JETWORKS

All versions

Sukhoi Su-57
Felon
Parkjet

3D PRINTED PARTS VERSION

Photograph of actual aircraft.

5th Generation Jet Fighter

Construction Guide

Su-57 Felon History

The Sukhoi Su-57 (Russian: Сухой Су-57; NATO reporting name: Felon) is a stealth, single-seat, twin-engine multirole fifth-generation jet fighter being developed since 2002 for air superiority and attack operations. The aircraft is the product of the PAK FA a fifth-generation fighter programme of the Russian Air Force. Sukhoi's internal name for the aircraft is T-50. The Su-57 is planned to be the first aircraft in Russian military service to use stealth technology.

Its maiden flight took place on 29 January 2010 and the first production aircraft was expected to be delivered in 2019 with a second to follow in 2020 but is being delayed due to a crash in late December 2019.

The fighter is designed to have supercruise, supermaneuverability, stealth, and advanced avionics to overcome the prior generation fighter aircraft as well as ground and naval defences. The Su-57 is intended to succeed the MiG-29 and Su-27 in the Russian Air Force and have a service life of up to 35 years.

The Su-57 is a fifth-generation multirole fighter aircraft and the first operational stealth aircraft for the Russian Air Force. The aircraft is stealthy, supermaneuverable, has supercruise capability, incorporate substantial amounts of composite materials and possess advanced avionics such as active phased-array radar and sensor fusion.

The aircraft has a blended wing body fuselage and incorporates all-moving horizontal and vertical stabilizers; the vertical stabilizers toe inwards to serve as the aircraft's airbrake. The aircraft incorporates thrust vectoring and has adjustable leading–edge vortex controllers (LEVCONs) designed to control vortices generated by the leading edge root extensions, and can provide trim and improve high angle of attack behaviour, including a quick stall recovery if the thrust vectoring system fails. The advanced flight control system and thrust vectoring nozzles make the aircraft departure-resistant and highly manoeuvrable in both pitch and yaw, enabling the aircraft to perform very high angles of attack manoeuvres such as the Pugachev's Cobra and the bell maneuver, along with doing flat rotations with little altitude loss.

Weapons are housed in two tandem main weapons bays between the engine nacelles and smaller bulged, triangular-section bays near the wing root. Internal weapons carriage eliminates drag from external stores and enables higher performance compared to external carriage, as well as enhancing stealth.

The Su-57 is planned to be the first operational aircraft in Russian Air Force service to use stealth technology. The Su-57's design emphasizes frontal stealth, with RCS-reducing features most apparent in the forward hemisphere; the shaping of the aft fuselage, the seams between parts, and rivets are much less optimized for radar stealth compared to the F-22. The combined effect of airframe shape and RAM of the production aircraft is estimated to have reduced the aircraft's RCS to a value thirty times smaller than that of the Su-27.

Designers Notes

The Felon was designed to have the following seven power options :-

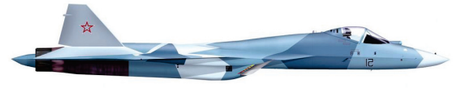
<u>Option 1 : Single pusher motor installation</u>

- 1.a. Fixed single pusher
- 1.b. Thrust vectoring - single axis (pitch)
- 1.c. Thrust vectoring - dual axis (pitch and yaw)

<u>Option 2: Dual EDF</u>

- 2.a. 50mm EDF
  - 2.a.a Fixed
  - 2.a.b Thrust vectoring (pitch and yaw)
- 2.b. 64mm EDF
  - 2.b.a Fixed
  - 2.b.b Thrust vectoring (pitch and yaw)

This guide is for building the model with 3D printed parts only. If you don't wish to use 3d printed parts use the 'Non 3d printed' construction guide



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!

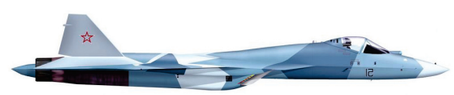
Tapes
> For holding parts tightly together whilst glue sets
- Low tack masking tapes

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

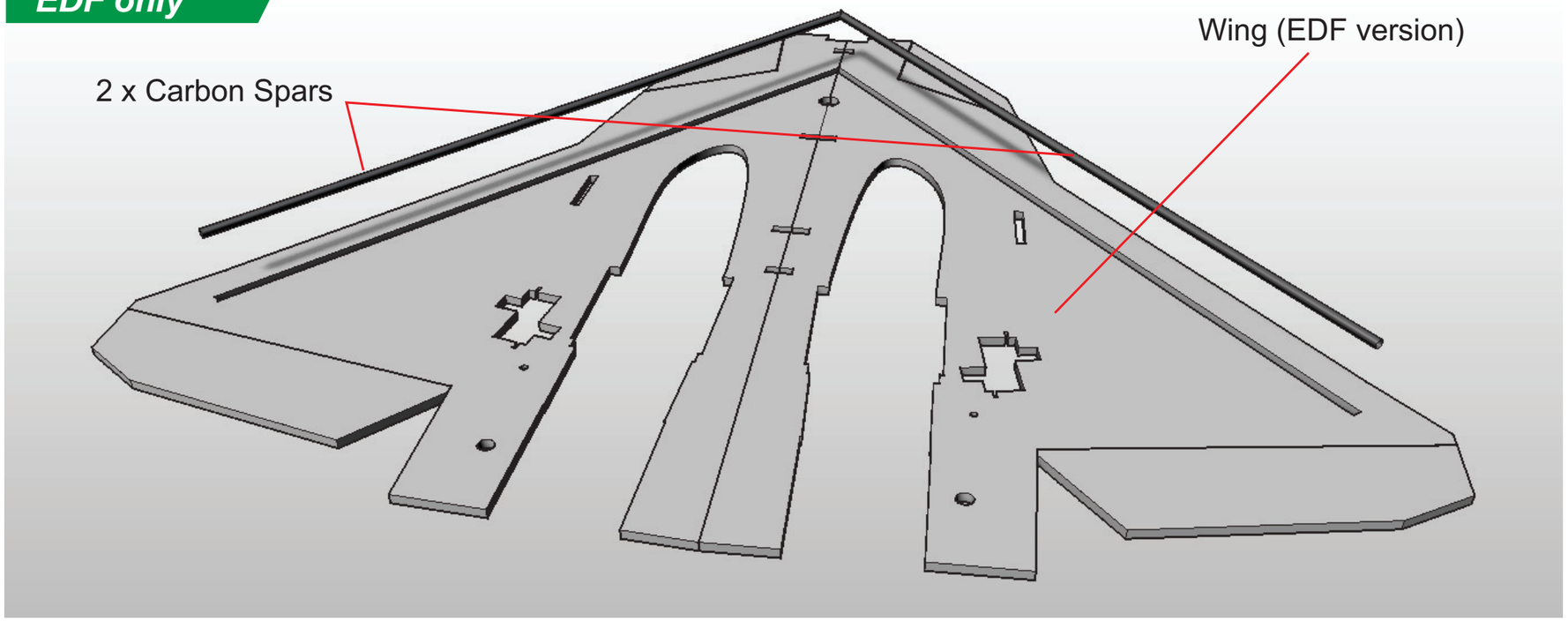
Cutting parts
1. Print the plans,
2. Cut around each part using scissors - allow a border of approx (1/4") 6mm
3. Use either 3M spray mount or a very light coat of 3M 77 to the back of the parts and stick in an economical layout on the Depron foam.
4. Using a safety rule and craft knife over a cutting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

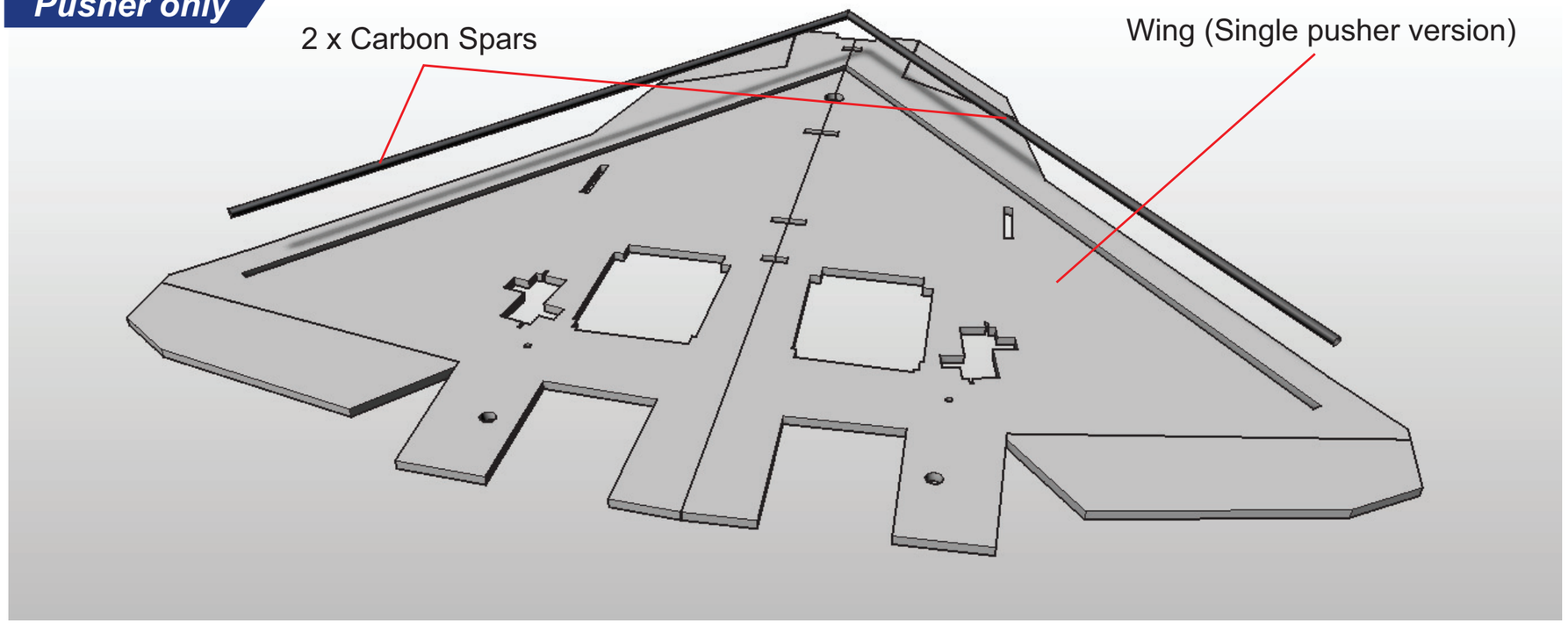
Glueing parts together.
1. Ensure a really good fit - this will reduce the amount of adhesive used. The Bar Sander is a great tool for this.
2. Follow the adhesive instructions closely.
3. Use ordinary steel head pins to help keep the parts located whilst epoxy sets.
4. Use objects as weights such as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



EDF only

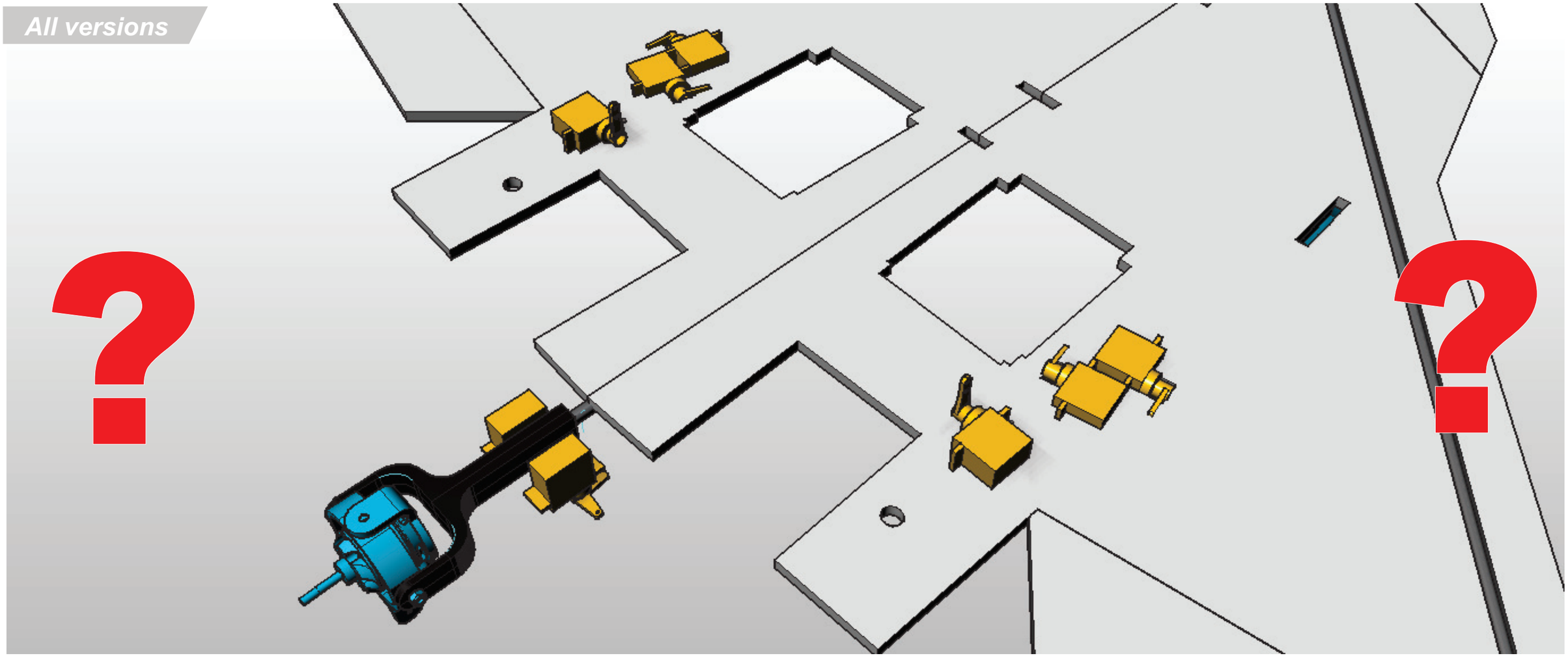


Pusher only



Choose which power system you wish to use, then glue the epoxy 6mm Carbon tubes into the slots of the relevent wing panel.

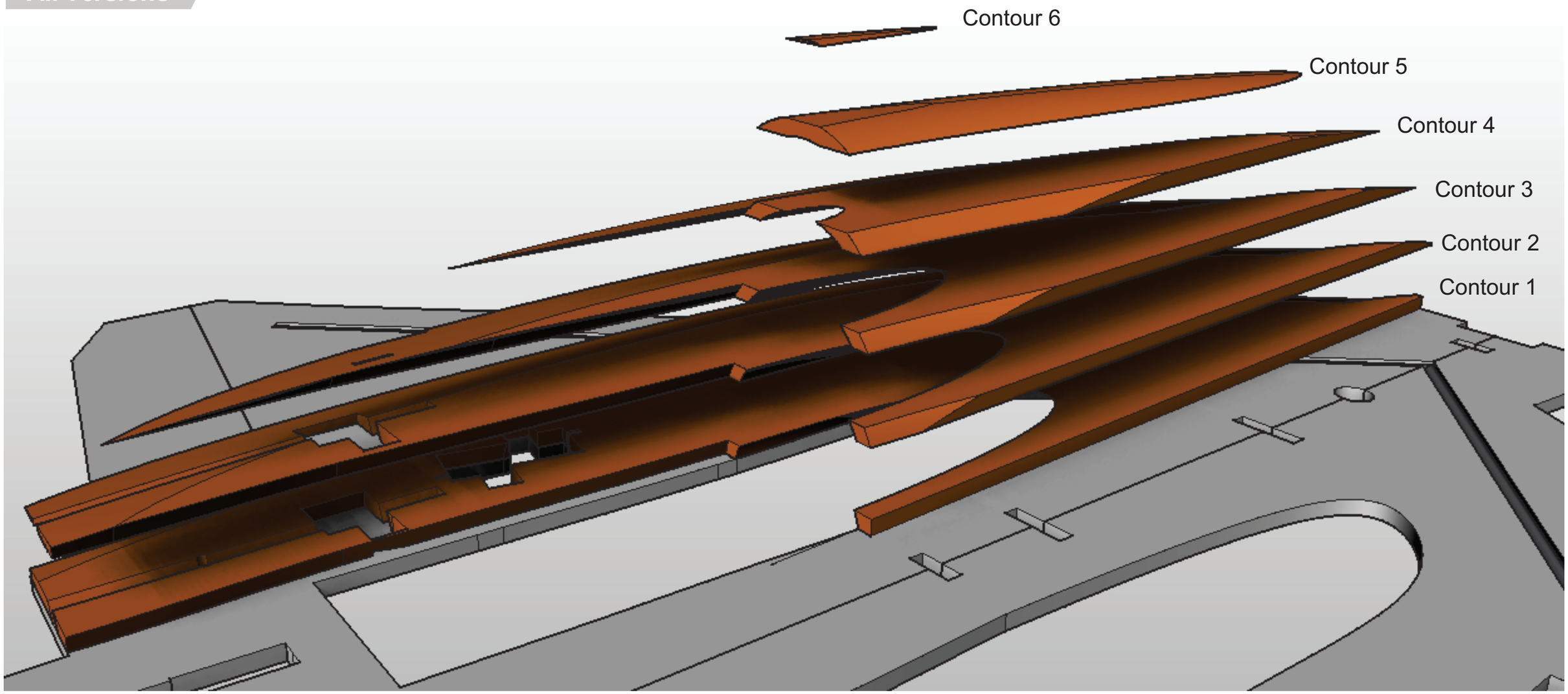
Mitre them together where they meet



This SU-57 design can become quite heavy as 3d printed parts along with EDF Units or twin-axis pusher mechanisms add a surprising amount of weight. It will fly with the weight, but you may need to bungee launch it depending on what components you choose.

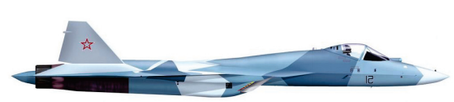
You can have a lot of fun with a fixed pusher prop and simple elevator/aileron function keeping the wing loading light. (4 servos). If you go for a 2 axis pusher with working rudders, you will need 8 servos.. I recommend you choose Metal Geared servos only for elevator and the T/V system, using nylon for the Ailerons and Rudder to help keep weight down.

Regarding the EDF versions, the 50mm EDF will provide lots of fun, I suggest you choose the 64mm units only if you want to bungee launch and desire speed above all. Print the 3d printable parts as light as you dare. 0.4mm wall, 5% infil on non structural parts. 40% infil on motor mounts etc. Consider using Lightweight PLA.

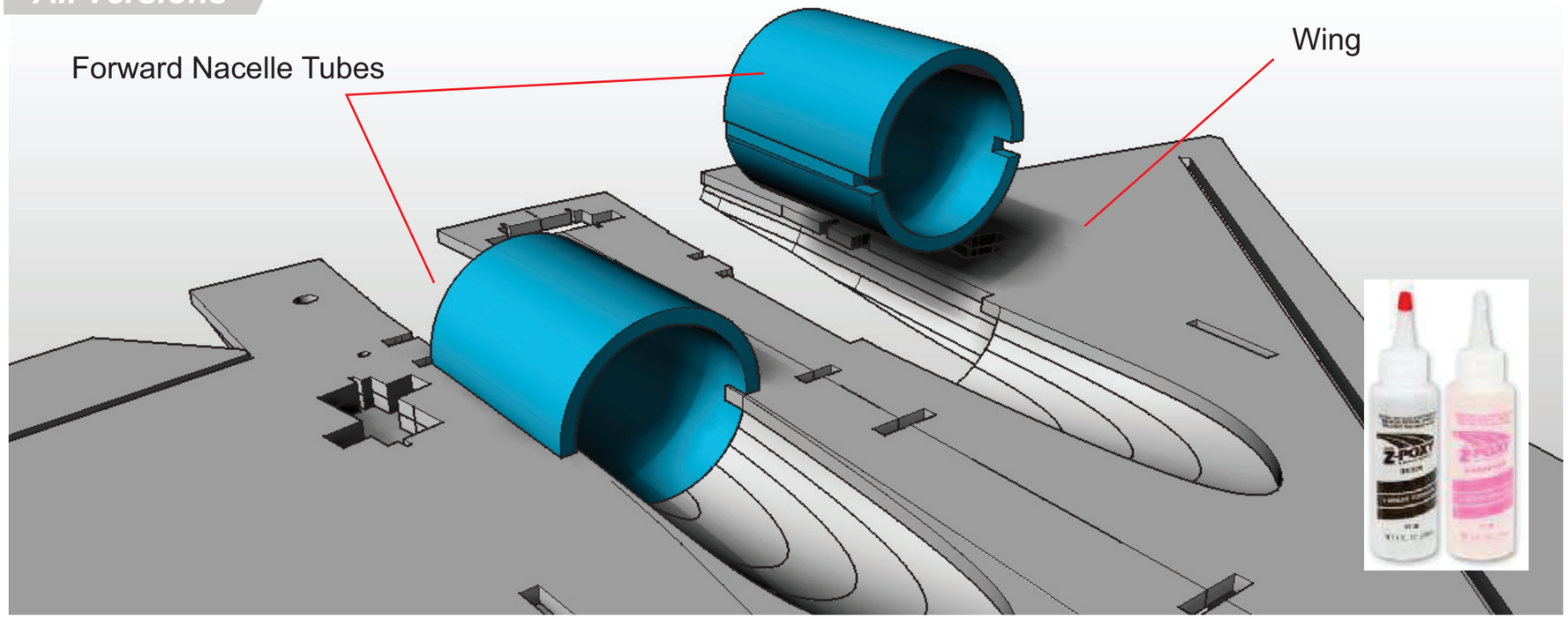


Pre-shape the contoured fuselage pieces to 90% complete. (to be finished when all are together).

