

JETWORKS



McDonnell Douglas
Phantom
Parkjet

Photograph shown is the real aircraft.



3rd Generation Fighter / Bomber

Construction Guide
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Phantom History

The McDonnell Douglas F-4 Phantom II is a tandem two-seat, twin-engine, all-weather, long-range supersonic jet interceptor and fighter-bomber originally developed for the United States Navy by McDonnell Aircraft.

It first entered service in 1961 with the Navy. Proving highly adaptable, it was also adopted by the United States Marine Corps and the United States Air Force, and by the mid-1960s had become a major part of their air arms.

The Phantom is a large fighter with a top speed of over Mach 2.2. It can carry more than 18,000 pounds (8,400 kg) of weapons on nine external hardpoints, including air-to-air missiles, air-to-ground missiles, and various bombs. The F-4, like other interceptors of its time, was initially designed without an internal cannon. Later models incorporated an M61 Vulcan rotary cannon. Beginning in 1959, it set 15 world records for in-flight performance including an absolute speed record and an absolute altitude record.

The F-4 was used extensively during the Vietnam War. It served as the principal air superiority fighter for the U.S. Air Force, Navy, and Marine Corps and became important in the ground-attack and aerial reconnaissance roles late in the war. During the Vietnam War, one U.S. Air Force pilot, two weapon systems officers (WSOs), [7] one U.S. Navy pilot and one radar intercept officer (RIO) became aces by achieving five aerial kills against enemy fighter aircraft. The F-4 continued to form a major part of U.S. military air power throughout the 1970s and 1980s, being gradually replaced by more modern aircraft such as the F-15 Eagle and F-16 Fighting Falcon in the U.S. Air Force, the F-14 Tomcat in the U.S. Navy, and the F/A-18 Hornet in the U.S. Navy and U.S. Marine Corps.

The F-4 Phantom II remained in use by the U.S. in the reconnaissance and Wild Weasel (Suppression of Enemy Air Defenses) roles in the 1991 Gulf War, finally leaving service in 1996. It was also the only aircraft used by both U.S. flight demonstration teams: the United States Air Force Thunderbirds (F-4E) and the United States Navy Blue Angels (F-4J). The F-4 was also operated by the armed forces of 11 other nations. Israeli Phantoms saw extensive combat in several Arab–Israeli conflicts, while Iran used its large fleet of Phantoms, acquired before the fall of the Shah, in the Iran–Iraq War. Phantom production ran from 1958 to 1981, with a total of 5,195 built, making it the most produced American supersonic military aircraft. As of 2020, 62 years after its first flight, the F-4 remains in service with Iran, Japan, South Korea, Greece and Turkey. The aircraft has most recently been in service against the Islamic State group in the Middle East

Designers Notes

I have always loved the look of the Phantoms - an impressive high speed jet used in lots of countries around the world. I particularly love the polyhedral wing and the raked vertical stabiliser with the steep elevator anhedral.

This design really lends itself to a 70mm EDF although a 64mm version will create a well mannered park flyer. The single EDF versions need a 3D printed bifurcated thrust tube, whereas a twin 50mm EDF is possible without 3D printed parts. A pusher prop version can also be made with these plans.

On the original plane, the elevator mechanism is an unusual arrangement, with the pivot pin positioned above the elevators. I replicated this as it causes problems with the elevators colliding with the fuselage without it.

UK Variants

The United Kingdom bought versions based on the U.S. Navy's F-4J for use with the Royal Air Force and the Royal Navy's Fleet Air Arm. The UK was the only country outside the United States to operate the Phantom at sea, launching them from HMS Ark Royal. The main differences were the use of the British Rolls-Royce Spey engines and of British-made avionics. The RN and RAF versions were given the designation F-4K and F-4M respectively, and entered service with the British military aircraft designations Phantom FG.1 (fighter/ground attack) and Phantom FGR.2 (fighter/ground attack/reconnaissance).

Initially, the FGR.2 was used in the ground attack and reconnaissance role, primarily with RAF Germany, while 43 Squadron was formed in the air defence role using the FG.1s that had been intended for the Fleet Air Arm for use aboard HMS Eagle. The superiority of the Phantom over the English Electric Lightning in terms of both range and weapon load, combined with the successful introduction of the SEPECAT Jaguar, meant that, during the mid-1970s, most of the ground attack Phantoms in Germany were redeployed to the UK to replace air defence Lightning squadrons

In 1982, during the Falklands War, three Phantom FGR2s of No. 29 Squadron were on active Quick Reaction Alert duty on Ascension Island to protect the base from air attack. After the Falklands War, 15 upgraded ex-USN F-4Js, known as the F-4J(UK) entered RAF service to compensate for one interceptor squadron redeployed to the Falklands.

The interceptor Phantoms were replaced by the Panavia Tornado F3 from the late 1980s onwards, and the last British Phantoms were retired in October 1992.

Phantom



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.

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.

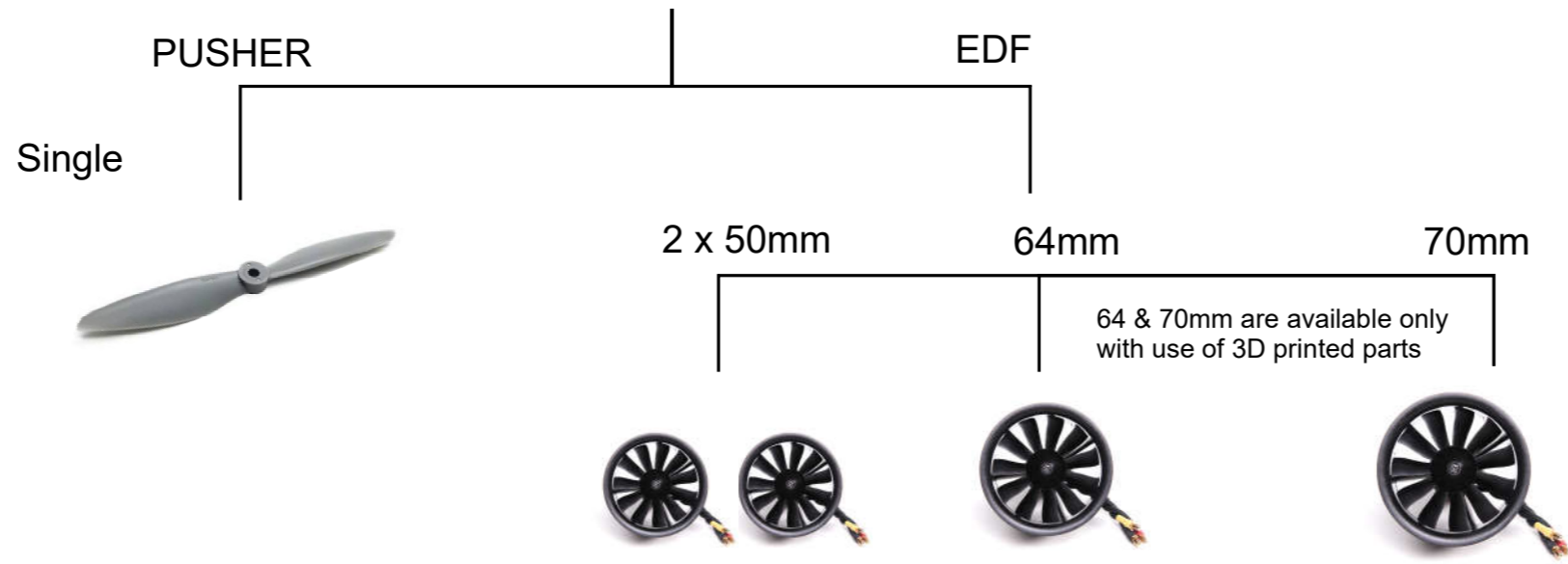
Glueing parts together.

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.

