

McDonnell Douglas A4 ***SKYHAWK*** *Parkjet*

BETA

Construction Guide

By Craig Clarkstone

SkyHawk History

The Douglas A-4 Skyhawk is a single seat subsonic carrier-capable attack aircraft developed for the United States Navy and Marine Corps in the early 1950s. The delta winged, single turbojet engined Skyhawk was designed and produced by Douglas Aircraft Company, and later by McDonnell Douglas.

The Skyhawk is a relatively lightweight aircraft and has a top speed of more than 670 miles per hour (1,080 km/h) and support a variety of missiles, bombs and other munitions. It was capable of carrying a bomb load equivalent to that of a World War II-era Boeing B-17 bomber

Skyhawks played key roles in the Vietnam War, the Yom Kippur War, and the Falklands War. Sixty years after the aircraft's first flight, some of the nearly 3,000 produced remain in service with several air arms around the world, including from the Brazilian Navy's aircraft carrier, São Paulo.

The Skyhawk was designed by Douglas Aircraft's Ed Heinemann to replace the older Douglas AD Skyraider. Heinemann opted for a design that would minimize its size, weight, and complexity. The result was an aircraft that weighed only half of the Navy's weight specification. It had a wing so compact that it did not need to be folded for carrier stowage. The diminutive Skyhawk soon received the nicknames "Scooter", "Kiddiecar", "Bantam Bomber", "Tinker Toy Bomber", and, on account of its nimble performance, "Heinemann's Hot-Rod".

The A-4 pioneered the concept of "buddy" air-to-air refueling. This allows the aircraft to supply others of the same type. A designated supply A-4 would mount a center-mounted "buddy store", a large external fuel tank with a hose reel in the aft section and an extensible drogue refueling bucket. This aircraft was fueled up without armament and launched first. Attack aircraft would be armed to the maximum and given as much fuel as was allowable by maximum takeoff weight limits, far less than a full tank. Once airborne, they would then proceed to top off their fuel tanks from the tanker using the A-4's fixed refueling probe on the starboard side of the aircraft nose. They could then sortie with both full armament and fuel loads.

The A-4 was also designed to be able to make an emergency landing, in the event of a hydraulic failure, on the two drop tanks nearly always carried by these aircraft. Such landings resulted in only minor damage to the nose of the aircraft which could be repaired in less than an hour.

Designers Notes

This iconic aircraft is a favourite of many pilots and enthusiasts alike. I designed it after a fellow RC pilot 'Red Comet' told me it was his favourite aircraft, and couldn't find plans he liked. So I took up the challenge.

This design has been designed from the outset to have the option of either 70mm EDF or Pusher prop powered. the rear fuselage is a little wider than the original aircraft for the purposes of ducting the EDF outlet.

If you enjoy this design please help me to fund my next project and send a donation for \$10 to Paypal address :-

clicketyclarkstone@gmail.com

Thank you! and happy flying.

Craig :)

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Construction

Before you start.



Adhesives

- > For the majority of construction :
 - UHU Creativ for Styrofoam (also called UHU POR)
 - 3M 77 Spray adhesive.
- > For wing spars and motor mounts :
 - Epoxy. (5 and 15mins cure times are the most convenient) micro-balloons can be added to reduce weight.
- > For servo's / and quick grab :
 - Hot melt glue gun - Caution if the glue gets too hot it will melt foam - test first!

Tapes

- > For holding parts tightly together whilst glue sets
 - Low tack masking tapes
- > For leading edges, hinges, general strengthening
 - 3M Gift tape (Purple - not green one!) - I prefer lightweight plastic hinges.
- > For decals
 - Coloured parcel tapes (strips taped to waxed paper & cut out)

Cutting parts

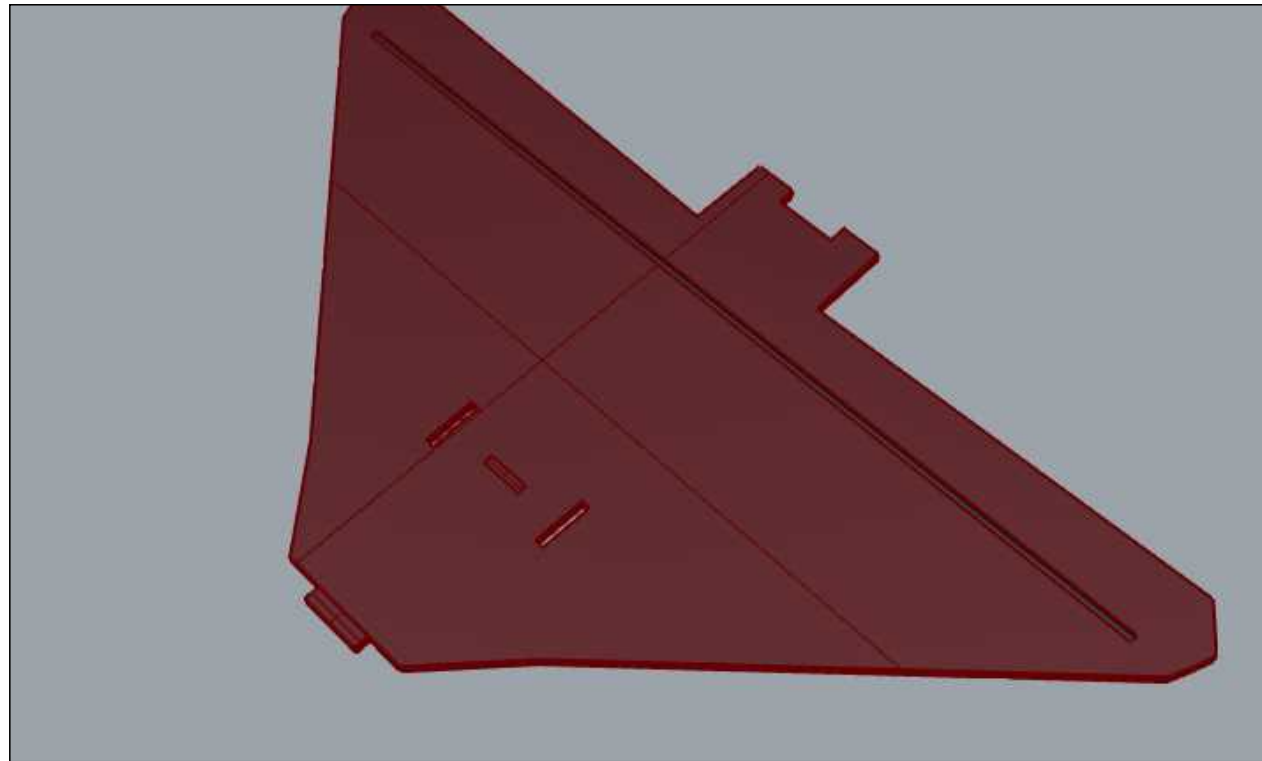
1. Print the plans,
2. Cut around each part using scissors - allow a border of approx (1/4") 6mm
3. Use either 3M spray mount or a very light coat of 3M 77 to the back of the parts and stick in an economical layout on the Depron foam.
4. Using a safety rule and craft knife over a cutting mat - important! use a fresh blade otherwise it will drag and spoil the foam. (I find the stanley knife perfect) make the straight edge cuts, then the curved parts freehand.
5. Once the parts are cut-out, keep the template stuck to the part until just before needed to help identify the parts.
6. After use, I find it helpful to keep all the used tempates in case replacement parts need making. (the glue eventually dries and they don't stick together!)

IMPORTANT Wherever the plans call for marking guidelines onto the depron, please ensure that you do otherwise it can cause problems later on. I suggest you use a Sharpie Fineliner to transfer the lines.

Glueing parts together.

1. Ensure a really good fit - this will reduce the amount of adhesive used. The Bar Sander is a great tool for this.
2. Follow the adhesive instructions closely.
3. Use ordinary steel head pins to help keep the parts located whilst epoxy sets.
4. Use objects as weights such as paperweights to apply pressure whilst adhesive sets.
5. Use masking tape to apply pressure whilst adhesive sets. Also use masking tape to along the slots for the wing spars whilst gluing the carbon rod spars into the wings. This prevents the glue protruding and gives a nice finish.










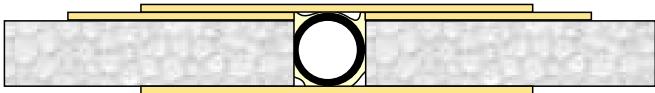



Glue 6mm Carbon rod into the Wing using Epoxy mixed with Micro Balloons.

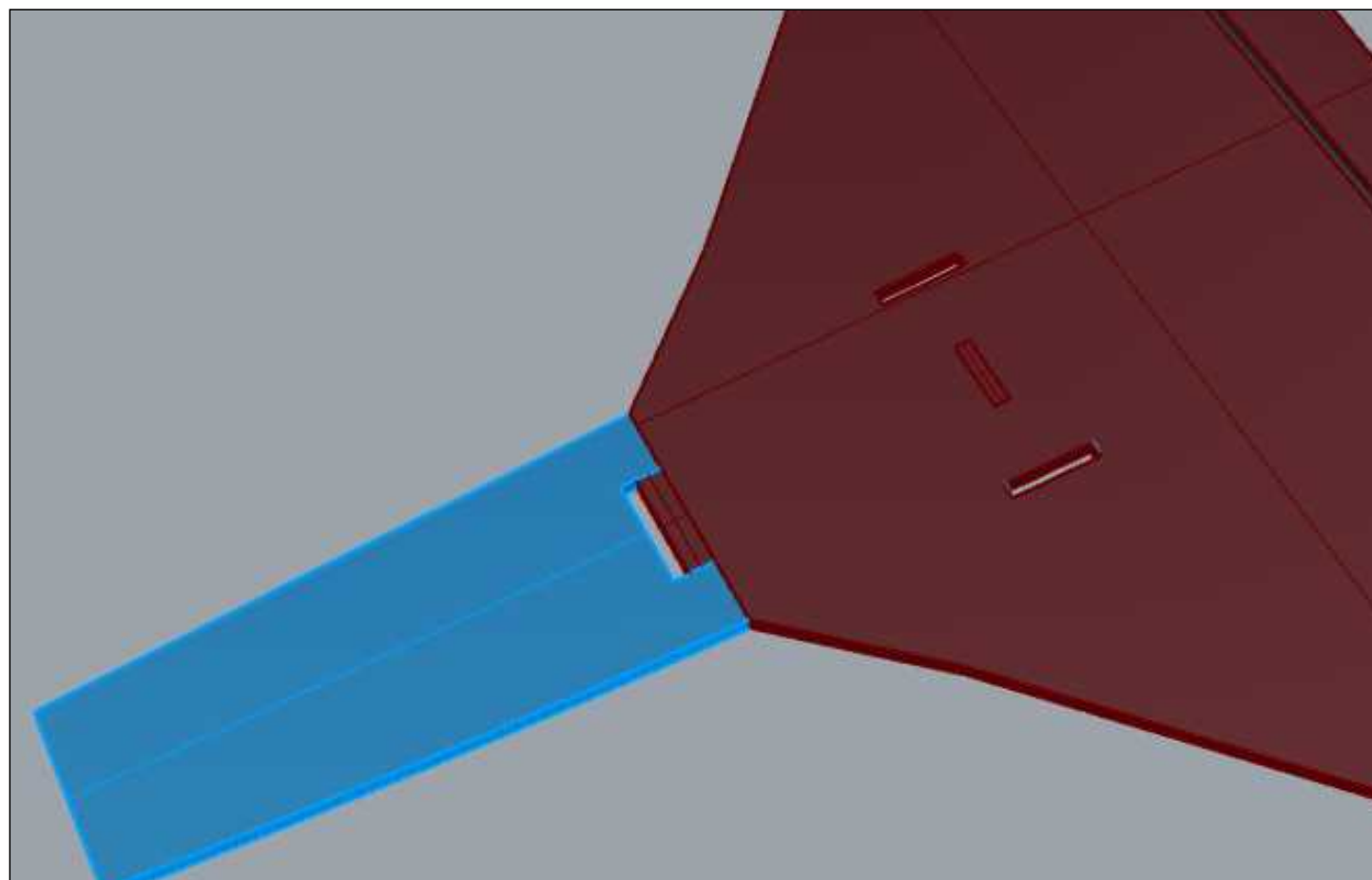
For extra protection to the leading edges, pre-shaped balsa could be glued on at this stage.

NOTE : if using 5 minute epoxy, do not attempt to do both spars at the same time - (learned from experience!)



Gluing Carbon rod into depron.

<p>1. Apply masking tape as shown.</p> 	<p>2. Mix Epoxy with micro-balloons and apply to carbon rod.</p> 	<p>3. Spread epoxy mix evenly all over the rod.</p> 
<p>4. Slide rod into position. Take care not to detach lower masking tape. Do this on a flat surface.</p> 	<p>5. Whilst the mix is still fluid, Scrape excess epoxy away.</p> 	<p>6. Apply masking tape to help smooth-out bumps. Place on flat surface with large books on top and leave to set (fully)</p> 
<p>7. Remove all tape and apply fresh tape as shown.</p> 	<p>8. Fill using lightweight filler, gently using spatula to achieve a near-flat surface.</p>  <p>When the filler has set, gently sand flat using a purpose made sanding block - be careful not to sand through the masking tape.</p>	<p>9. Remove masking tape to leave a near-perfect finish.</p> 

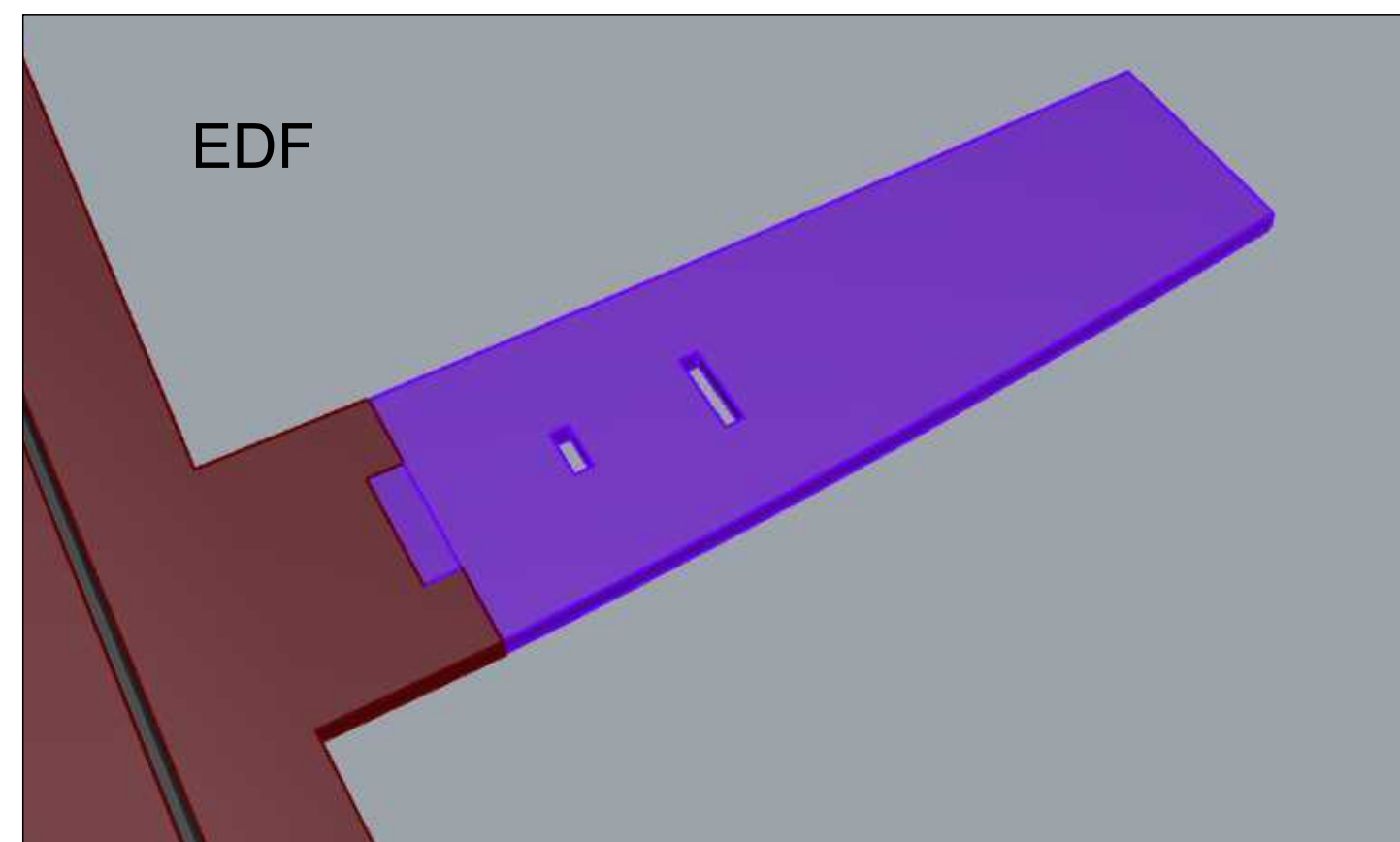
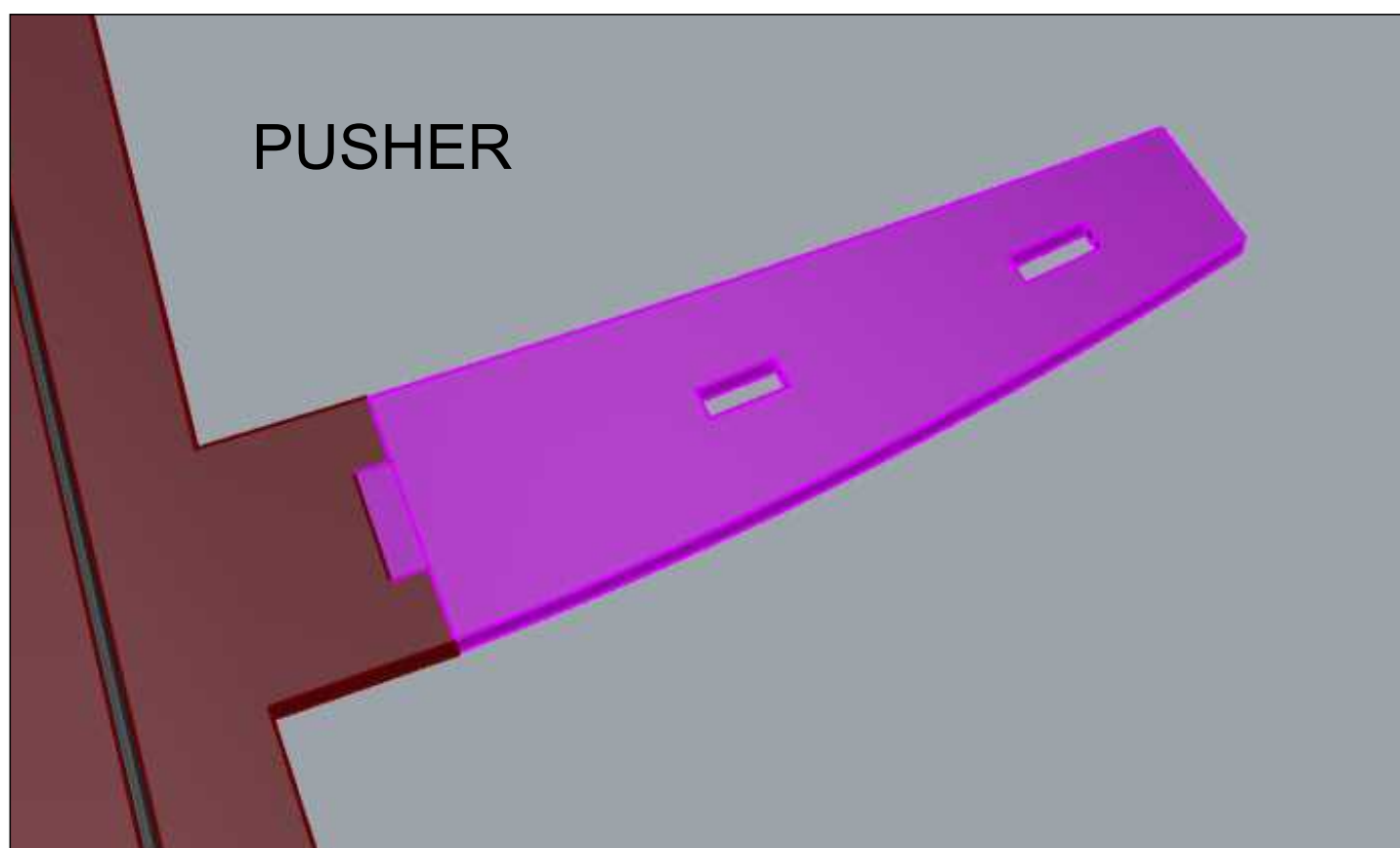


Glue the fuselage forward belly onto the wing.



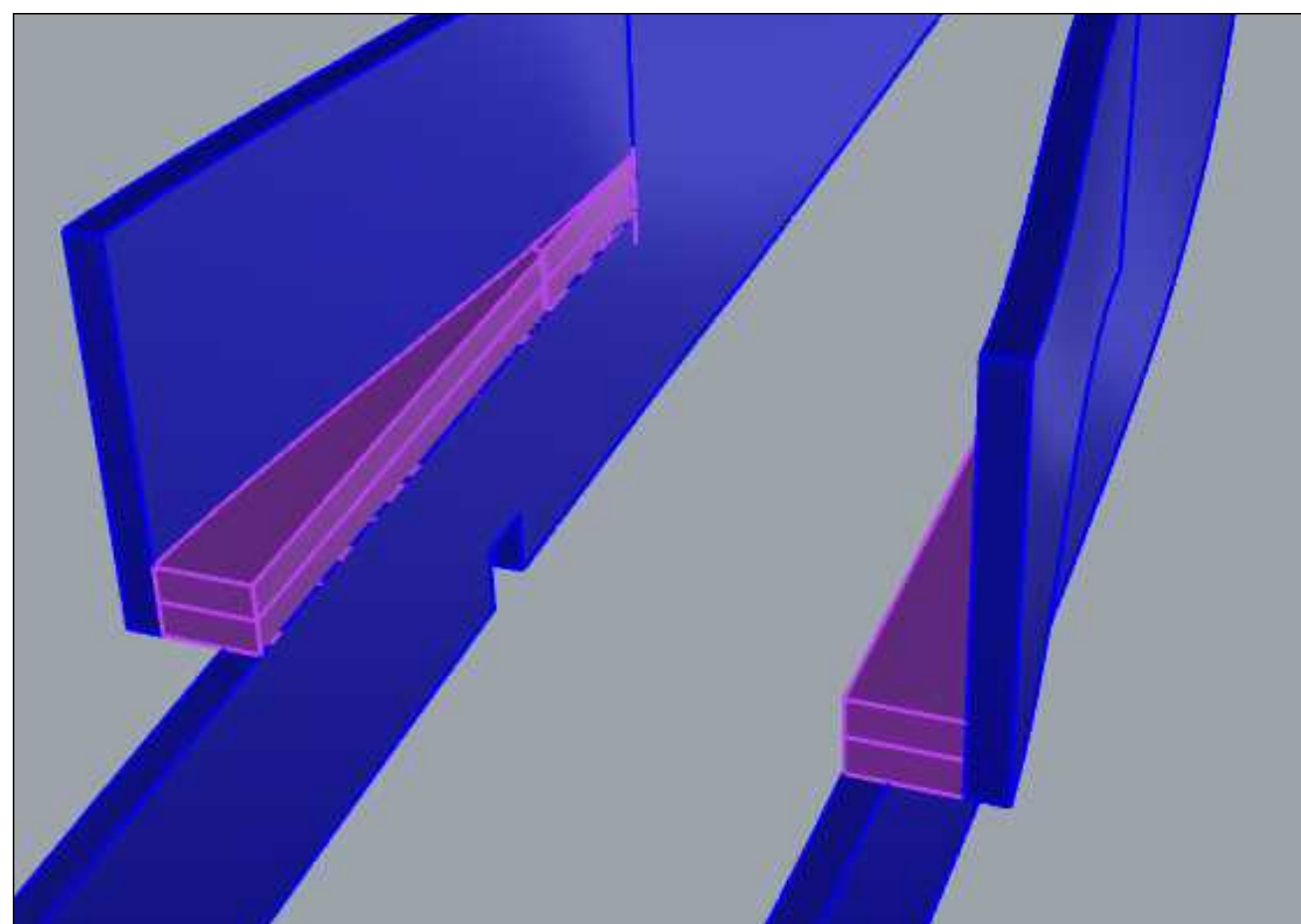
Choose Either EDF or Pusher and glue the fuselage rear belly in place with the correct slots cut out.