Laminate the 6 pieces using UHU Por.



All versions

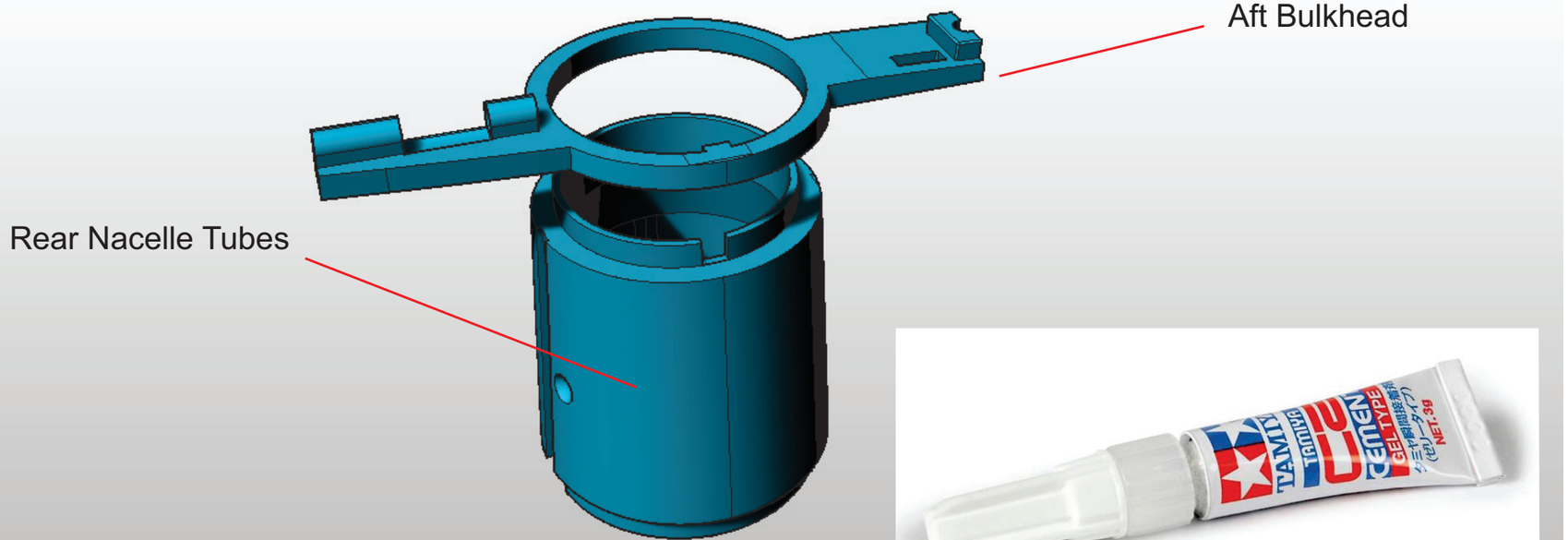


Position the **Forward Nacelle Tubes** by aligning the flat recesses to the wing, then slide the notch over the wing 'tabs' within the cut out area.

Note : there is a 'dimple' on the tube to help you identifiy its correct orientation. This should be top-outside facing.

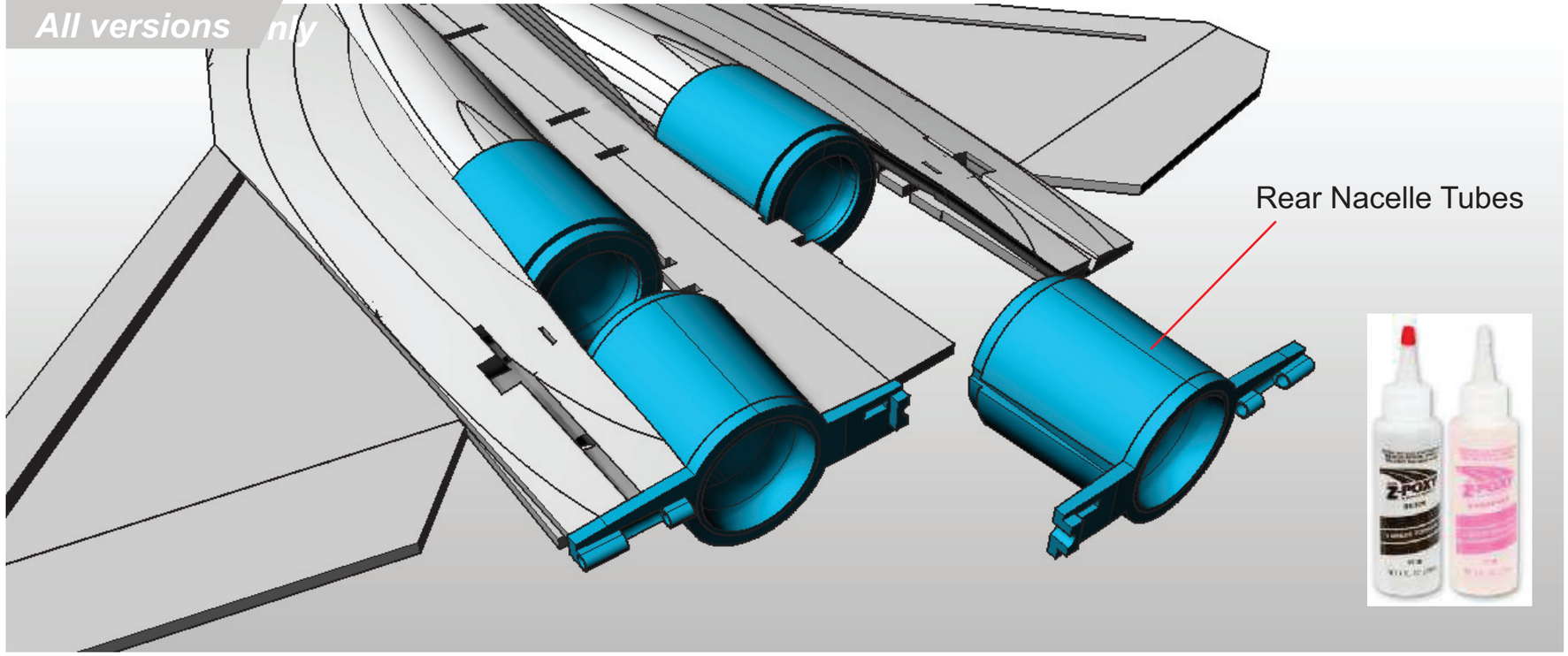
Glue the mirrored forward Nacelles into the wing assembly.

All versions



Ensure a good fit then, Glue the **Aft bulkhead** to the **Rear Nacelle Tubes** using CA Glue.

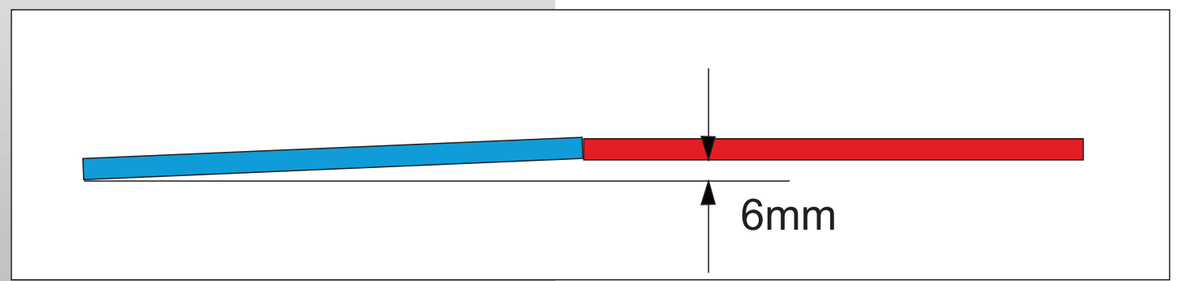
All versions only



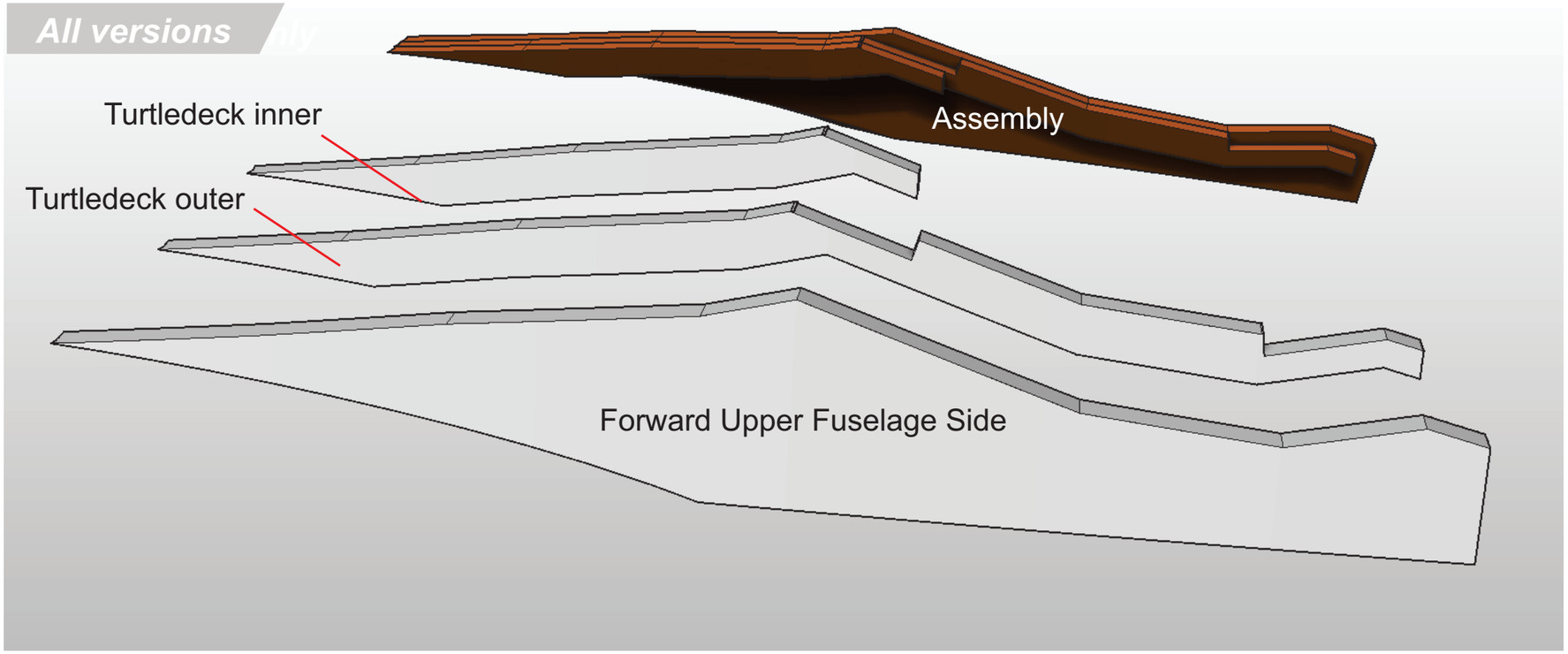
Check for a good fit, then slide the aft nacelle assembly in place, using a epoxy (sparingly)

All versions

Glue the **Forward Fuselage Frame** to the assembly using epoxy glue. Angle the frame to the assembly 6mm lower than the wing as diagram below.



All versions fly

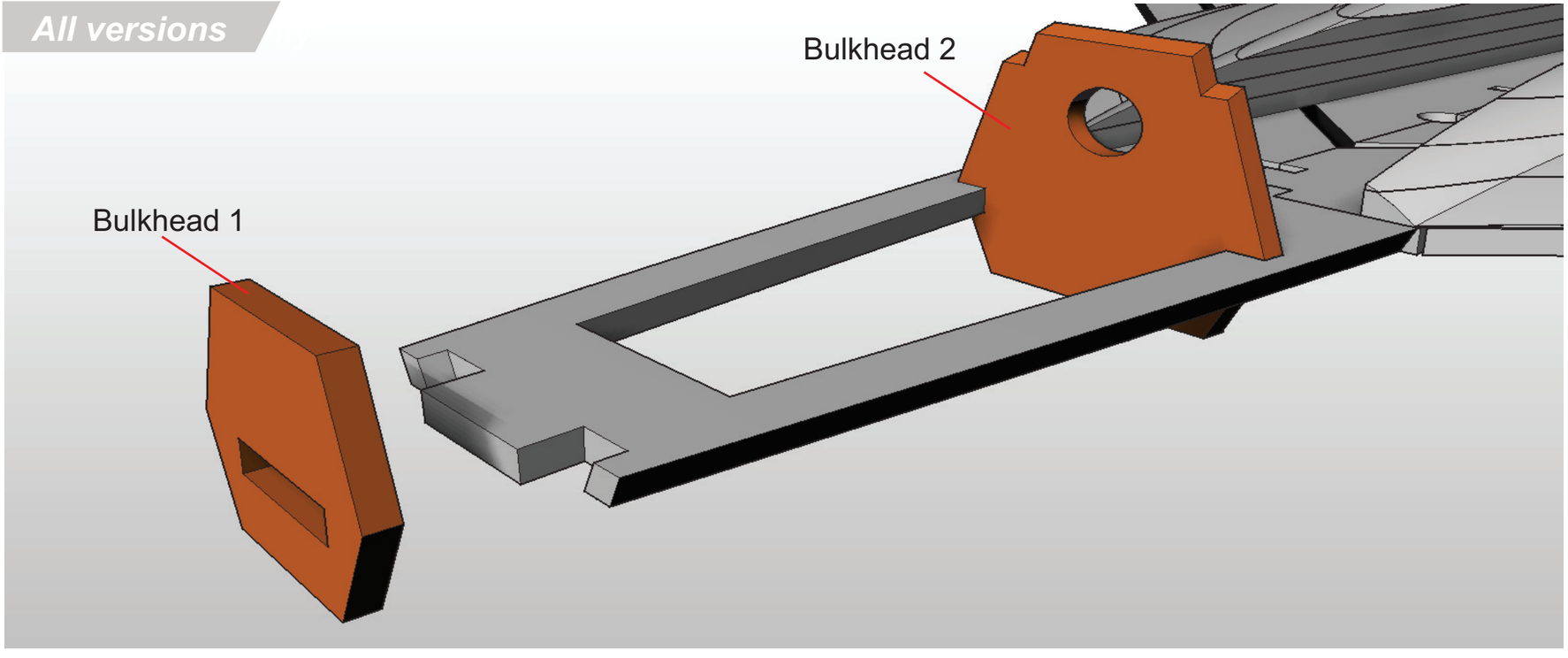


Create the two forward fuseage upper side assemblies as shown.

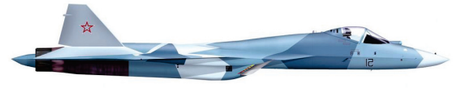
Glue the **Turtledeck inner** to the **Turtledeck outer**.

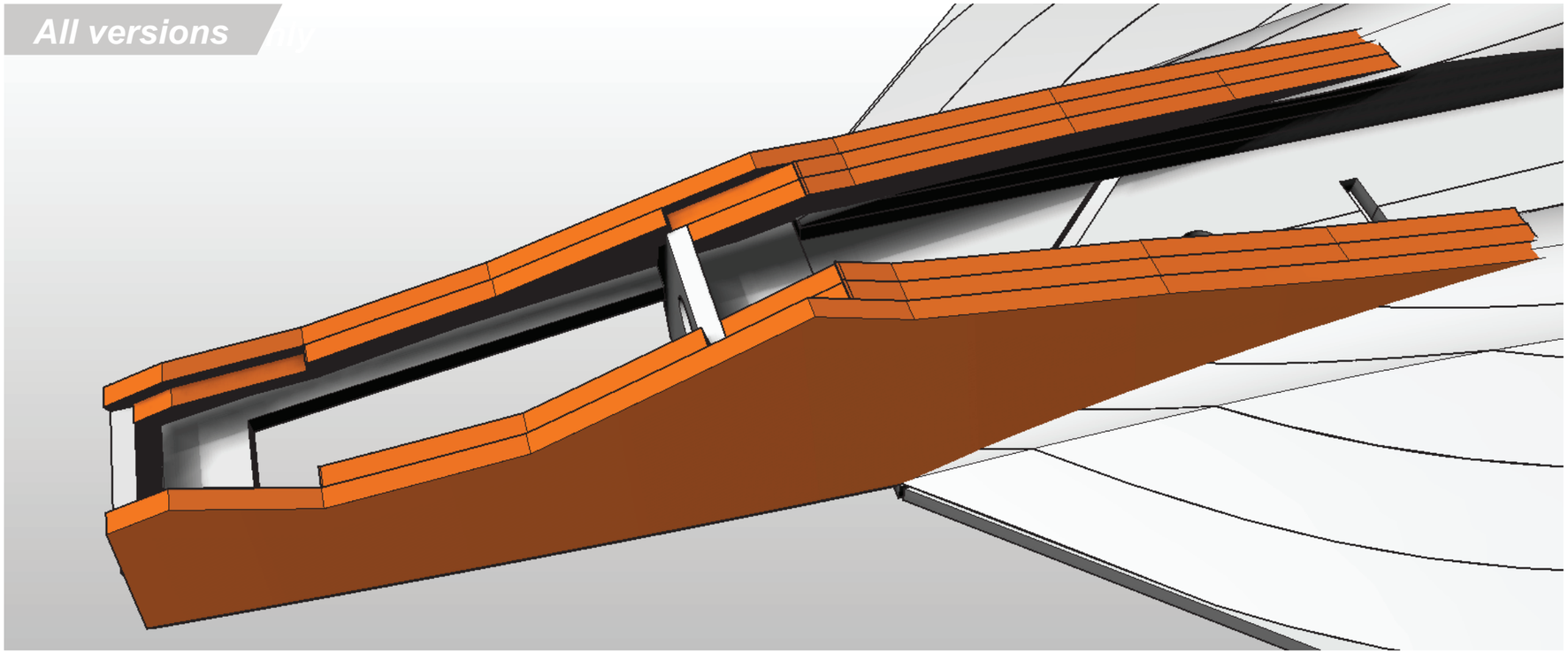
Glue the Turtledeck parts to the **Forward Upper fuselage side.**

All versions fly

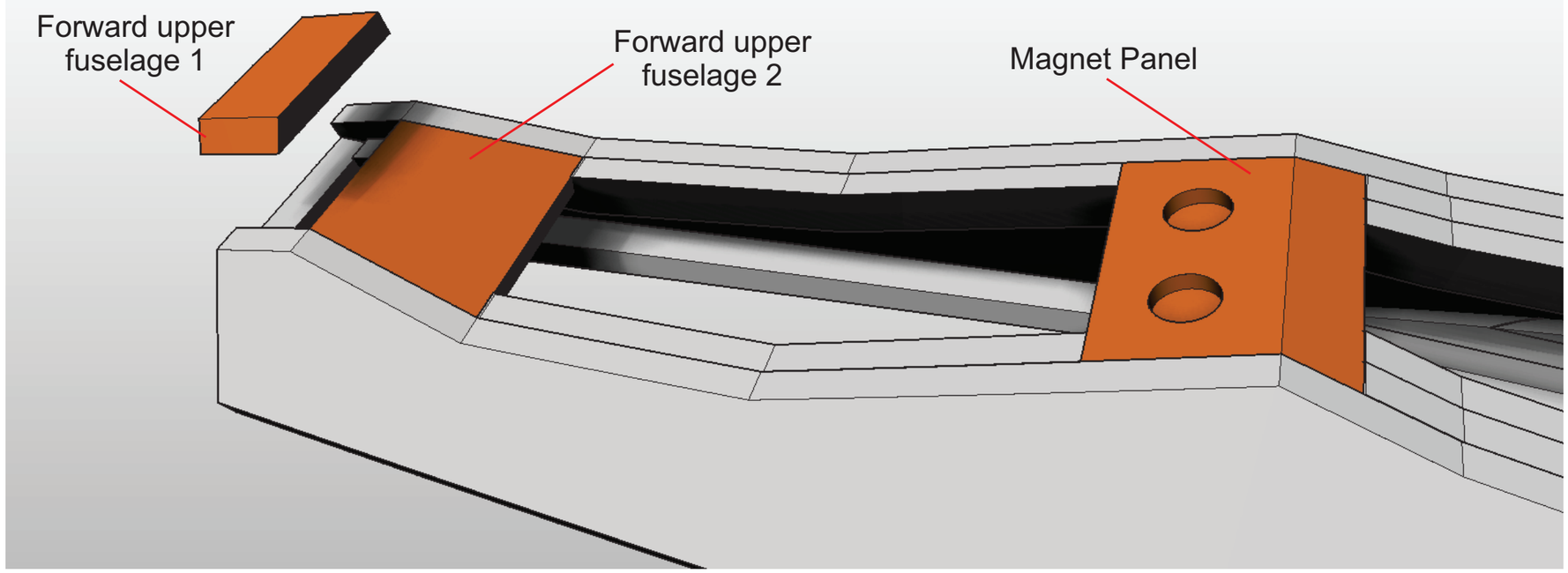


Glue **Bulkhead 1** and **Bulkhead 2** in place.