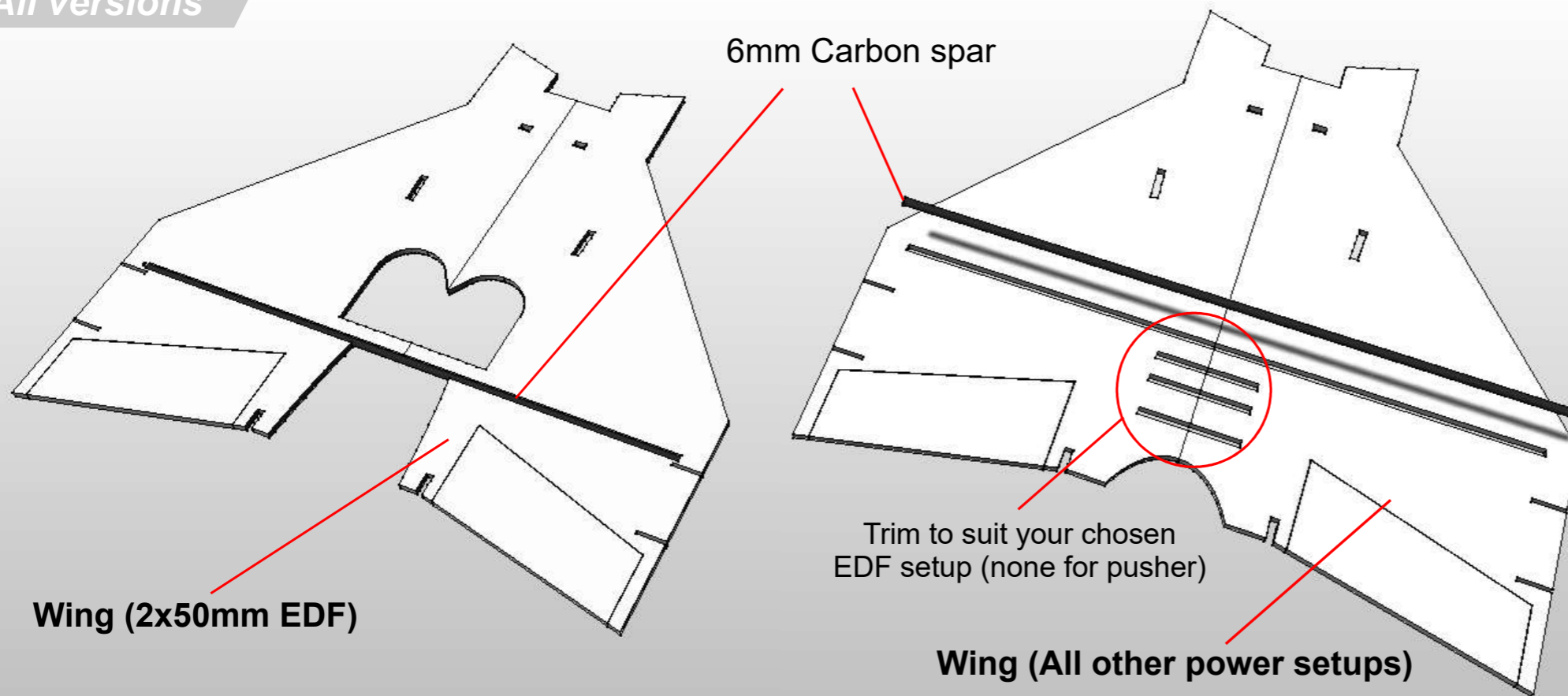


Choose your preferred variant and its powertrain.

CHOOSE POWERTRAIN



All versions



Glue the 6mm Carbon tube into the slot in the **Wing**. Use Masking tape top and bottom to retain the epoxy until it is set.

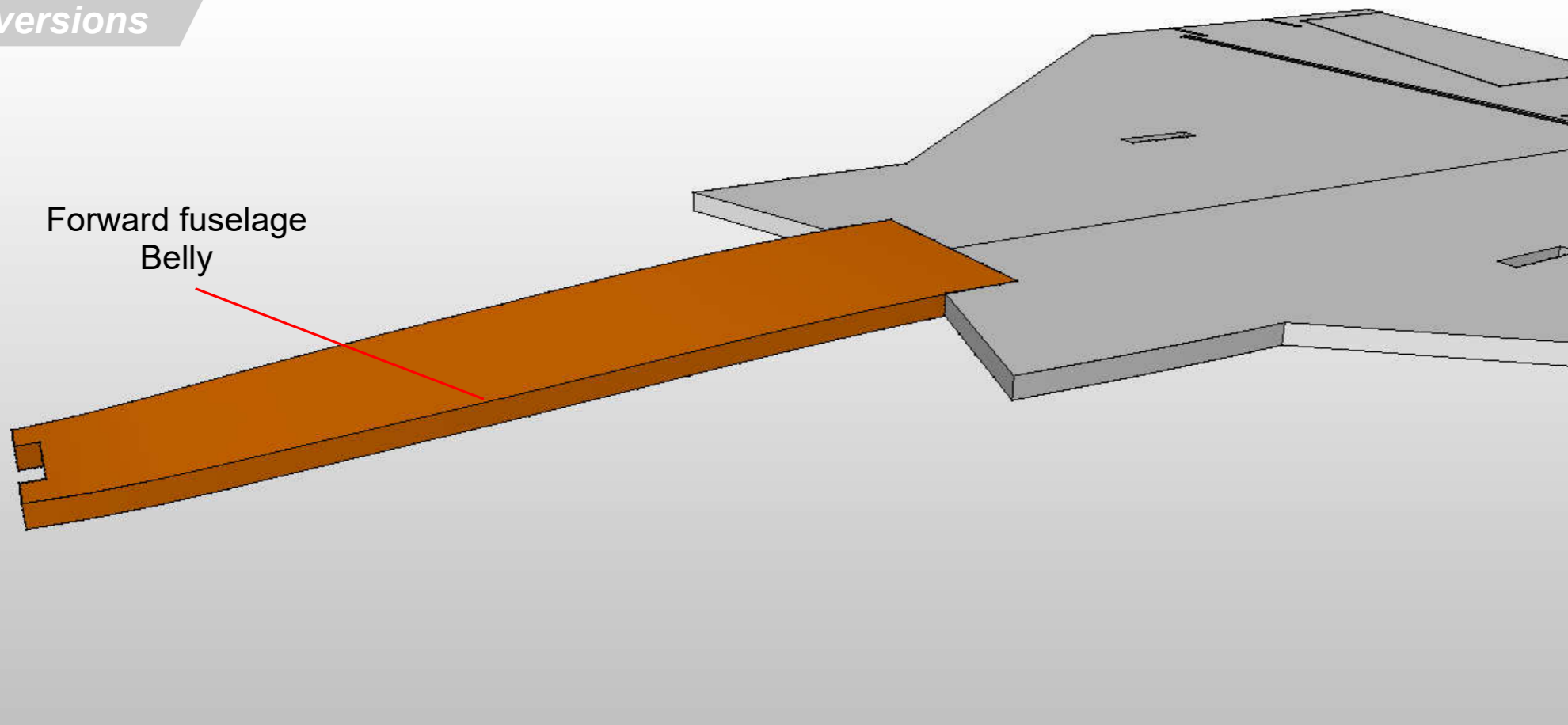
tip: Try Washi Tape, it makes a better job than ordinary masking tape.



Phantom



All versions

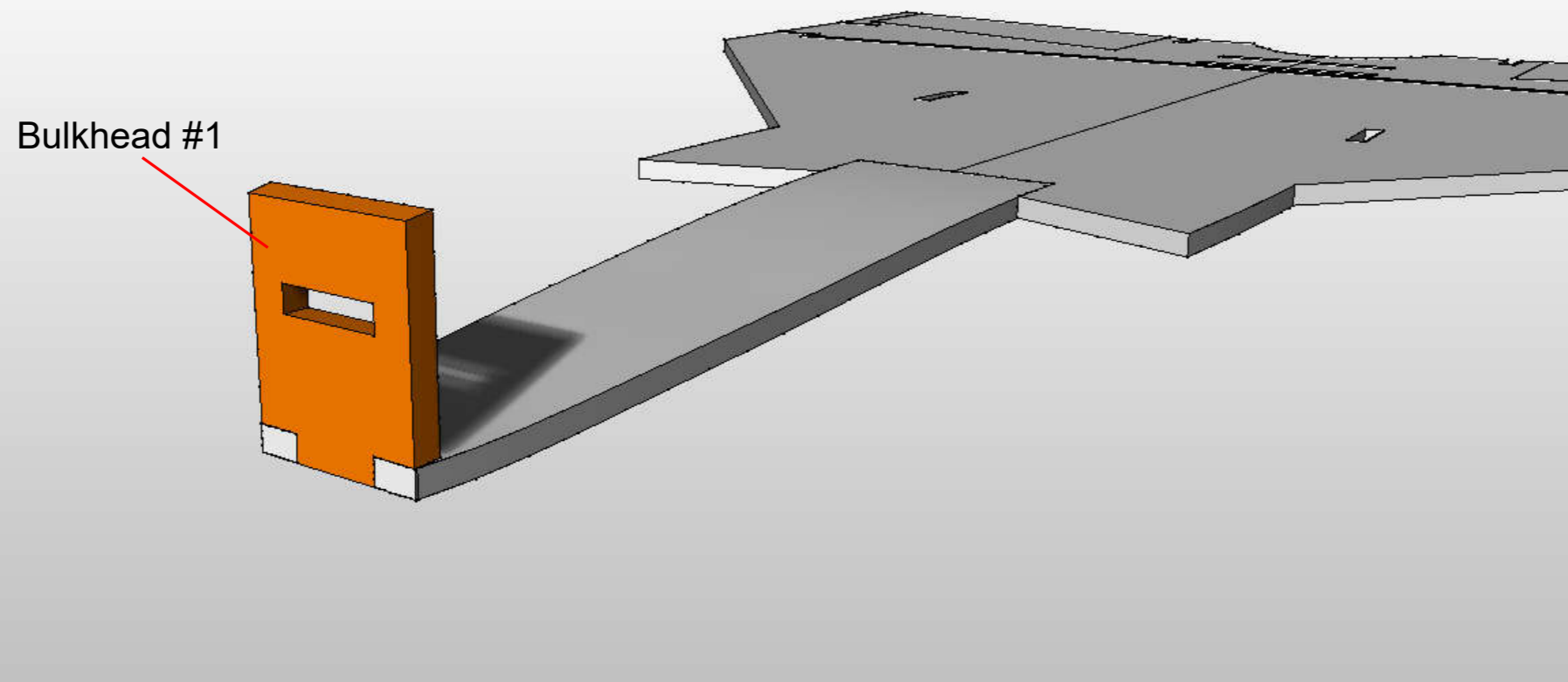


Pre-shape the **Forward Fuselage Belly** to match the shape of the bottom of the forward fuselage sides (inner)

Glue to the wing with epoxy (sparingly).



