
# English Electric Lightning Parkjet

By Craig Clarkstone

BETA **Construction Guide**

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# Lightning History

The English Electric Lightning is a supersonic fighter aircraft of the Cold War era. It was designed and made by English Electric, later absorbed by the British Aircraft Corporation. It was then marketed as the BAC Lightning. The Lightning was the only all-British Mach 2 fighter aircraft. The Lightning was used by the Royal Air Force (RAF) and the Royal Saudi Air Force (RSAF). Although it was the RAF's primary interceptor for more than two decades it was never required to attack another aircraft.

The Lightning is powered by two Rolls-Royce Avon turbojet engines in a unique staggered stacked installation in the fuselage. The Lightning was developed to intercept increasingly capable bomber aircraft (Tupolev Tu-16, Tupolev Tu-22, Tupolev Tu-95), and thus has exceptional rate of climb, ceiling, and speed; pilots have described flying it as "being saddled to a skyrocket". This performance made the Lightning a 'fuel critical' aircraft meaning that its missions are dictated to a high degree by its limited range. Later developments provided greater range and speed along with aerial reconnaissance and ground-attack capability.

The Lightning possessed a remarkable climb rate. It was famous for its ability to rapidly rotate from takeoff to climb almost vertically from the runway, though this did not yield the best time-to-altitude. The Lightning's trademark tail-stand manouevre exchanged airspeed for altitude; it could slow to near-stall speeds before commencing level flight. The Lightning’s optimum climb profile required the use of afterburners during takeoff. Immediately after takeoff, the nose would be lowered for rapid acceleration to 430 knots (800 km/h) IAS before initiating a climb, stabilising at 450 knots (830 km/h). This would yield a constant climb rate of approximately 20,000 ft/min (100 m/s). Around 13,000 ft (4,000 m) the Lightning would reach Mach 0.87 (1,009 km/h) and maintain this speed until reaching the tropopause, 36,000 ft (11,000 m) on a standard day. If climbing further, pilots would accelerate to supersonic speed at the tropopause before resuming the climb. A Lightning flying at optimum climb profile would reach 36,000 ft (11,000 m) in under three minutes.

# Designers Notes

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

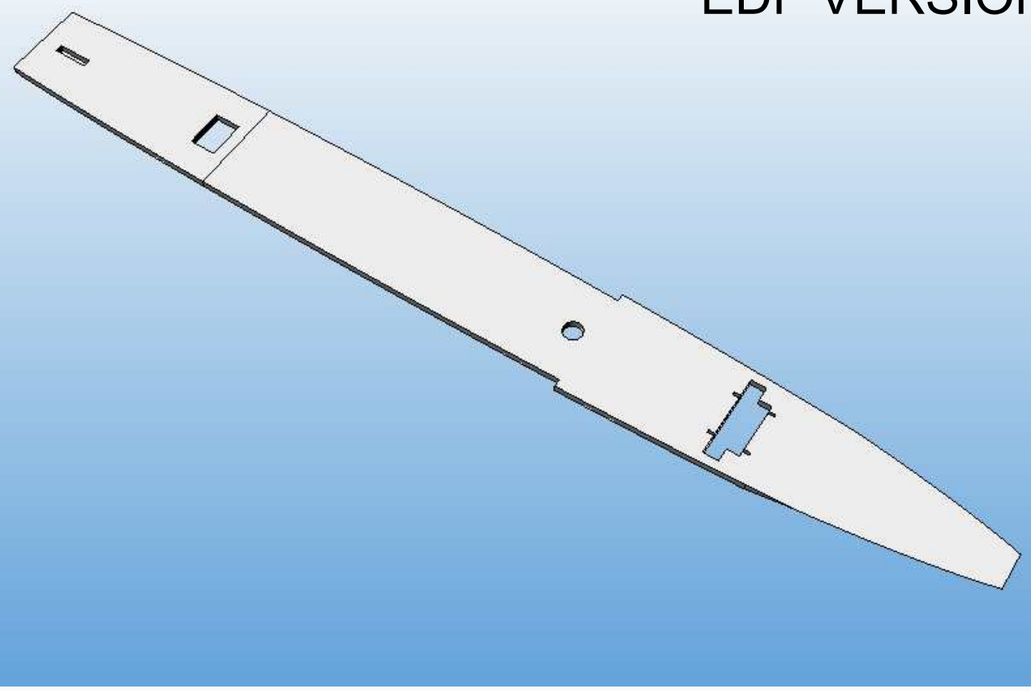
> For leading edges, hinges, general strengthening
- 3M Gift tape (Purple - not green one!) - I prefer lightweight plastic hinges.

> For decals
- Coloured parcel tapes (strips taped to waxed paper & cut out)

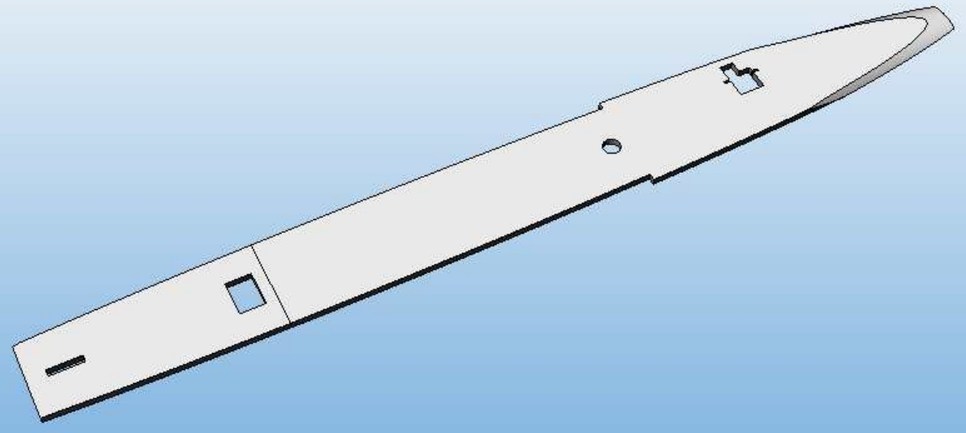
**Cutting parts**
1. Print the plans,
2. Cut around each part using scissors - allow a border of approx (1/4") 6mm
3. Use either 3M spray mount or a very light coat of 3M 77 to the back of the parts and stick in an economical layout on the Depron foam.
4. Using a safety rule and craft knife over a cutting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



EDF VERSION



PUSHER VERSION
(shown from underneath)

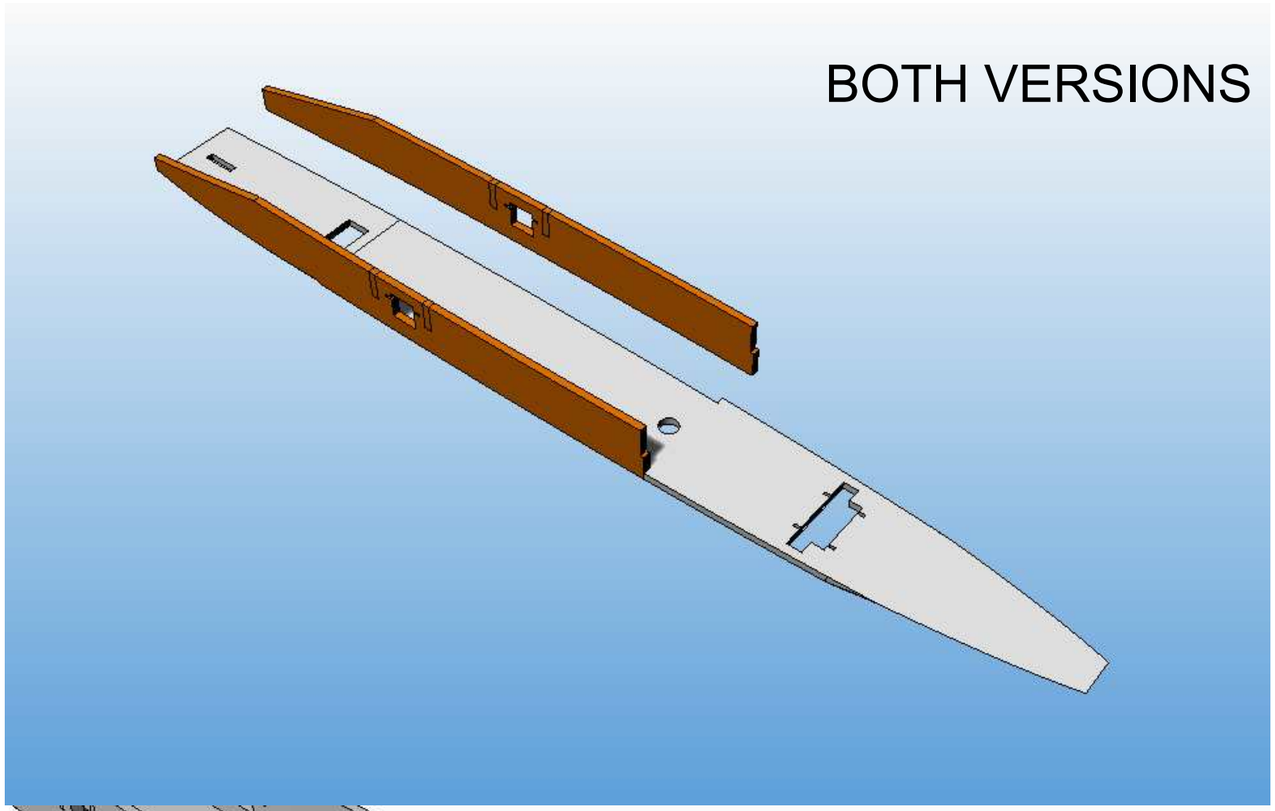
Choose which version of the plane you want to build either EDF or PUSHER.

Please note that on the template drawings cut out the correct versions, the pieces are indicated in the following colours :-

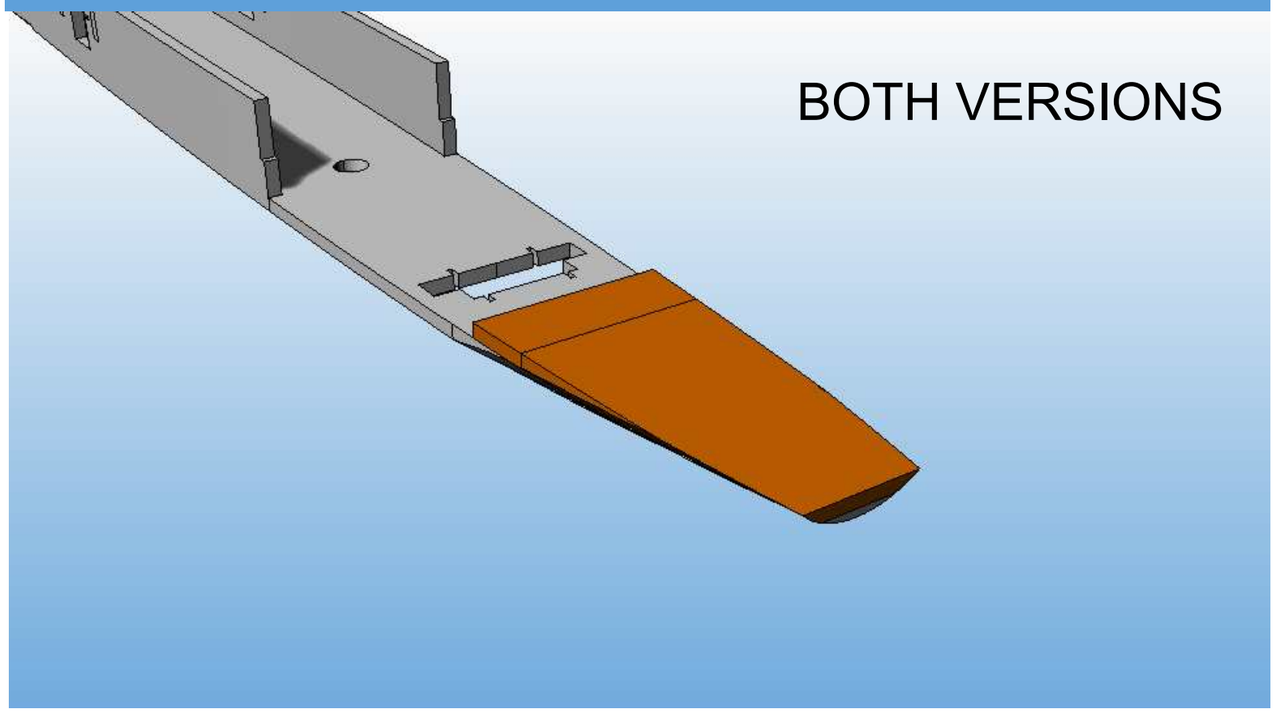
Pusher - Green
EDF - Blue

Prepare the Fuselage Lower panel (part 1)





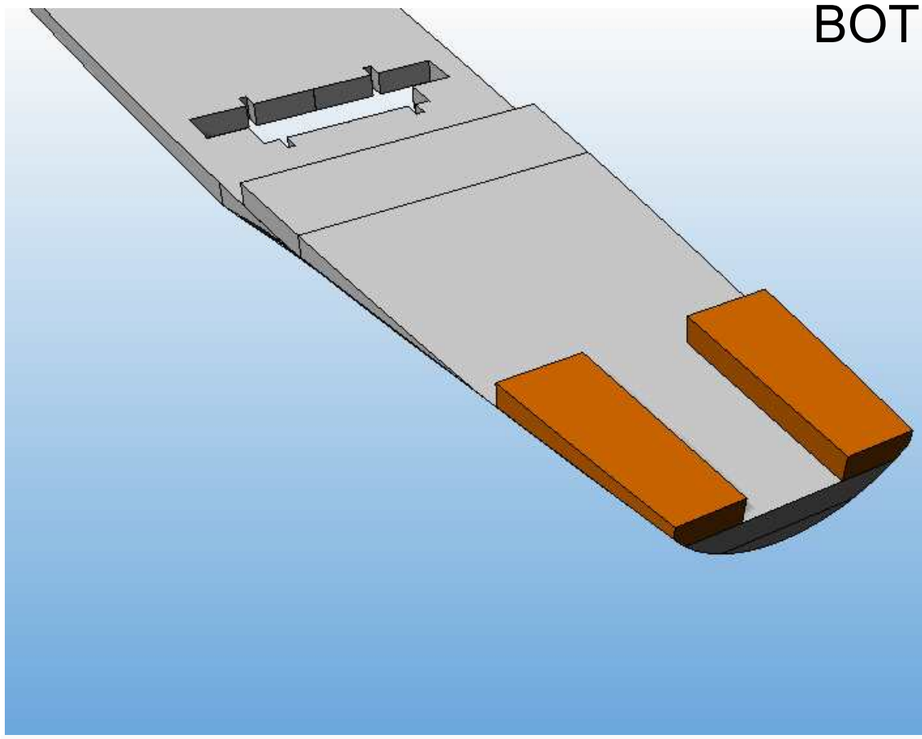

Glue the Wing and Servo support strips (part 2) to the Fuselage Lower panel (part 1) as shown.


Glue the upper rear belly (part 3) to the Fuselage Lower panel (part 1) as shown.



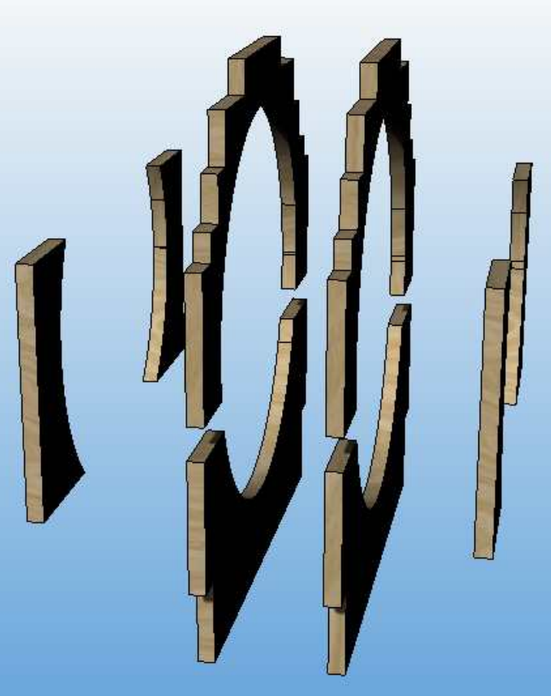

BOTH VERSIONS



Glue the rear lower fuselage corner supports (part 4) to the Fuselage Lower panel (part 1) as shown.


Check the size of your EDF unit, and adjust the Ply parts to suit.

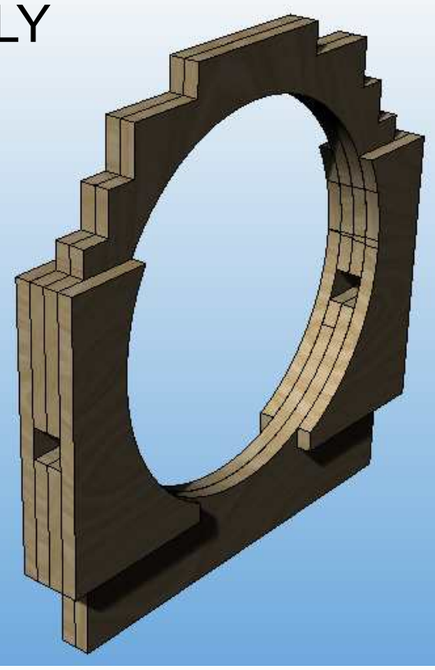
Then cut and sand smooth all parts of the the EDF / Spar support and check that they fit ok.