Note the EDF version has a wider shape in order to get the correct sized thrust tube inside the model.

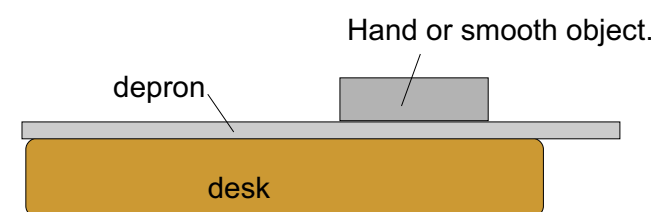




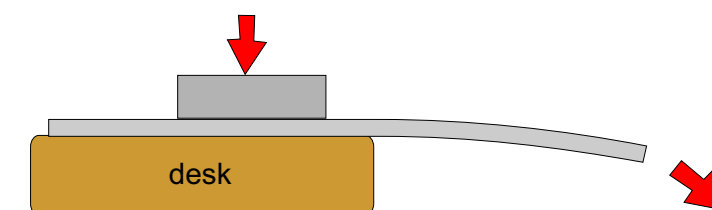
Cut the pair of lower side fuselage sides to suit the version of the model you wish to make.



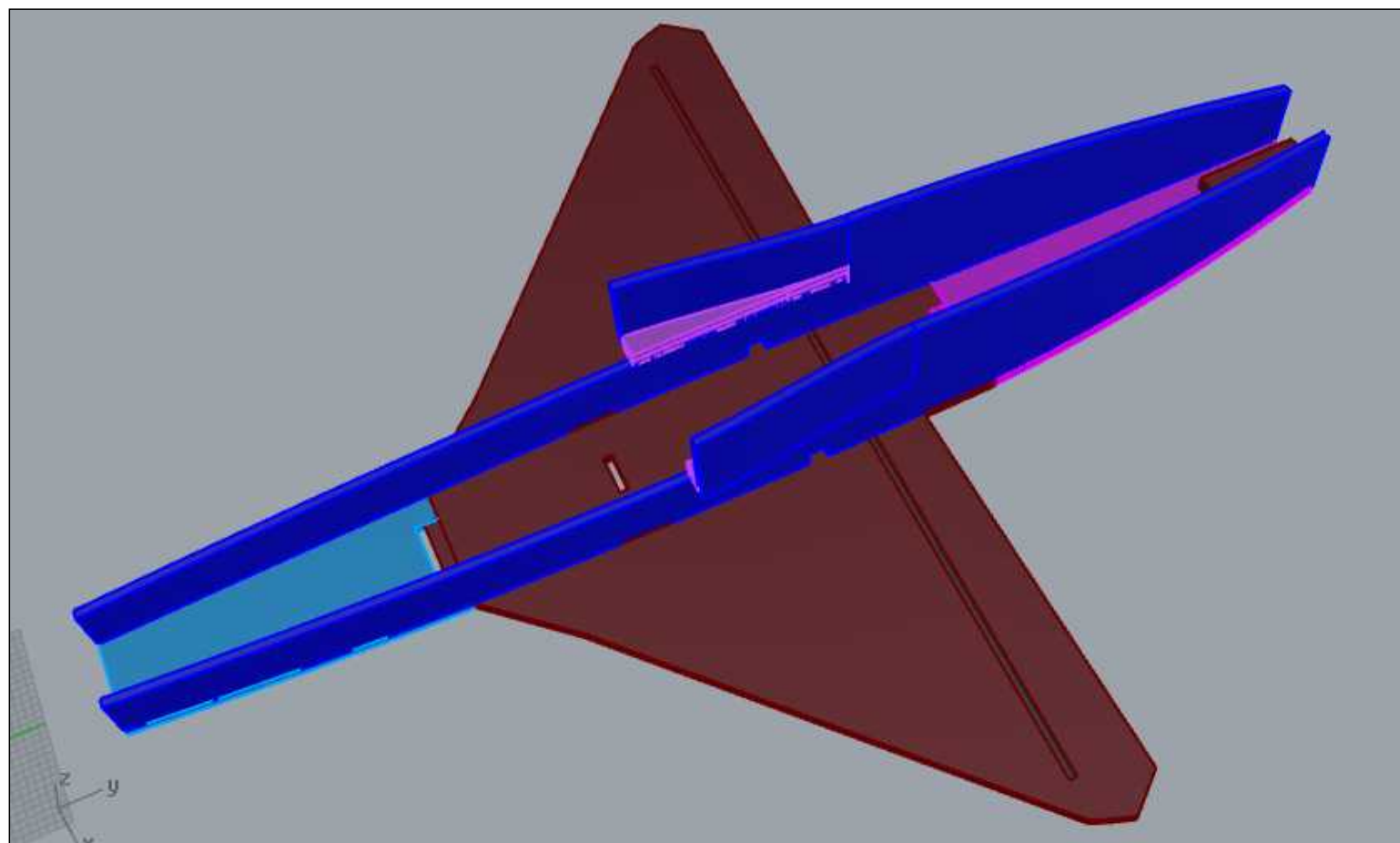
Take the four air intake lower formers and make two pairs by glueing together. Then use them along with bending techniques to create the shape shown in the picture opposite.



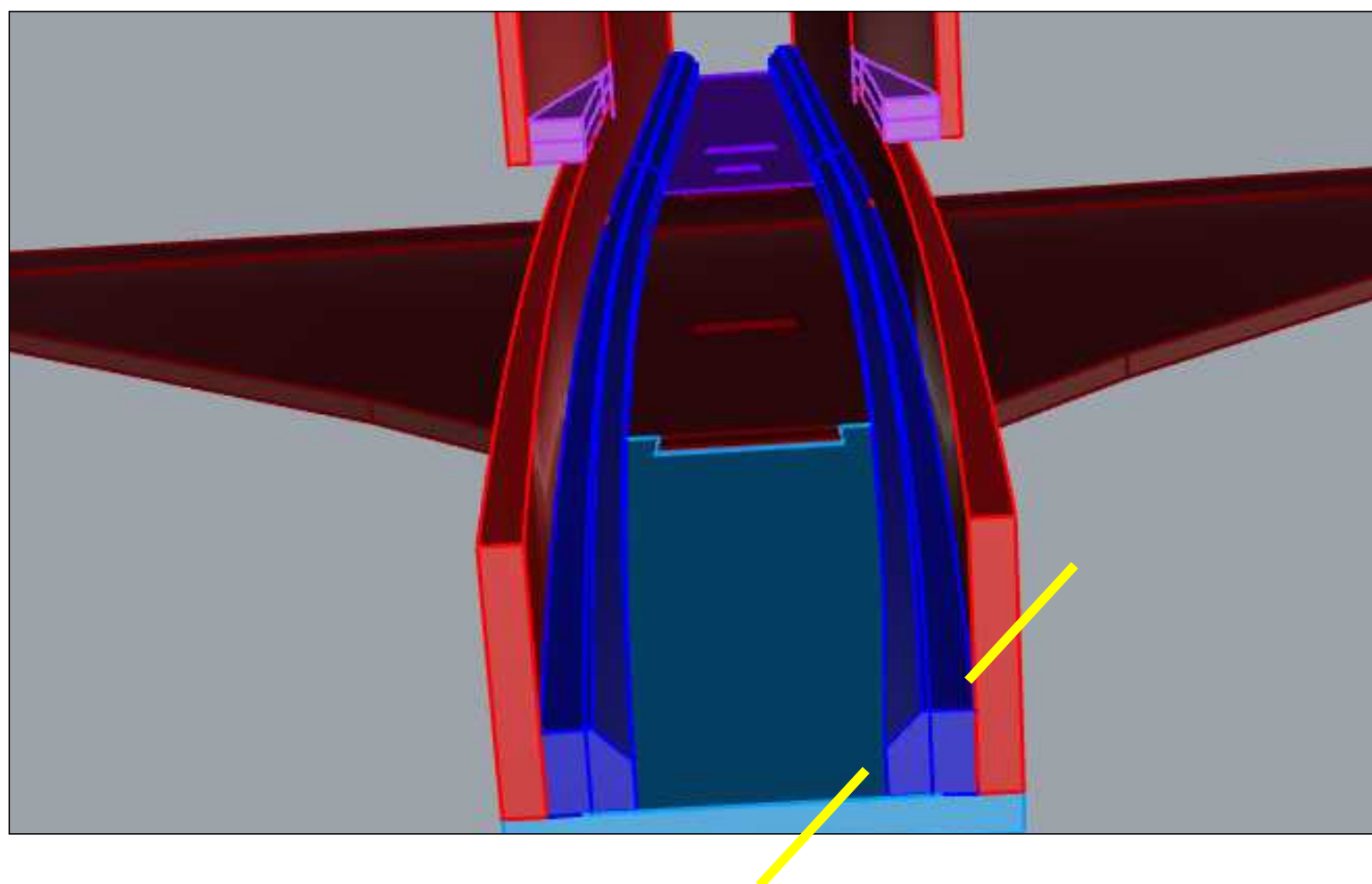
1. Place over edge of desk.
firmly press down on the deptron
75mm (3") from the edge of the desk.



2. Whilst still pressing down, Drag the deptron
over the edge of the desk, pulling down as you go.
This motion will put a nice curl in the deptron.

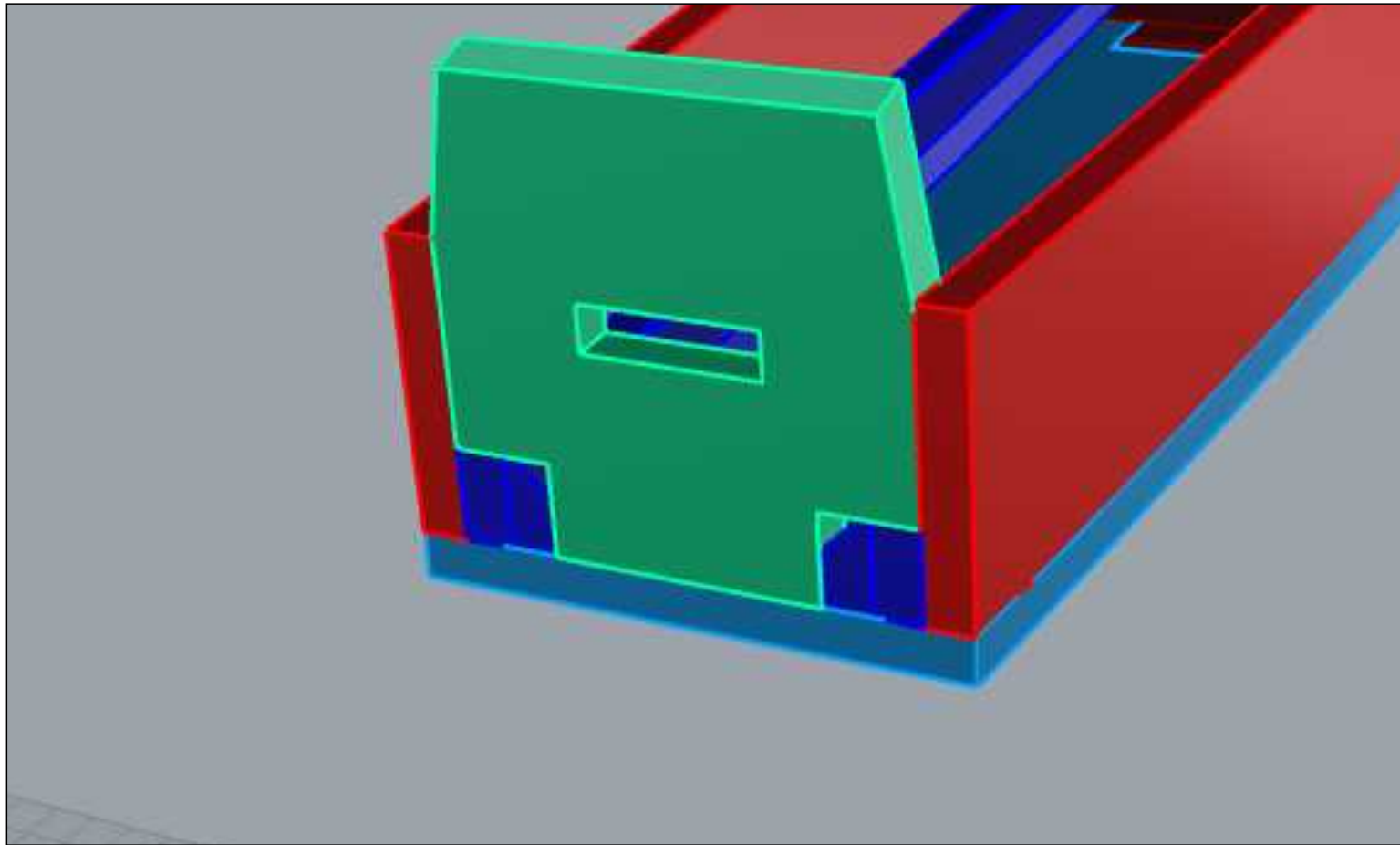


Glue the lower fuselage sides onto the wing assembly using the locating tabs.

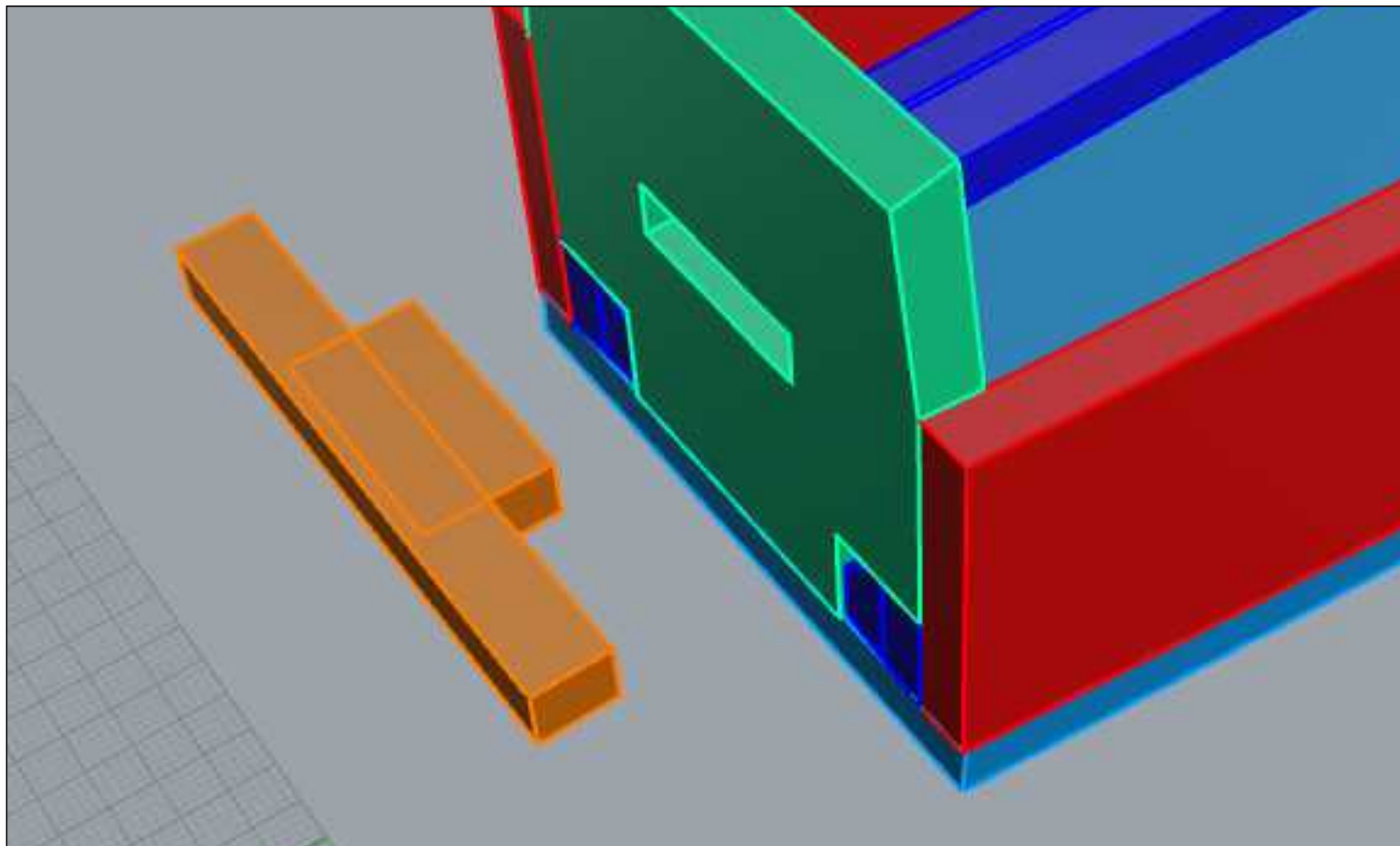


glue four 12mm x 6mm strips of depron together and glue into the corners as shown. Chamfer the inside corner edge as shown.



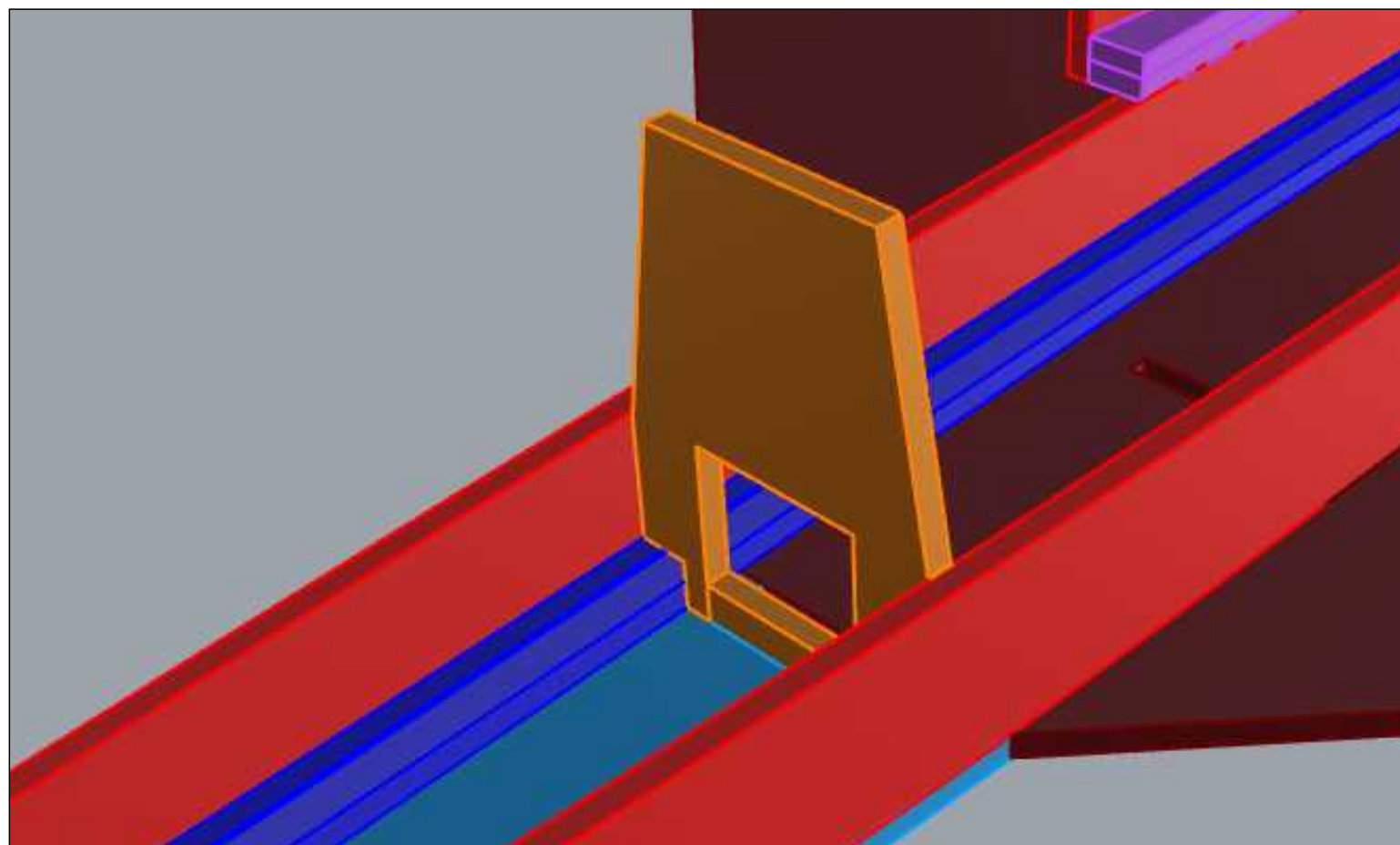


Glue bulkhead 1 in place.