All versions

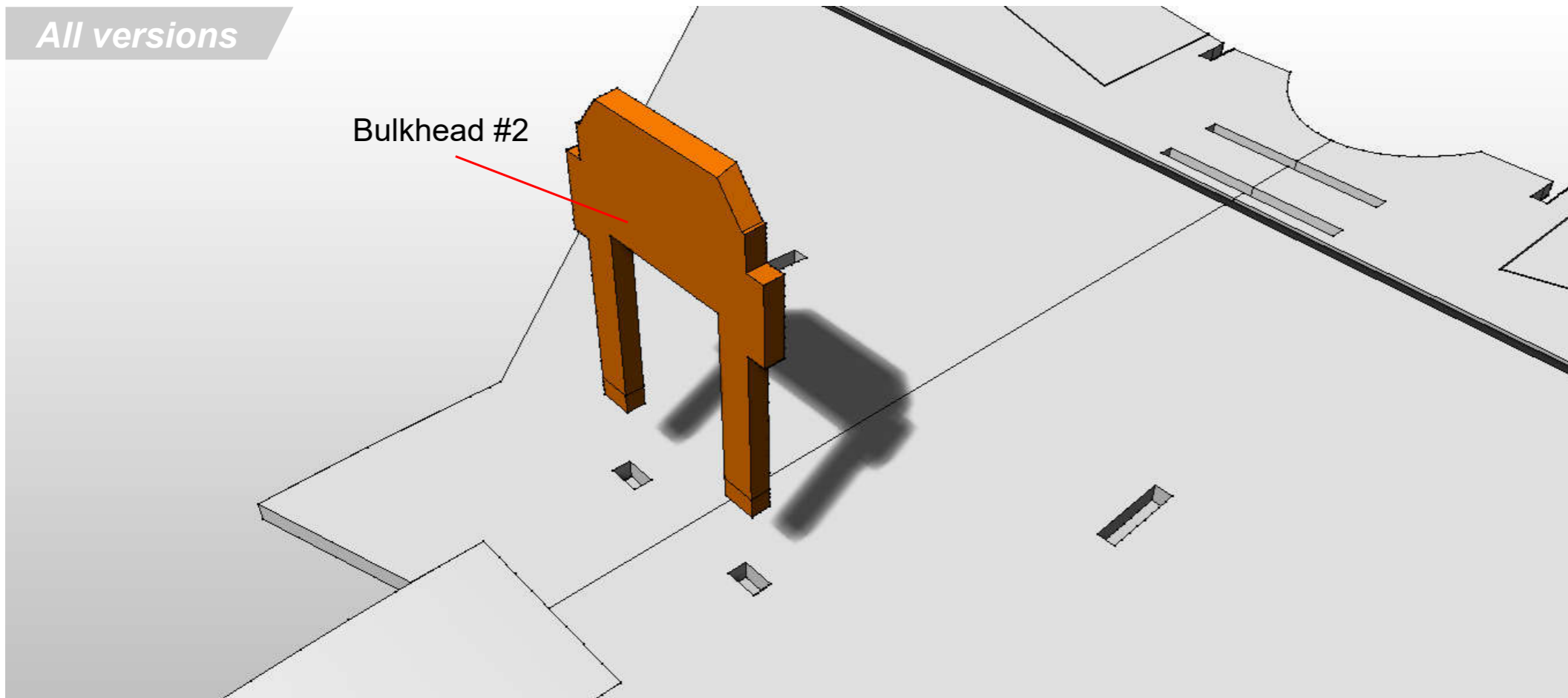


Glue **Bulkhead #1** to the assembly.



All versions

Bulkhead #2

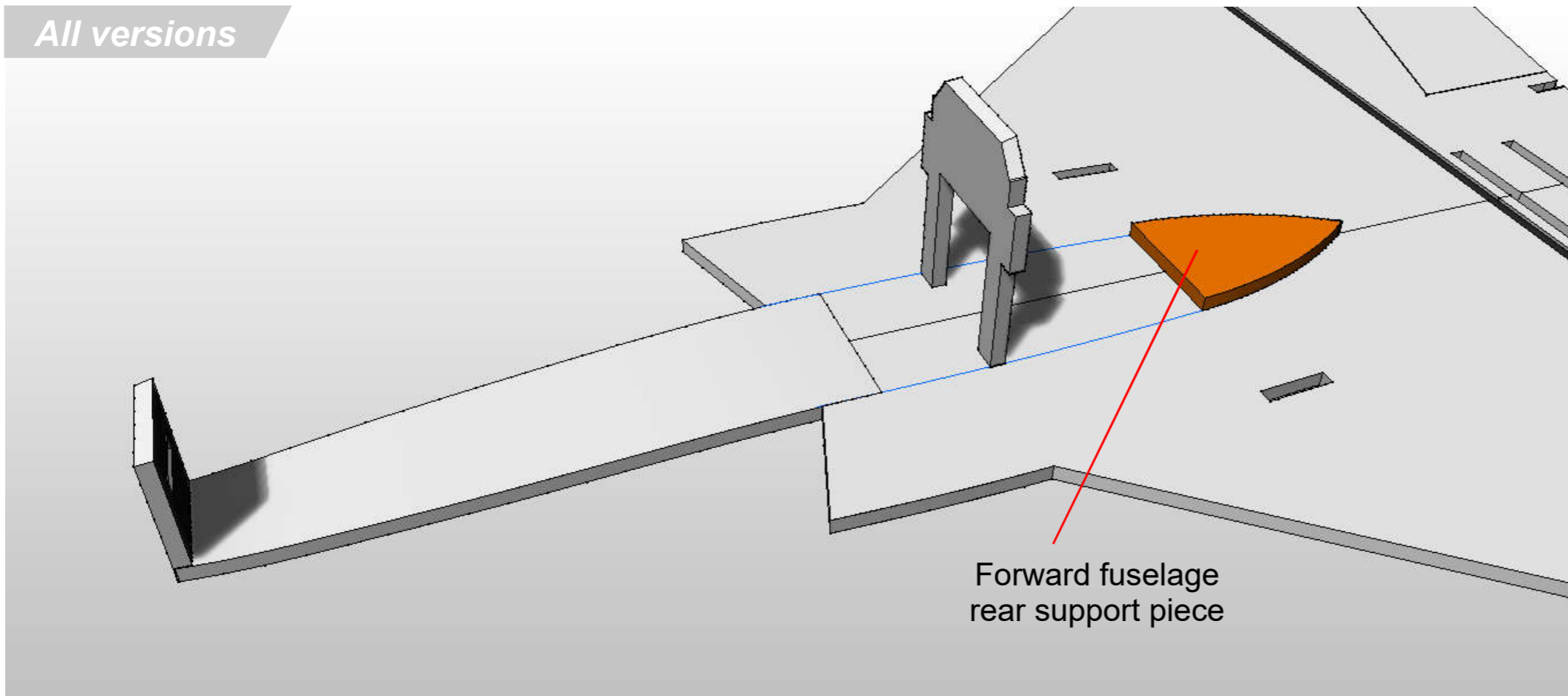


Use masking tape below, and use a tiny amount of epoxy to hold **Bulkhead #2** in place.



All versions

Forward fuselage rear support piece



Mark the location of the **Forward Fuselage Rear Support Piece** onto the wing assembly from the plans then glue in place.