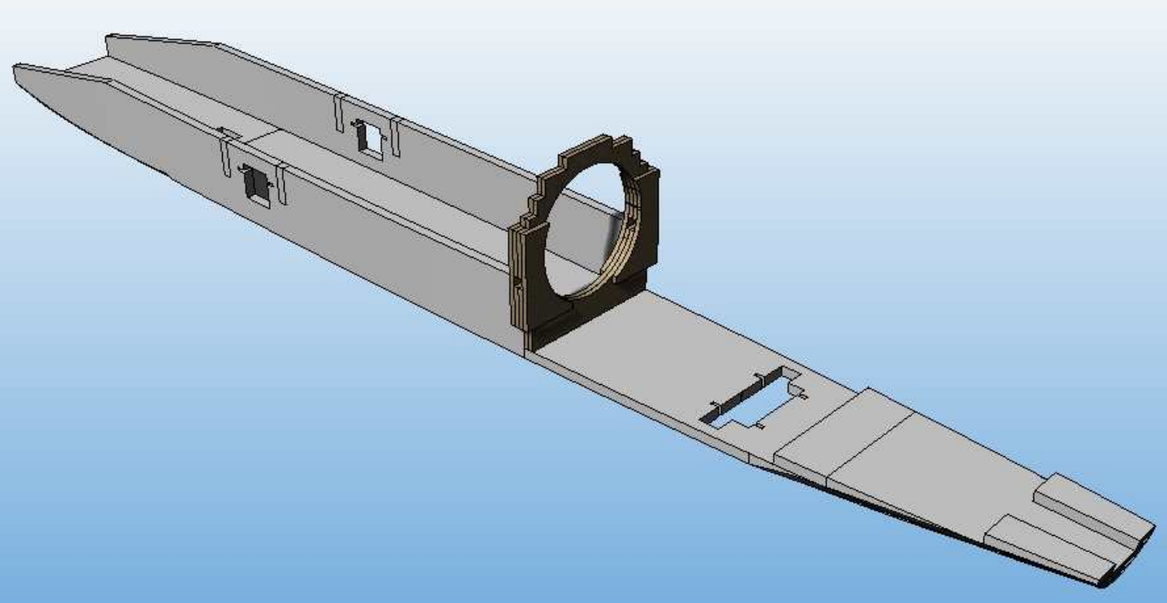


EDF VERSION ONLY



EDF VERSION ONLY





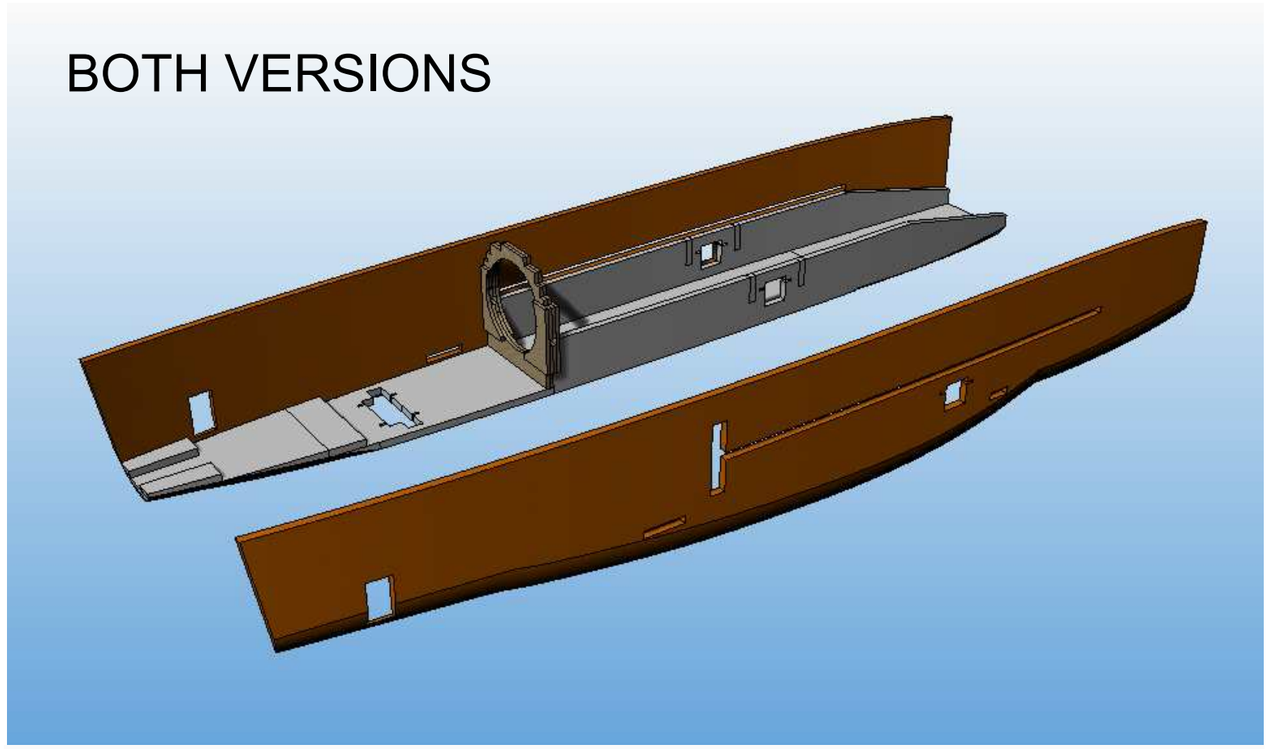
EDF VERSION ONLY

Glue the EDF / Spar support together.

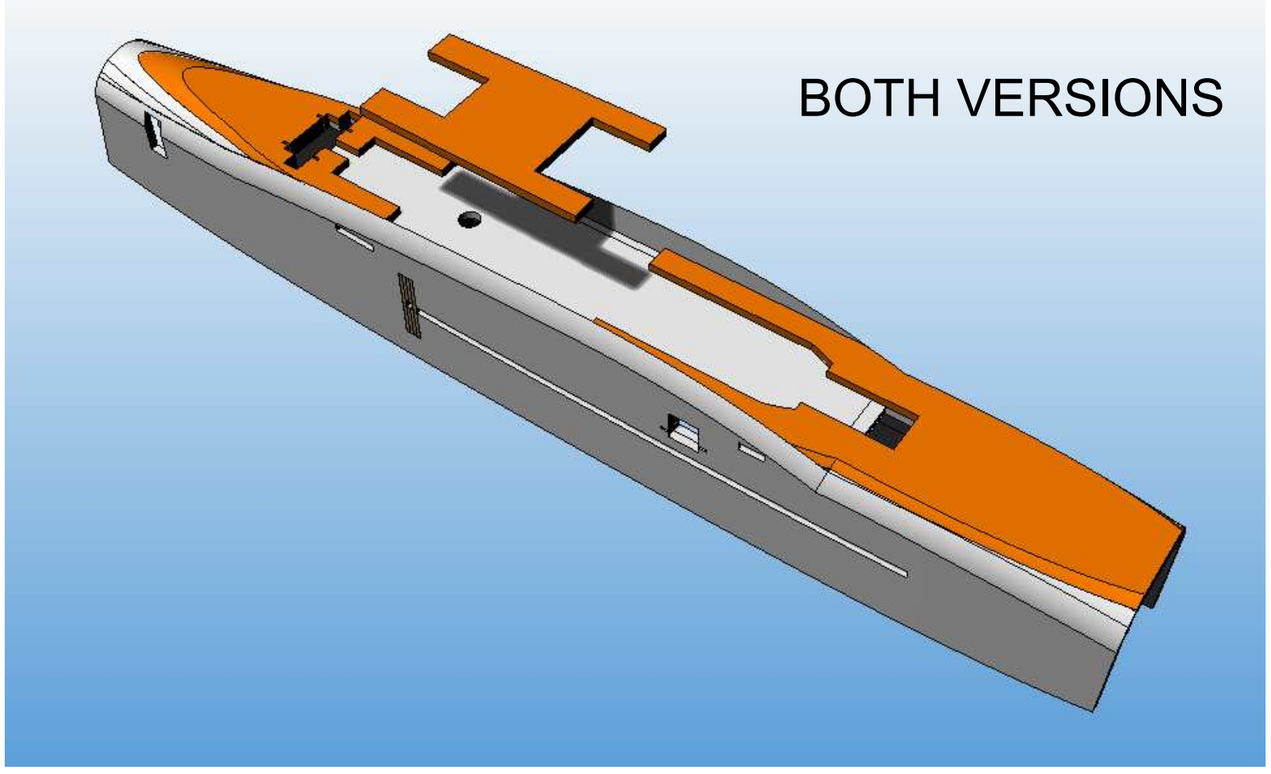
Check that your EDF unit can be cradled inside.  Adjust to suit.


Glue the EDF/Spar support to the fuselage assembly.



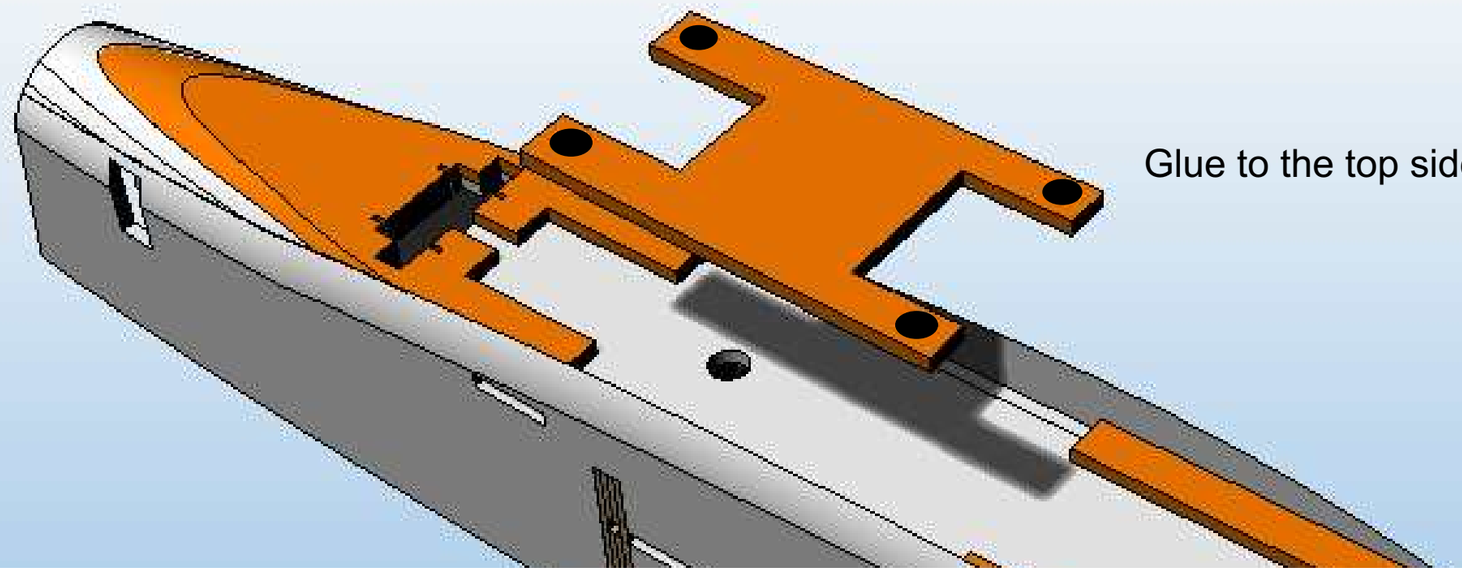

Align the fuselage sides (part 5) carefully to the assembly. the length should match exactly and the top of the fuselage assembly  should match the bottom of the wing slot.

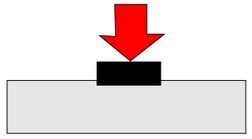

Separate Belly 1 (part 6) into three pieces and glue the front and rear pieces to the assembly as shown.  The non-glued piece will form the basis for an access hatch.




# BOTH VERSIONS



Glue to the top side of the hatch (not the bottom shown here)



1. press magnet into depron to impress shape.

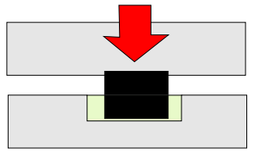
2. Dig out a recess for the magnet using a sharp knife.

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.

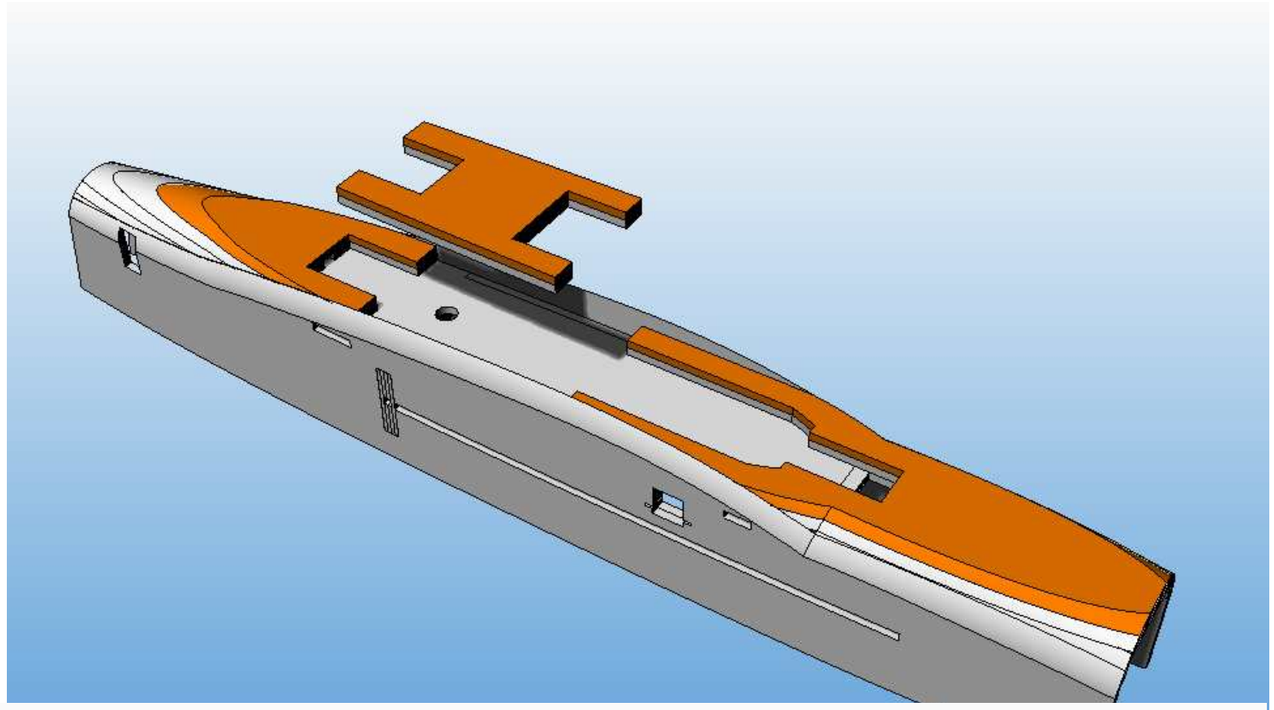


6. When correctly aligned, press adjoining depron onto the sticking up magnet to impress shape.

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

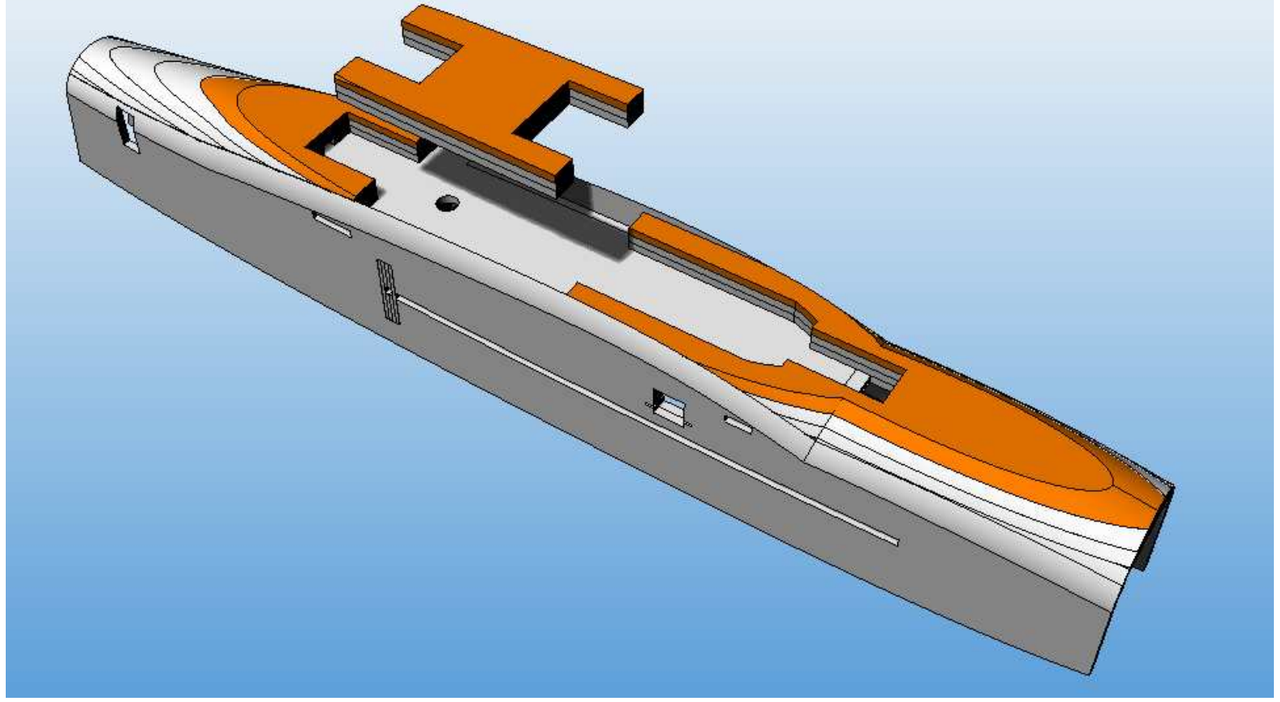
Glue rare earth magnets into the fuselage assembly and in the hatch piece as shown in the assembly.