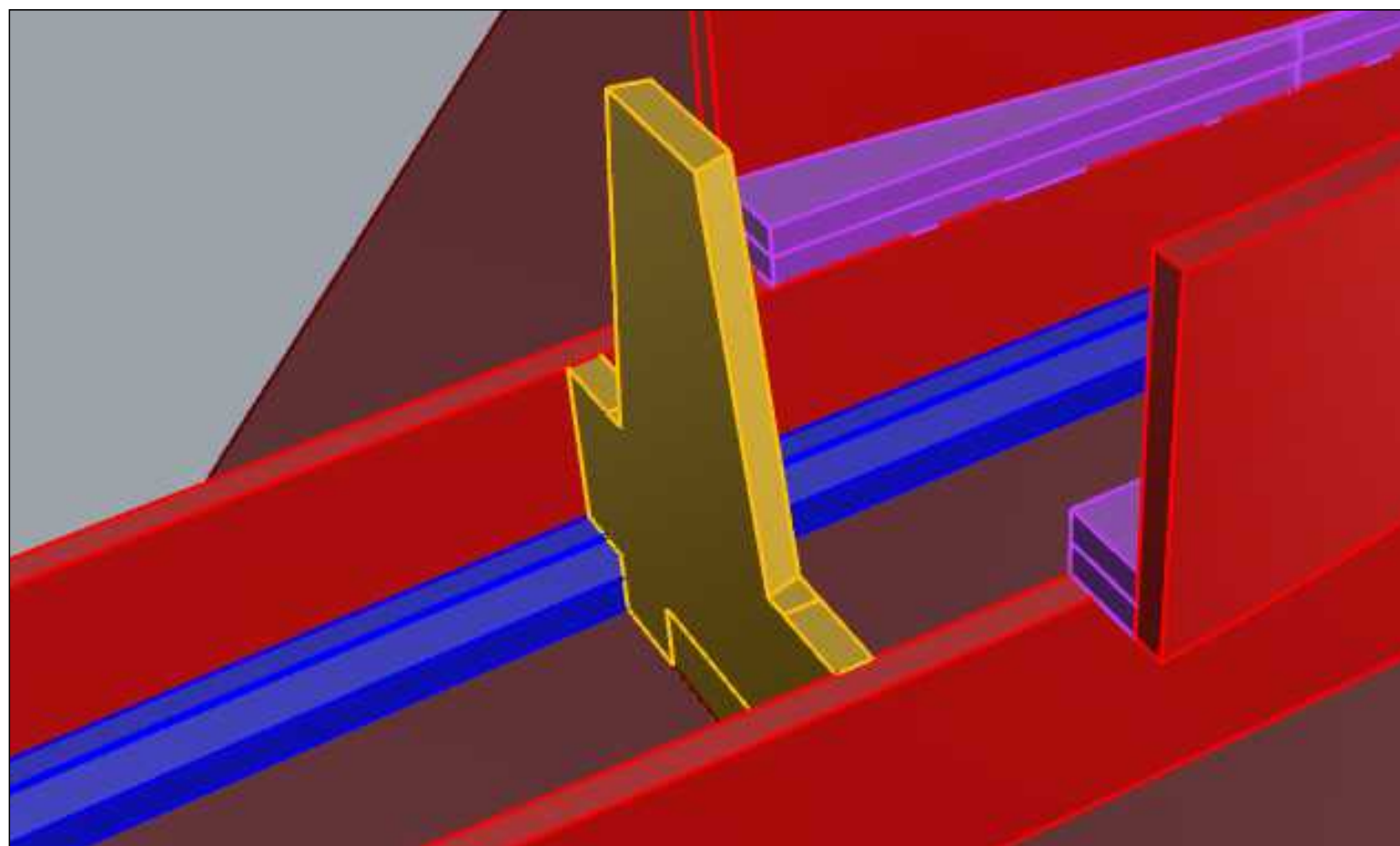


Glue the nosecone aligner in place.



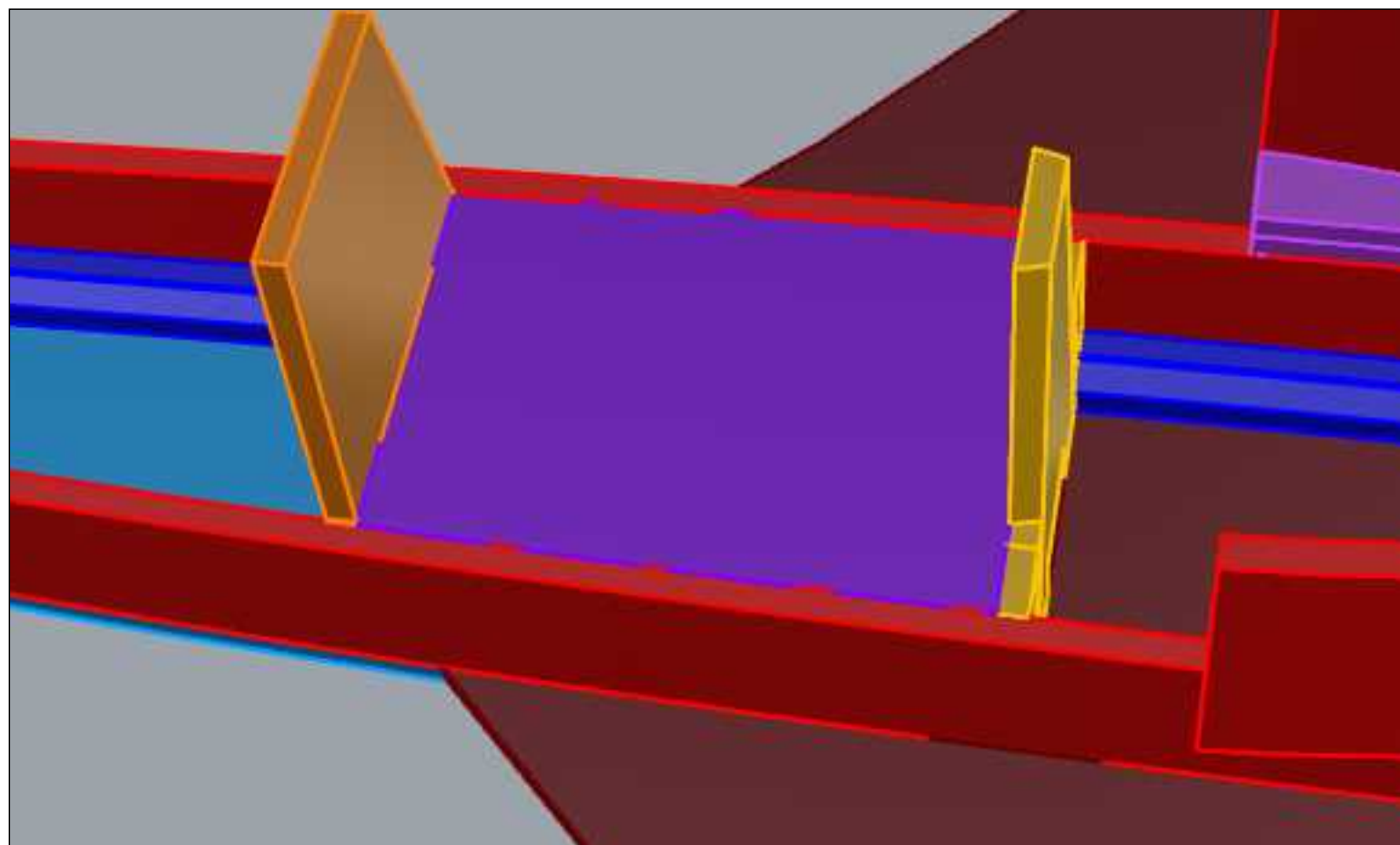


Glue in bulkhead 2. The hole is for EDF version to allow the battery to move backwards to gain the CG. On the pusher version this just can be a hole for the battery connectors to pass through.

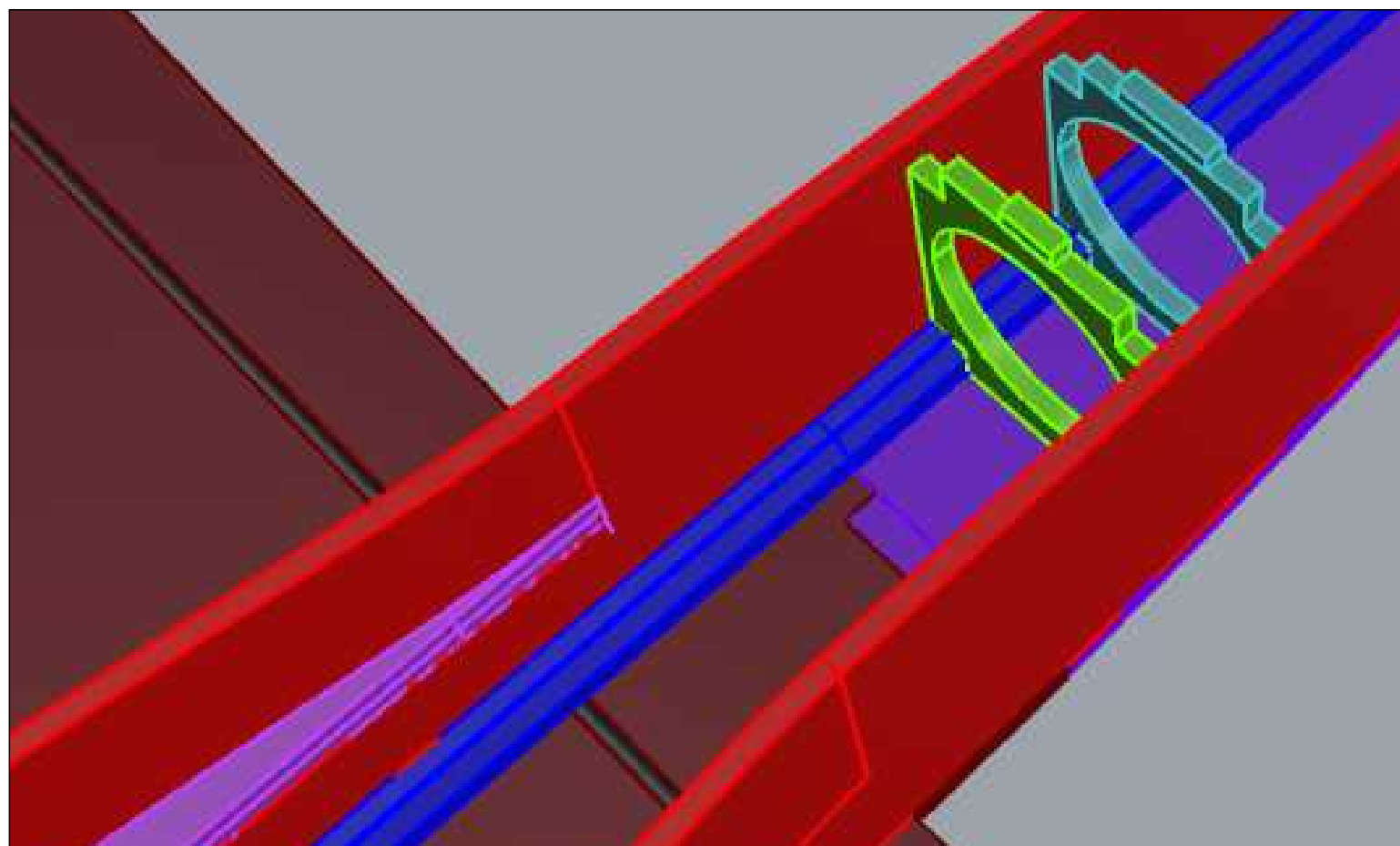


Glue in bulkhead 3. Ensure the edge angles are correct.





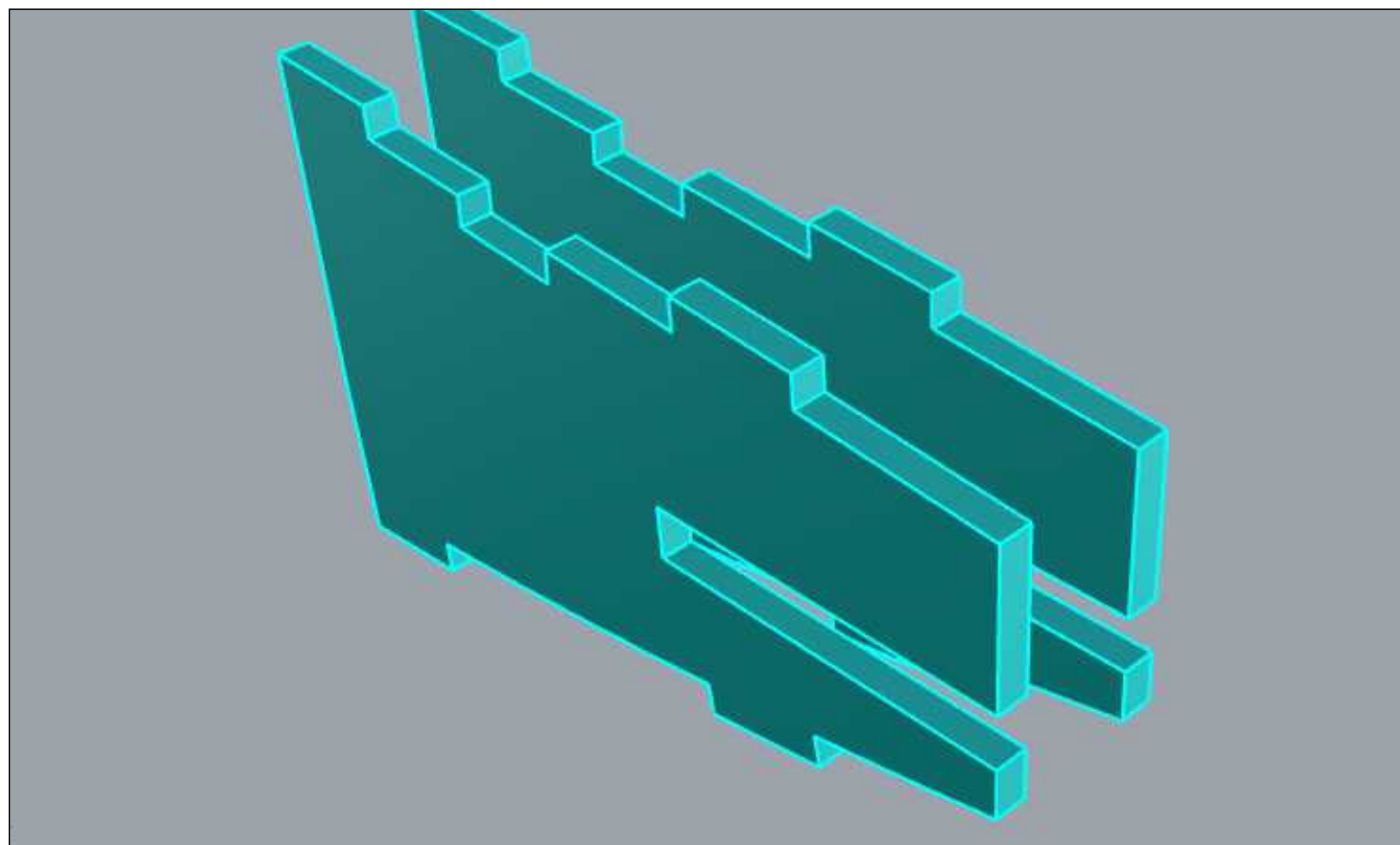
Glue the horizontal bulkhead into the assembly using a light coat of 5min epoxy.



EDF ONLY.

Glue the two EDF mount bulkheads in place as shown.





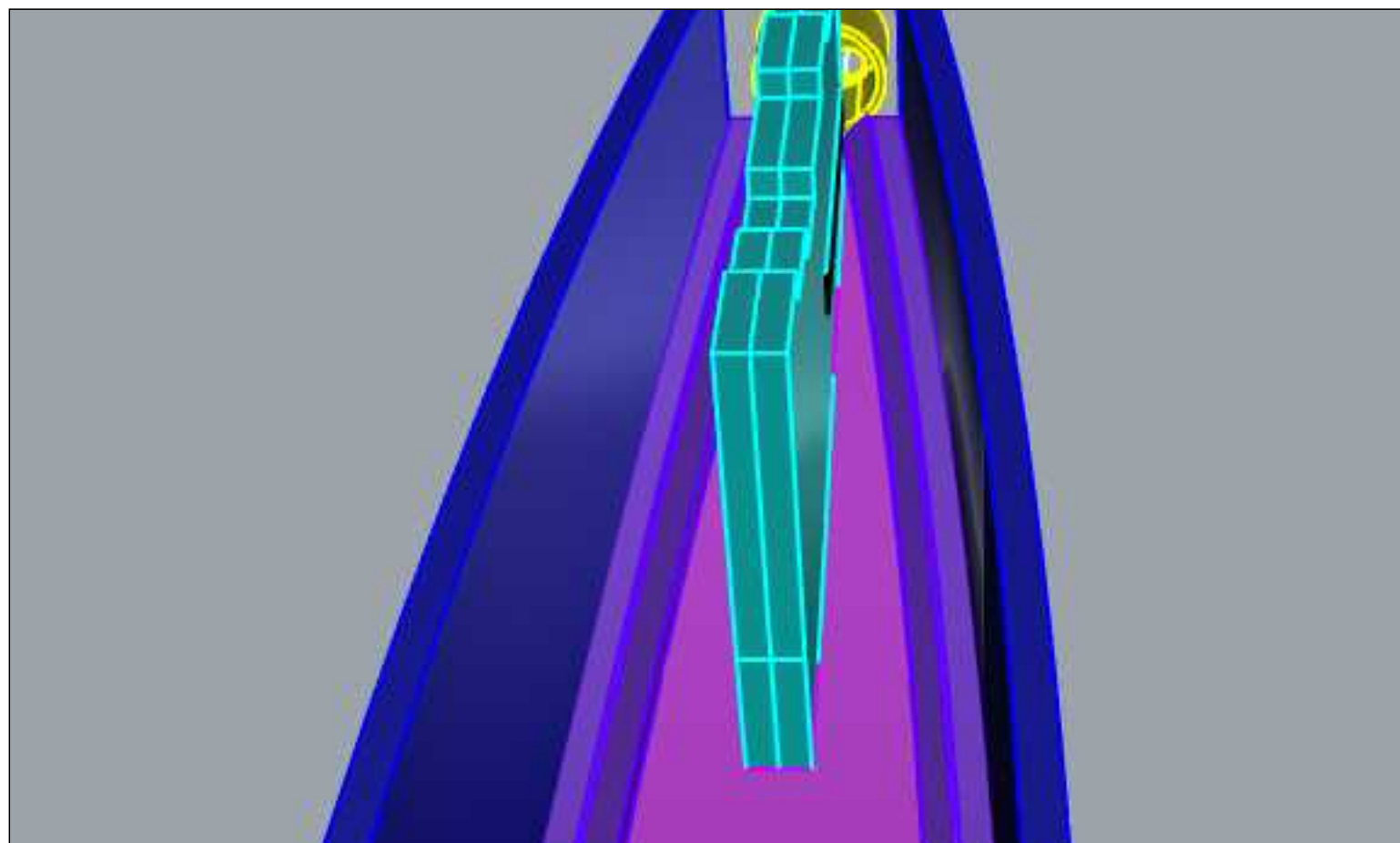
PUSHER ONLY

Glue the two pusher motor mount pieces together.

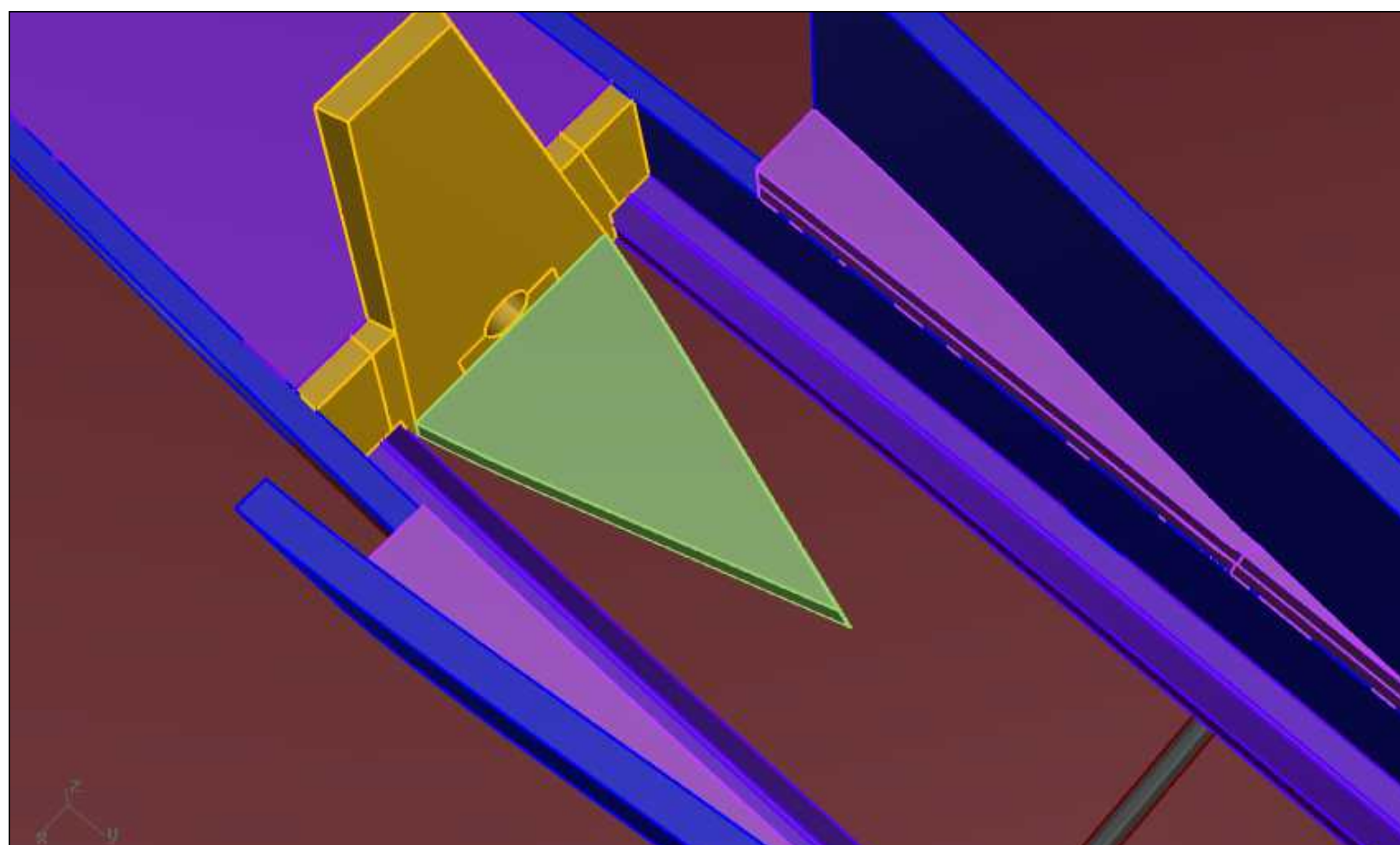


Glue the plastic mounting stick into the depron using hot melt glue. Mount the motor onto the plastic mount (check that the shaft doesn't catch on the plastic mount).



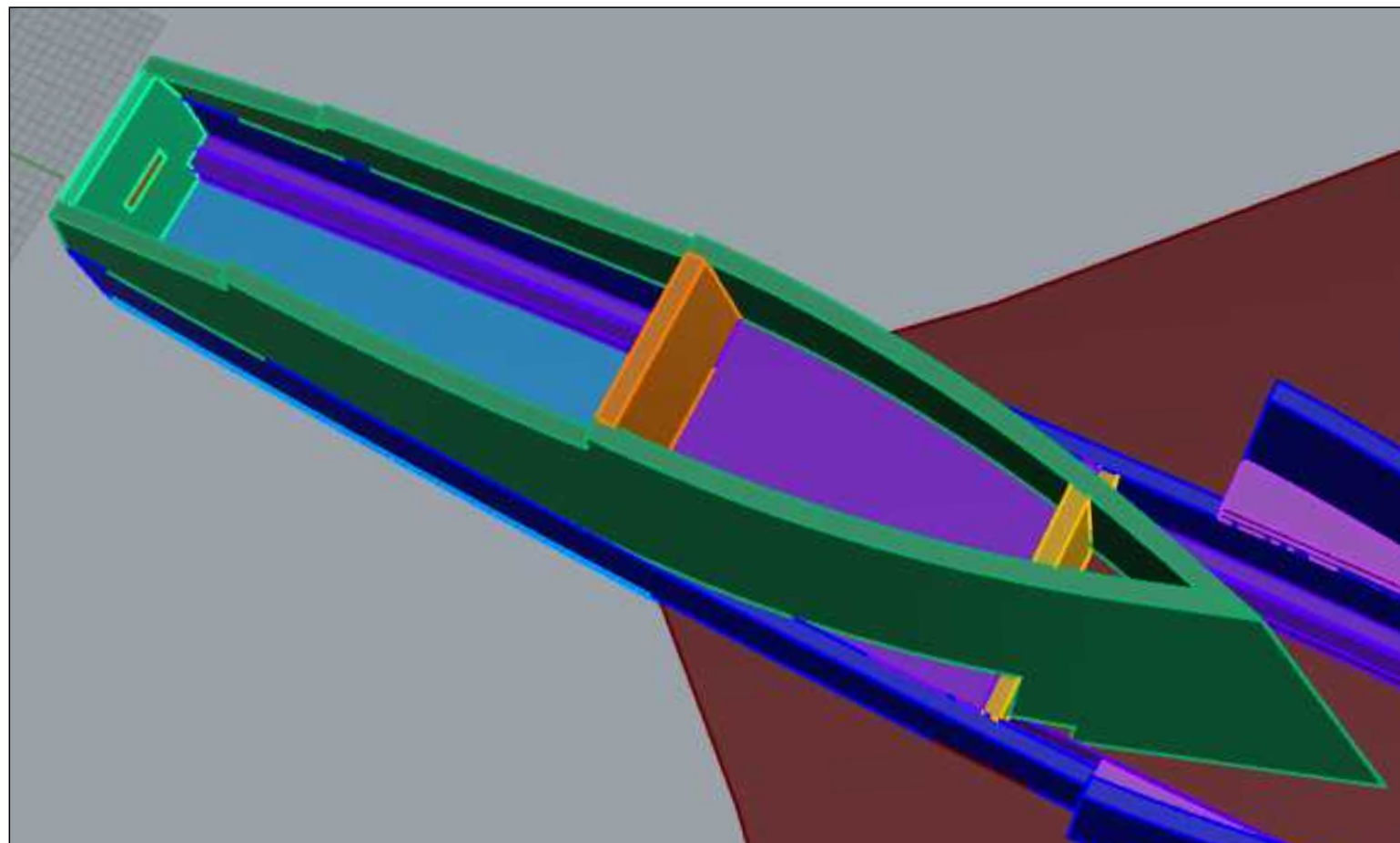


PUSHER ONLY - Glue the pusher motor mount assembly to the main fuselage.