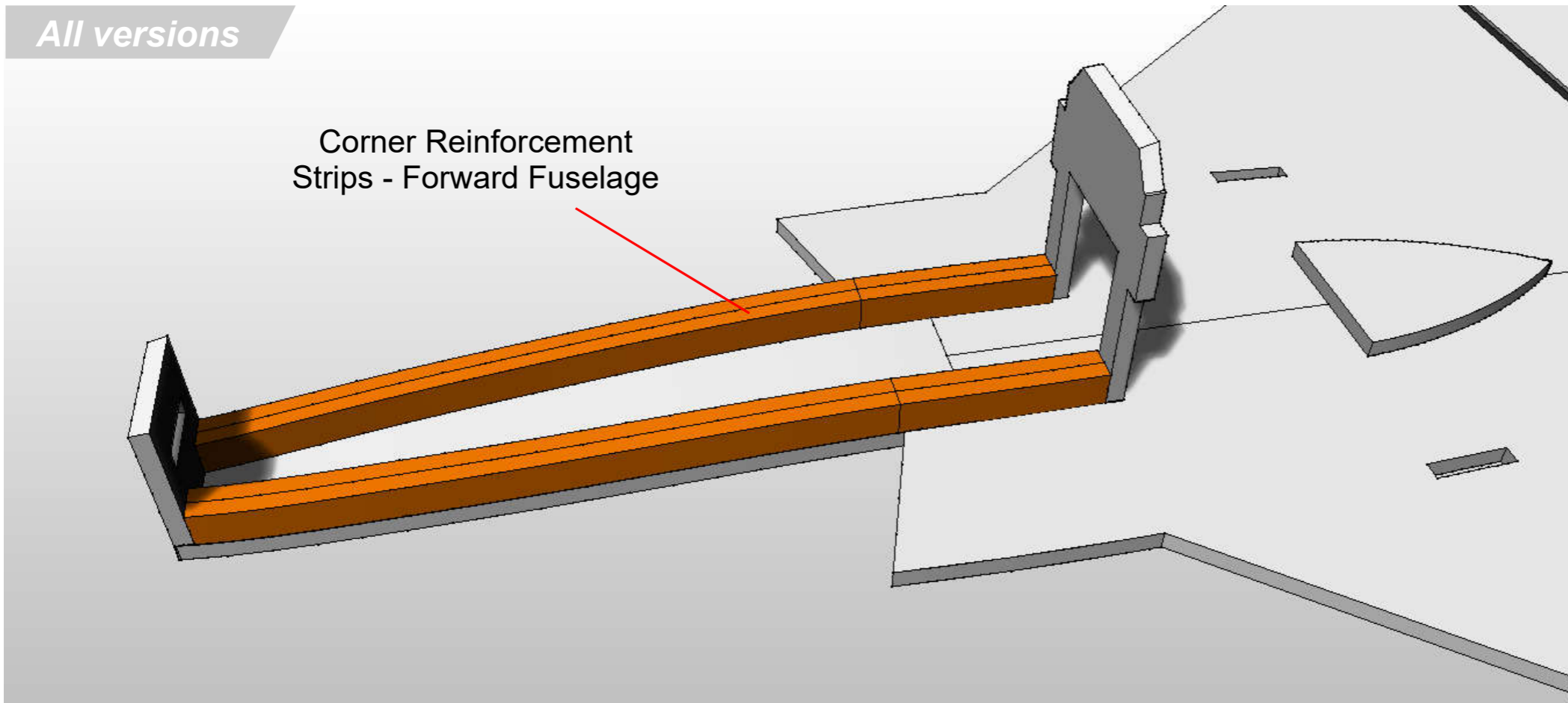


Phantom



All versions

Corner Reinforcement Strips - Forward Fuselage

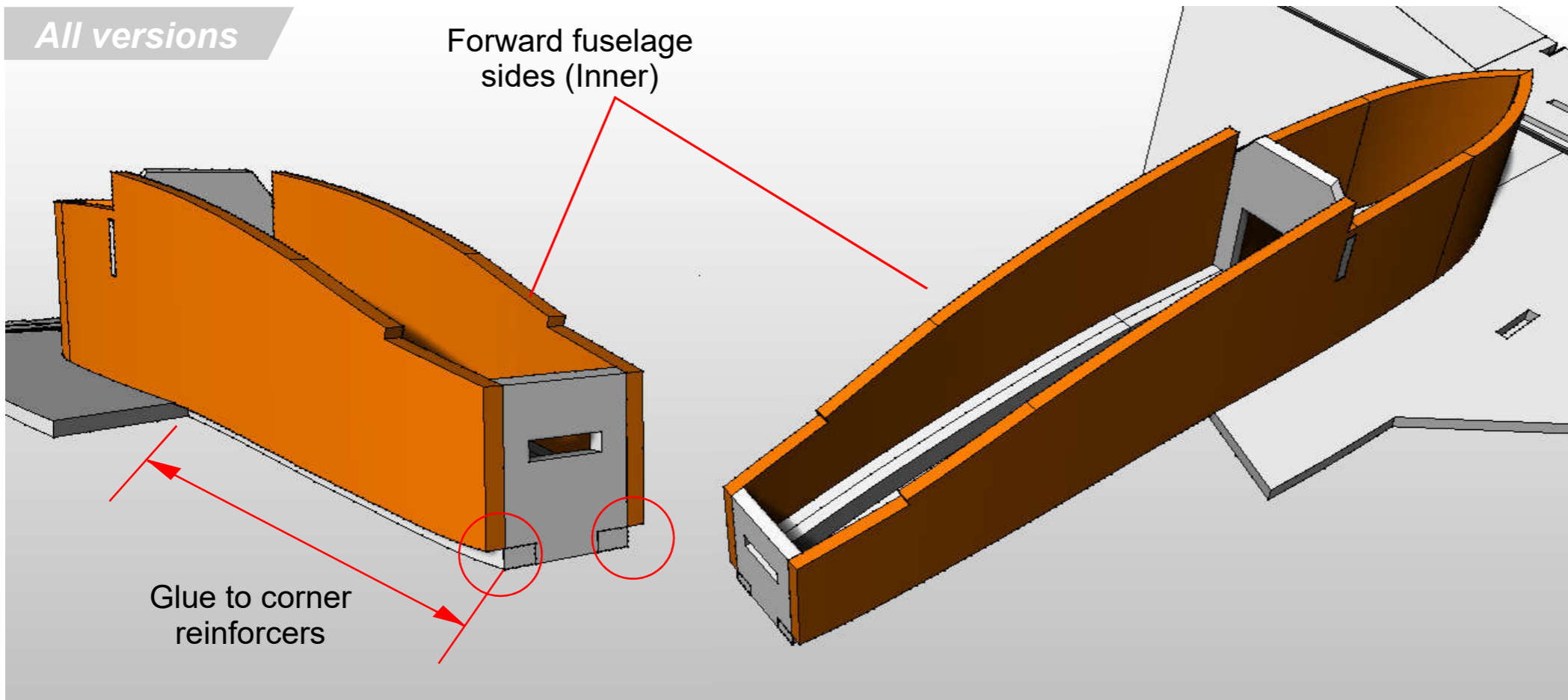


Glue the 4 x **Corner Reinforcement Strips** - **Forward Fuselage** in place



All versions

Forward fuselage sides (Inner)



Curve the trailing edge of the **Forward Fuselage Sides (Inner)** and glue to the assembly as shown

NOTE : Forward of the wing, glue directly to the corner reinforcers and not the belly panel - see image.

