

BETA Construction Guide

Berkut History

The Sukhoi Su-47 Berkut (Russian: Golden Eagle) was an experimental supersonic jet fighter developed as a technology demonstrator to be later used in the 4.5 generation fighter SU-35BM and current fifth-generation jet fighter prototype Sukhoi PAK FA T-50.

The project was launched in 1983 on order from the Soviet Air Force. But when the USSR dissolved, funding was frozen and development continued only through funding by Sukhoi.

The Su-47 is of similar dimensions to previous large Sukhoi fighters, such as the Su-35. To reduce development costs, the Su-47 borrowed the forward fuselage, vertical tails, and landing gear of the Su-27 family. Nonetheless, the aircraft includes an internal weapons bay, and space set aside for an advanced radar.

Though similar in overall concept to the Grumman X-29 research aircraft of the 1980s, the Su-47 is larger and far closer to an actual combat aircraft than its US counterpart.

Interestingly, the Su-47 has two tailbooms of unequal length outboard of the exhaust nozzles. The shorter boom, on the left-hand side, houses rearfacing radar, while the longer boom houses a brake parachute.

The Su-47 has extremely high agility at subsonic speeds, enabling the aircraft to alter its angle of attack and its flight path very quickly while retaining maneuverability in supersonic flight.

The forward-swept midwing gives the Su-47 its unconventional appearance. A substantial part of the lift generated by the forward-swept wing occurs at the inner portion of the wingspan. This inboard lift is not restricted by wingtip stall and the lift-induced wingtip vortex generation is thus reduced. The ailerons—the wing's control surfaces—remain effective at the highest angles of attack, and controllability of the aircraft is retained even in the event of airflow separating from the remainder of the wings' surface.

Designers Notes

The Su-47 Berkut carries a lot of presence in the air with its black paint, its forward swept wings and dynamic handling.

I asked my friend Fernando "If you could have any RC plane, what would it be", and he said the Berkut. Hence I am doing this in time for his Christmas present!!

Its not just a cool looking plane, here are some of the advantages of a forward swept wing :-

- > higher lift-to-drag ratio
- > better agility in dogfight situations
- > higher range at subsonic speed
- > improved stall resistance and anti-spin characteristics
- > improved stability at high angles of attack
- > a lower minimum flight speed
- > a shorter take-off and landing distance

The original plane's canards are computer controlled to help keep control in High Alpha conditions, but as we don't have a computer in ours, I will use the models canards as part of the elevator pitch function - a few RC model Berkuts have also done the same thing.

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, choose which model type you wish to build - either EDF or Pusher. This construction guide shows both types throughout the build. Please read the instructions carefully.

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-baloons 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)

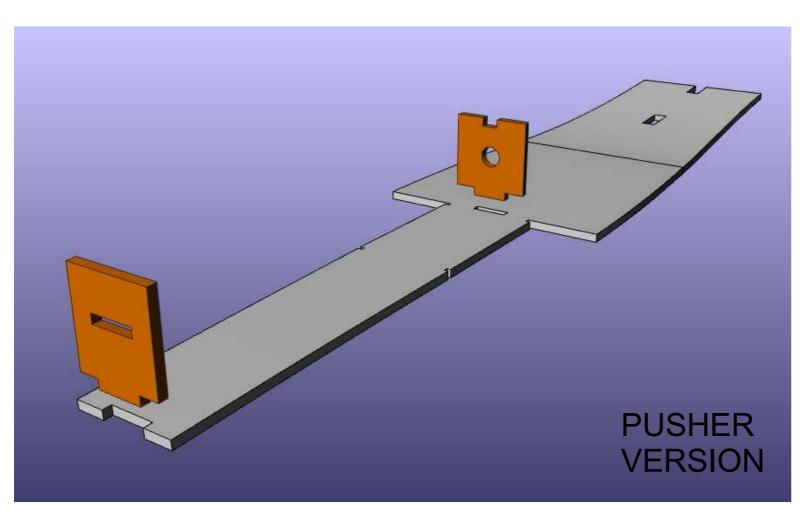
Cutting parts

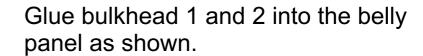
- 1. Print the plans,
- 2. Cut around each part using scissors allow a border of approx (1/4") 6mm
- 3. Use either 3M spray mount or a very light coat of 3M 77 to the back of the parts and stick in an economical layout on the Depron foam.
- 4. Using a safety rule and craft knife over a cutting mat important!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

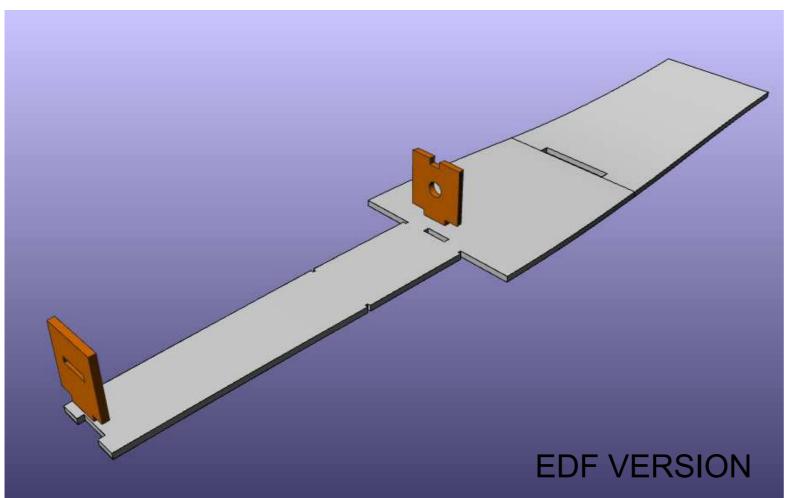
Glueing parts together.

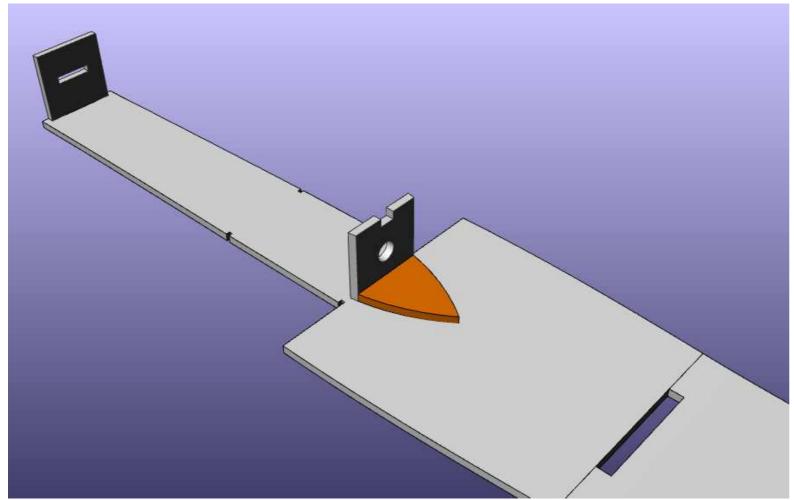
- 1. Ensure a really good fit this will reduce the amount of adhesive used. The Bar Sander is a great tool for this.
- 2. Follow the adhesive instructions closely.
- 3. Use ordinary steel head pins to help keep the parts located whilst epoxy sets.
- 4. Use objects as weights such as paperweights to apply 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.

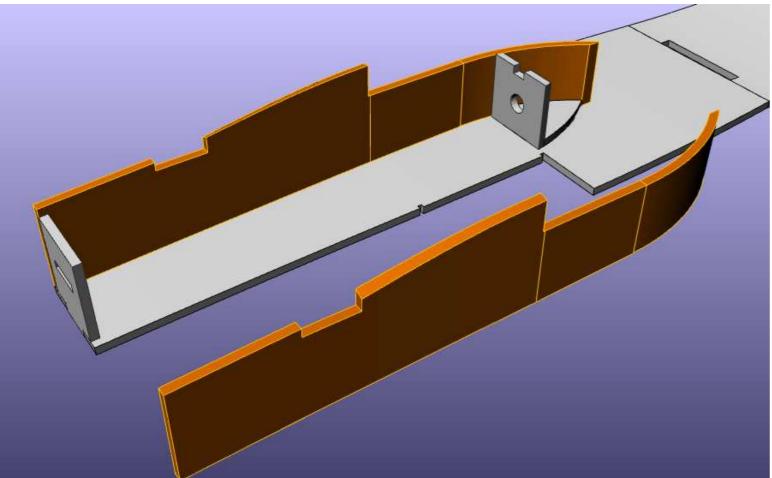








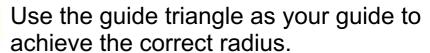




Align the guide triangle to bulkhead no.2 and glue in place.

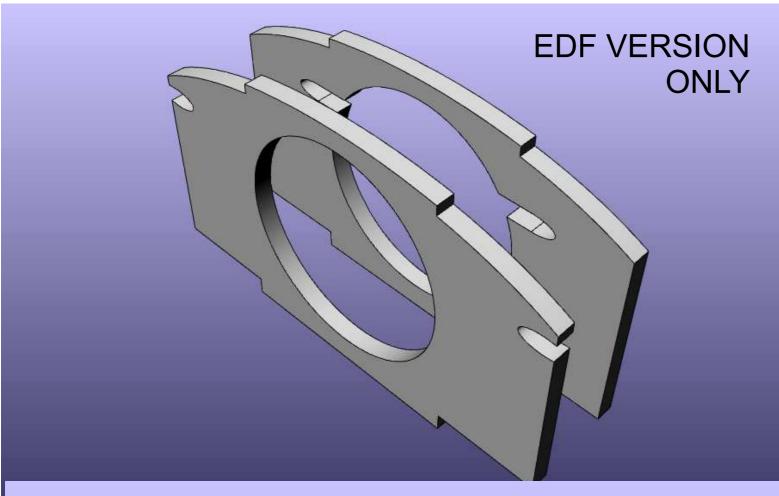


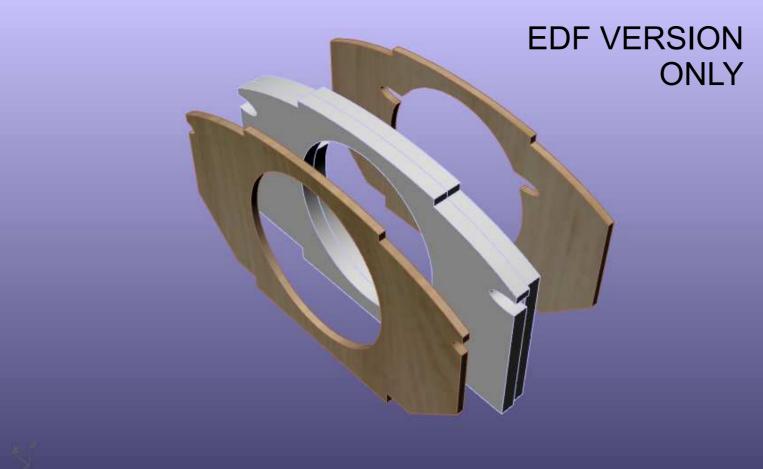
Carefully bend the forward fuselage sides as shown. Either use a heatgun or the table edge bending technique. either way - practice on scrap first.



Glue in place.