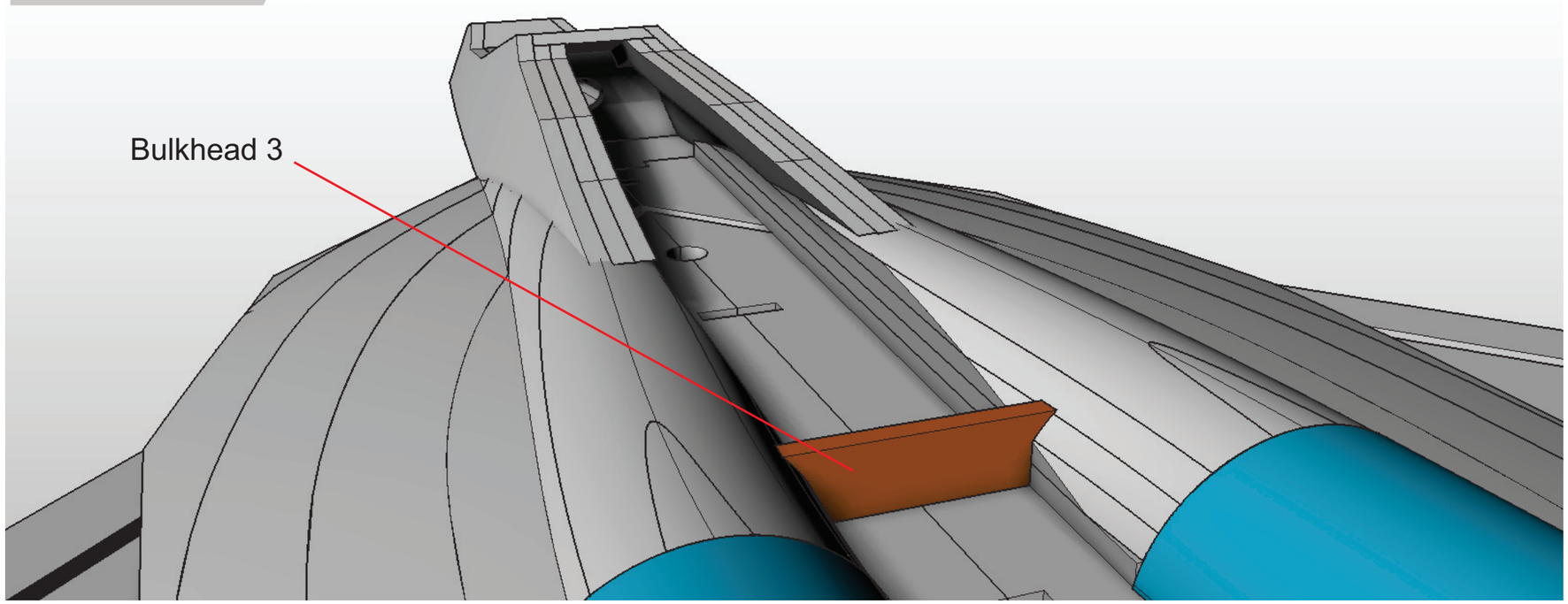
Glue the two forward fuseage upper side assemblies to the fuselage. Sand the mating faces to ensure a good fit.



Glue the **Forward Upper Fuselage 1 & 2**, and the **Magnet panel** in place.

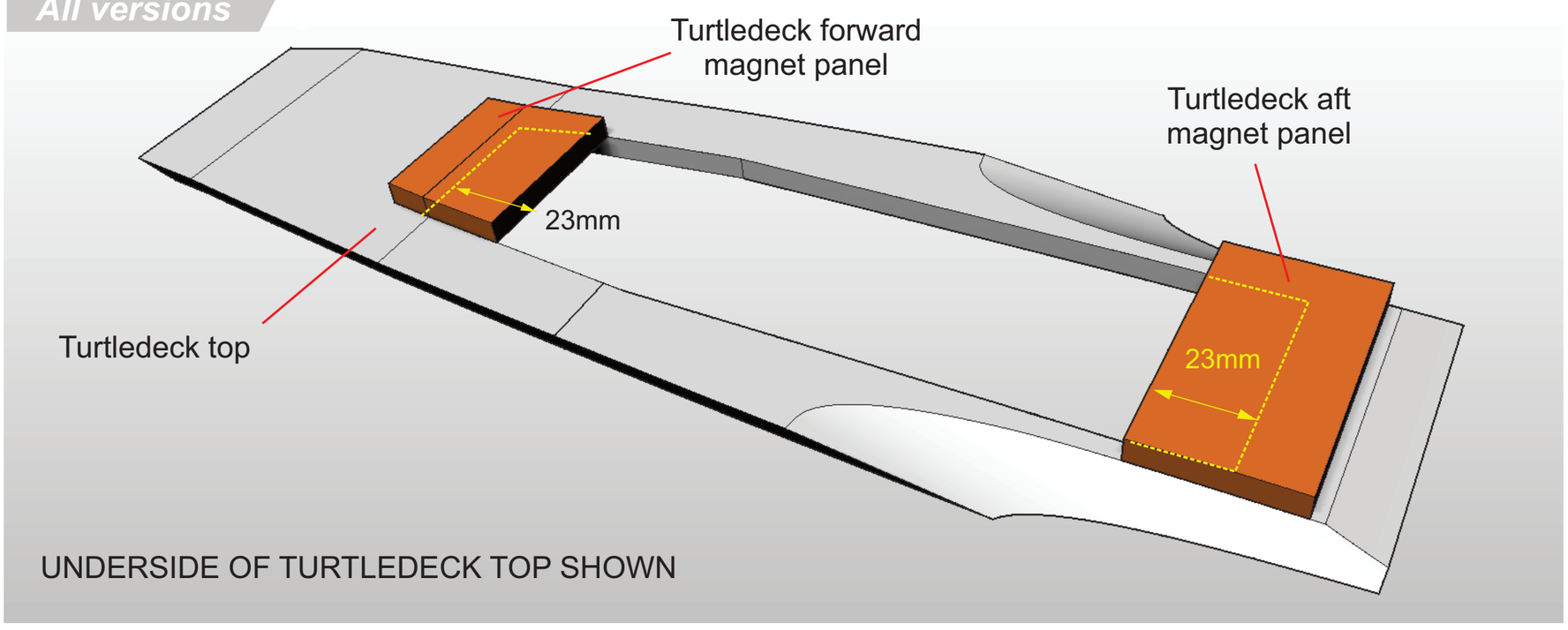
You will need to flex the fuselage side assemblies out a little to get them to fit.

All versions

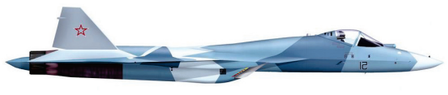


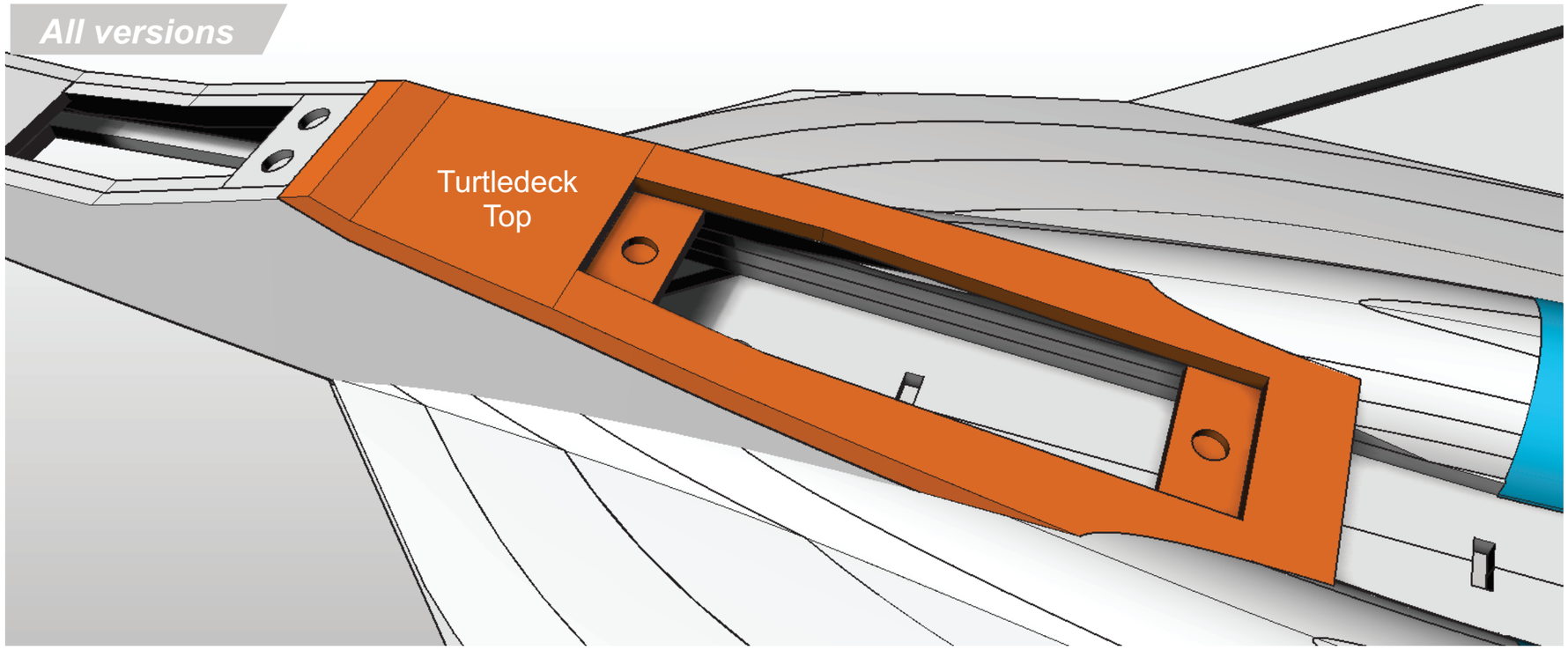
Glue **Bulkhead 3** in place.

All versions



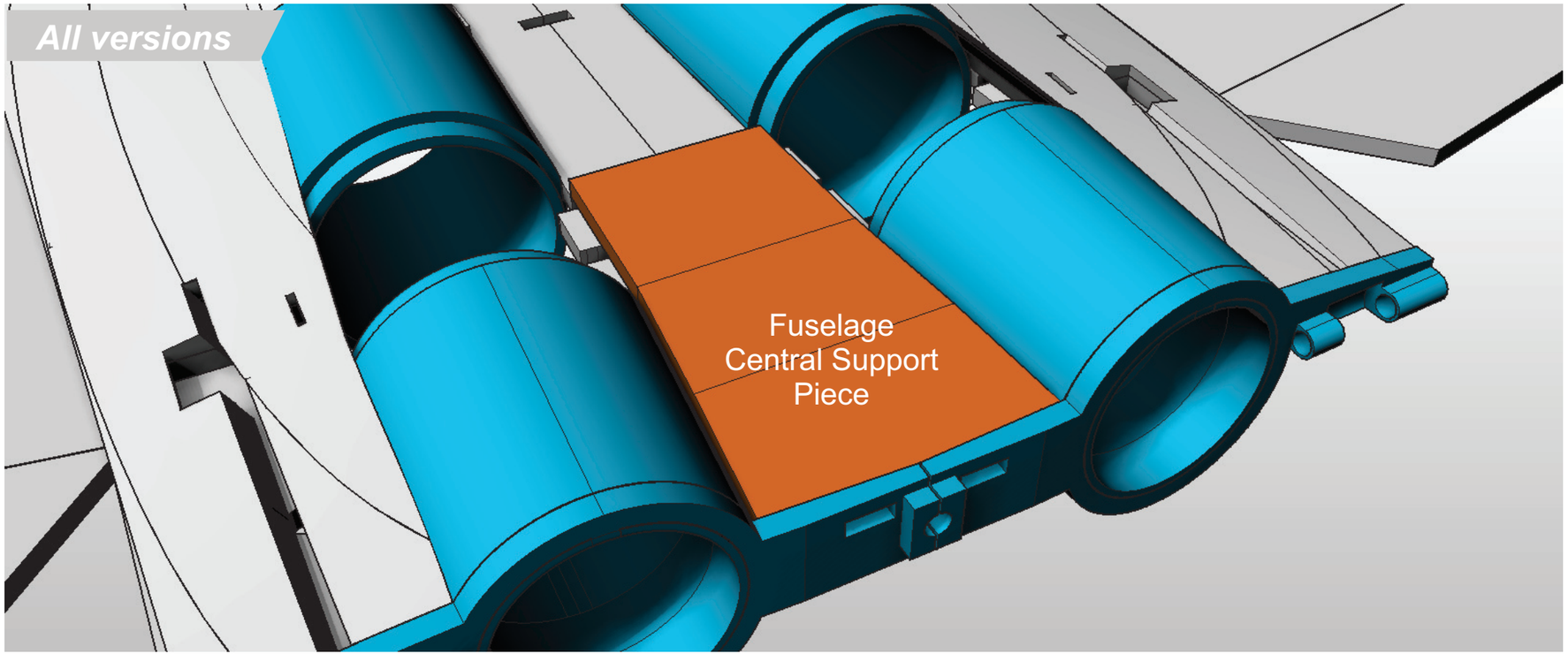
Glue the two magnet panels in place - leaving 23mm of flange showing to fit the magnets in.



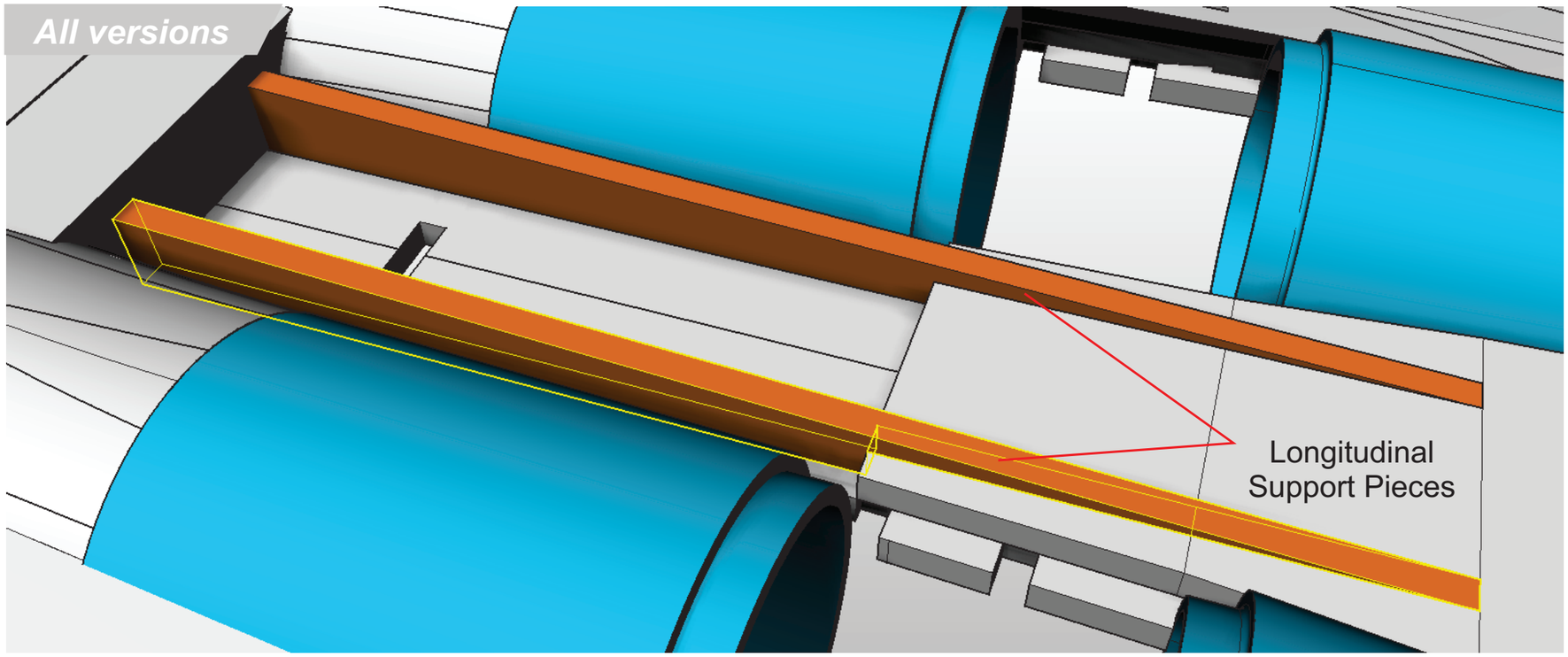


Crease and 'crush bend' the Turtledeck top assembly to get the shape near the canopy.

Sand to get a good fit, then glue in place

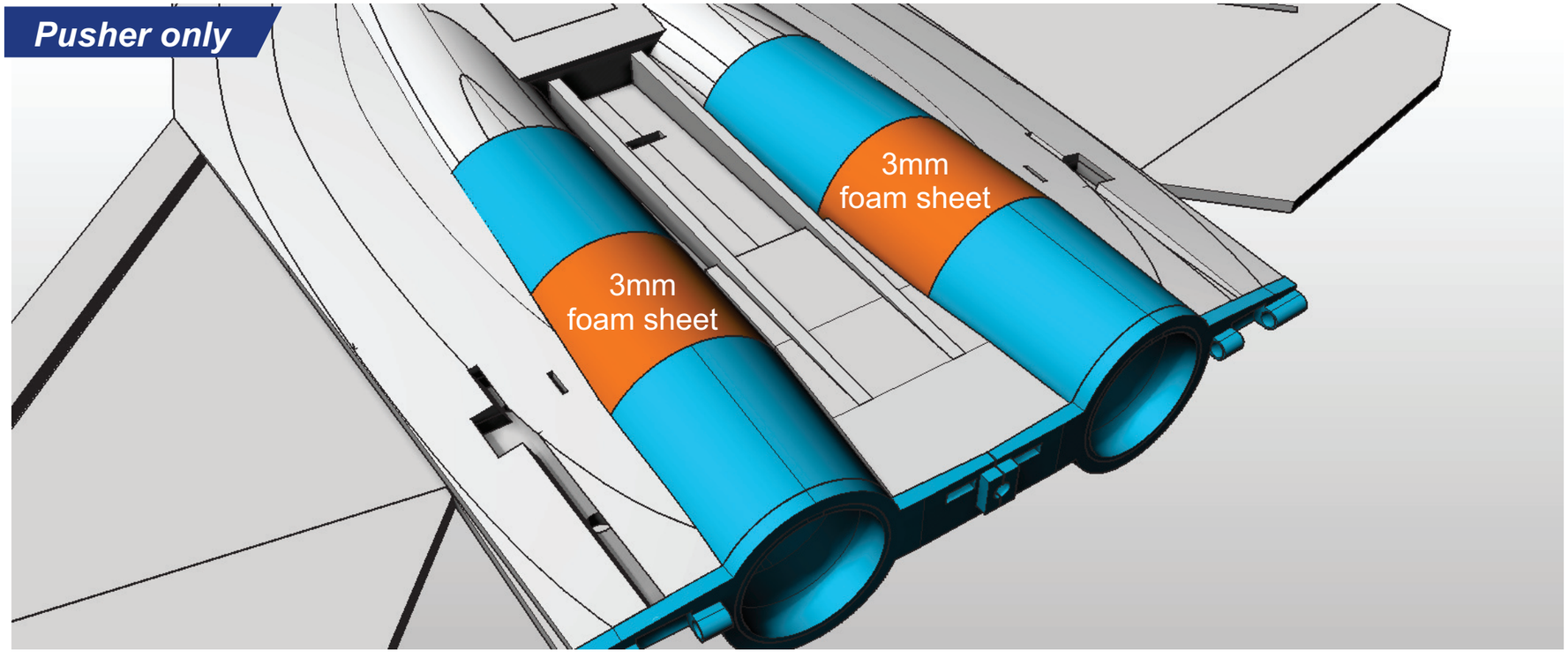


Sand the **Fuselage Central Support piece** to give a good fit, then glue in place.



