plate with release film applied, a single ply of 4 Ounce BID laid up on the plate and micro filling the upper longeron and under the plate

The fuselage side is then notched so that the glass edges at the elevator tube are higher than the foam between them, a firm edge below the 70 degree longeron face extends toward the missing elevator tube - just right for a thick metal plate to rest on the fuselage and lean back against the longeron leading edges.



9. Thick metal plate looking aft toward the longeron(out of sight behind the metal plate). The foam dug out of the fuselage side is not as easy to see – the gray section at the bottom of the photo is the bed for the canard to rest on.

In fact, if you don't have a good ledge there, you create one by filling under the plate. First you treat the metal plate with mold release around the areas of the longeron, then using a stick against the upper nose skin to jam the plate in place, you fill the last 1.3" of the longerons with pretty stiff micro, filling under the plate on the fuselage to complete the ledge previously described.

When cured you will have a rearward leaning surface about 1"x 1.3" or so on the longeron.

Building the fuselage side bearing for the center barrel.

Dave put mold release on the 3 barrels of the eccentric. He dug out the small amount of glass and about 1/8" of foam in the fuselage side, clearing foam from the fuselage sides where we were to build the lower bearing for the center barrel of the eccentric, both sides.



10. Better photo of ledge and foam dug out of the side.

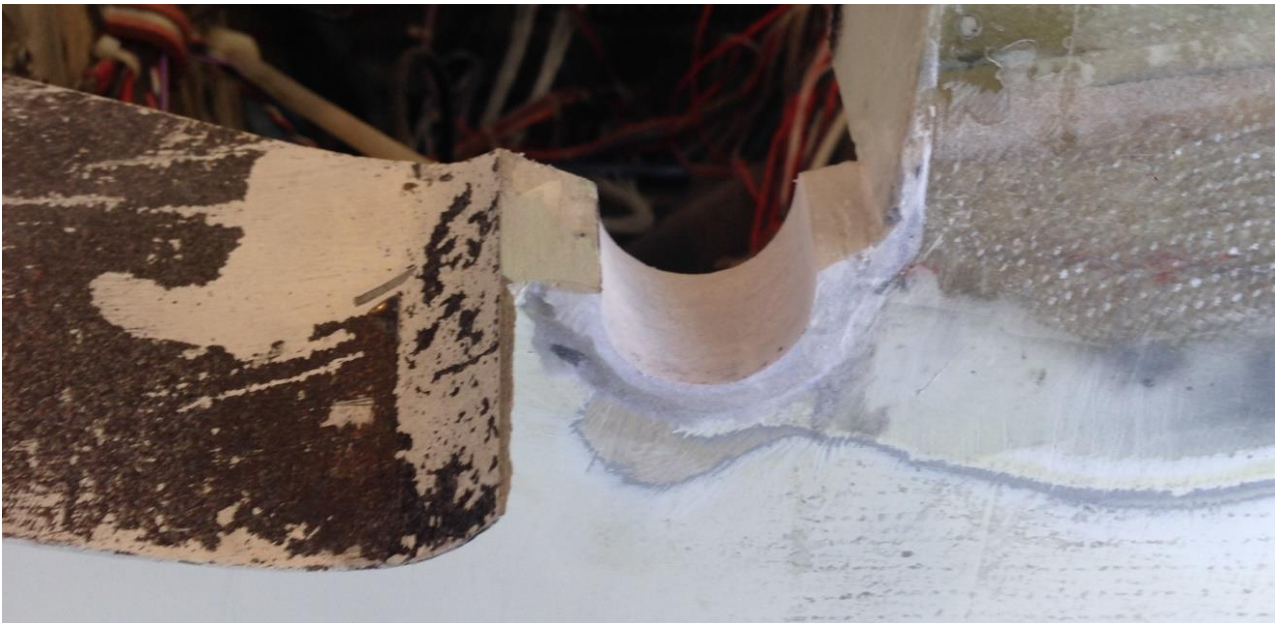
The photo was taken after the longeron sloping ends were created (top left in the photo) and you can see mostly the outside of the fuselage, left side.