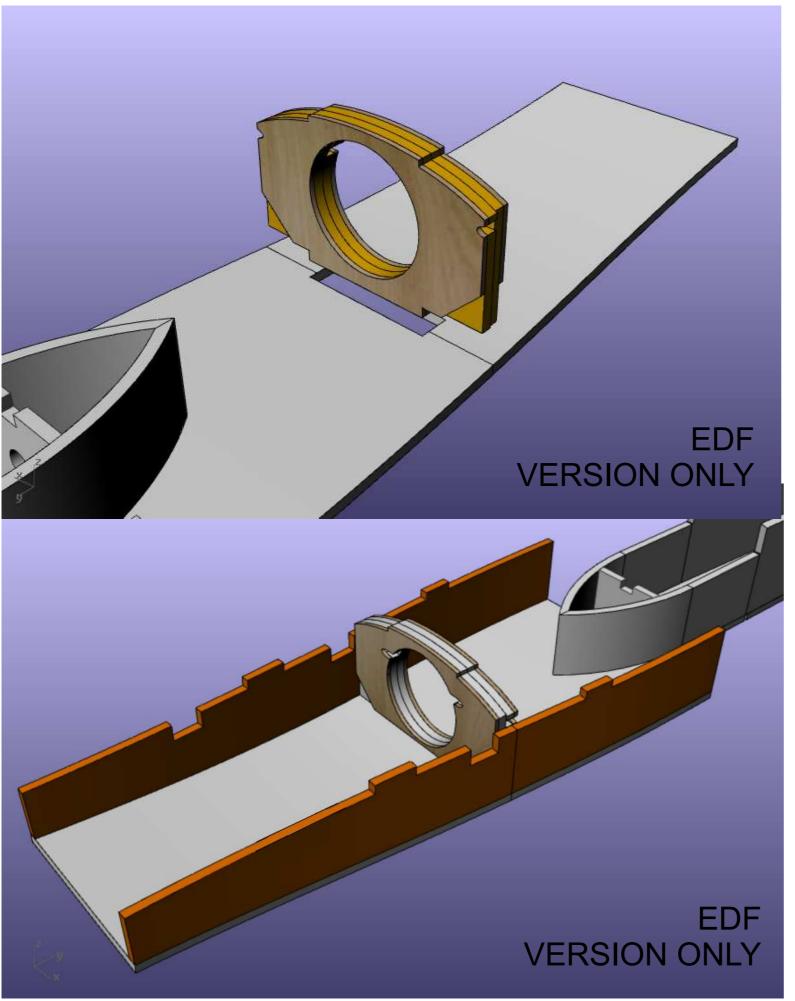


Glue the two EDF bulkheads together.



Glue the two 3mm liteply pieces either side of the EDF bulkhead - ensure the correct part at the correct side.





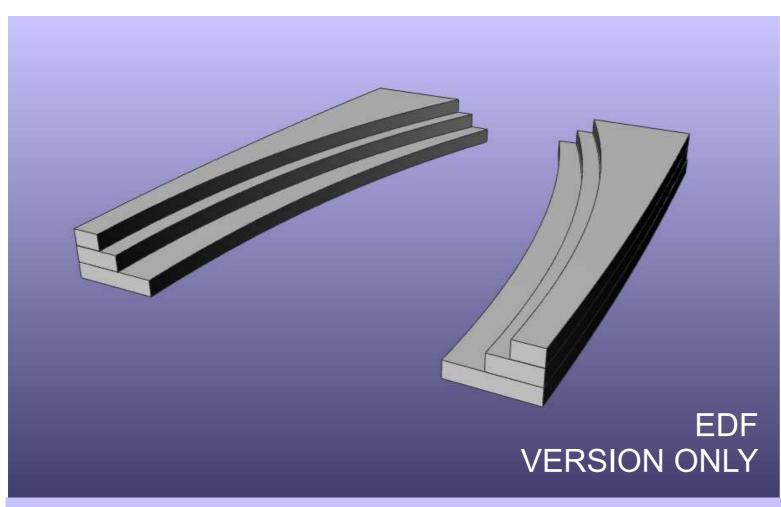
Glue the EDF bulkhead to the belly panel as shown



Using the table edge bending technique, gently curve the rear fuselage panels to fit the shape of the belly panel then glue in place.

NOTE - there is only one rear servo cutout.

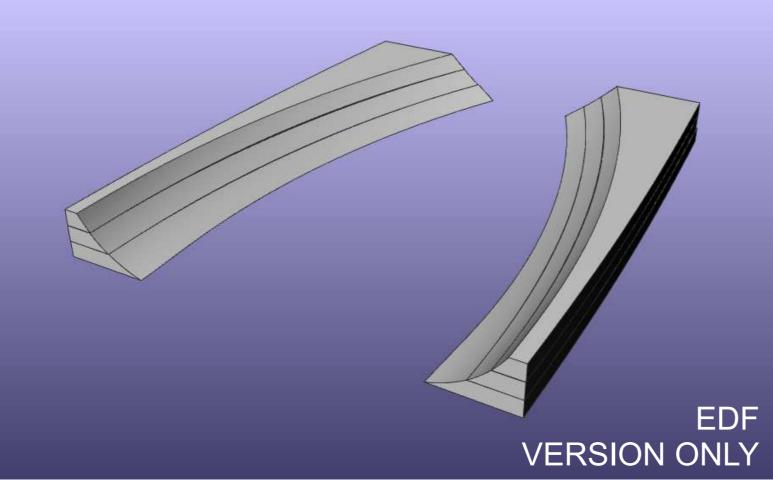


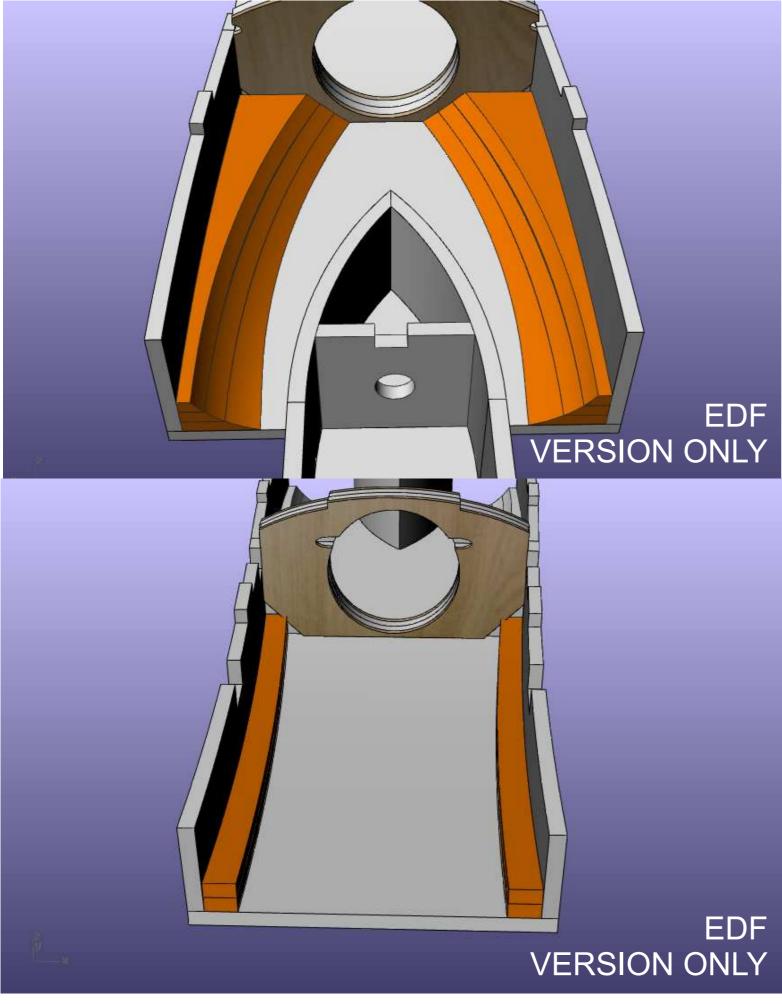




Glue the EDF air intake corner supports together as shown.

Then using sandpaper, sand down the edges in the inner side until it looks similar to the image below.



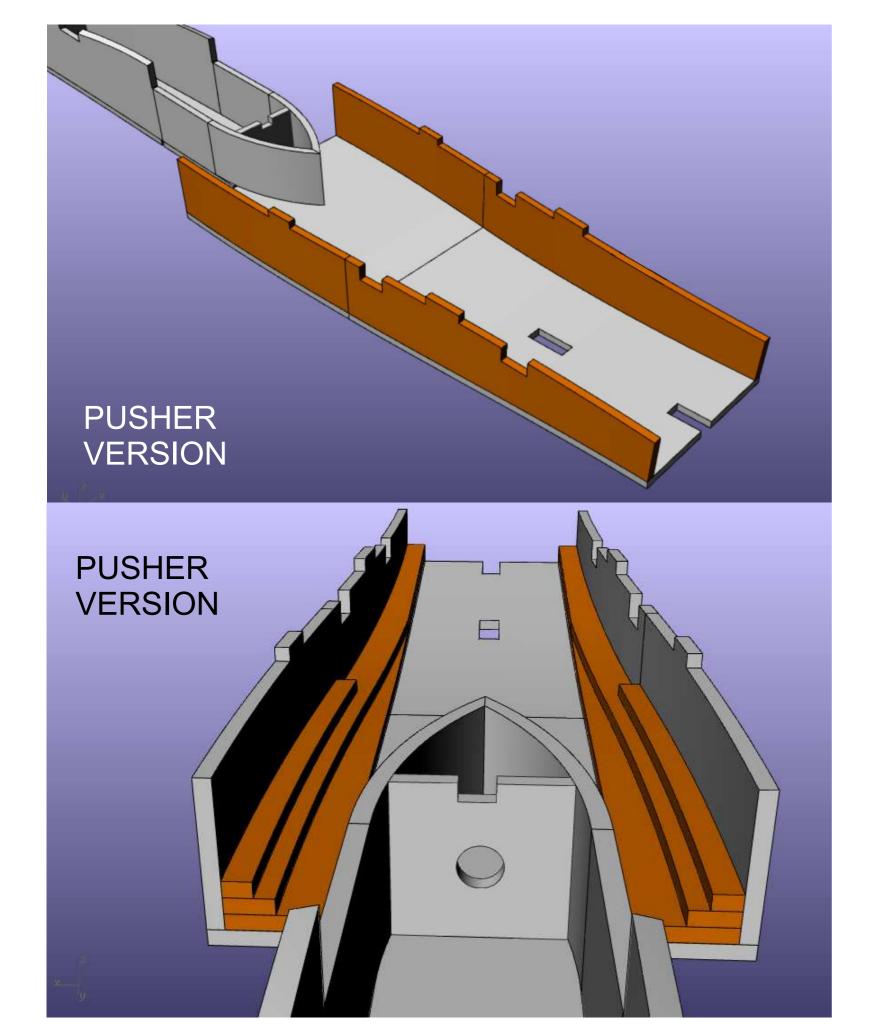


Glue the two air intake corner supports in place as shown.

At the rear of the fuselage, glue the rear fuselage corner supports in place as shown. Sand the inner edge as shown.







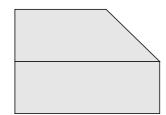


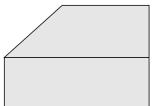
PUSHER VERSION ONLY Glue the two rear fuselage sides in place as shown.

Glue the corner supports as shown, glueing one strip at a time, so that they follow the shape of the belly panel.

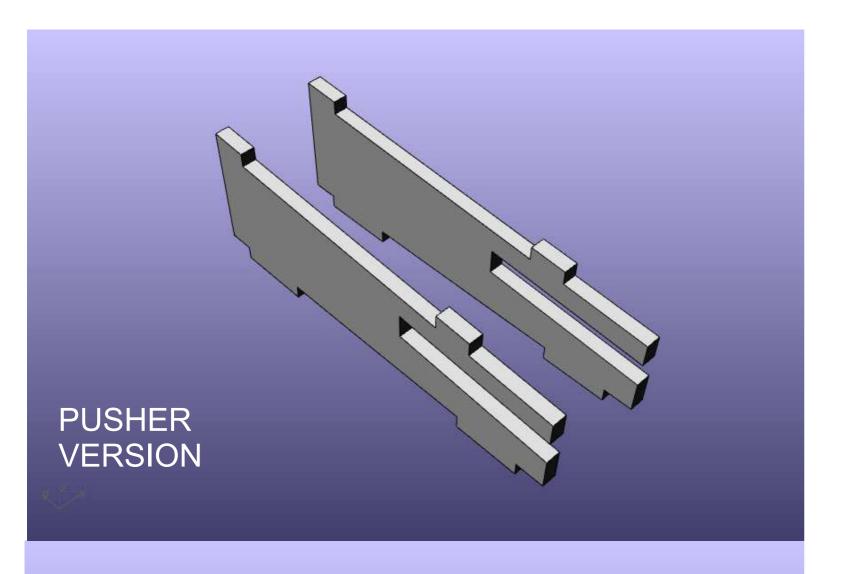


Using a small sanding block, sand the edges away.







