

JETWORKS



Avro
Vulcan
Large Parkjet



1st Generation Jet Bomber

Construction Guide

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Vulcan History

The Avro Vulcan (later Hawker Siddeley Vulcan[2] from July 1963)[3] is a jet-powered tailless delta wing high-altitude strategic bomber, which was operated by the Royal Air Force (RAF) from 1956 until 1984. Aircraft manufacturer A.V. Roe and Company (Avro) designed the Vulcan in response to Specification B.35/46.

Of the three V bombers produced, the Vulcan was considered the most technically advanced and hence the riskiest option. Several scale aircraft, designated Avro 707, were produced to test and refine the delta wing design principles.

The Vulcan B.1 was first delivered to the RAF in 1956; deliveries of the improved Vulcan B.2 started in 1960. The B.2 featured more powerful engines, a larger wing, an improved electrical system and electronic countermeasures (ECM); many were modified to accept the Blue Steel missile. As a part of the V-force, the Vulcan was the backbone of the United Kingdom's airborne nuclear deterrent during much of the Cold War.

Although the Vulcan was typically armed with nuclear weapons, it was capable of conventional bombing missions, a capability which was used in Operation Black Buck during the Falklands War between the United Kingdom and Argentina in 1982.

The Vulcan had no defensive weaponry, initially relying upon high-speed high-altitude flight to evade interception.

After retirement by the RAF one example, B.2 XH558, named "The Spirit of Great Britain" was restored for use in display flights and air shows, whilst two other B.2s, XL426 and XM655, have been kept in taxiable condition for ground runs and demonstrations at London Southend Airport and Wellesbourne Mountford Airfield respectively. B.2 XH558 flew for the last time in October 2015, before also being kept in taxiable condition at Robin Hood Airport, Doncaster.

Designers Notes

My family, more specifically my mother has always marvelled at the jet age and military aircraft that thrilled her so much when we used to live under a military flight path.

Out of all of the aircraft she loved, the vulcan is her favourite and it's easy to understand why, it has such presence and makes so much noise it is a much loved British icon.

When we heard last year that XH558 would be grounded, I decided to fight the decision by making my own XH558! Hence this project. In fact we managed to witness the very last flight and final approach of the Vulcan flying to Robin hood airport, a very sad moment.

I have decided to go to a large 1.4m wingspan as it's the smallest I could design to fit two 70mm high power EDF's on board with a loud efflux sound so that it made a Jet like sound that would honour the original. It can be easily adapted to have pusher props if required.

Taking 6 sheets of depron, it is the largest jet I've built to date. It is designed to have a working bomb bay and retracts.

Thank you! and happy flying.

Craig :)

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

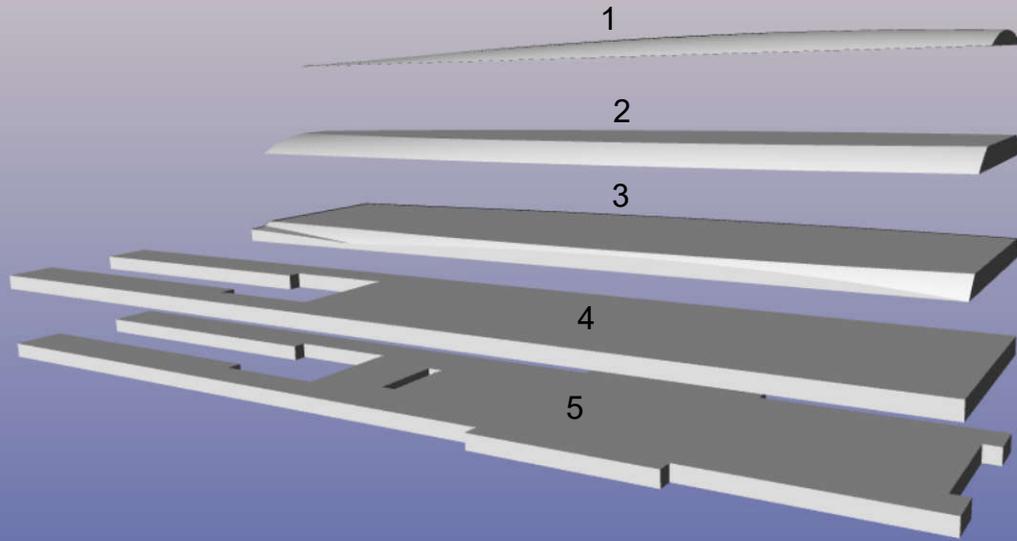
1. Print the plans,
2. Cut around each part using scissors - allow a border of approx (1/4") 6mm
3. Use either 3M spray mount or a very light coat of 3M 77 to the back of the parts and stick in an economical layout on the Depron foam.
4. Using a safety rule and craft knife over a cutting mat - important! 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.

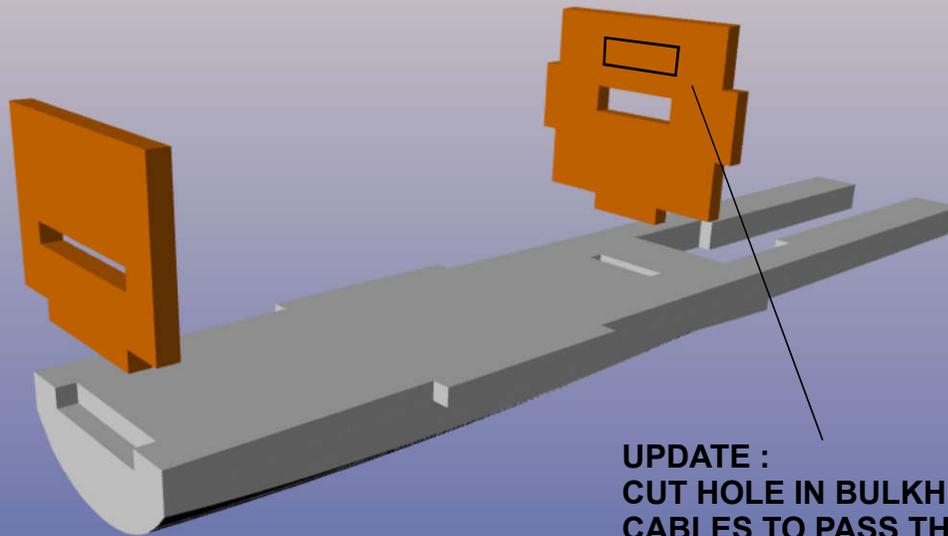
Forward fuselage belly



Laminate the forward fuselage belly pieces together using either 3M 77 or UHU Por.



Stick bulkhead 1 and 2 onto the fuselage belly assembly using UHU por.

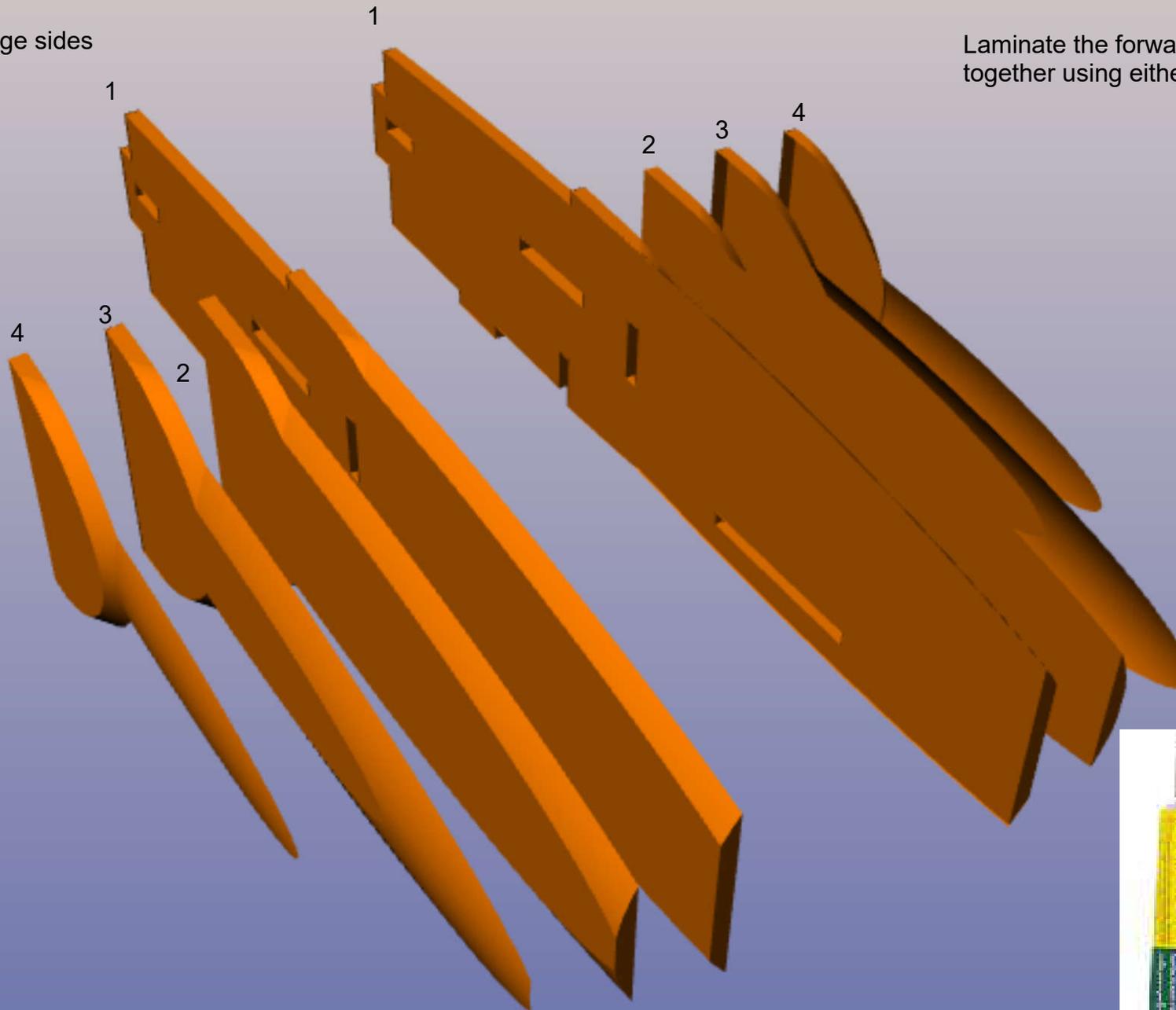


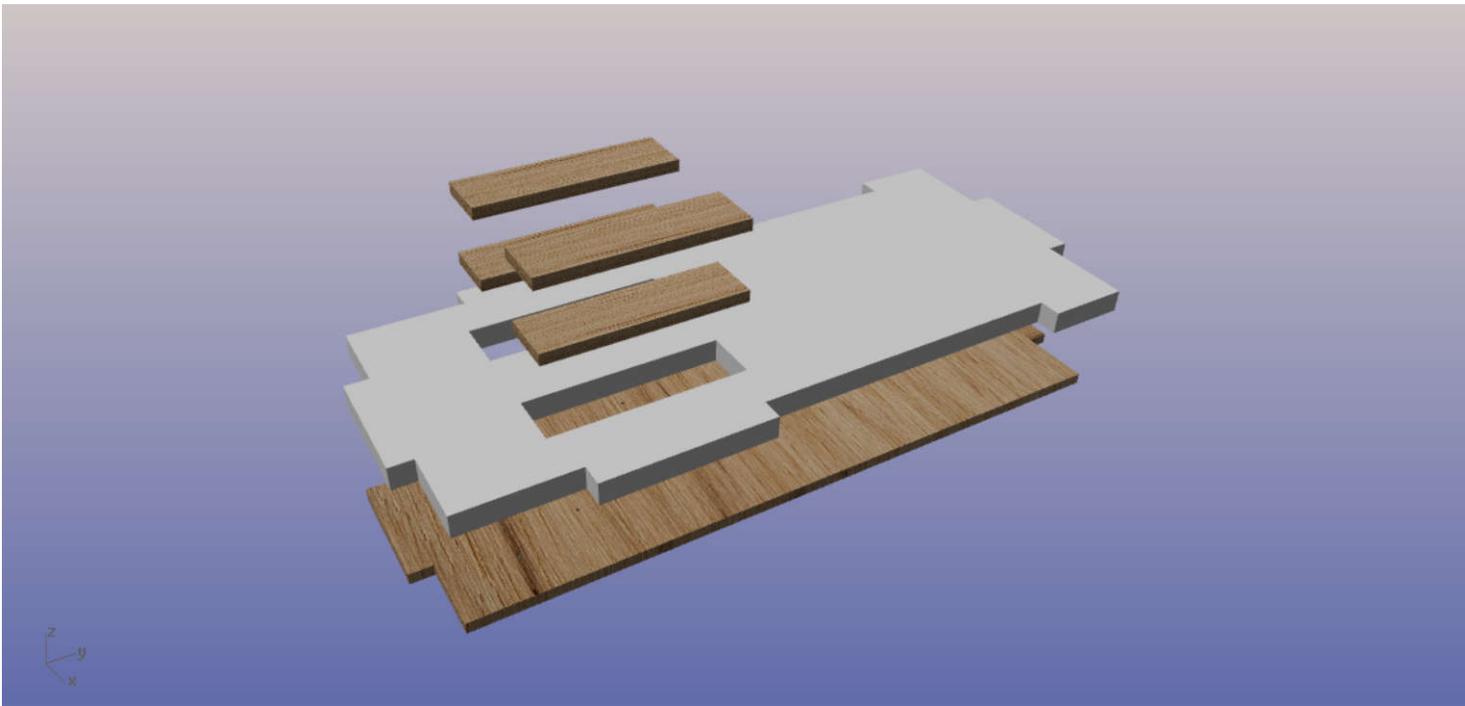
UPDATE :
CUT HOLE IN BULKHEAD 3 FOR
CABLES TO PASS THROUGH



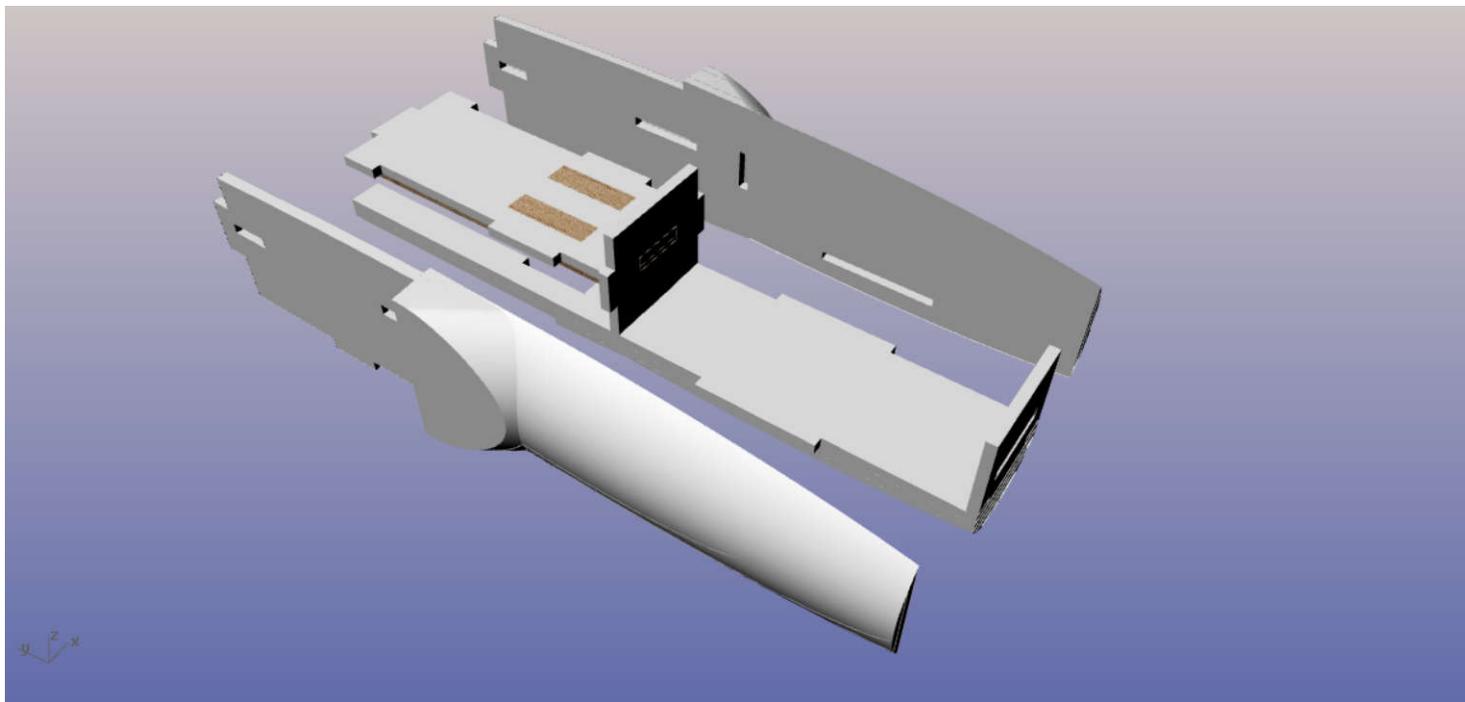
Forward fuselage sides

Laminate the forward fuselage side pieces together using either 3M 77 or UHU Por.



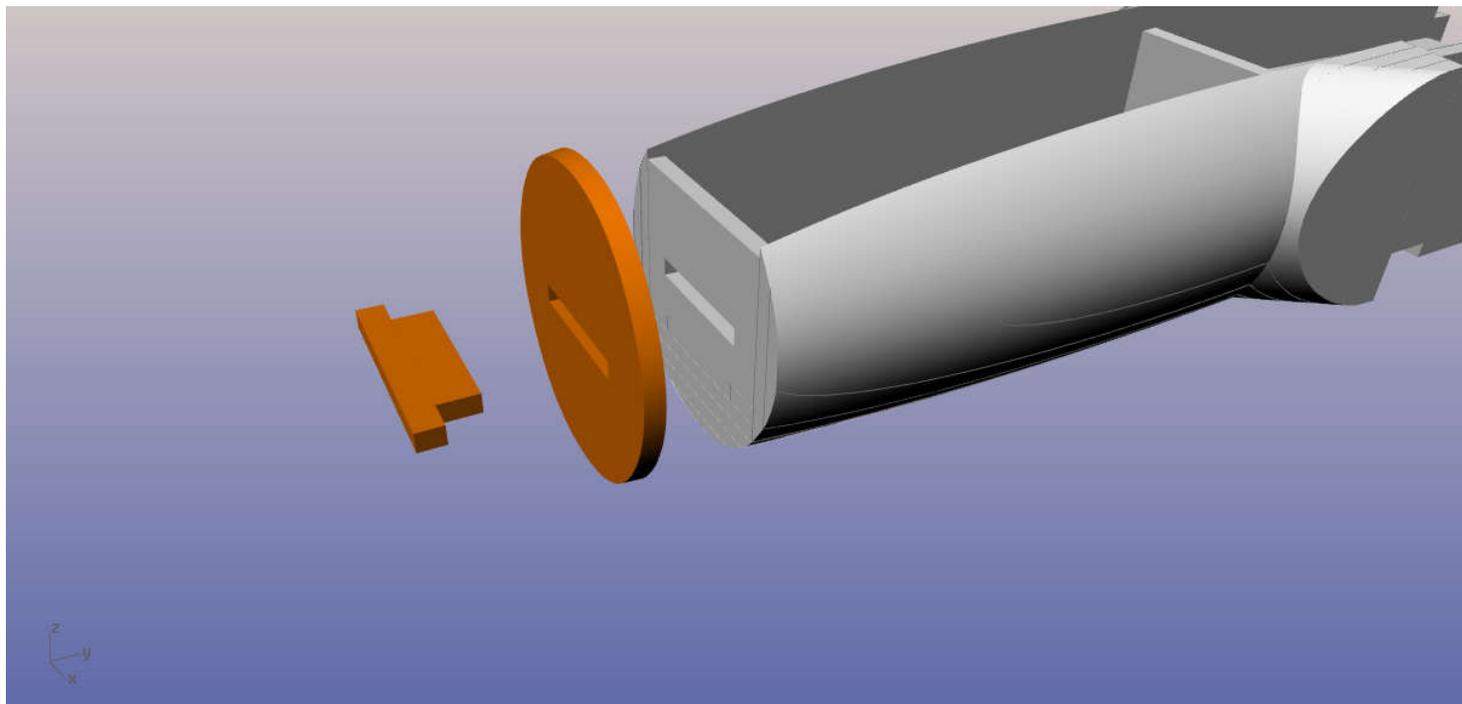


Assemble the forward retract base, using 3mm lite ply glued to depron using UHU Por.

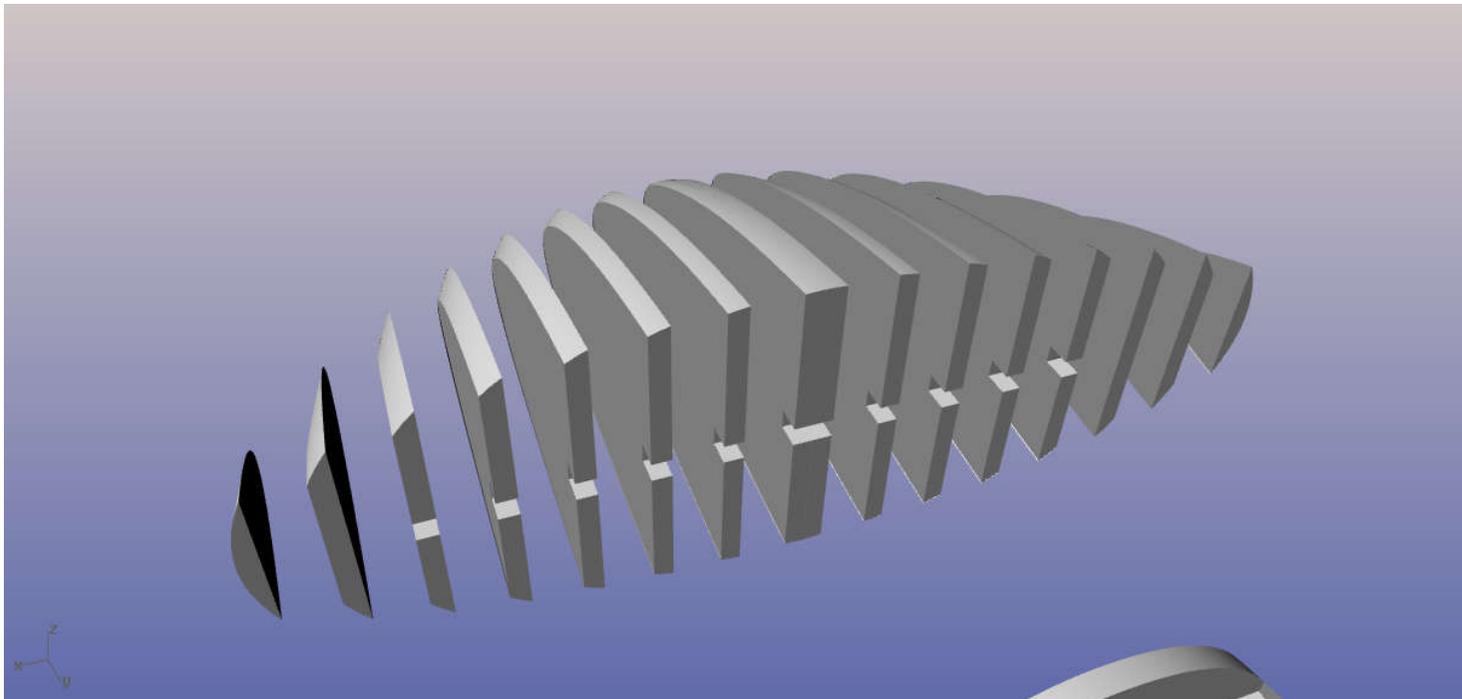


Glue together the 4 sub assemblies to make the forward fuselage assembly using UHU por.



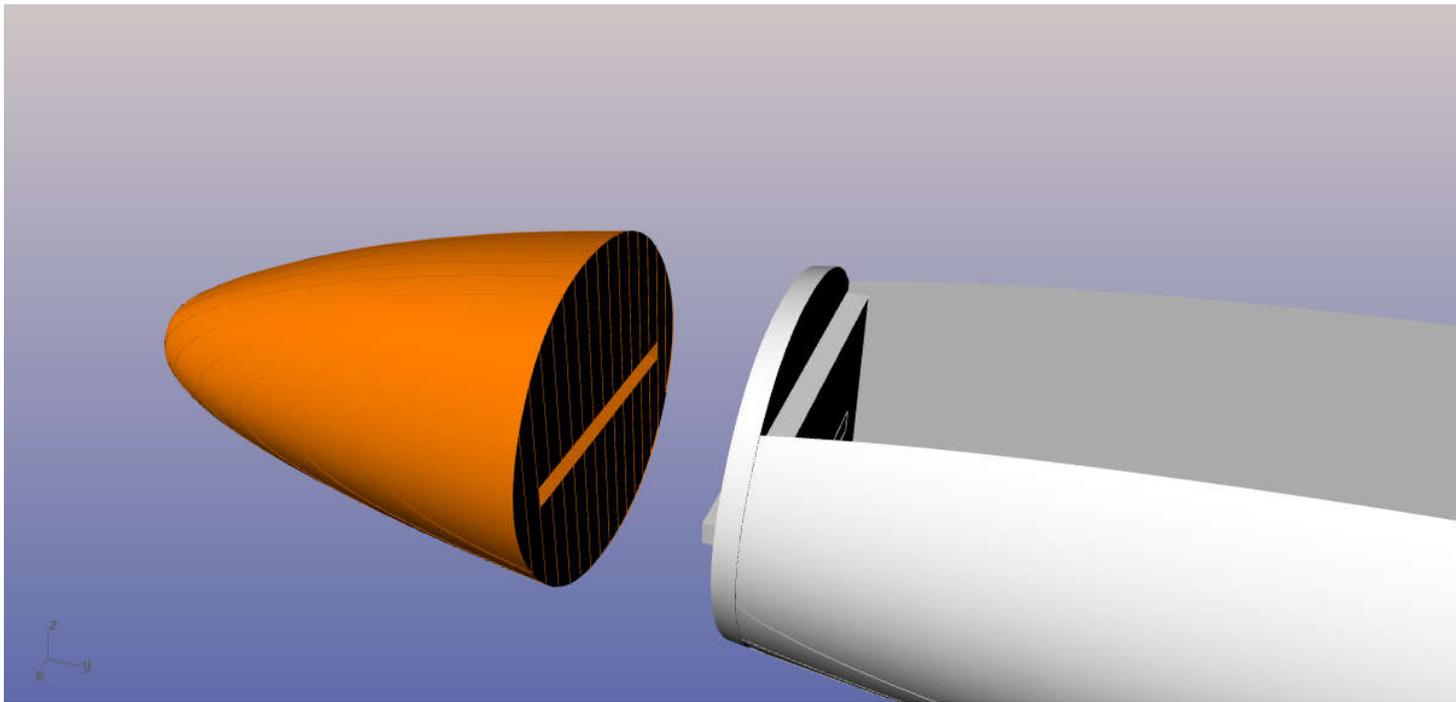


Glue bulkhead1 in place using the nose cone alignment piece.