Glue the **Longitudinal support** pieces in place as shown.

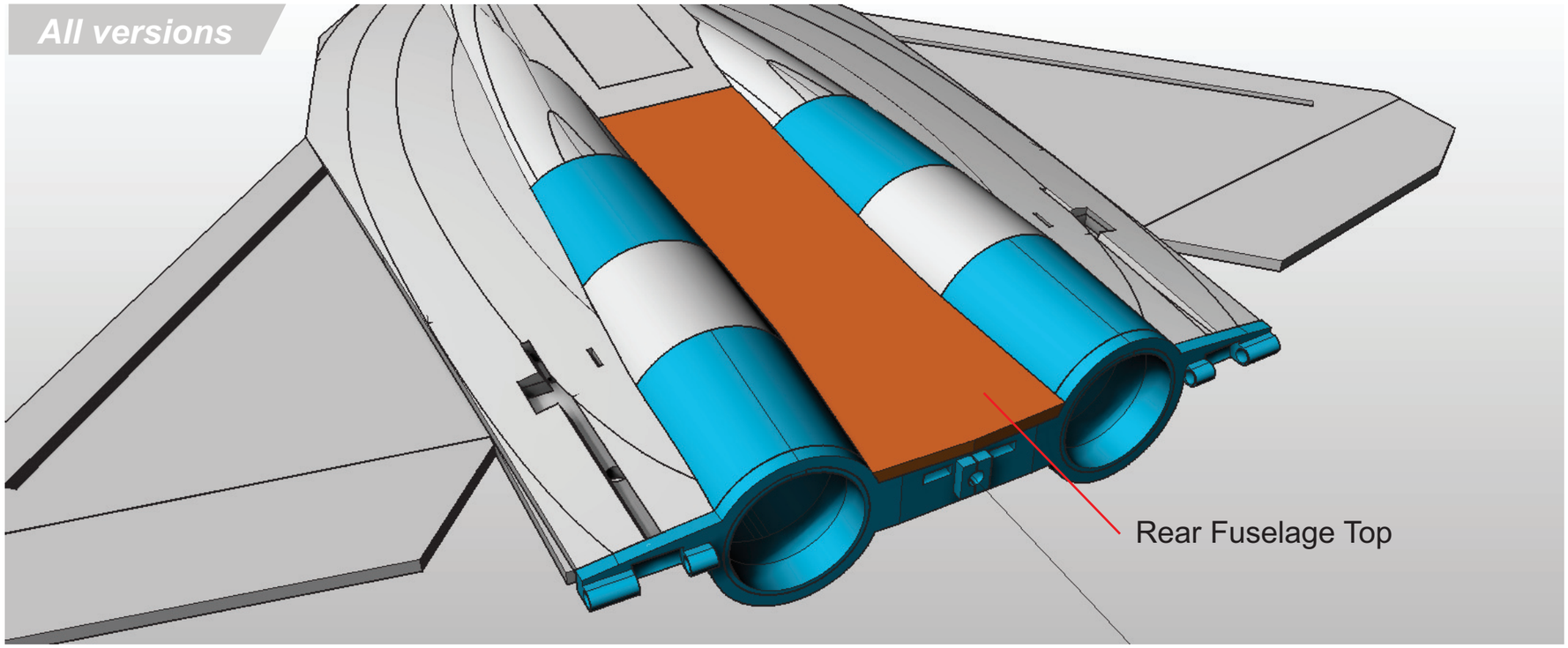
They are positioned parallel to centreline as far outboard as possible.



PUSHER ONLY
Cut and bend some 3mm foam sheet to fit neatly on the flanges of the nacelle tubes and glue in place.

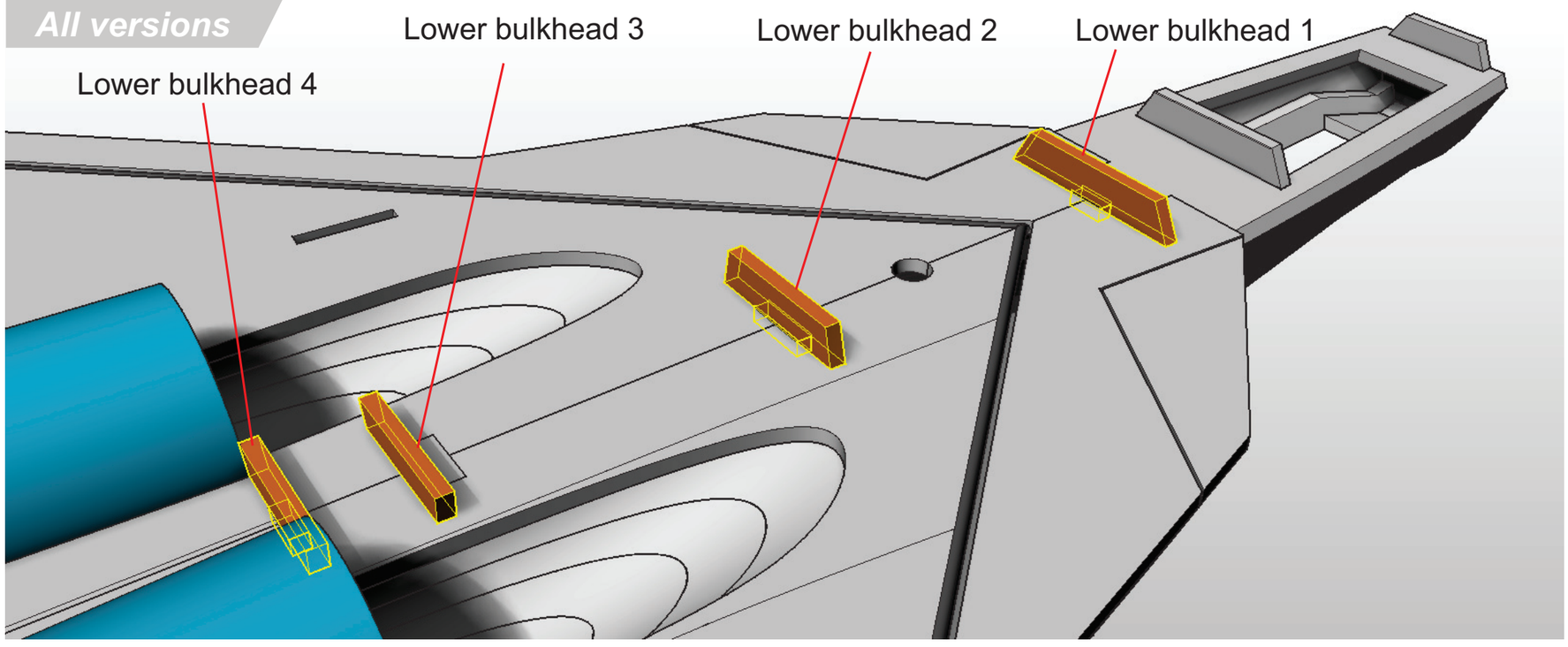
For the EDF versions, this needs to be left off for access to fit the EDF units.

All versions

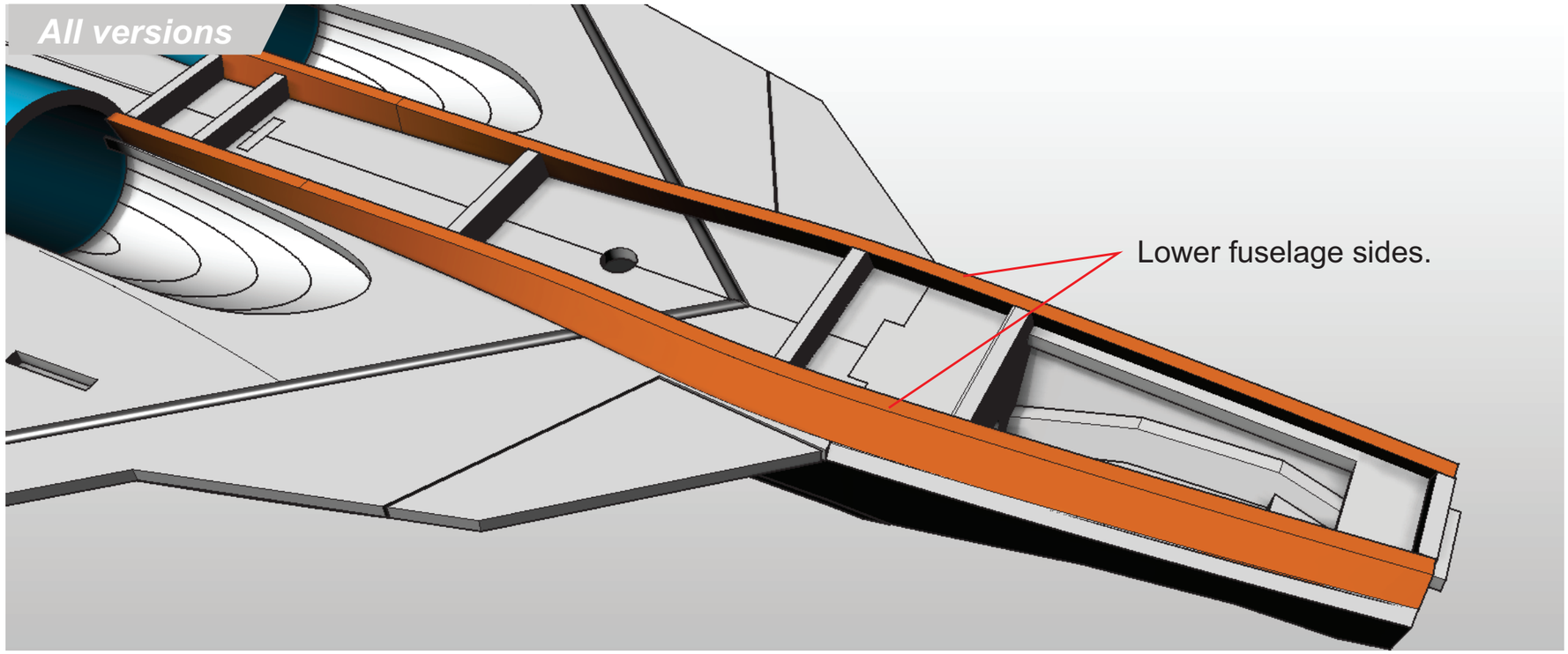


Glue the **Rear Fuselage Top** to the fuselage.

All versions



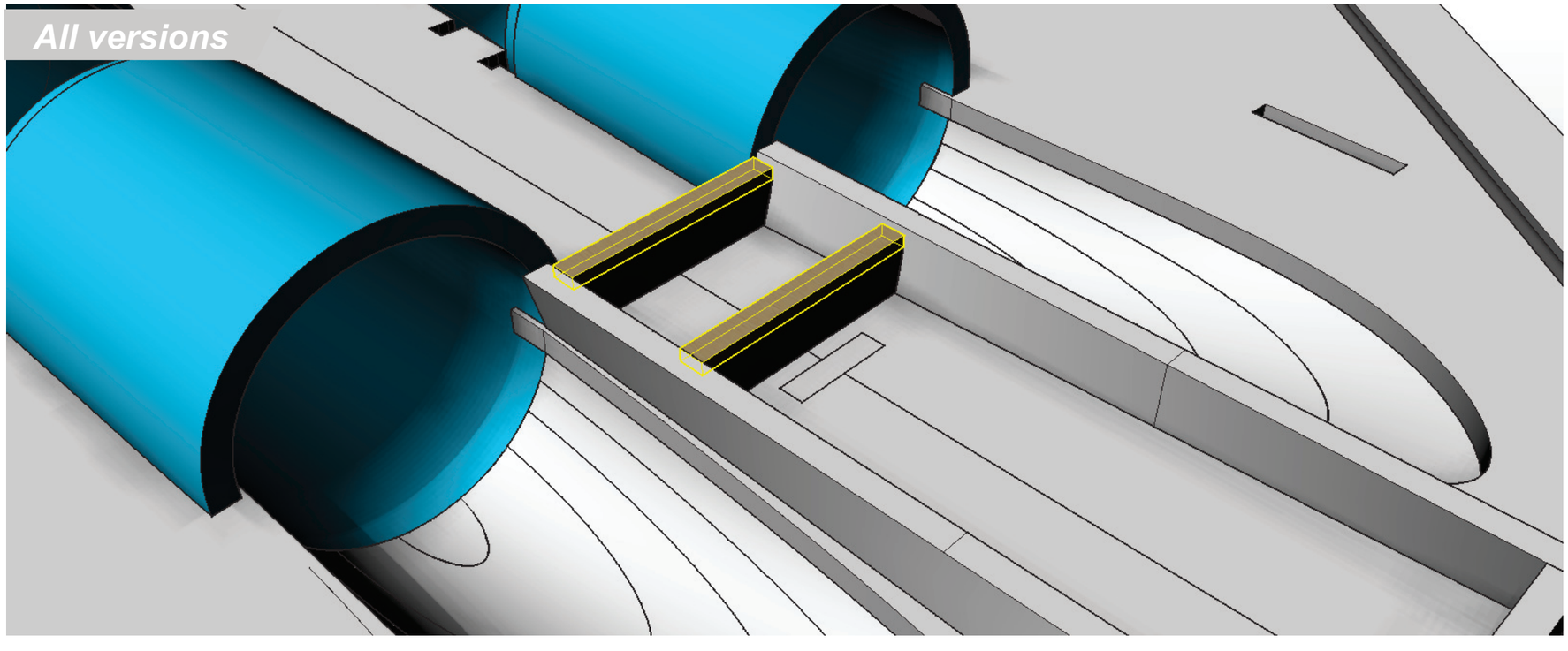
Glue the lower bulkheads in place.



Glue the **Lower Fuselage sides** to the fuselage.

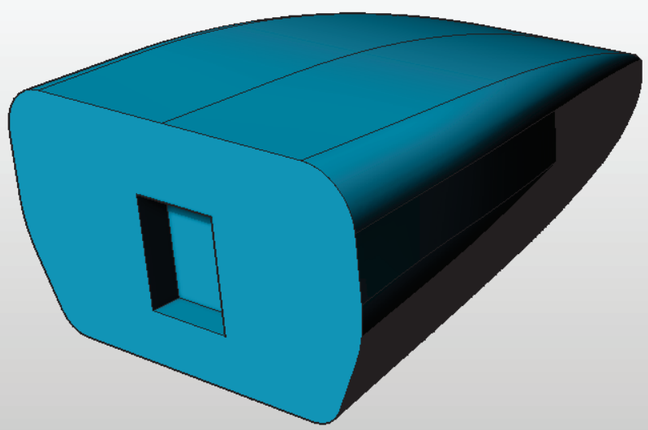
Please note that the sides twist and may require additional sanding to shape.

also note : The rear two lower bulkheads are deliberatly lower.

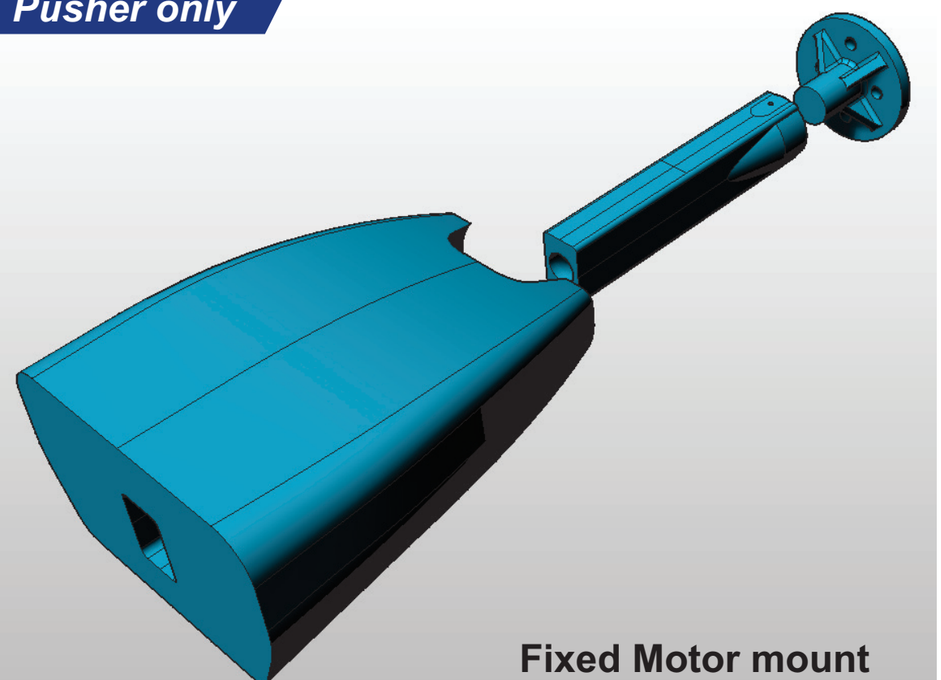


Glue two coffee stirrers to the rear two bulkheads - this is to insulate the foam from a hot speed controller.

EDF



Pusher only



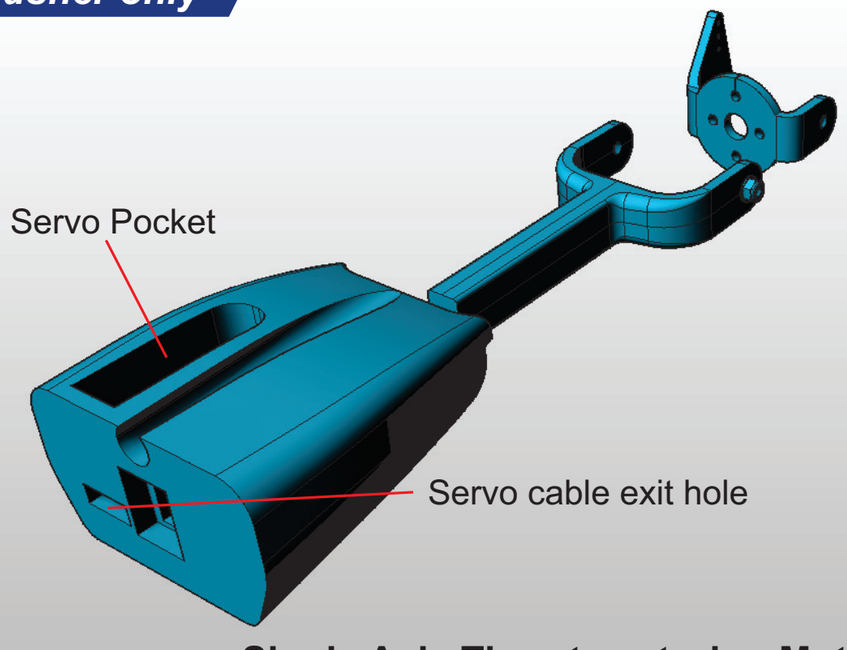
Fixed Motor mount

Choose which 'avionics' pod you wish to use according to your preferred power system.

For thrust vectoring options, use Ball joints to connect the servos to.