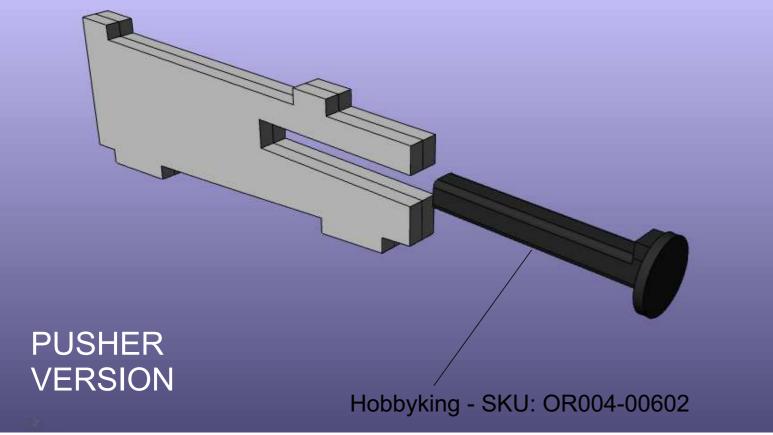


Glue the Pusher motor mount pieces together

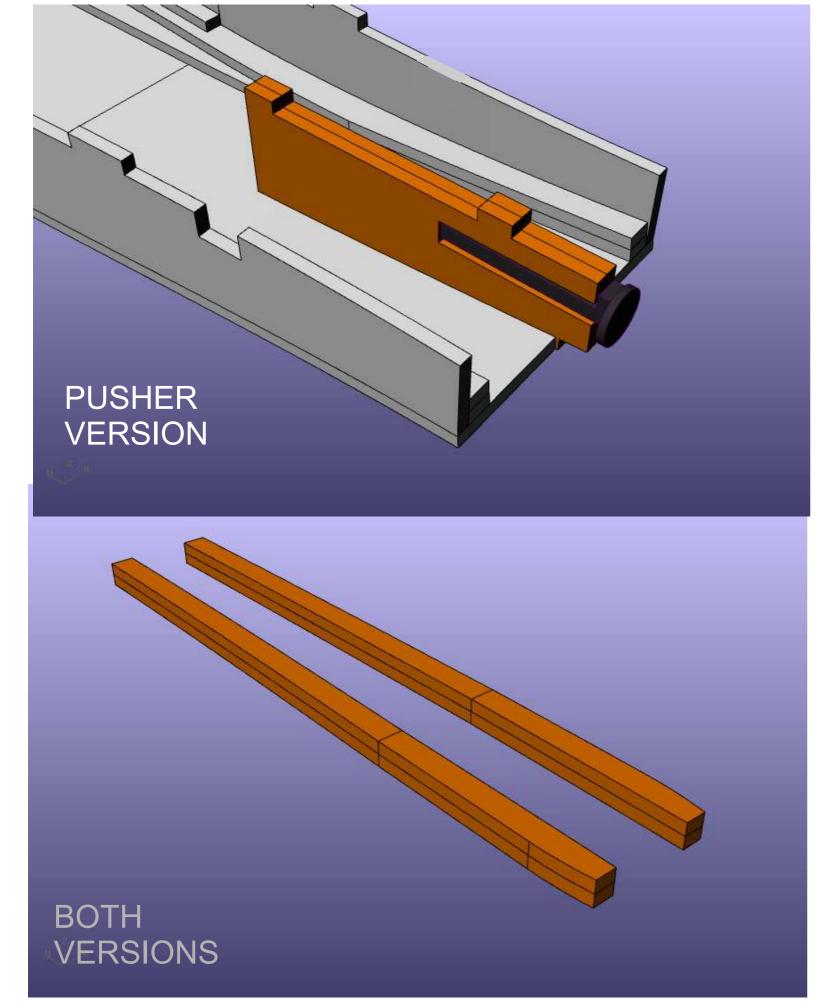


Using hot melt glue, glue the pusher stick mount in the slot prepared for it.

Hobbyking - SKU: OR004-00602







Glue to Pusher motor mount assembly into the slot at the rear of the belly panel as shown.

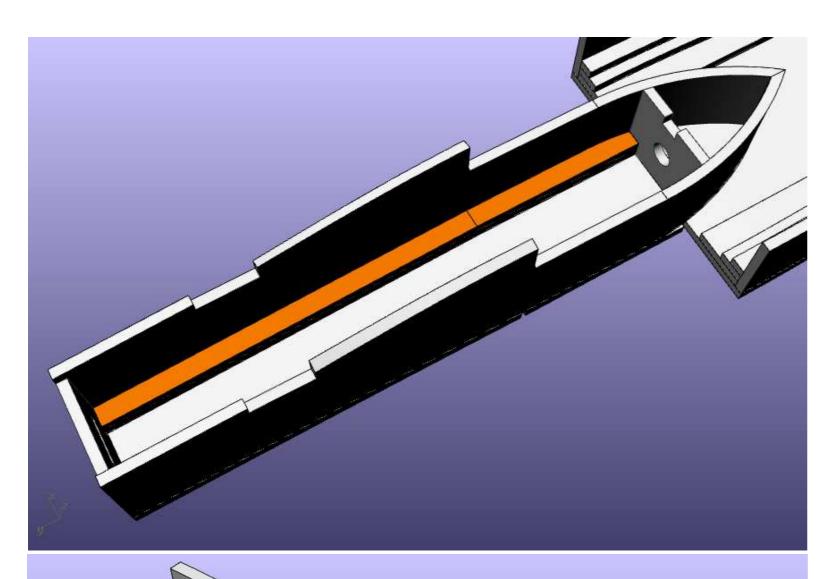


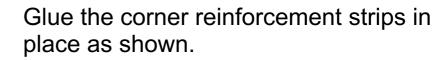
ON BOTH VERSIONS



Glue the forward fuselage corner reinforcer strips together as shown





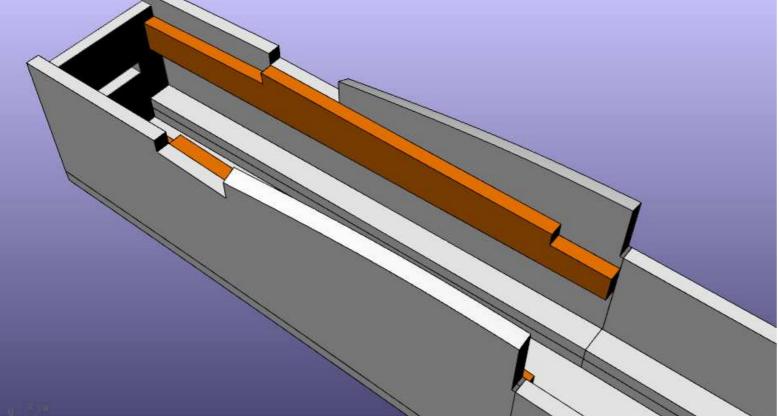


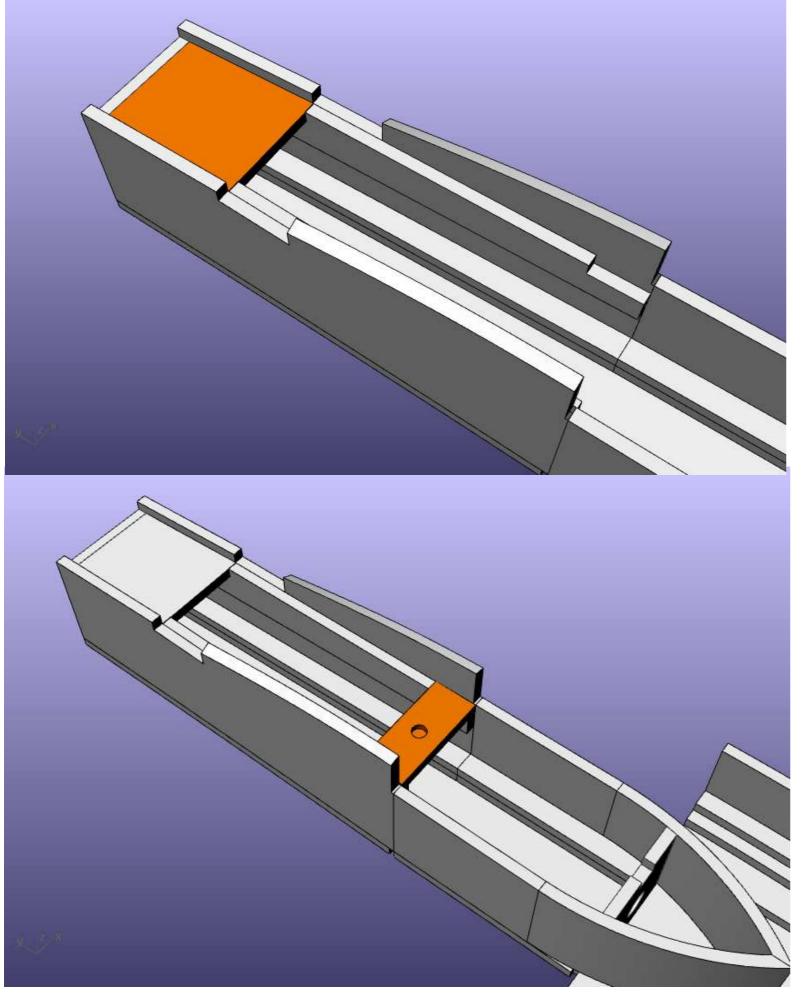


Glue the canopy support pieces in place as shown.



The top face should be aligned with the top of the rear end of the forward fuselage.



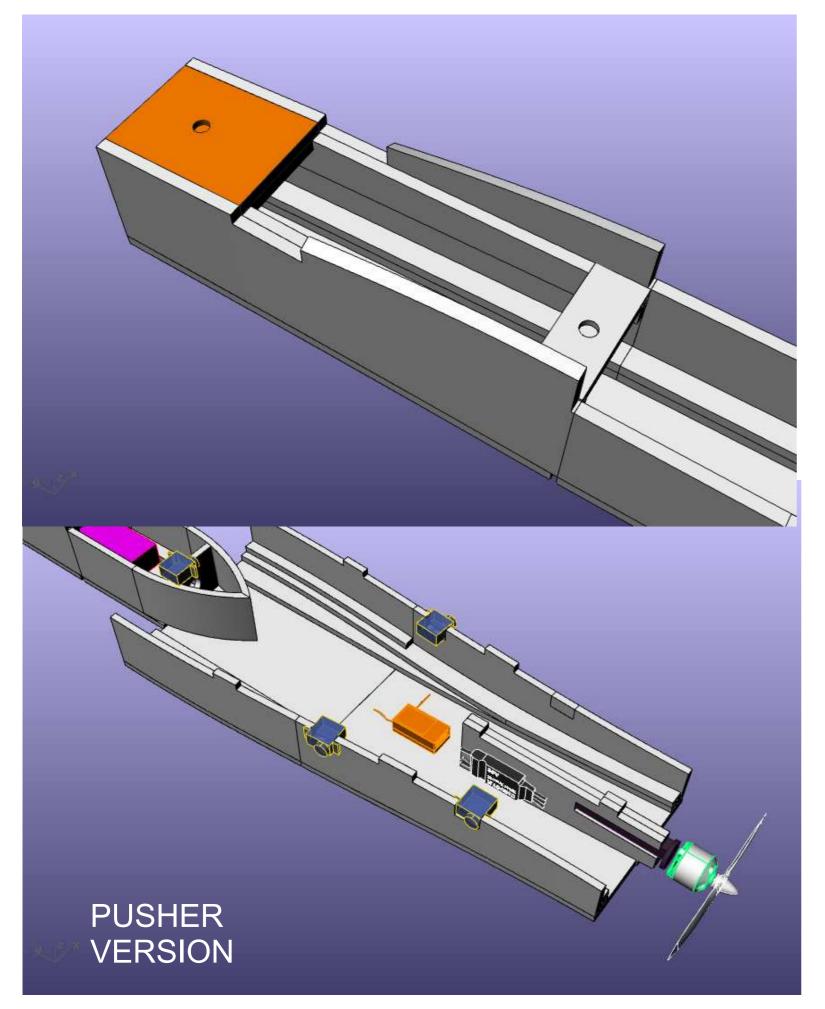


Glue the forward fuselage upper 1 part in place.