Assemble nosecone, by laminating the 16 pieces together as shown, starting in the middle.

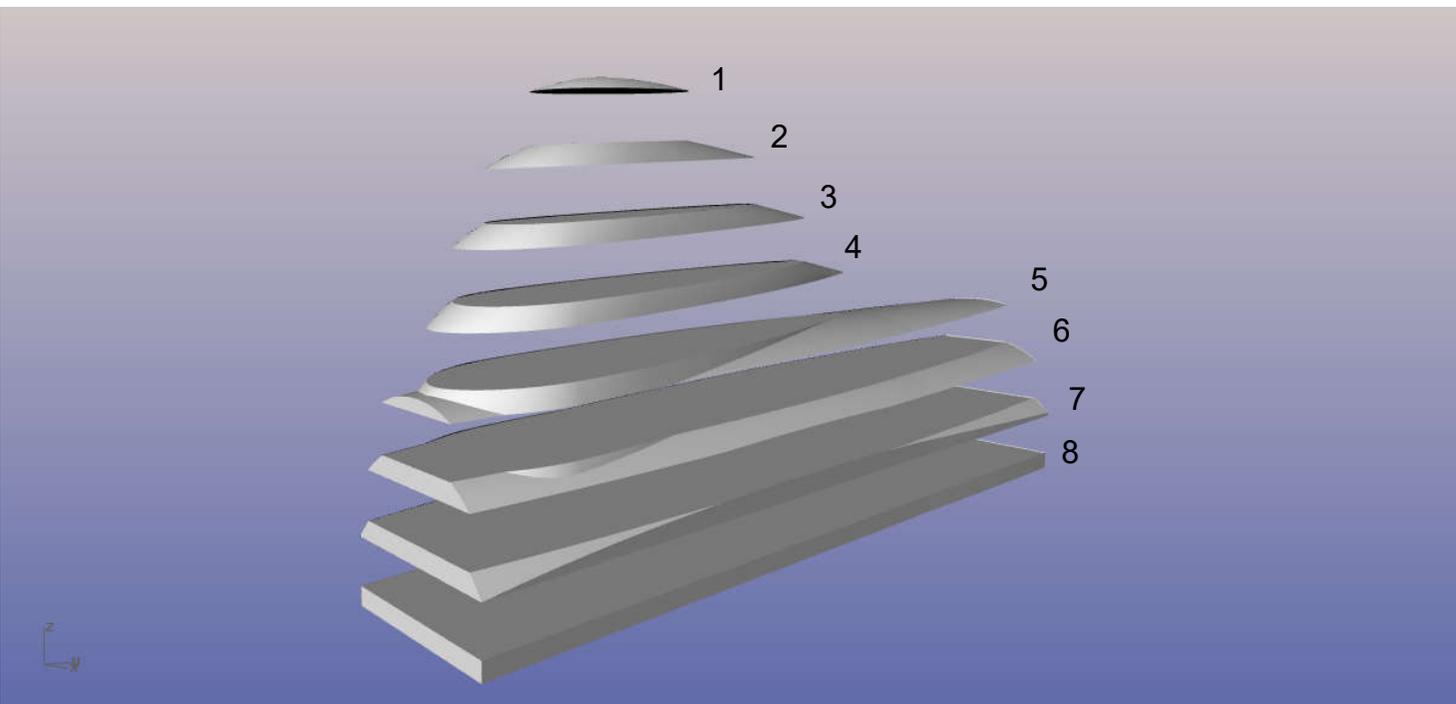


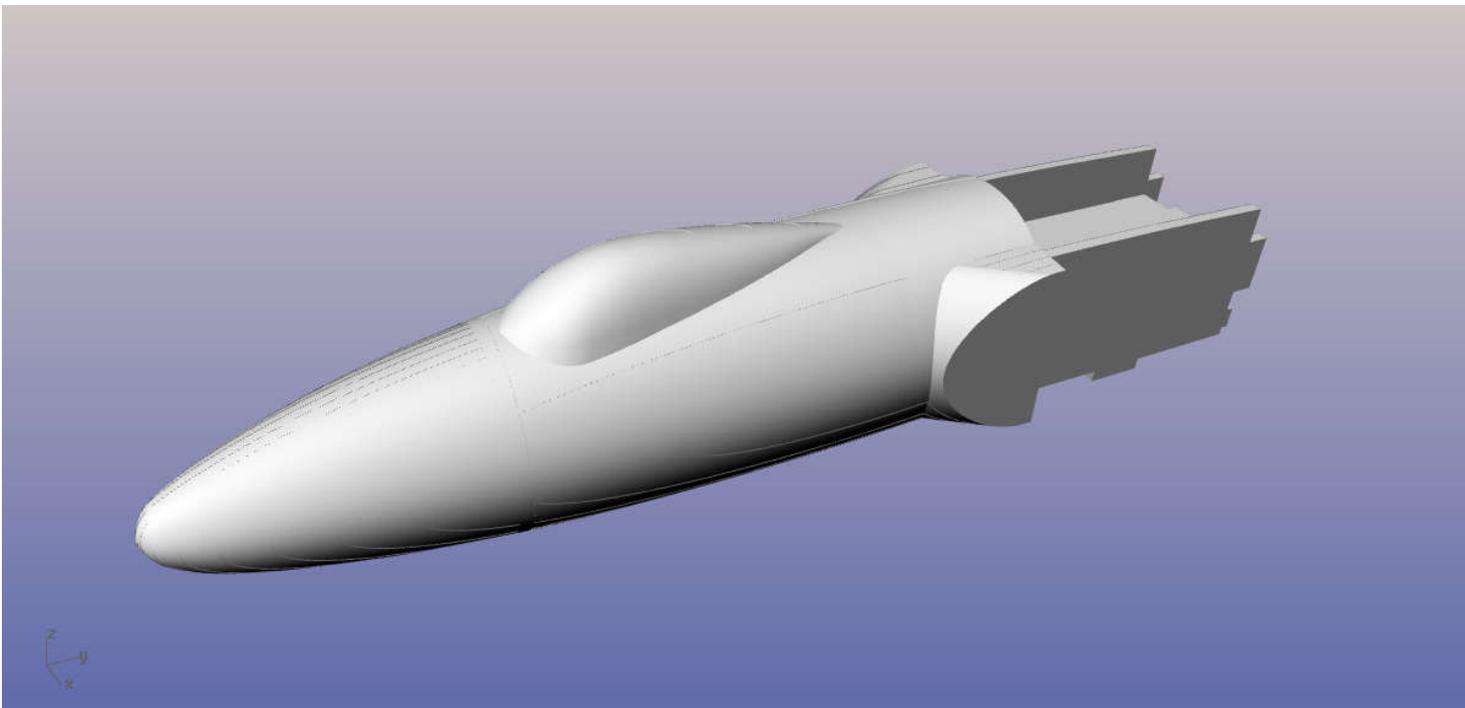


Glue the nosecone in place.



Assemble canopy, by laminating the 8 pieces together as shown, starting in the middle.



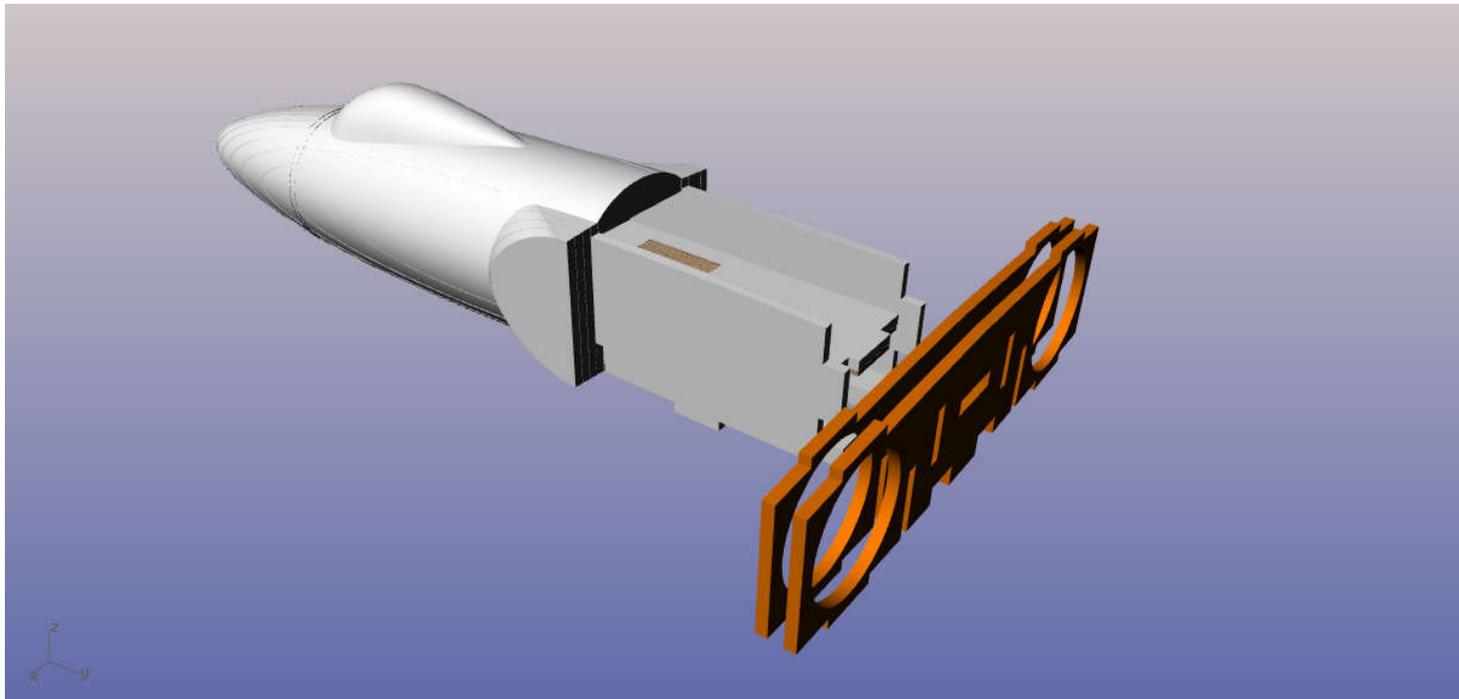


Sand the contoured depron to shape. The canopy piece is not glued to the assembly, so it can be removed to access electronics etc

Construction guide update :-

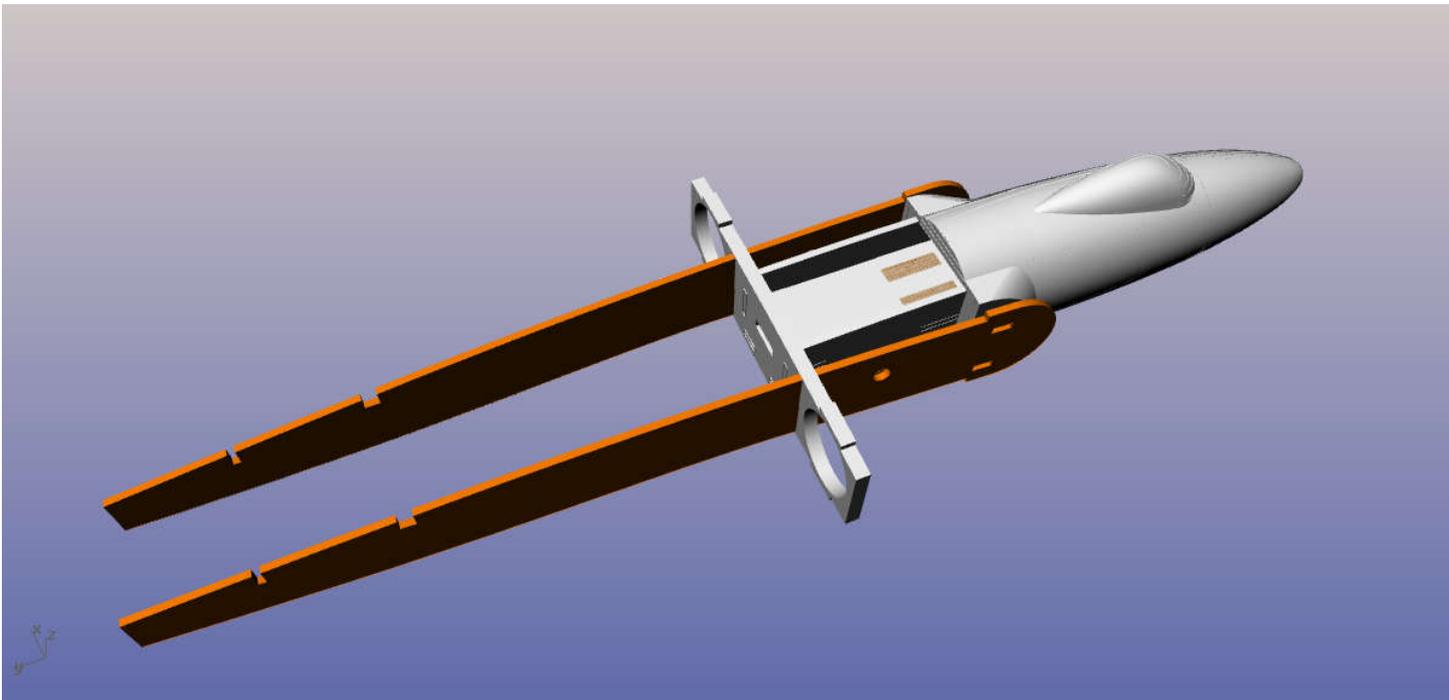
Please mount the forward retract at this stage (see later on in the manual) and fit the steering servo into the forward fuselage sides before the aircraft is built around this area (making it difficult to mount the steering servo)

Test for full operation before proceeding to next stage.

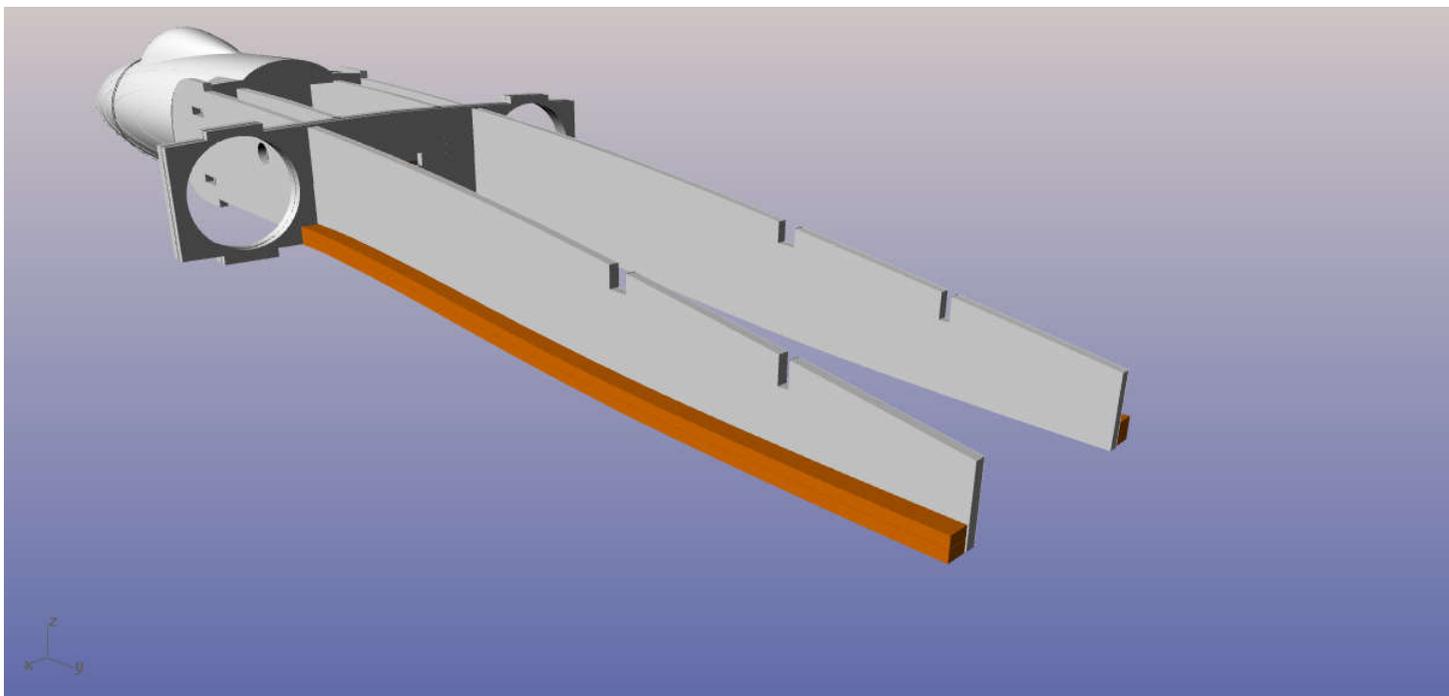


Glue together the two pieces of bulkhead 4, and then glue to the front fuselage assembly as shown.



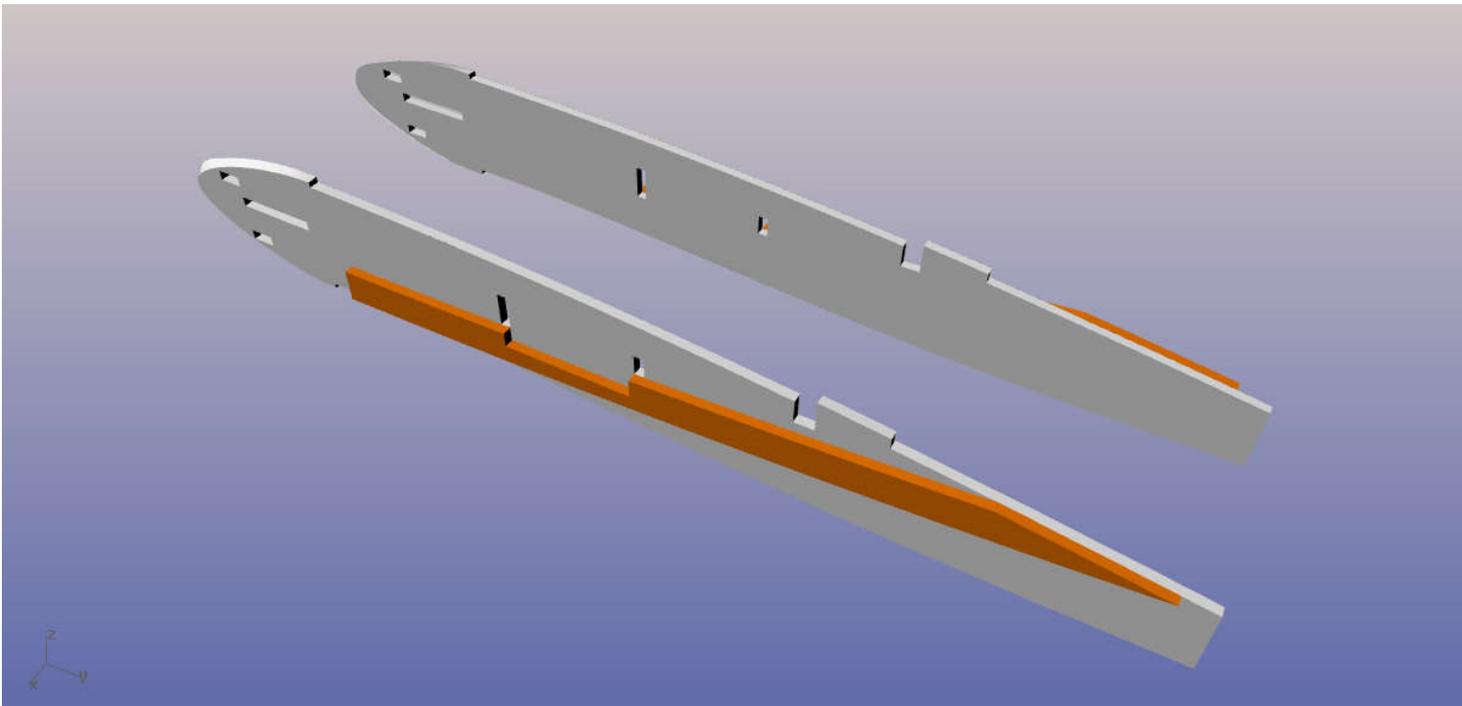


Glue the two longitudinal 1 pieces to the assembly, flex the pieces to ensure the contact adhesive works. Use a light coating of epoxy in the slots.



Glue together the 12mm wide corner reinforcement strips and then glue to longitudinal 1 pieces as shown.

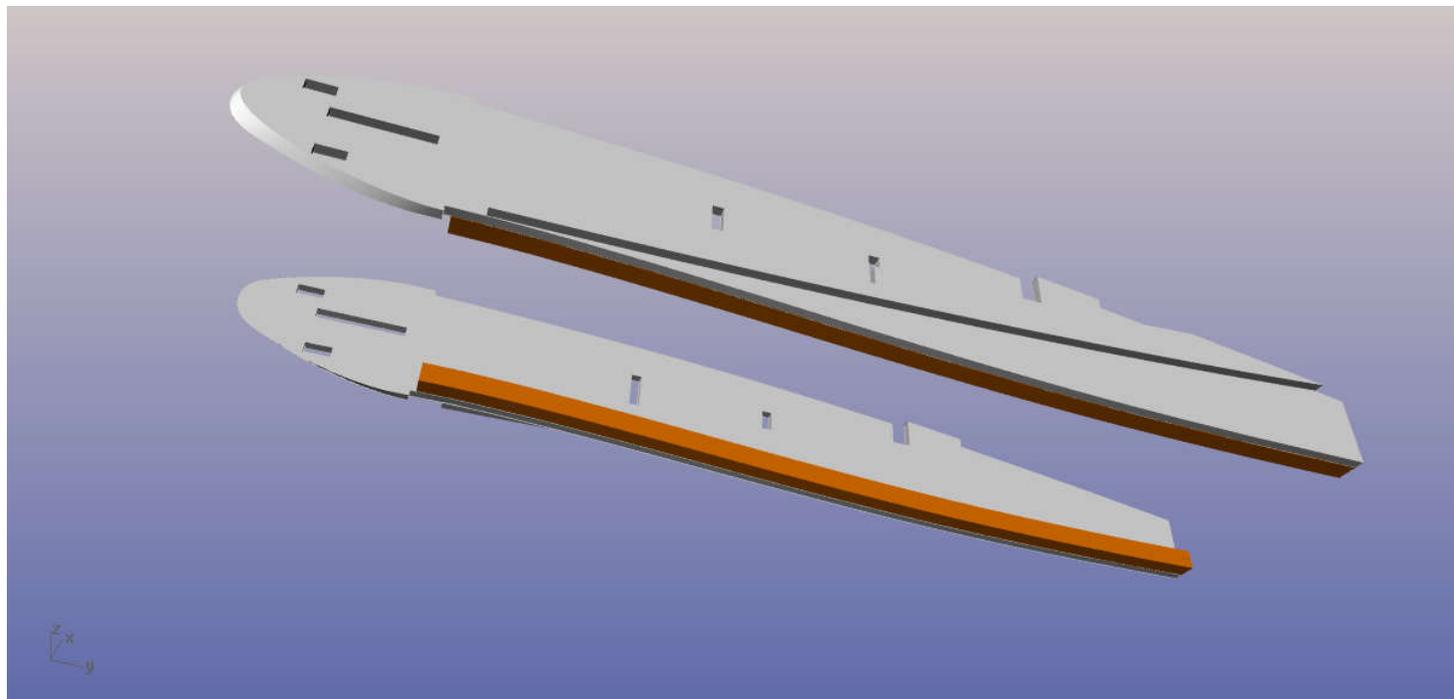




Glue the Corner braces for both Longitudinal 1 pieces in place carefully aligning vertically to the top face and bottom face in the images left and below.