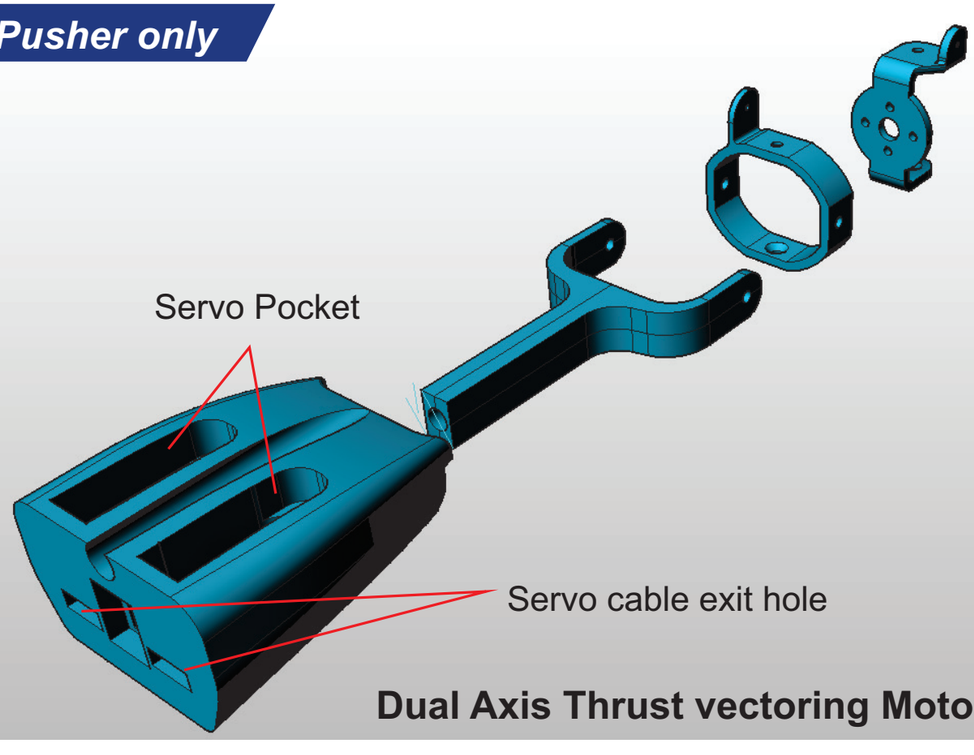
Use 6mm carbon spar through the hole in the centre of the motor mounts and into the fuselage of the plane - fixed with hot melt glue - to reinforce the pod/motor mount.

Pusher only



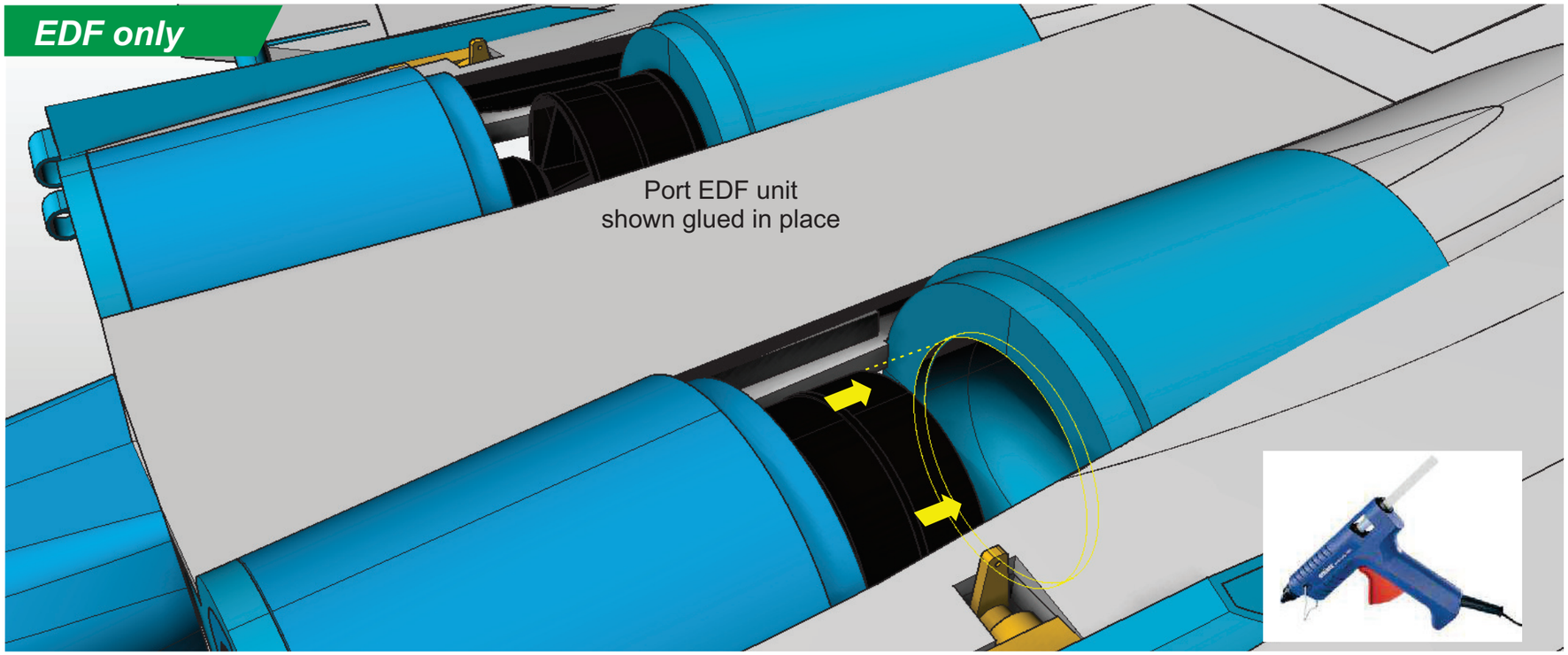
Single Axis Thrust vectoring Motor mount

Pusher only



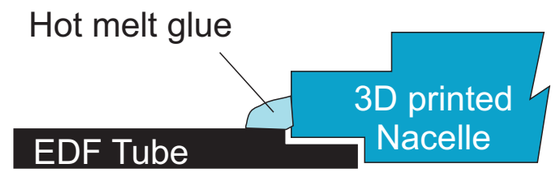
Dual Axis Thrust vectoring Motor mount

EDF only

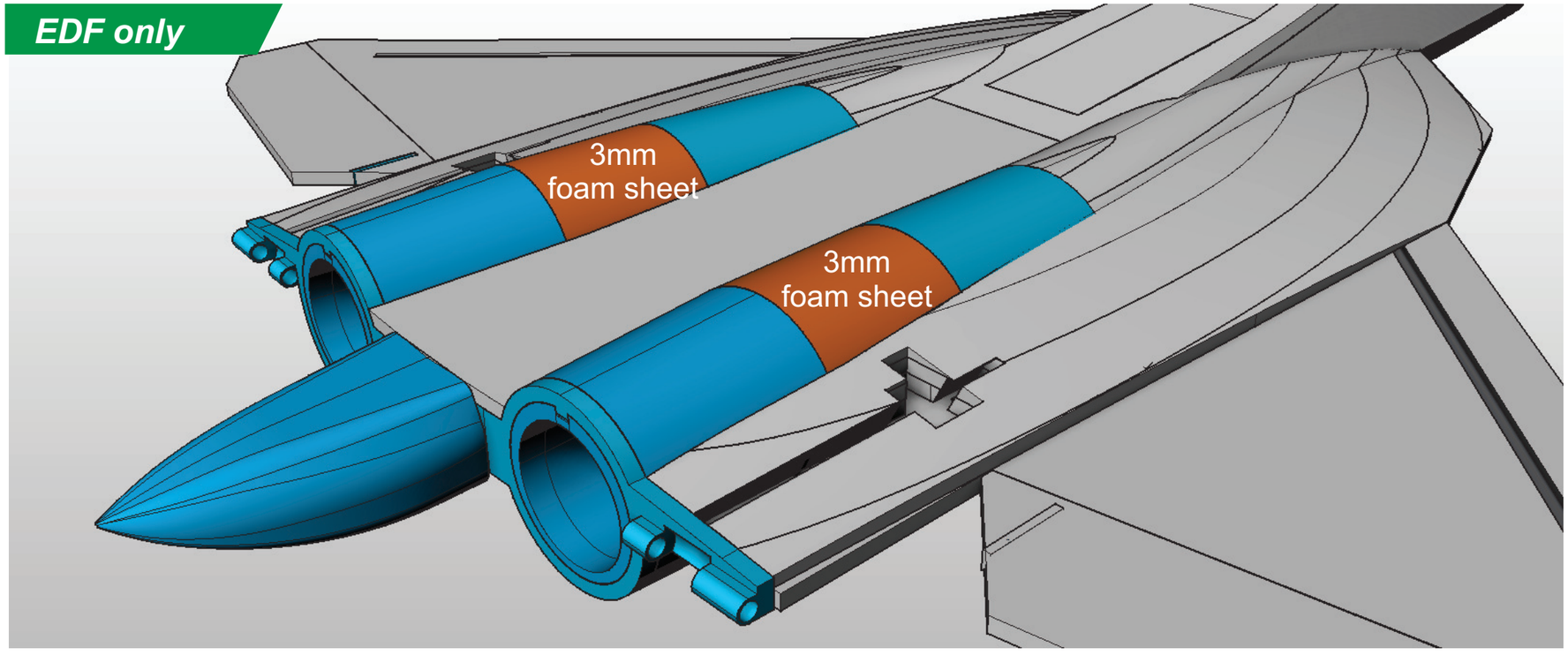


Remove the bell-mouth from the EDF unit, and locate the EDF unit into the 3d printed 50mm / 64mm EDF forward Nacelle flange.

Ensure a good fit, then glue around the perimeter to hold in place using hot melt glue.

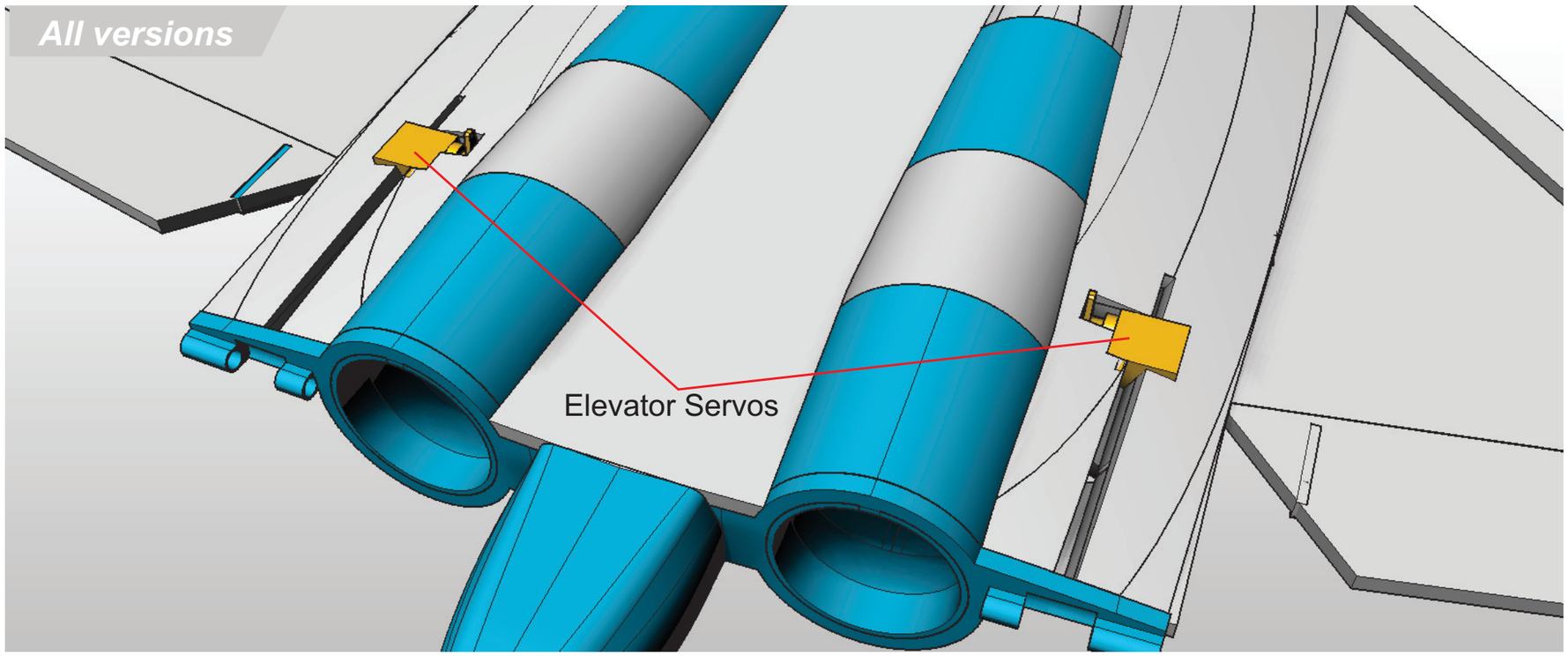


EDF only



Glue the two 3mm upper nacelle pieces in place.

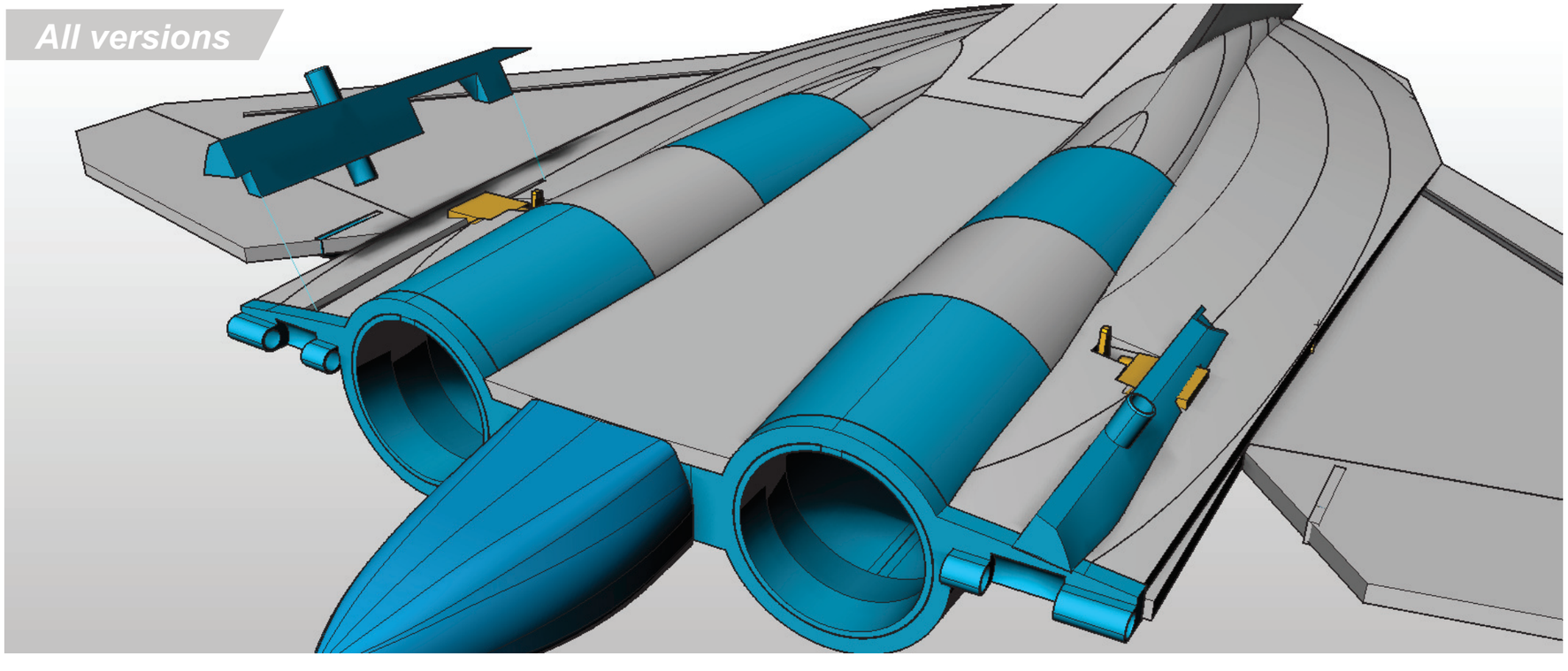
All versions



Dry fit the two elevator servos in place, trimming away the depron to ensure a neat snug fit.

These will need to be adjusted when the electronics are setup, so don't glue yet.

All versions



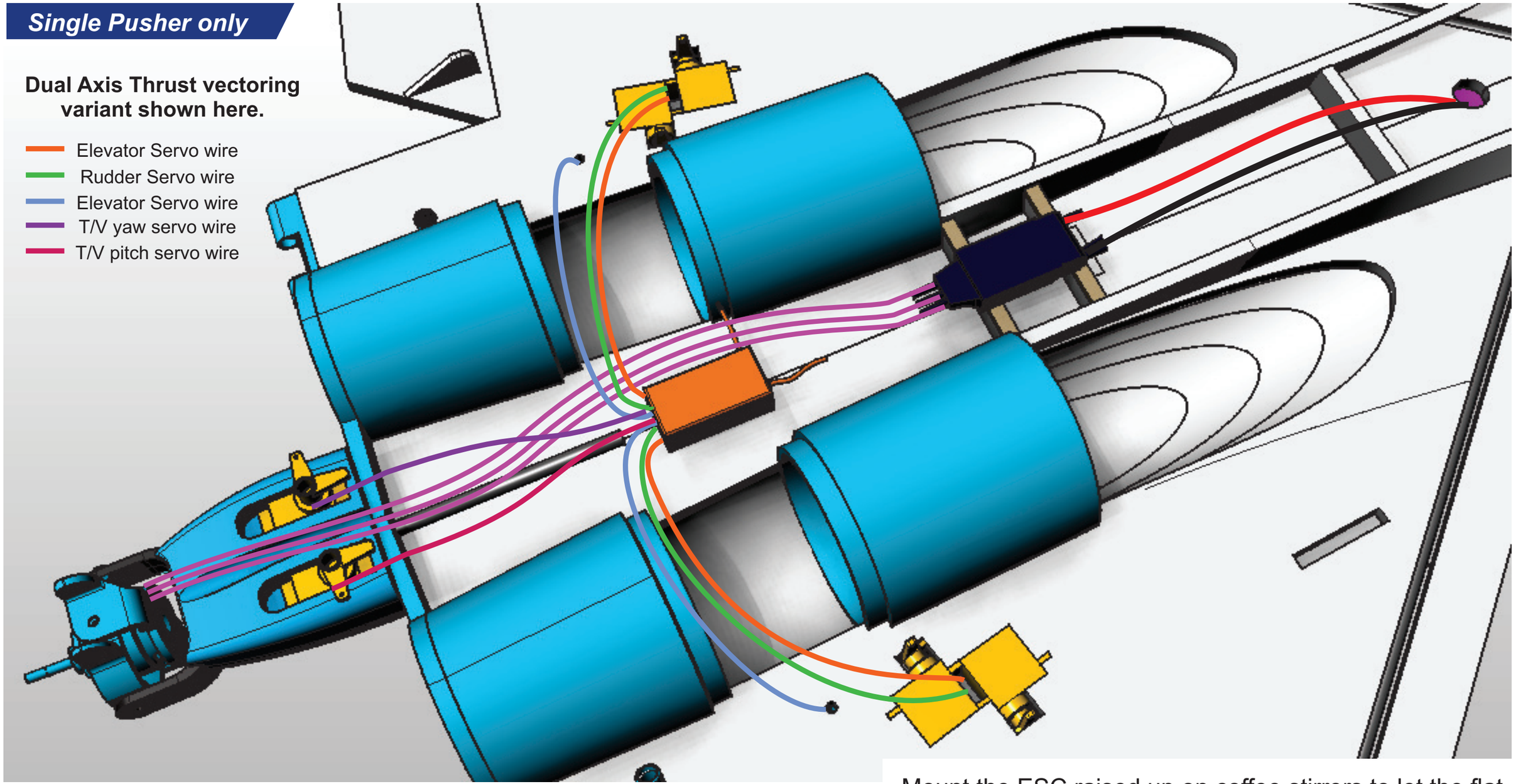
Dry fit the **Vertical Stabiliser bases**, ensure a snug fit, and the rudder shaft tube is protruding out of the underside of the fuselage.

As the servos will need adjustment upon setup, dry fit for now.

Single Pusher only

Dual Axis Thrust vectoring variant shown here.

- Elevator Servo wire
- Rudder Servo wire
- Elevator Servo wire
- T/V yaw servo wire
- T/V pitch servo wire



Run the Elevator servo cable through the wing to protrude as indicated.