Glue the rear magnet panel in the recess provided.





Glue the forward fuselage upper 2 piece in place as shown.

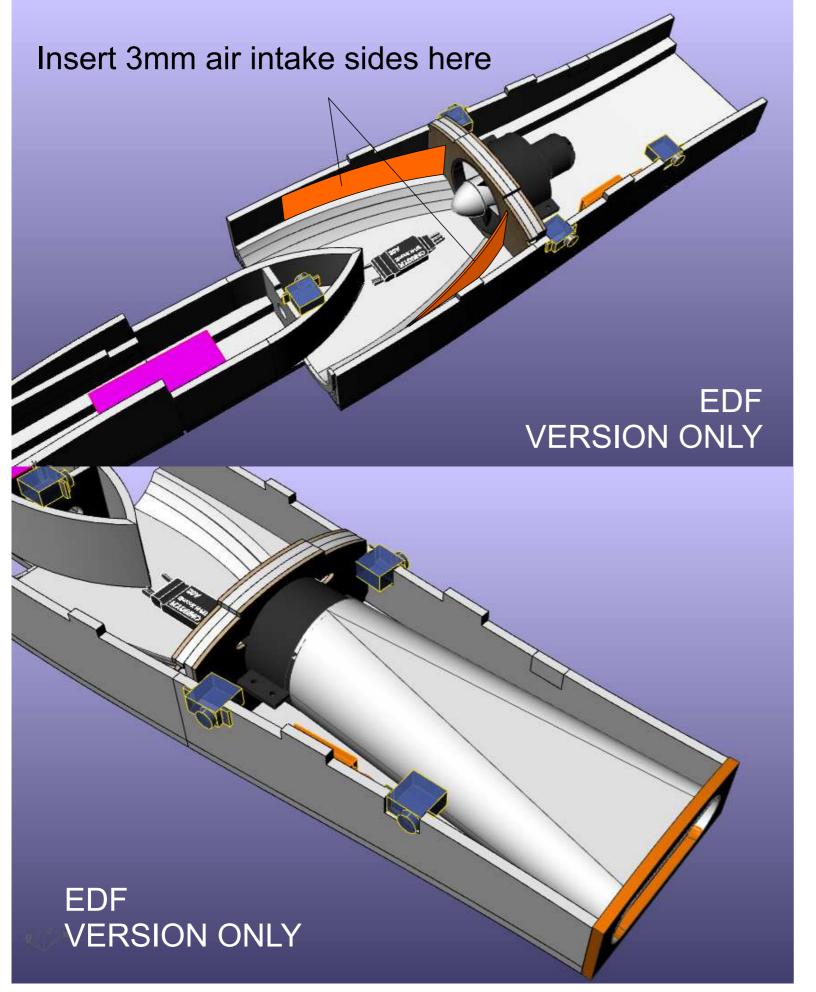


PUSHER VERSION ONLY.

Connect together all the electronics and test.

Glue in place as shown using hot melt glue to hold everything in place.





EDF VERSION ONLY

Glue in the electronics using hot melt glue as shown. Drill holes through the bulkhead for the power cables to suit your ESC.

Using UHU Por, glue the two 3mm air intake sides in place following the shape of the lower pieces, so that the tops will align under the wing part (later on)



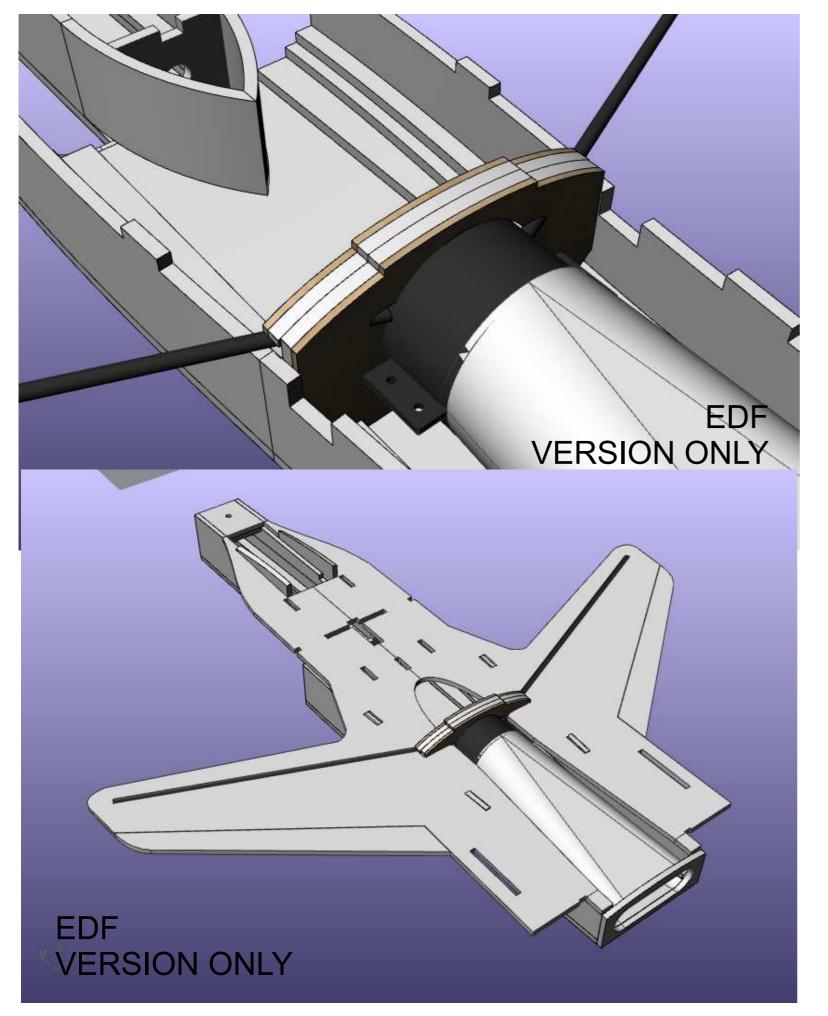


Glue the exhaust bulkhead in place.

Make the duct, oversize in paper, and trim to fit your particular installation. Then use that as a template for one made from 0.5mm plastic sheet (eg overhead projector acetate material), joined together with nylon reinforced tape.

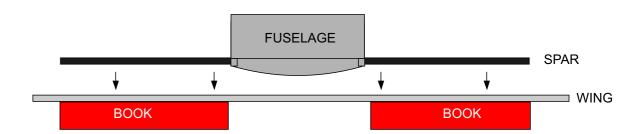






Using the wing panel to get the reference angle, carefully drill a 6mm hole through the EDF bulkhead so that both ends of the carbon rod are supported in place. Test fit the wing.

- 1. Apply UHU por to all the surfaces that will touch the wing panel, including the servo sides, and the 3mm air intake sides. Touch together to wet both faces and separate.
- 2. Apply masking tape to the topside of the Carbon spar channels in the wing.
- 3. Apply 20minute epoxy to the end of the carbon rods and insert into the EDF bulkhead.
- 4. Apply 20minute epoxy to the carbon rods.
- 5. Using two objects (eg books) of the exact same thickness to keep the wings supported. lay the wing upside down and carefully press the fuselage onto the wing.



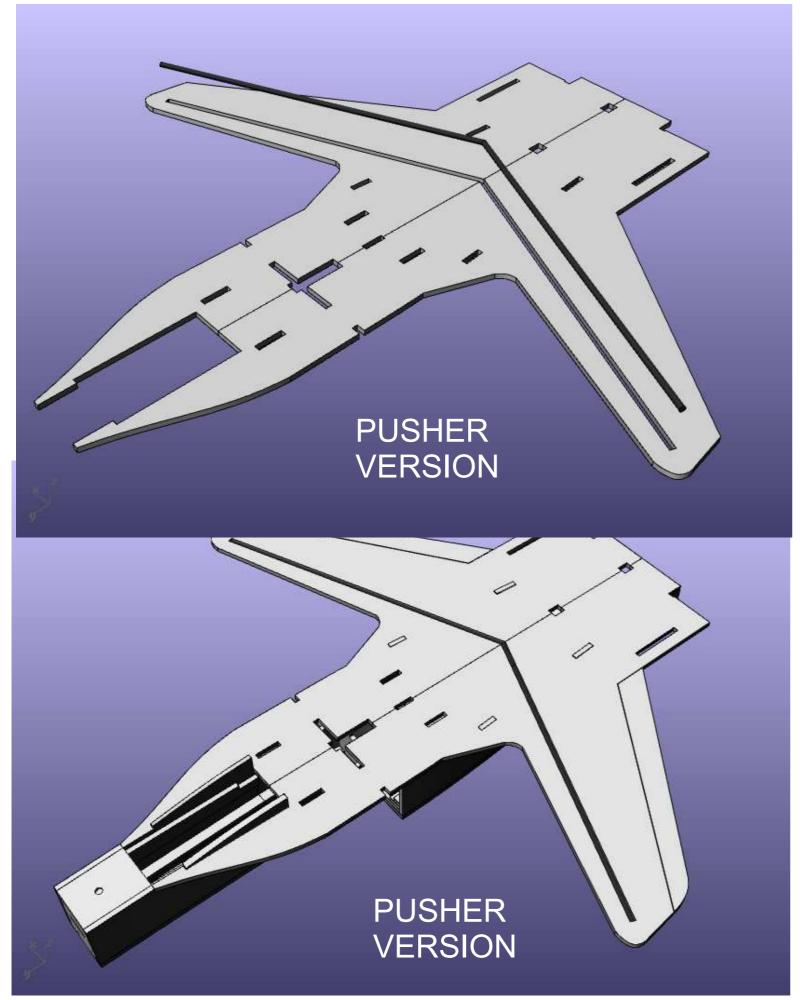
Put more epoxy if needed over the spar in the channel, and using a scrap piece of depron, ensure that the epoxy is scraped of the wing.

Apply masking tape to the underside of the wing to flatten the glue and provide a smooth finish when set.

Add more books over the wings to ensure they keep shape the glue sets.







Cut the carbon to length with a mitre joint in the middle. Using masking tape on the underside of the spar slot. cover the carbon with epoxy and then press into the slot. scrape off any excess epoxy and apply masking tape over the top.

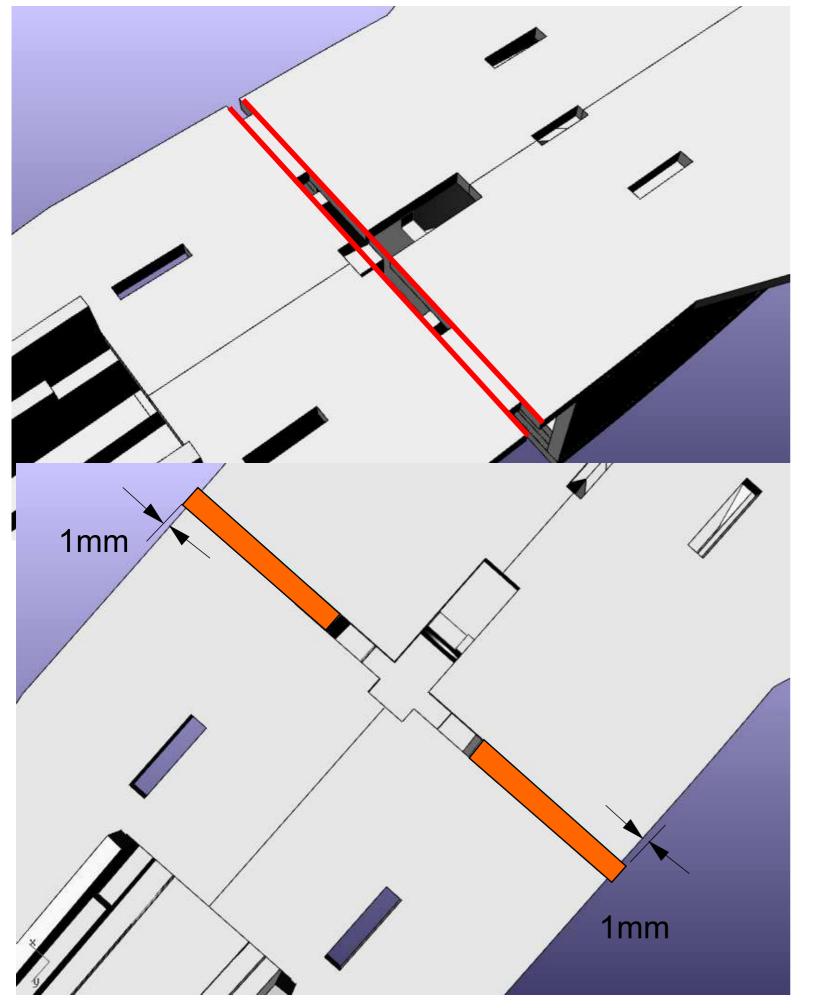
leave to set in a flat place. weighed down if necessary