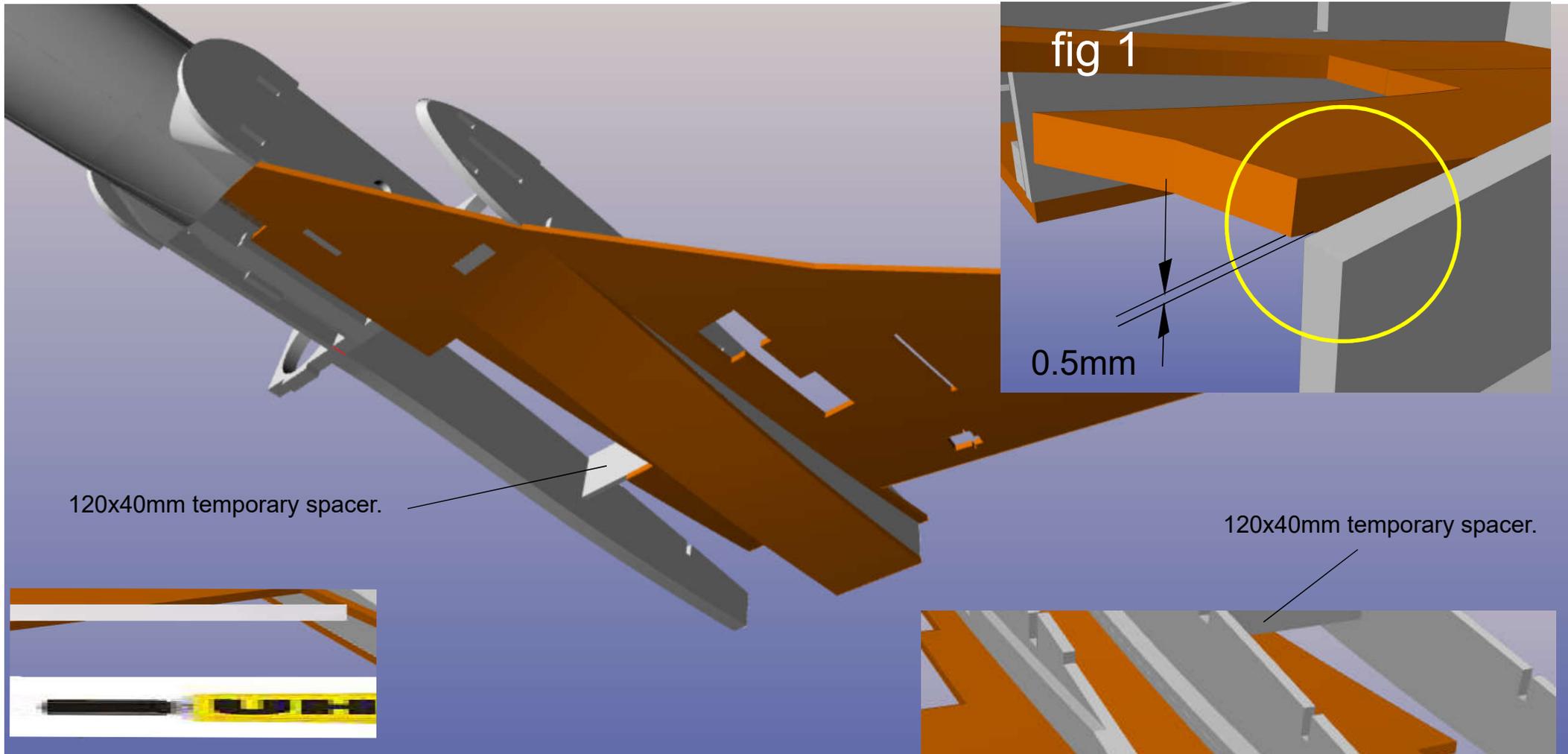
Align the cut out section horizontally with the two holes in Longitudinal 1 as shown.

Do this mirrored to both port and starboard



On each of the inside faces of the Longitudinal 1 pieces, glue 2 x 12mm corner strips as shown.





120x40mm temporary spacer.

fig 1

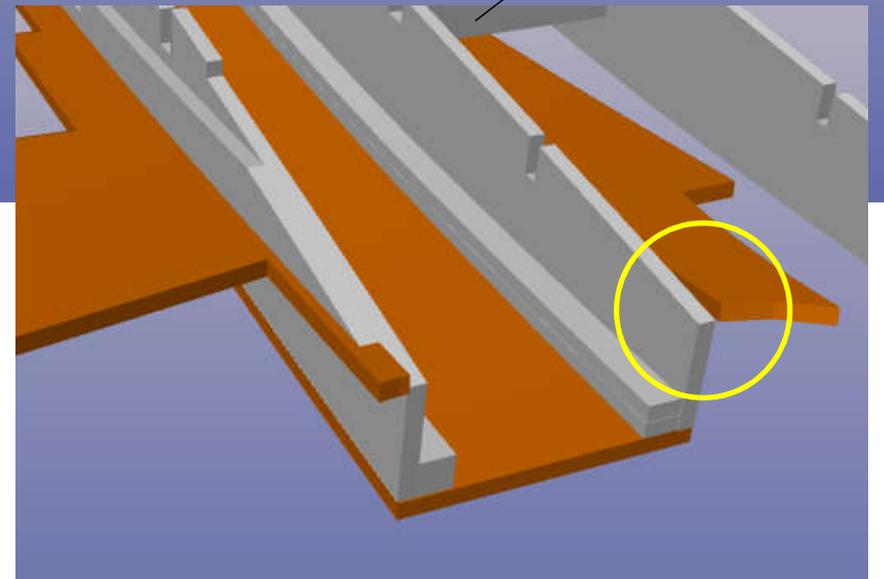
0.5mm

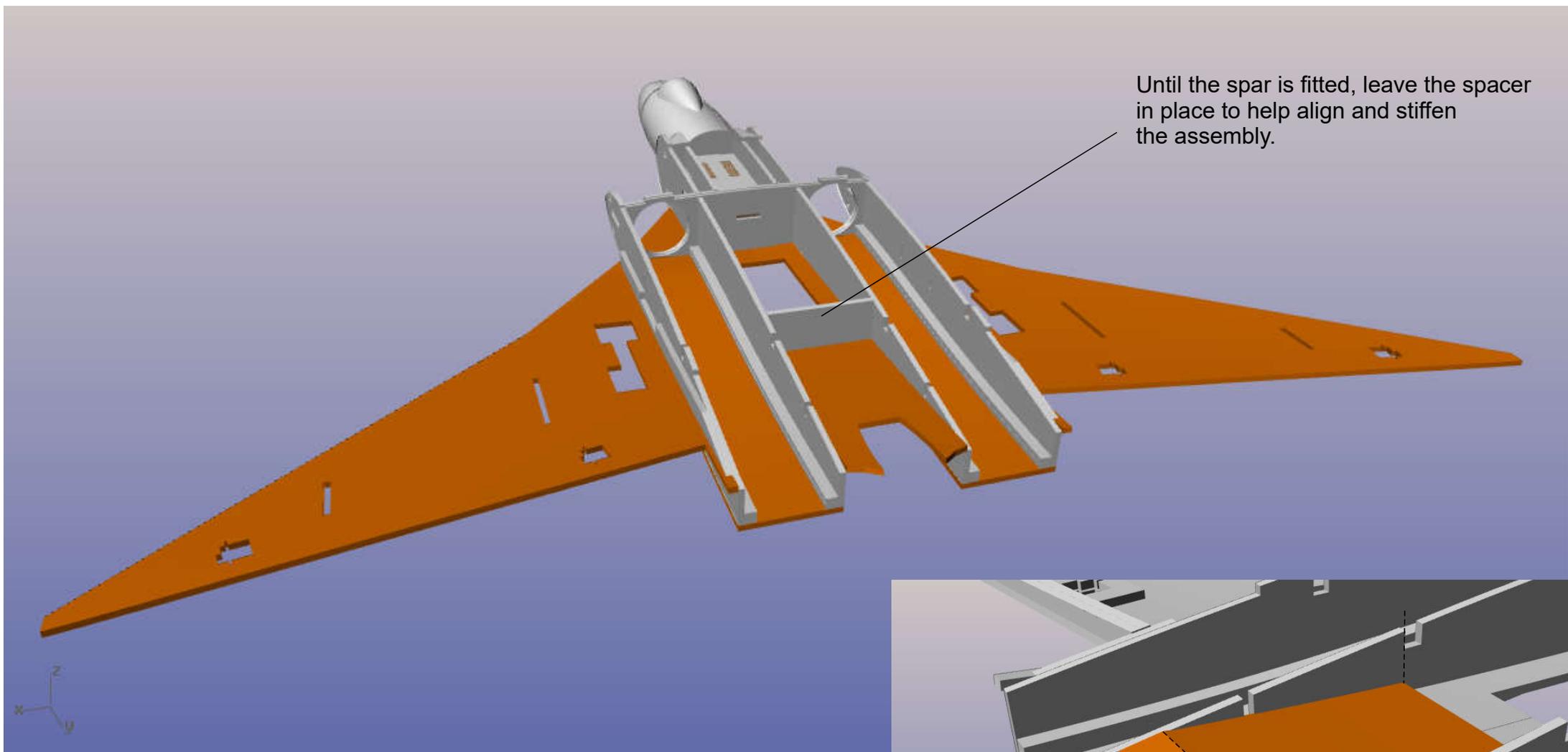
120x40mm temporary spacer.

Taking great care not to break the lower wing pieces, carefully assemble the components as shown here.

Using masking tape to hold in position use a 120mm x 40mm scrap bit of depron (or the spar) to act as a spacer aligned with the spar location to act as a guide for bending the area between the engine nacelle area.

The wing self locates onto the tabs on the fuselage assembly, with the area between the engine nacelle area, located by lifting upward (naturally curving the depron) until the end is 0.5mm above longitudinal 1. (see fig 1)

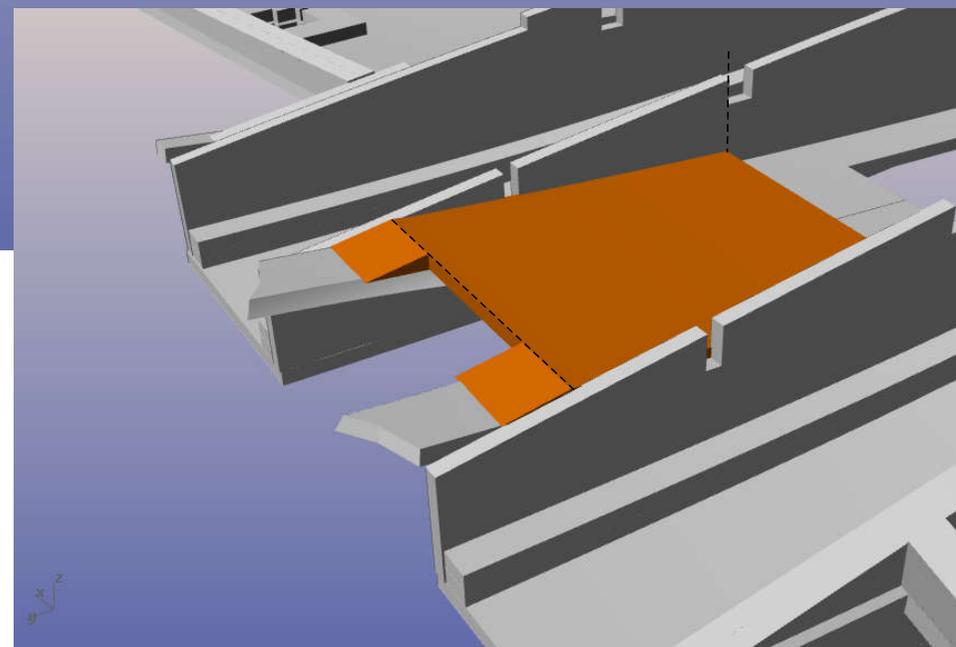
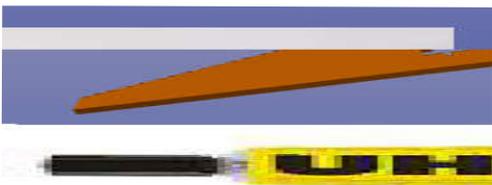


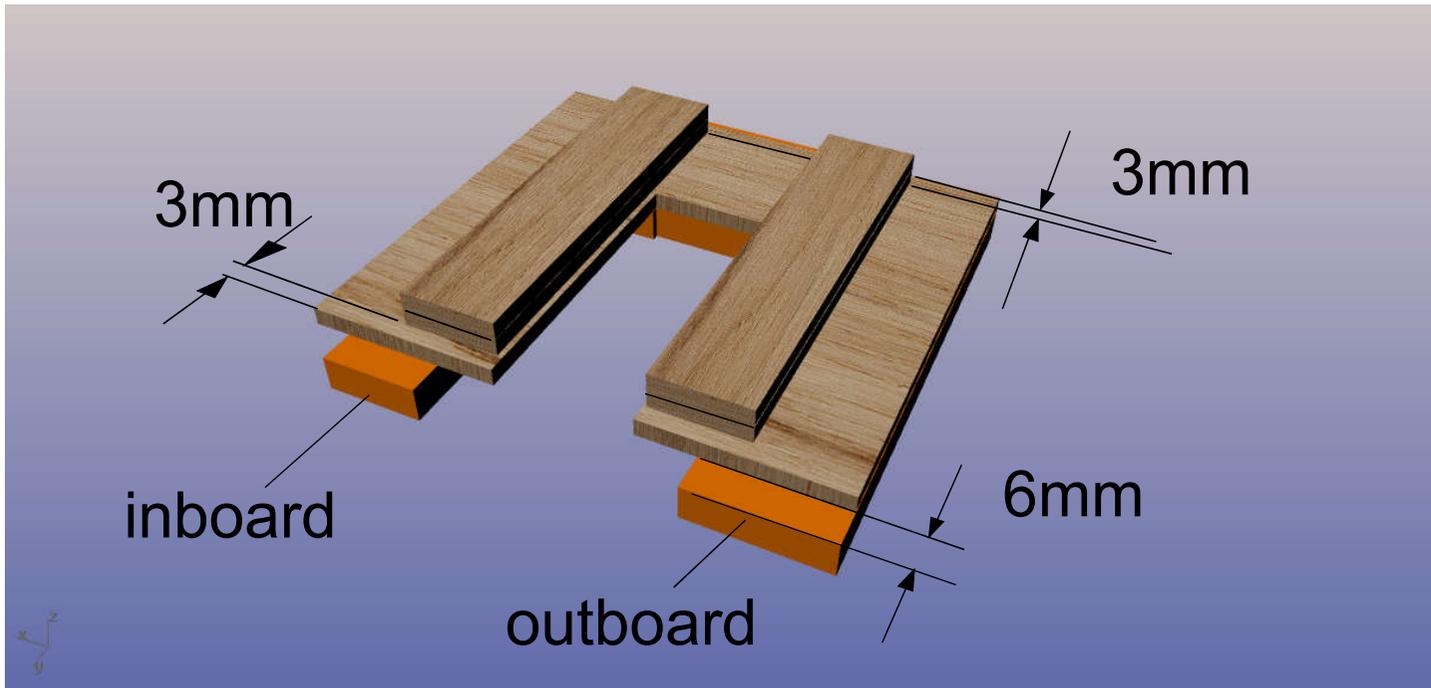


Until the spar is fitted, leave the spacer in place to help align and stiffen the assembly.

Repeat the previous step for the opposite wing.

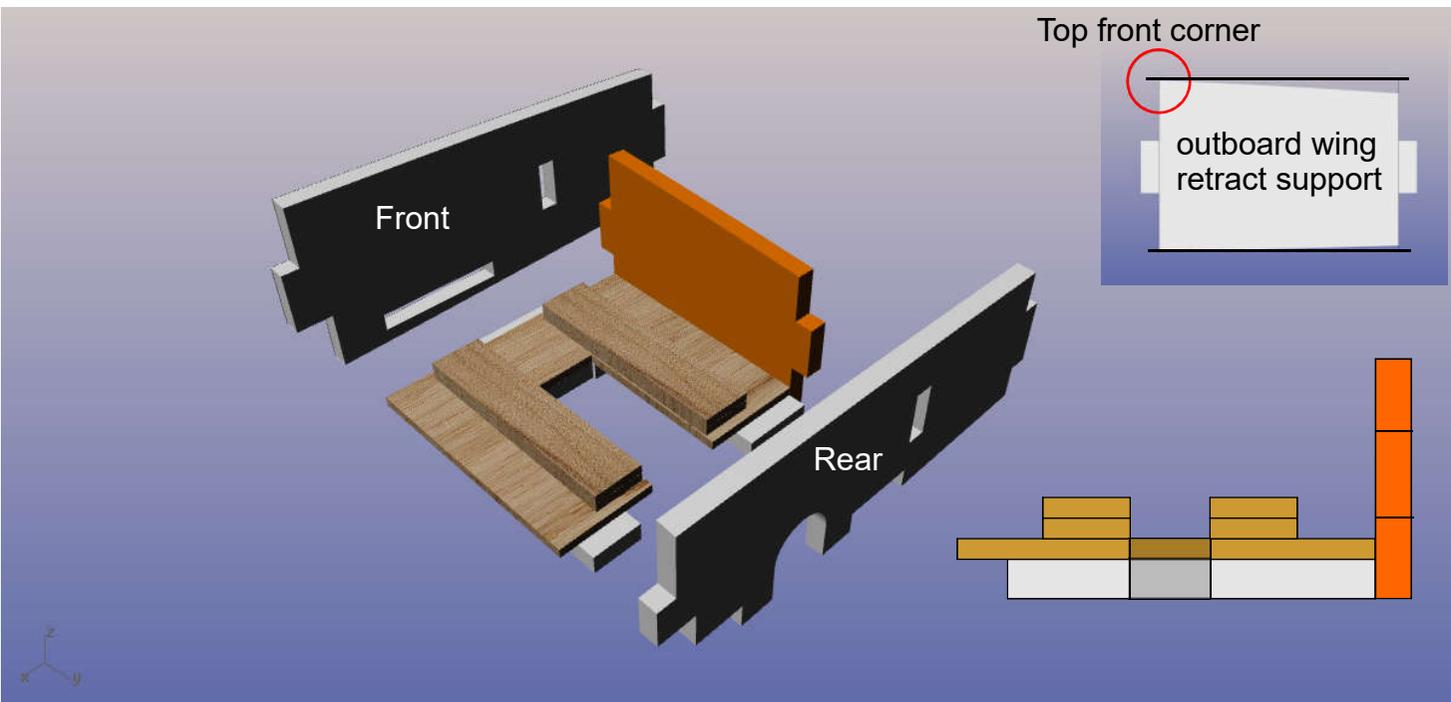
Shape the lower wing reinforcer, tapering the edge as shown here, and glue to the lower wings, ensuring that the forward edge aligns with the spar slot, and the rear edge being flush with the top edge of longitudinal 1.





Glue together the 3mm lite ply pieces as shown here, and then onto the lower wing retract support depron pieces.

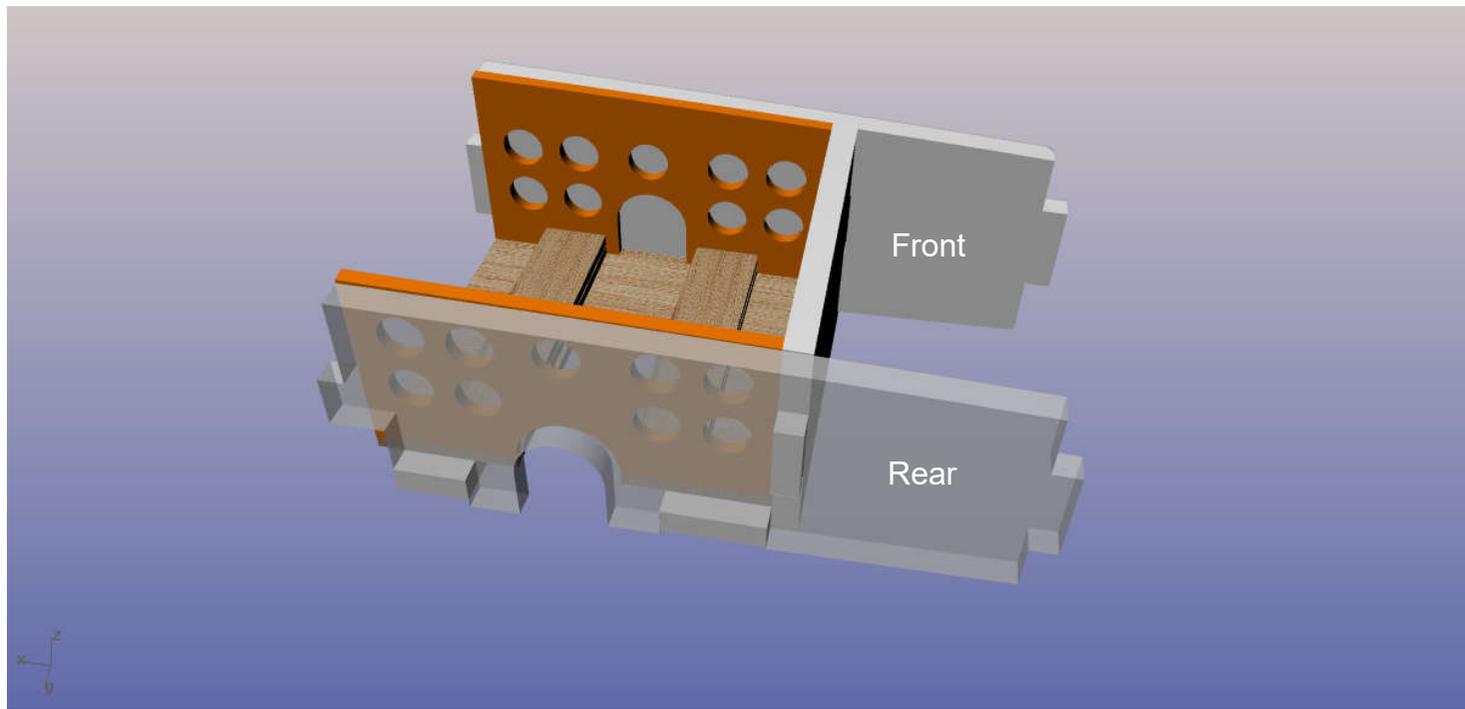
Make both mirrored assemblies.



Onto the outboard edge of the lower wing retract support piece, glue the outboard wing retract support noting the correct orientation

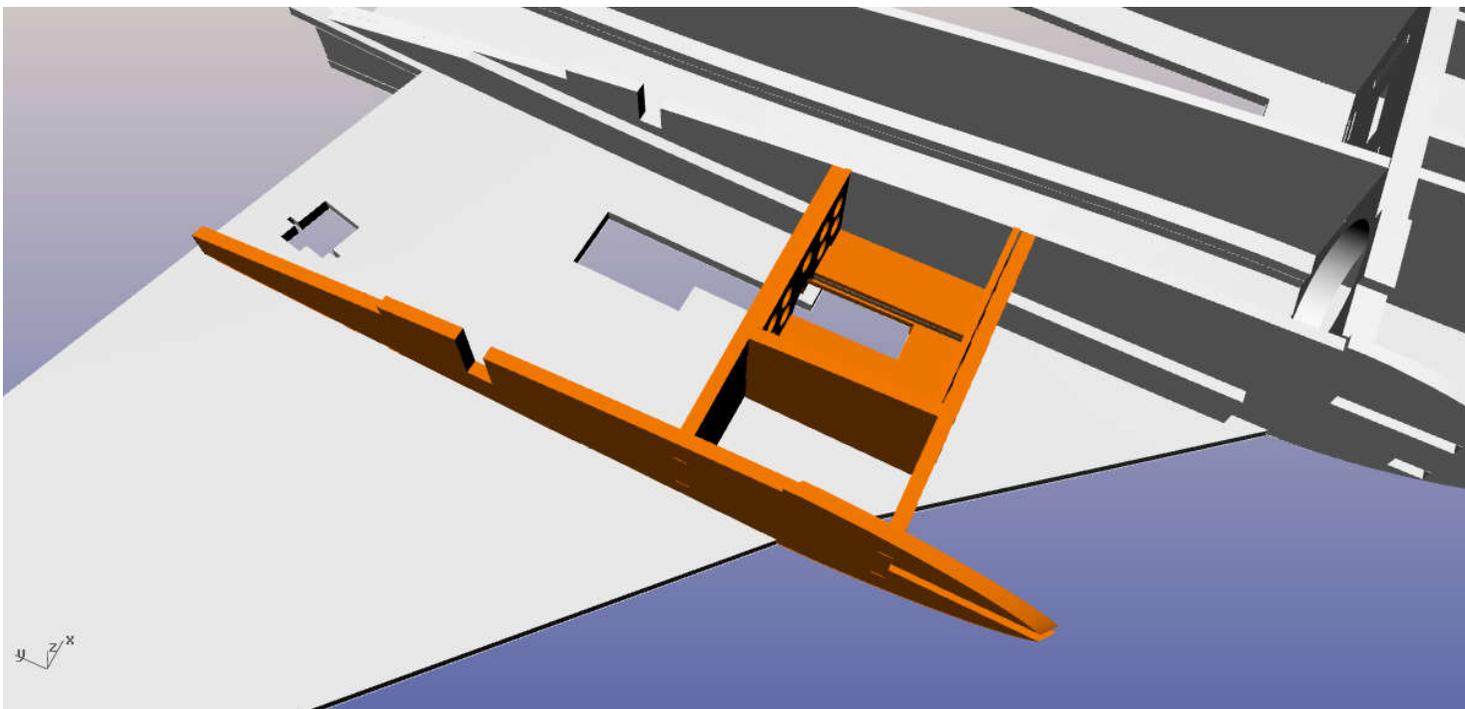
Then glue the wing undercarriage front and rear latitudinals onto the assembly.

make both mirrored assemblies.