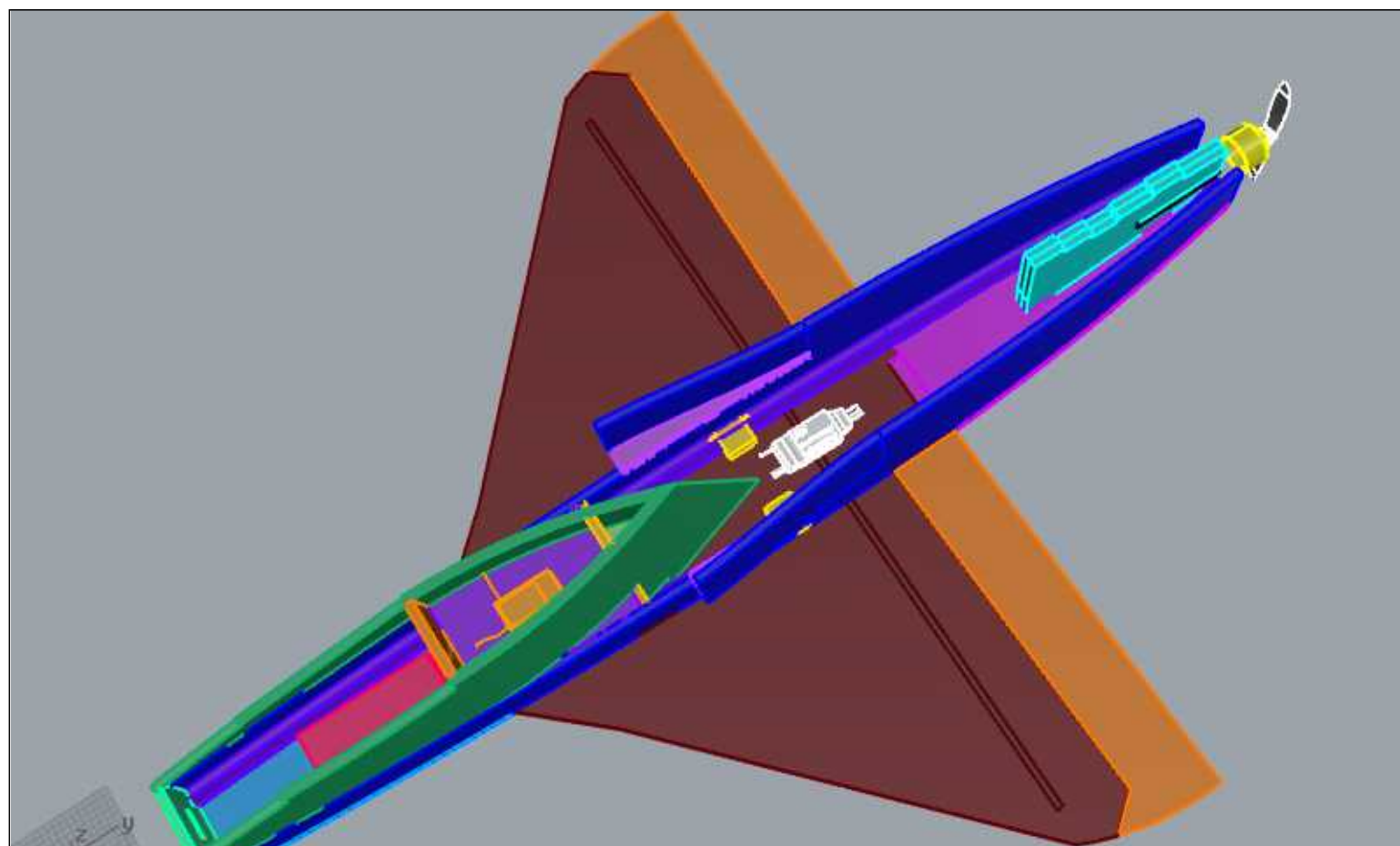


Glue the triangle former piece in centrally aligned as shown.





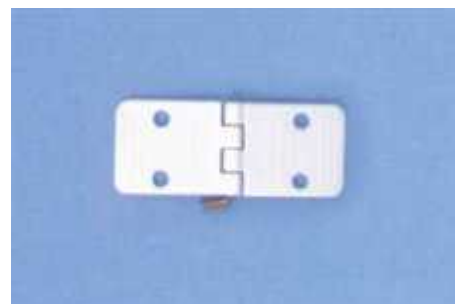
Curve the two front upper fuselage pieces as shown and glue in place.

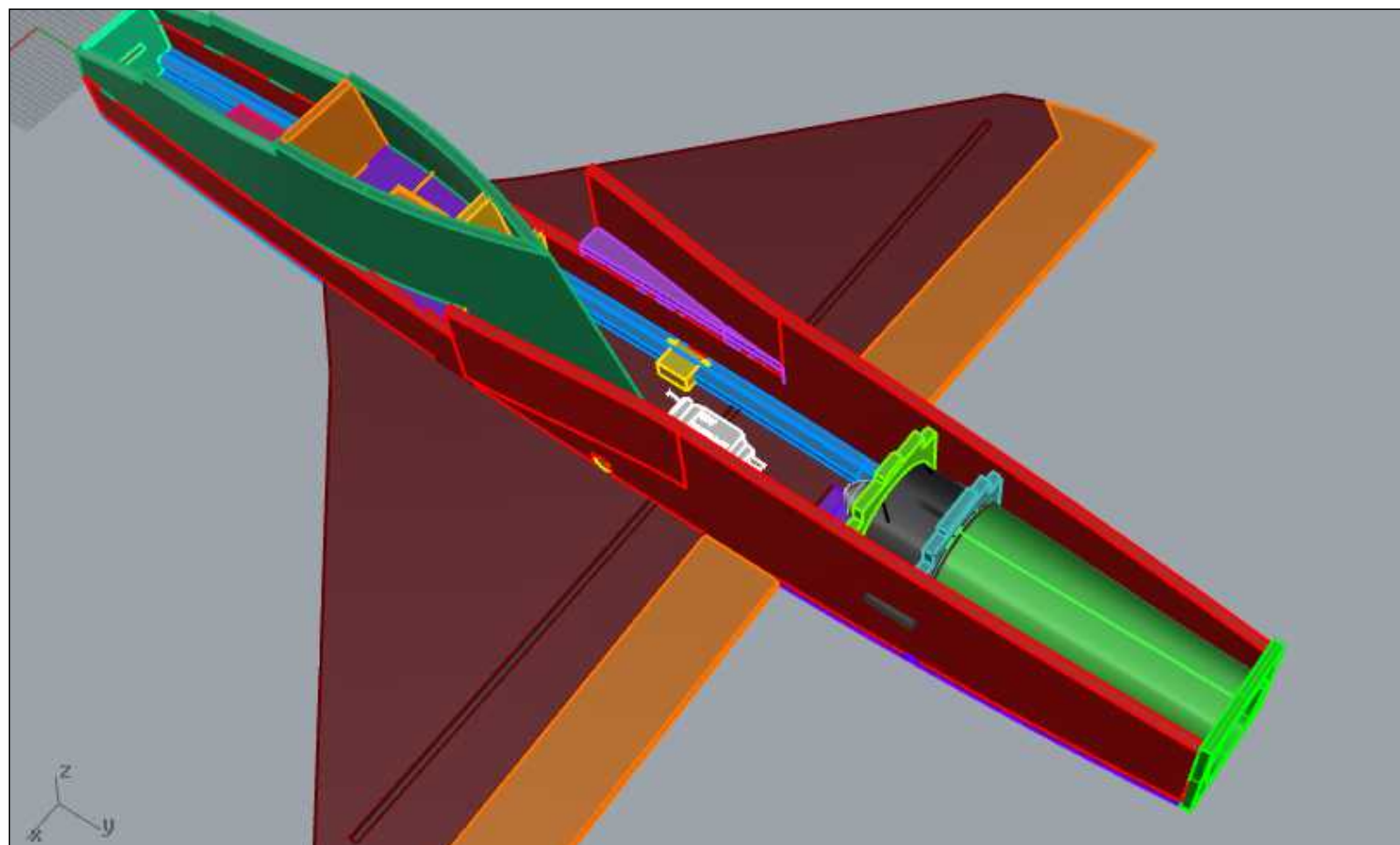


Attach the ailerons using 3 graupner mini hinges on each wing and create the control horn made from 3mm lite ply.

Connect all the electronics and cut out the corner reinforcement to glue the servos in place.

Test the motor direction and the aileron operation. maximum deflection should be 30 degrees.



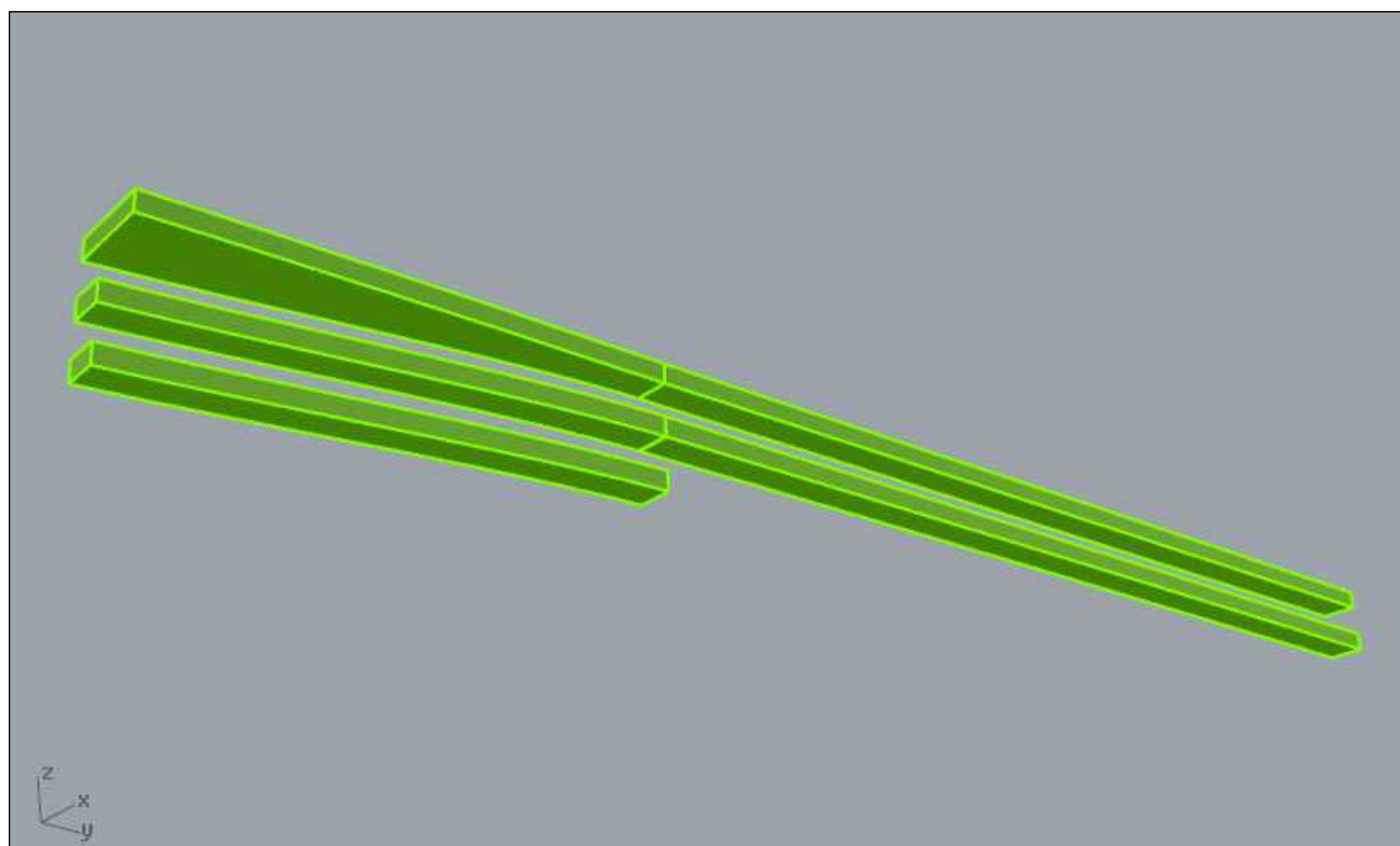
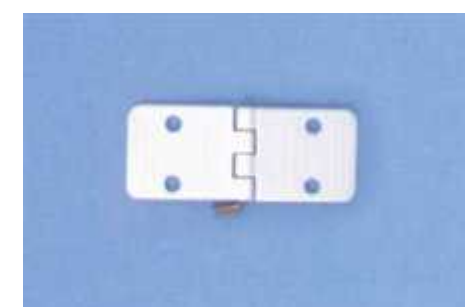


EDF VERSION

Attach the ailerons using 3 graupner mini hinges each side and create the control horn from 3mm lite ply.

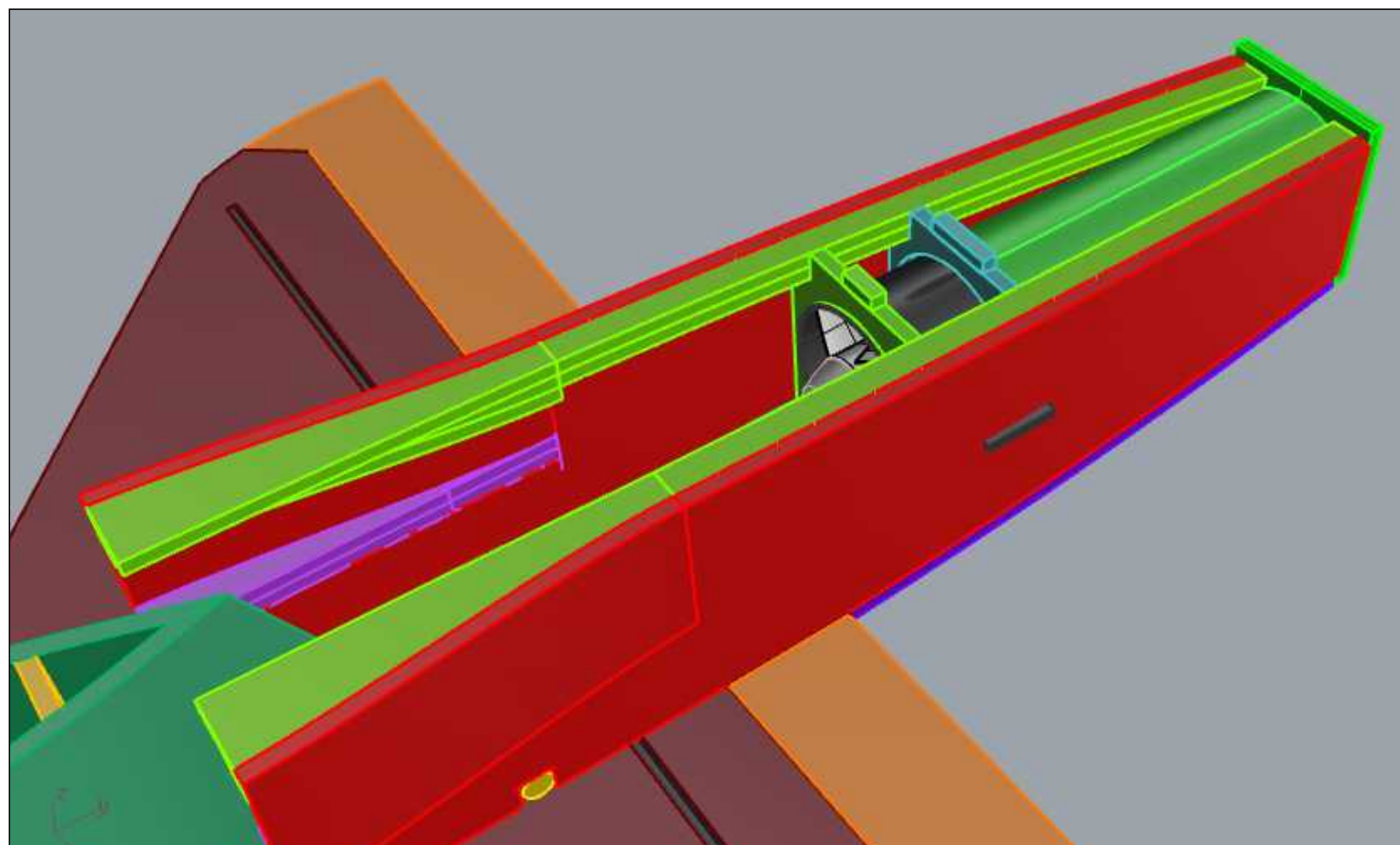
Connect all the electronics and cut out the corner reinforcement to glue the servos in place.

Test the motor direction and the aileron operation. maximum deflection should be 30 degrees.

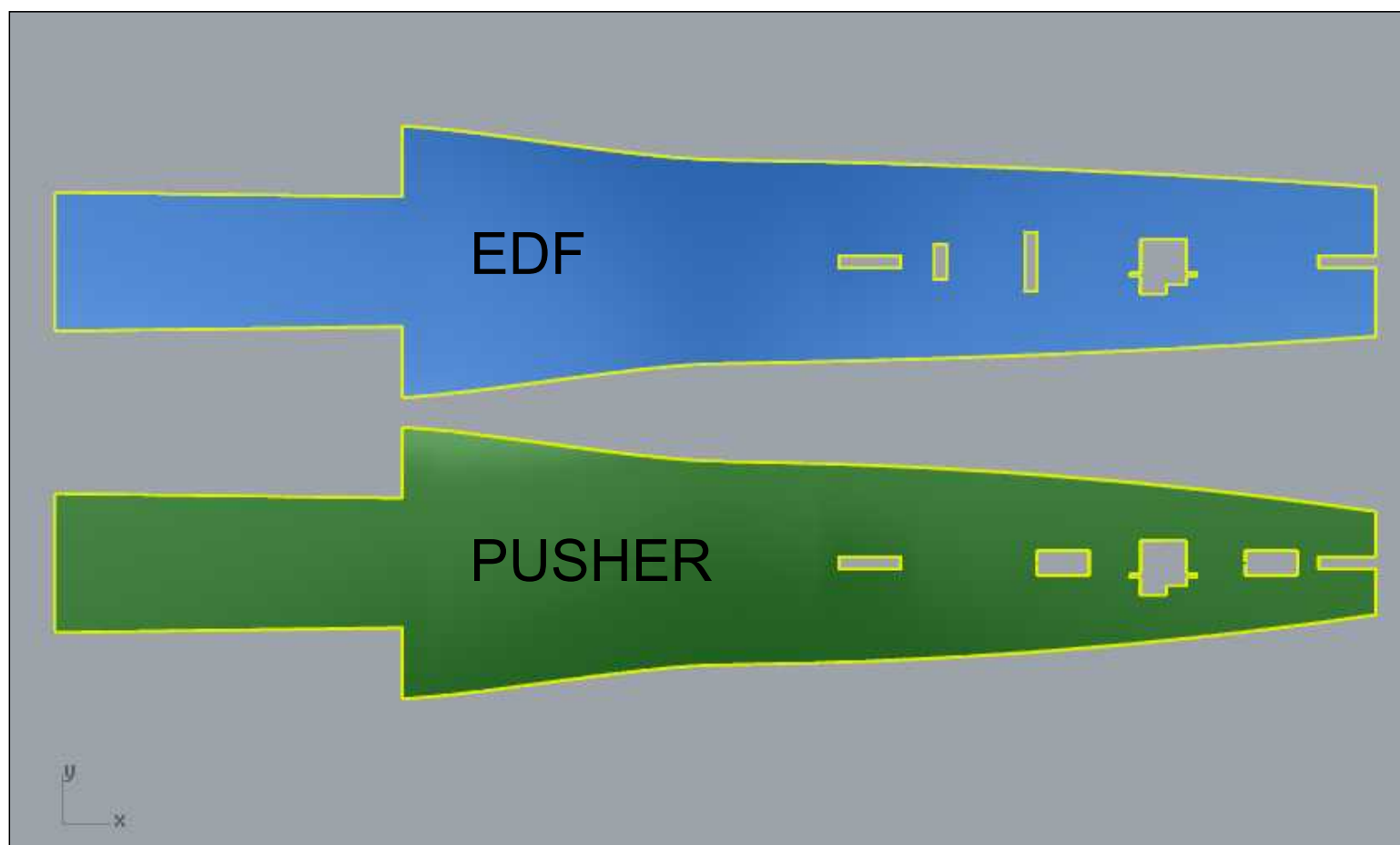


Glue together the upper corner reinforcement strips. 1 mirrored pair.