He was loath to build the entire bearings out of flox, so he brought the fuselage side up to about 3/16" from the barrel position and then added a mix of Flox and Micro (or Flocro) to complete the lower bearing. He sanded and filed the bearing sides to match the fuselage shape and lowered the canard with elevators installed down on the two bearing Flocro beds and secured the canard with the canard bolts. A little sanding and filing resulted in the lower bearing for the middle barrel of the eccentric.



11. The right side of the fuselage, mostly inside skin, longeron to the right, elevator bulkhead to the bottom left, and canard "bed" (worn painted black paint) on the left.

This is the left eccentric bearing – Dave confessed it took several layers to get it to this position in other planes.



12. Note the longeron (top right) with it's tilted front surface, the flat halves of the bearing and the canard bed in black paint to the left.

Creating the upper bearings

Again, with the eccentrics mold released, you sand the elevator opening in the main canard for good attachment.



13. You are looking at the left side elevator trough (sanded to skin) on the canard and the light green saddle on canard/instrument cover that drops on the left longeron.

On the fuselage you mold release the bottom bearing halves created in photo 11 and areas ahead and behind it and the forward face of the upper longerons.



14. This is prep on the other side.

Then you fill the two spaces up with stiff micro from the saddle to the canard trough – filled up to about $\frac{1}{2}$ the tube thickness. And then you lower the canard down on the fuselage and again insert the canard bolts.



15. Left side upper half of bearing hidden from this angle, the left saddle in green to the left side of the photo, canard bolt nutplate on washer to the right side below the elevator tube.

As you can see, this is easier to access with the panel removed... You tend to the outer and inner surfaces of the micro on both side before you let it cure.



16. Right side bearing in fuselage, longeron front edge filled with micro, upper bearing not so clear to see. Right side saddle is again light green extending to the right side of the photo.

After cure, you carefully dress the upper bearing edges, in the canard's elevator trough; you apply a single layer of 4 oz BID to the micro surfaces to protect it.



17. Canard off and upside down – fill sanded and 4 oz cloth applied.

Then you put the canard back on the aircraft and test the movement of the elevator – if you find that the tube is touching the lower bearing, apply a little black marking pen to the center barrel and rotate the elevator a few times.