Drill out to save weight, then glue the front and rear plywood load spreaders in place as shown. They should sit on top of the horizontal ply pieces, glued to the front and rear undercarriage latitudinals.

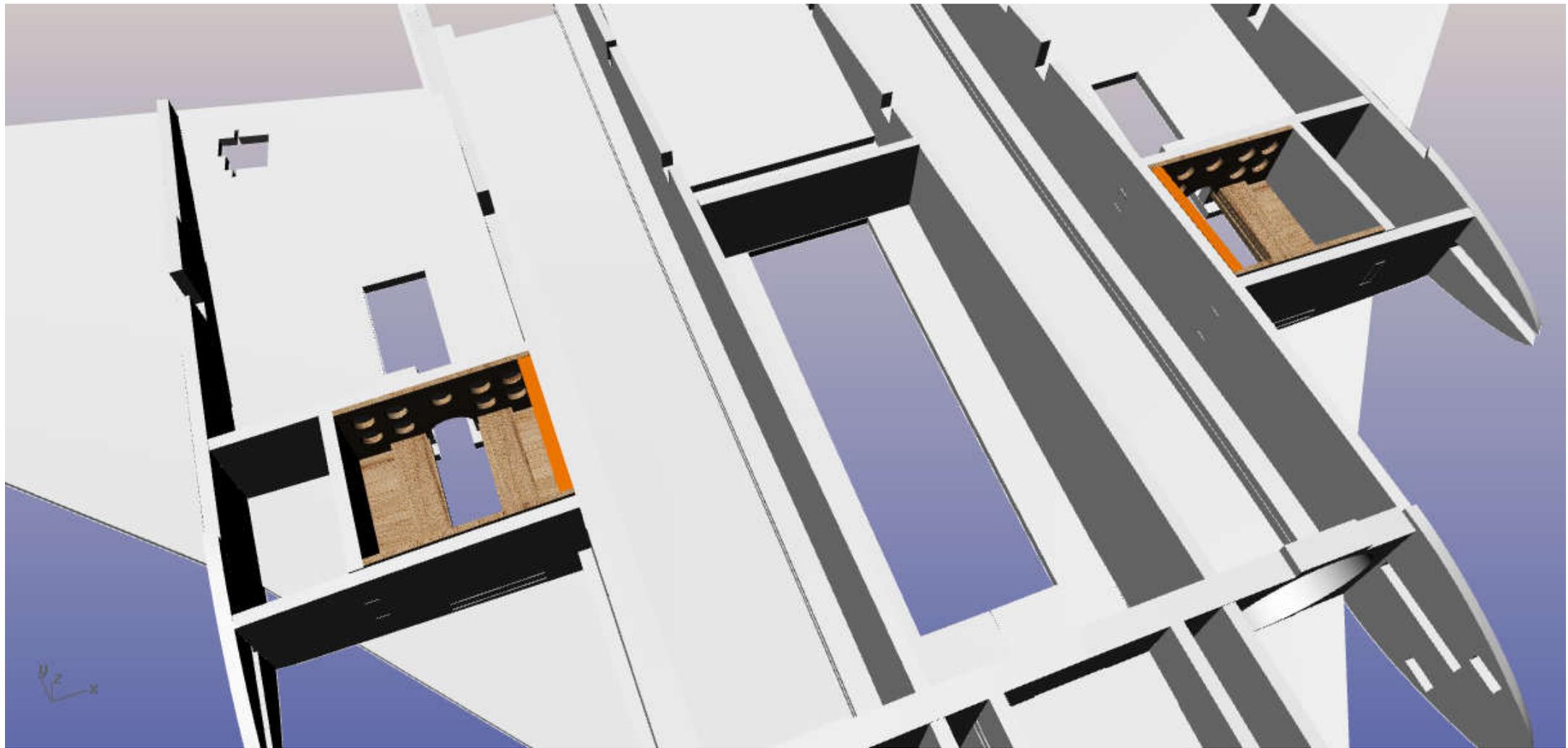
Repeat on the mirrored version.



Glue the longitudinal 3 piece to the assembly, then locate the tabs in the slots in the wing and longitudinal 2 pieces.

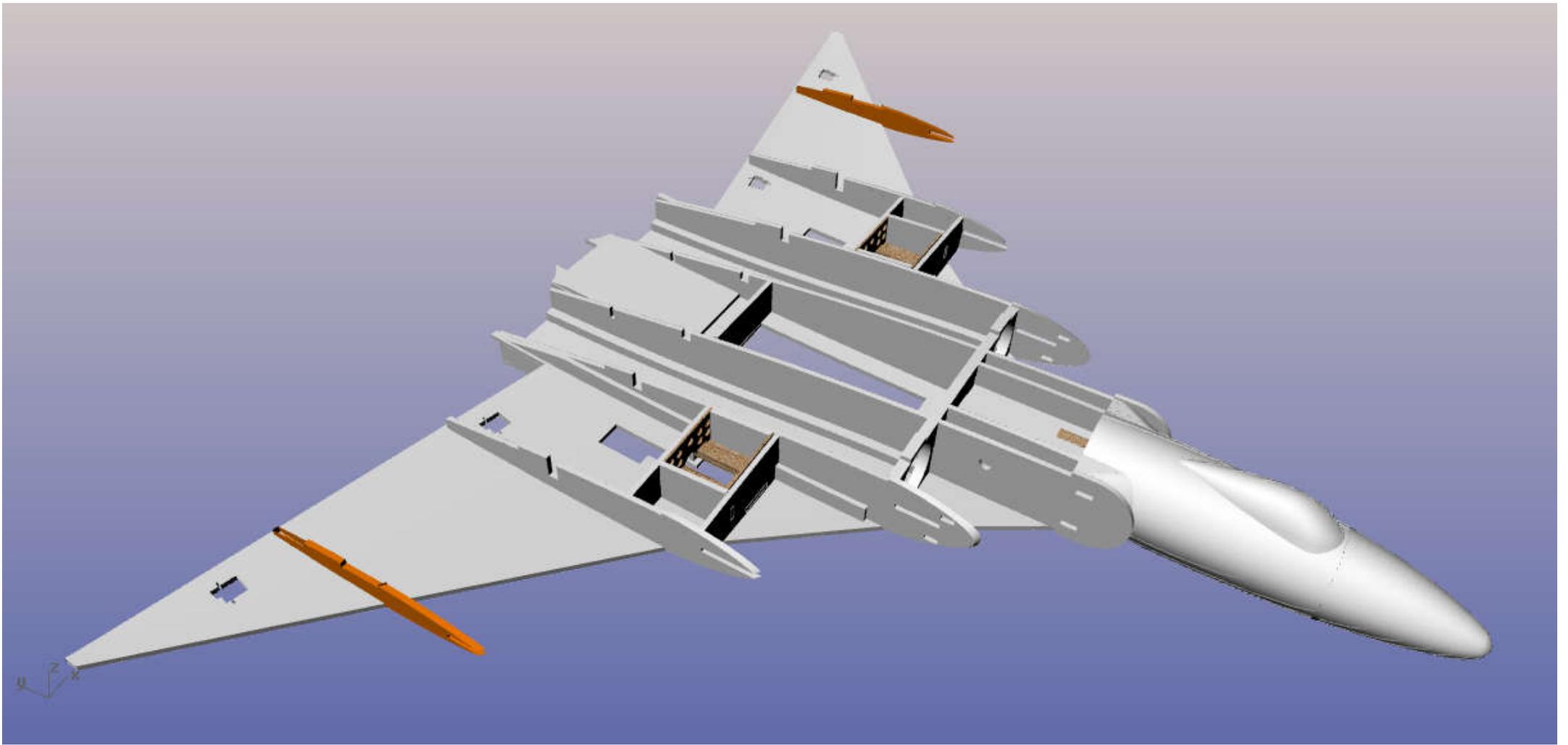
Repeat on the other wing.





Glue the inboard vertical retract support pieces in place as shown here.





Glue the longitudinal 4 pieces onto the assembly as shown.





20 minute epoxy



Using 20m epoxy, Create the Spar assembly, by glueing the depron pieces to the 10mm square sectioned carbon tube (1m).

I found it helpful to glue bigger strips of depron to the top of the spar and then sand down to size due to the very thin nature of it. I have included dimensions above.

Ensure accurate location of parts to

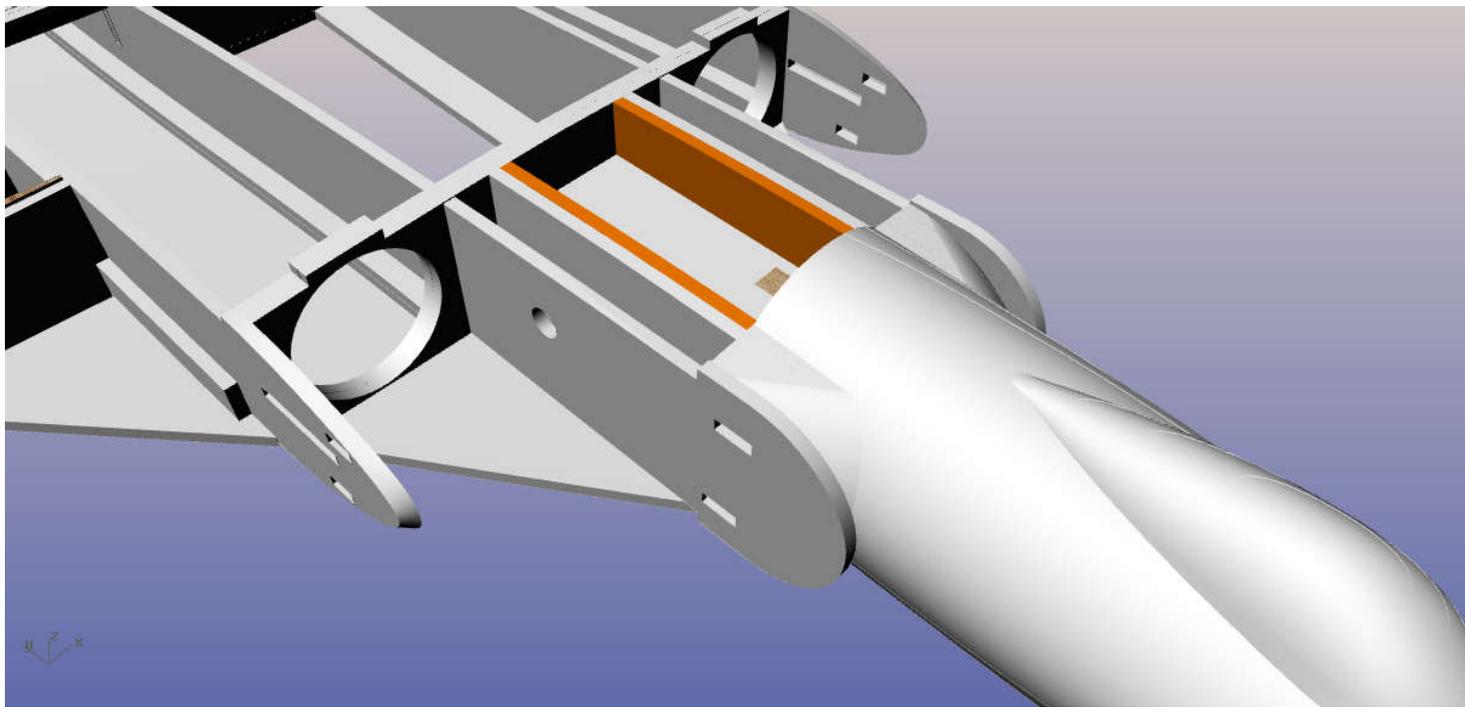
20 minute epoxy



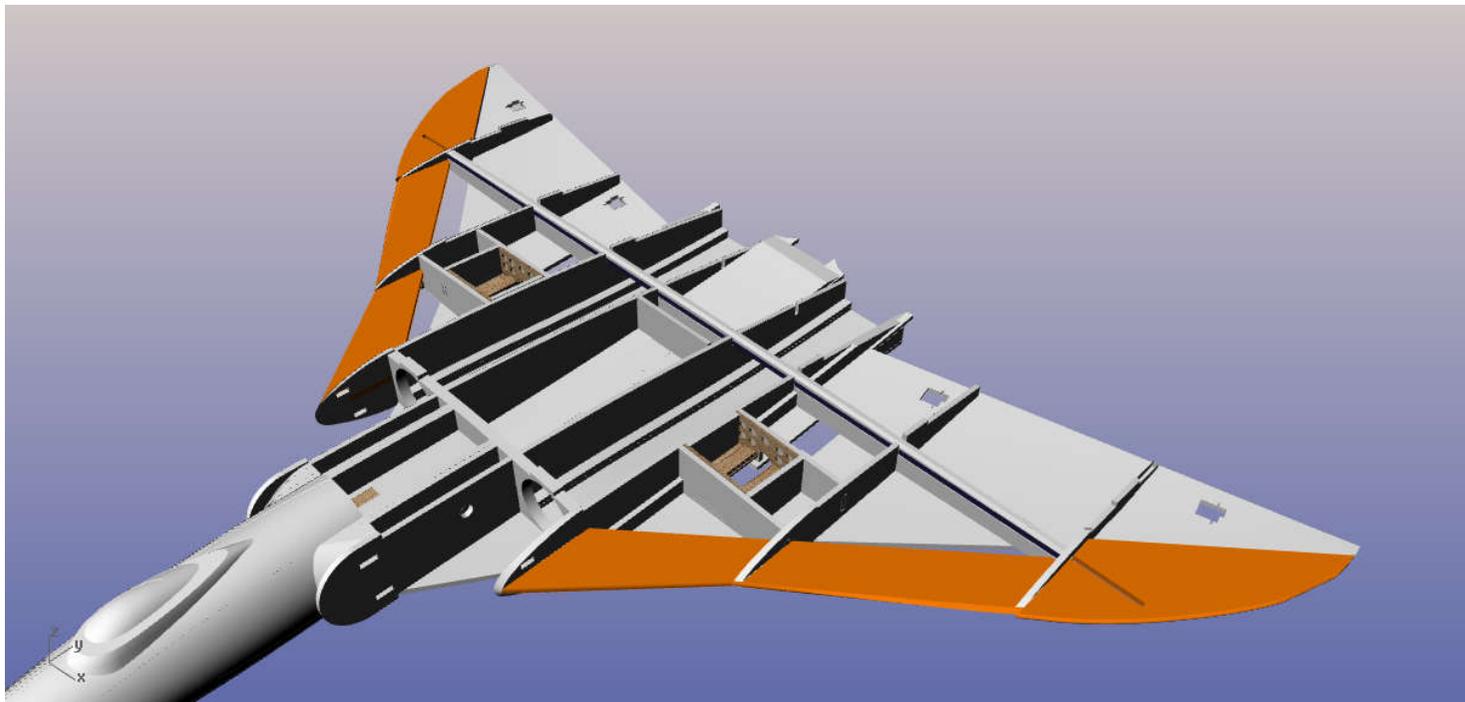
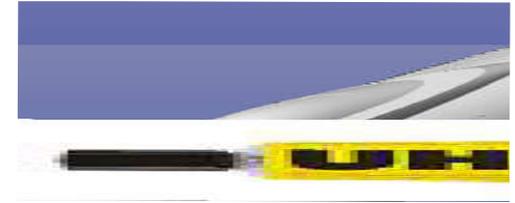
Dry fit the spar into the aircraft. the airframe will not be perfectly aligned, so prop up the wings etc to help prepare the model for accepting the spar. as part of this process, offer the upper wing pieces to help the alignment. The two parts should meet in the middle.

Using 20m epoxy (not 5m!) assemble. Dry fit the upper wing (careful not to get epoxy on it by using masking tape) and pull the upper wing together using masking tape.

When the glue has set, remove the upper wing.

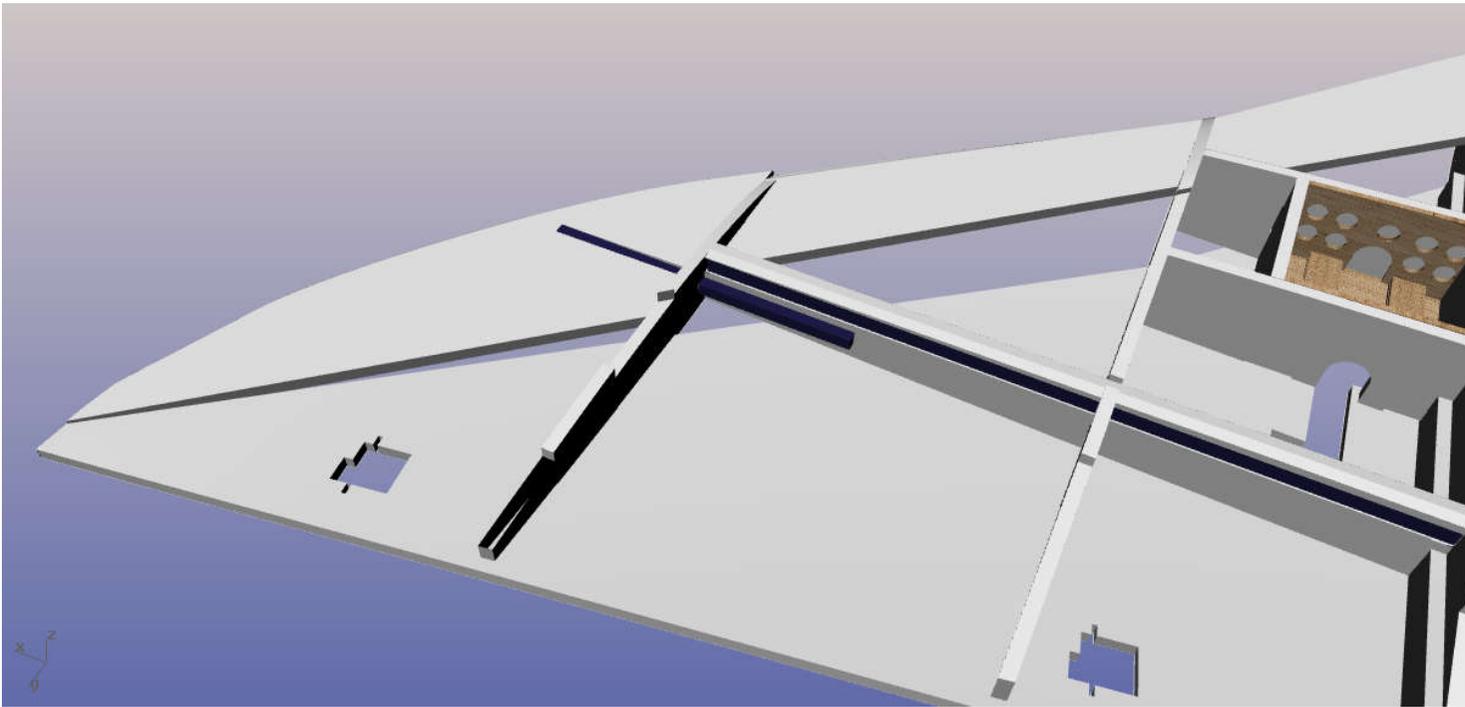


Glue the front retract cheek supports in place using UHU por.

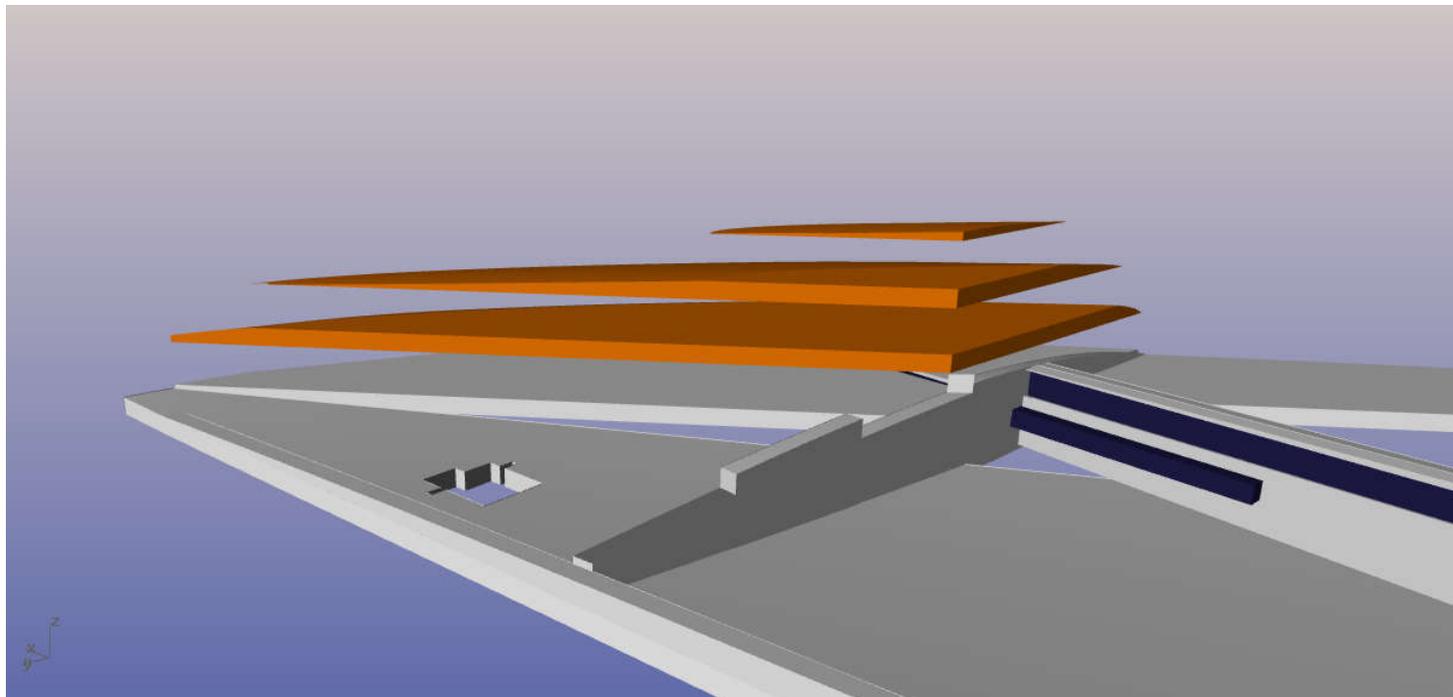


Slide the two leading edge pieces into place using epoxy (sparingly)

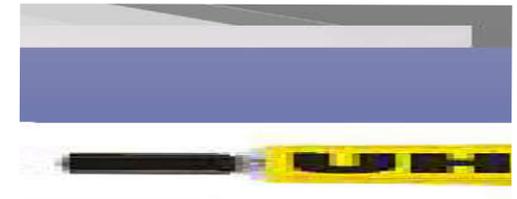


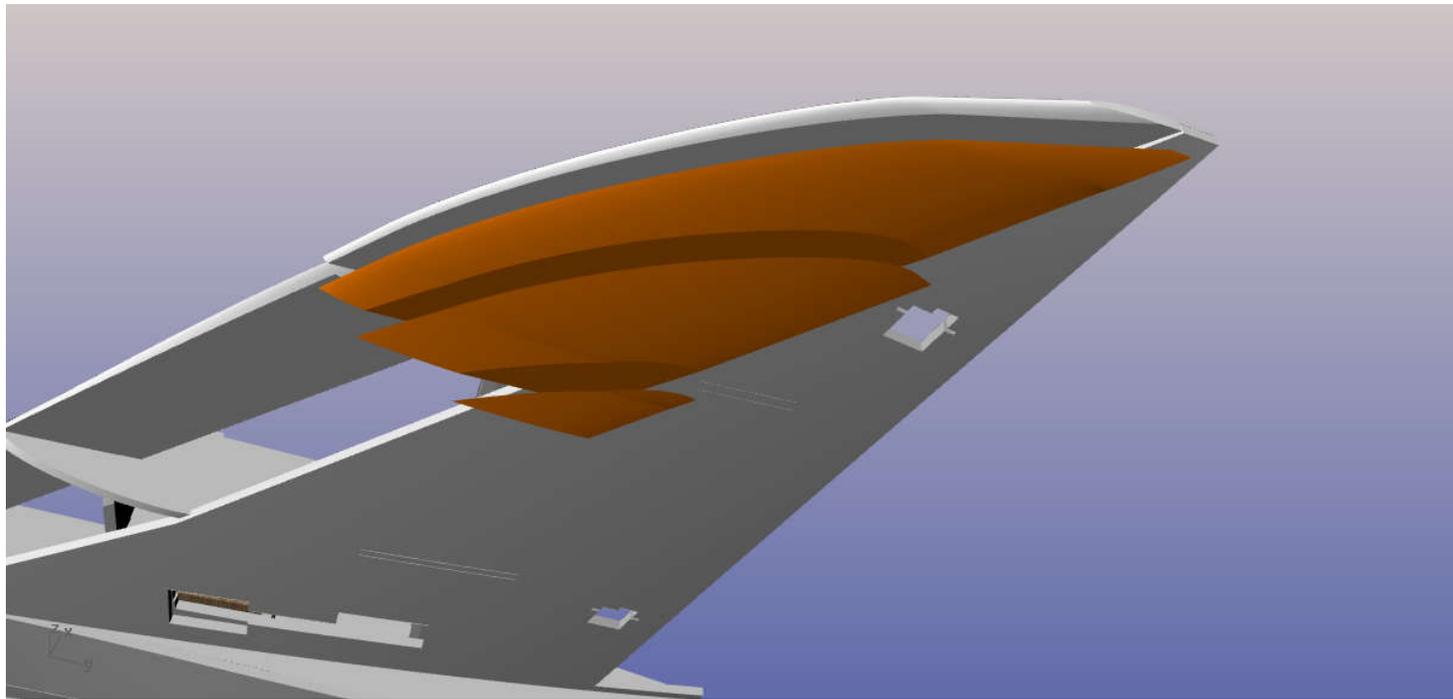


Using two 150mm x 6mm carbon tubes, create the bracing as shown here, stiffening the wing tip part. use epoxy.