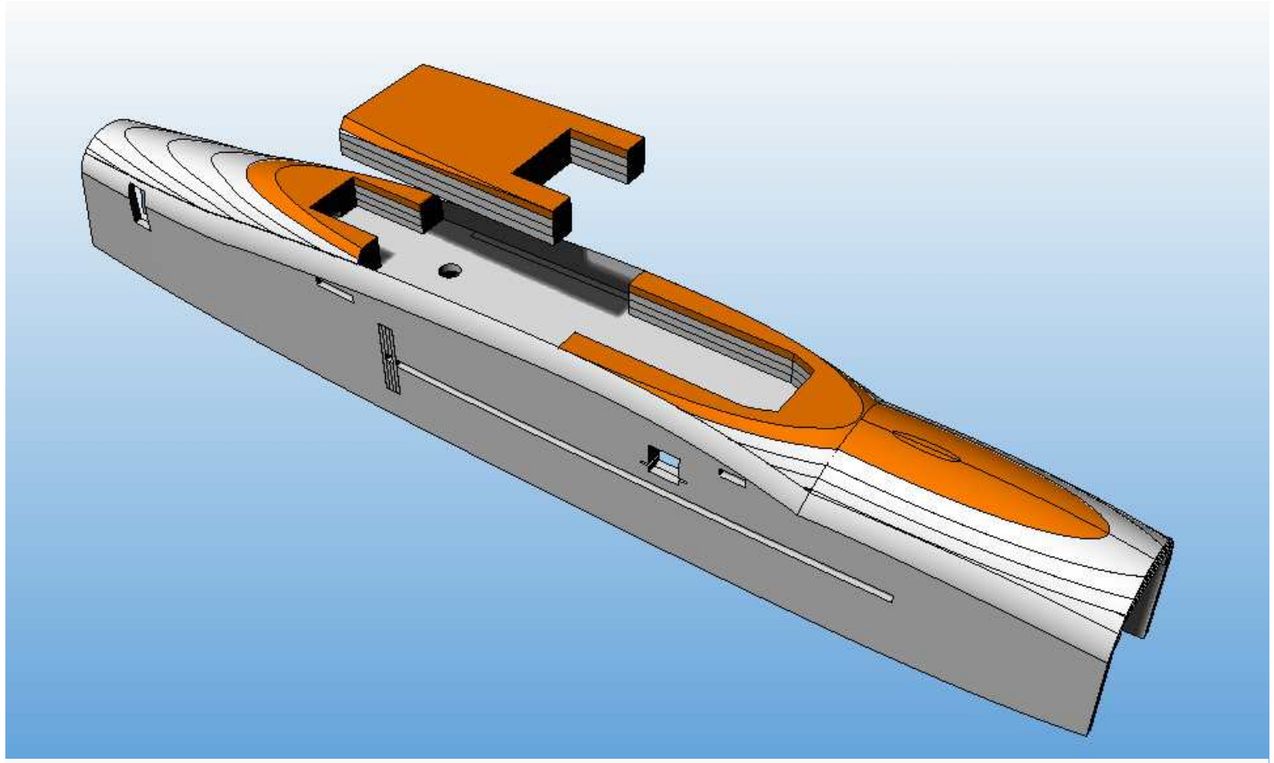


Glue Belly 2 (part 7) to the assembly


Glue Belly 3 (part 8) to the assembly

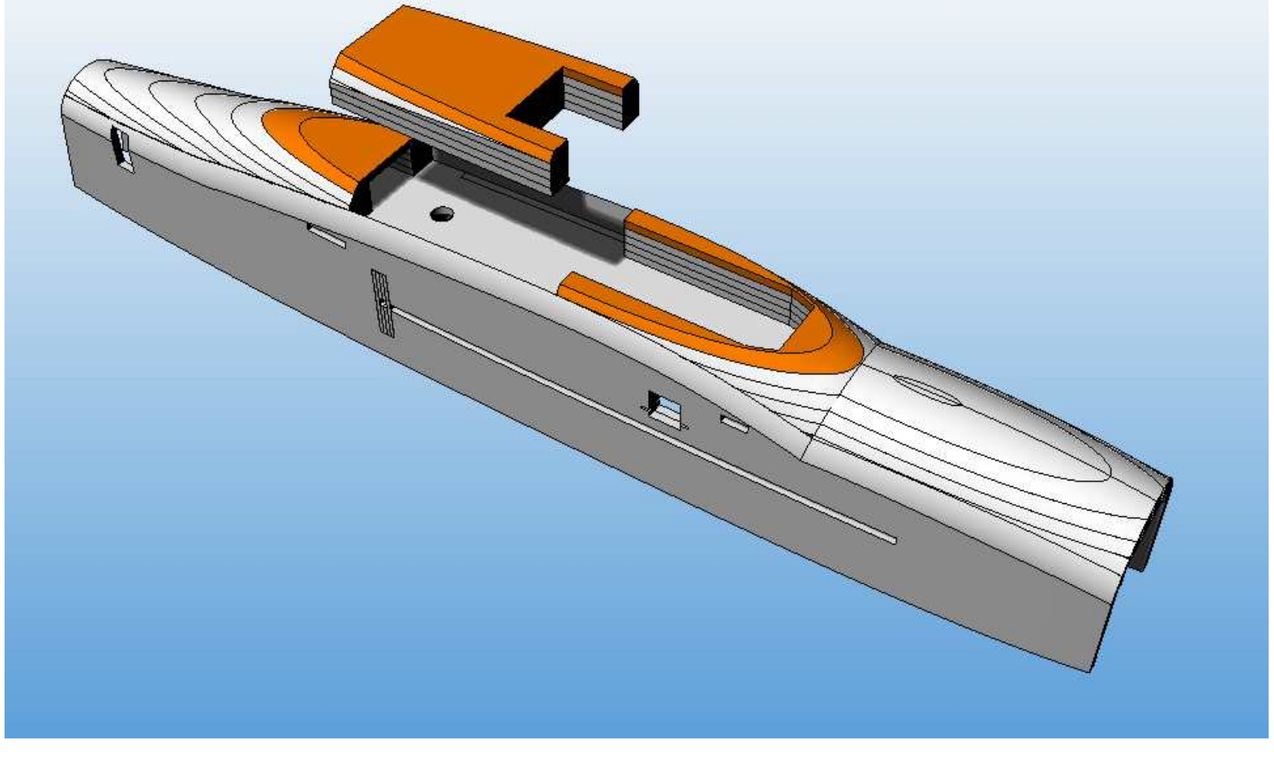




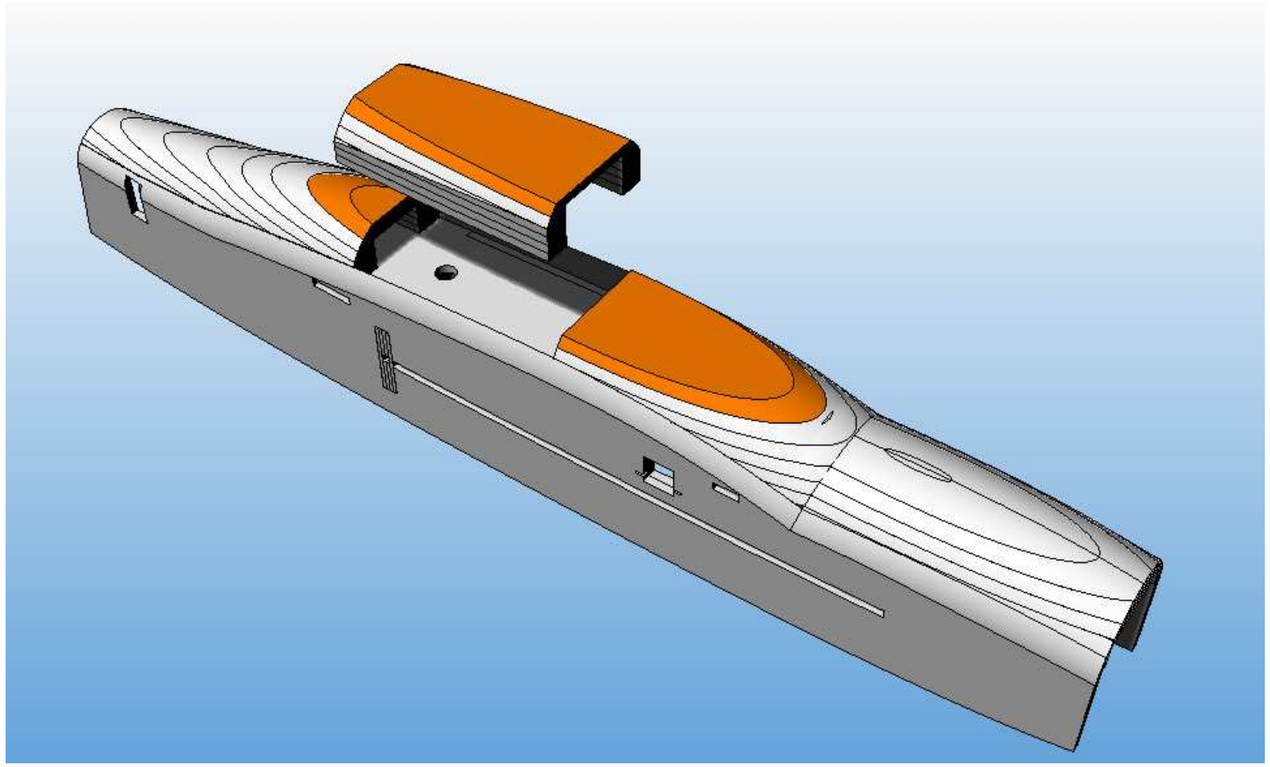



Glue Belly 4 (part 9) to the assembly


Glue Belly 5 (part 10) to the assembly

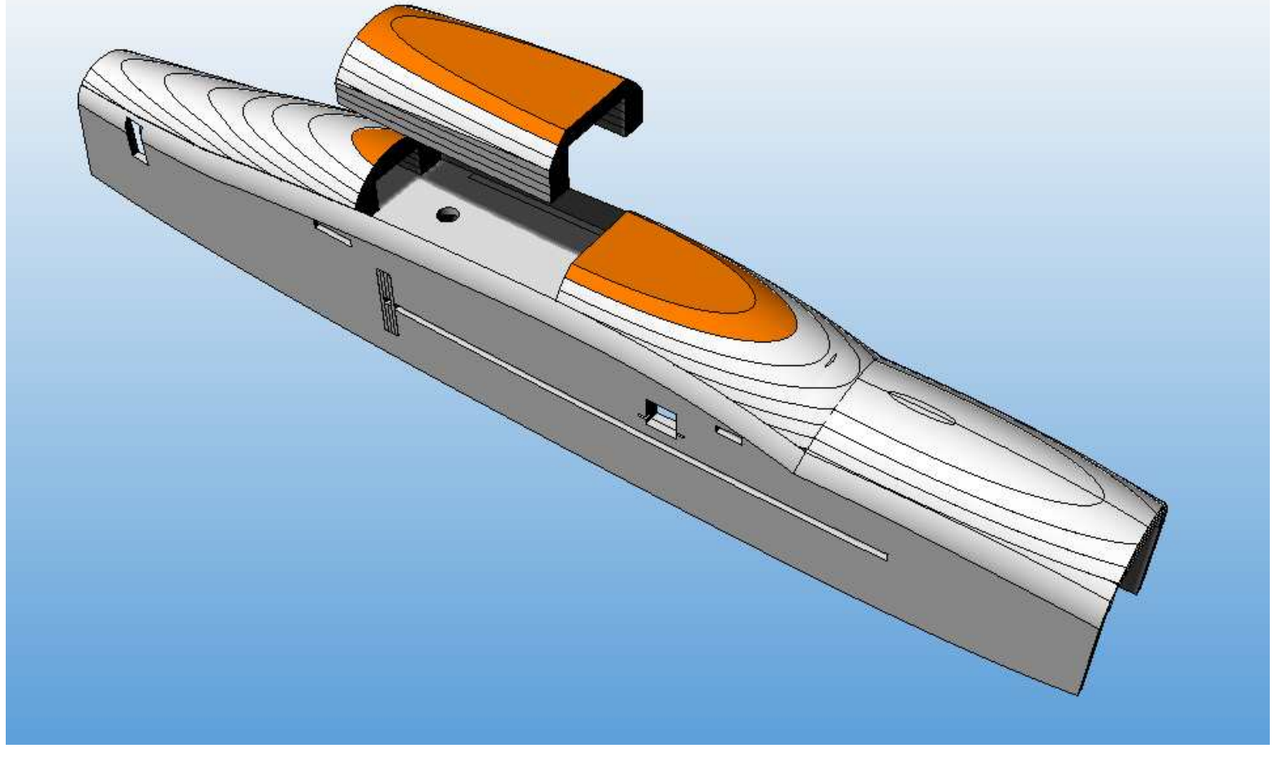




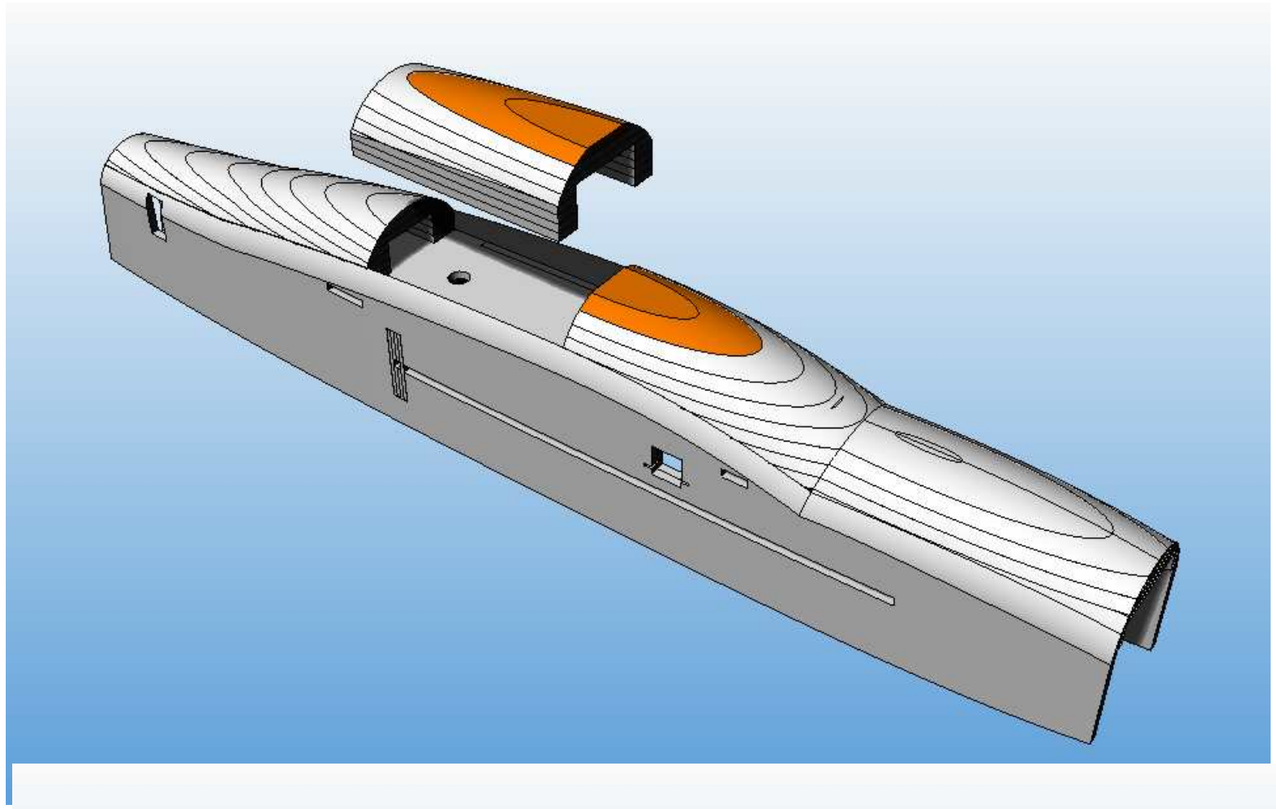



Glue Belly 6 (part 11) to the assembly


Glue Belly 7 (part 12) to the assembly

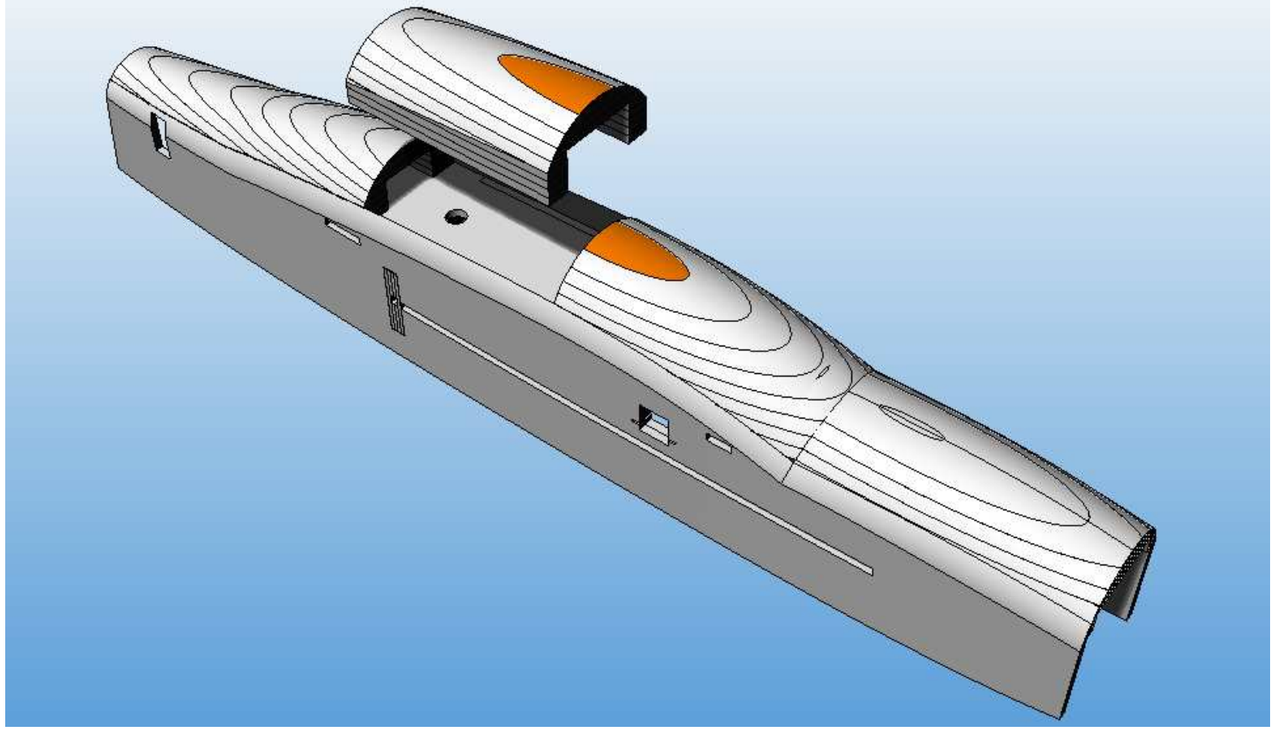




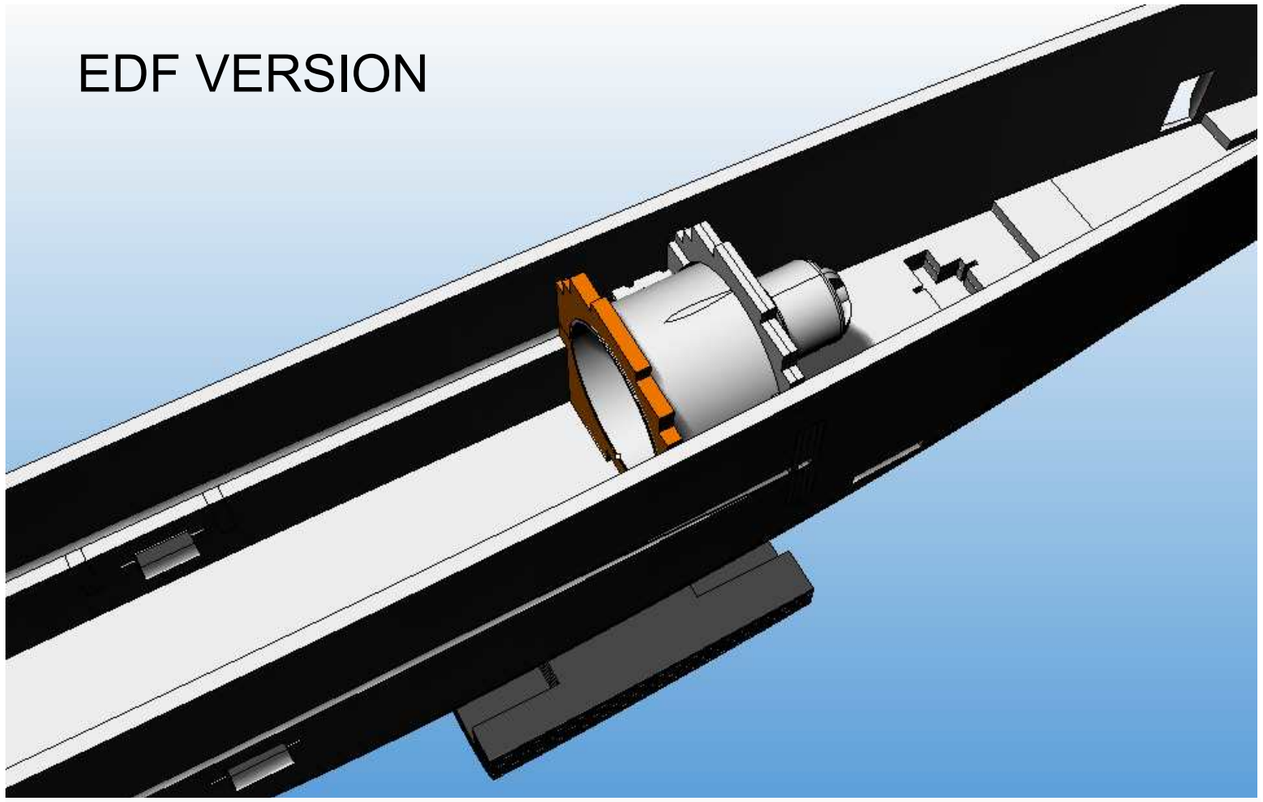



Glue Belly 8 (part 13) to the assembly


Glue Belly 9 (part 14) to the assembly



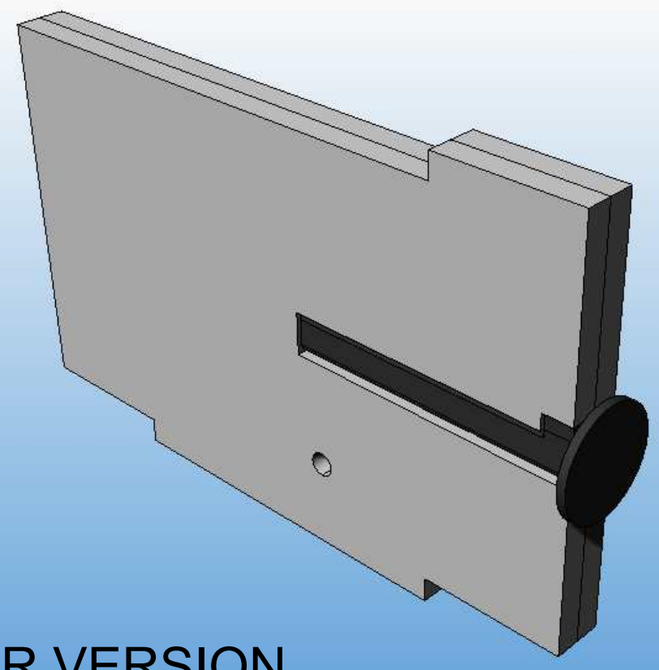
Sand the contours down until it resembles a lightning belly!!