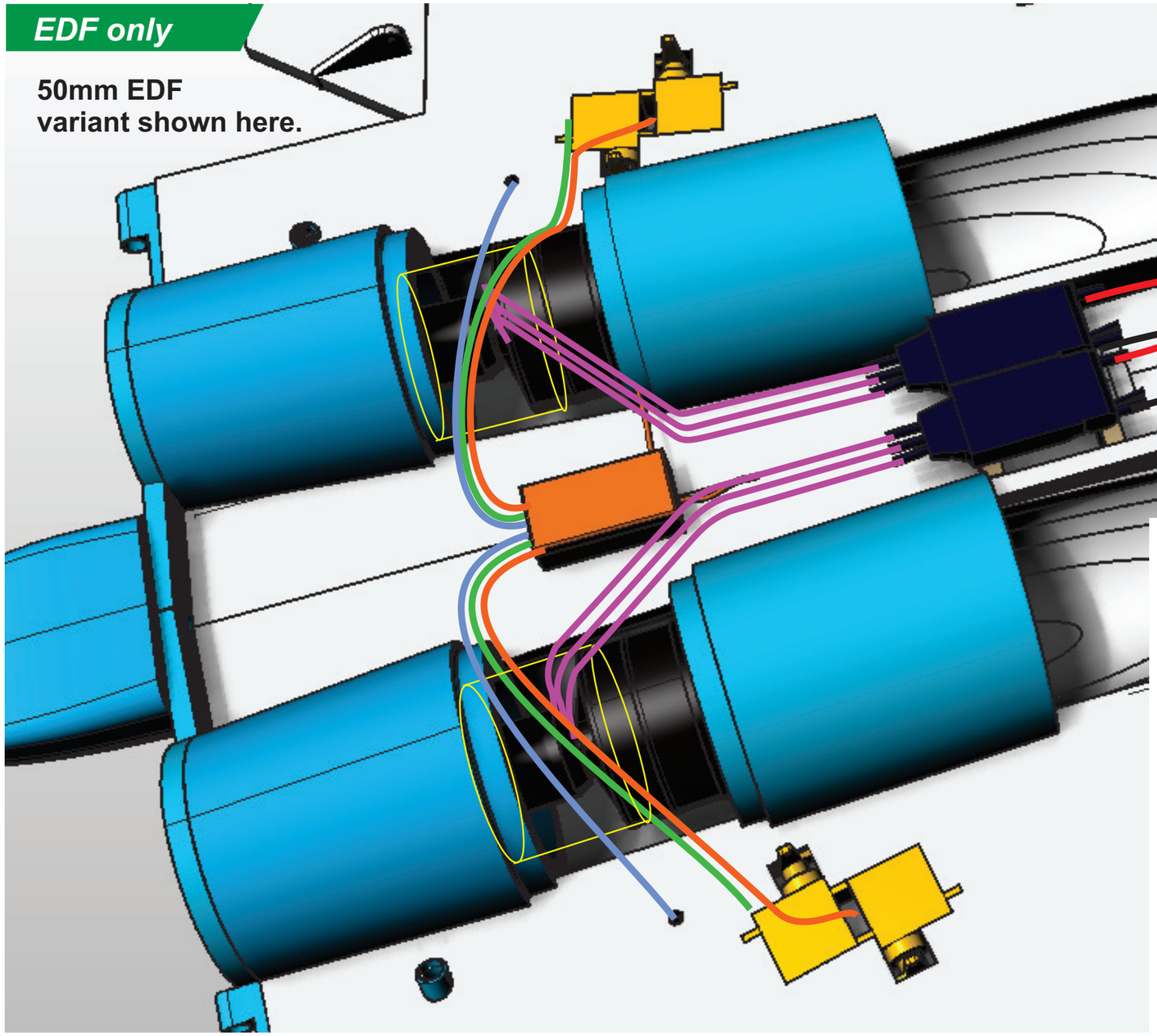
Dry fit the Rudder and Aileron servos. Carve a shallow channel in the wing to run all the servo cables through the wing, around the inside of the 'engine nacelle' then into the RX as shown. Connect to the RX. Test the system.

Mount the ESC raised up on coffee stirrers to let the flat face of the ESC lie flush with the belly of the fuselage. Connect to the motor/battery connector.

Connect the ESC to the Receiver (RX) Test (and adjust) the system to ensure the propellor is spinning the correct way.

EDF only

50mm EDF variant shown here.



Elevator Servo wire
Rudder Servo wire
Elevator Servo wire

Run the Elevator servo cable through the wing to protrude as indicated.

Dry fit the Rudder and Aileron servos. Carve a shallow channel in the wing to run all the servo cables through the wing, around the edf then into the RX cavity as shown. Connect to the RX. Test the system.

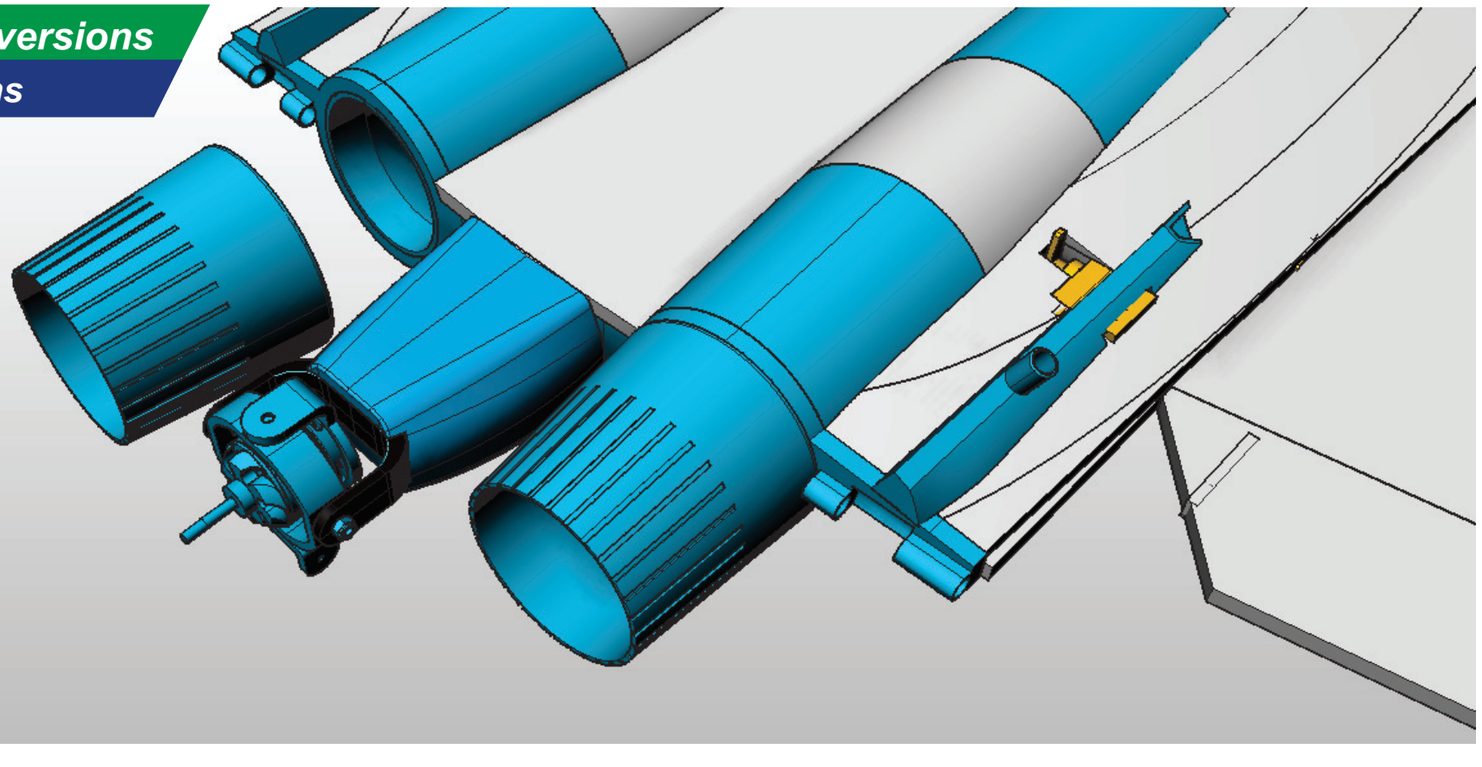
Bridge the gap between the EDF unit and rear Nacelle part using thin plastic sheeting (250-400 microns) (denoted in yellow) - trimming around the EDF power cables.

Mount the two ESC's together, raised up on coffee stirrers to let the flat face of the ESC lie flush with the belly of the fuselage. Connect the EDF's to the ESC's. Join the two ESC's power cables together to form a single pair as shown.

Connect the ESC's to the Receiver (RX) - if you are using the onboard BEC, then snip one of the red servo wires from the ESC to the RX - alternatively snip both and use a dedicated BEC. Test (and adjust) the system to ensure the EDF's are spinning the correct way.

Non T/V EDF versions

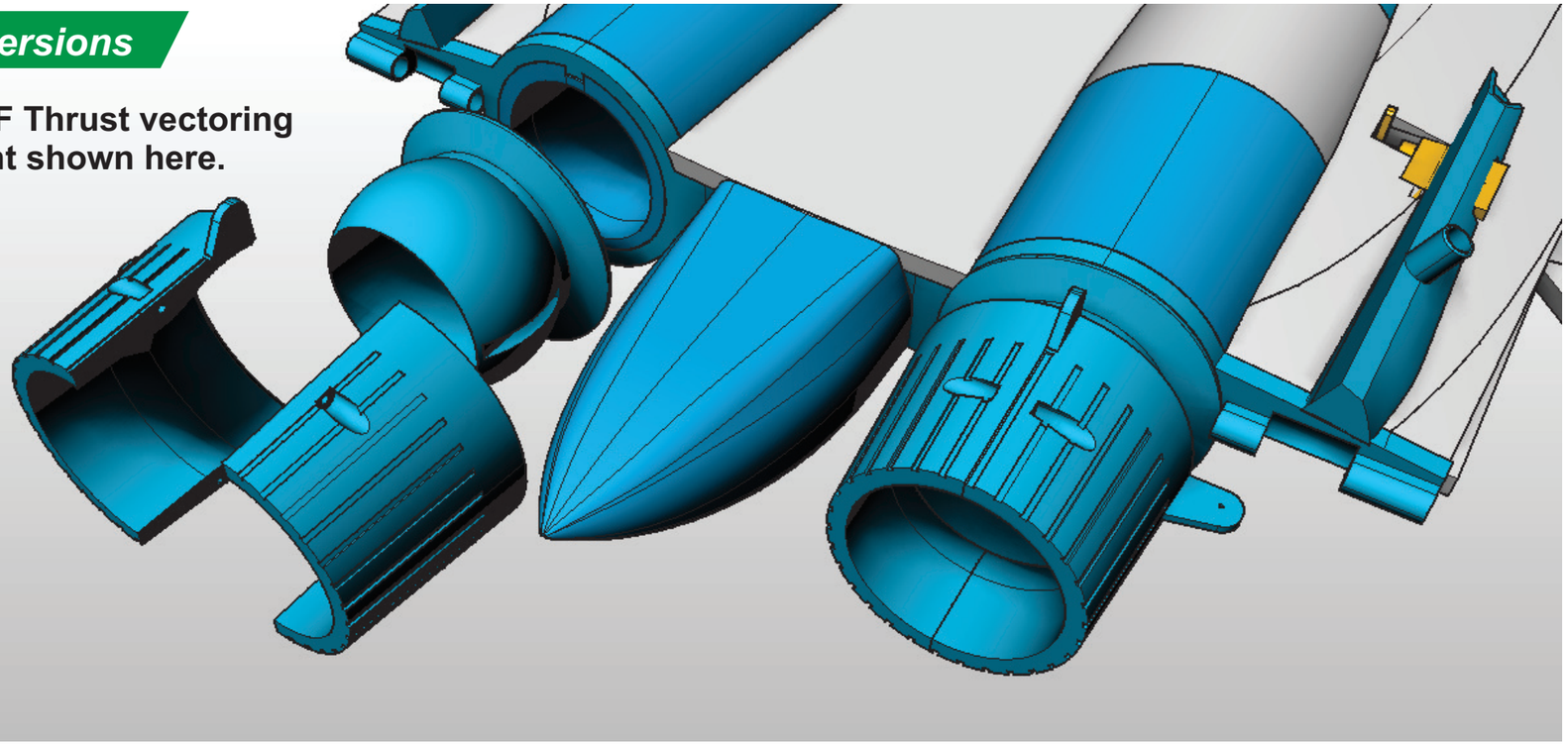
Pusher versions



Glue the Exhaust cones to the assembly according to your chosen variant.

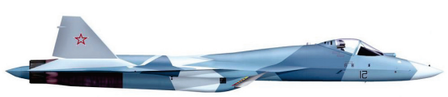
T/V EDF versions

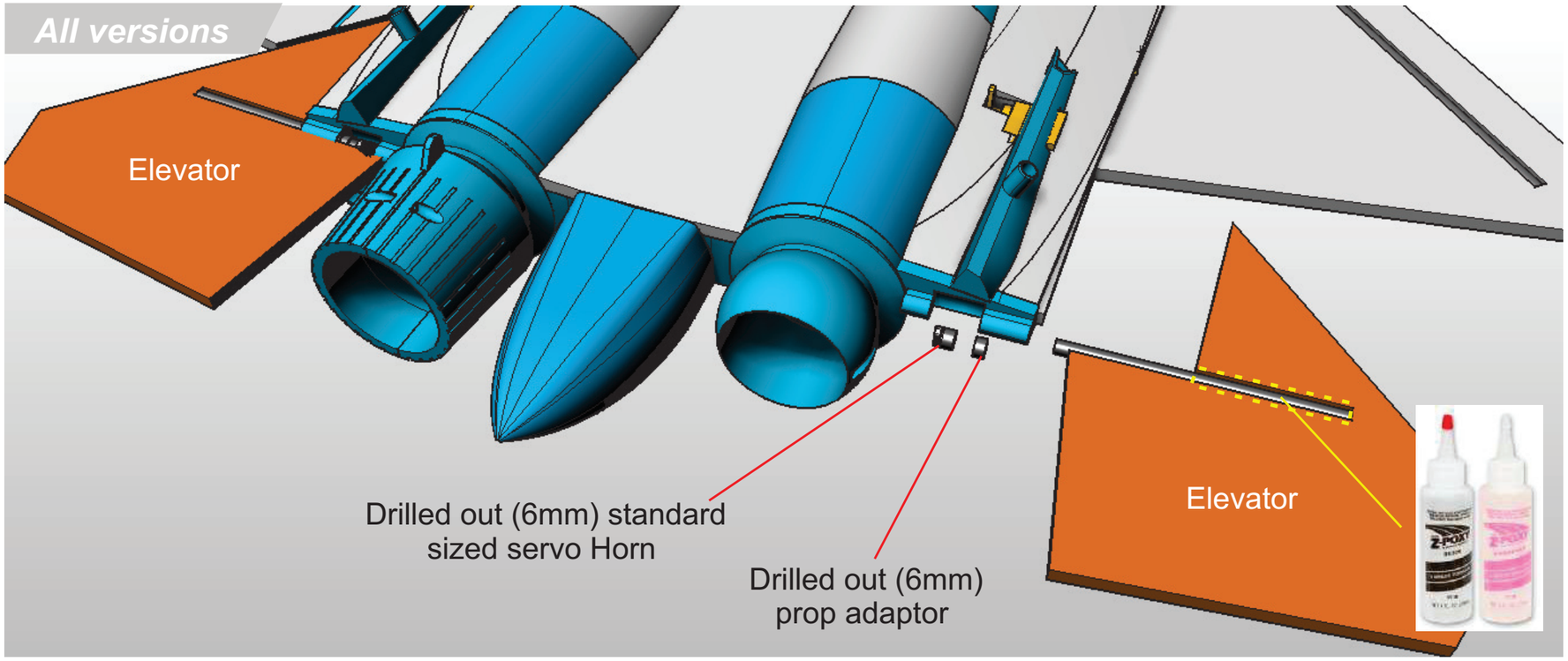
50mm EDF Thrust vectoring variant shown here.



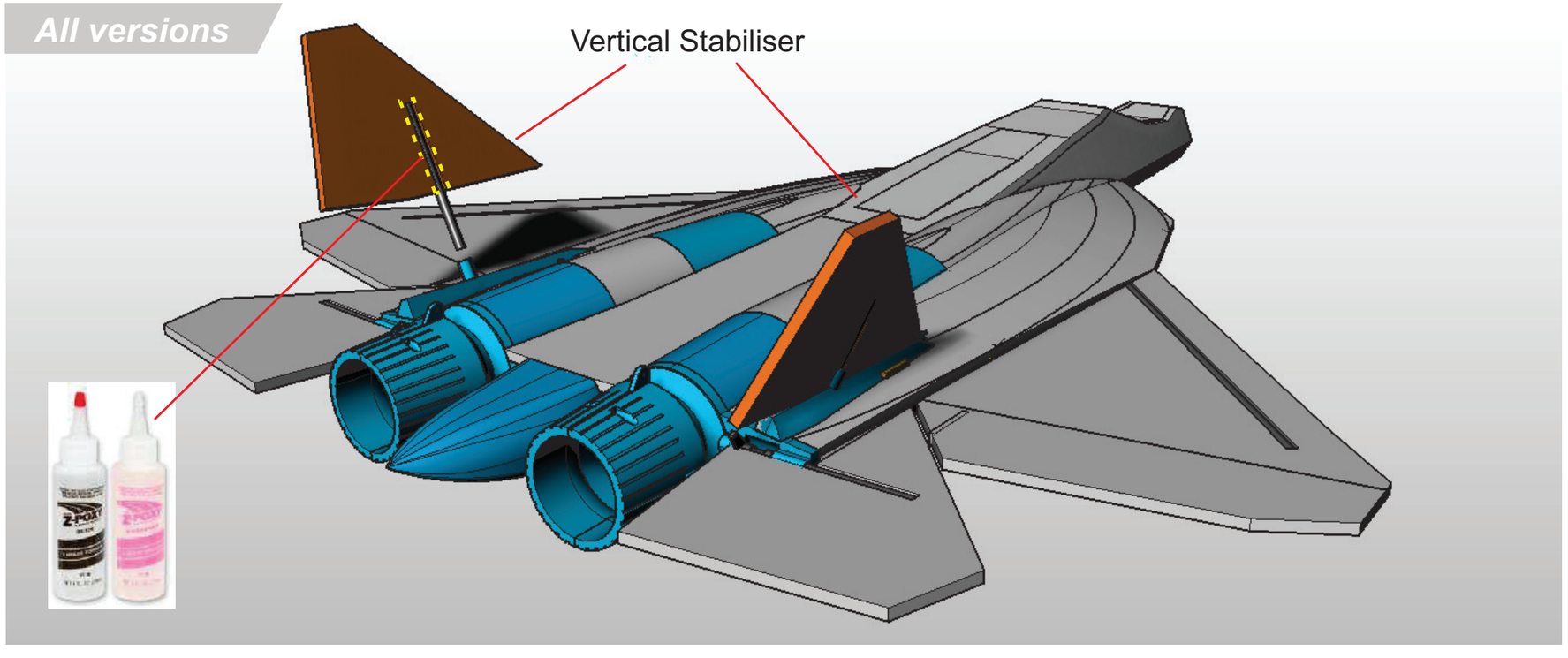
Glue the EDF thrust vectoring exhausts to the assembly. Sand the ball-and-socket mating faces smooth and apply silicone grease (after you paint the plane as it easily contaminates the paint application)

Fix ithe cone in place using 2mm machine screws.





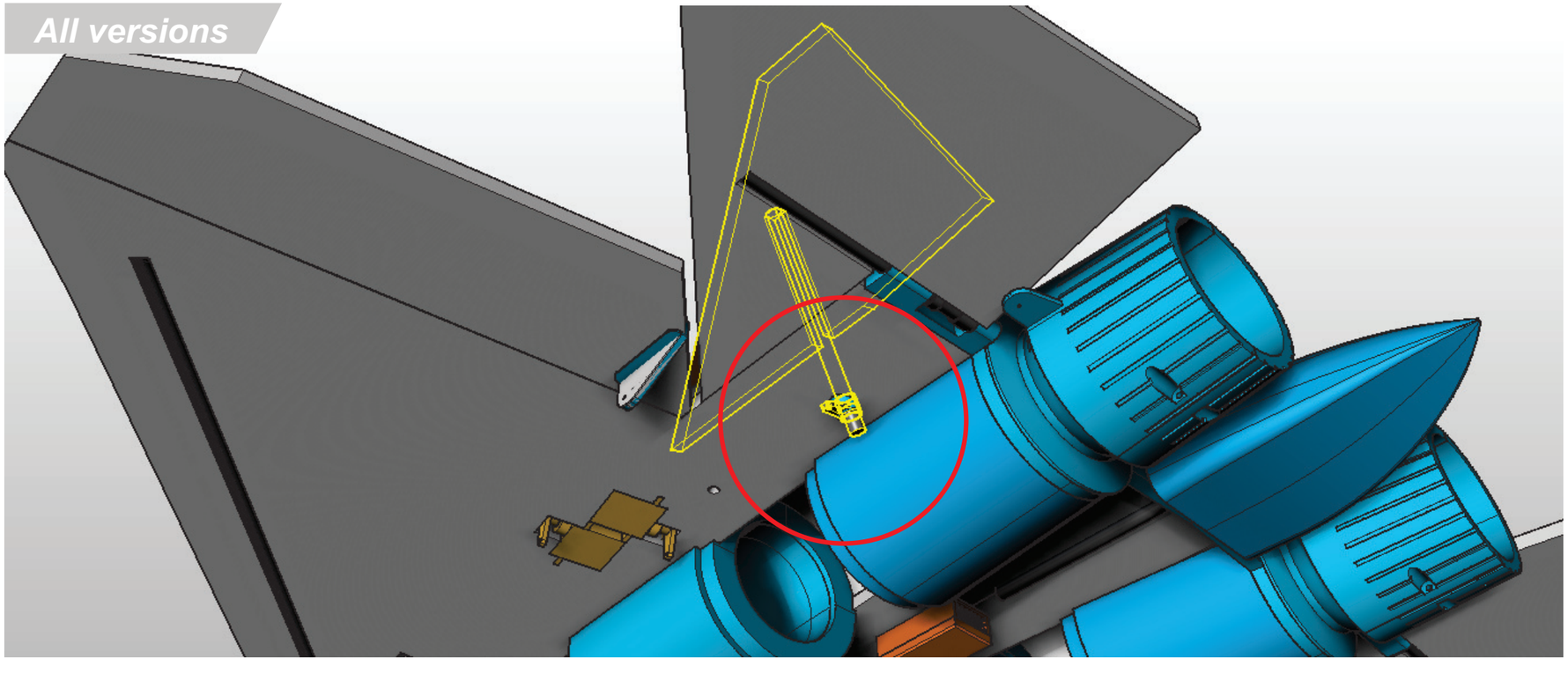
Glue the 6mm Carbon spar into the **Elevator** as you did with the wing. Use a drilled out standard sized servo horn along with a drilled out prop adaptor ring to hold the elevator secure.