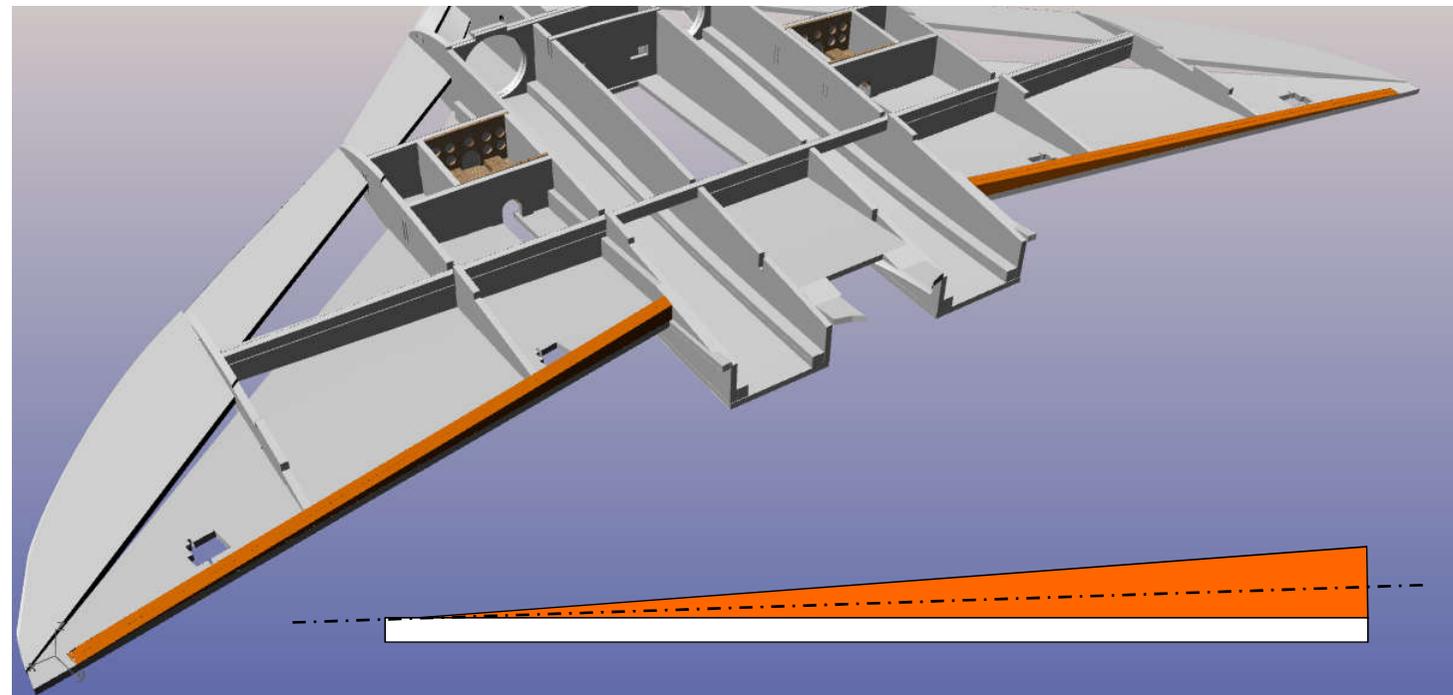
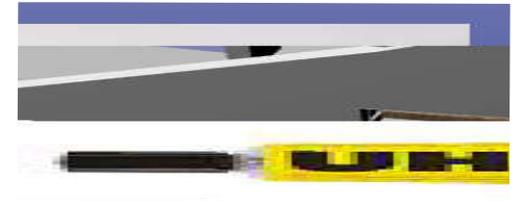


Laminate the three upper wingtip pieces onto the assembly.



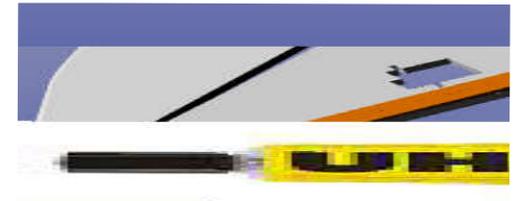


Laminate the three lower wingtip pieces onto the assembly.



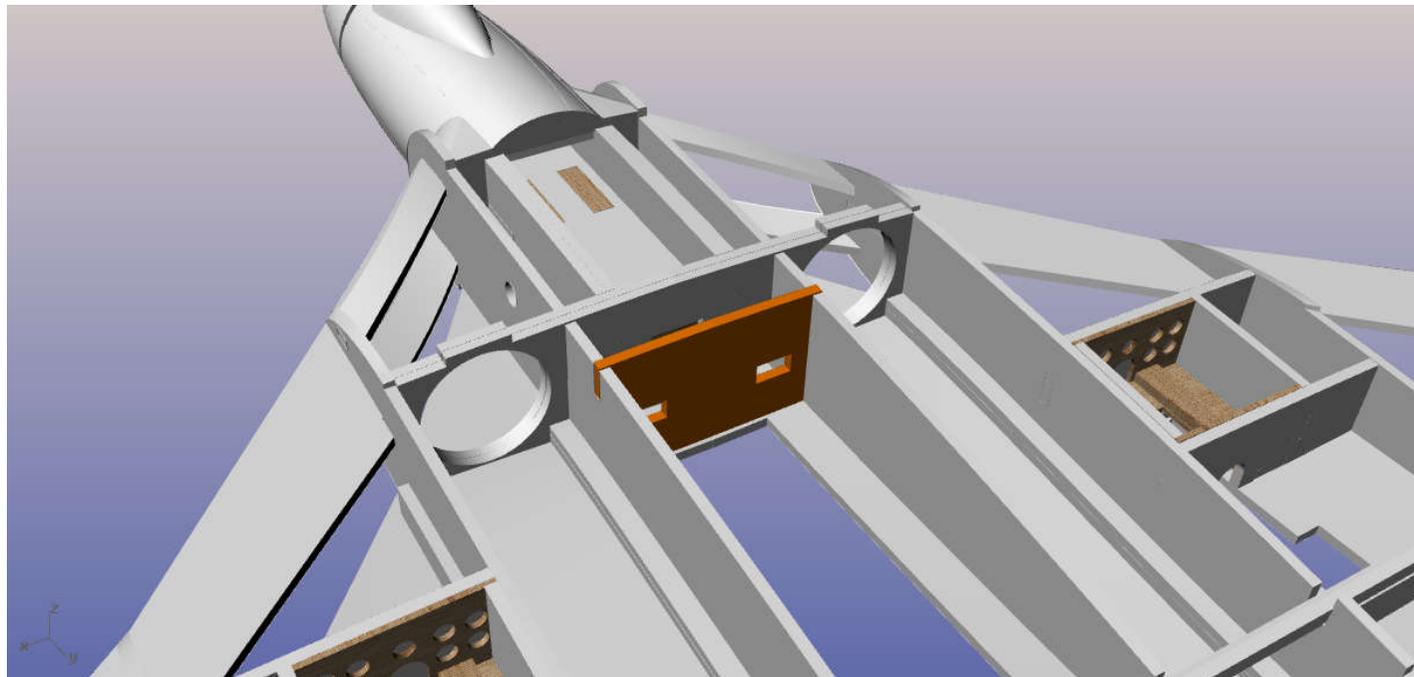
Laminate the two elevon support pieces together for each wings and glue to the aircraft.

Mark a centreline down the centre of the rear elevon support piece to form the hinge line.



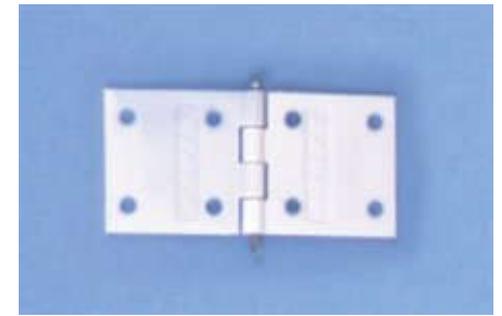
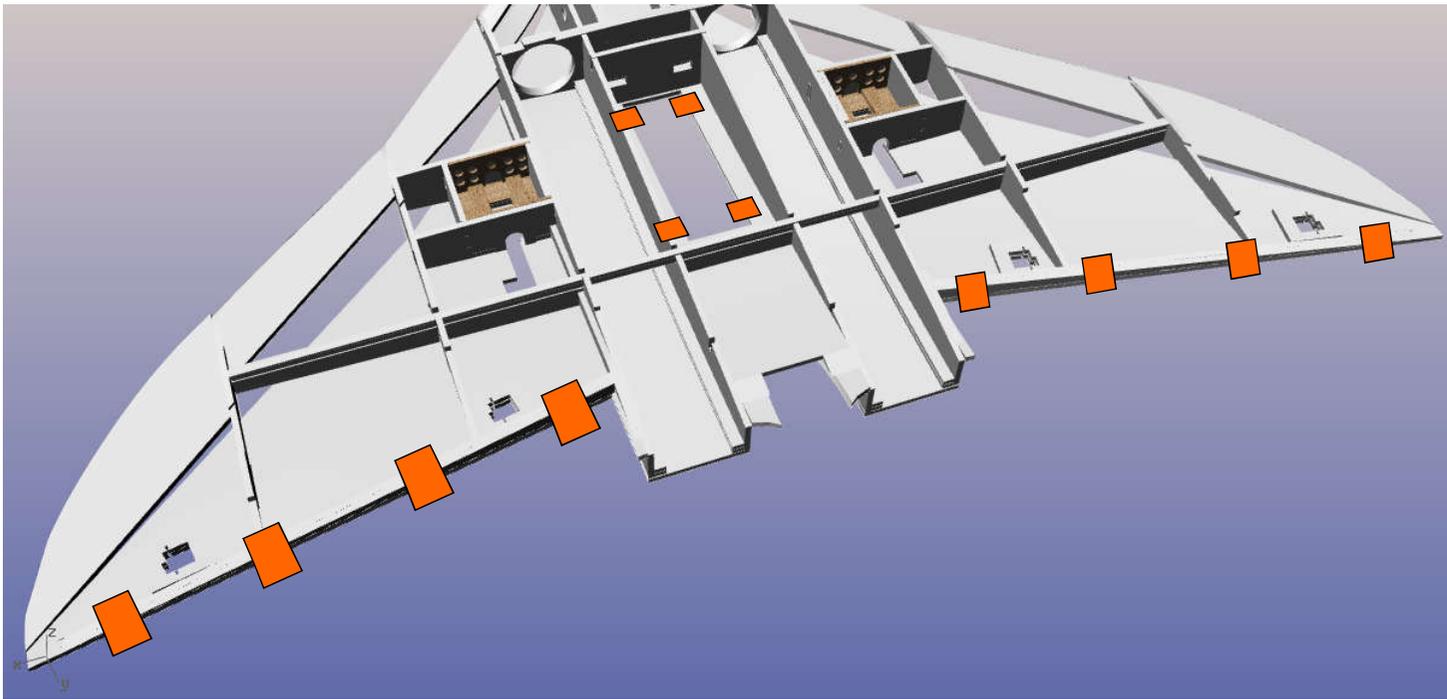


Glue the servo support pieces to the wing.



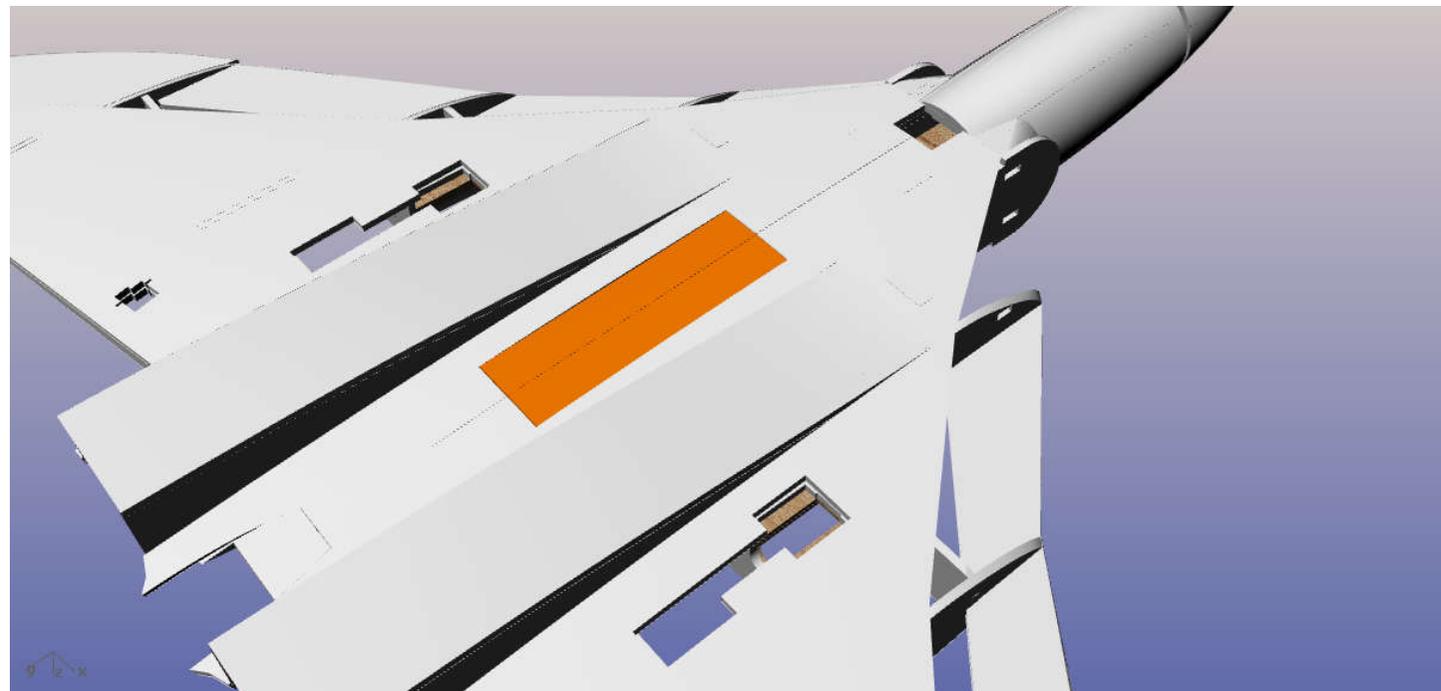
Glue the bomb bay door servo bulkhead in place using epoxy sparingly.





Using a sharp knife, slice the depron to make a slot to receive the hinges. The Graupner hinge (above) would be my preference.

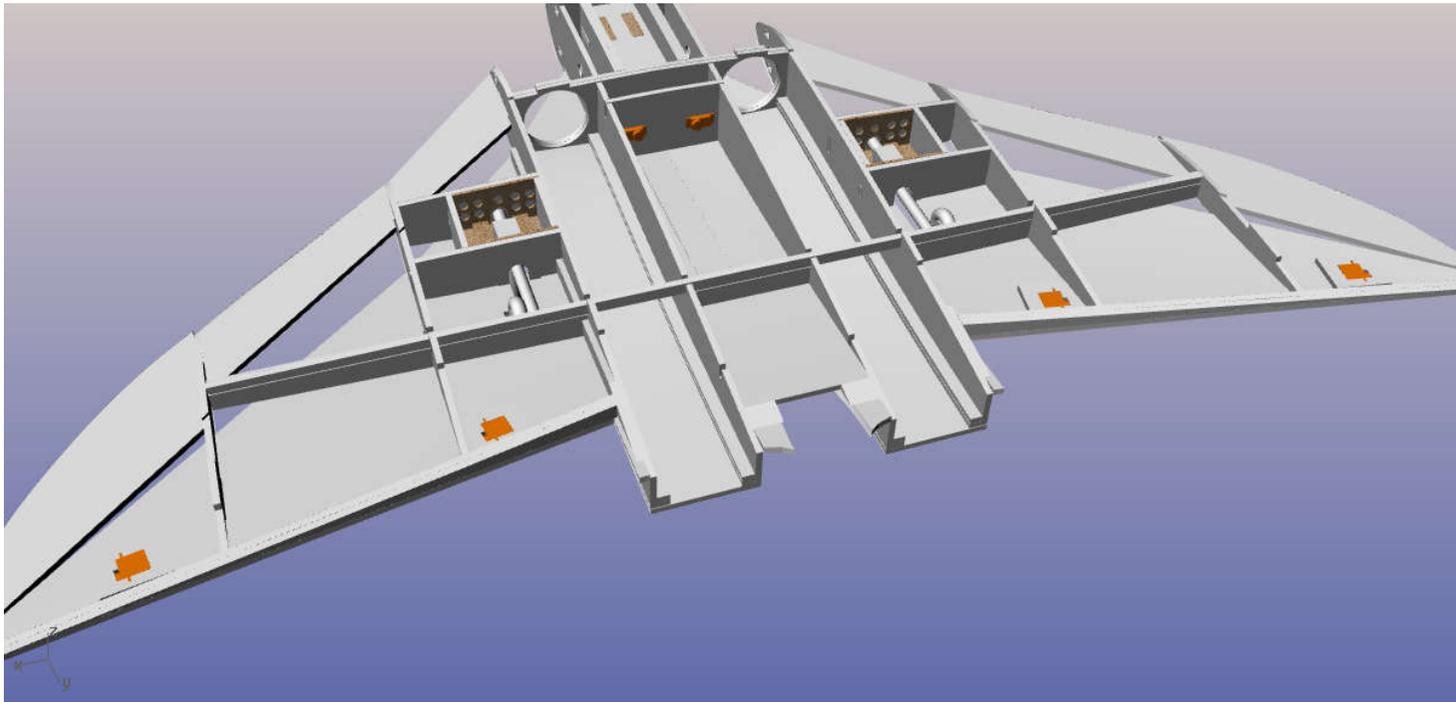
Glue in place using Hot melt Glue.



Repeat the process above with the bomb bay doors, ensuring that they can open a full 90 degrees.

Glue in place using Hot melt Glue.





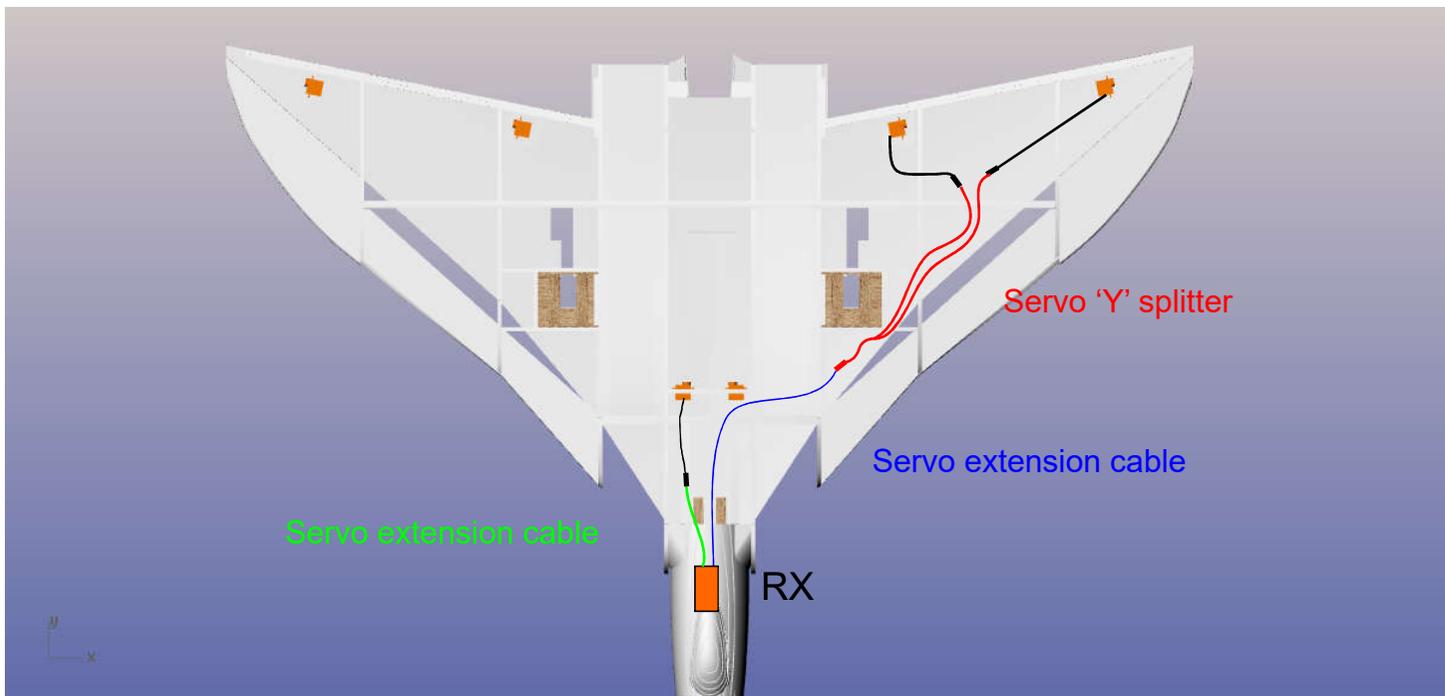
Glue in the six 11gram servos. Use metal gear servos to prevent stripping of the gears.

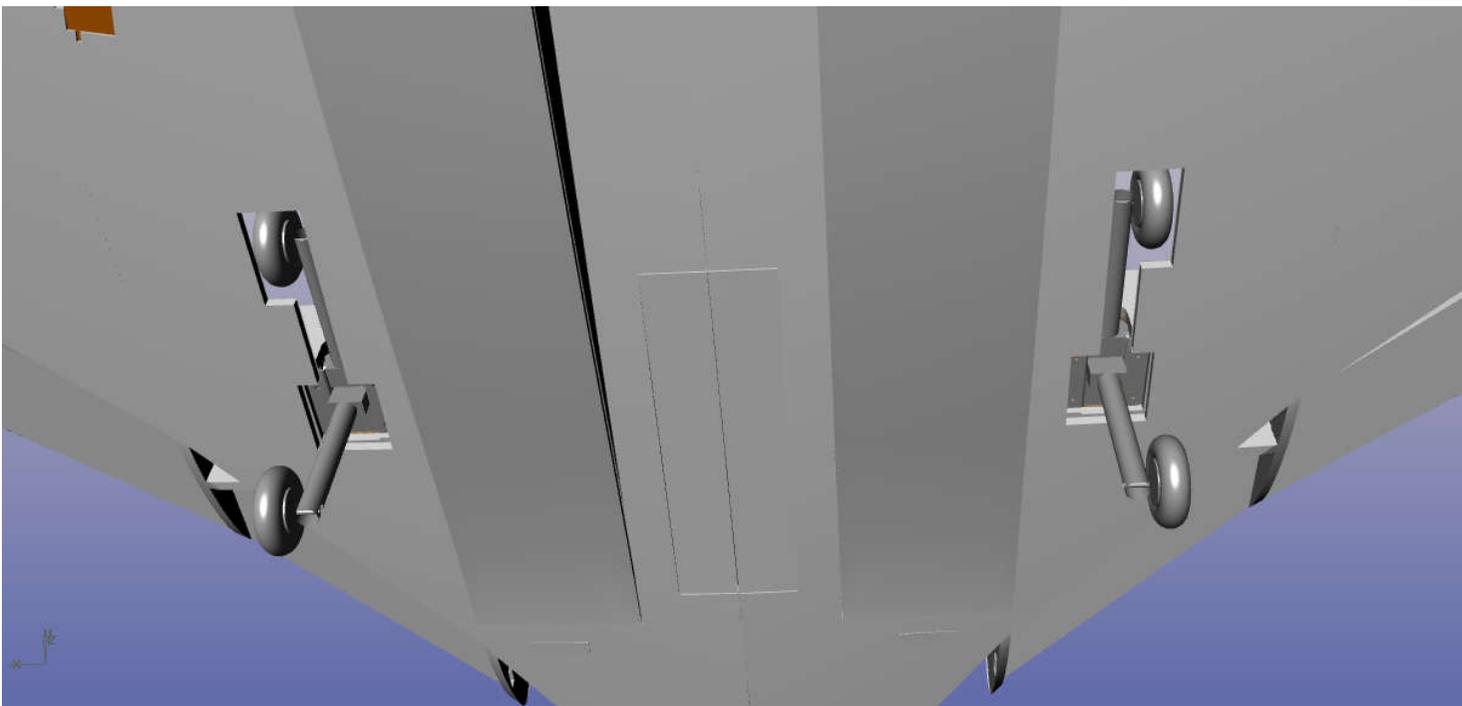
On the elevons, run the control horns downwards to protrude under the wing.



Connect the servos up to the receiver as shown. position the receiver under the canopy.