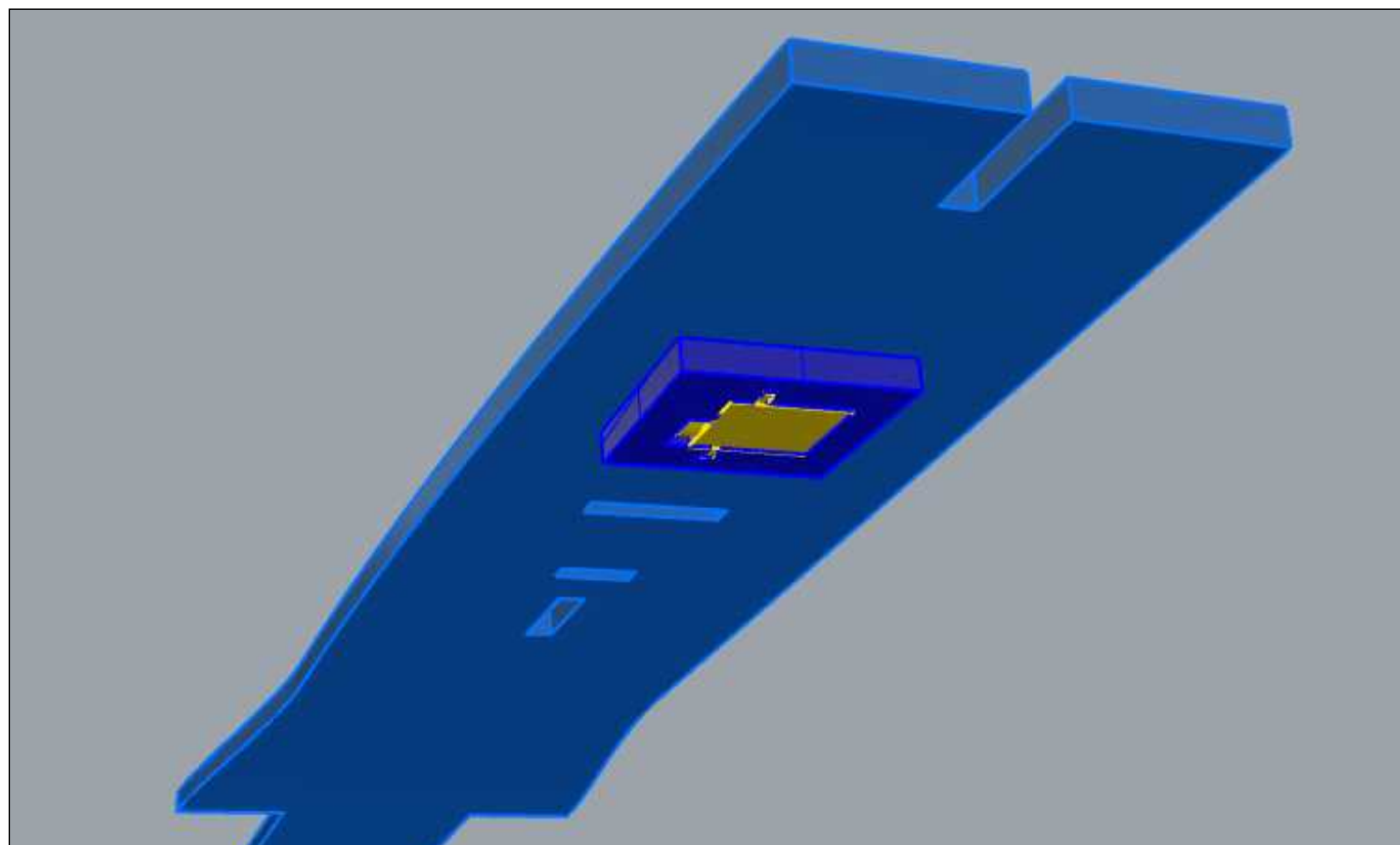




Test fit the corner reinforcement strips into the fuselage as shown. Trim away the excess around the ducting on the EDF version. Glue in place.

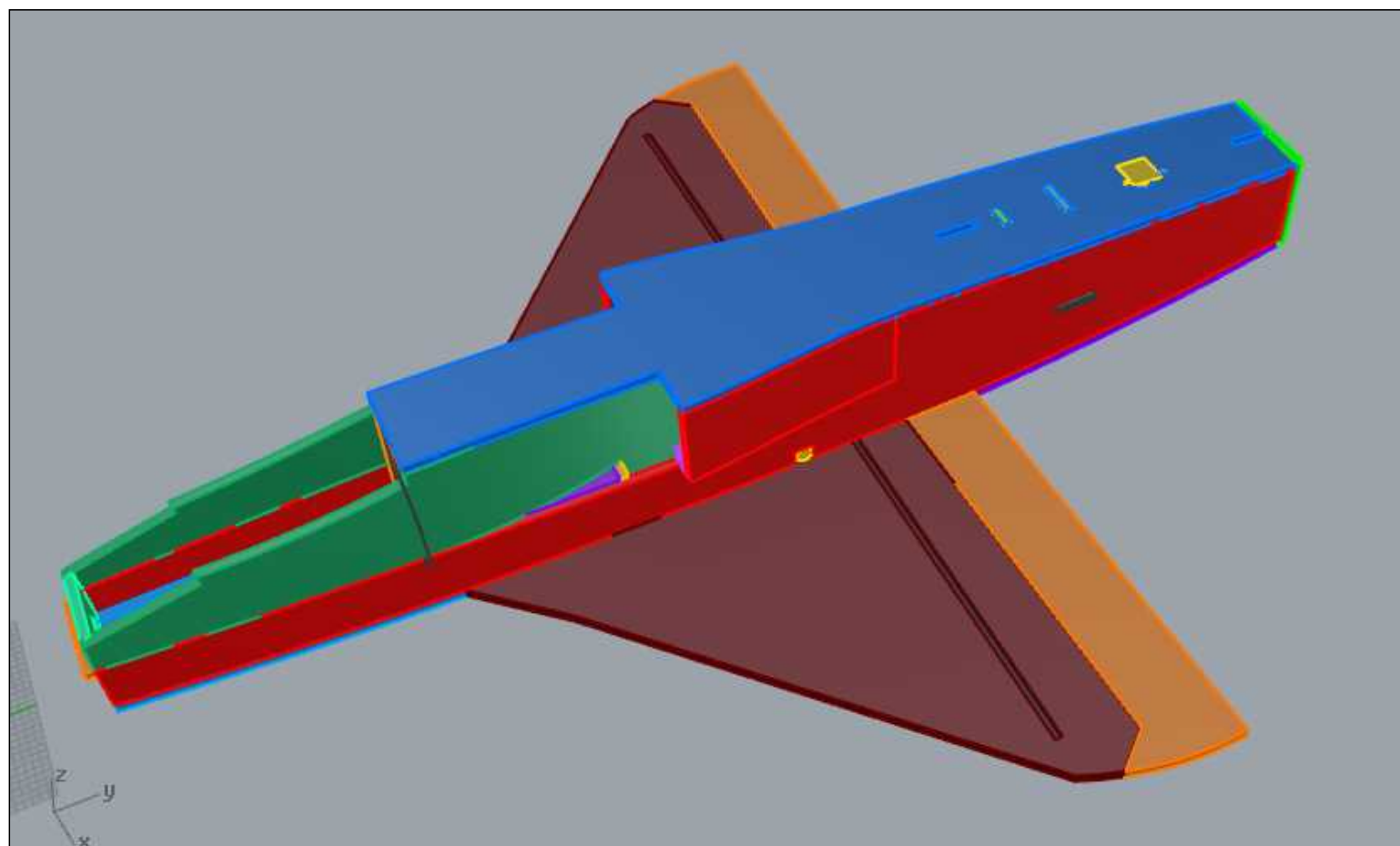


Prepare the correct fuselage top piece as shown.



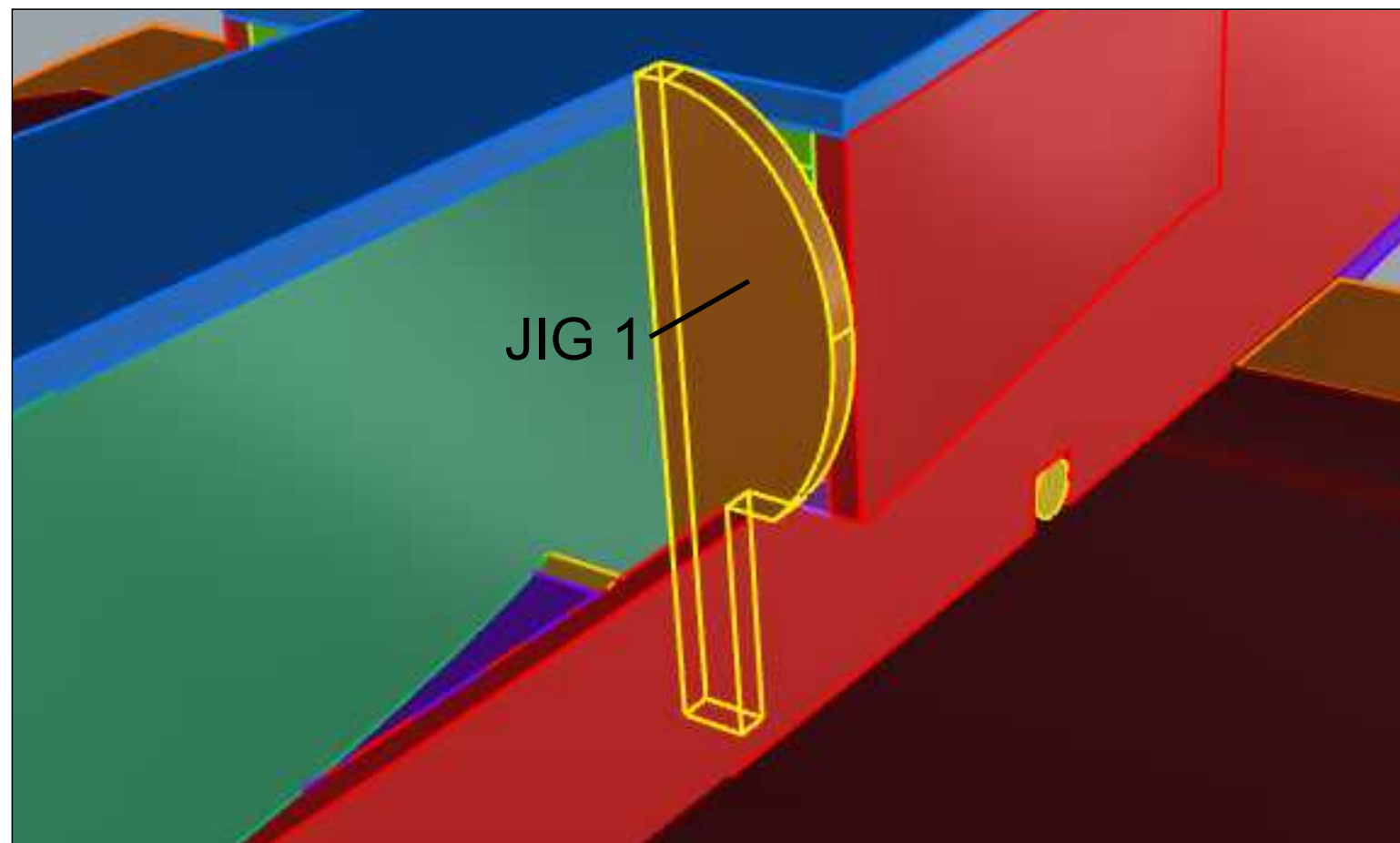
On the underside of the EDF fuselage top version (only) glue the servo support piece in place with UHU.

On both fuselage tops, glue the servo in place - flush to the top surface using hot melt glue. be careful not to leave any glue that could spoil the outer airplane surface.



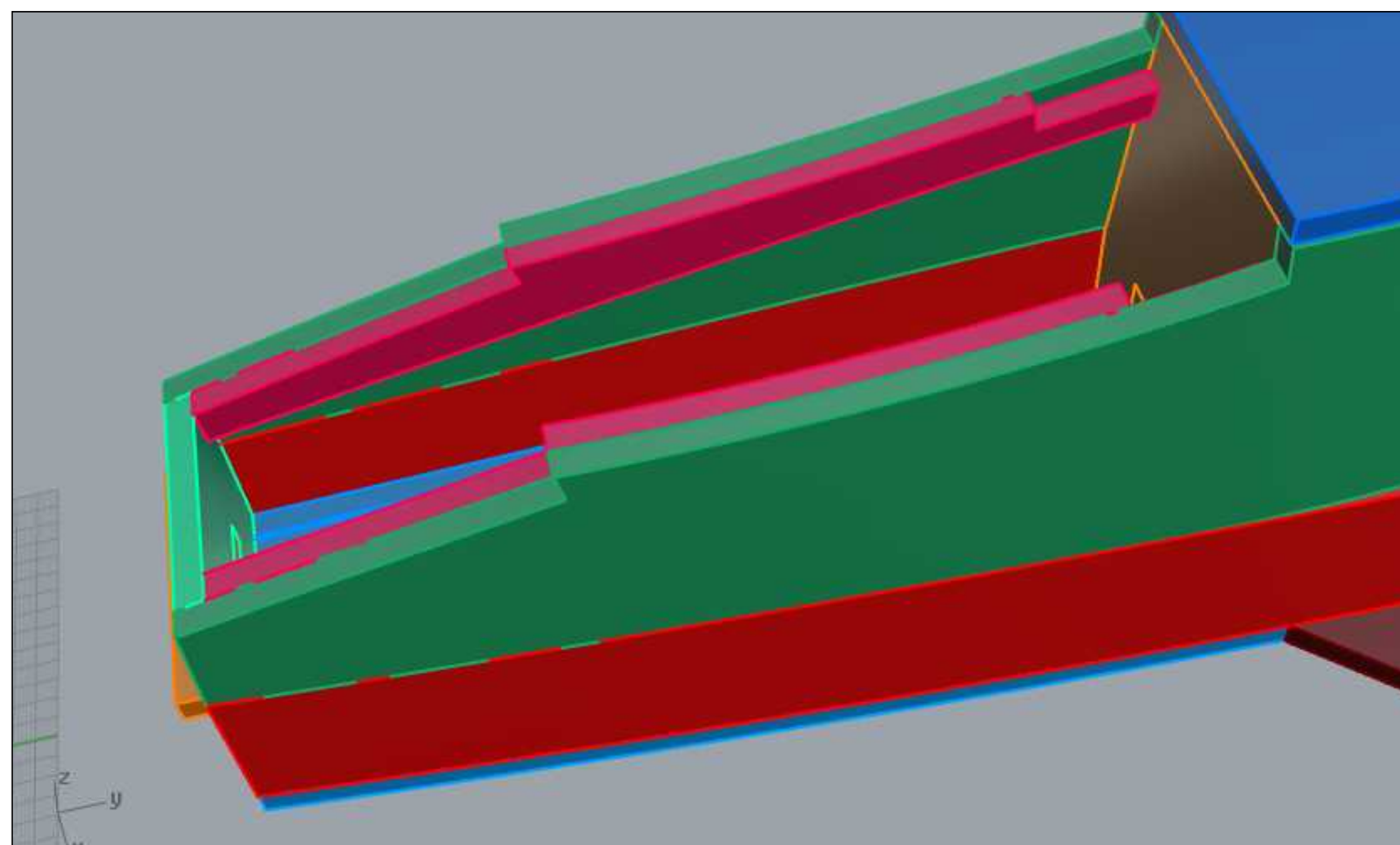
Wire up the servo to the RX, then glue the top fuselage piece in place.





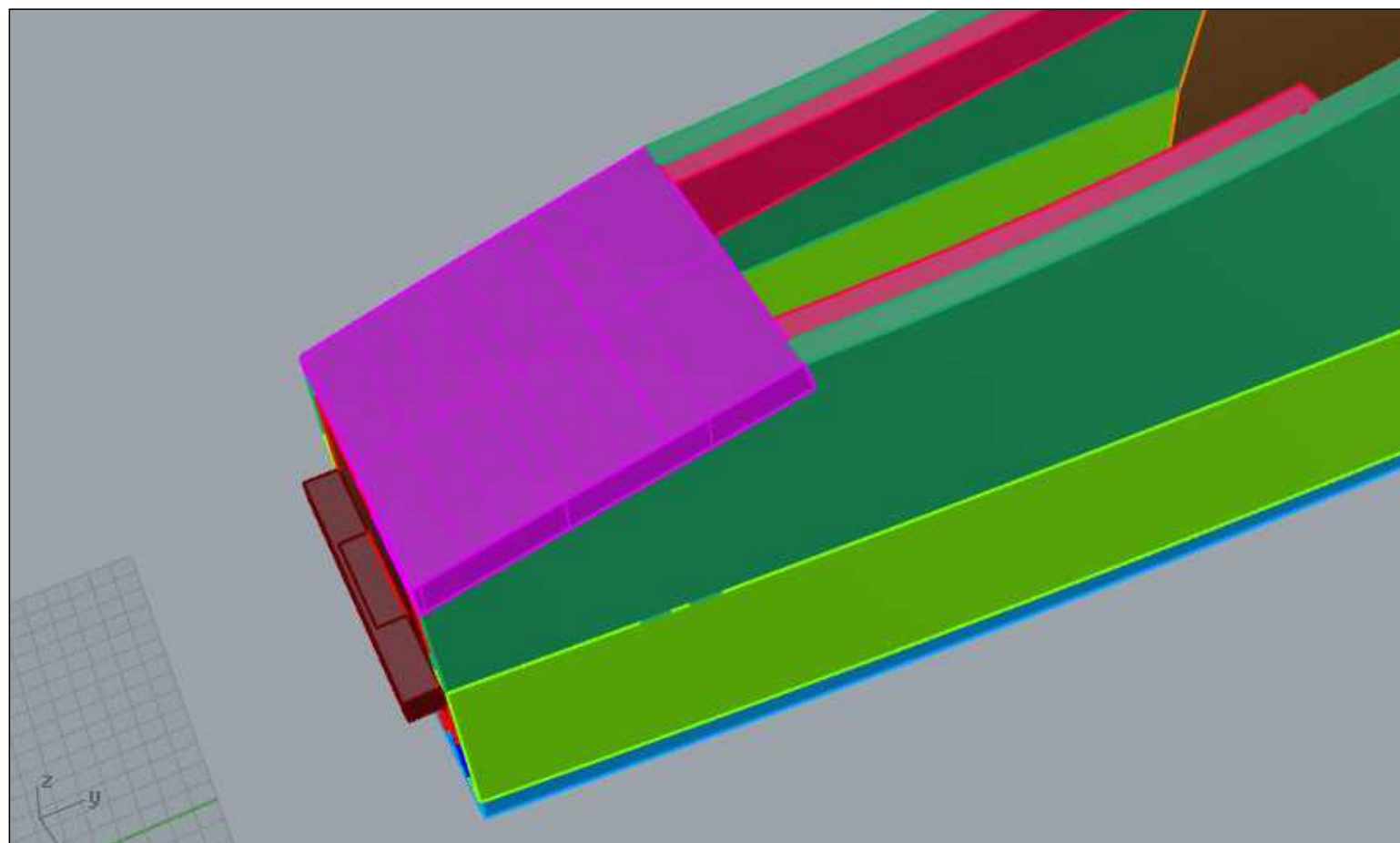
Using the Jig, mark on the fuselage the arc of the air intake. Then using a sanding block and sandpaper, rub a radiused edge along the entire rear fuselage right to the tail-pipe.

Do this both sides.

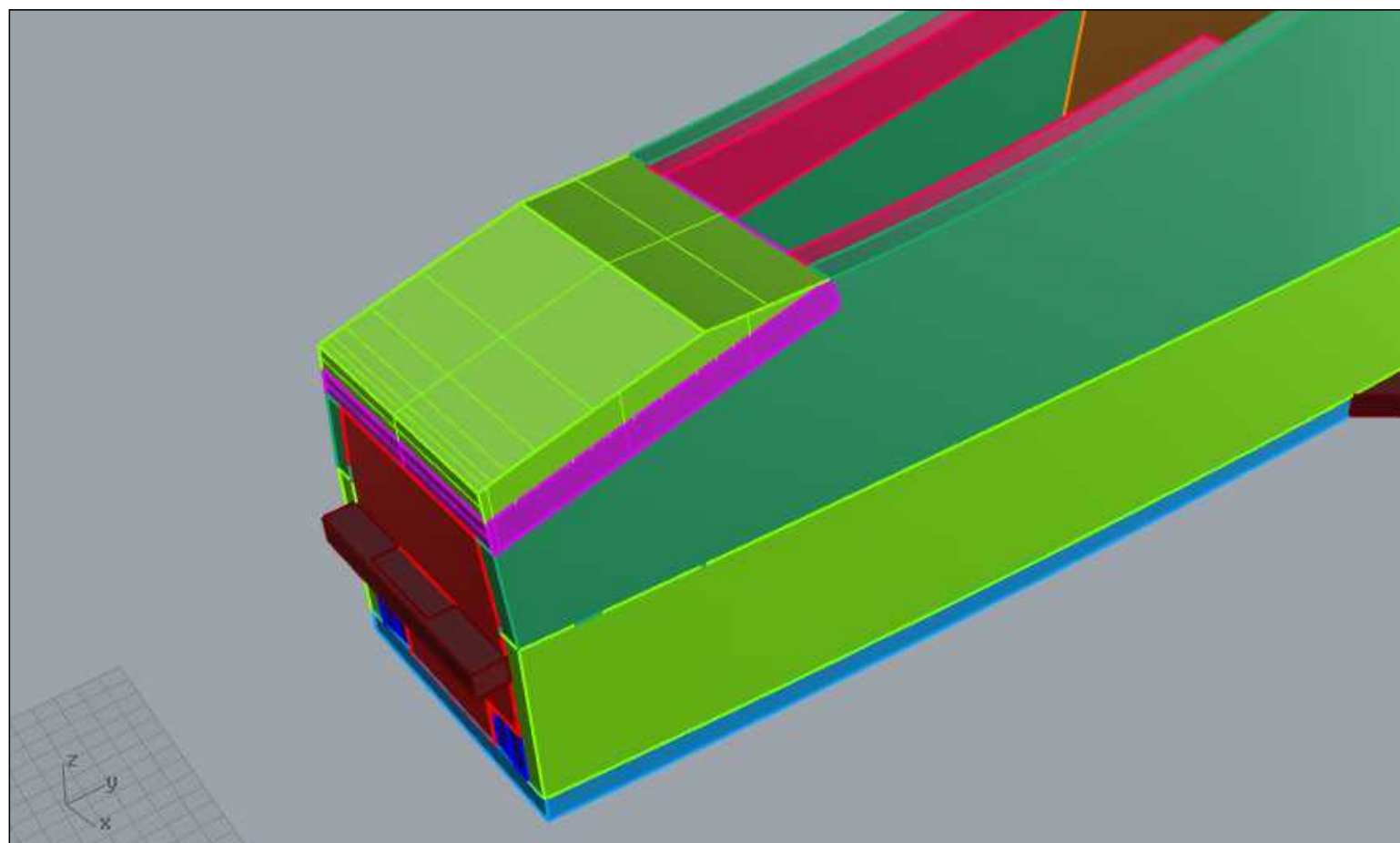


Glue the canopy support strips in place as shown.