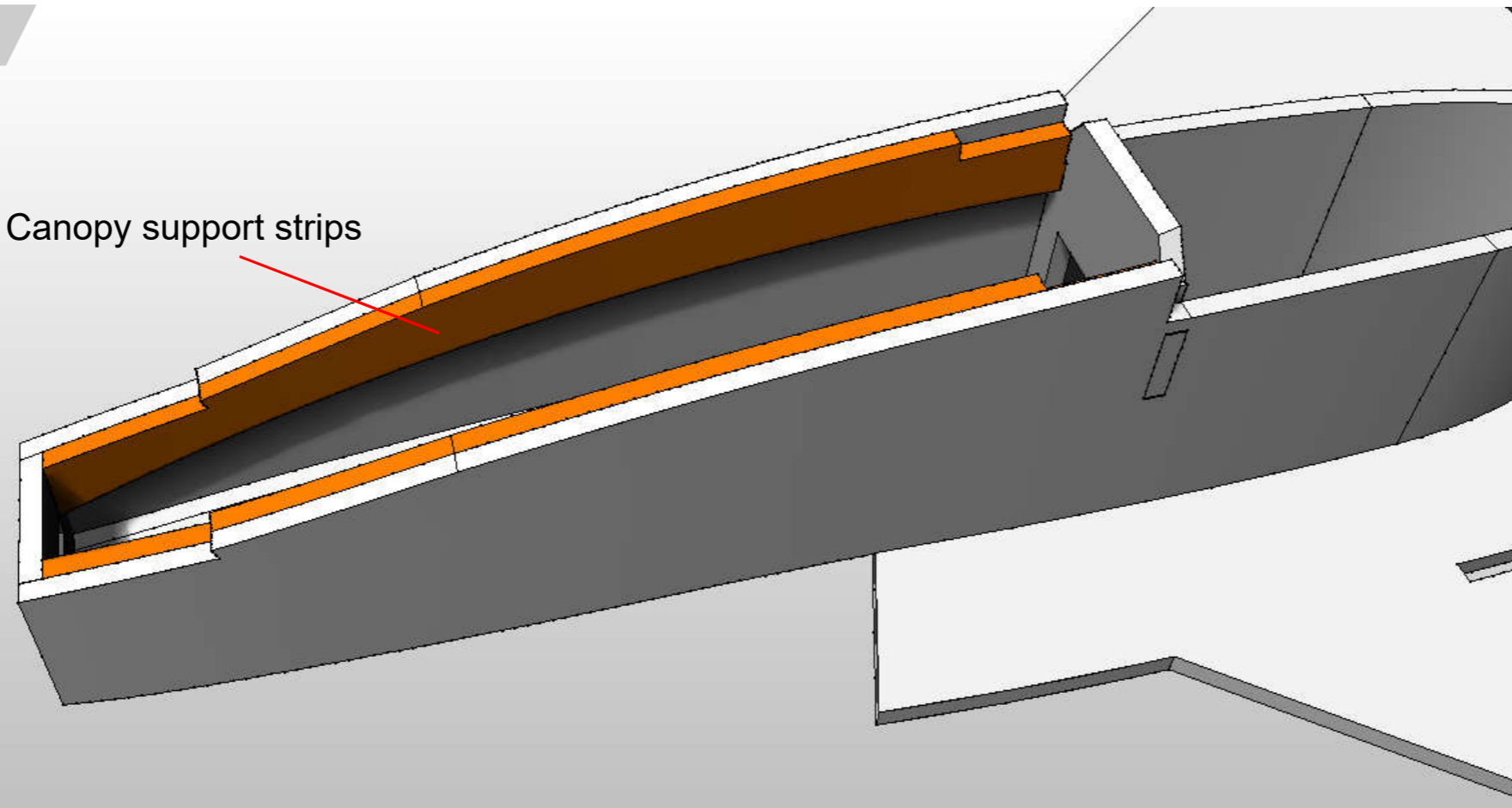


Phantom



All versions

Canopy support strips



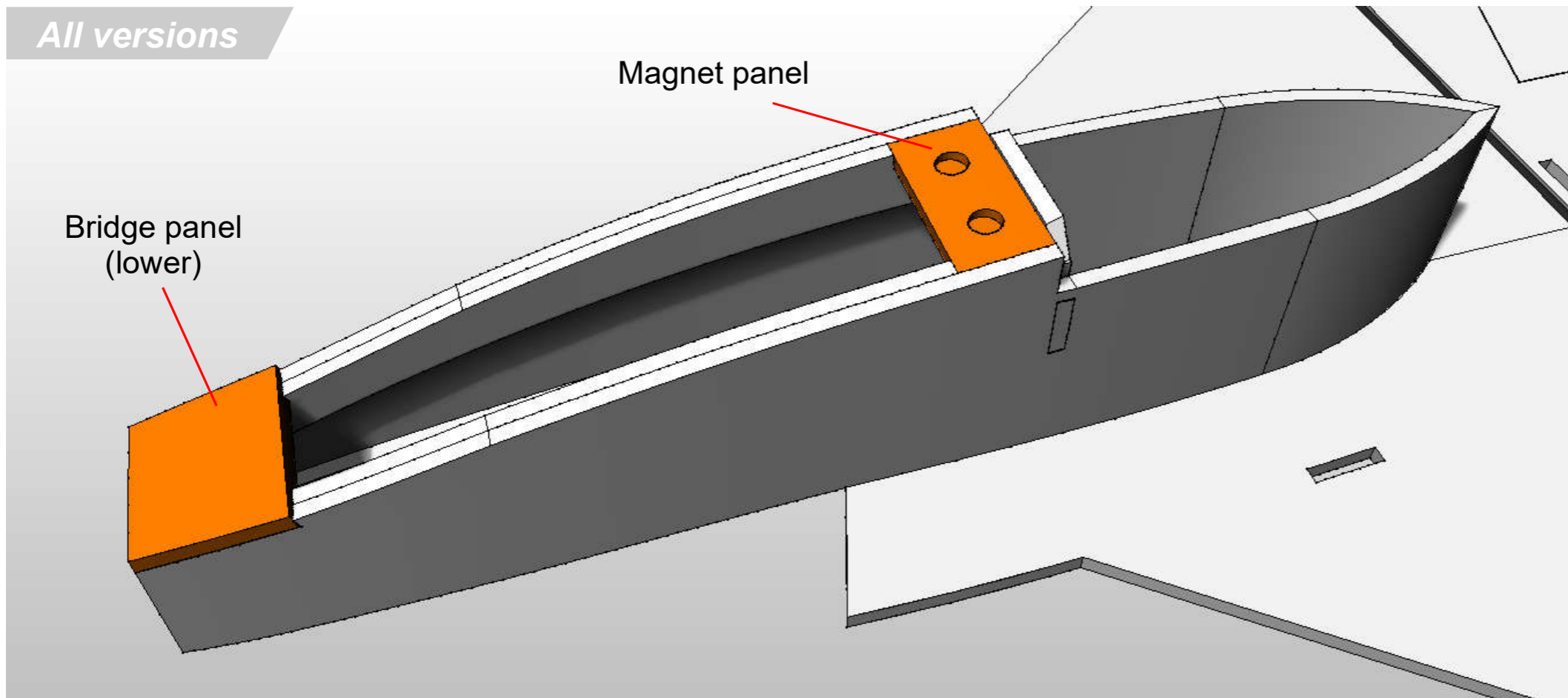
Glue the **Canopy Support Strips** to the assembly.



All versions

Magnet panel

Bridge panel (lower)



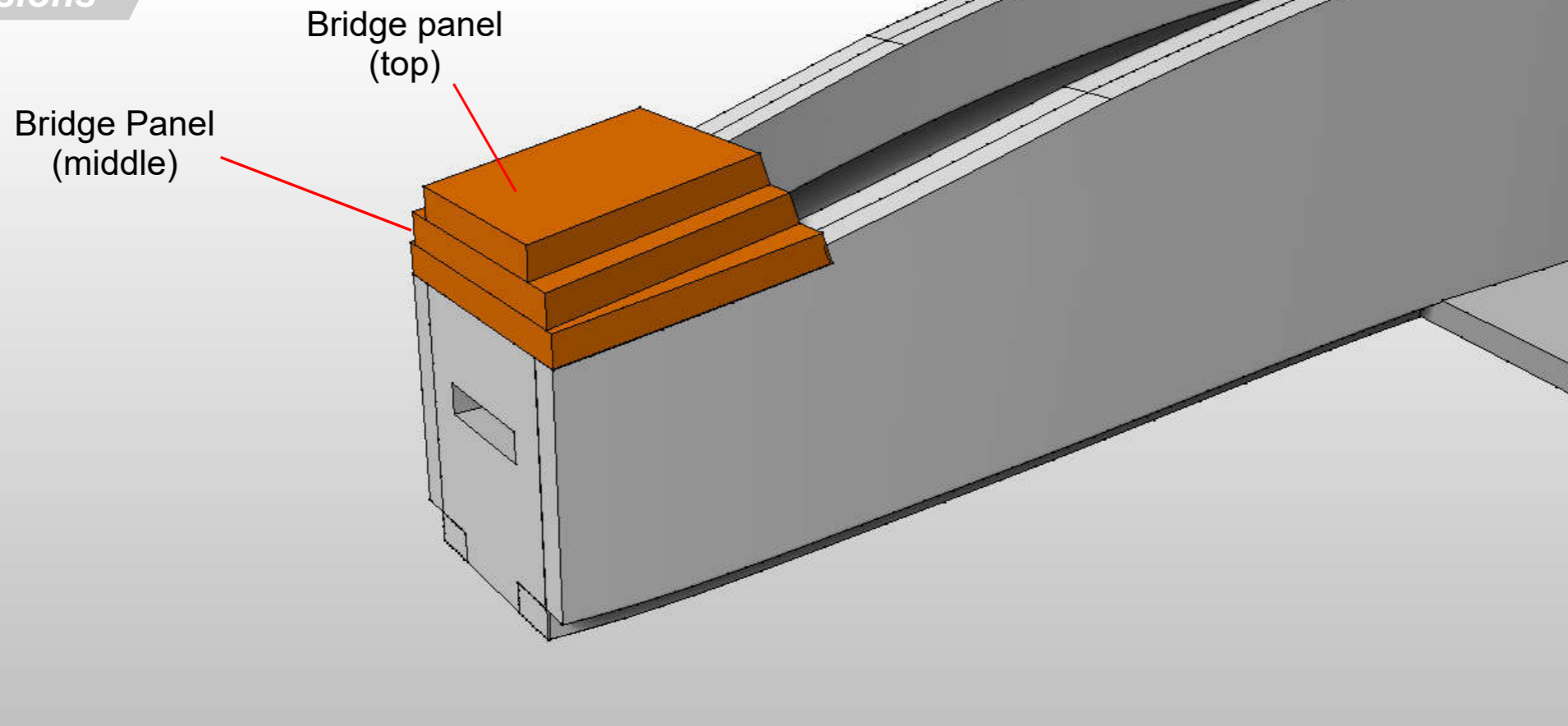
Glue the **Magnet Panel** and the **Bridge Panel (lower)** to the assembly.



Phantom



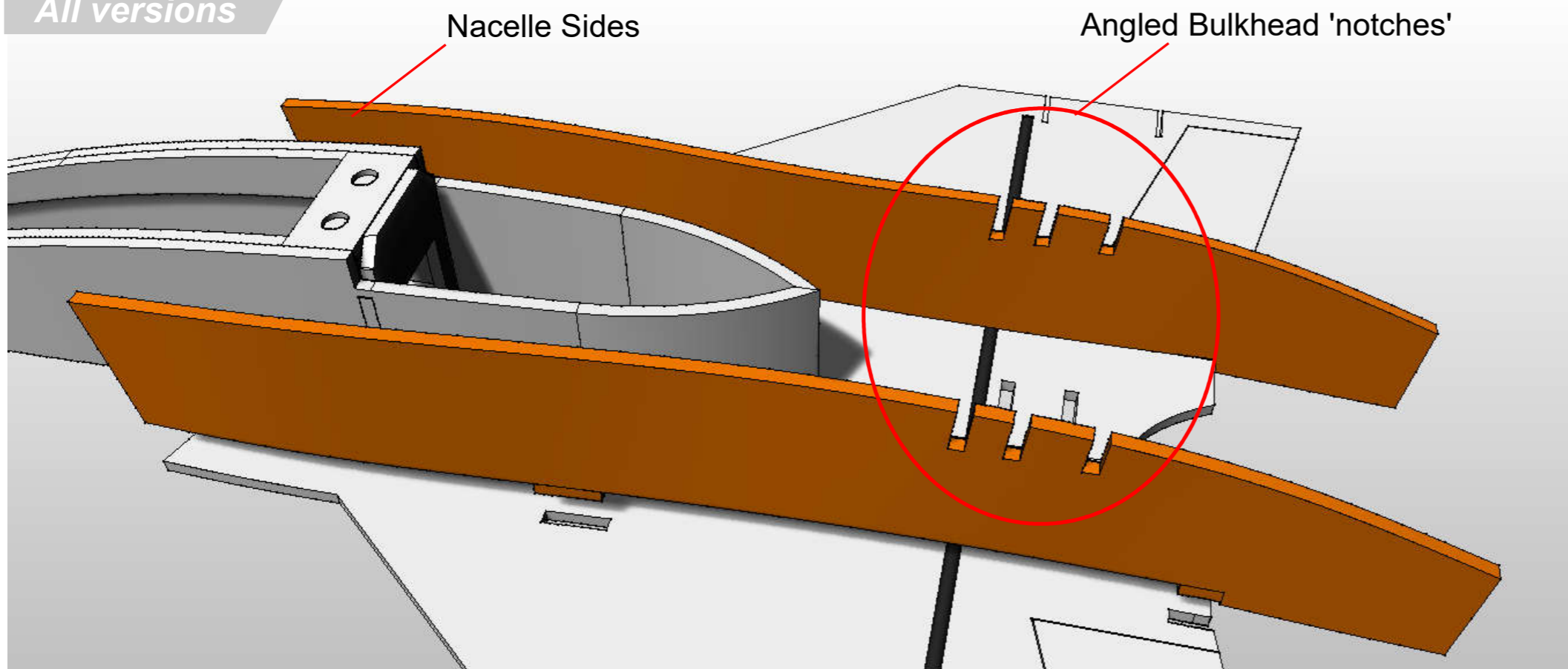
All versions



Glue the **Bridge Panel (Middle)** and **Bridge Panel (Top)** to the assembly.



All versions



Trim away notches in the Nacelle sides to suit your power setup.