Exactly as you Epoxied the Elevators and 6mm carbon spar together, do the same for the **Vertical Stabilisers.**

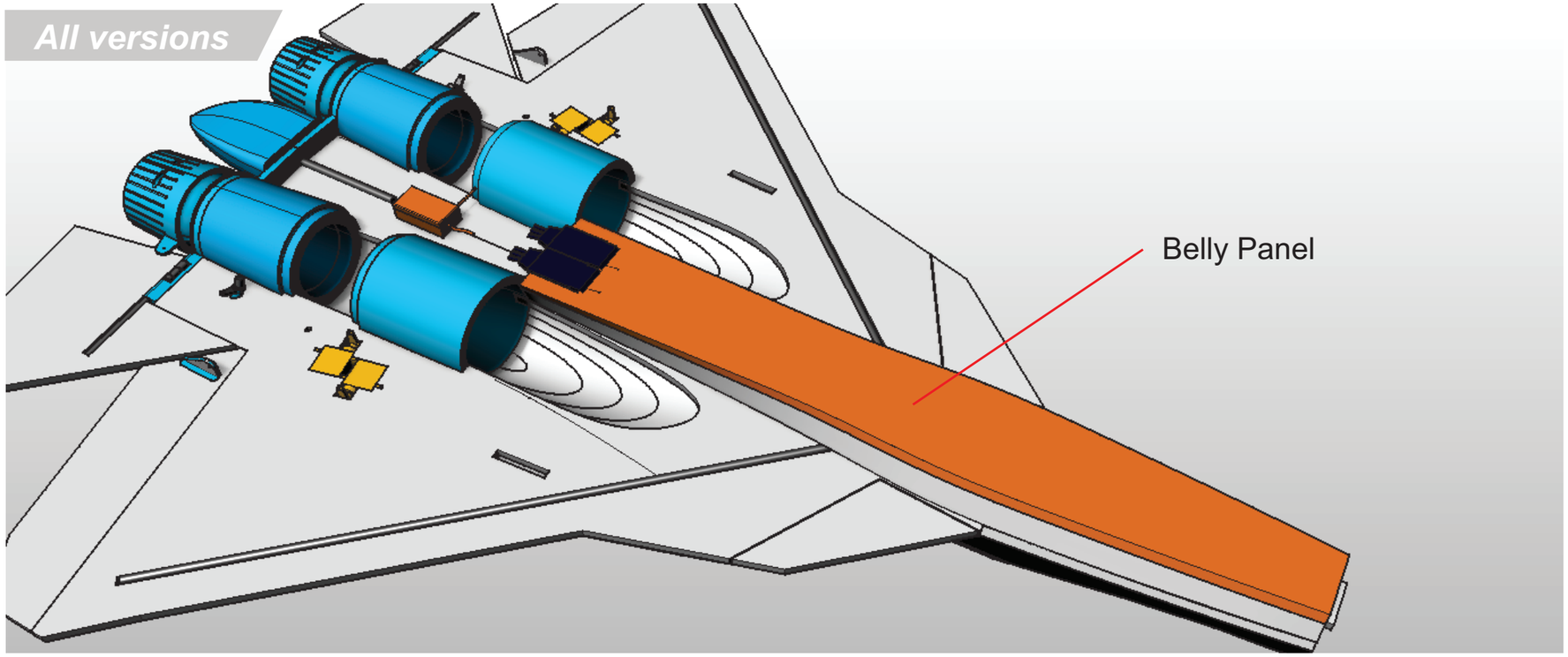
If you are planning to have fixed rudders, you can cut the spar shorter to prevent it prodruding under the plane, and glue the rudder to the plane at this stage.

All versions

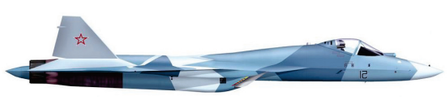


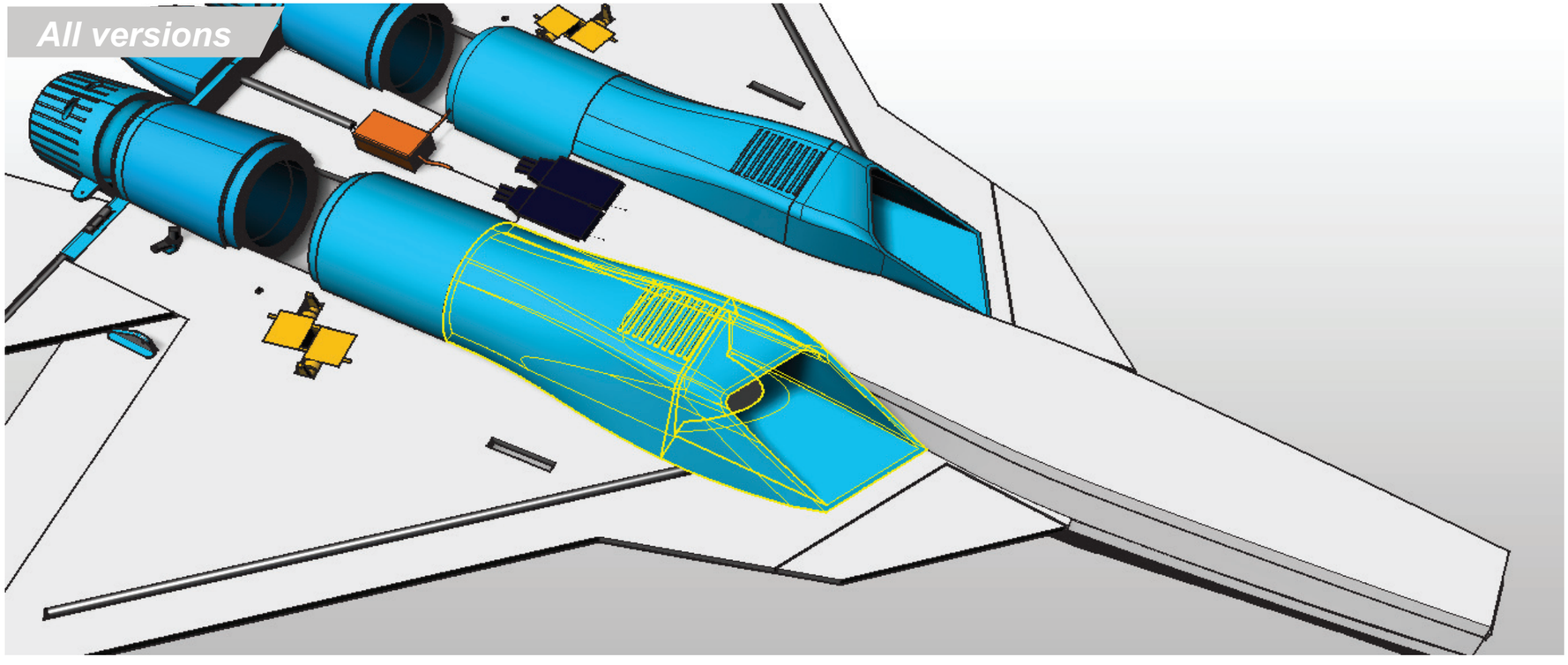
Fit 6mm drilled out standard sized servo horn to the ends of the rudder shafts.

All versions

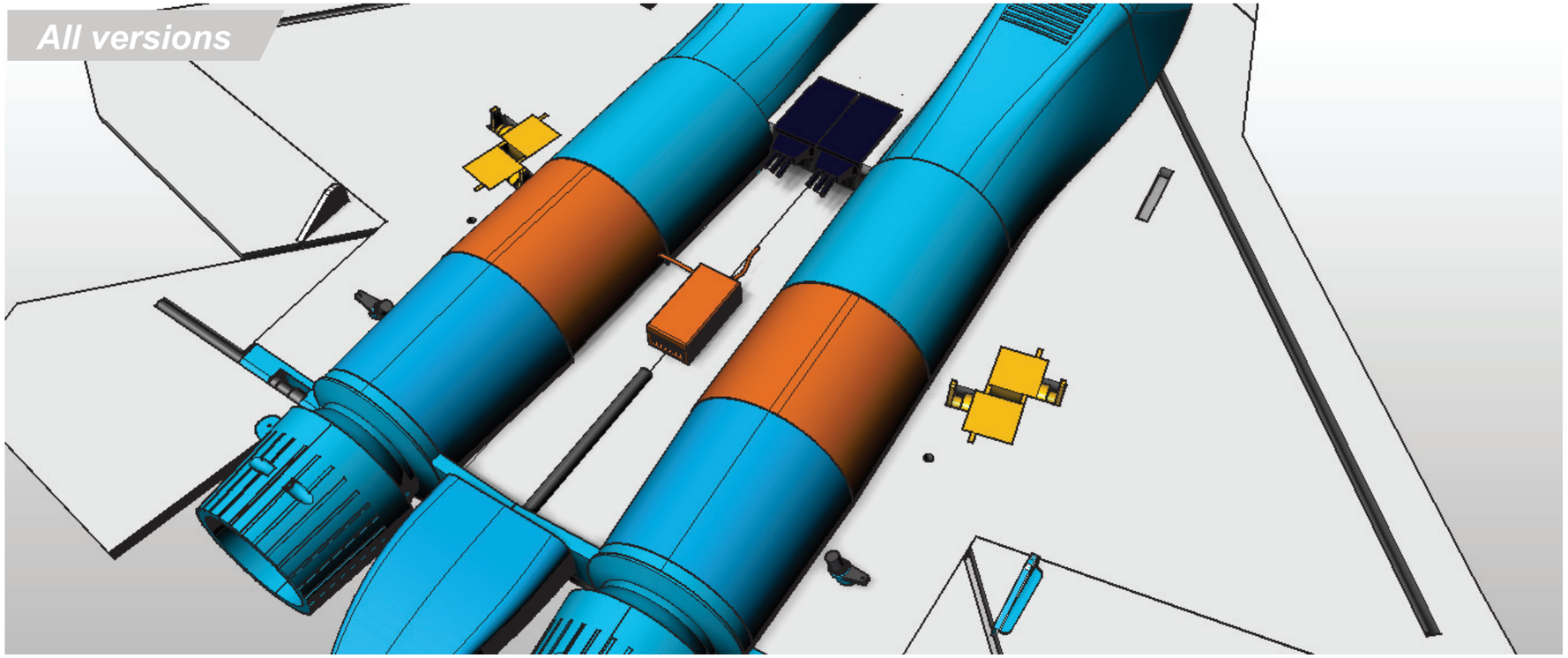


Glue the **Belly panel** in place.



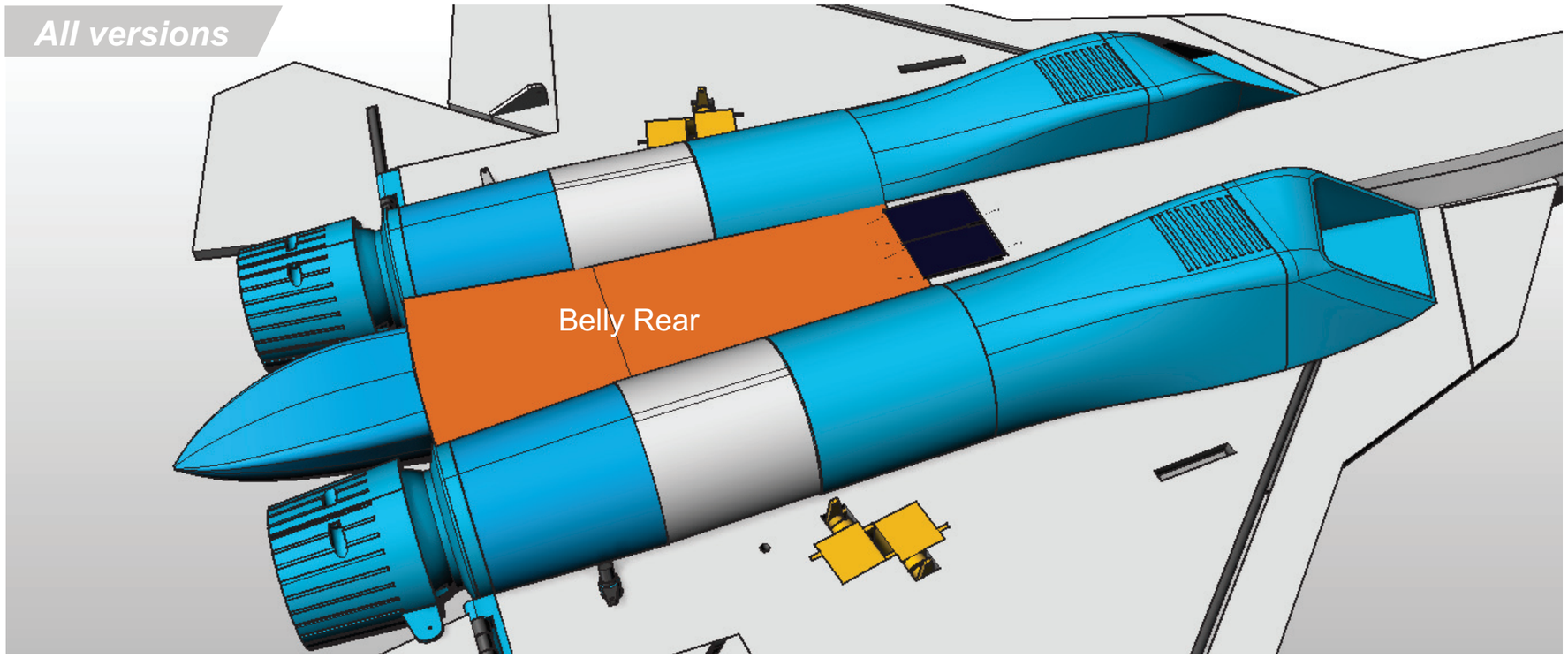


Glue the air intakes to the fuselage.

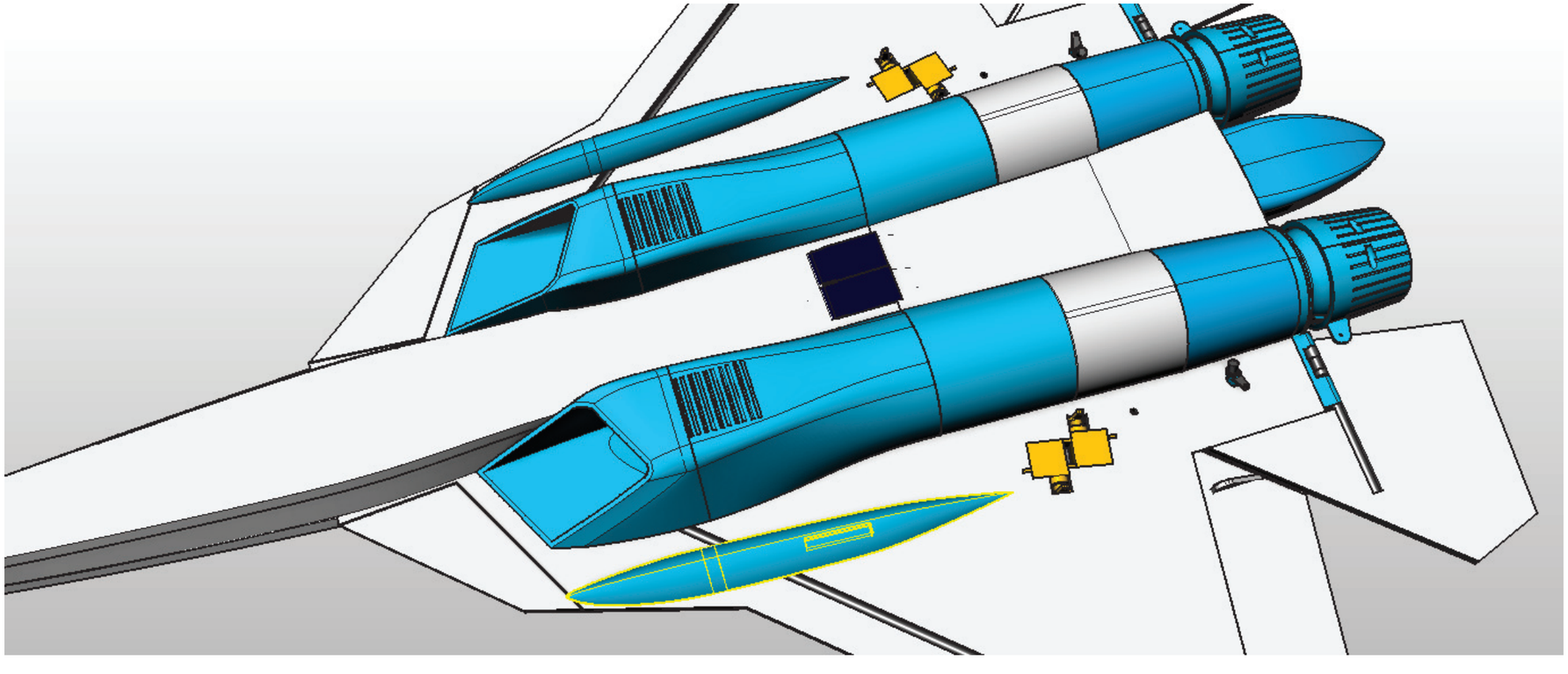


Using 3mm foam, bridge the gap in the Nacelle 3d printed parts.