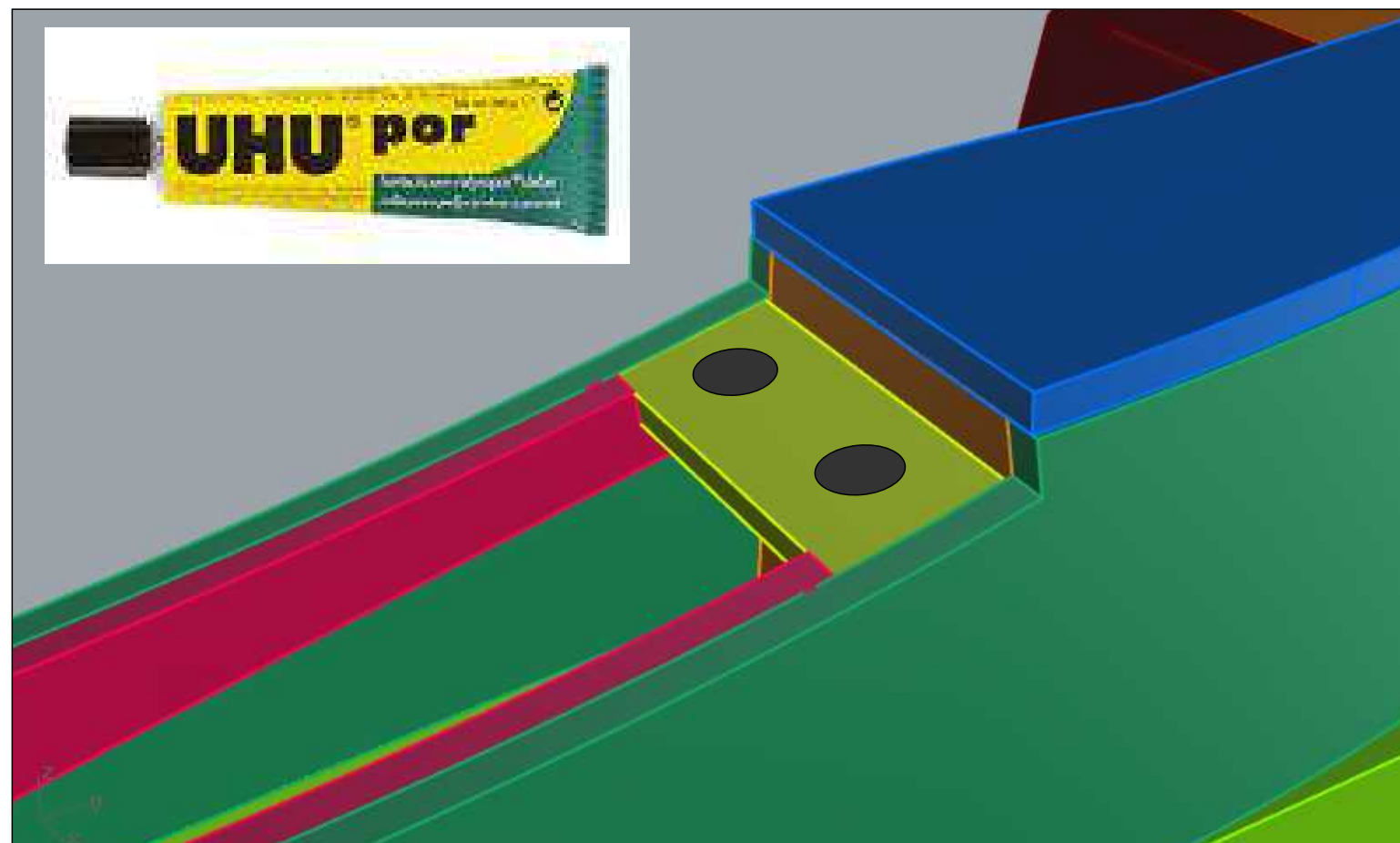


Glue the lower canopy bridge piece into the slot as shown.



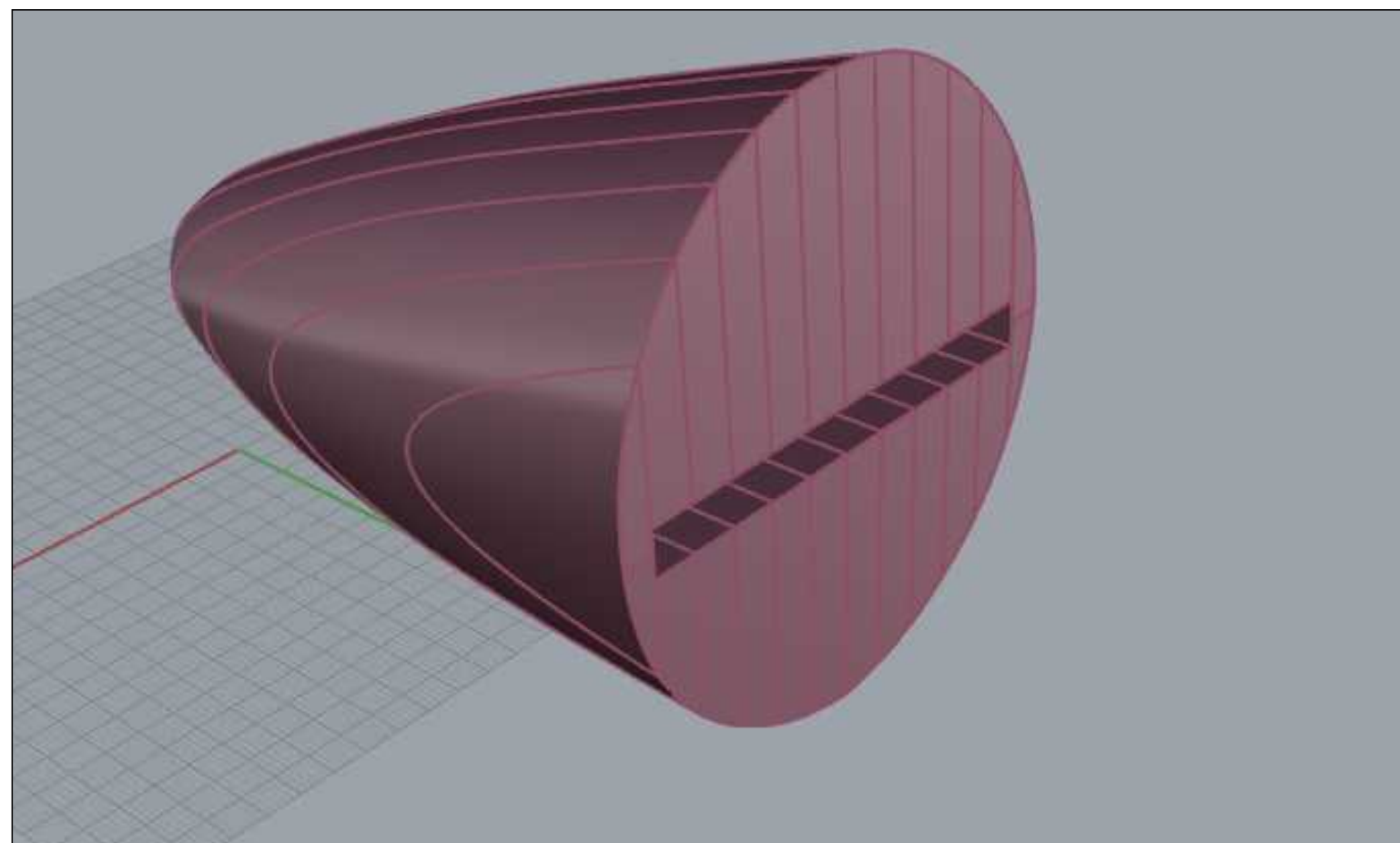
Glue the upper canopy bridge in place as shown





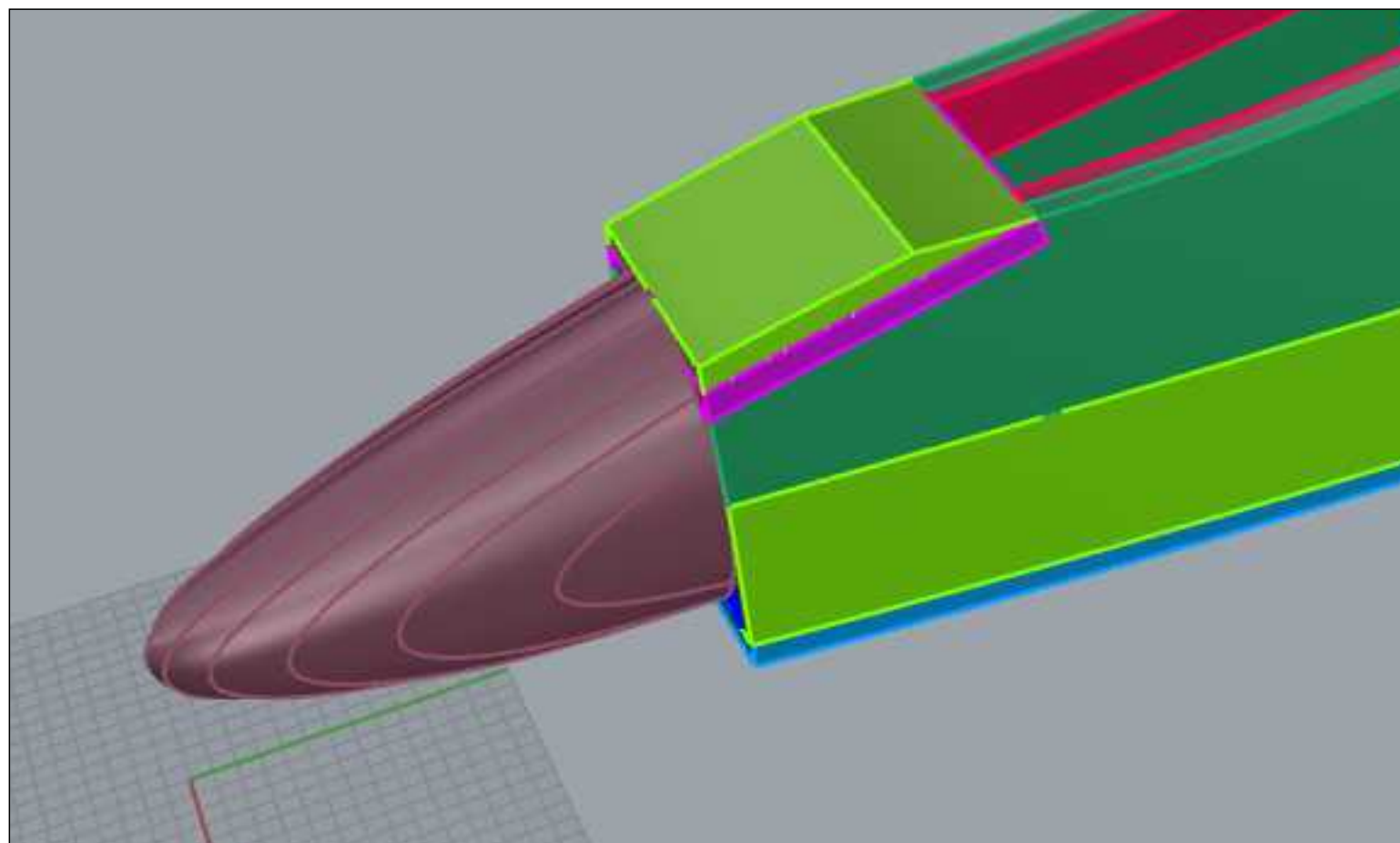
Glue the canopy magnet shelf in place. Rare-earth Magnet attachment process

1. press magnet into depron to impress shape.
 2. Dig out a recess for the magnet using a sharp knife.
 3. Apply glue into recess and push magnet into it.
 4. Whilst still wet, lay masking tape over the area.
 5. When fully cured, remove tape and put adjoining magnet on top.
 6. When correctly aligned, press adjoining depron onto the sticking up magnet to impress shape.
 7. Repeat steps 2-4 for the upper part.
- IMPORTANT.**
Before glueing the upper magnet in, check that the magnet is the right way around!

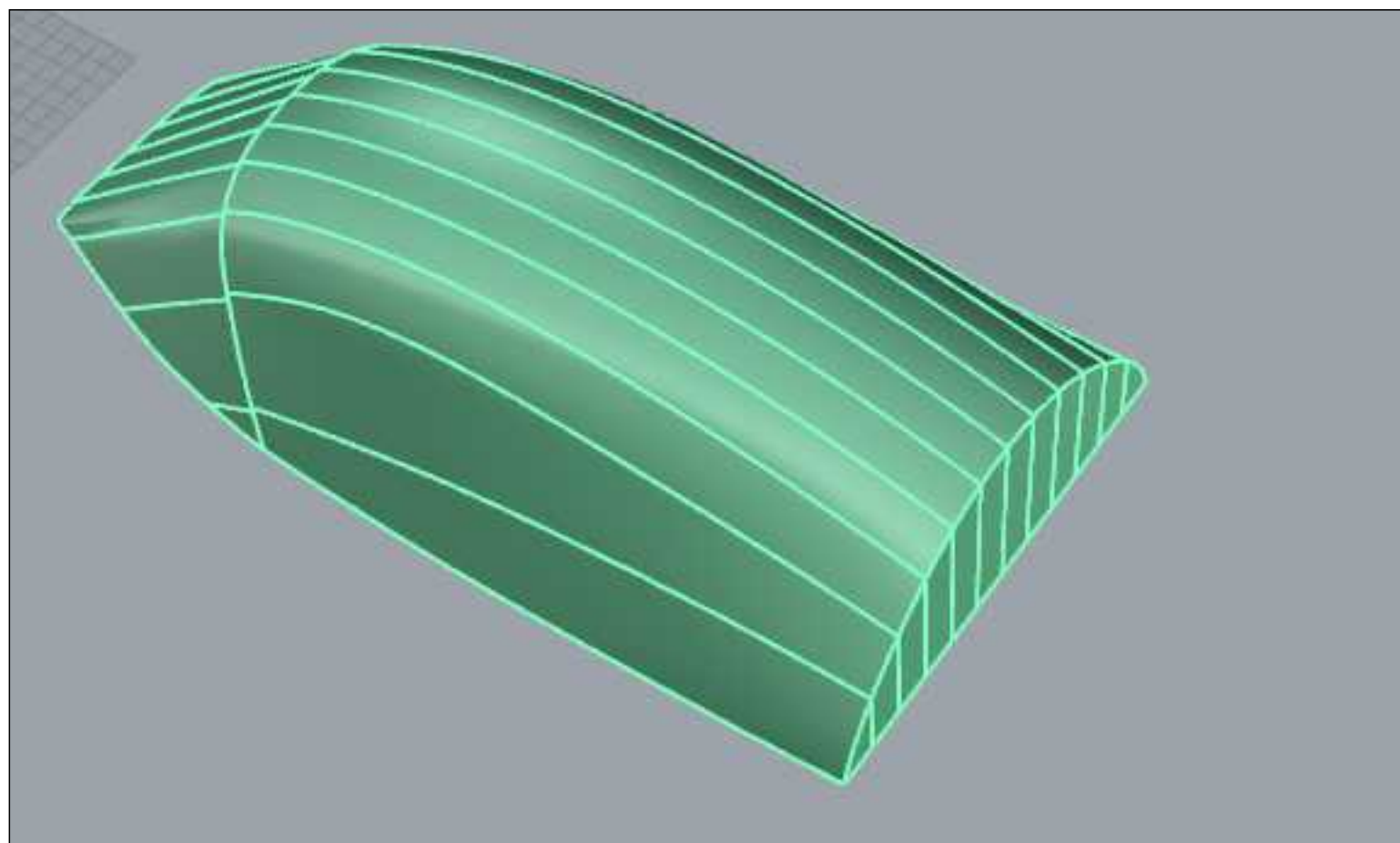


Glue and assembly the nosecone as shown. Sand until the ridges become smooth.



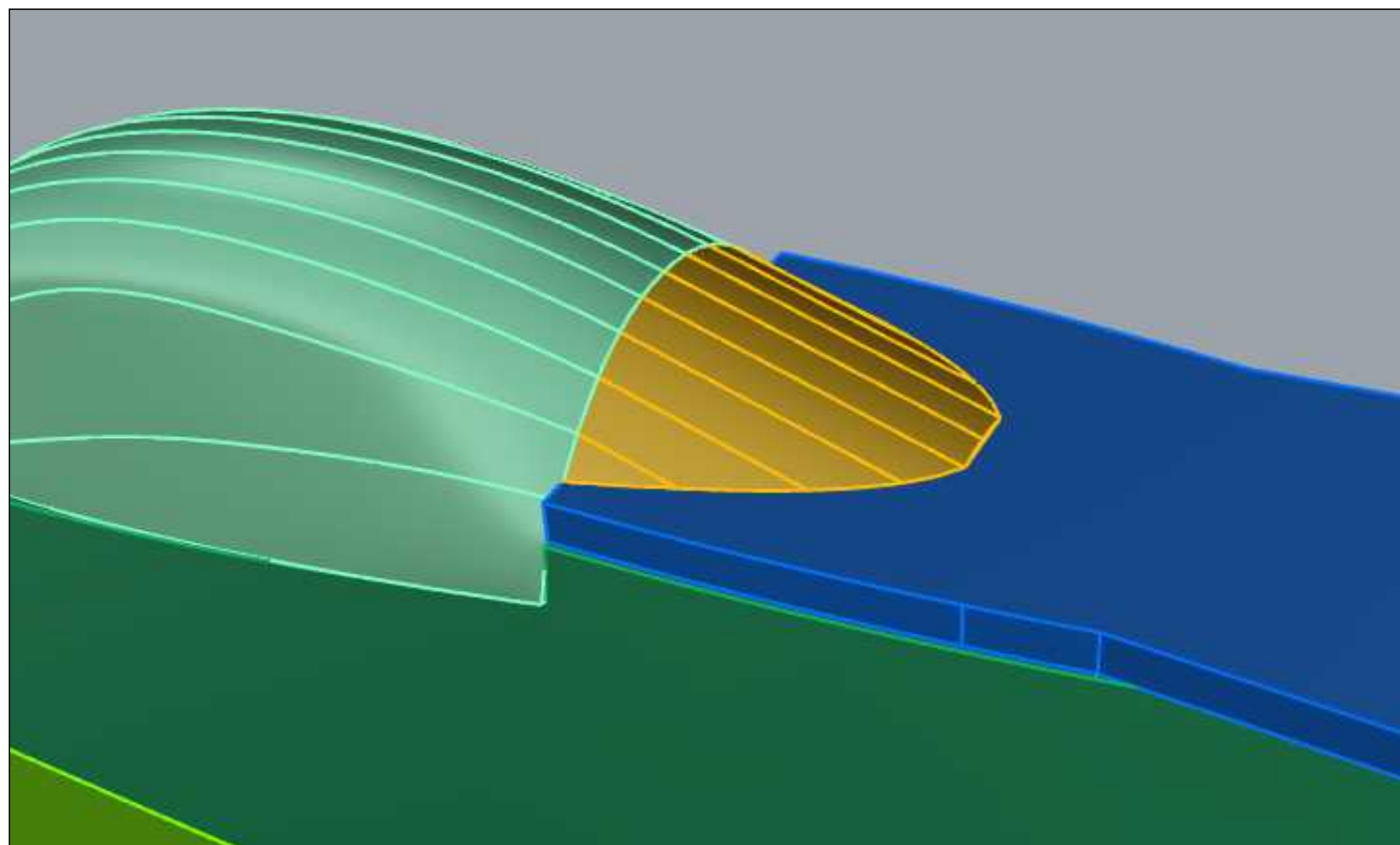


Glue the nosecone to the assembly.

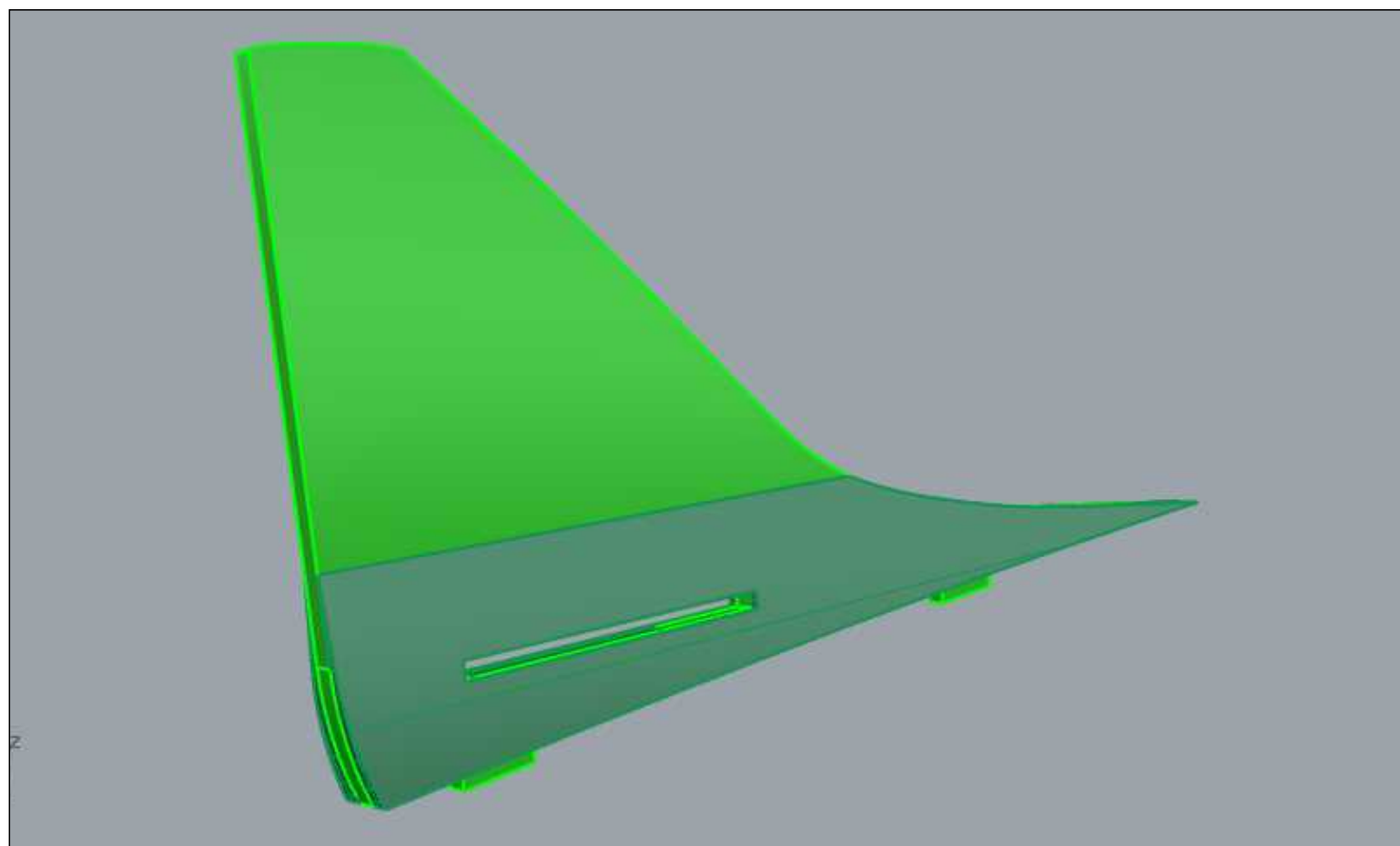


Glue the canopy together as shown. Sand until the ridges are smooth.