Glue the wing panel to the fuselage assembly



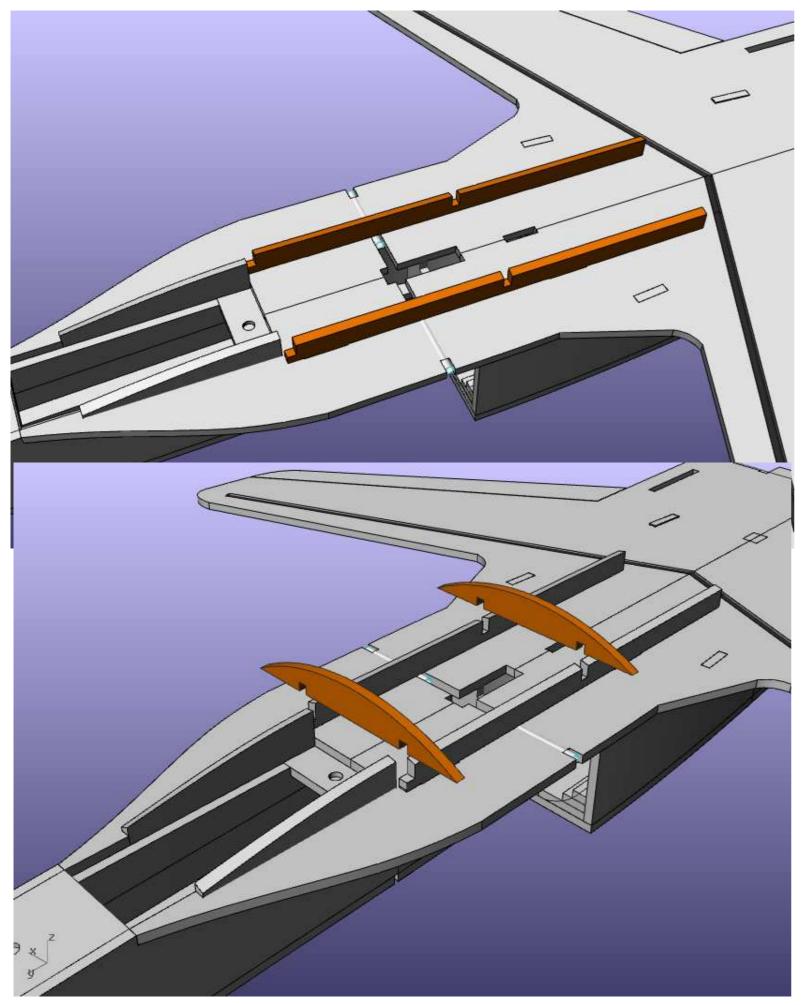


Cut a channel across the wing panel as indicated by the slots that are already cut out.

Cut two aluminium tubes for the carbon spar to pass through and epoxy them into the slot, leaving space around the longitudinal slot for a servo horn to operate.

Leave 1mm aluminium protruding outside of the fuselage. This will be a shoulder for the plastic stopper to rub against.



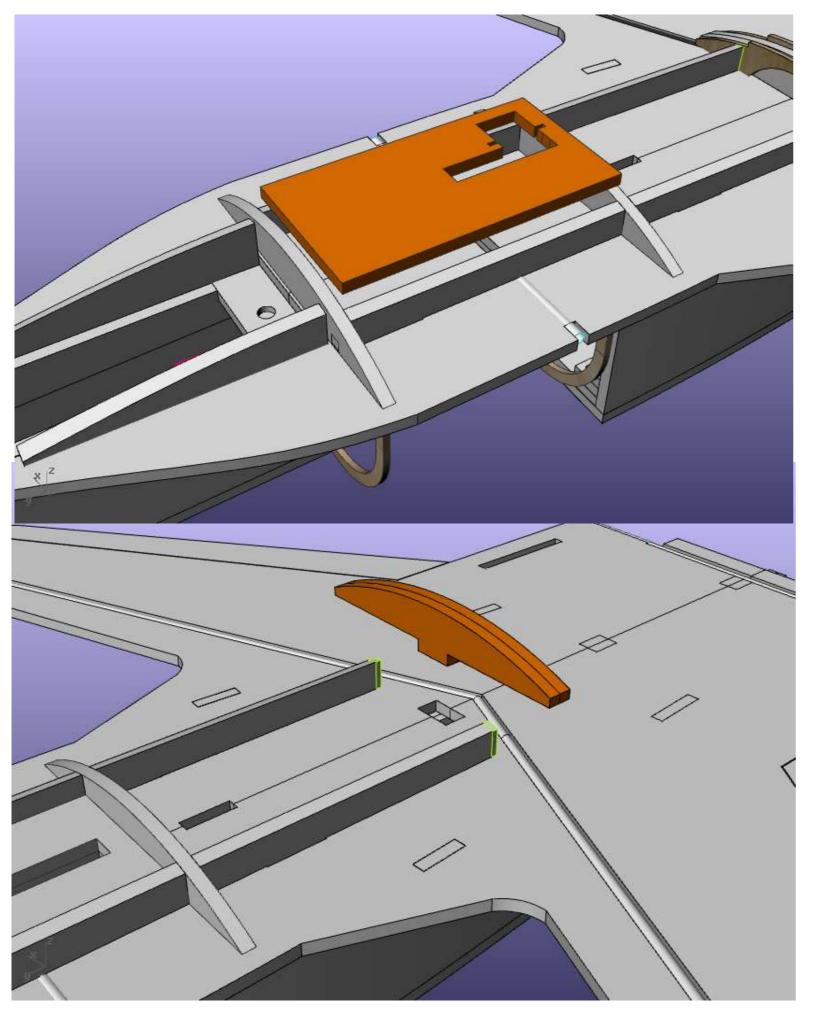


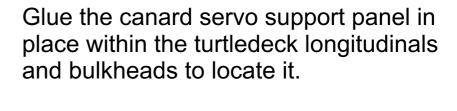


Stick the turtledeck longitudinals onto the wing panel as shown. Use the slot and tabs to locate.

Glue the two Turtledeck bulkheads in place as shown - use the slot and tabs to locate



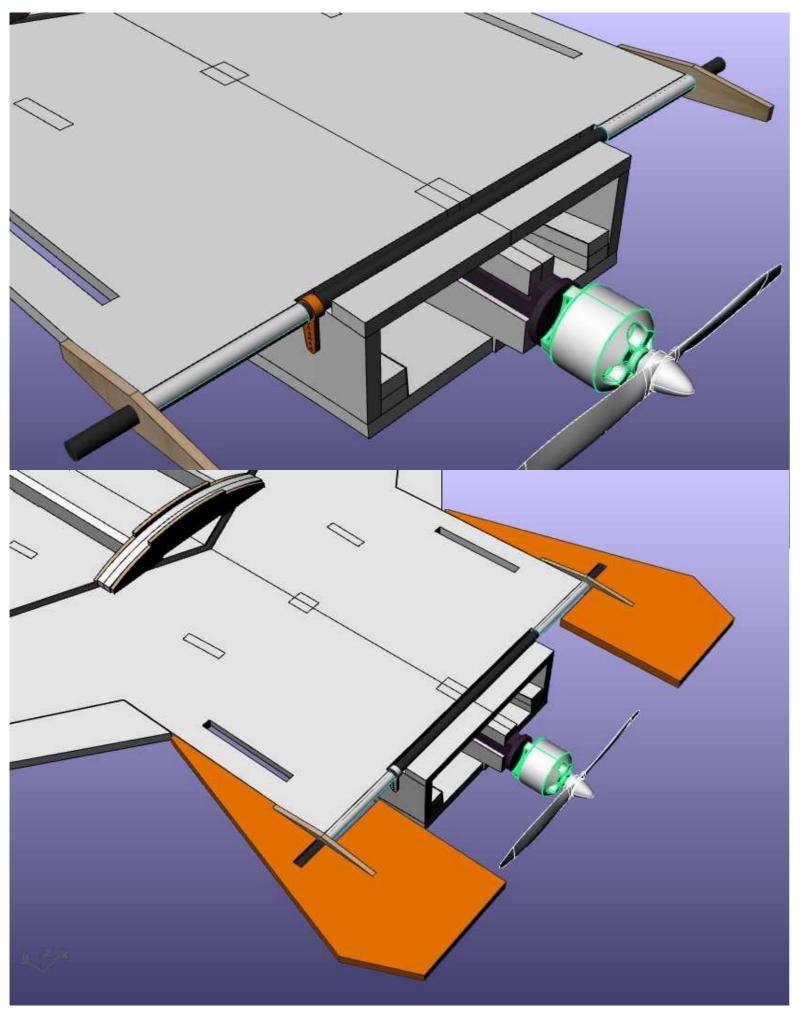






Glue the two Turtledeck bulkhead No.3 parts together and then onto the wing in the slot provided.





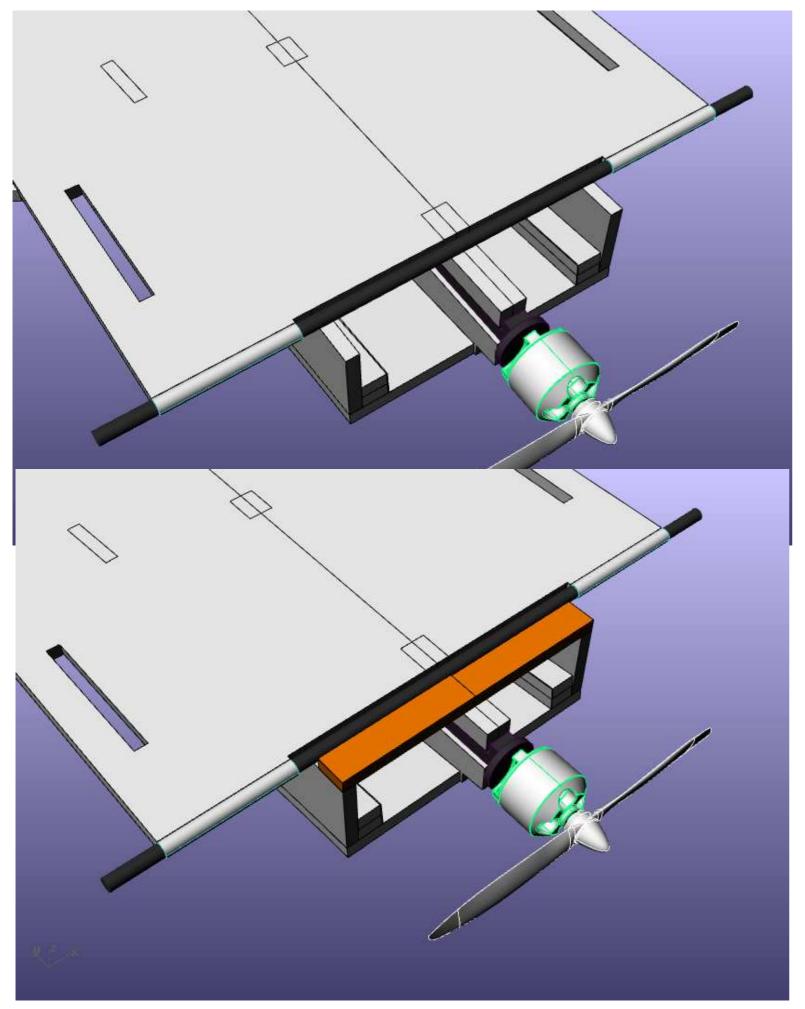
Drill out a standard sized control horn with a 6mm drill bit. slide in the gap between the fuselage side and the aluminium tube, and then slide the carbon tube through.