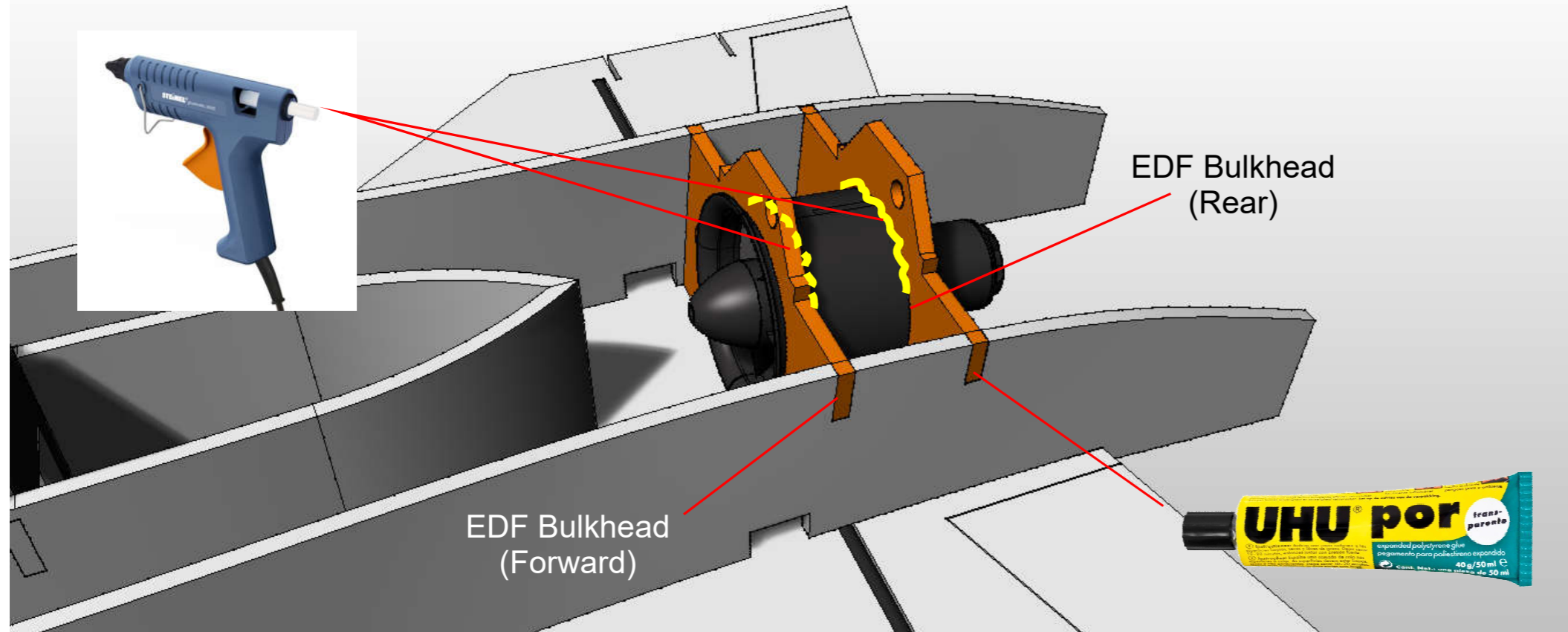
Pre-curve then glue to the assembly using the alignment tabs.



Phantom



64 & 70mm EDF only

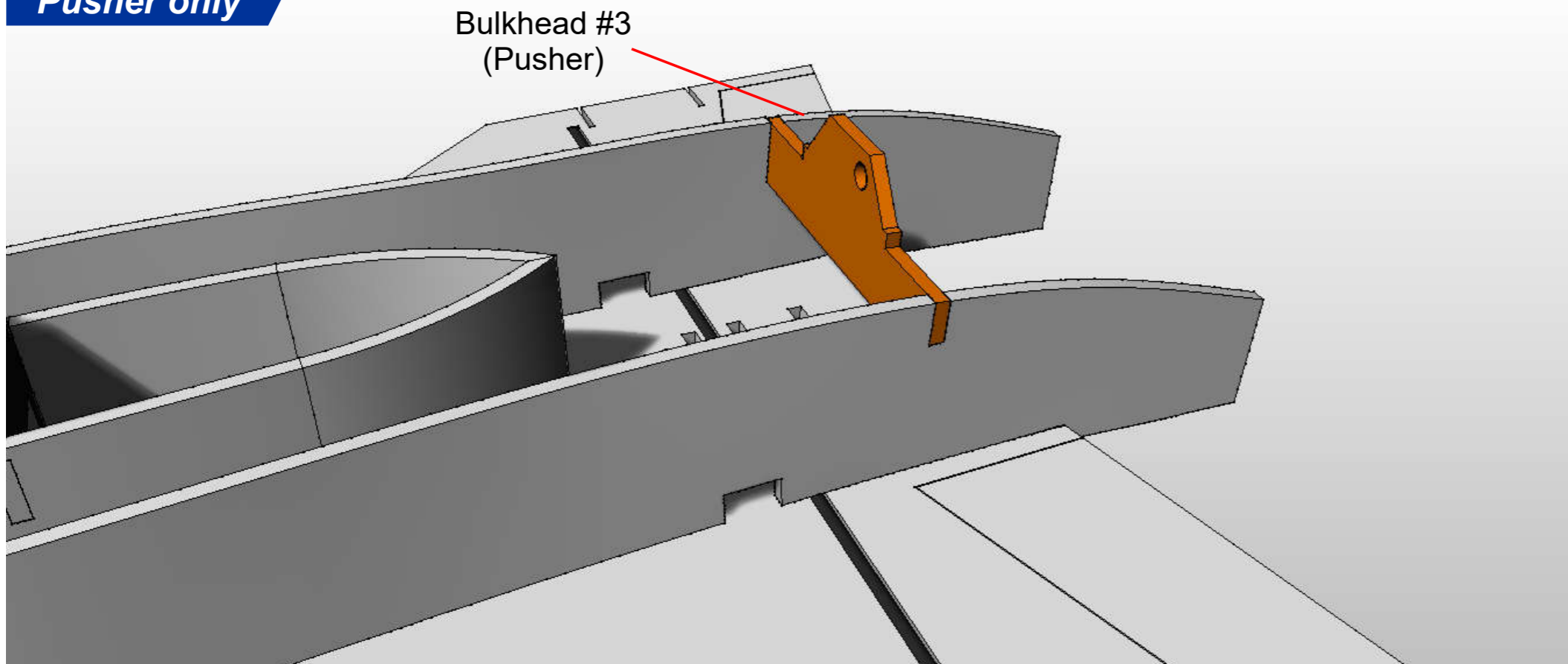


Test fit your chosen EDF into the two **EDF Bulkheads**. Align the frontal edge of the EDF housing to the front face of the forward bulkhead. please note that the bulkheads are deliberately leaning rearwards.

Glue the bulkheads to the assembly to the fuselage using UHU por. Use hot melt glue to secure the EDF unit.

Note. 64mm EDF's are typically shorter than 70mm EDF - this is the reason for the difference in bulkhead spacing.

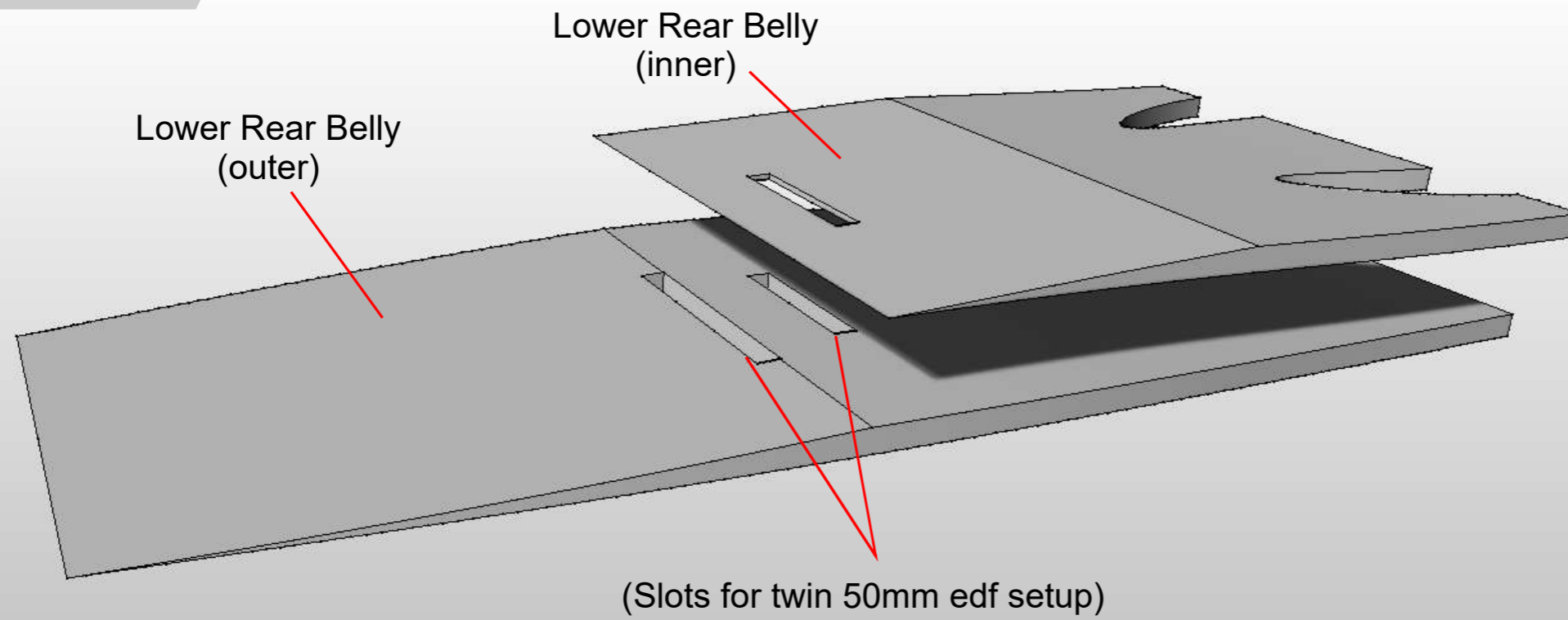
Pusher only



Glue **Bulkhead #3 (Pusher)** into the assembly.