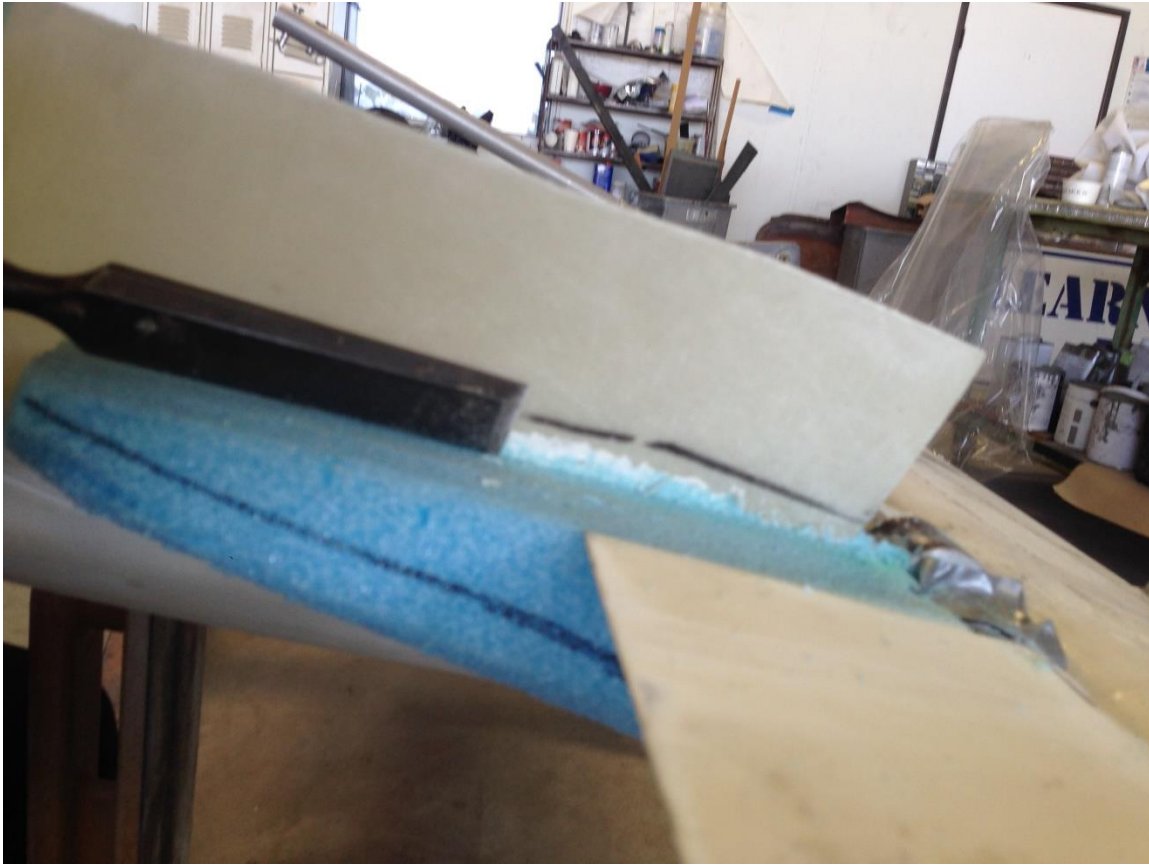


18. Center barrel of eccentric marked up.

You will see black transferred to the lower bearing which gives you guidance as to where to sand a little bearing away carefully with a finger. Repeat until the canard moves perfectly.

Installing the faux elevators between elevator and drop side of the canard/instrument cover.

You need to find some blue foam to install between the elevator and the drop side of the canard/instrument cover. But first, you need to put the canard and elevator on the plane and clamp the elevator in cruise position – you draw a line on that drop side that mimics the bottom of the elevator and extend it towards the instrument panel as a guide. Shape the blue foam into a shape that completely fills the space between the elevator and the drop side. Glue it in position with a mix of 5 minute epoxy and micro balloons – **TO THE DROP SIDE OF THE CANARD/INSTRUMENT COVER ONLY.** Then remove the canard from the aircraft and lay it between two saw horses. Work on the bottom surface first – it is a flat surface from the canard to the fuselage, starting with a fairly sharp turn and a long straight line. Dave developed a simple process – he then recesses the foam by about 4 ply thickness of glass and epoxy.



19. Canard and elevator upside down, first leveling the bottom side of the faux elevator blue foam, then sanding to depress the foam about 1/16".

Mounting the bottom and then top skin on the Faux Elevator.

Dave then recesses the foam by about 4 ply thickness of glass and epoxy. Here's his simple way of confirming the bottom of the faux elevator will be level with the elevator bottom:



20. Saw blade used as dummy before installing the bottom skin of the left faux elevator.

Mounting the bottom and then top skin on the Faux Elevator.

Then find some sheet glass – 3 or 4 ply BID thick – or make it on a flat smooth surface, and trim a piece that will fill the bottoms space you have created with the blue foam.



21. Cutting the faux elevator bottom skin off scrap glass.

Keep the shiny side outward and sand the rougher side of the 4 ply plate and glue it to the bottom of the blue foam – slight depression - with 5 minute epoxy and micro balloons.

Start forming the top shape using a round Surfoam file – working the trailing edge to a sharp point along the fuselage.



22. The Faux elevator bottom on the right side of the canard/elevator.

Shaping the Faux Elevator top

This is where the shaping efforts can help you. Note that Dave has used light sandpaper to open the elevator to Faux elevator gap, then installed Duct Tape over the elevator and returned it to the streamlined position. Using Surfoam tools you take this shape:



23. Top of the left Faux Elevator before real shaping.



24. Dave used surfoam tools, the $\frac{1}{4}$ circle and a little $\frac{1}{2}$ thick surfoam tube.

Then he cut out the last inch of blue foam to replace it with micro for strength.



25. A chisel used to make a flox tip.

Then the trailing edge for a Flox edge:



26. Taking out the foam on the trailing edge of the faux elevator.

Then he sanded down into the foam along the fuselage (drop side) and removed a little filler and smoothed the foam to accommodate the 2 ply of BID on top:



27. Right side trimming for glass.

In fact you need to make space for two ply of BID below the curved surface, sand away the first .4" of fuselage fill above the Faux elevator and add Micro



28. Right side. Note tape to protect the elevator and sanded away.

As you have used 5 minute to glue the foam against the drop side of the fuselage/instrument cover, you can create a little gap on the elevator side of the faux elevator:



29. Sawing some clearance between faux elevator and elevator.

As you can see, smooth filling of foam with micro for glass layup.