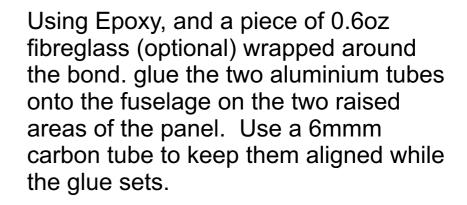
Accurately cut and slide on the two liteply elevator supports and carefully glue (on the outer face of the ply) to the carbon tube - being very careful not to let any epoxy into the tube



Glue the Elevators to the ply and carbon tube as shown. Be careful not to glue the Elevators to the aluminium tube.



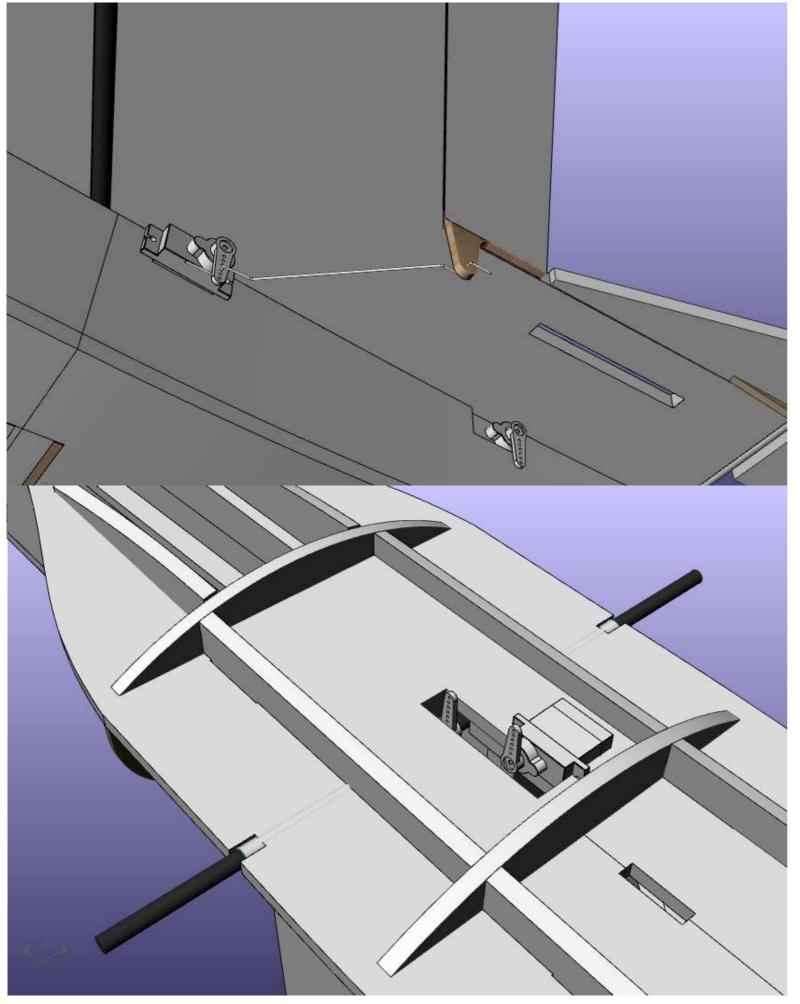




TIP: Roughen the aluminium tube outer with sandpaper to help achieve a good bond

Stick the fuselage tail piece in place - ensuring it doesn't hinder the free rotation of the carbon spar.





Using 3 Graupner mini hinges per wing, Glue the ailerons to the wings using hot melt glue. Create the control horn from 3mm lite ply and glue to the ailerons with hot melt glue.

Connect to the servos using piano wire.



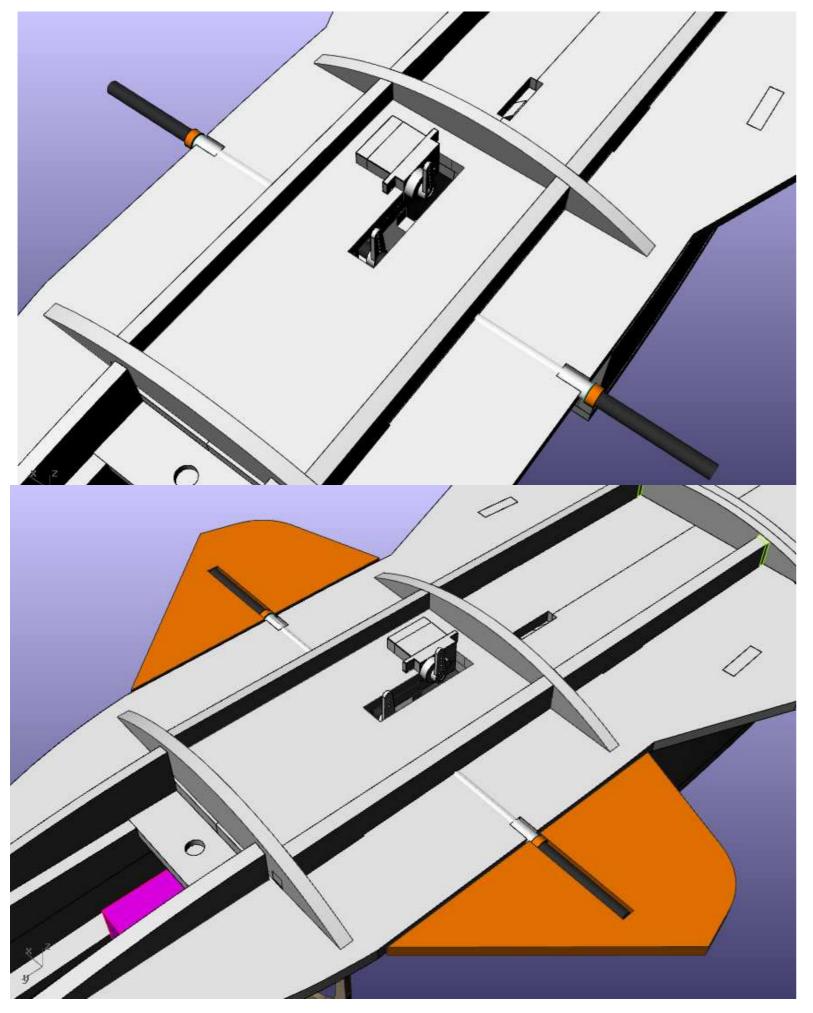
Using a standard sized servo horn, drilled to 6mm, slide the canard carbon tube into the aluminium tubes and horn, as shown.

Glue the servo in place using hot melt glue.

Use piano wire to connect the two together.

Ensure that your control horns do not exceed the height of the turtledeck 3mm outer skin!



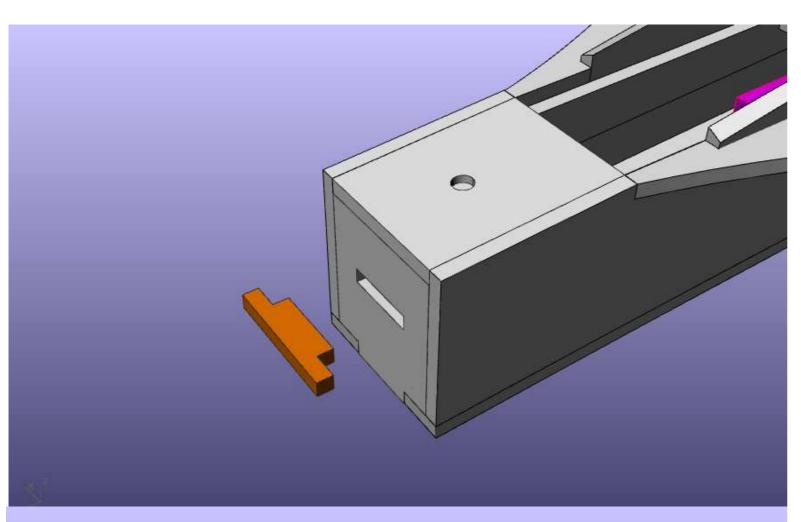


Use two propellor shaft adaptors (or similar) drilled out to 6mm to use as end stops to prevent the carbon tube sliding sideways too far.



Use the epoxy and masking tape method to glue the canards to the carbon tube.

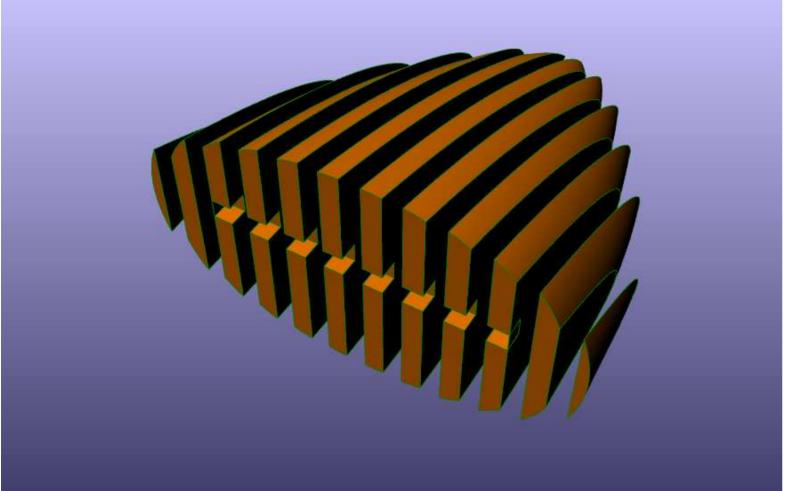




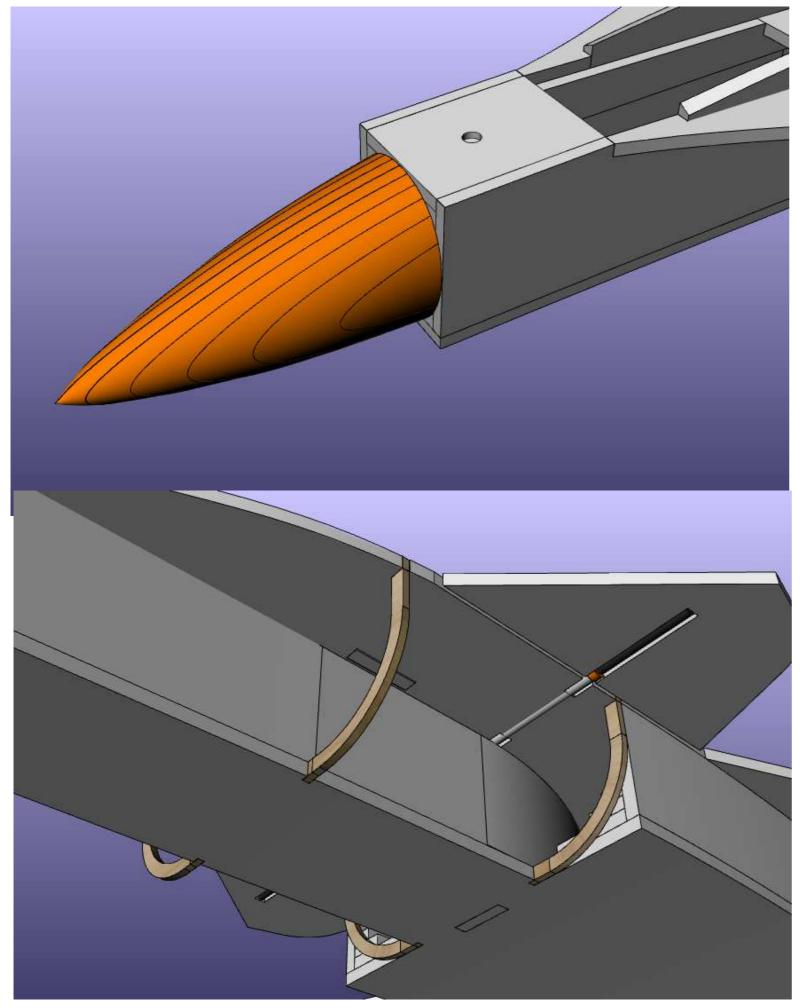




Glue the pieces of the nosecone together and sand until smooth.