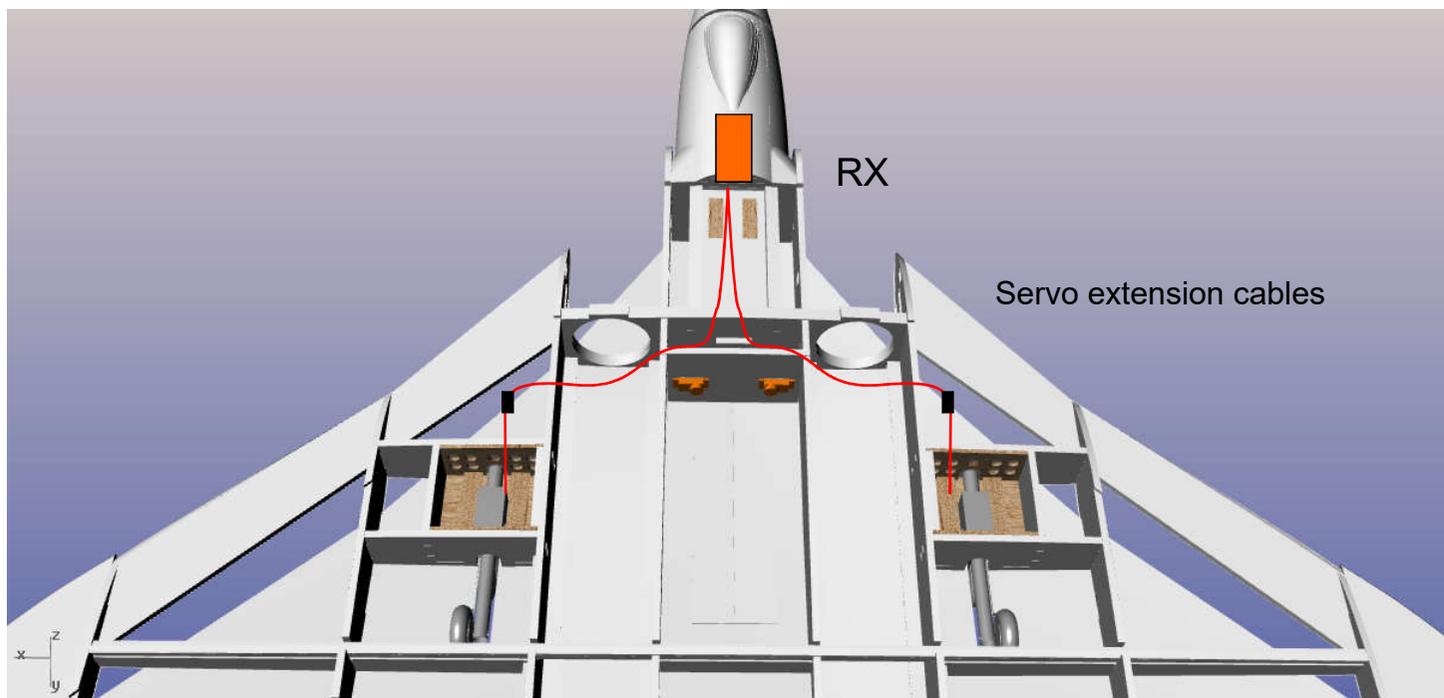
Diagram shows 3 servos connected only. Replicate the wiring on both sides of the aircraft.





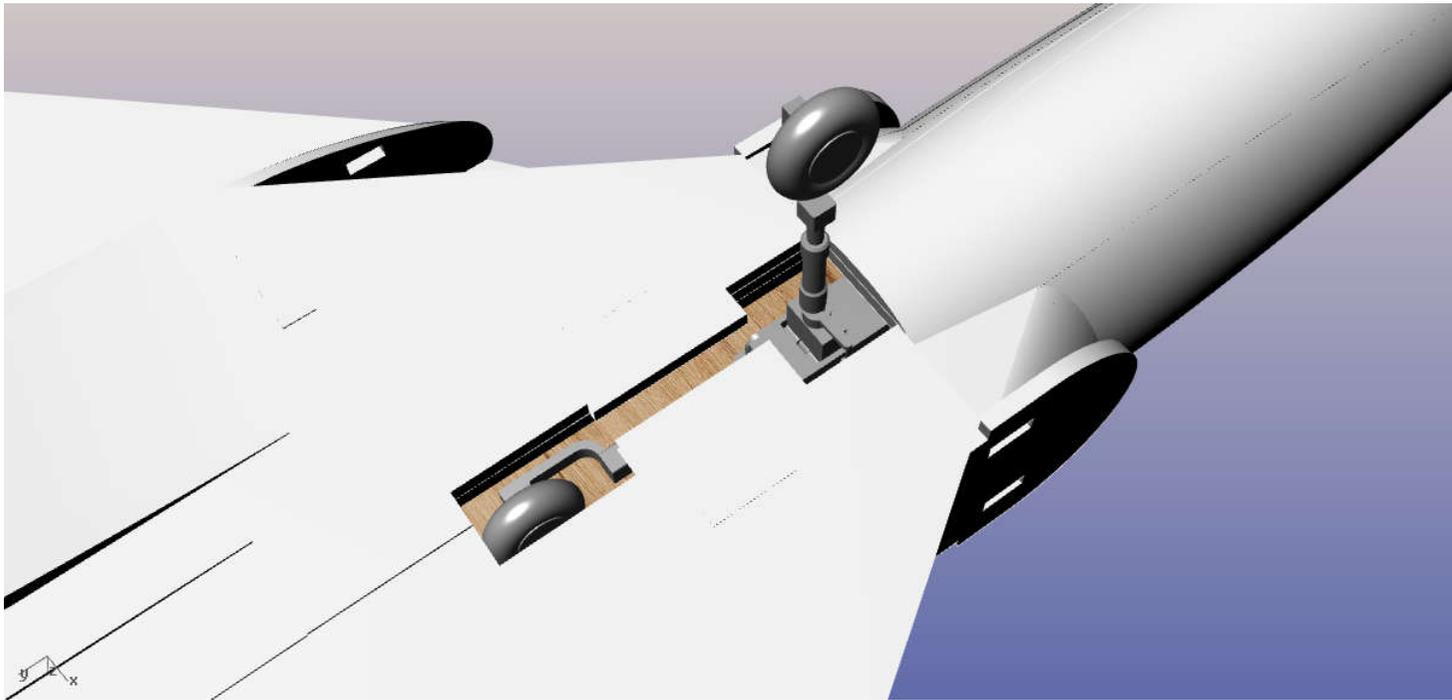
Mount the Turnigy MCR-F wing retracts in place, carefully aligning to run straight.

Take time to make a strong fixing, using correctly sized pilot hole through the ply.



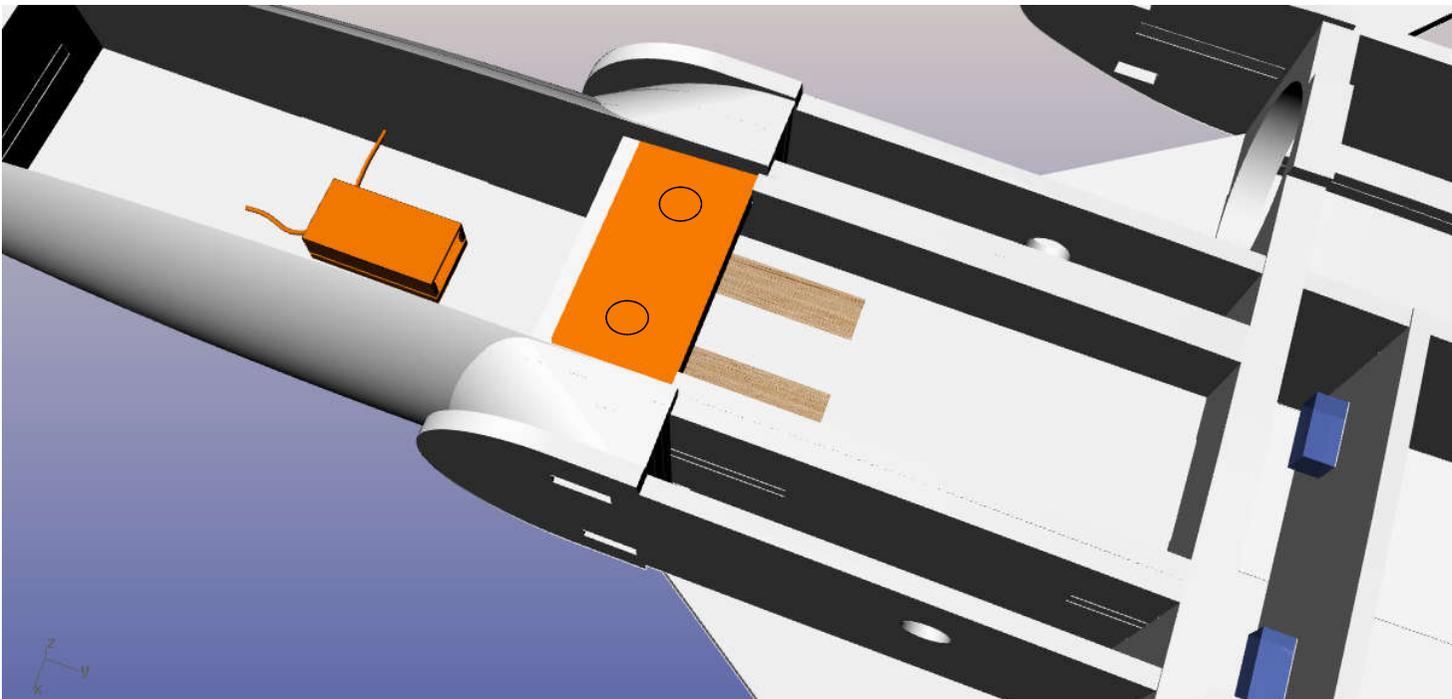
Connect the servos up to the receiver as shown. position the receiver under the canopy.

Diagram shows 3 servos connected only. Replicate the wiring on both sides of the aircraft.



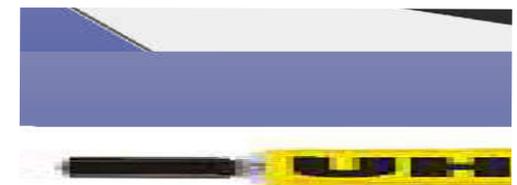
If the retract was fitted at the earlier stage now cut away the lower wings to allow the forward Turnigy MCR-F wing retracts to open without hindrance.

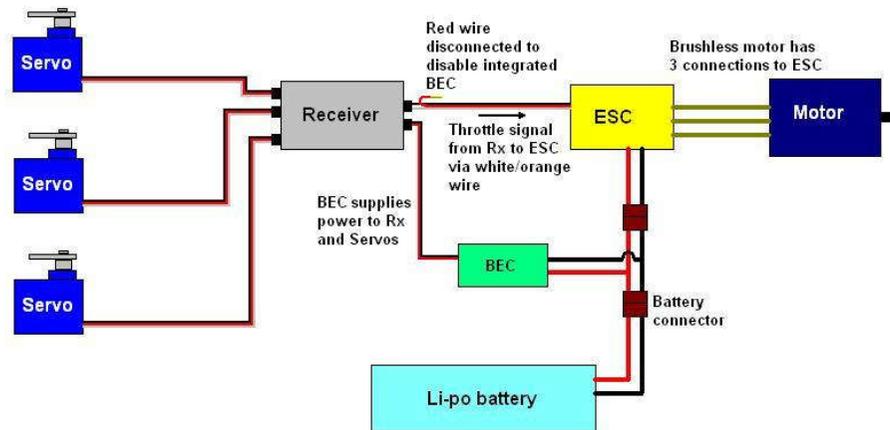
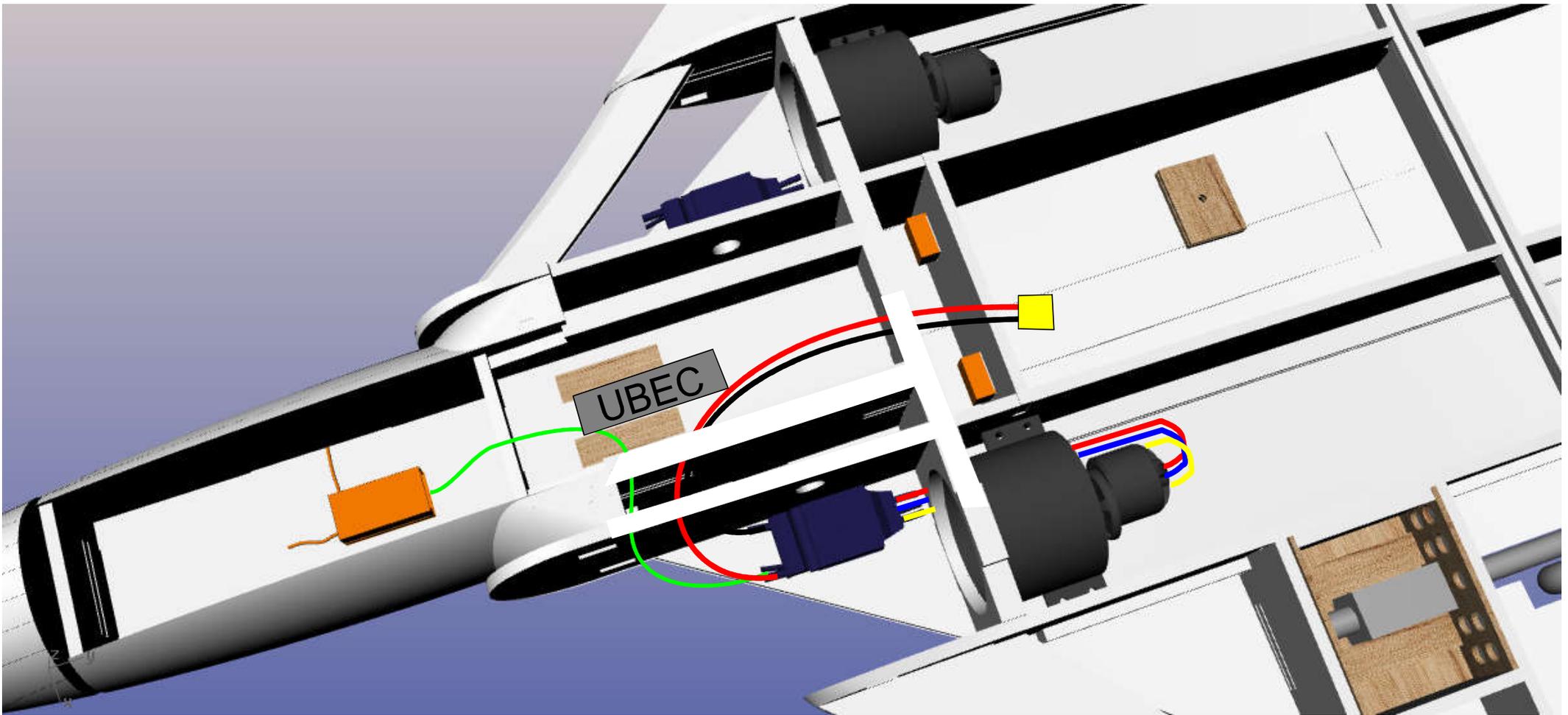
Connect the retract and servo to the RX.



Glue in the Canopy Magnet piece (incorrectly named forward retract bulkhead).

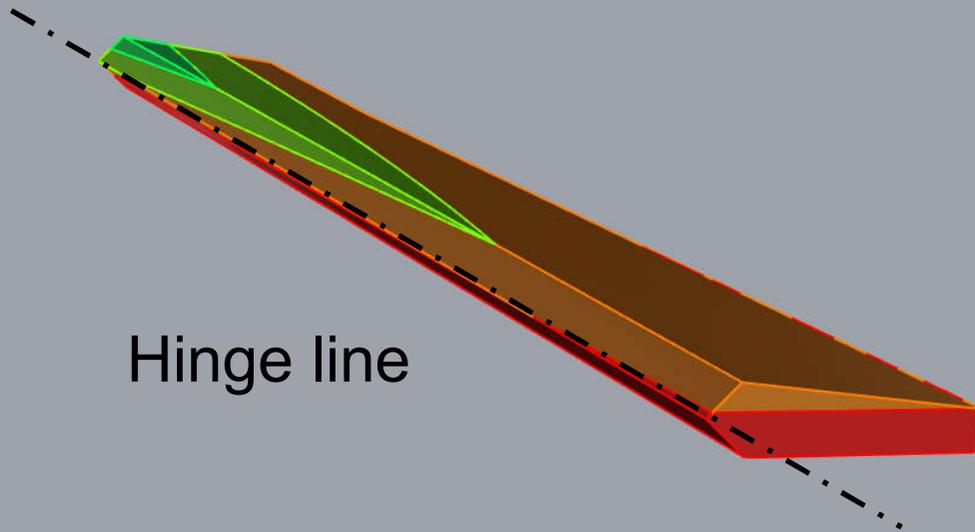
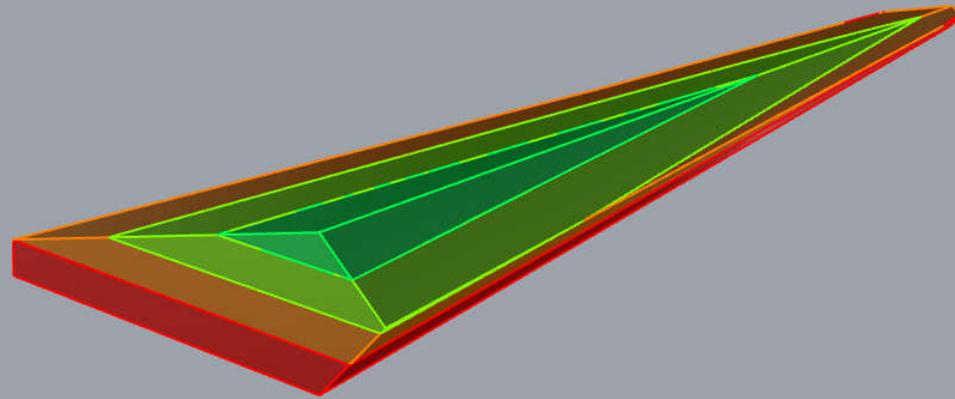
This will house rare earth magnets to hold the canopy in place.





Connect the Speed controllers to the EDF Units (test for correct spin direction) and run the cables through for the battery connectors as shown above. (repeat both sides) - cut through bulkheads as necessary)

I would strongly recommend you fit a separate BEC to ensure control in the event of an ESC failure.



Hinge line



Laminate the elevon pieces together as shown and sand to shape with a sanding block.

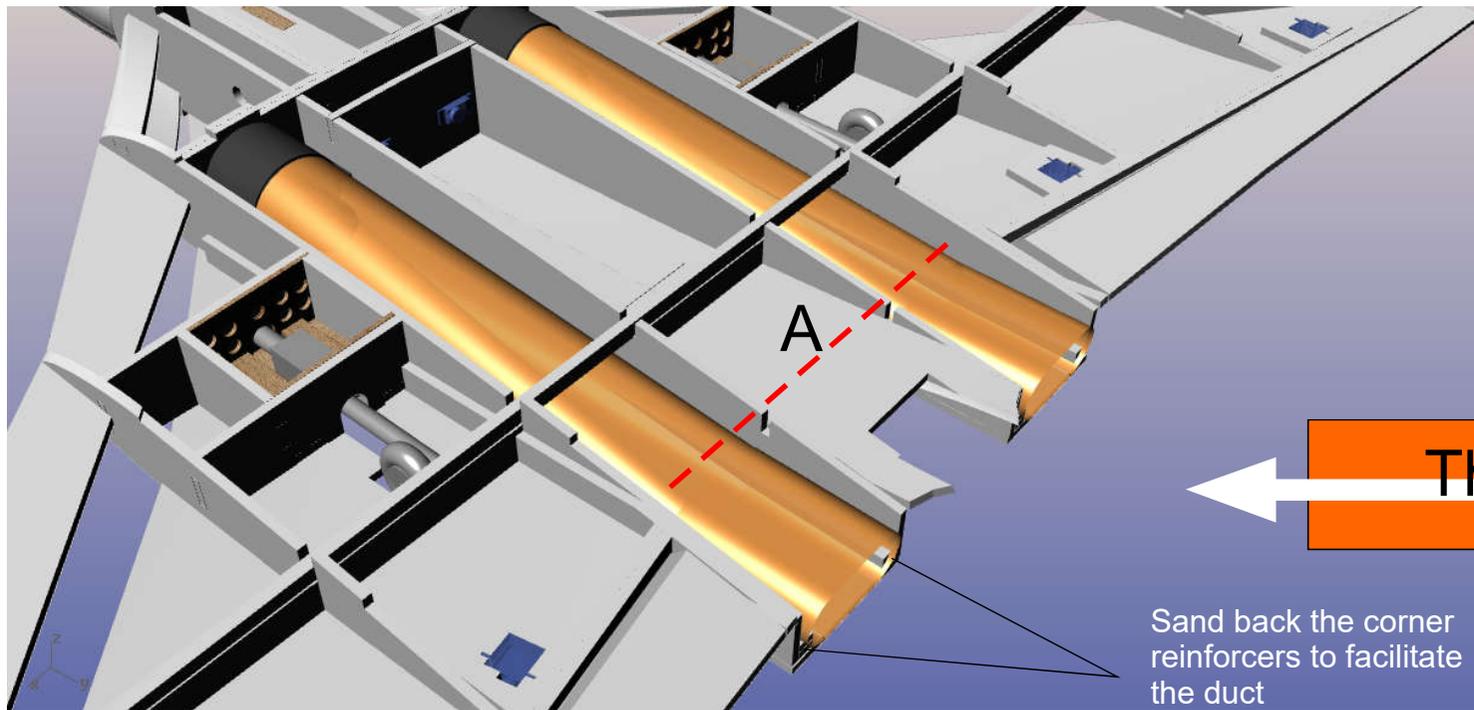


Slice the elevons using a sharp knife to accept the graupner hinges.

Attach to the assembly using 5m epoxy - ensuring no glue gets into the hinges.

Create control horns to give +/- 30 degrees of travel. (untested at present).

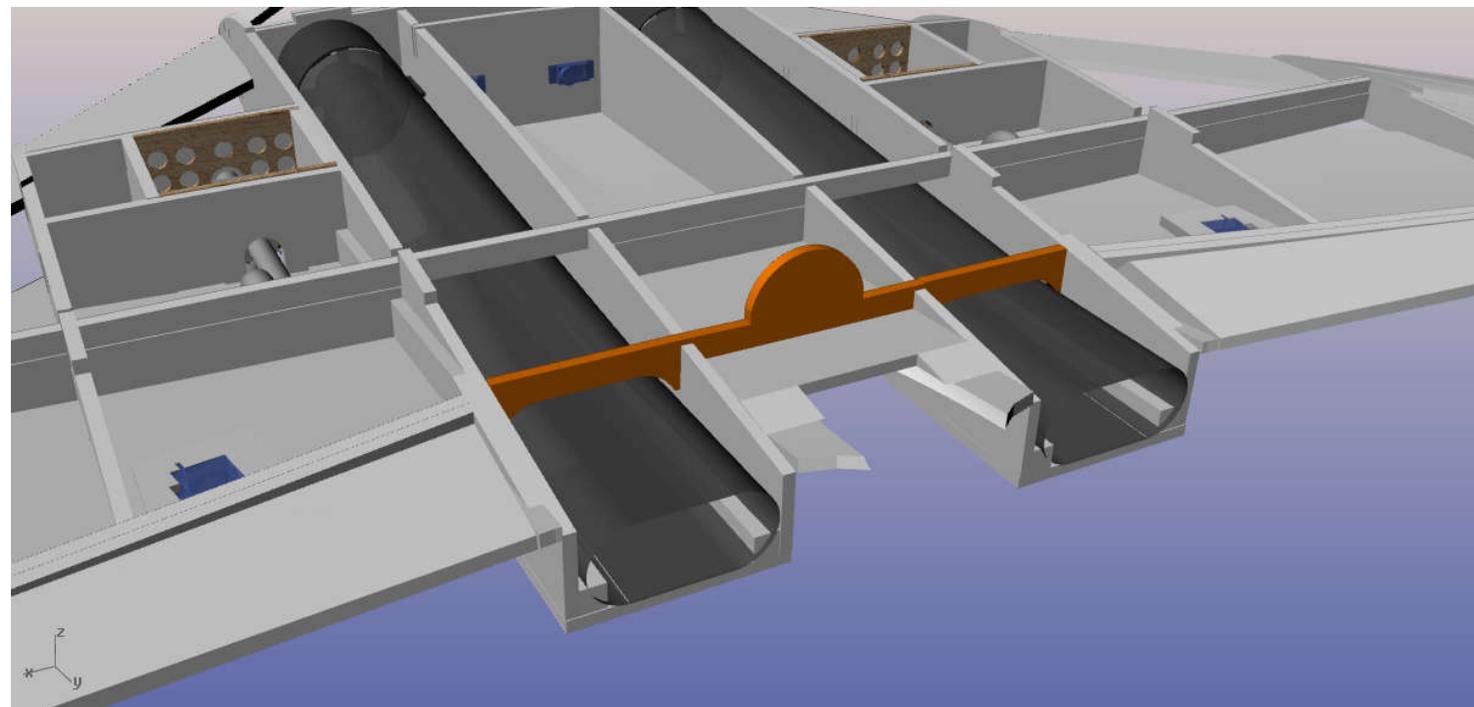
Set your transmitter to 40% expo.



Using 1mm plastic sheet make the ducting to take the circular exit of the edf to the oval shape indicated (at point 'A'). Then make an oval to oval exhaust exit to help the maintain the thrust angle.