Check your EDF unit will fit in the depron EDF bulkhead. Adjust to suit.

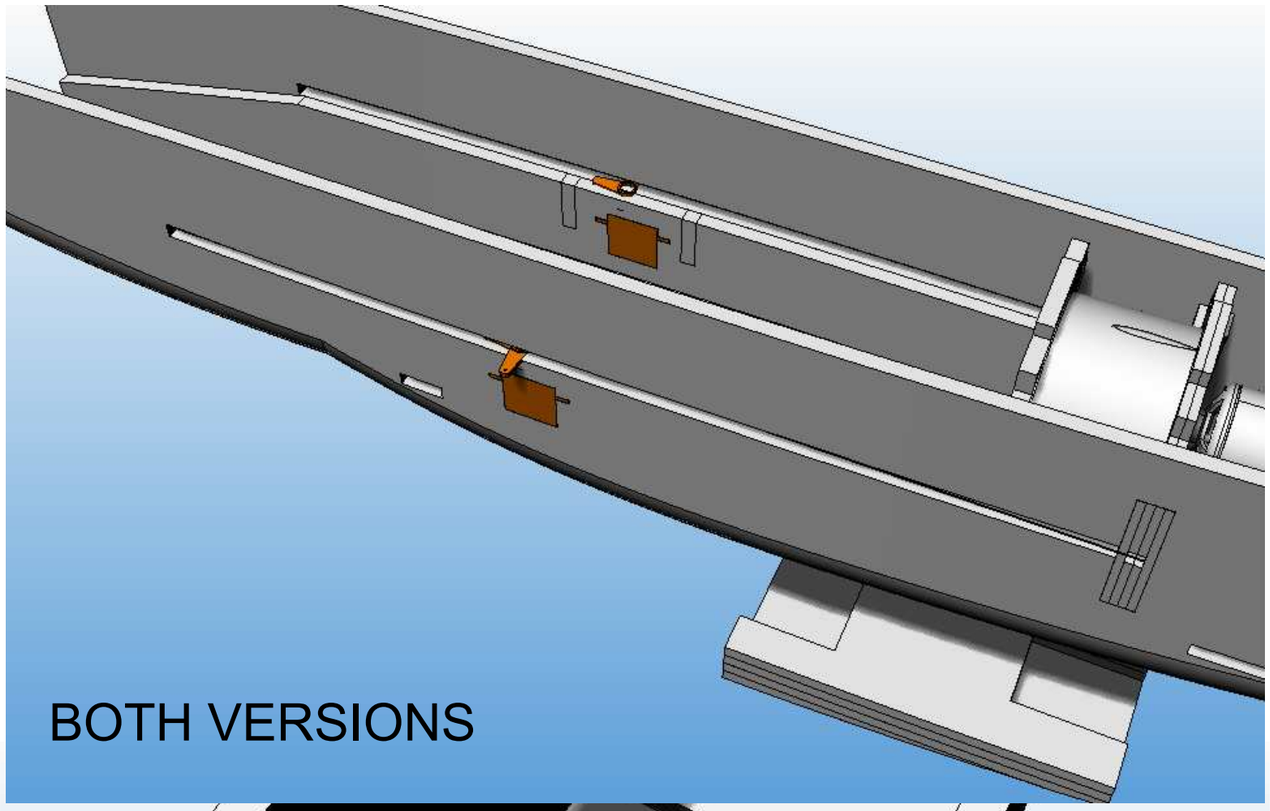
Slide the EDF unit in place into the wooden EDF bulkhead. Glue the Depron bulkhead into the assembly.

Then Glue the EDF in place.  Use either Hot melt Glue or Silicone sealant for noise reduced sound (thanks Grant)


Glue the two Pusher motor mount pieces (Part 18) using UHU por.  Then glue the motor mount stick in place using hot melt glue.

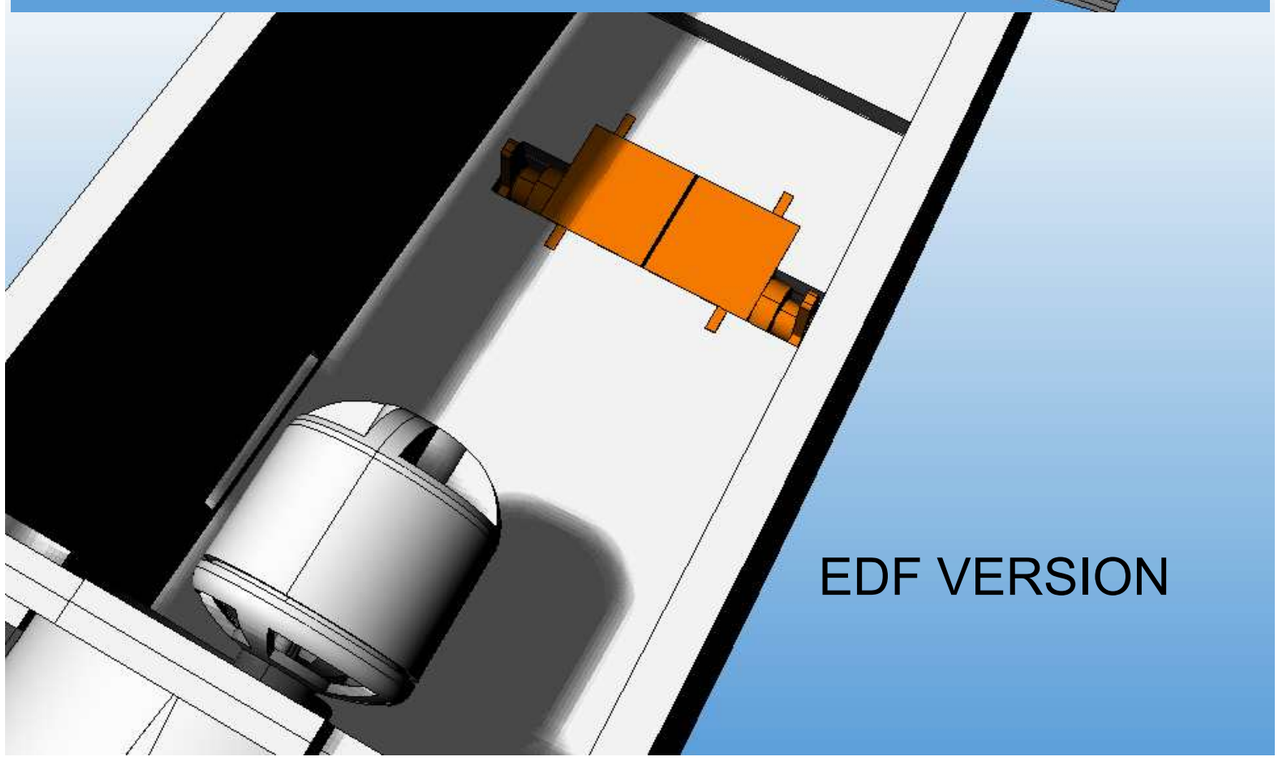
Hobbyking - SKU: OR004-00602


Carefully position your preferred servo so that the arm clears the wing by 1 or 2mm.

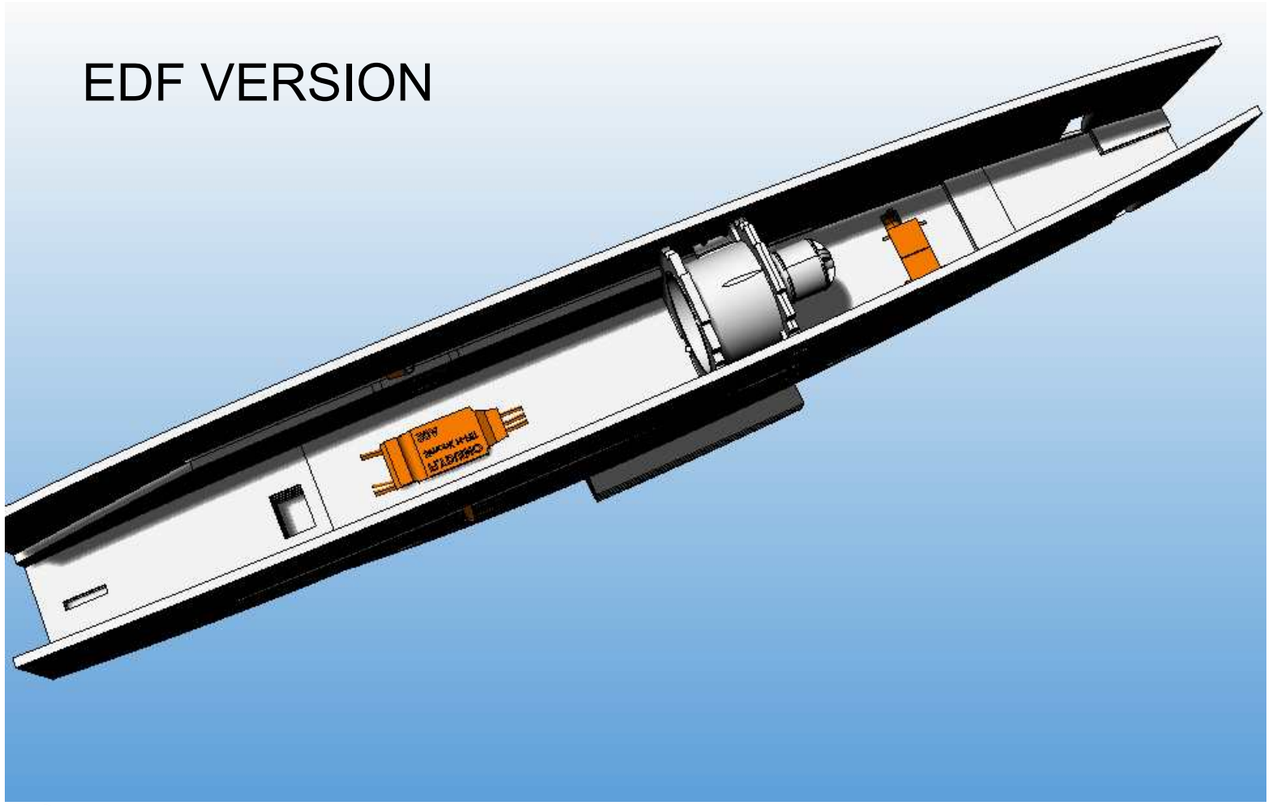
Set your arms to be angled 90 degree to the rebated slot in the wing.

Glue in place using hot melt glue.




On the EDF version use 2 servos, Pusher one servo.

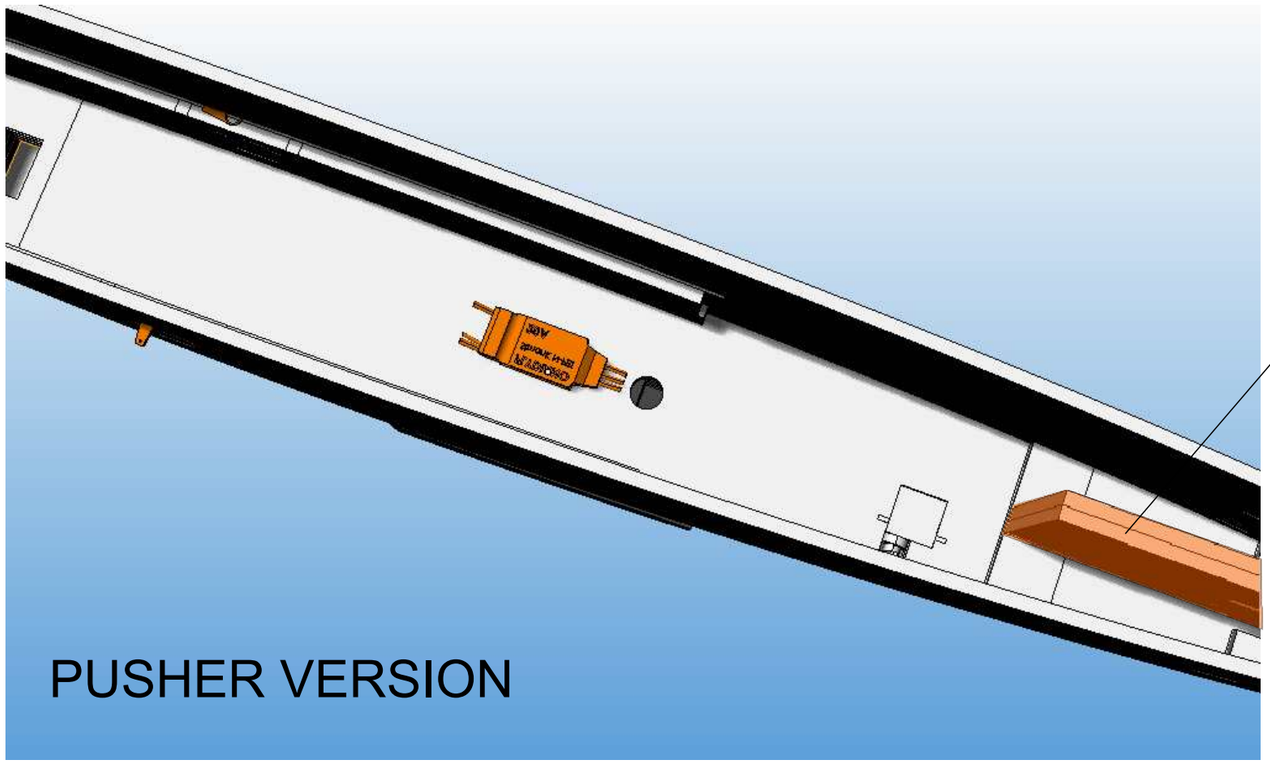
Glue in place as shown using hot melt glue.




Solder the ESC for the EDF version as indicated.  Run the servo leads through the hole though to the belly area.

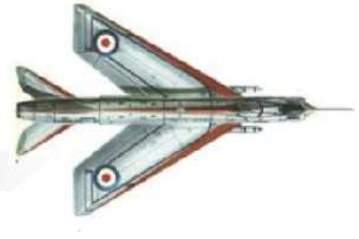
Don't glue in place just yet in case you wish to position it for airflow within an intake tube (see pages 21 & 22)

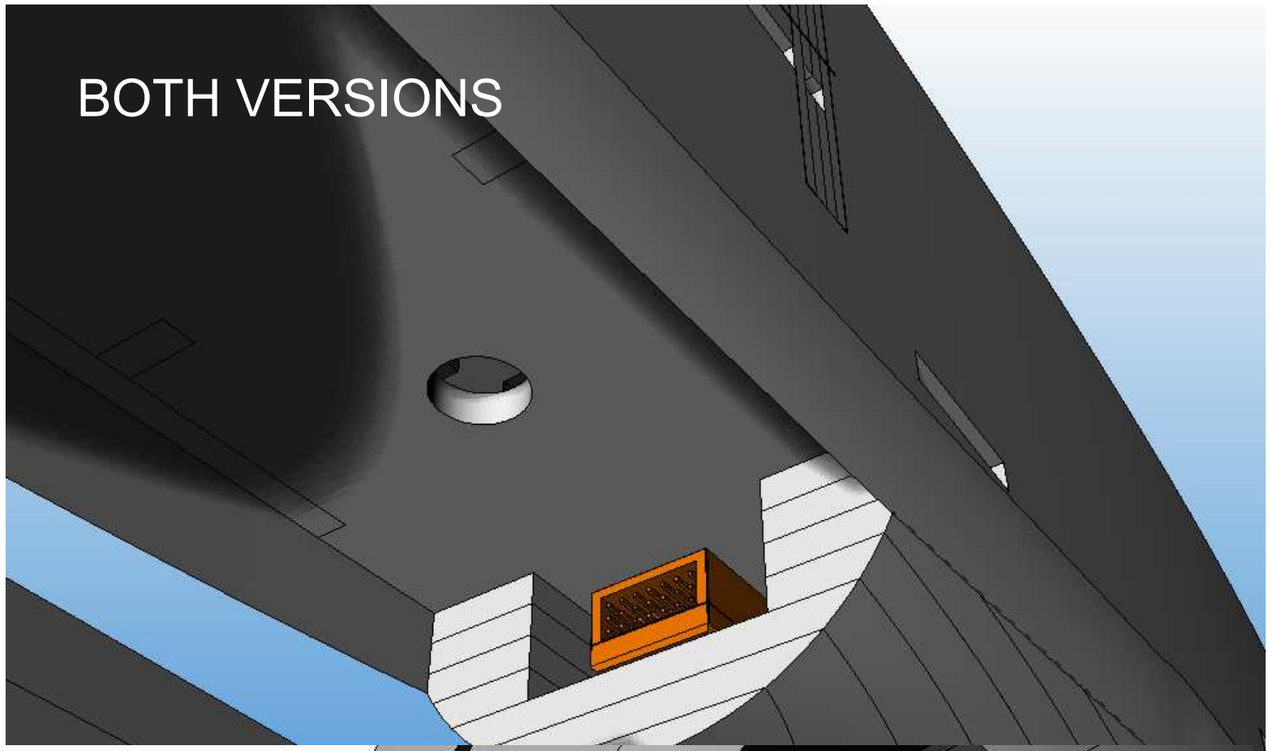
Please note the intake tube is optional - but will increase EDF performance.



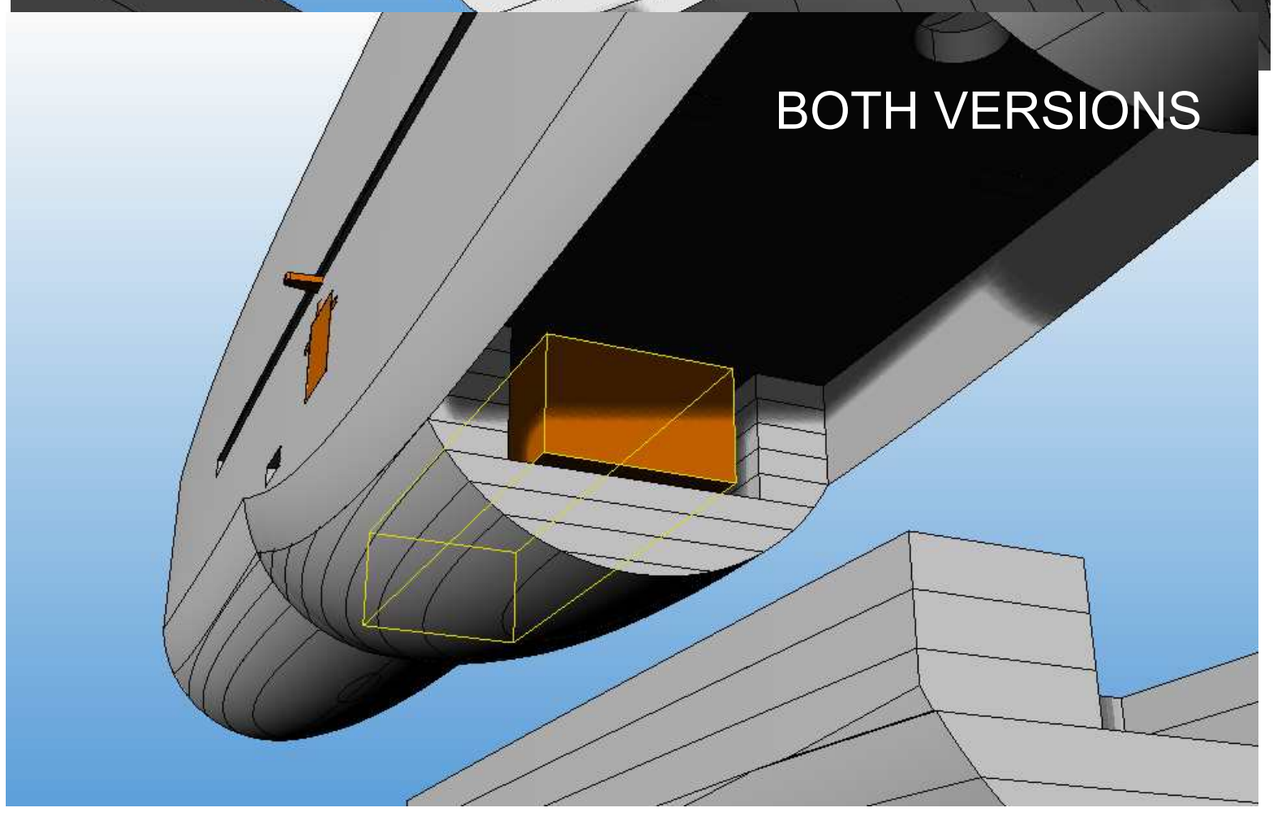

Solder the ESC for the pusher version as indicated and glue in place.  Run the servo leads through the hole though to the belly area.