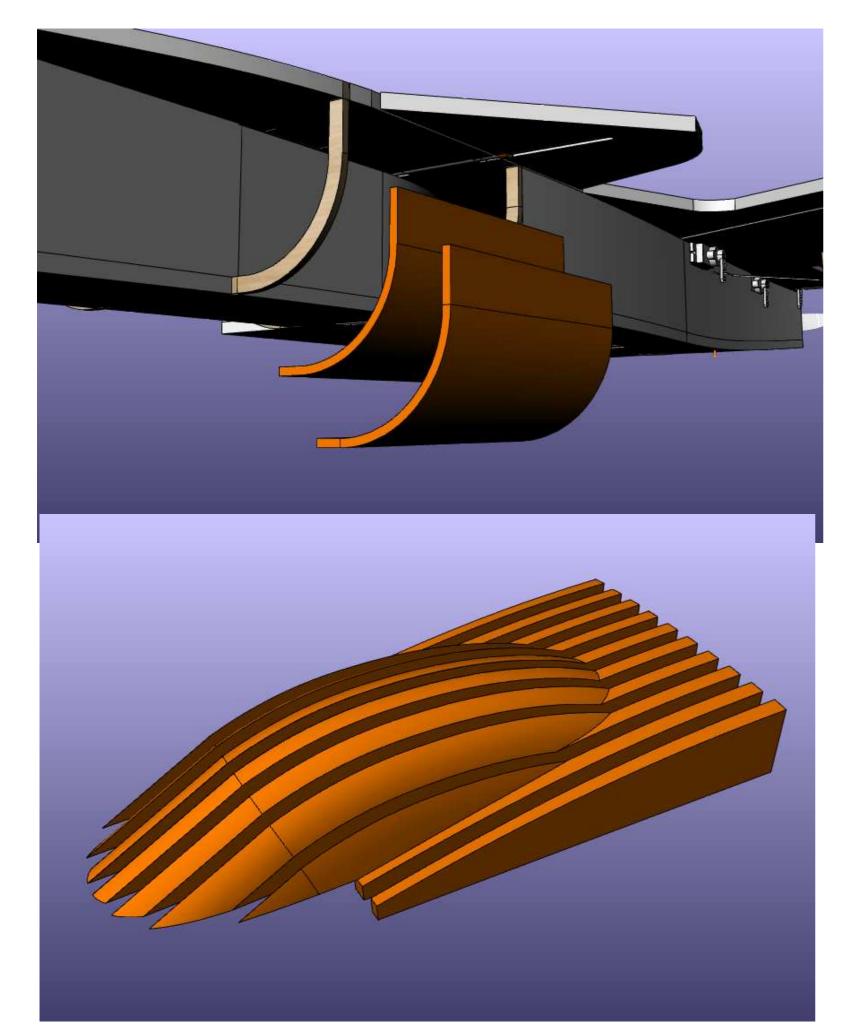


Glue the nosecone to the fuselage



Glue the liteply air intake formers in place using the locator tabs.



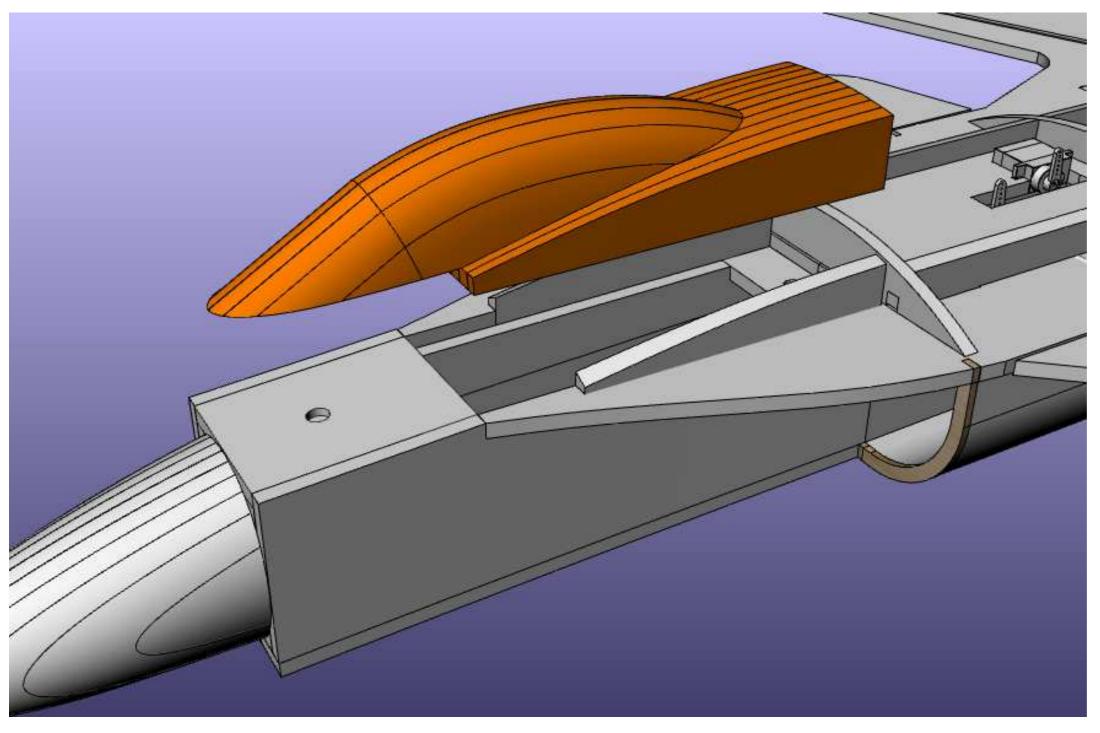




Using two layers of 3mm depron, shape the depron to match the perimeter shapes.

Glue together the parts of the canopy, and sand to shape.









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.



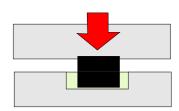
4. Whilst still wet, lay masking tape over the area.



5. When fully cured, remove tape and put adjoining magnet on top



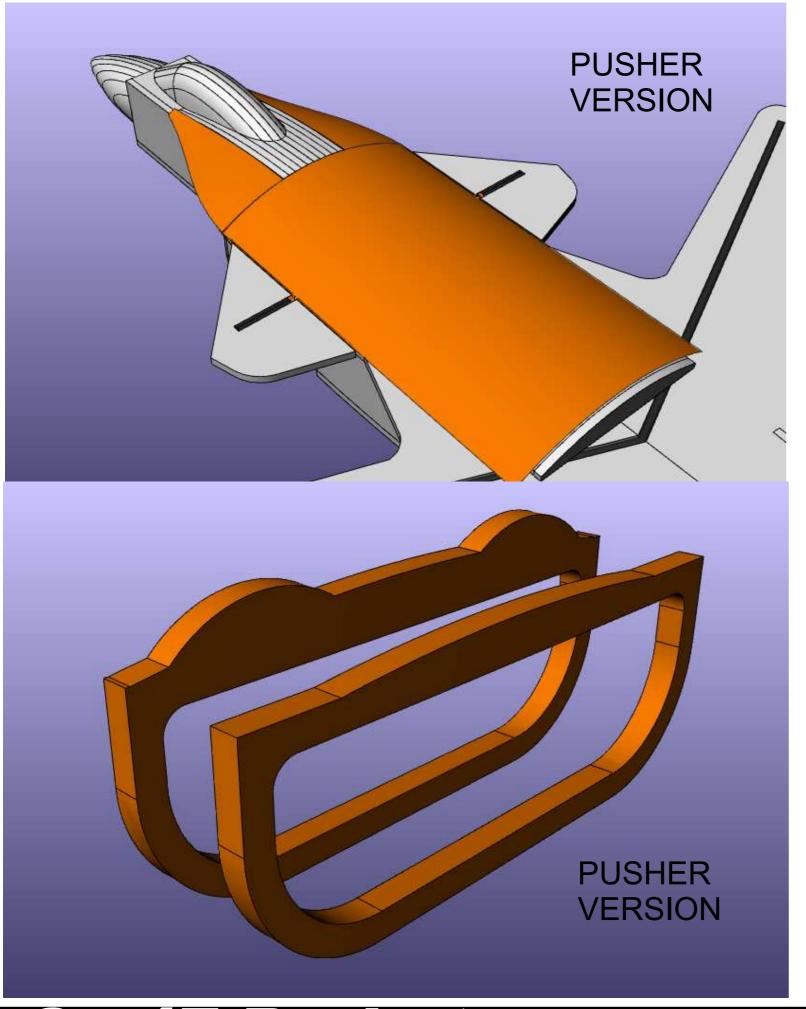
7. Repeat steps 2-4 for the upper part.



6. When correctly aligned, press adjoining depron onto the sticking up magnet to impress shape.

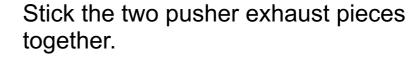
IMPORTANT.
Before glueing the upper magnet in, check that the magnet is the right way around!

Fit the canopy magnets as shown on both the canopy and canopy bridge to ensure a good fit.



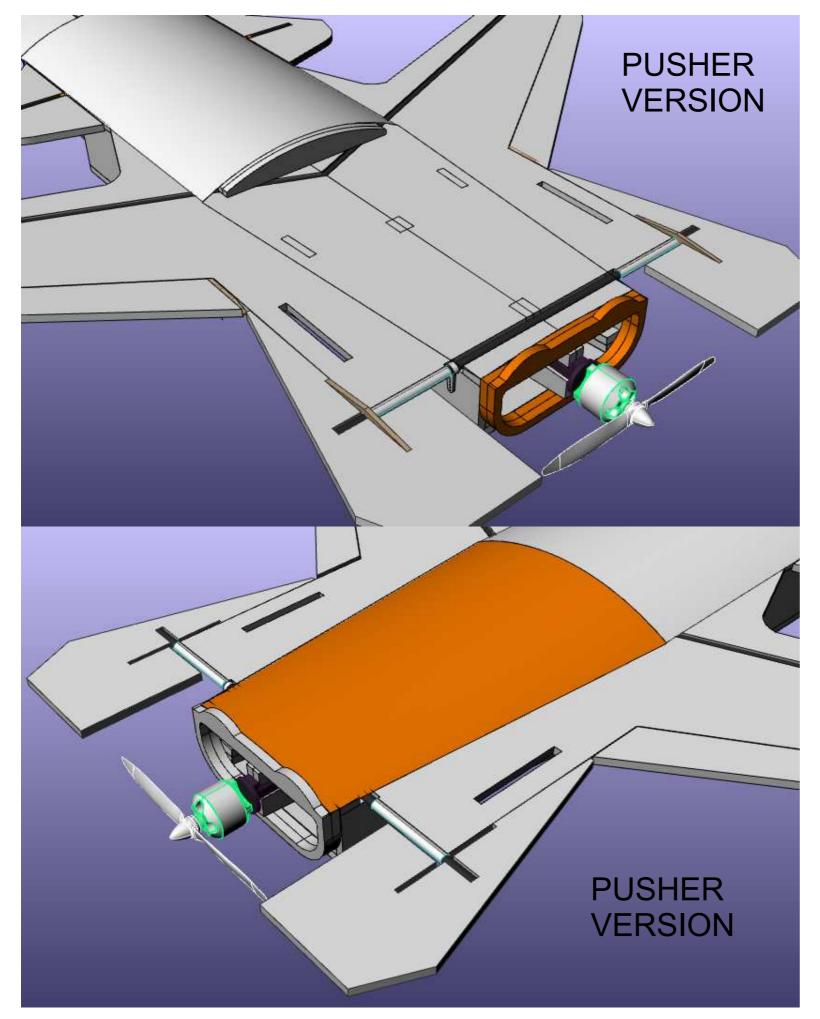
PUSHER VERSION ONLY

Carefully shape and sand the bottom, of the 3mm front turtledeck piece and stick to the wing panel.