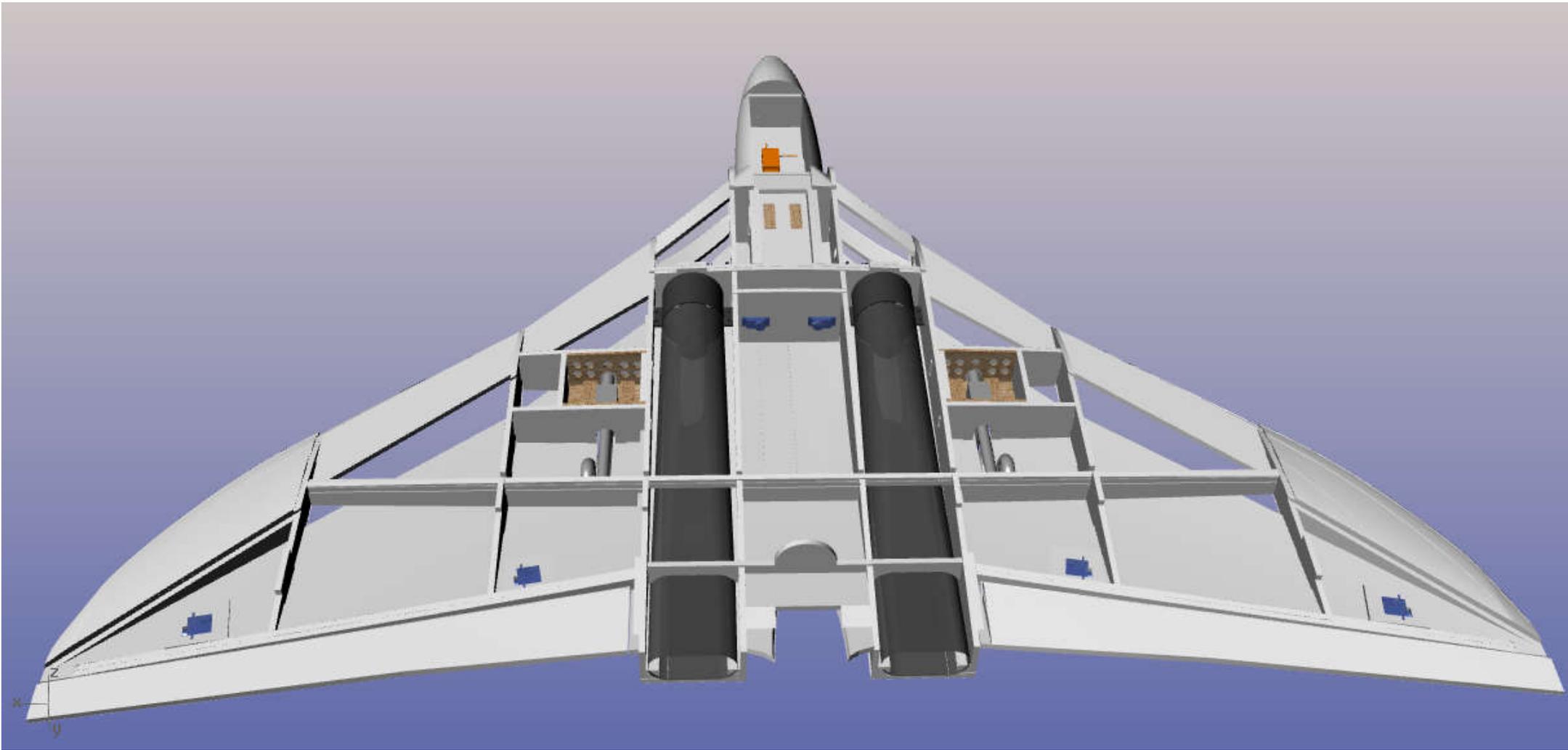


Sand back the corner reinforcers to facilitate the duct

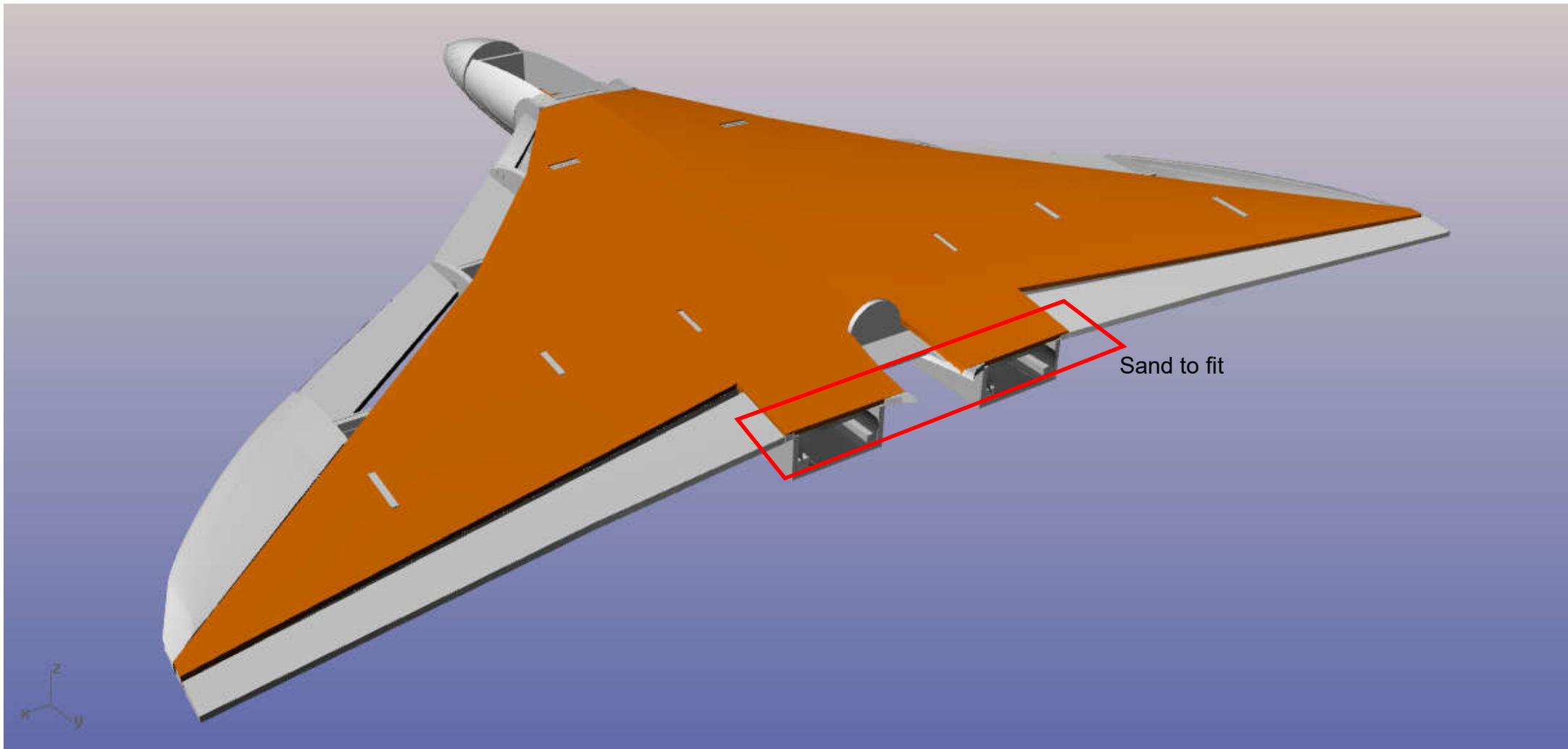


Fit bulkhead 7 in place.



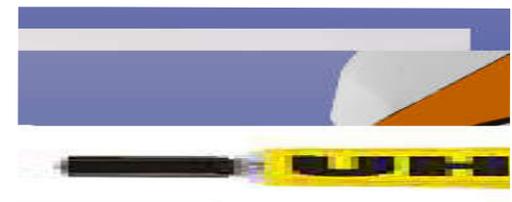


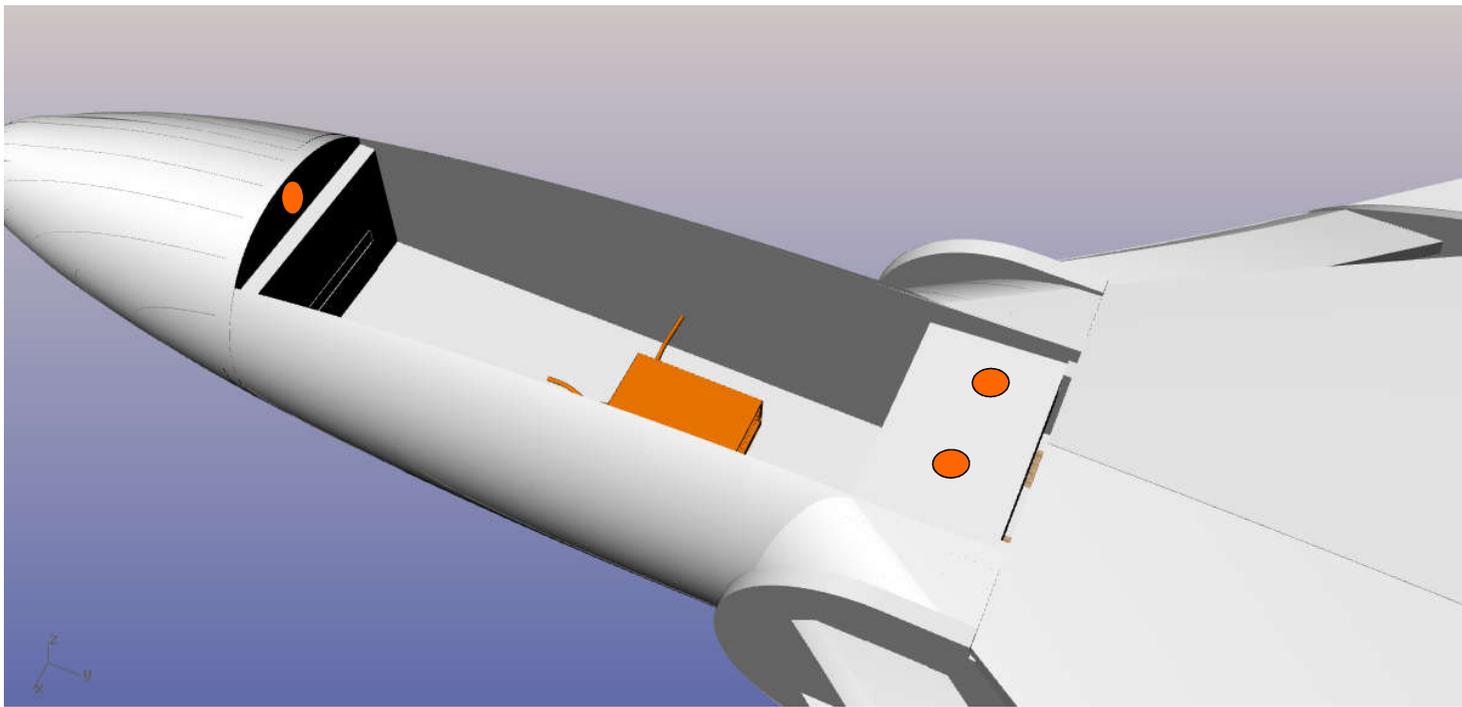
Test all electronics and servos, retracts etc, securing all cables and ensuring non of the servo connectors will come apart.



Carefully fit the upper wings to the aircraft, constantly checking for good fit.

At the trailing edges of the wing, near the tail, the edges will need sanding to marry up with the lower wing pieces.



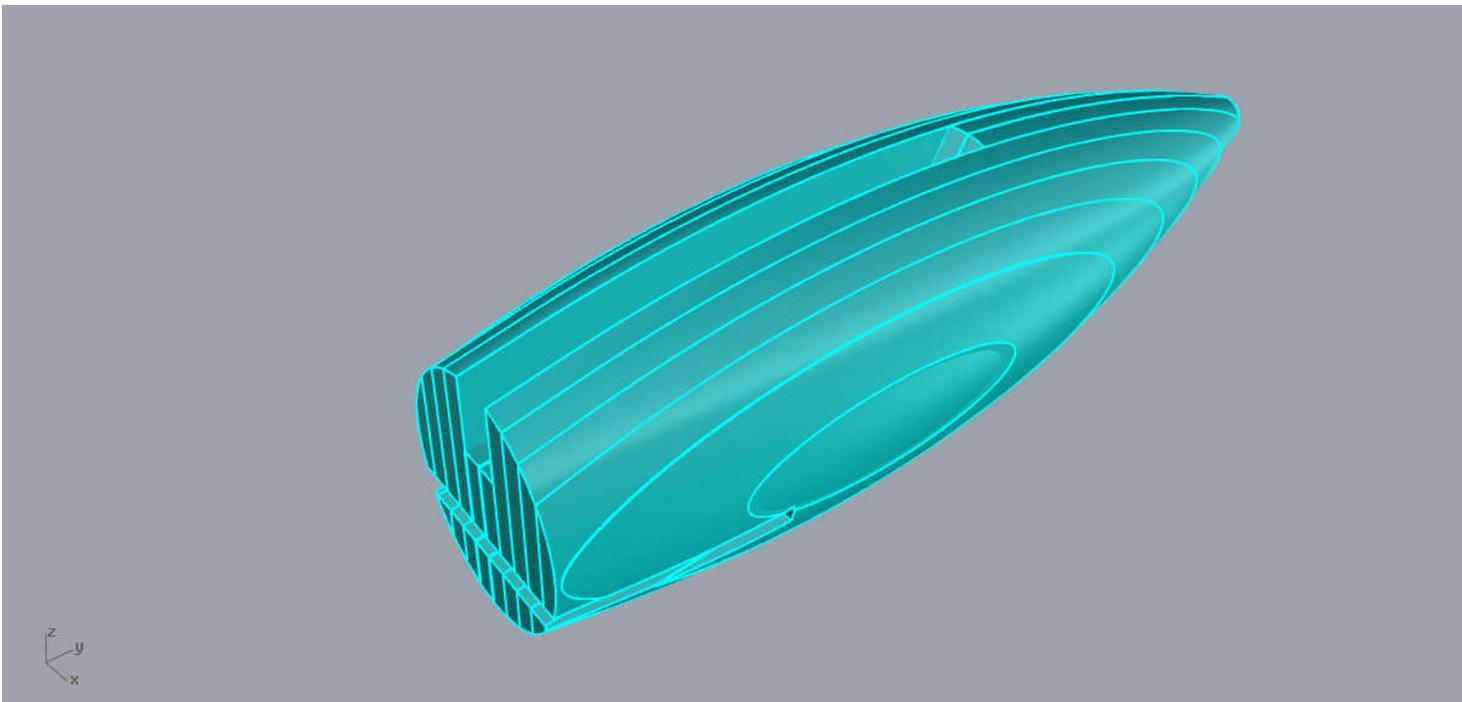


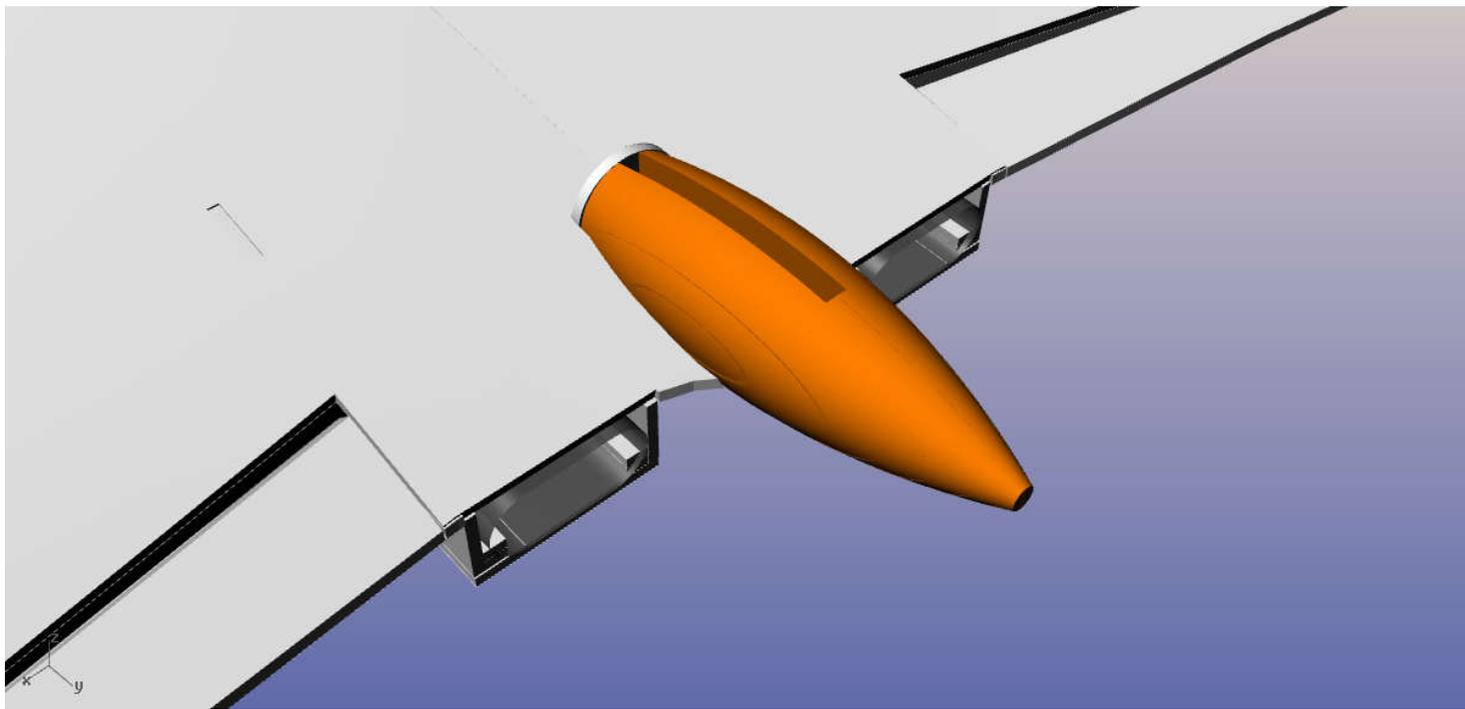
Fit rare earth magnets to both the canopy and airframe to hold the canopy in place.

Ensure the correct polarity!

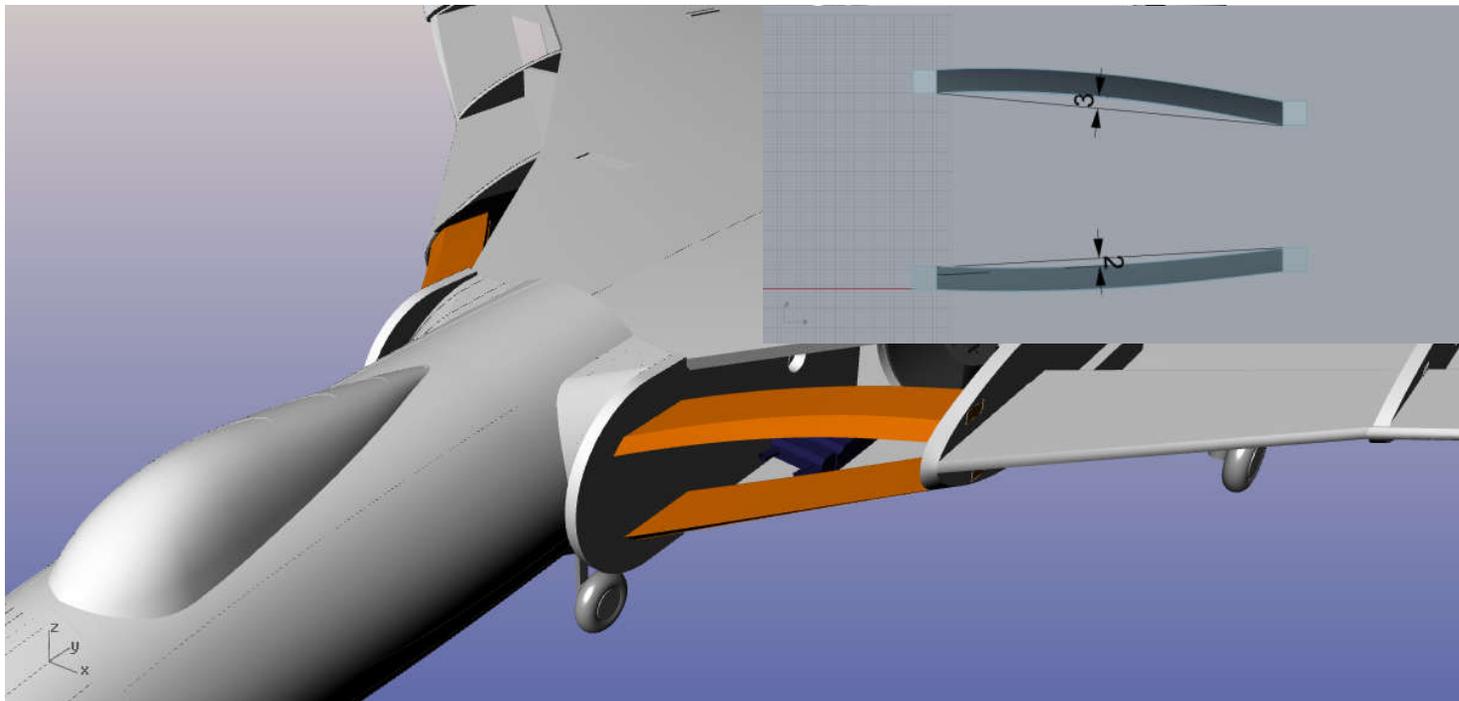
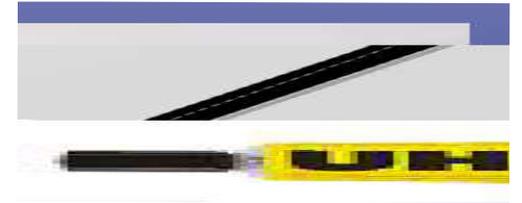


Assemble the tail cone.





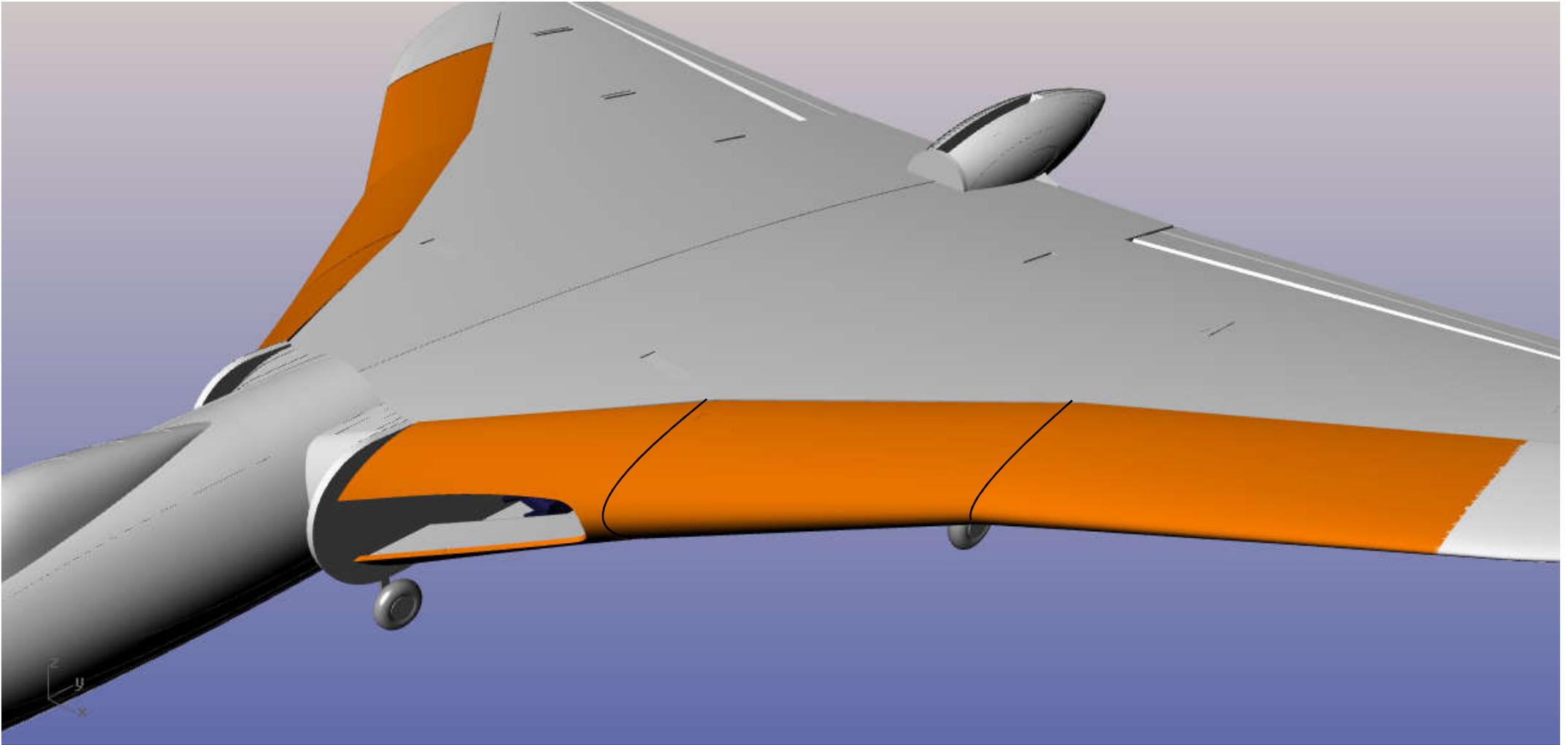
Fit the tail cone to the airframe, carefully shaping the wing depron to ensure a snug fit



Using 3mm depron, shape pieces to aid airflow into the EDF. Ensure as smooth a flow as possible without inhibiting the cooling airflow over the speed controllers.