Glue the Pusher motor mount in place using UHU Por.

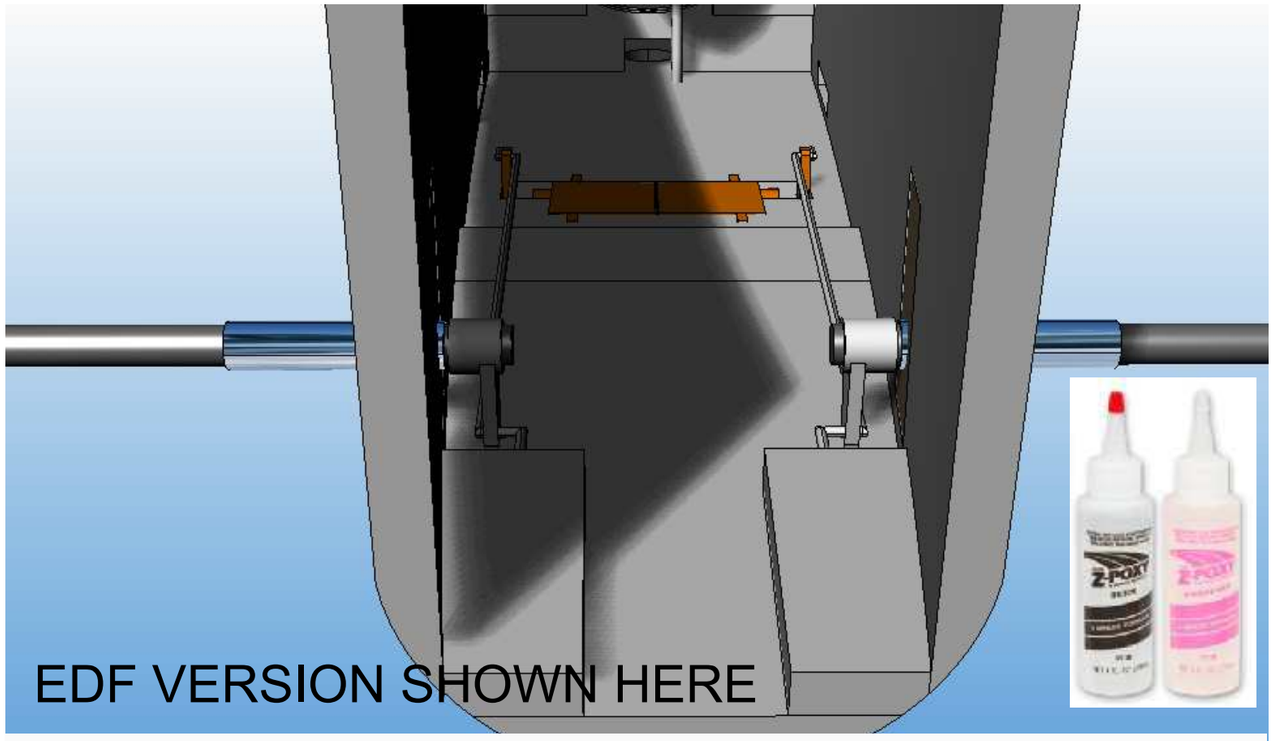


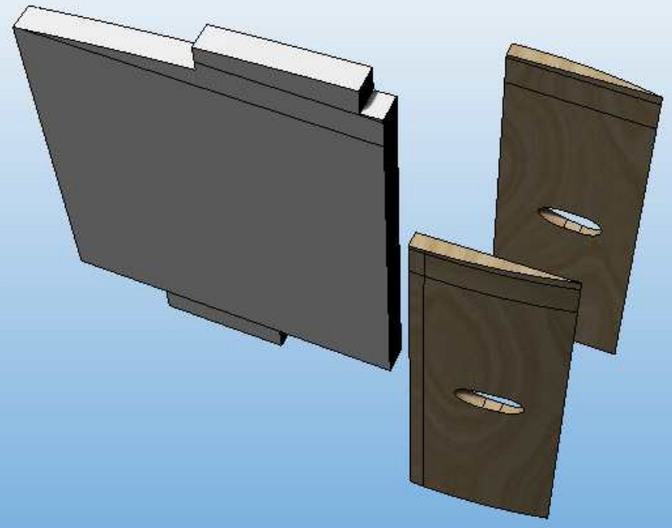

Run the servo and ESC cables through to your receiver.
Glue in place with a drop of hot melt glue




Run your power cables through from your esc, through the channel designed for them and down the side of your battery. You may need to trim the depron away a little with needle files to facilitate your choice of battery.






1. Cut the plywood elevator support pieces, glue together and shape to fit the fuselage belly.  Glue in place.

2. Drill out the plywood elevator support pieces to take the aluminium tubes.

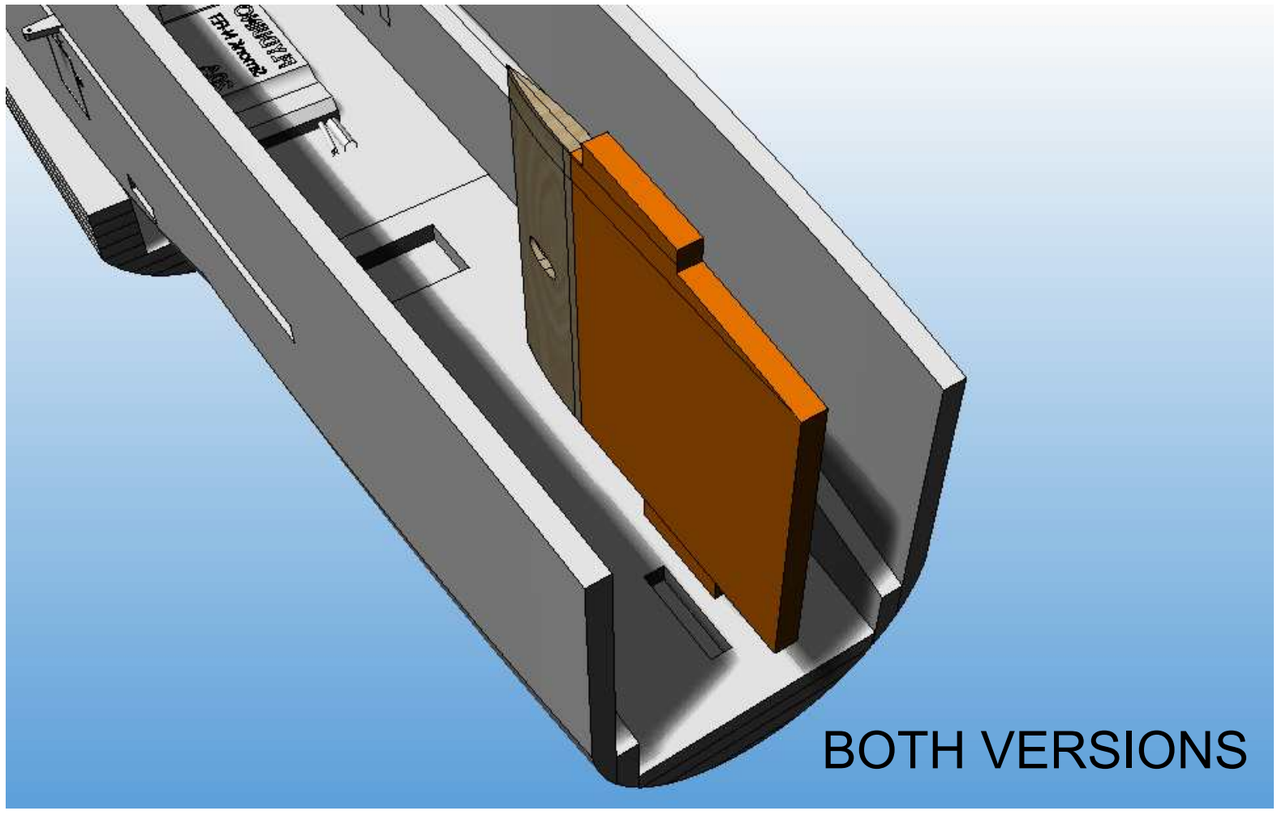
3. Use a longer piece of carbon tube to position the aluminium tube so that both are aligned.  Glue the Aluminium tubes in place, ensuring that 1-2 mm of the tube is revealed on the inside of the fuselage.

4. Drill out 2 standard sized servo horns (1 for pusher) and glue to the carbon elevator tubes as shown for EDF.  For pusher use a long length of carbon tube to operate both port and starboard elevators.  Use drilled out prop adjusters as end-stops.

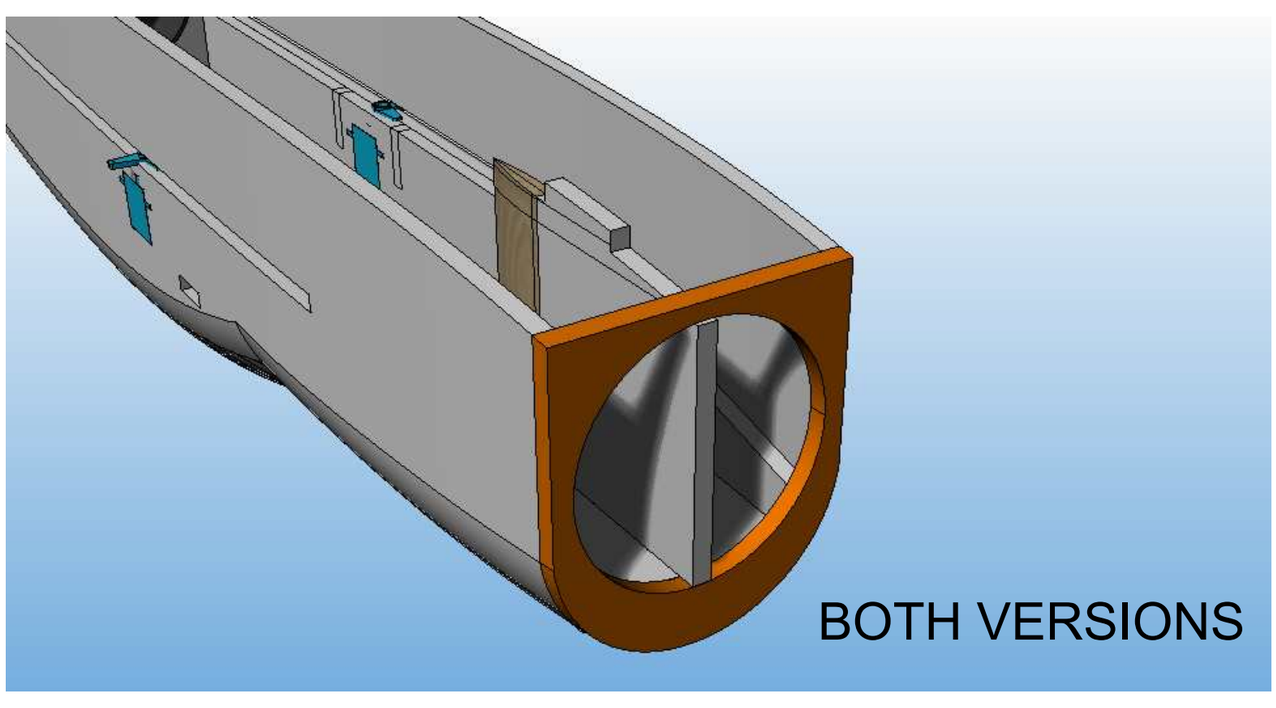
5. Connect the servos to the elevator control horns using stiff piano wire - ensure no flex or loose fit.

you may need to remove some depron from around the moving parts.

Shape the splitter Plywood parts as indicated and glue together using epoxy - glue to the depron at the same time.

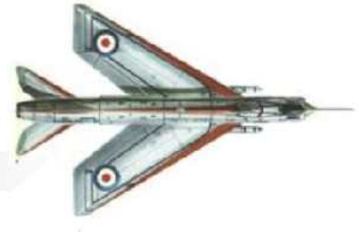


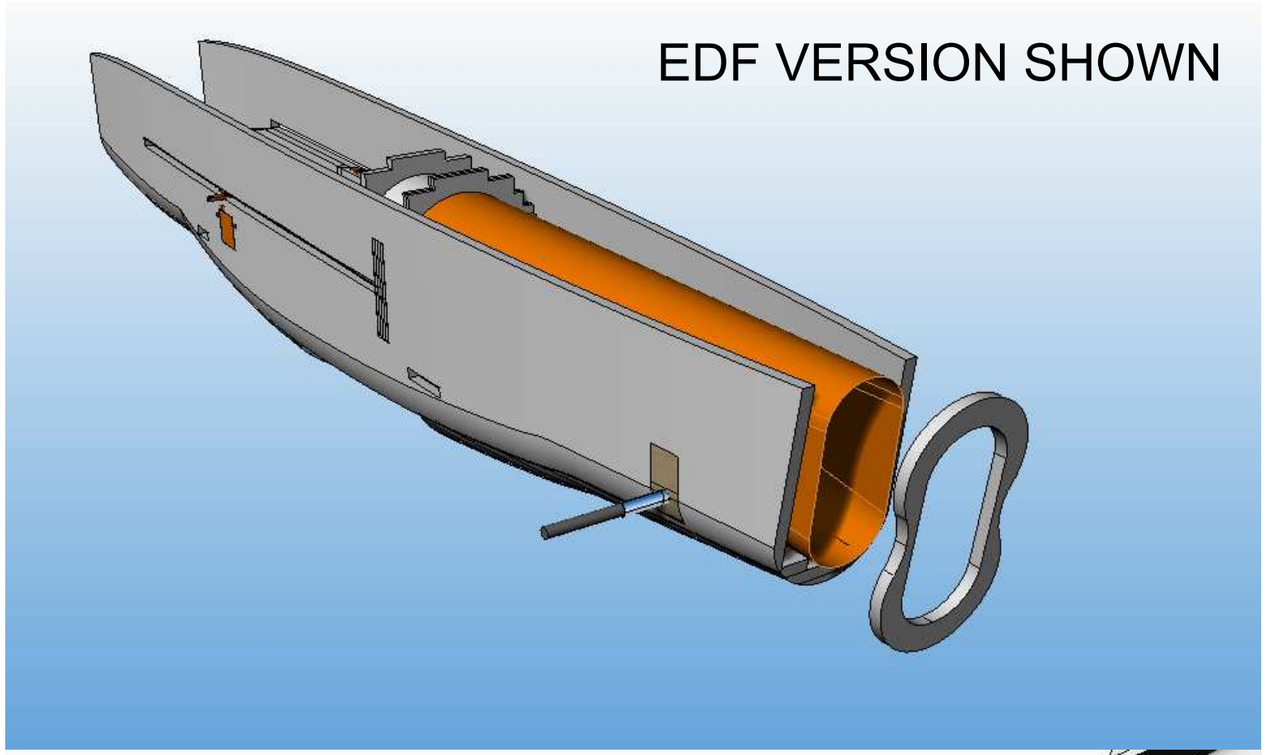

Glue the splitter in place as shown


Glue bulkhead 1 in place as shown






EDF - check, adjust and fit the thrust tube.  Sand away the depron corner supports a little if required.

Use the circular support shoulder piece to help attach the thrust tube to the plywood EDF bulkhead.  Use Nylon reinforced tape to join the sides of the thrust tube.

BOTH - Glue the exhaust bulkhead in place.

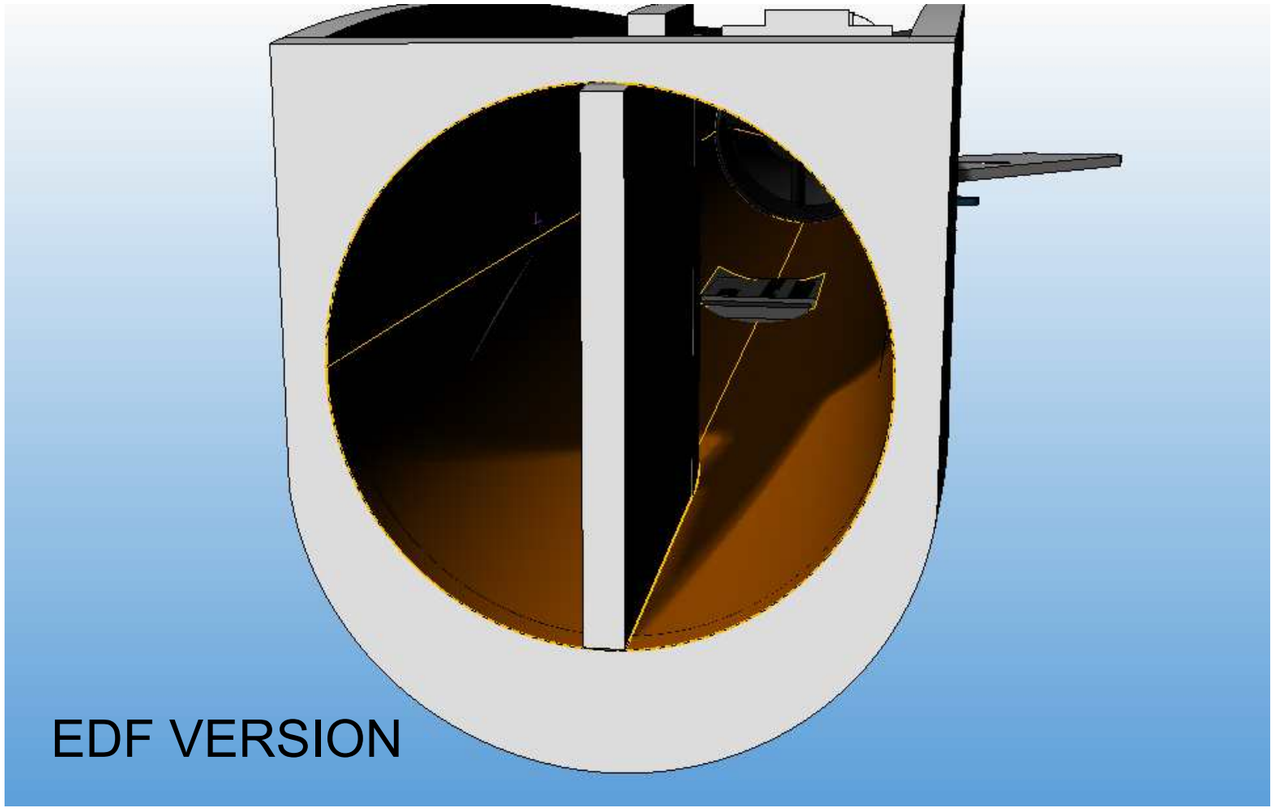


Check, adjust and fit the intake tube.