All versions

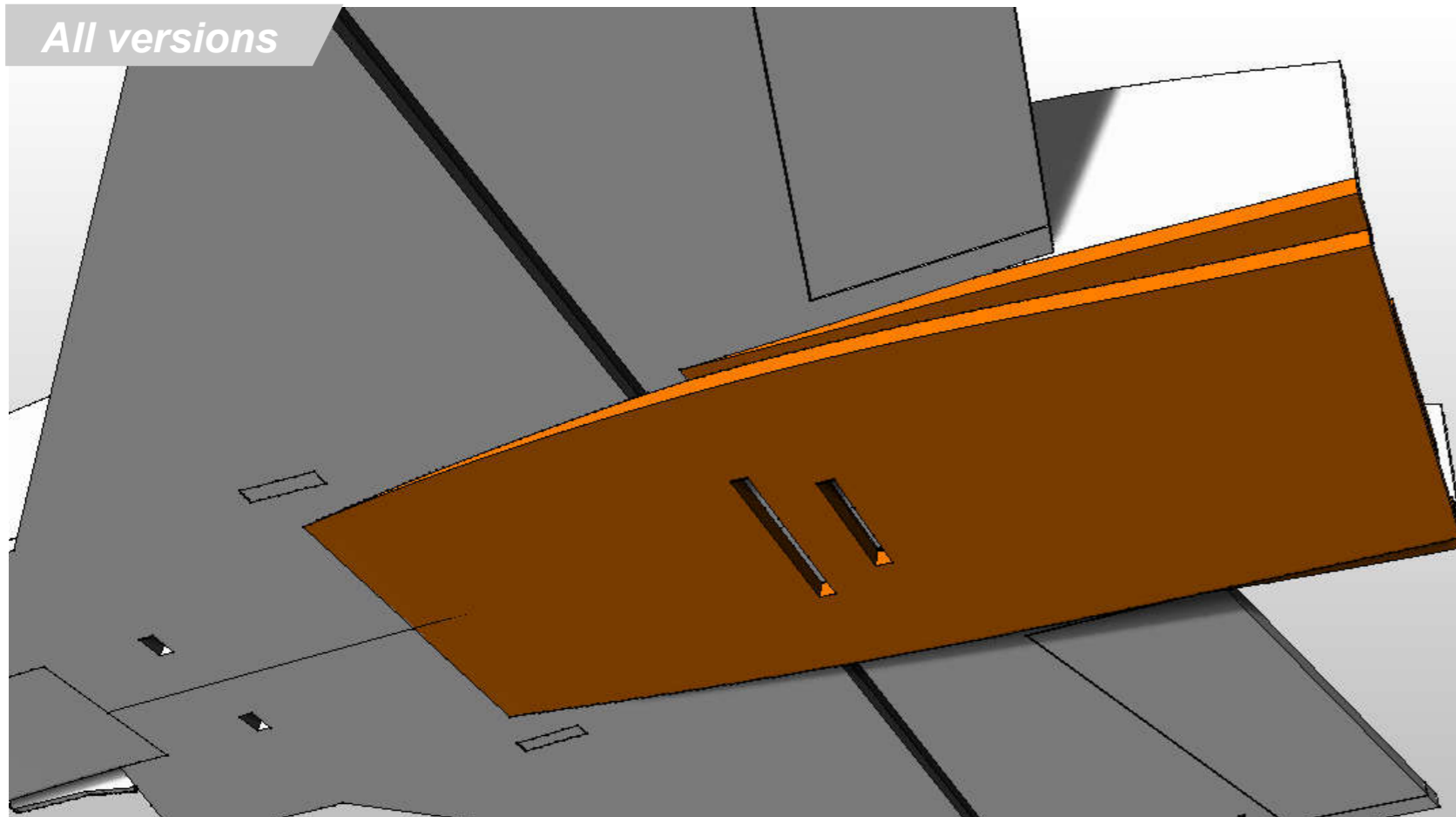


Glue the two **Lower Rear Belly** parts together.



Glue the Lower Rear Belly assembly onto the fuselage.