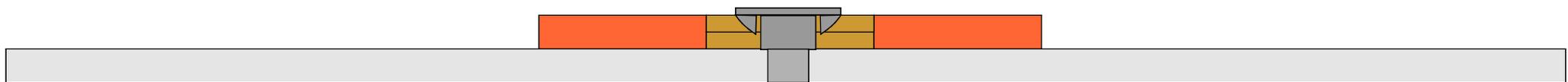
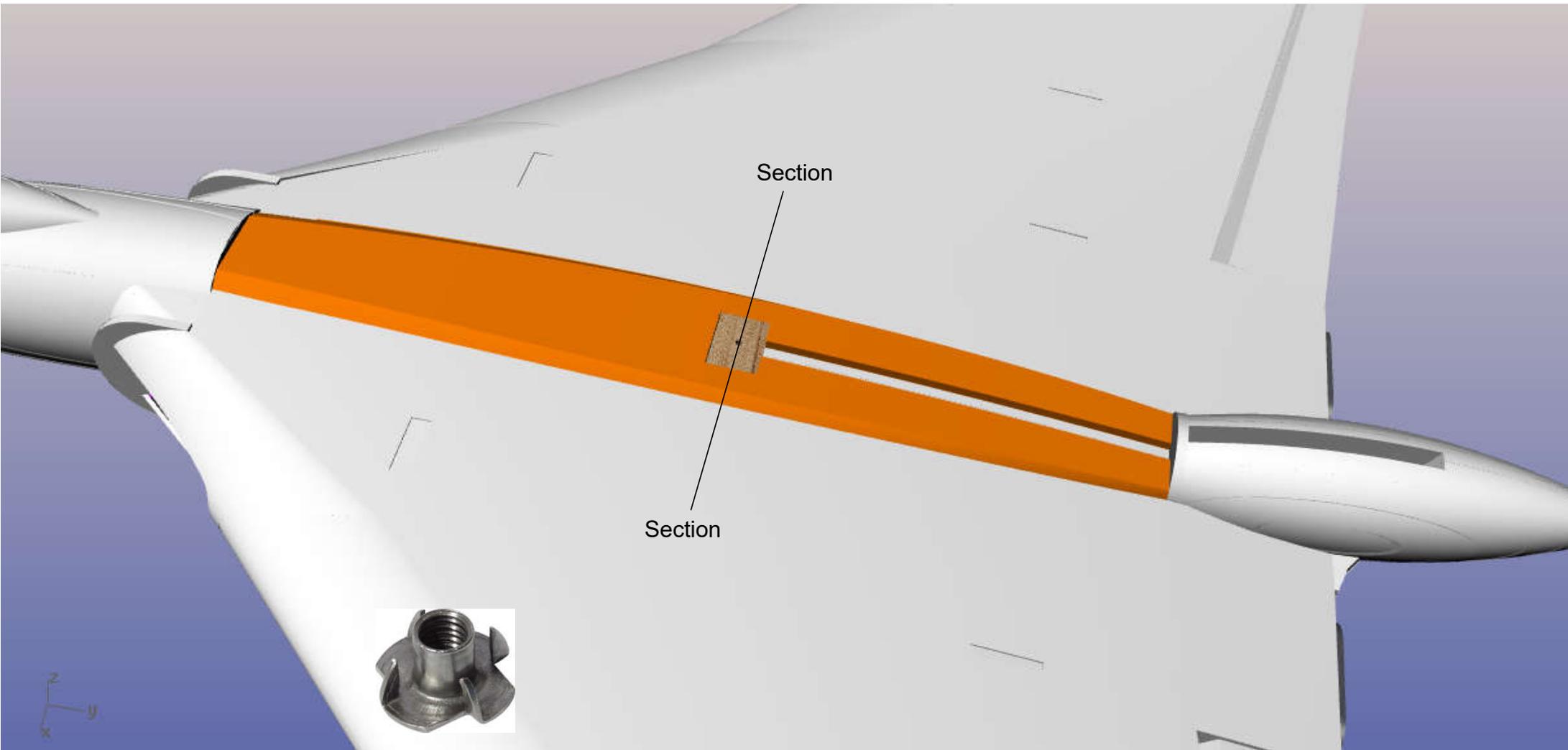
Glue the four air intake nacelle formers in place. Gently bend them so that the top piece has a 3mm arch, and the bottom piece has a 2mm arch.





Using 3mm depron, shape to fit the three sections, adding extra support behind them as necessary to maintain the shape.

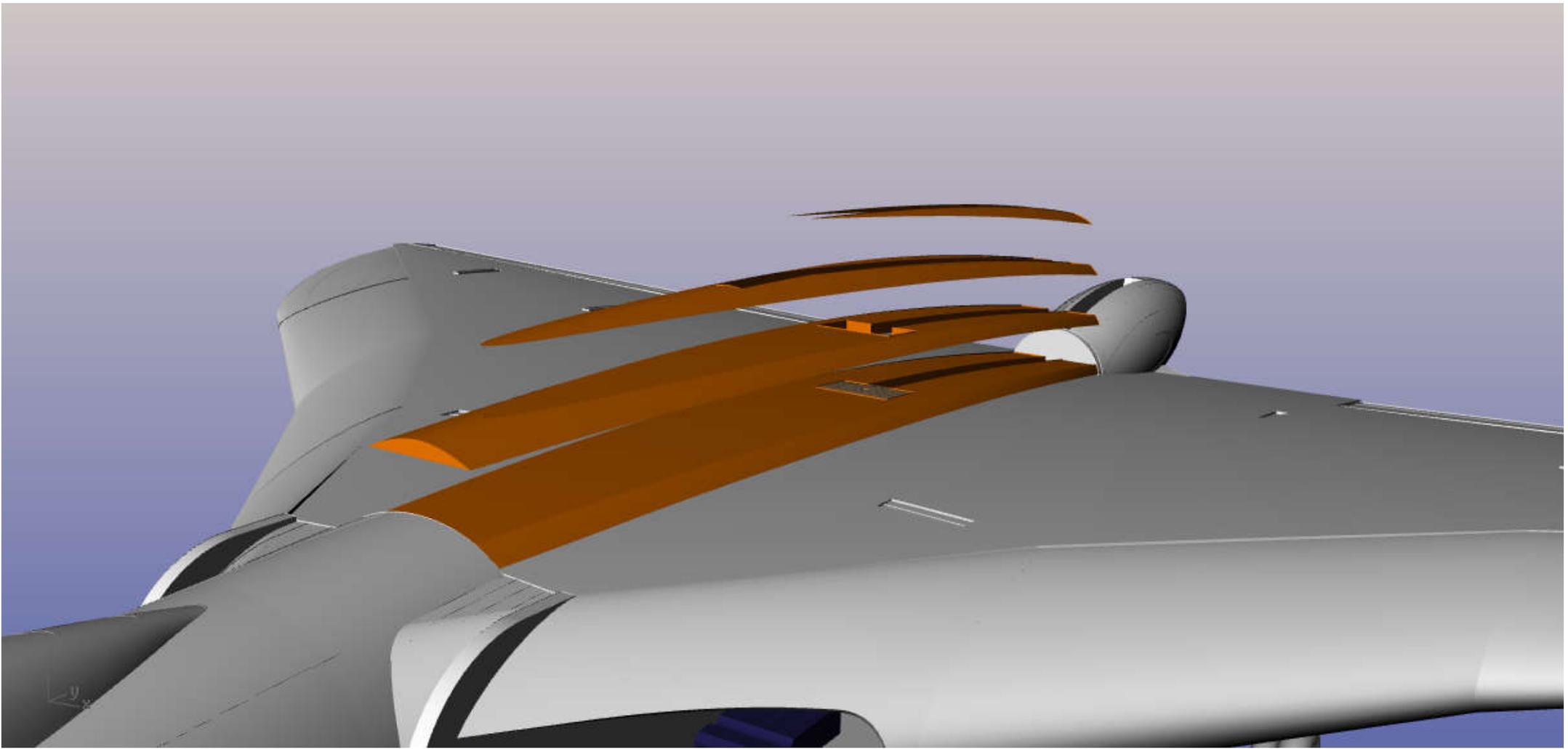
Sand the wingtips and wings to ensure a smooth flowing transition.



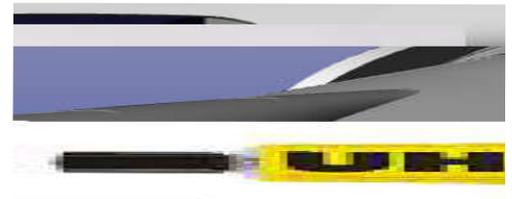
Drill out then hammer an M4 T-nut into the plywood, as shown. This is for attaching the battery retainer to.

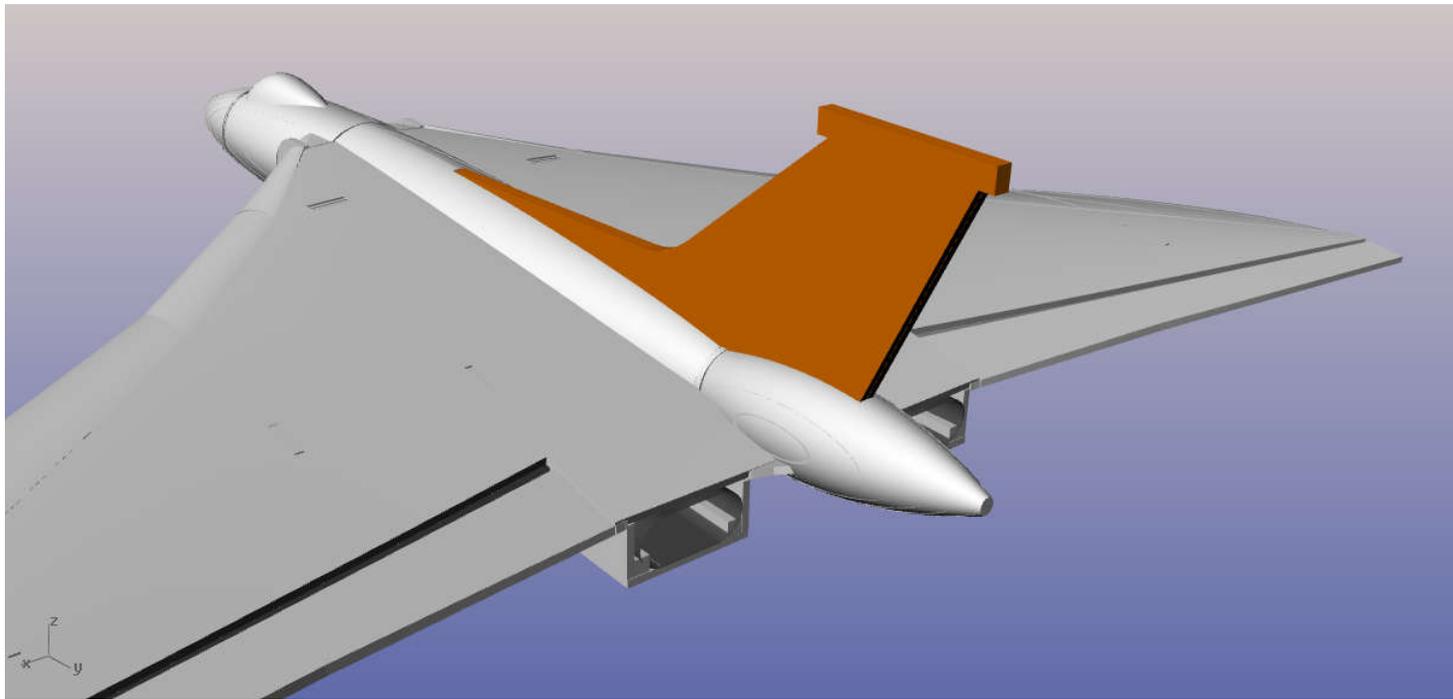
Glue to the depron, located by the Turtledeck 1 piece as shown. Glue in place using UHU por.



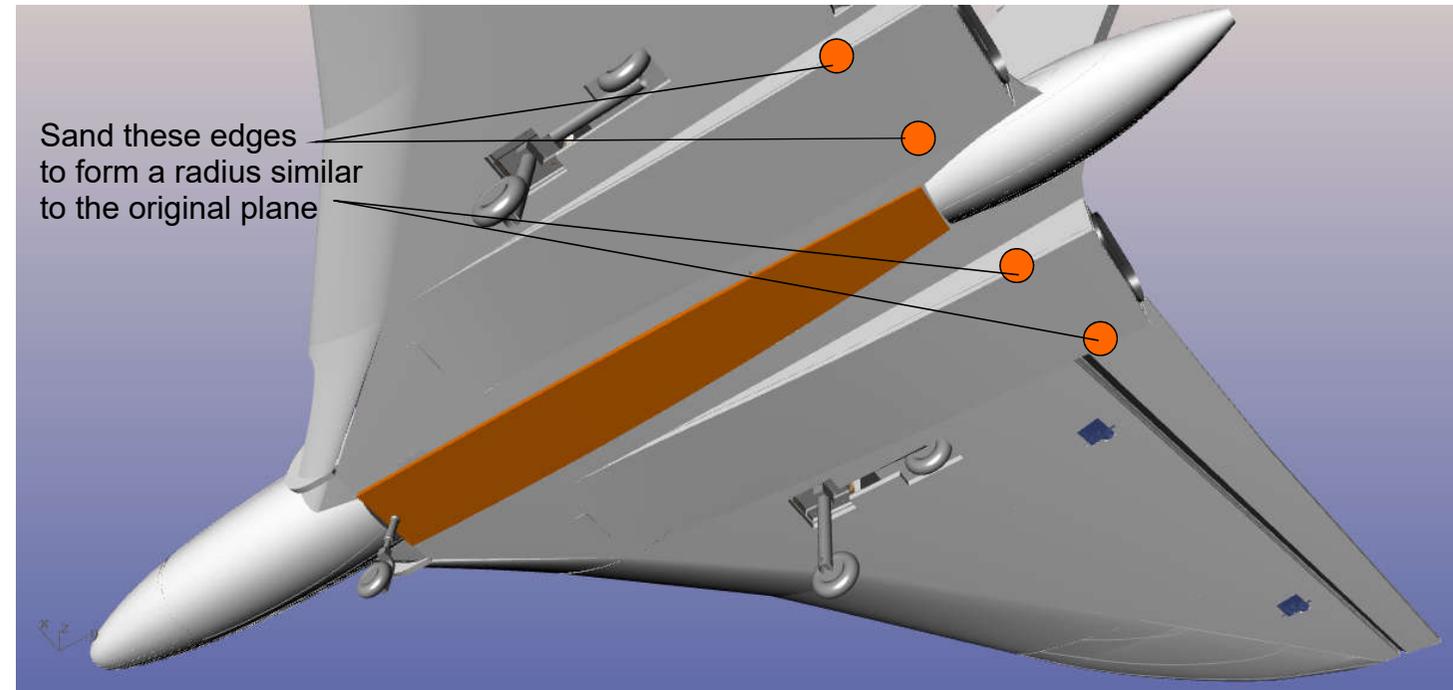


Glue the Turtledeck pieces 2,3 and 4 in place one after the other, so that the curved shape of the wing is followed. Sand to shape.



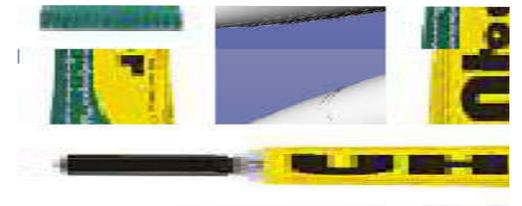


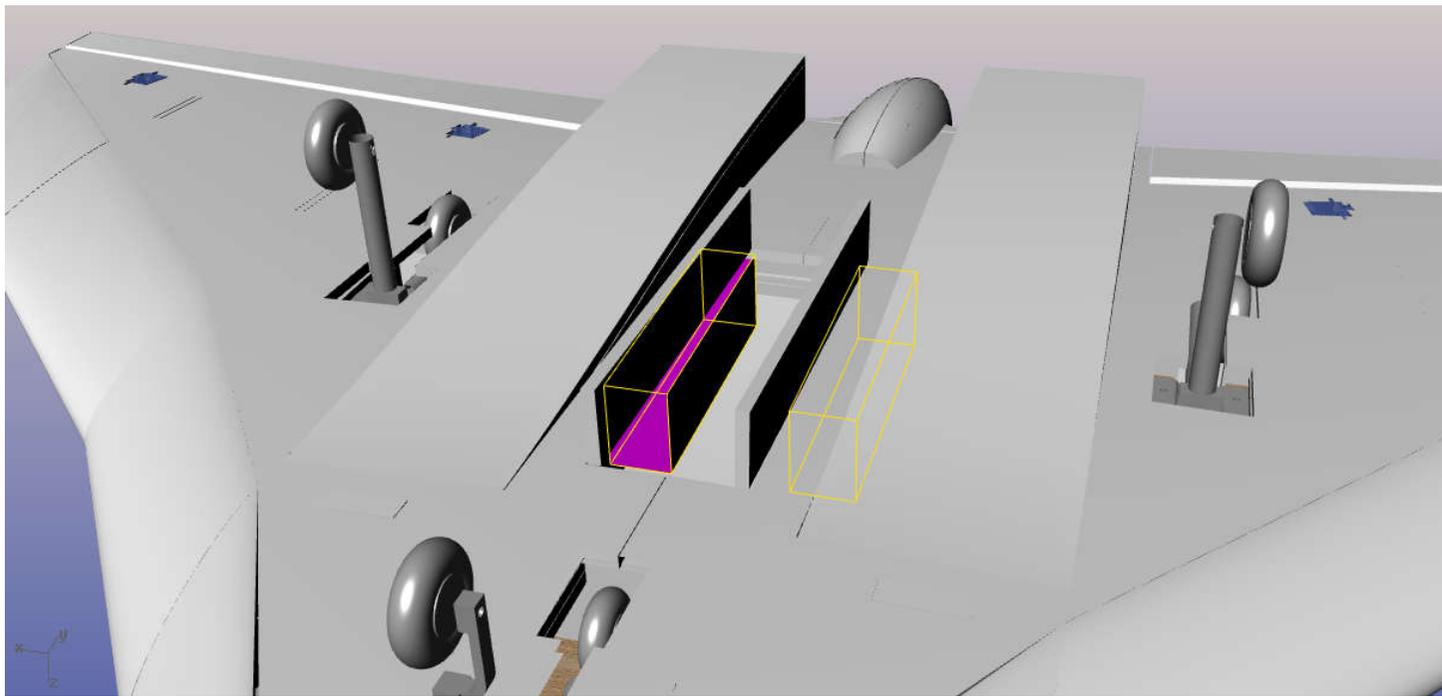
Laminate the two pieces of vertical stabiliser together using uhu por, then slot into the aircraft using a light coat of epoxy.



Shape the belly panel to link the tail and nose sections, maintaining the same profile shape using sandpaper and a block.

Once the shape has been achieved, then cut out the hole for the forward retract and the door for the bomb bay doors, then glue into place.



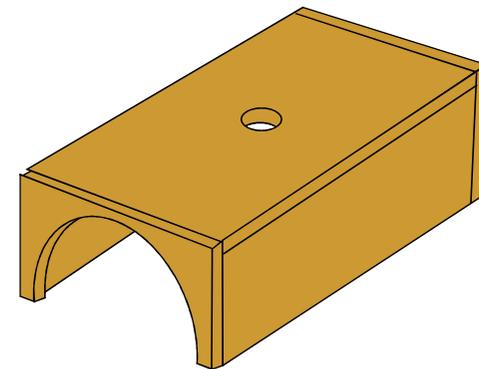
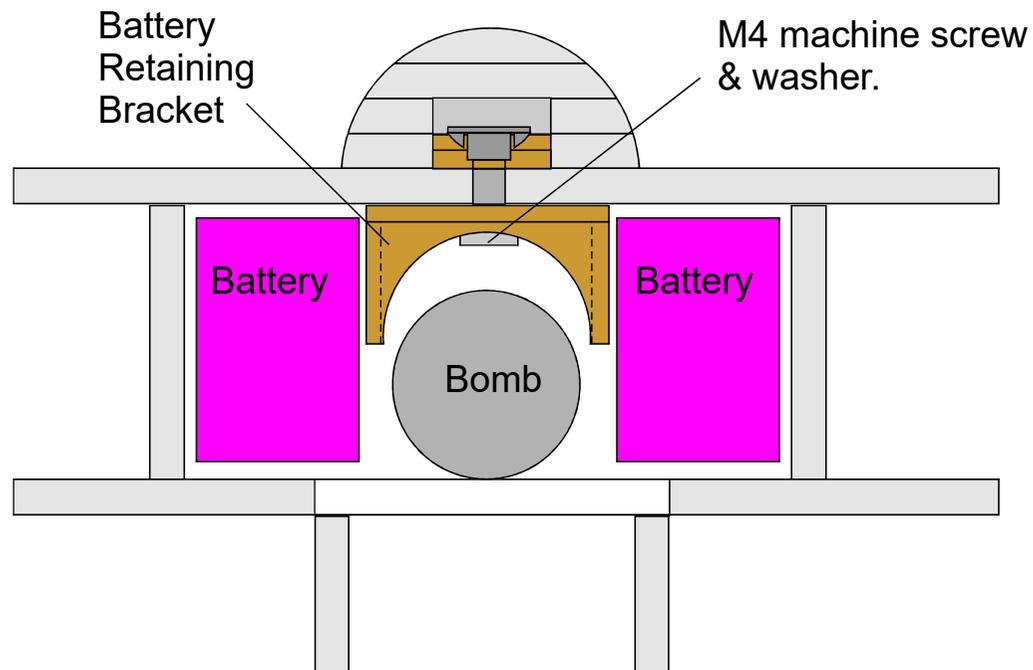


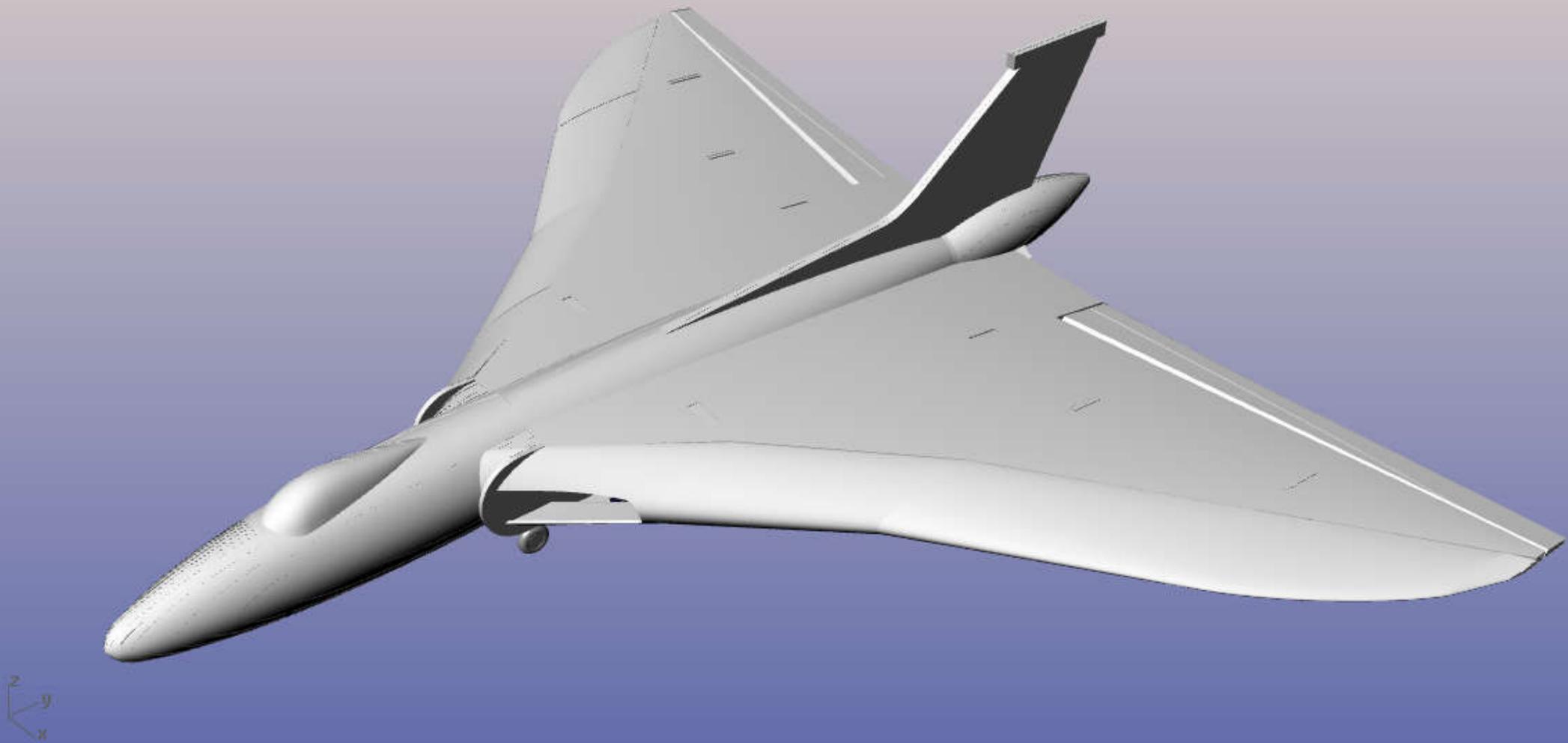
Because the airframe was the smallest I could get two 70mm EDF fans into, they are mounted as far forward towards the fattest part of the wing to get them to fit, as a result, the batteries need to be located in the bomb bay.

I wanted to make a droppable bomb so I devised a system to retain both the batteries and a bomb system, both serviced through the bomb bay doors.

Depending on the battery size you want to use, will depend on the placement and size of retaining bracket, but the principle is sound.

Happy bombing!!





Your model is now complete. Please refer to the finishing guide on how to prepare it for painting, painting and decals.

Happy Flying. Please send pictures to clicketyclarkstone@gmail.com or post on my RC groups page.

Thanks for choosing my design!



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