Use the circular support shoulder piece to help attach the thrust tube to the EDF bulkhead.

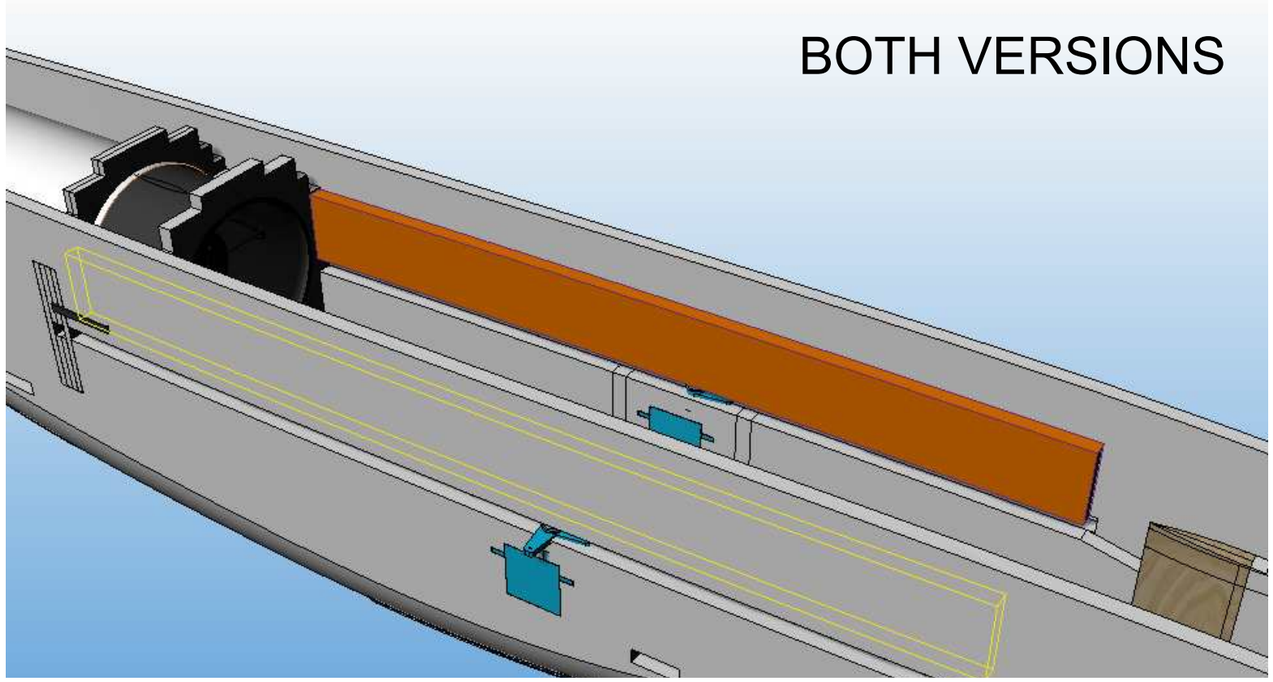
Use Nylon reinforced tape to join the sides of the tube.

Be sure to cut away a hole for cooling the E
need to raise the ESC to optimise air flow.
(see next page)

EDF VERSION

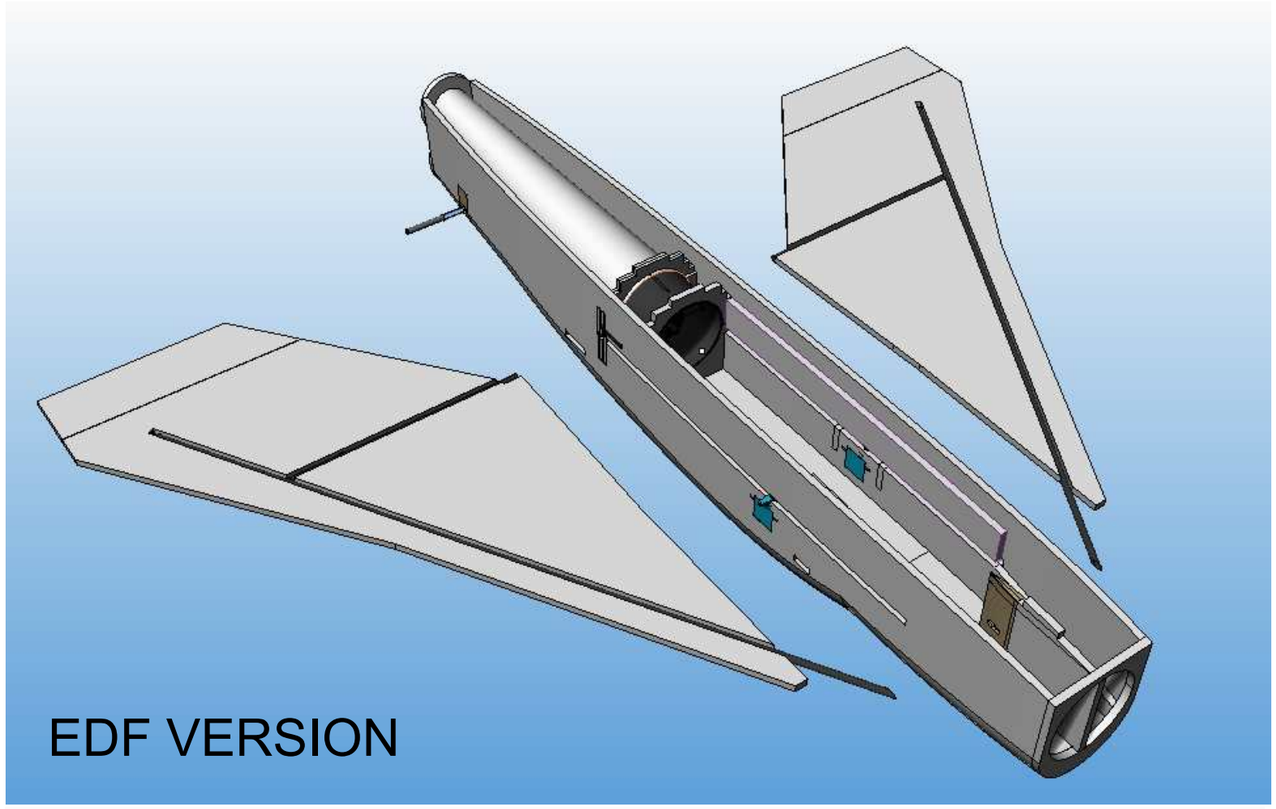
EDF speed controller ideally positioned in the intake airflow.

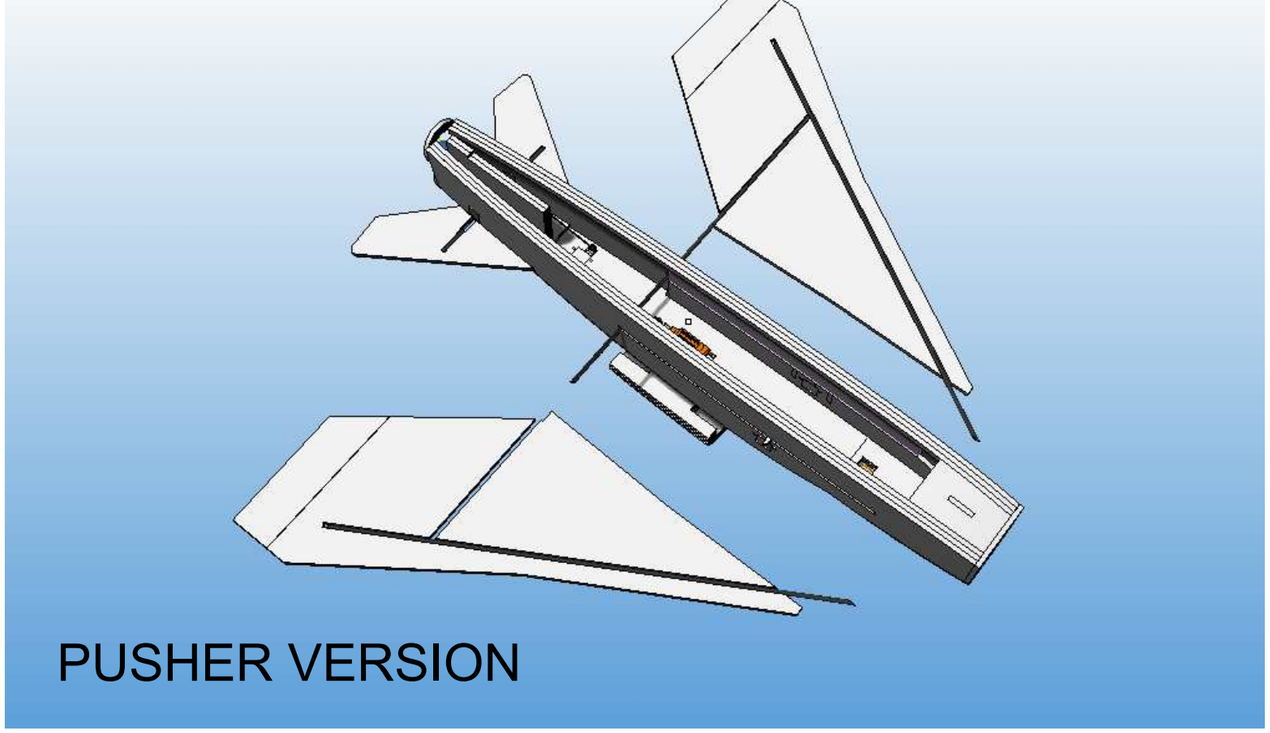


BOTH VERSIONS

Glue the upper wing support pieces in place so that the bottom edge aligns with the top edge of the slot in the side fuselage pieces.



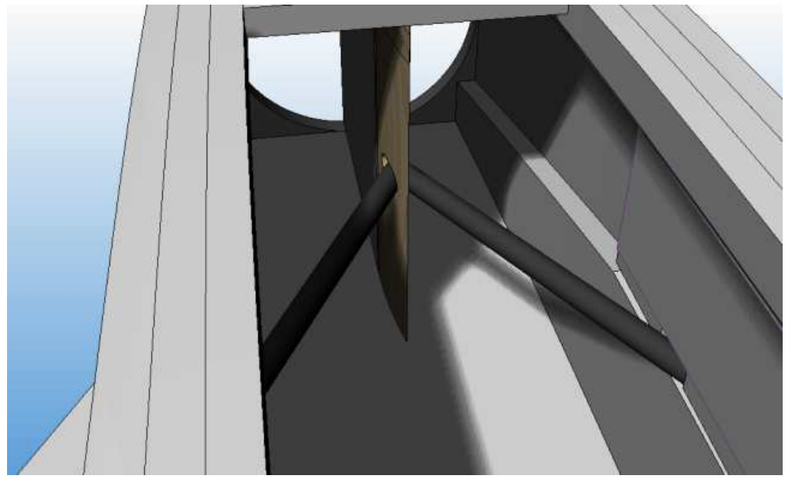




Pre assemble the wings using epoxy and masking tape - extending the front carbon tubes just the correct length to touch within the hole in the front splitter (see image below)

Sand the end of the carbon tube to the correct angle.

If you are using an intake tube, you will need to run a drill through the path of the carbon tube first.

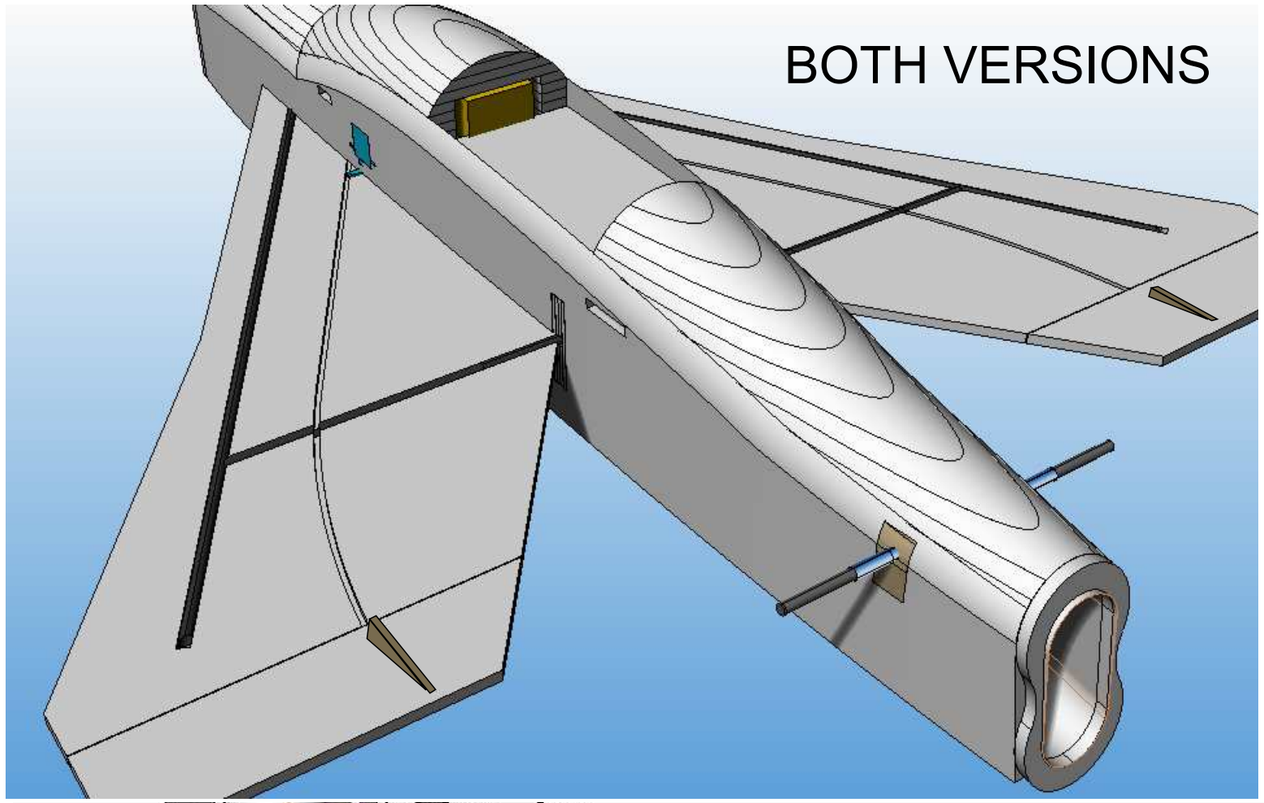


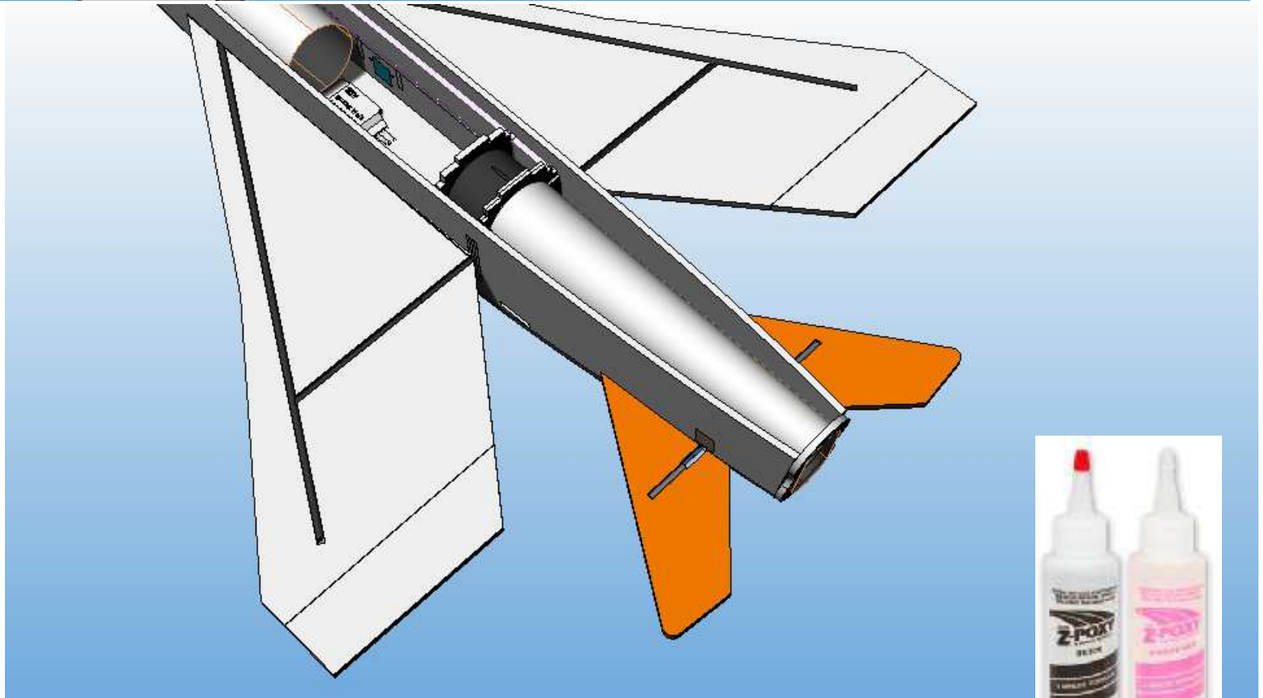
On the pusher version, slide the main spar through the slot at the rear of the fuselage.

Glue the wing spars into the wings using Epoxy.

Slide the spars at the front of the wings into the ply support, and then position the wings and main spar together.  Ally masking tape and glue, and support on two matching piles of flat books untile set.









Cut a groove 3mm wide and 3mm deep through the depron.

Grind away part of the carbon tube using a dremel.

Glue in a plastic sheath with piano wire inside to become the aileron pushrods.

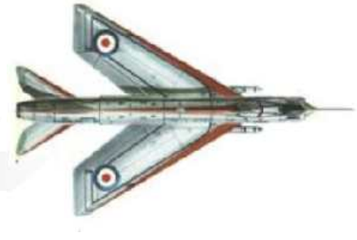
Apply a layer of 0.6 oz fibreglass with water base polyurethane varnish to the underside of the wings to compensate for grinding away part of the structure.