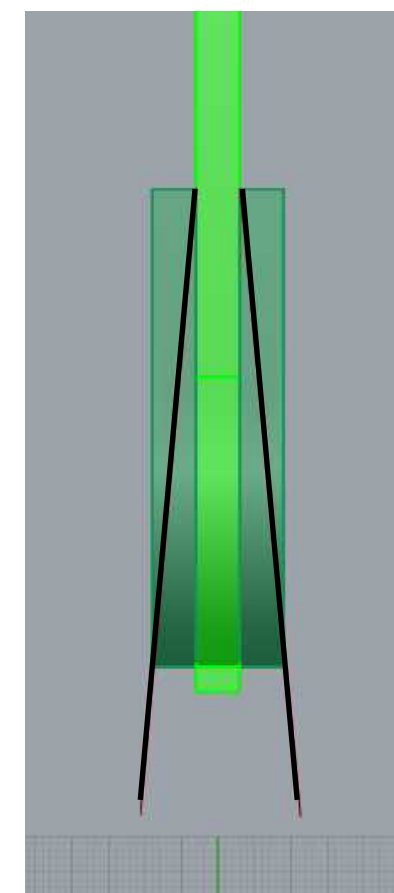


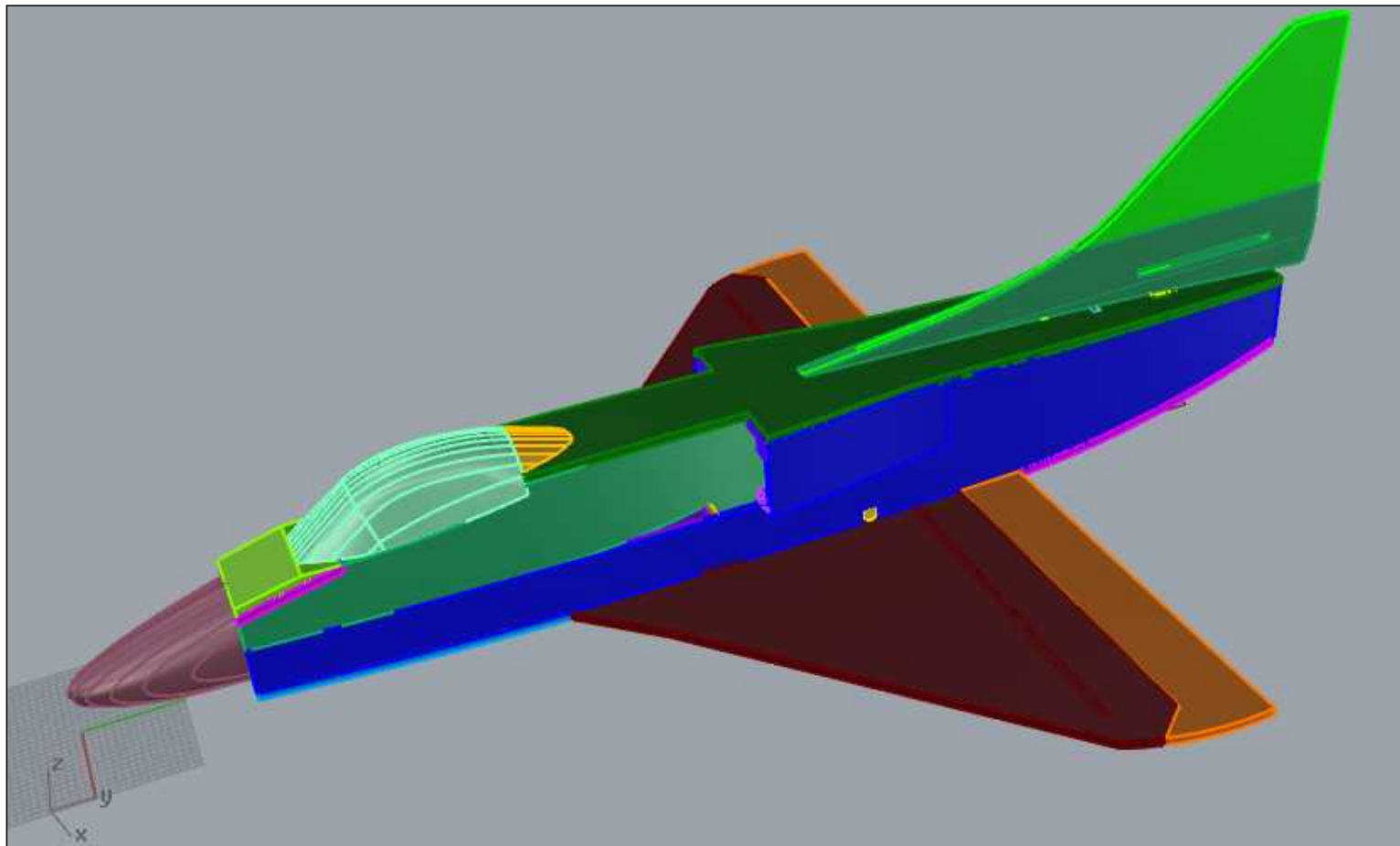
Once the canopy has been fitted in place with the magnets. Assemble the turtledeck and glue in place touching the canopy. ensure the canopy and turtledeck are flush.



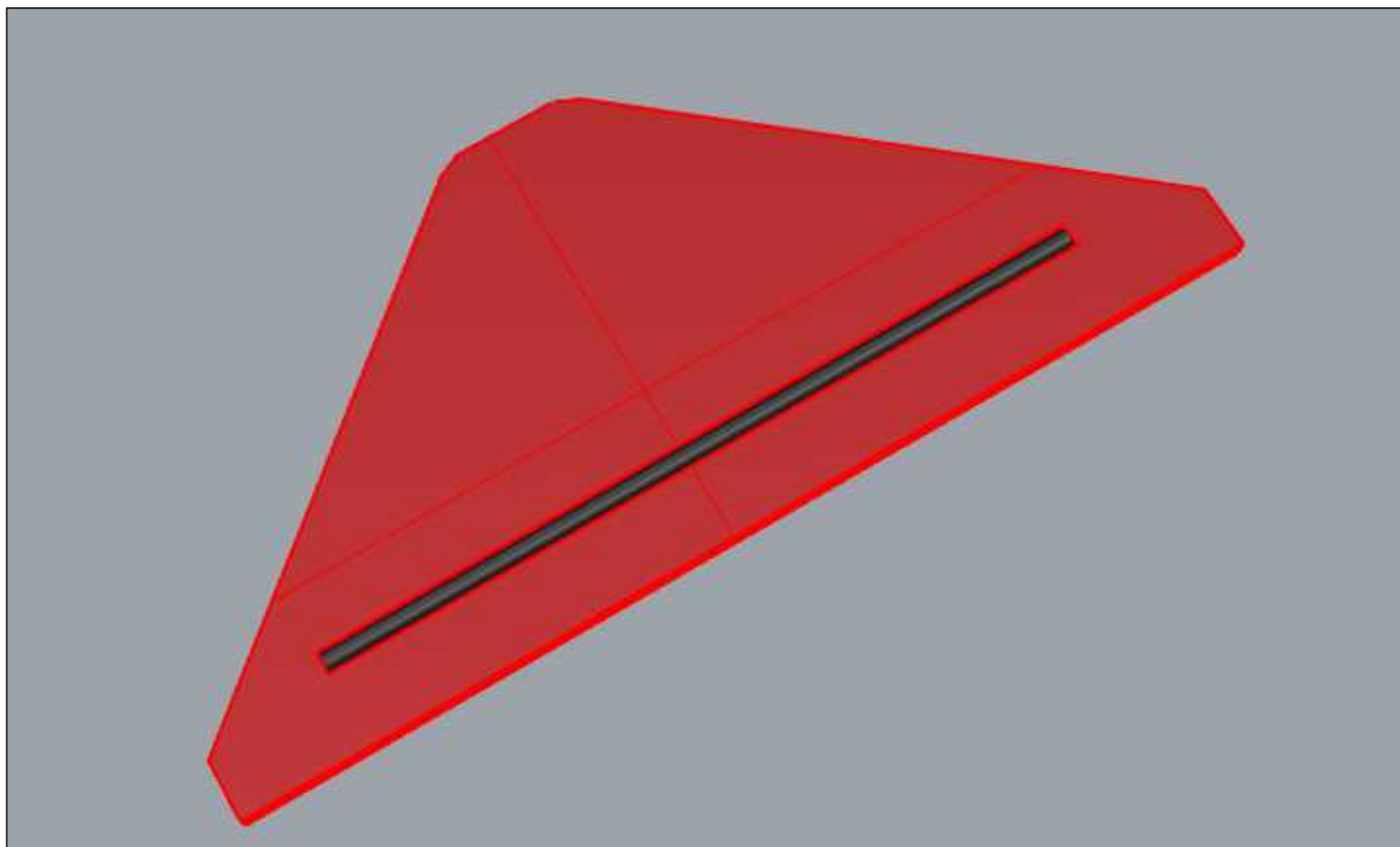
Sand the vertical stabiliser side pieces as shown on the image on the right.

Glue into place as shown on the left.

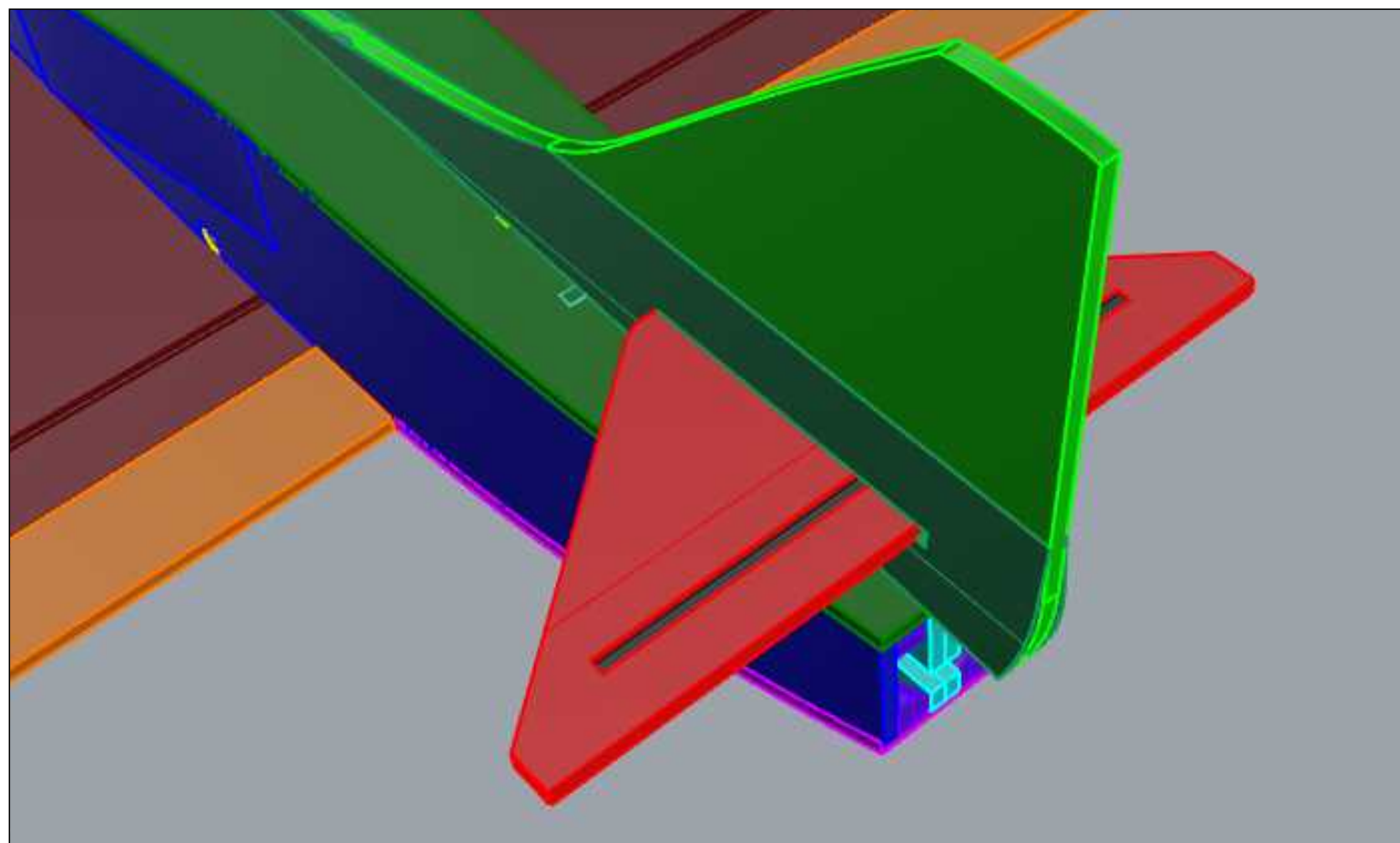




Glue the vertical stabiliser in place. Ensure that it is mounted true.

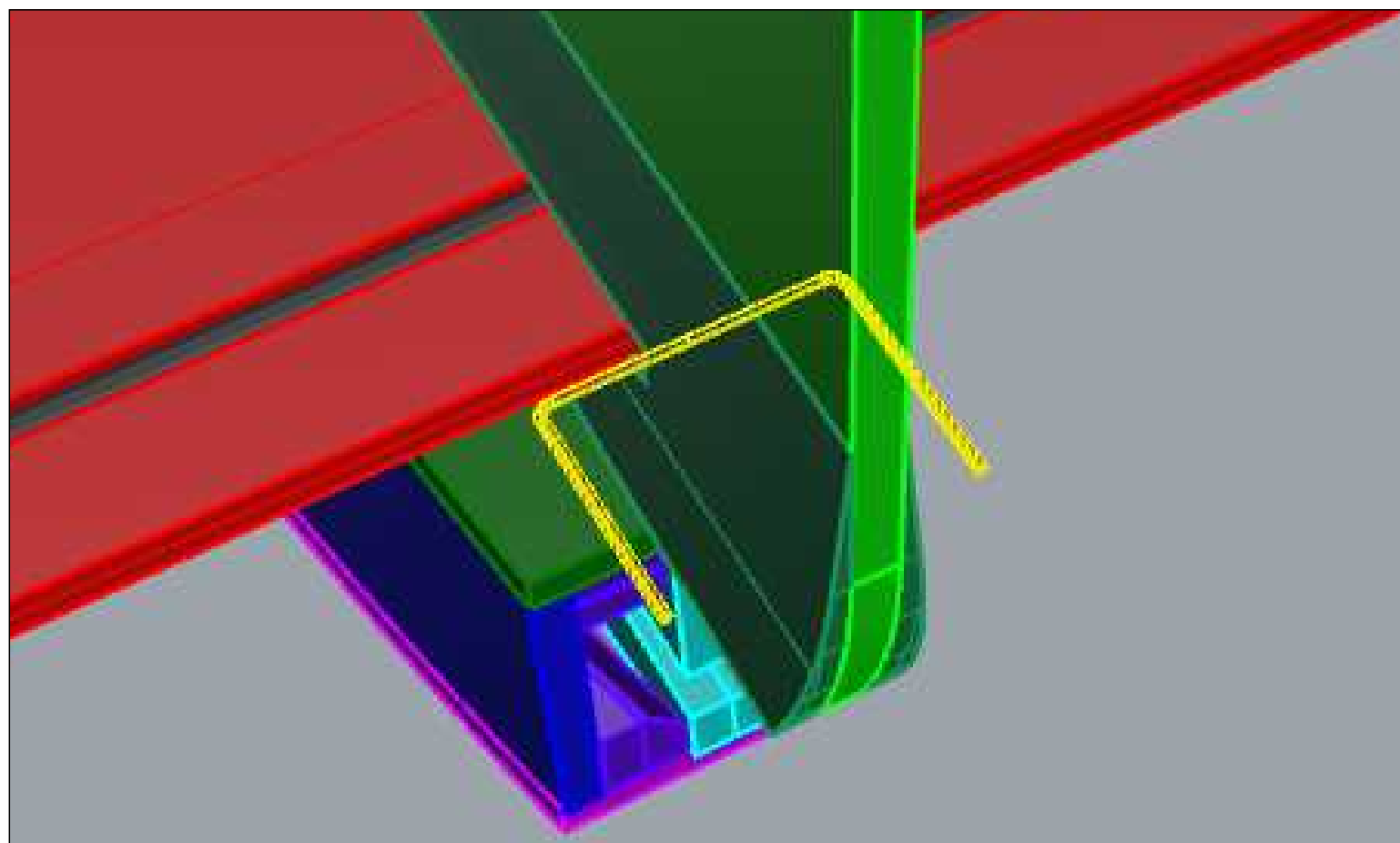


Glue the carbon tube into the horizontal stabiliser as per the wing method.

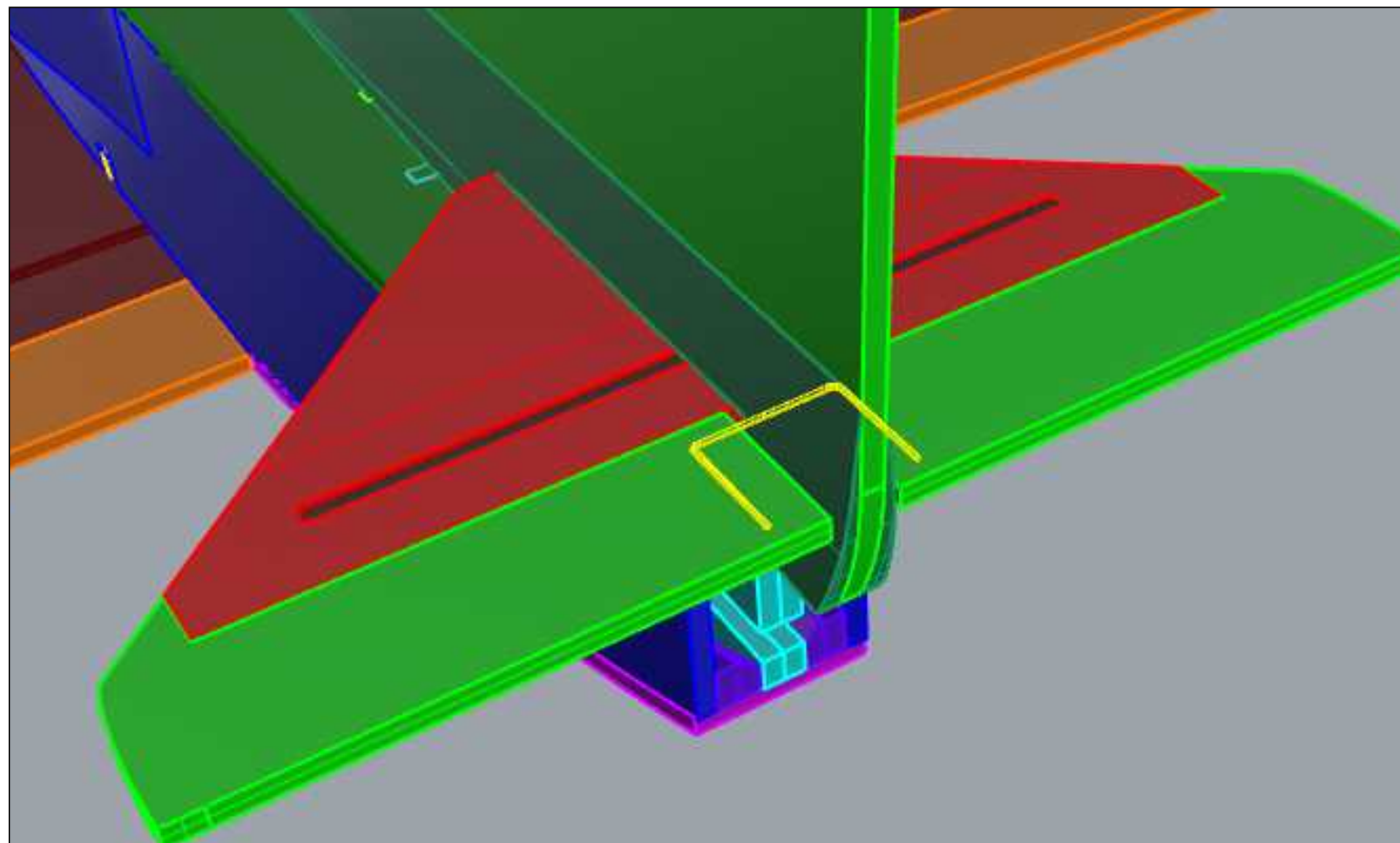


Carefully mark up the horizontal stabiliser to ensure it will be fitted on centreline. then glue in place using epoxy glue.

Note : there is a gap at the rear of the slot deliberately.

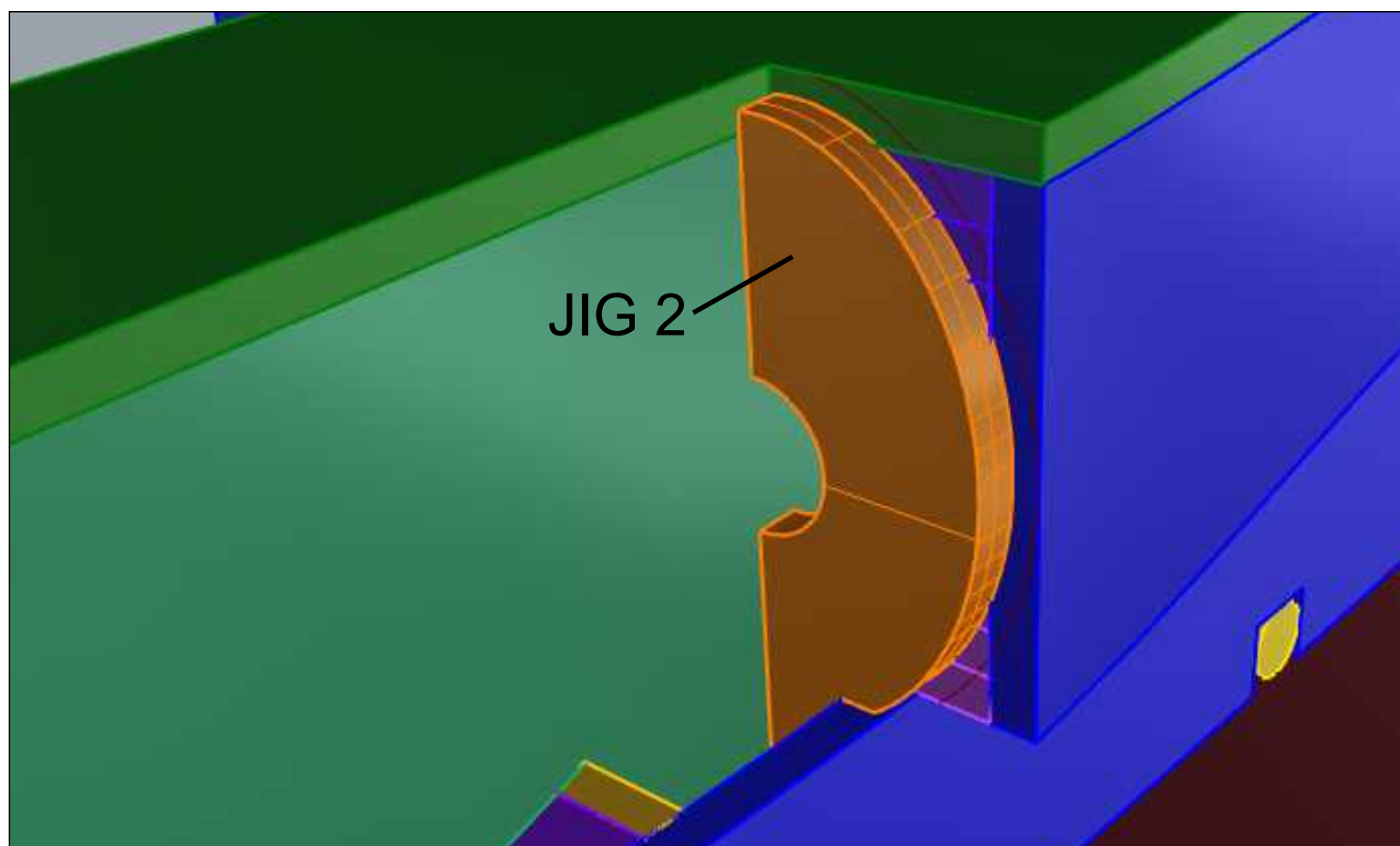
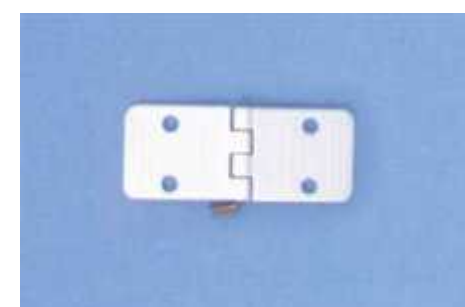


Bend some piano wire to shape and pass it through the hole at the back of the horizontal stabiliser as shown.