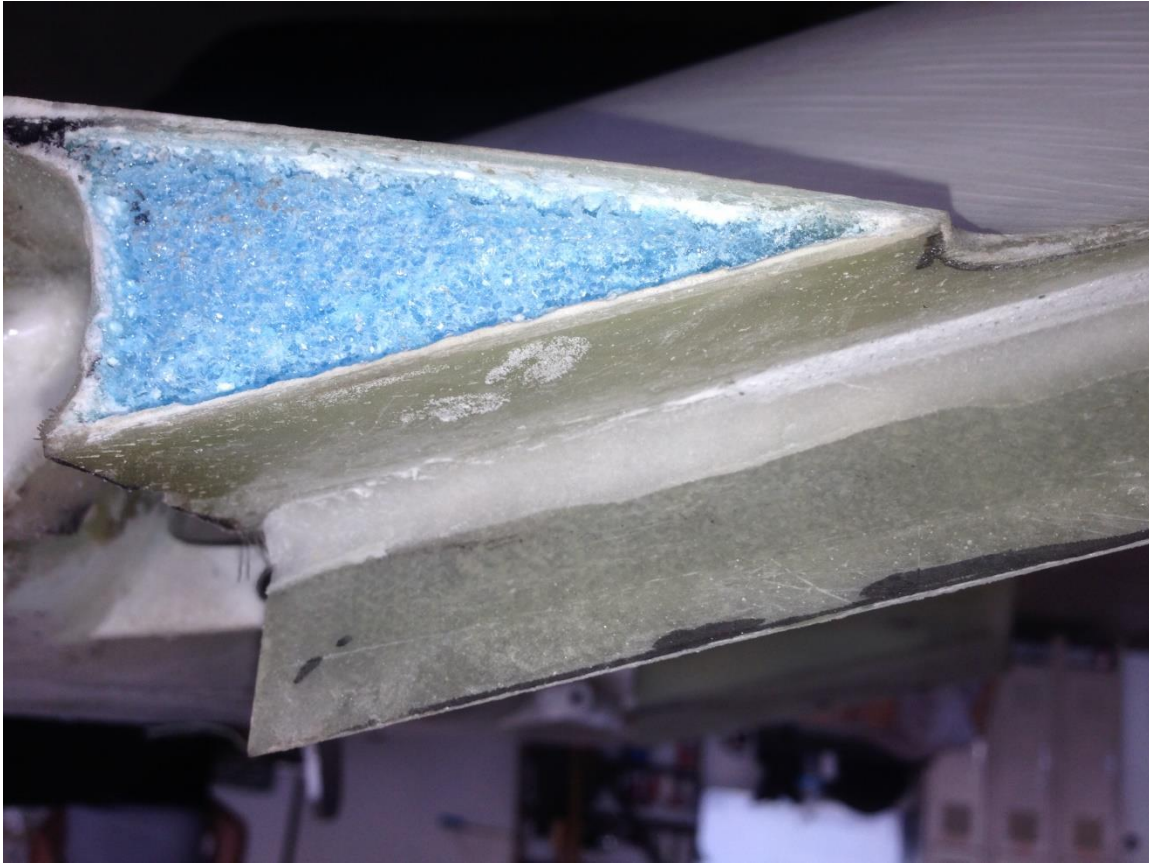


30. Two ply BID getting wetted out.

Then let it all cure and sand away the excess glass.

Adding the outboard surface to the faux elevators:

The canard comes off, the elevators out and you create a little flox corner in the blue foam.



31. The foam removed back about 1/16" inch for micro corners and 1 ply 4 ounce BID cloth.

Lay up 1 ply of BID or even better 1 ply of 4 ounce BID on the outboard surface of the faux elevator fairings, both sides, apply micro to the whole outer surface before it cures. Trim.

Then you reinstall the elevator and see what interference you encounter – put some thin light sand paper between the faux elevator and the elevator and run the elevator up and down to sand first one side and then the other. Use some doubled sand paper to create a little more room for painting. Lubricate the elevator rotating points.

Fin...