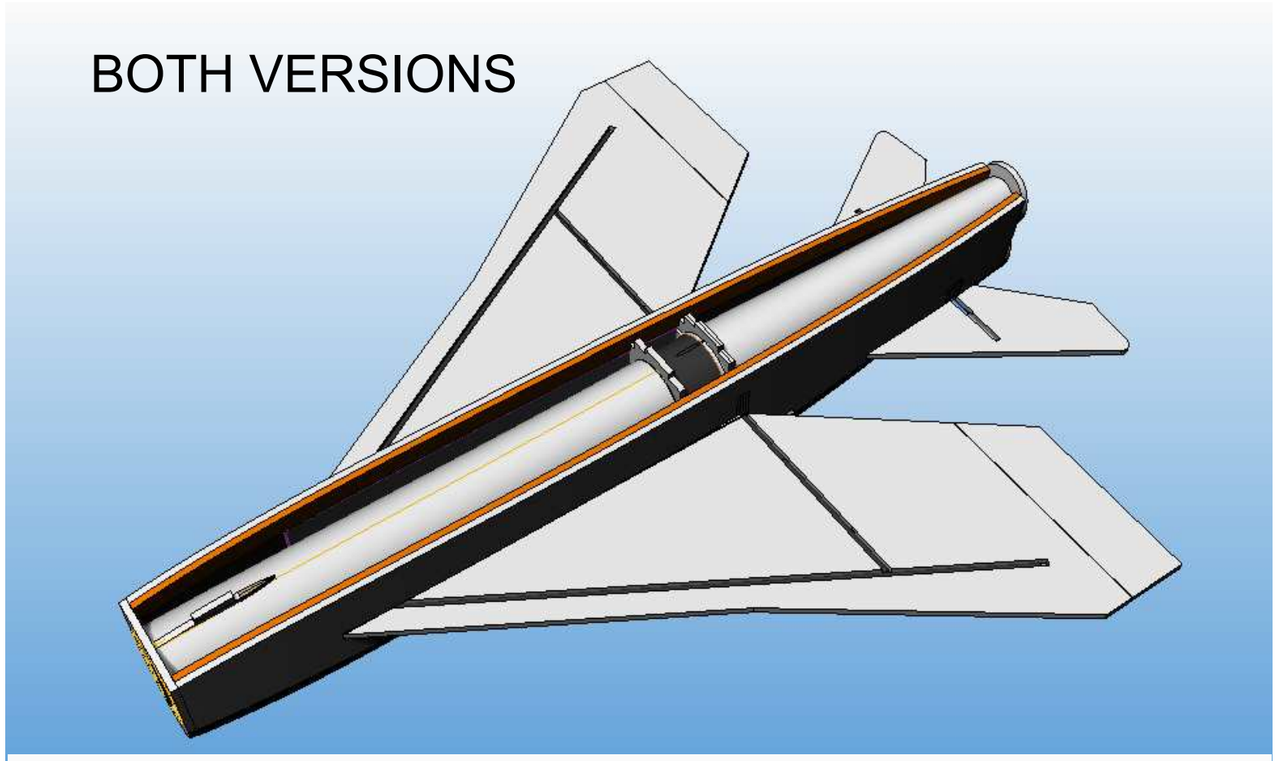
Hot glue two Graupner mini hinges into the end grain of the depron.

Connect the piano wire to the servo, and then to control horns mounted to the ailerons.

Slide two drilled out prop adaptor rings onto the carbon elevator spar(s) to act as a stopper, and also to prevent glue getting into the aluminium tube.

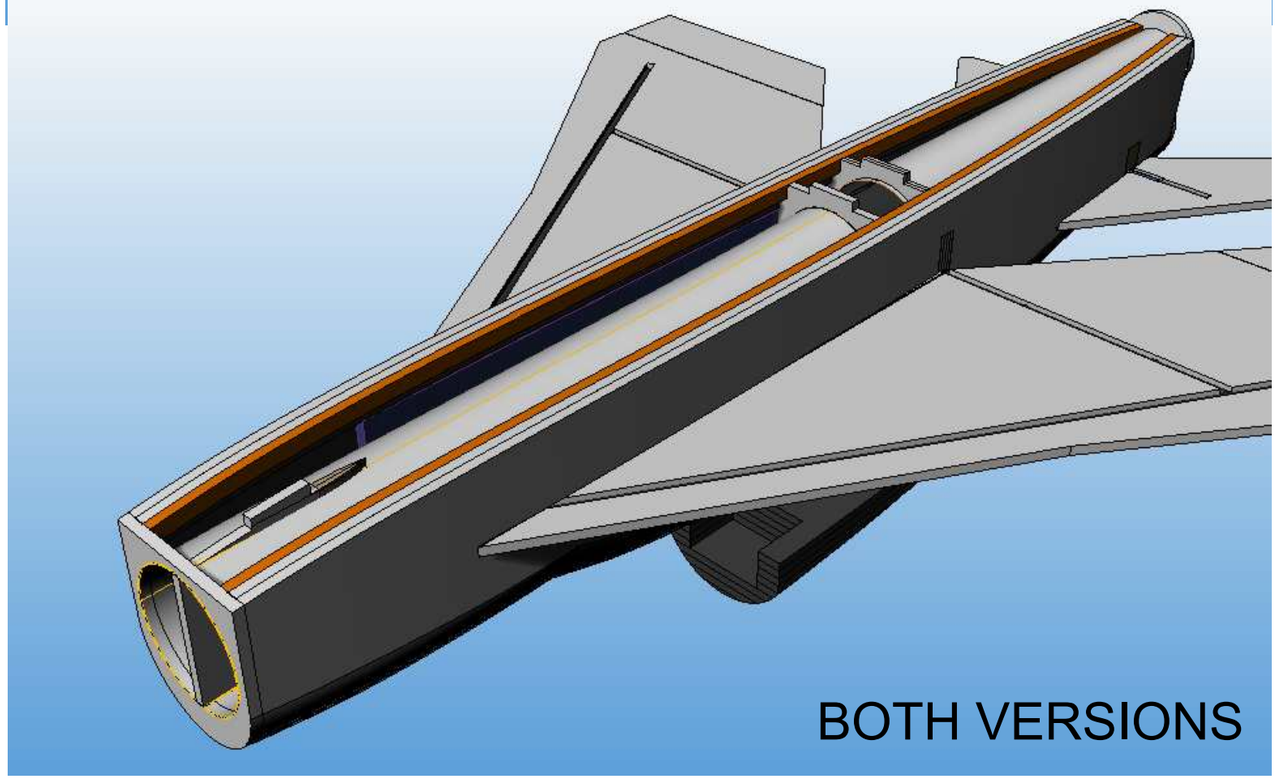
First set all your controls to zero on your TX and then using Epoxy and Masking tape Glue the elevators into position





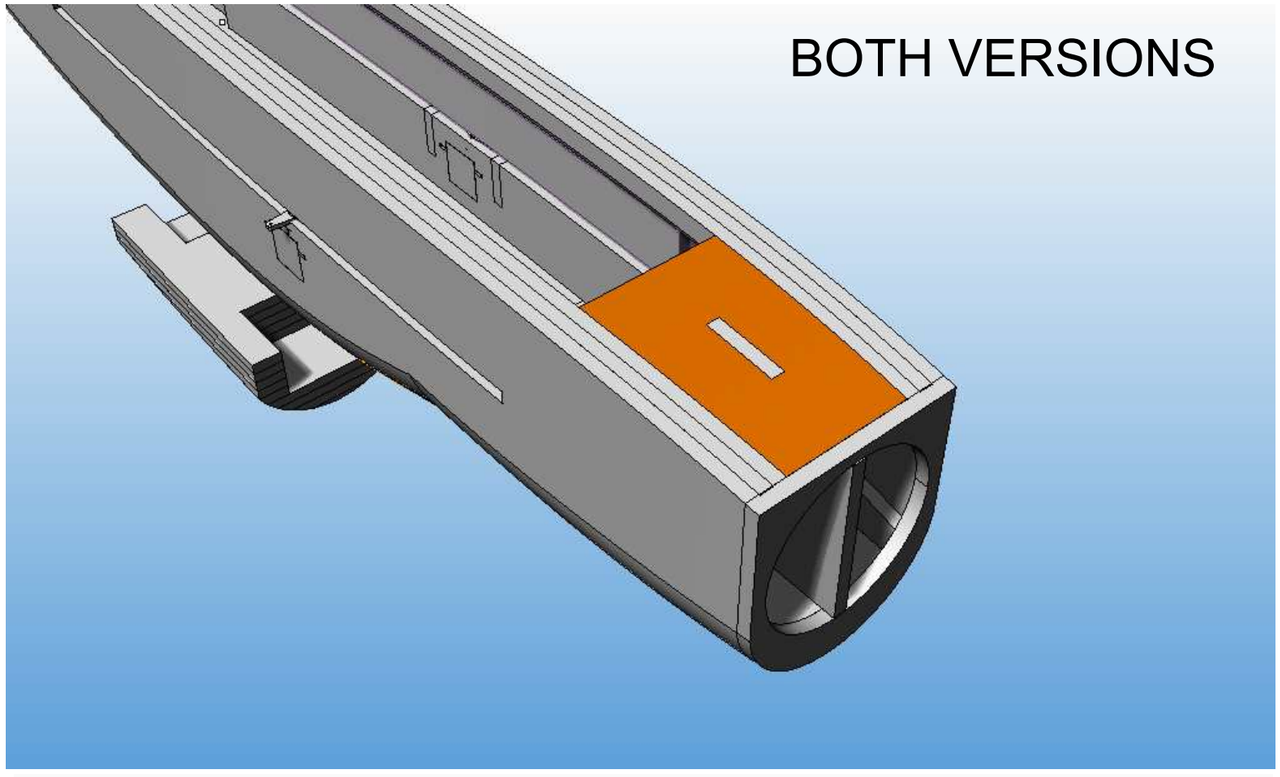

Glue the outer corner reinforcement strips in place as shown


Glue the inner corner reinforcement strips in place as shown

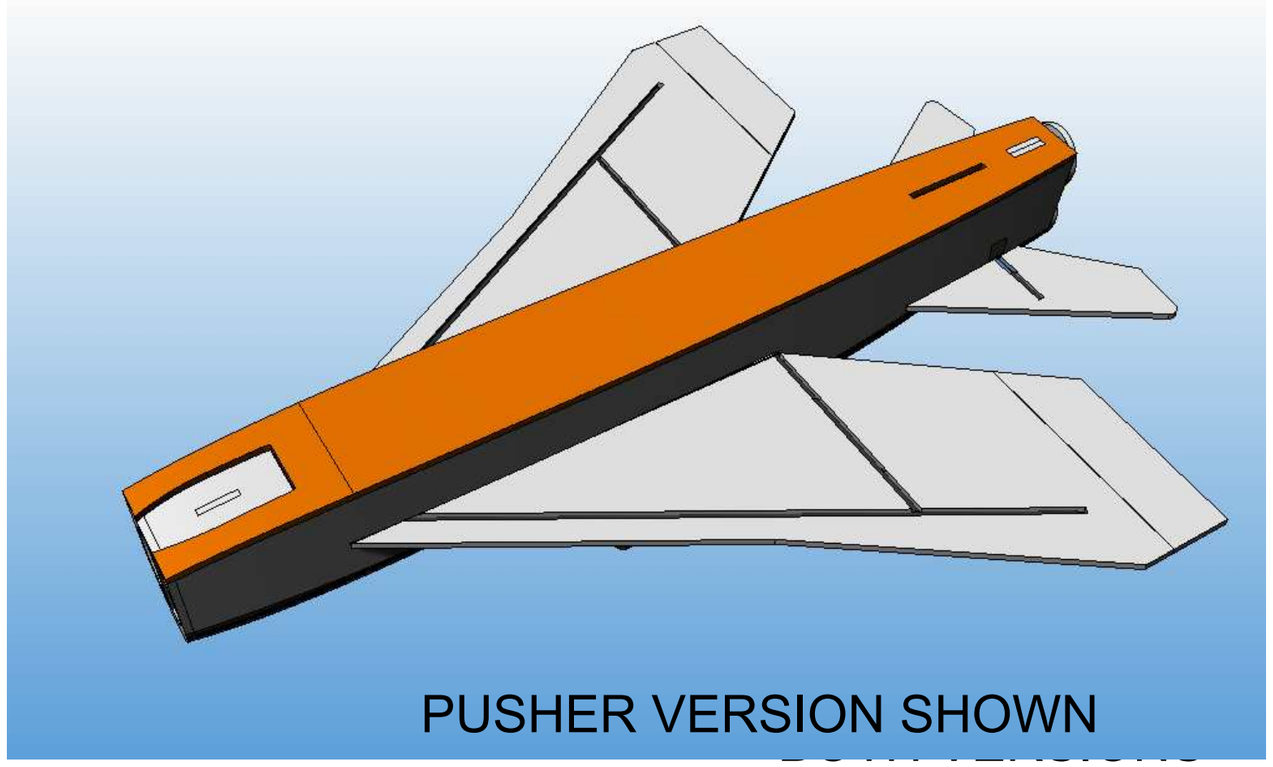






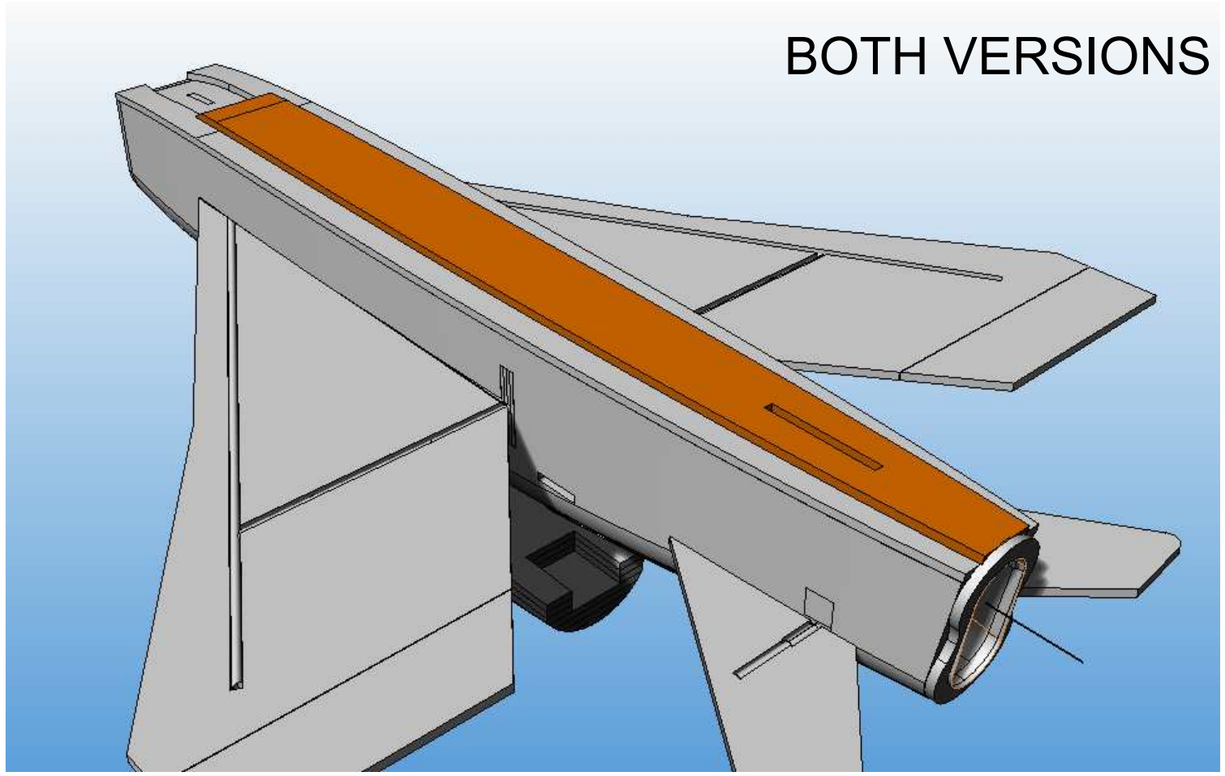



Glue the cockpit floor piece in place.