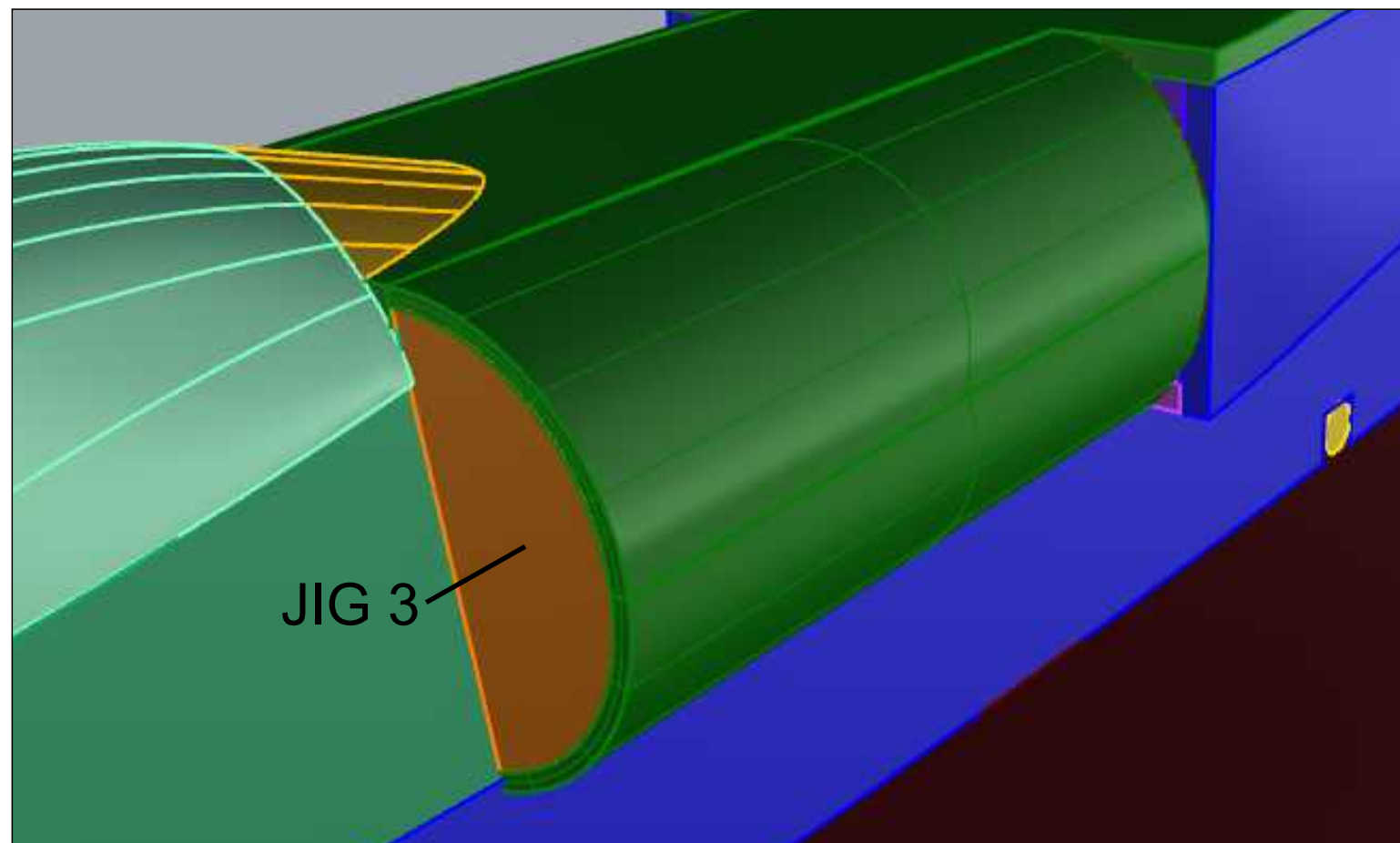


Using 2 mini graupner hinges (see image below) on each side of the elevator, dry fit the elevator onto the horizontal stabiliser, making holes into the depron with the piano wire so that both sides move together.

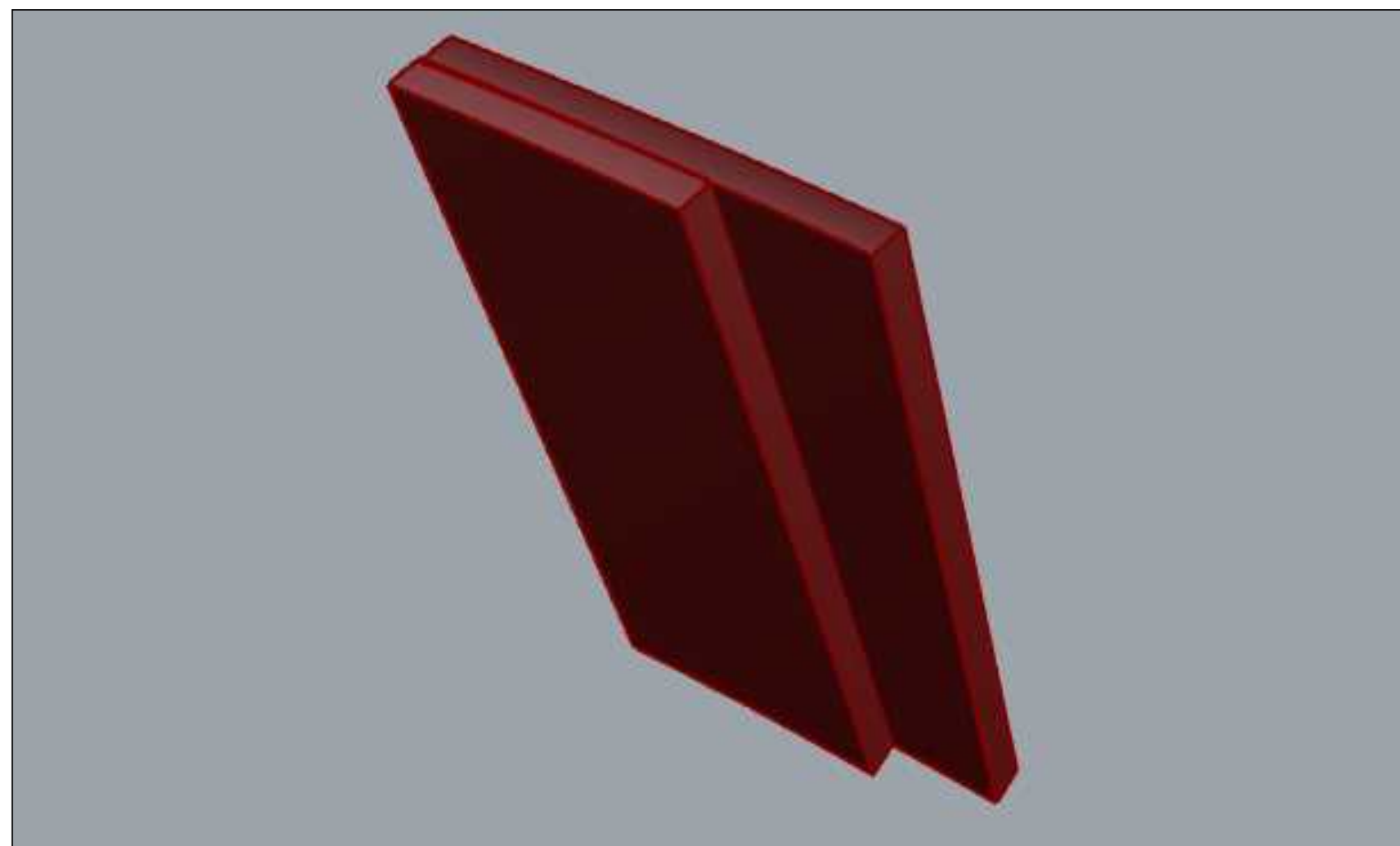
Glue mini hinges in place using hot-melt glue.



Using the **smaller jig** - mark on the fuselage the inner line. (3mm offset the outer line). then remove and using sandpaper wrapped around a finger, sand smooth the inside of the air intakes to reduce as much drag as possible. This is especially important for the EDF version.

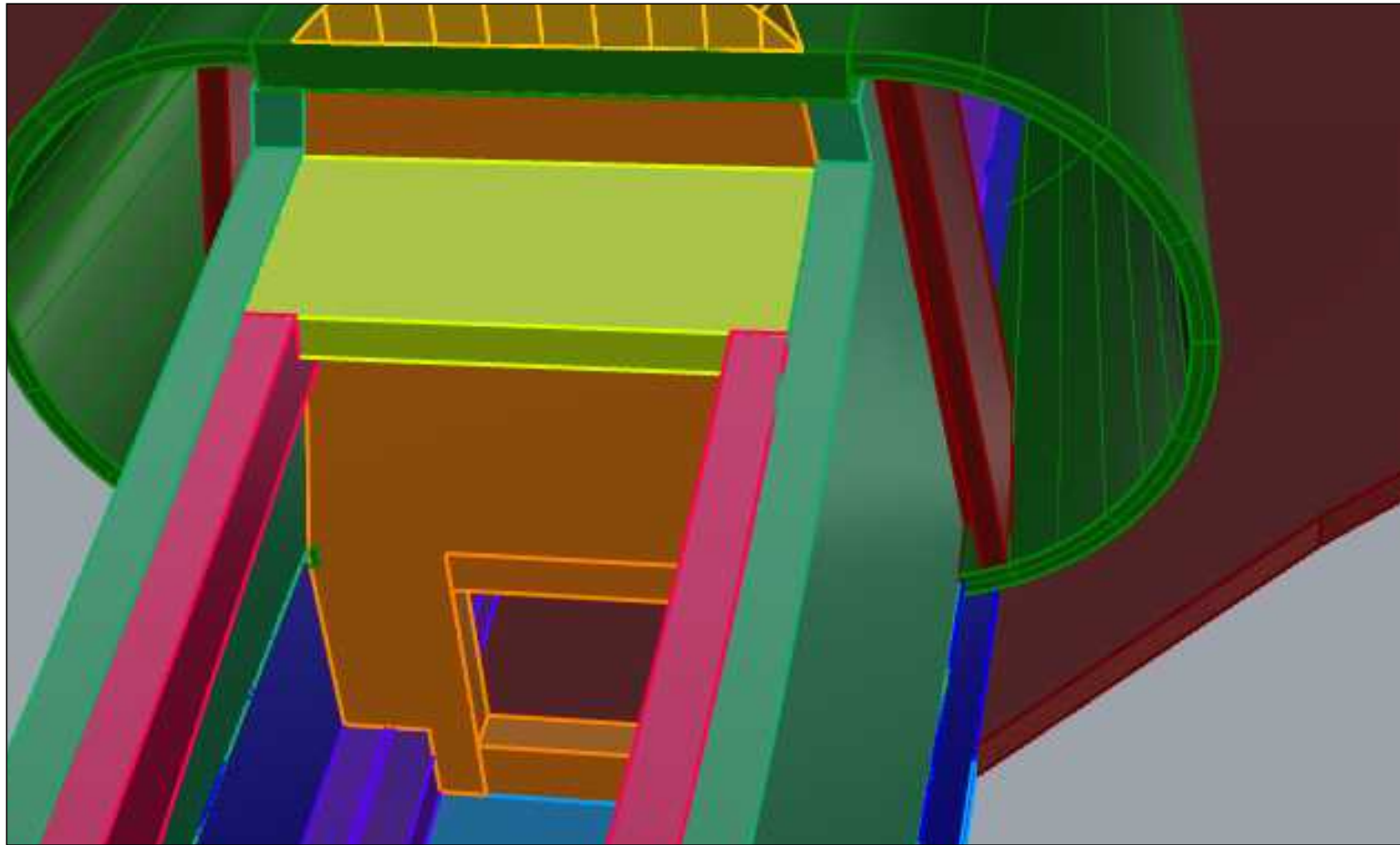


Using the 3rd Jig, shape some 3mm Depron to fit the 3rd jig (shown here) and cut to fit along the edges until it fits well all around. Glue in place. This piece may need reinforcement with 0.6oz fibreglass/WBPU to prevent it collapsing with a powerful EDF unit.



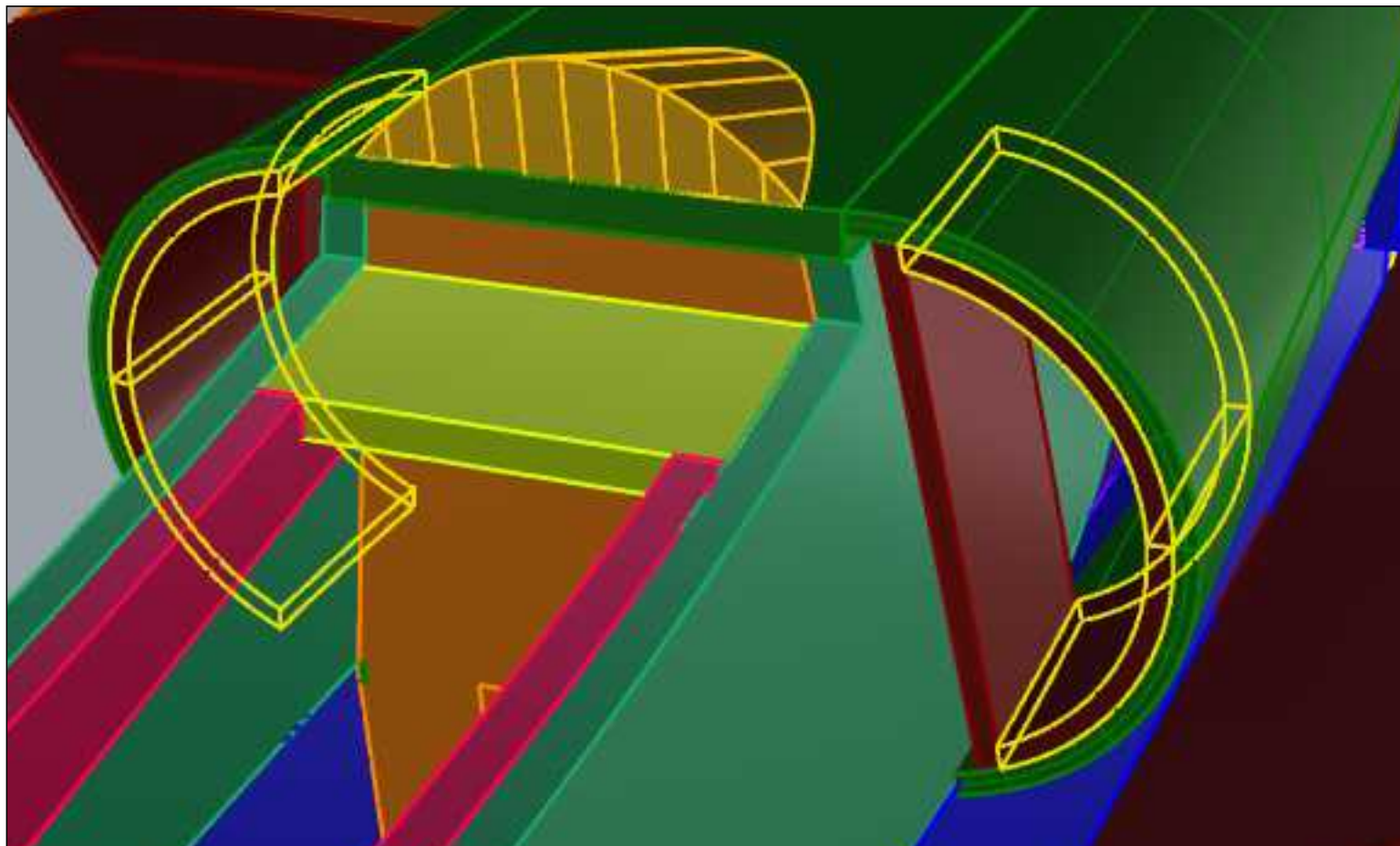
PUSHER ONLY.

Glue the two 3mm splitter parts together as shown



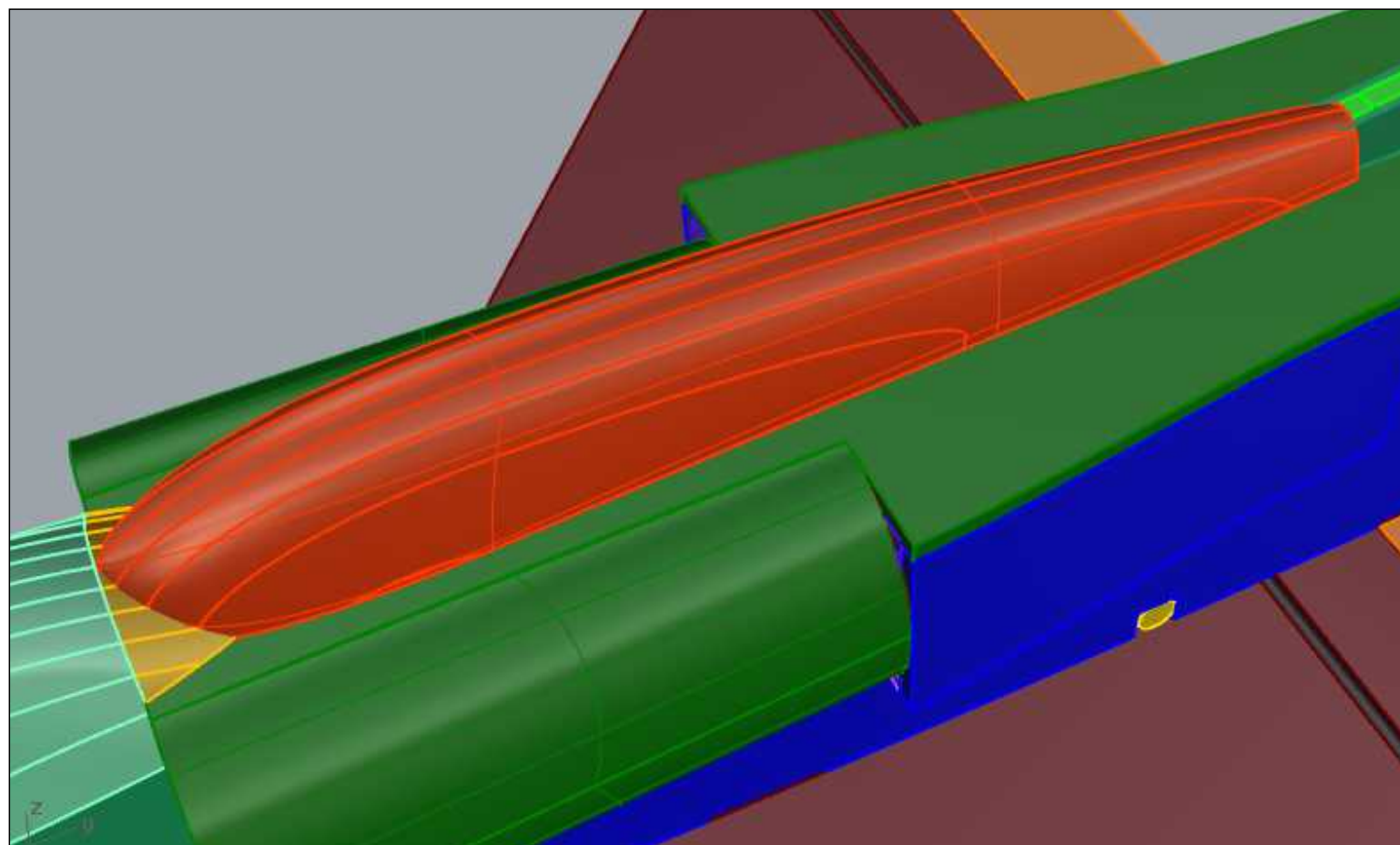
PUSHER ONLY.

Glue the splitters in place as shown.



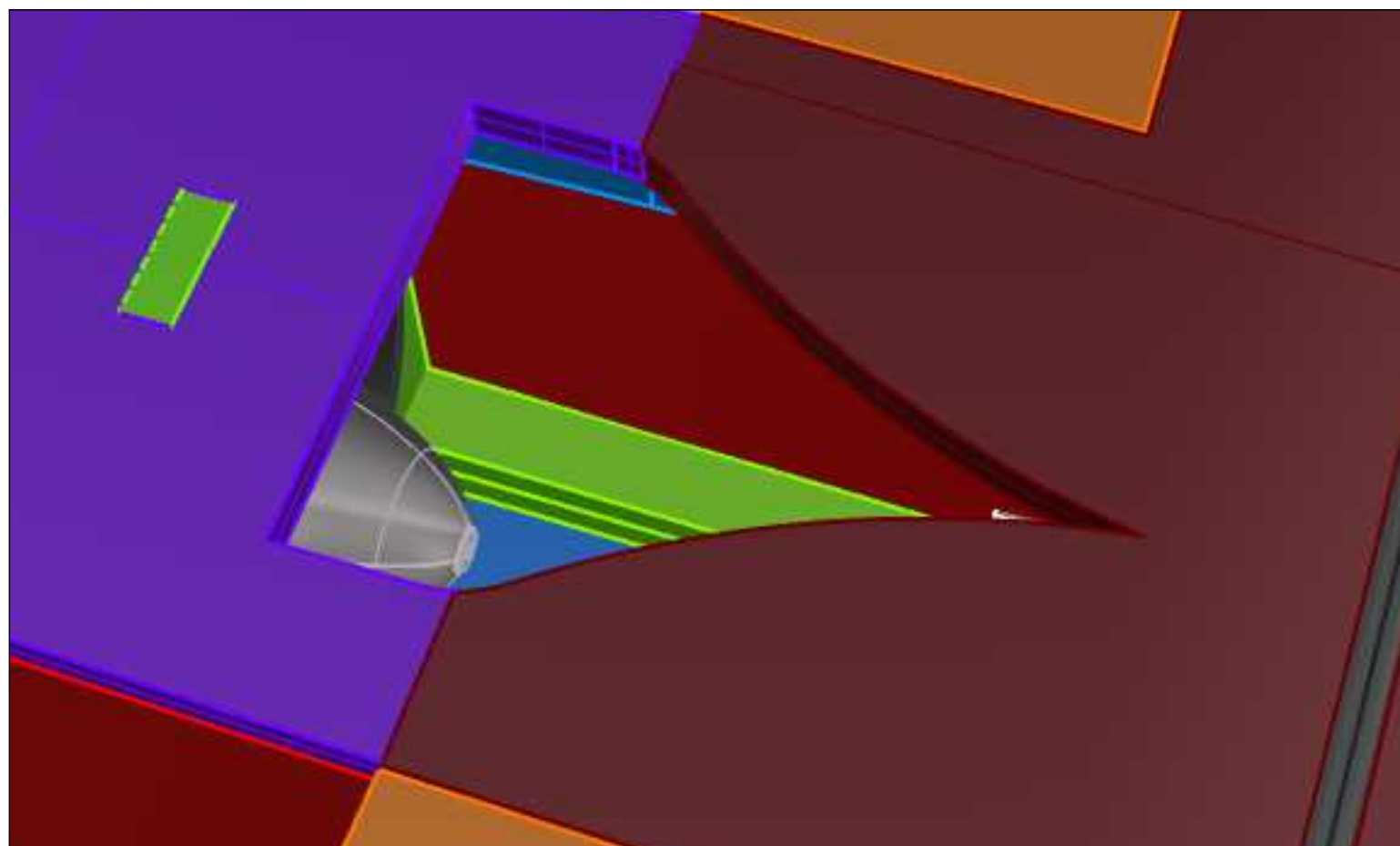
PUSHER ONLY.

Line the inside of the air intakes with another 3mm piece as shown.



OPTIONAL

Depending on the model of Skyhawk you wish to make, you can include the hump on the back of the fuselage. This is made the same method as the nose and canopy. Sand the forward face and cut away the parts of the vertical stabiliser to make it fit.



EDF ONLY.

Using the JIG as shown, cut away part of the wing and rear bottom as shown to form a 'cheater' hole. This will ensure a that the plane looks scale from the most seen side of the plane, while optimising the EDF airflow to ensure maximum performance.



Sand and shape your model to represent the real thing. Use photos as reference