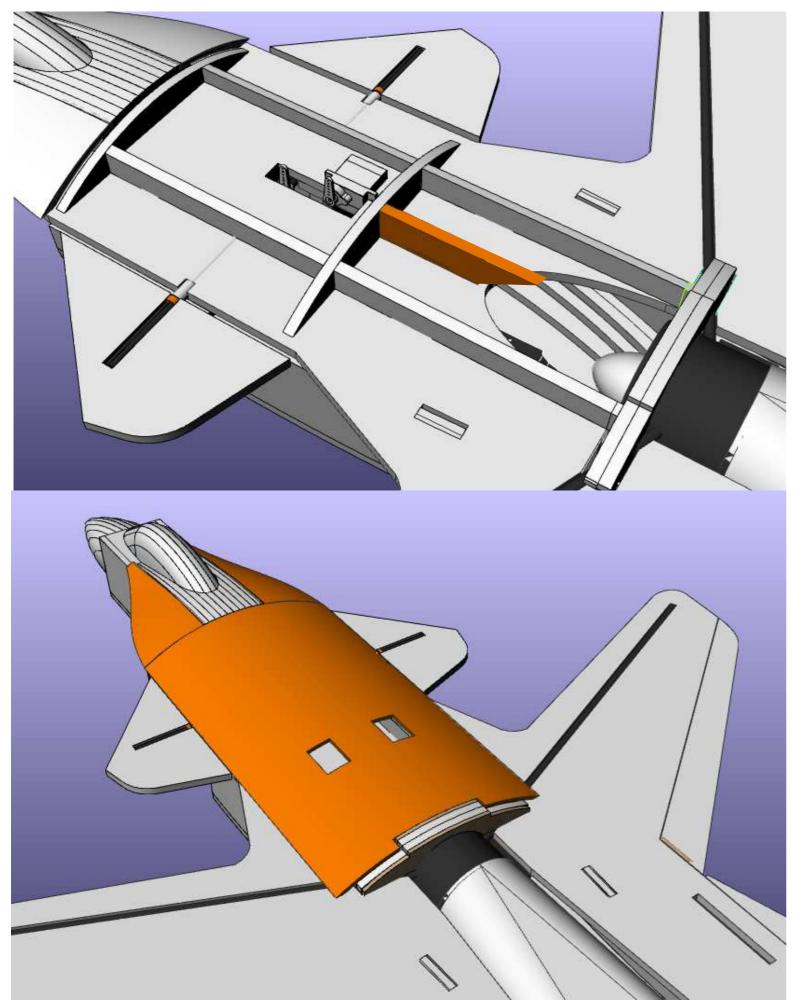


Stick the exhaust bulkhead to the assembly.



Sand and shape the rear turtledeck piece and glue to the fuselage





EDF VERSION ONLY

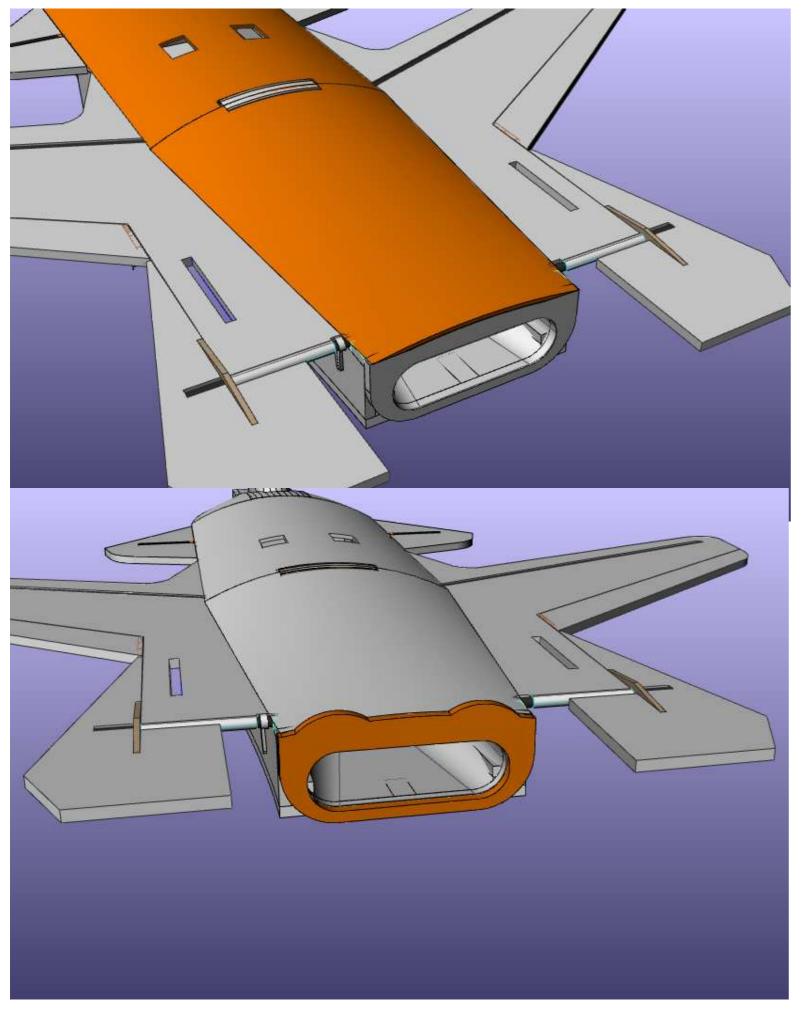
Stick the vacuum support piece in place



EDF VERSION ONLY

Shape and sand the forward 3mm fwd turtledeck, cutting out the two vents as indicated. Glue to the wing panel





EDF VERSION ONLY

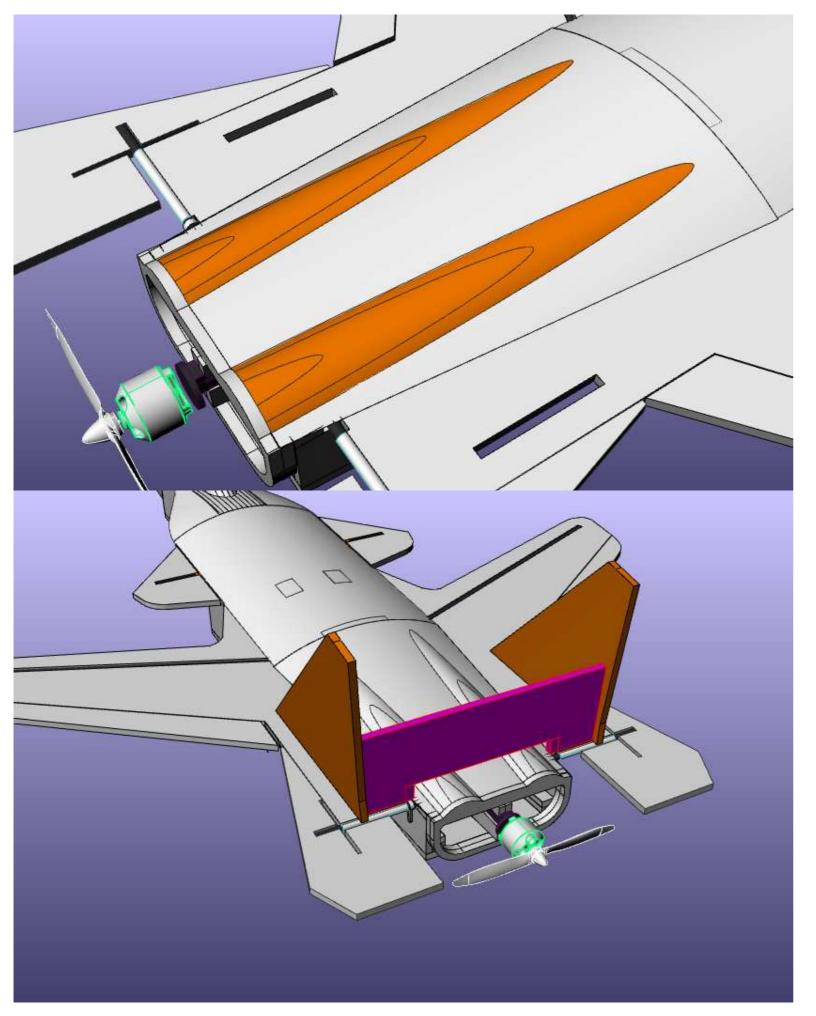
Shape and sand the 3mm turtledeck rear piece, then glue to the assembly.



EDF VERSION ONLY

Glue the rear exhaust bulkhead in place as shown.





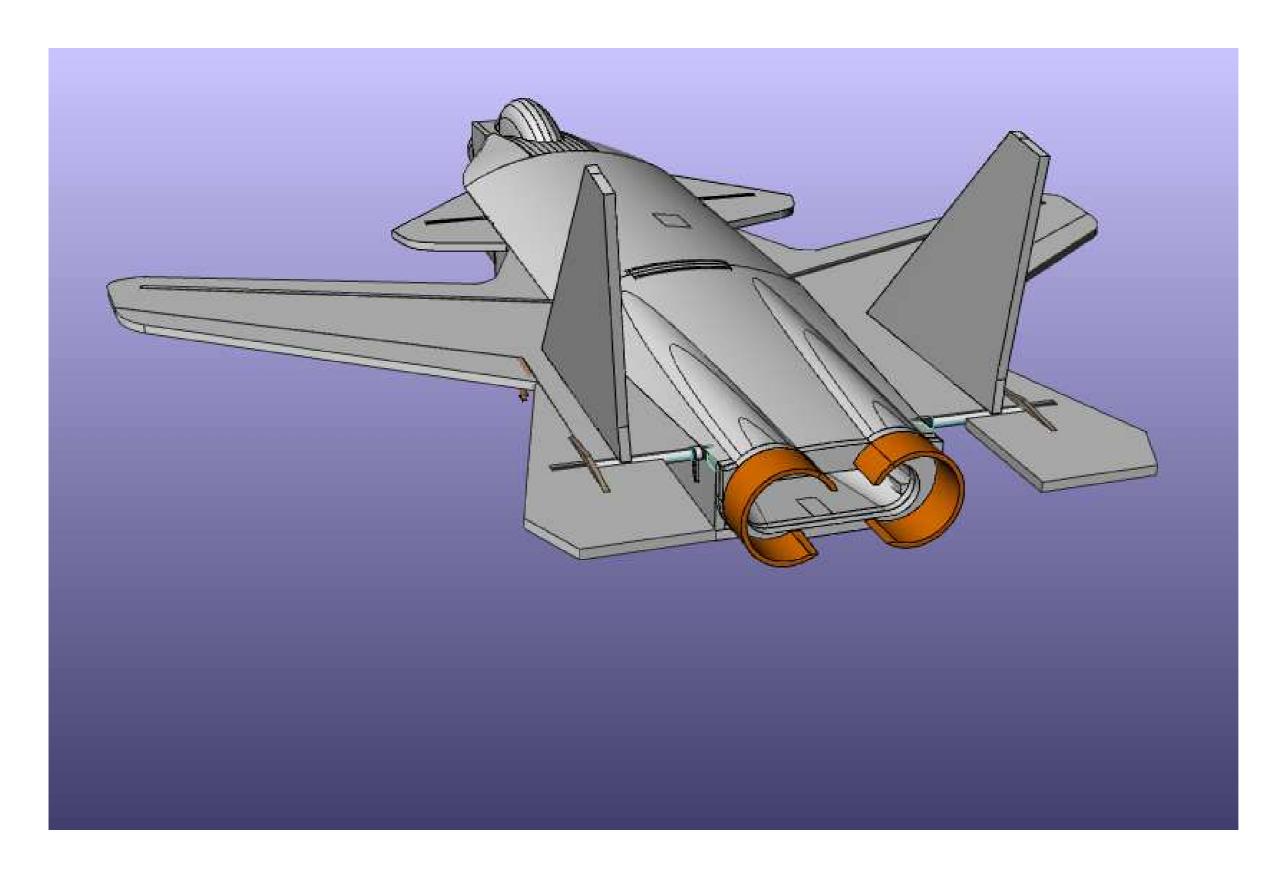
BOTH VERSIONS



Glue together the 3mm nacelle parts.and sand to shape - using the rear exhaust panel as a guide.

Using the angle Jig, fit the two vertical stabilisers. Ensure a snug fit, and use epoxy to ensure a good bond.







Using 3mm depron, shape the exhausts as shown. for a tougher exhaust, use 2 x 3mm depron laminated together. Cut away the depron around the EDF exhaust outlet as shown to prevent airflow restriction. This is less important on the pusher version.