All versions

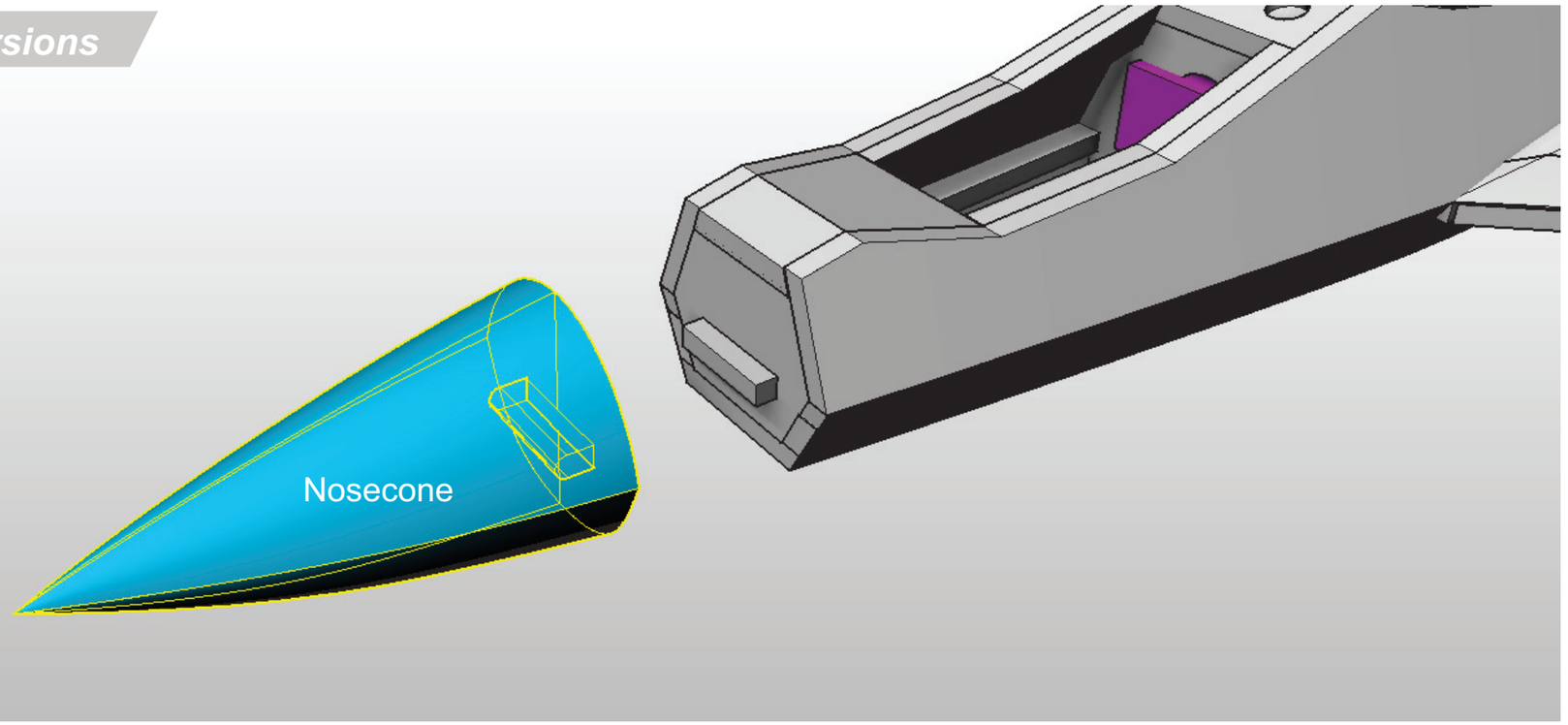


Glue the **Belly Rear** panel to the fuselage, sanding to shape where necessary.



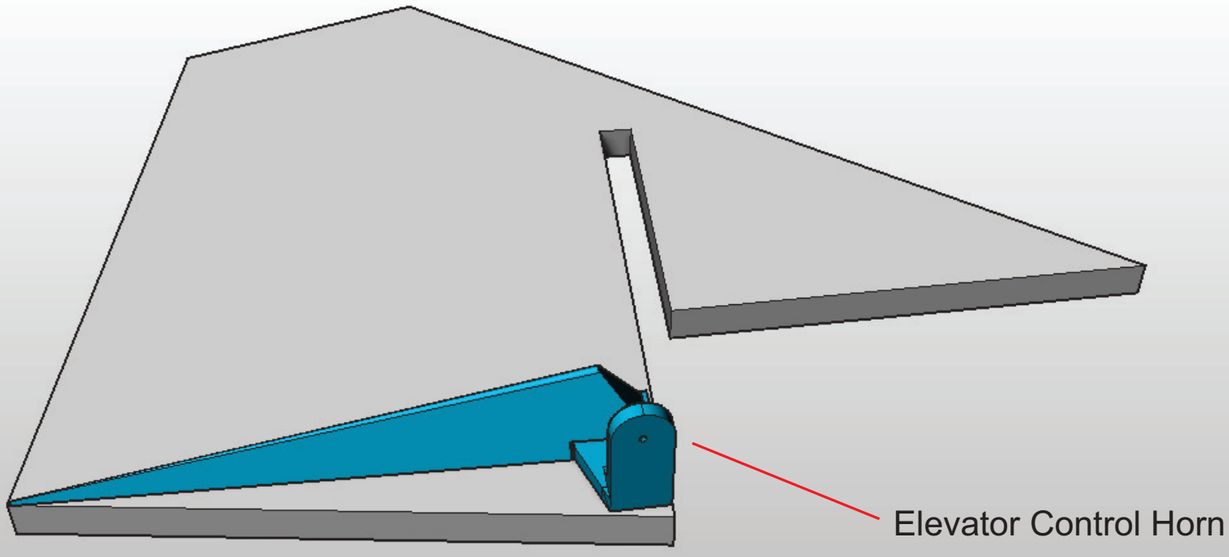
Glue the weapon pods in place. if desired, cut a piece of foam to act as a key to location.

All versions

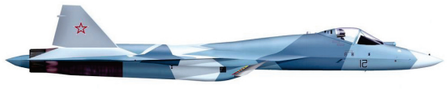


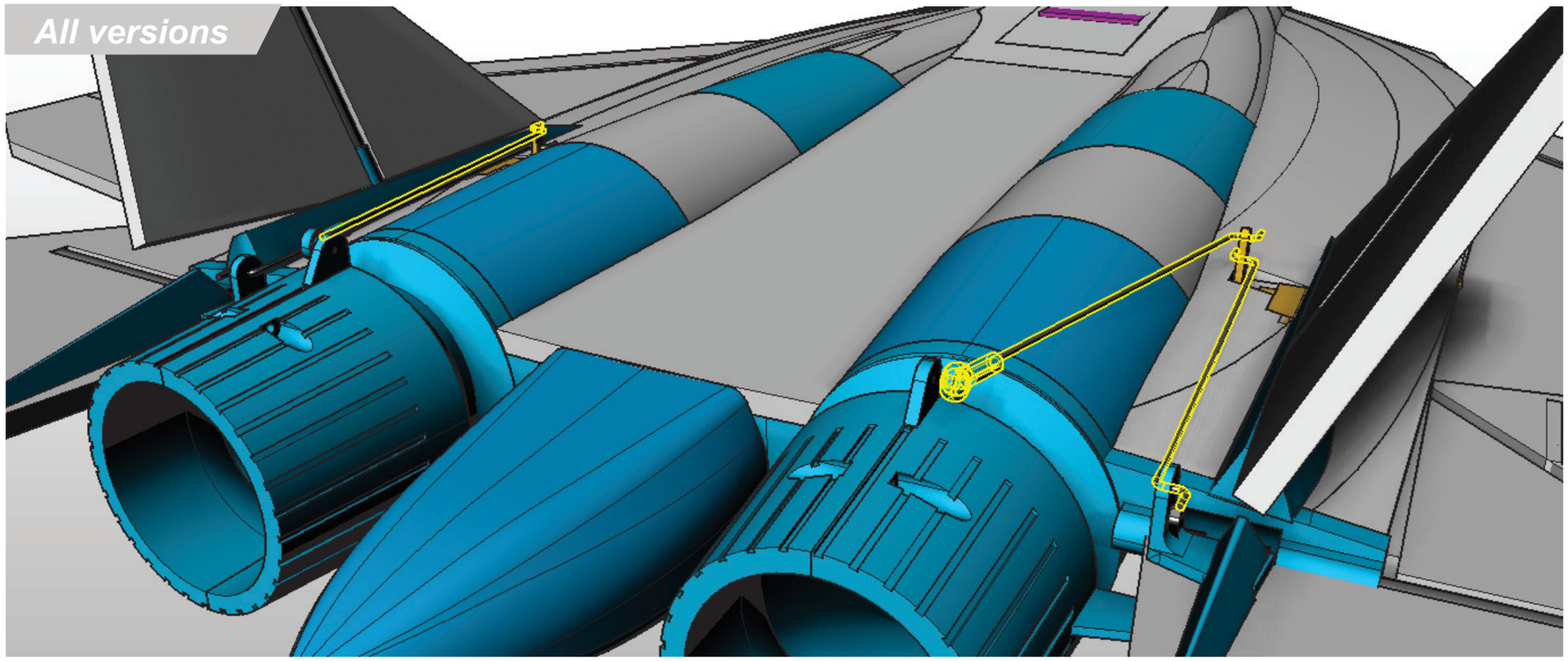
Glue the nosecone in place.

All versions



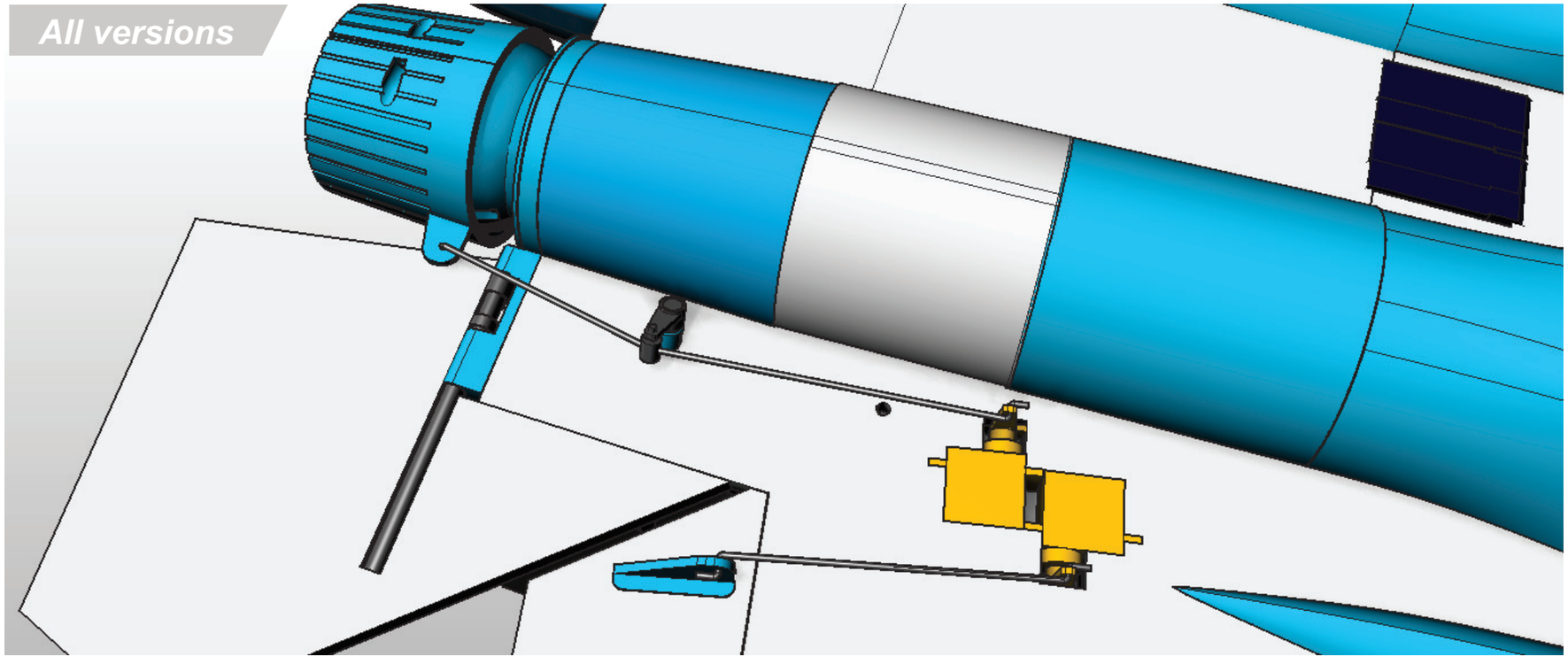
Glue the **Elevator control horn** parts together using CA glue. Glue to the elevators using UHU Por.





Connect the elevator servo to the elevator control horn.

If you are using EDF thrust vectoring. use a longer servo horn, and connect the thrust vectoring exhaust as shown using a ball joint.

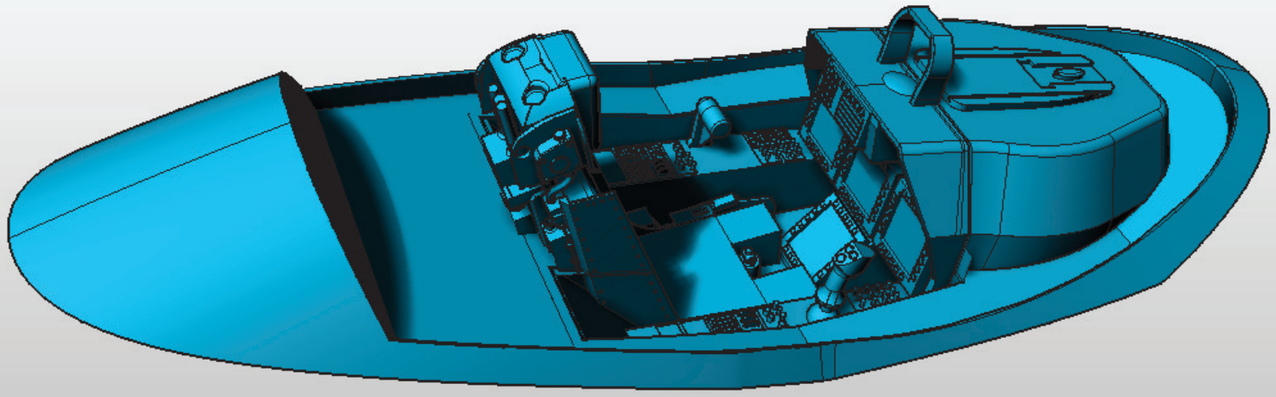


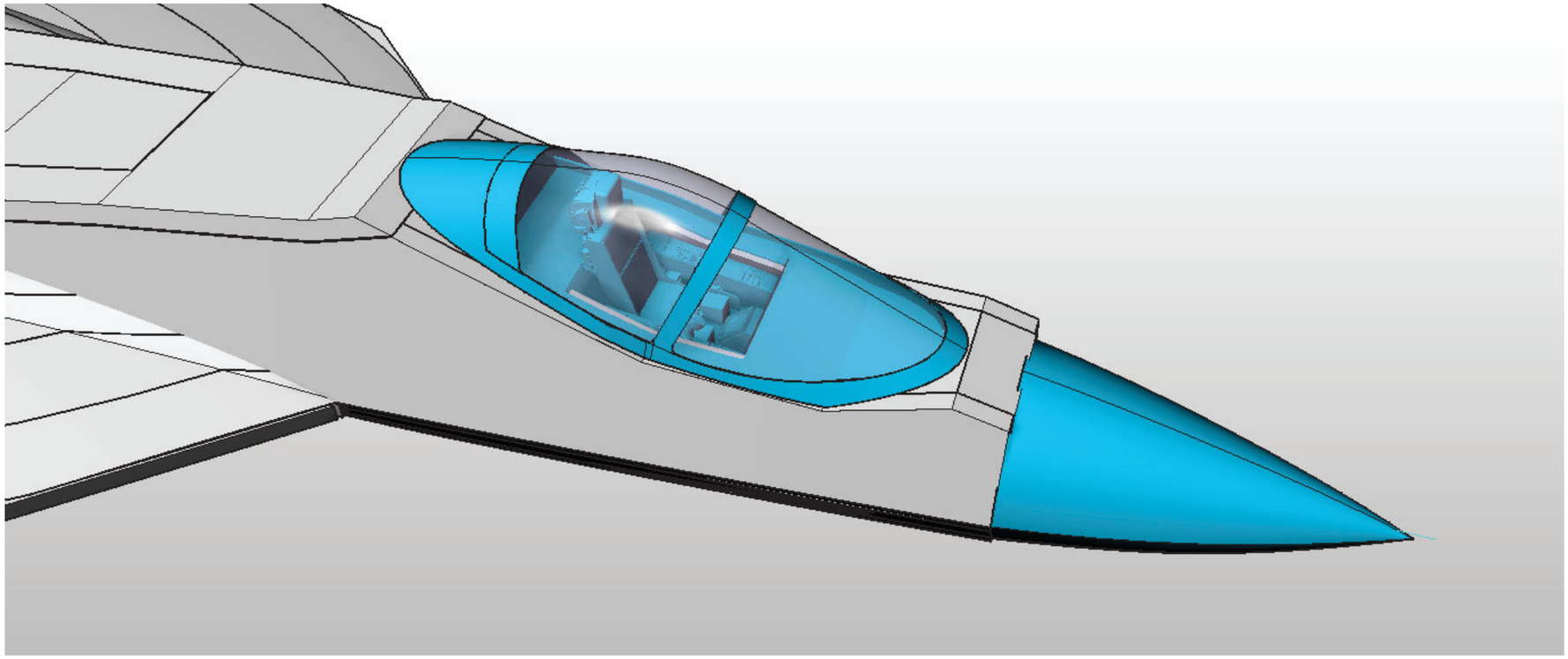
Connect the Ailerons as shown.

Connect the Rudder servos to the rudder control horn.

If you are using EDF thrust vectoring, then use a pushrod keeper attached to the rudder control horn, bend the pushrod after the keeper and connect the Thrust vectoring exhaust as shown.

All versions



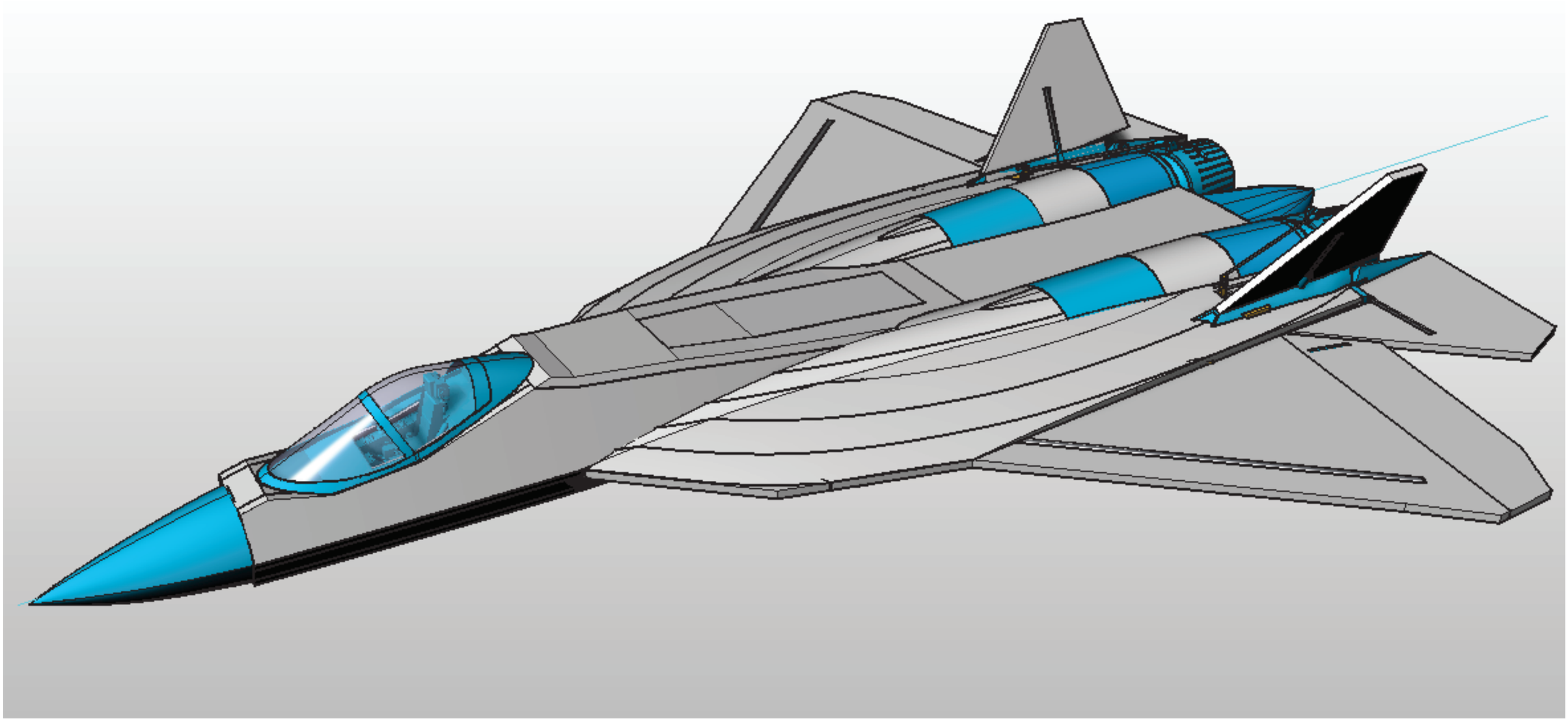


OPTIONAL : Glue together the parts of the cockpit using Superglue Gel (CA)

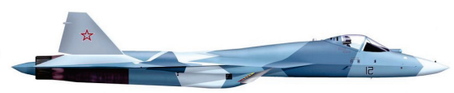
Either use the 3d printed cockpit without the cockpit, or use the cockpit with a vacuum formed canopy (attached using UHU por)

To fit the cockpit, cut away the pieces of the foam to allow the cockpit to neatly slot into the fuselage.

Both cockpit options - use magnets to hold in place.



Congratulations, your SU-57 is complete. Either fly it as it is, or finish it further.



Use images of the real plane to help you sand it to shape and paint.