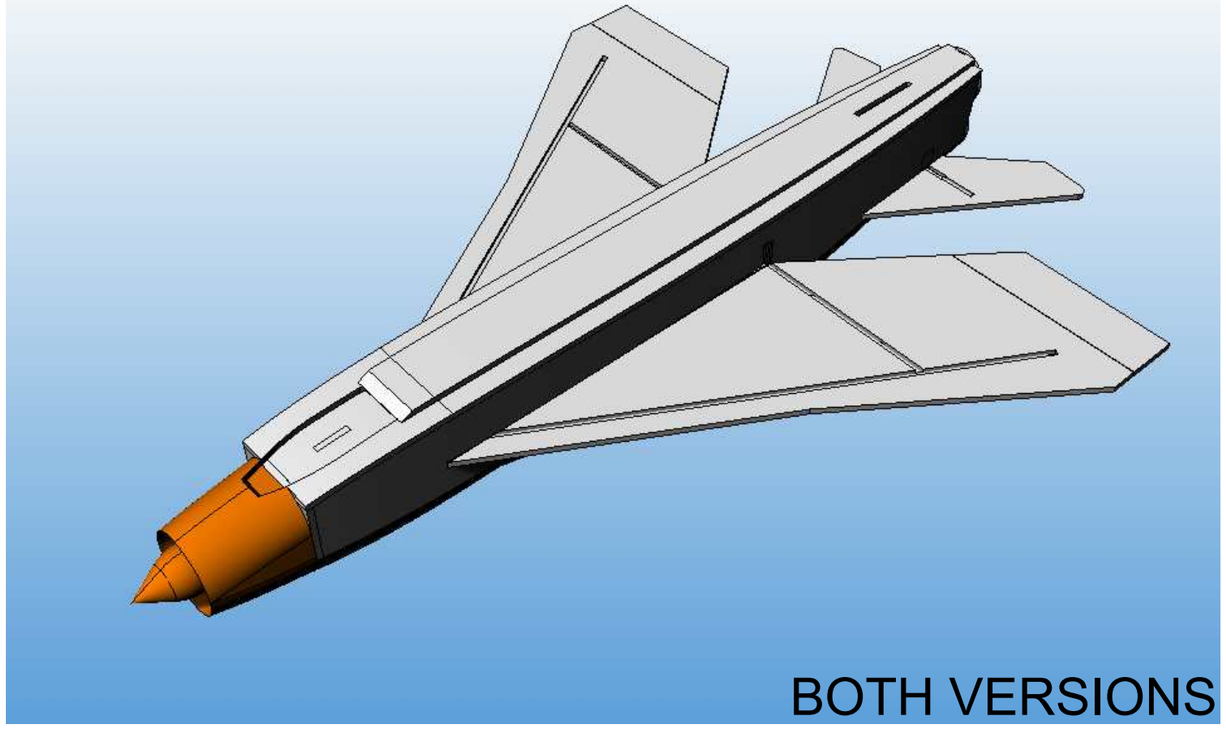

Glue the fuselage top (lower) in place



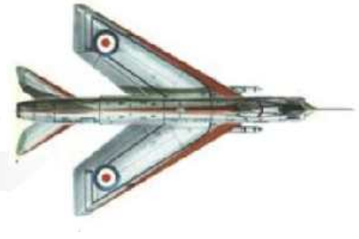



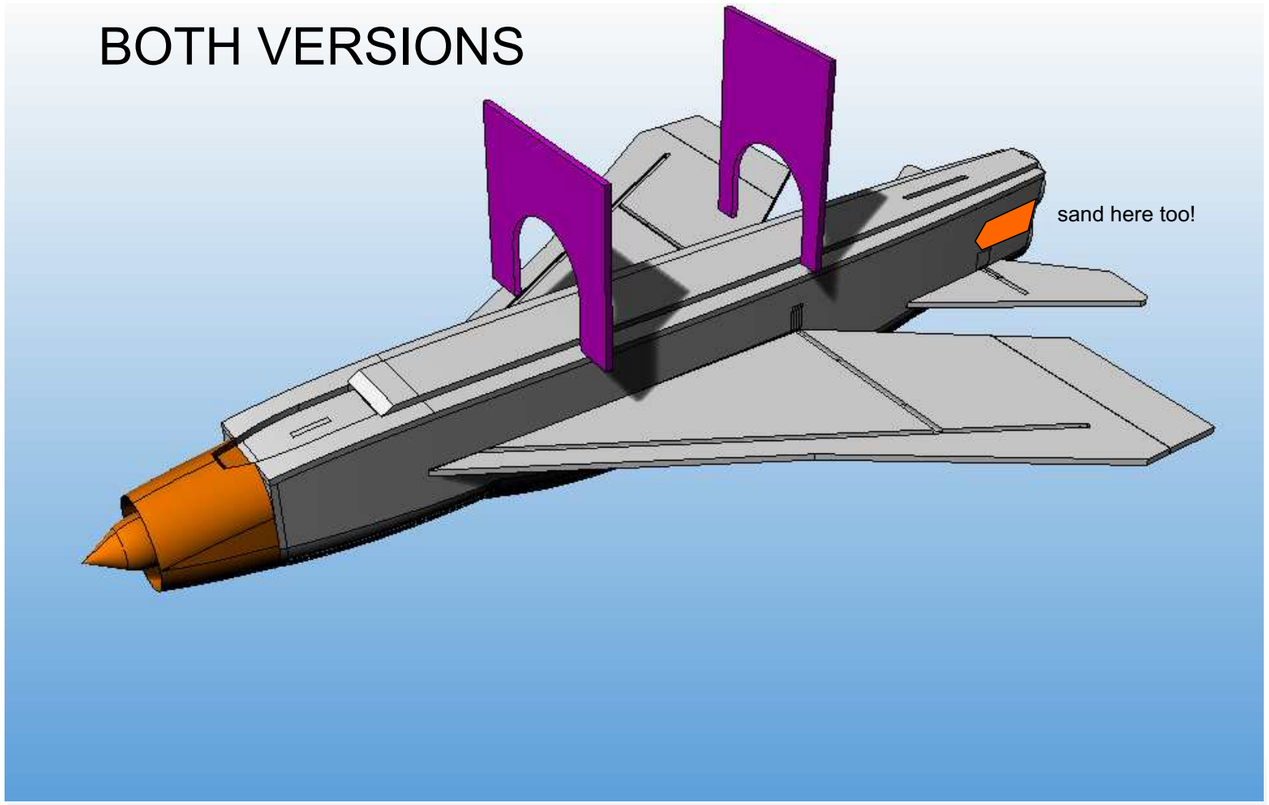

Glue the fuselage top (upper) in place


Glue the nosecone onto the aircraft assembly

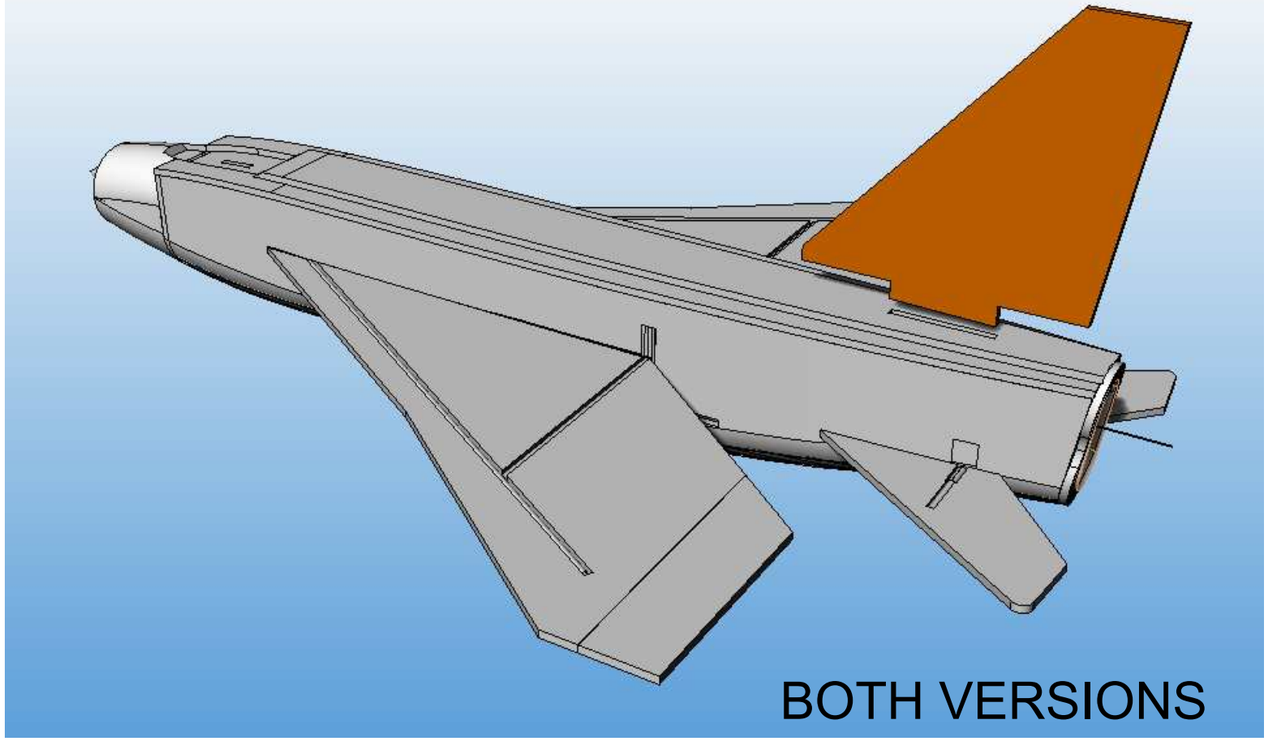




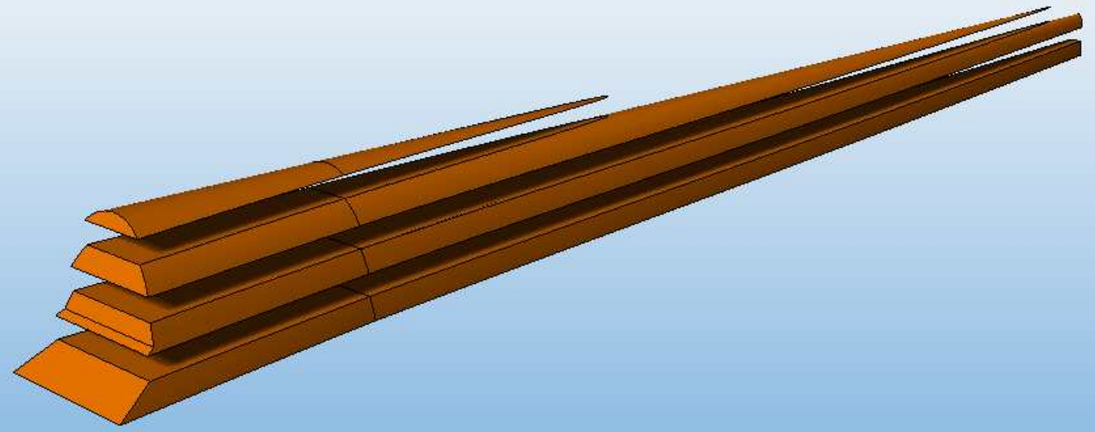

Using the Nosecone, Exhaust bulkhead and the two jigs, carefully trim away the top edges of the fuselage with a sharp knife, then sand using a sanding block until you get a semi-circular sectional shape from front to rear.

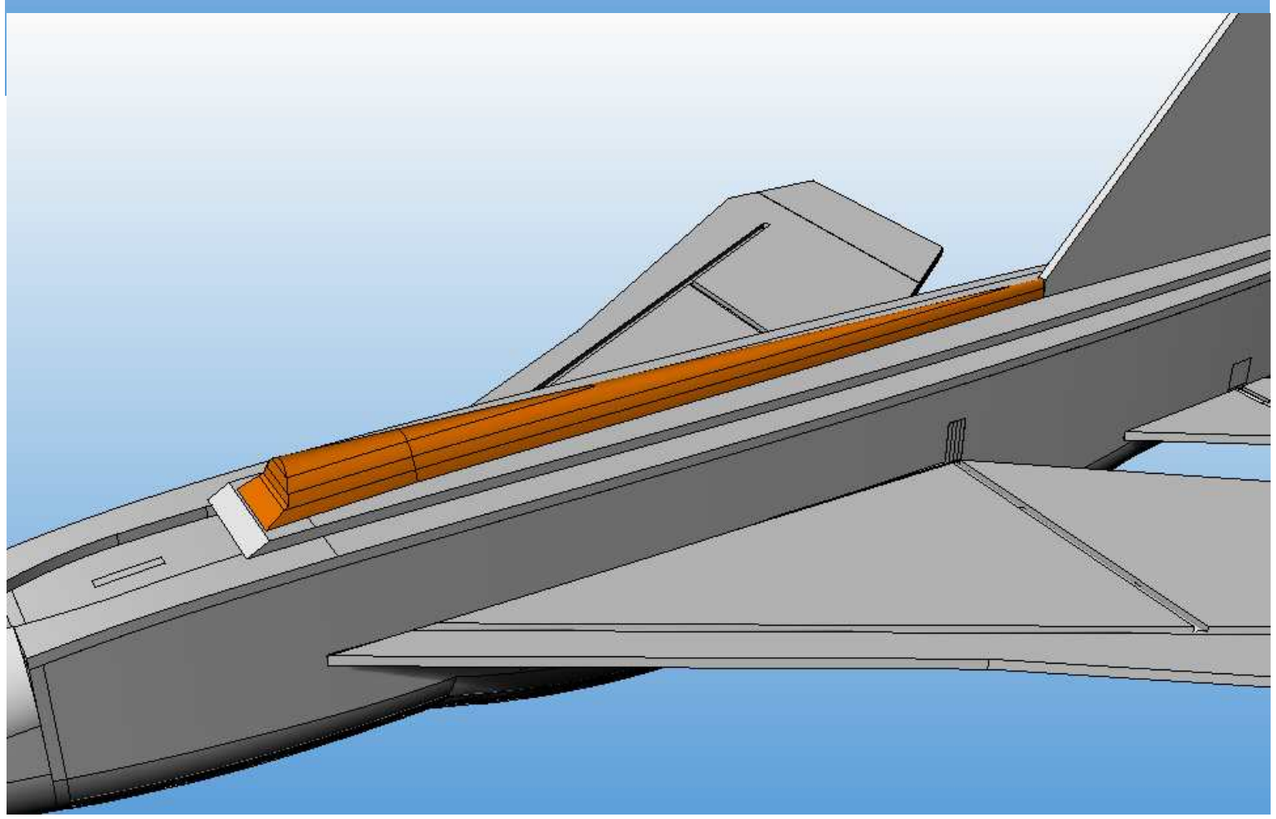
Also scallop the fuselage at the rear using sandpaper wrapped around your finger to create the indent shown on the real plane.




Glue in the vertical stabiliser using epoxy.

## BOTH VERSIONS

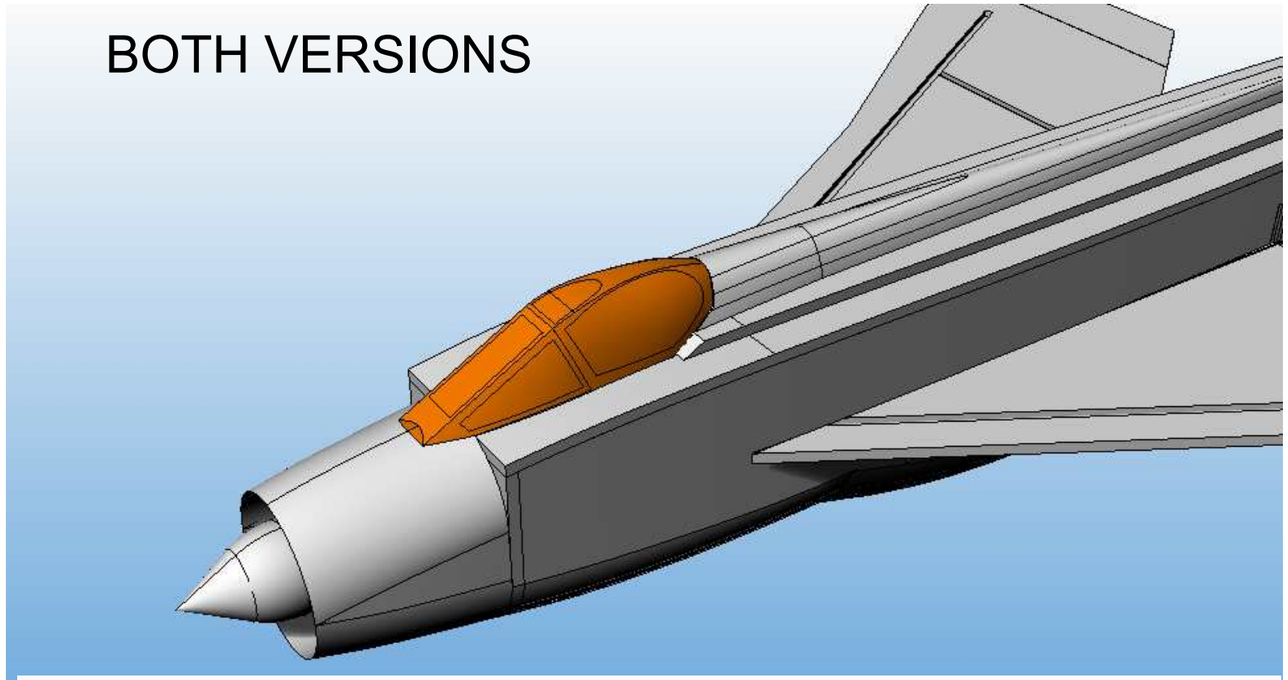




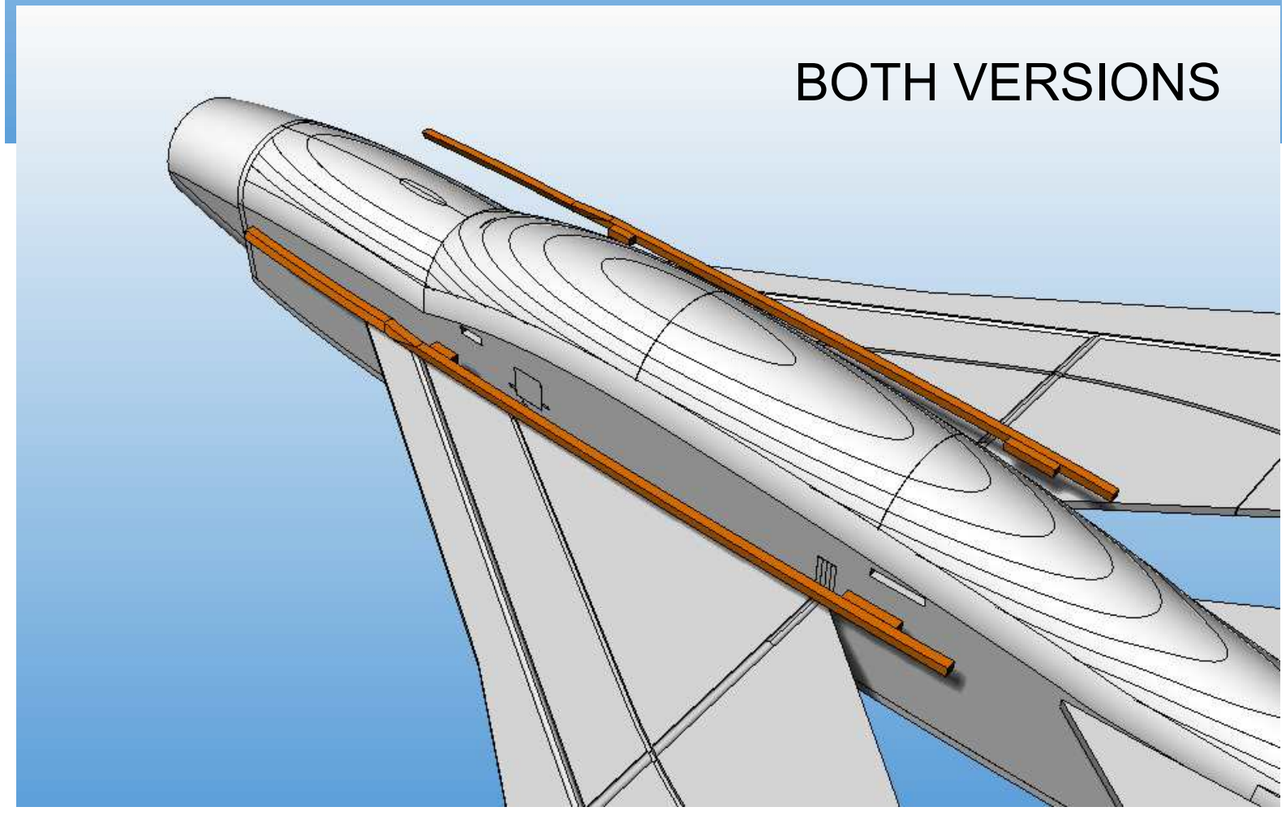
Laminate together and shape the turtledeck parts


Mark a centreline and then glue the turtledeck in place



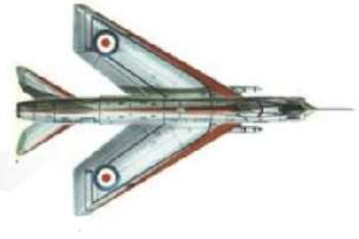



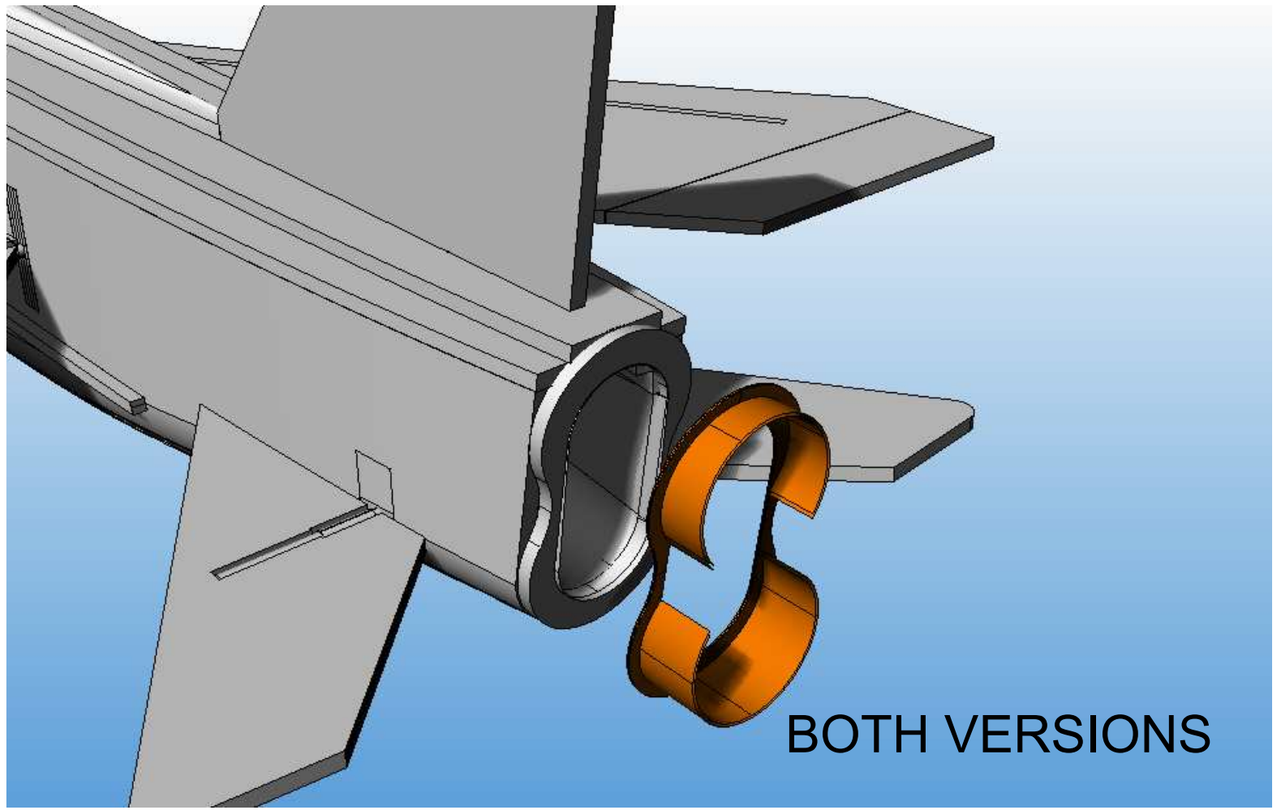

Laminate the canopy, sand to shape and glue in place.


Sand to shape, then glue the two side rails in place.






Shape 3mm depron, or use a 3d printed exhaust glued in place.  (3d printed version shown here)

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