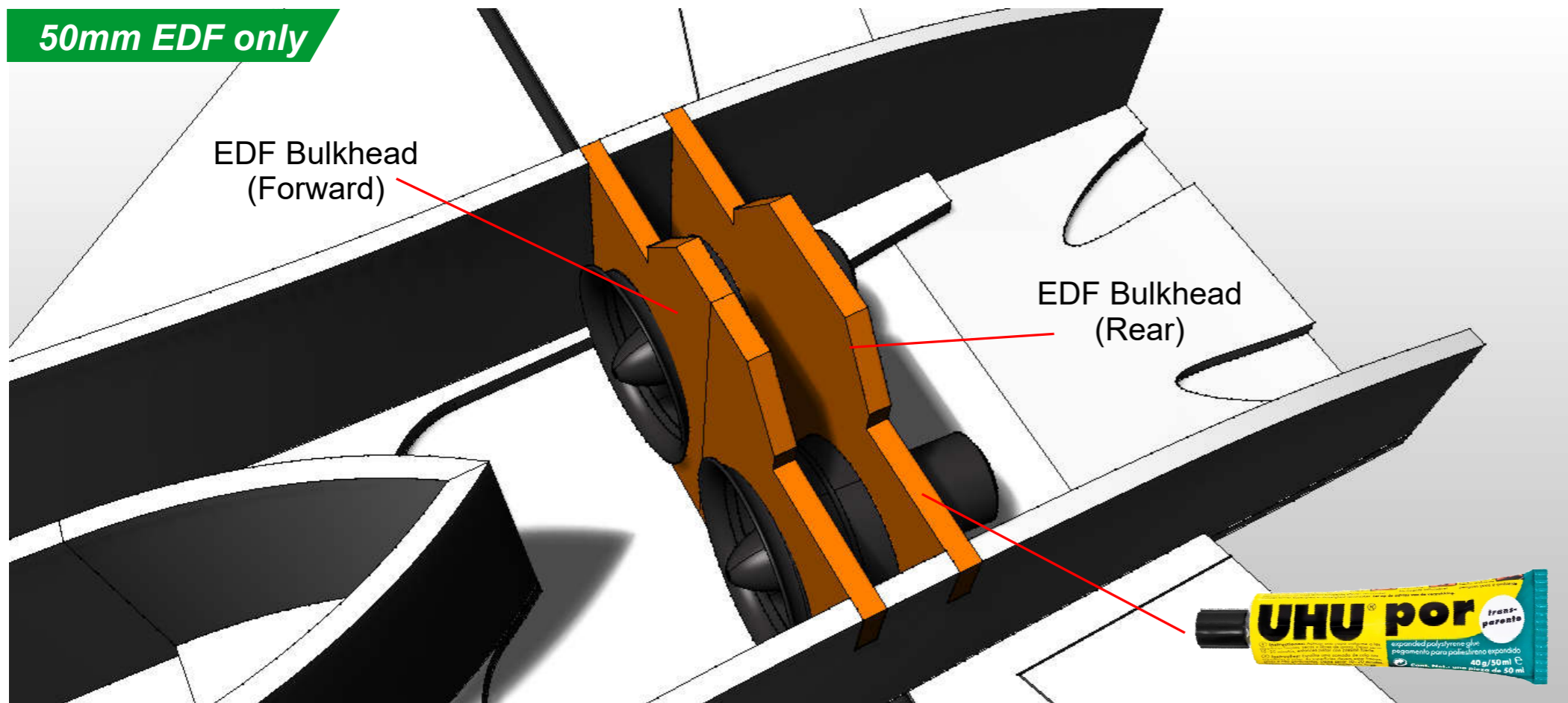
All versions



Phantom



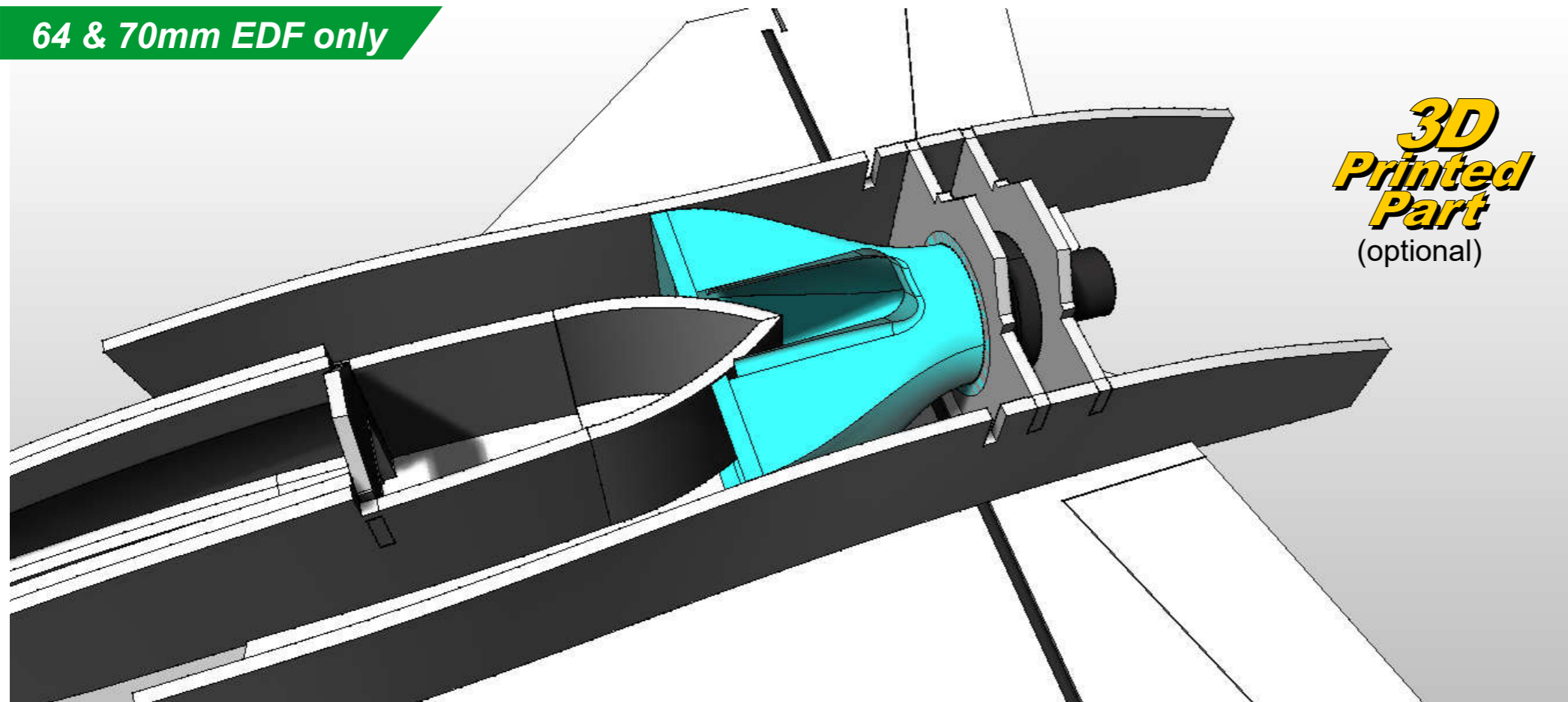
50mm EDF only



Test fit your chosen 50mm EDF units into the two **EDF Bulkheads**. Align the frontal edge of the EDF housing to the front face of the forward bulkhead. please note that the bulkheads are deliberately leaning rearwards.

Glue the bulkheads to the assembly to the fuselage using UHU por. Don't glue the EDF's to the bulkheads yet as they will be angled outwards to suit the exhaust bulkhead.

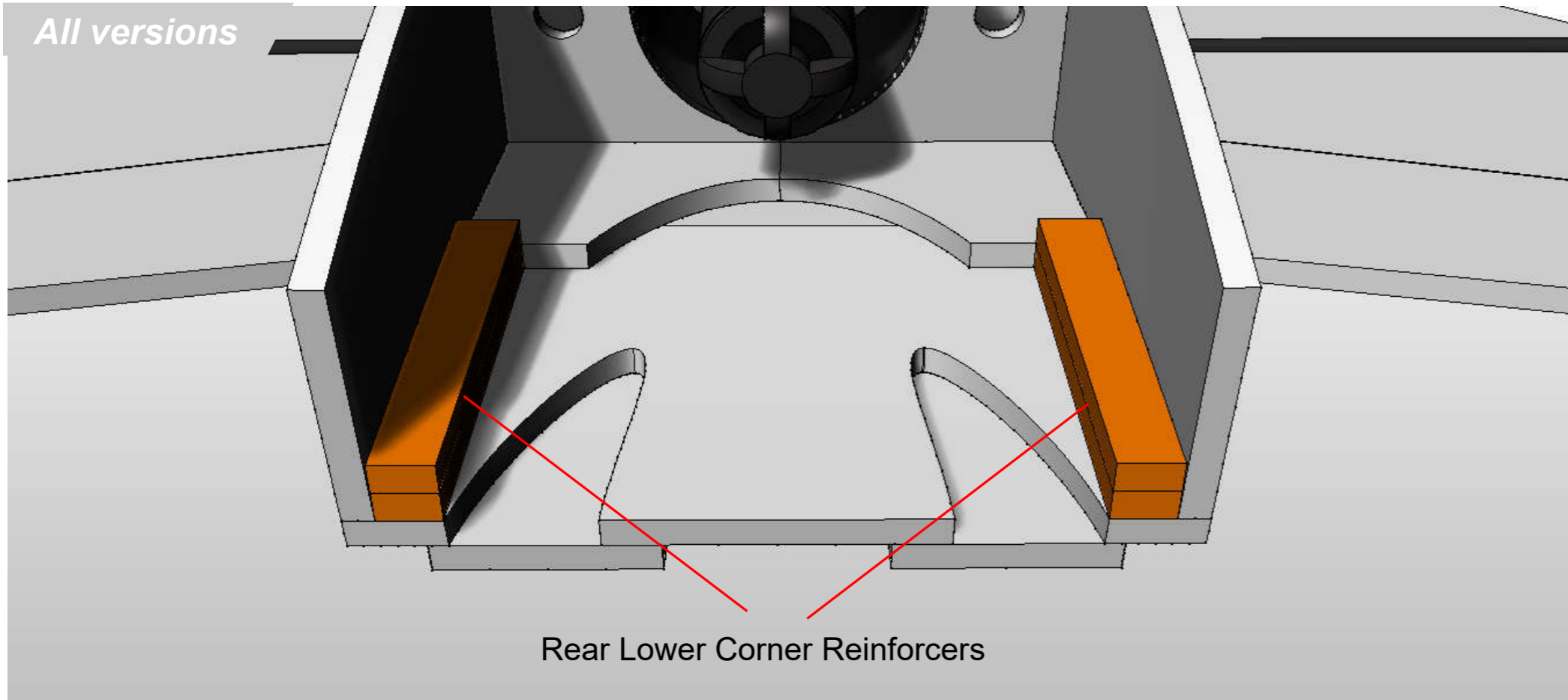
64 & 70mm EDF only



3D print the **EDF Intake duct** and glue in place as shown.



All versions



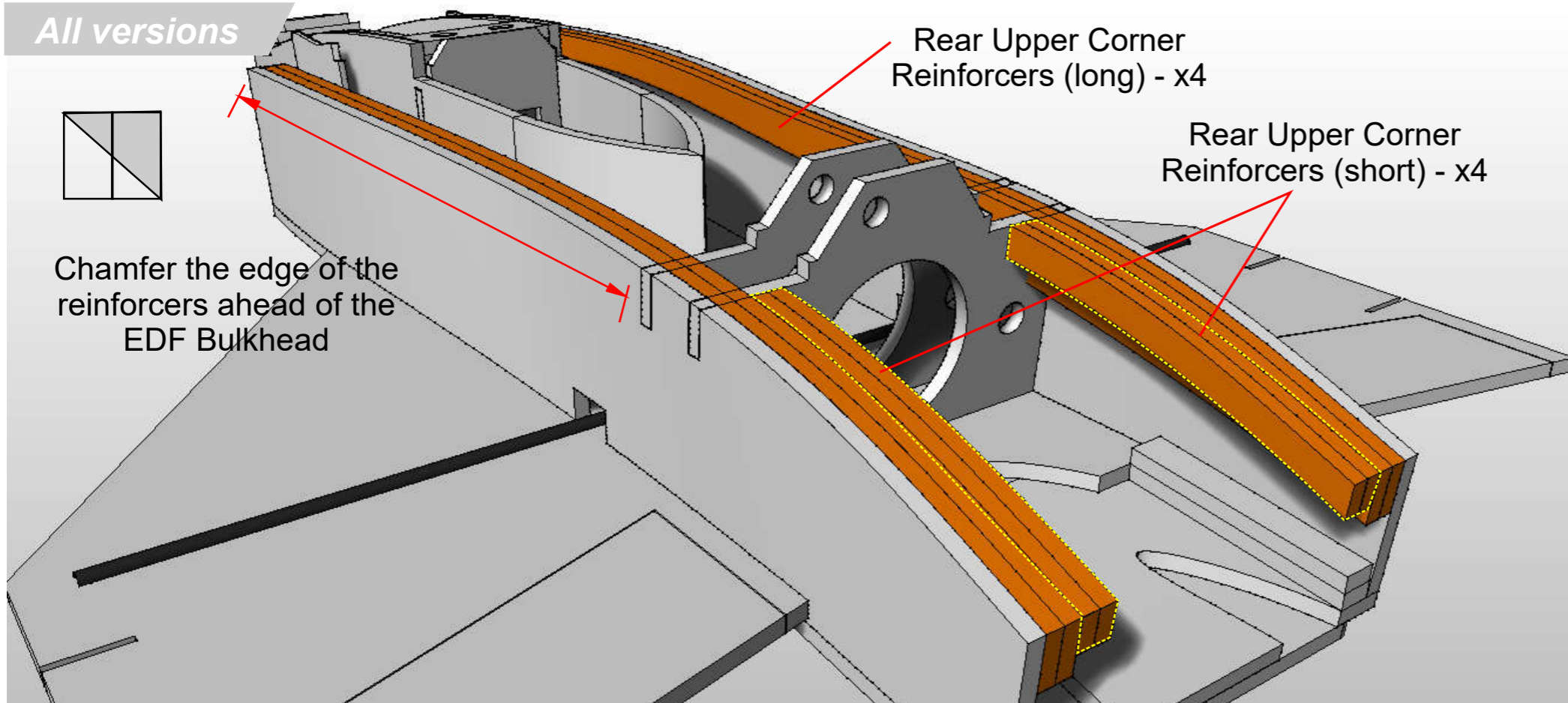
Rear Lower Corner Reinforcers

Glue the 4 x **Rear Lower Corner Reinforcers** in place.

When it comes to fitting the thrust tube (EDF only), you will need to sand these parts down in order to fit the tube.



All versions



Rear Upper Corner Reinforcers (long) - x4

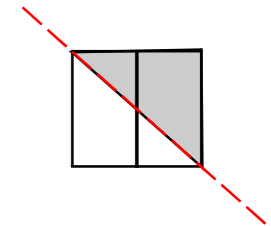
Rear Upper Corner Reinforcers (short) - x4

Chamfer the edge of the reinforcers ahead of the EDF Bulkhead

Trim the 4 x **Rear Upper Corner Reinforcers** so that they fit around the EDF/Pusher bulkhead.

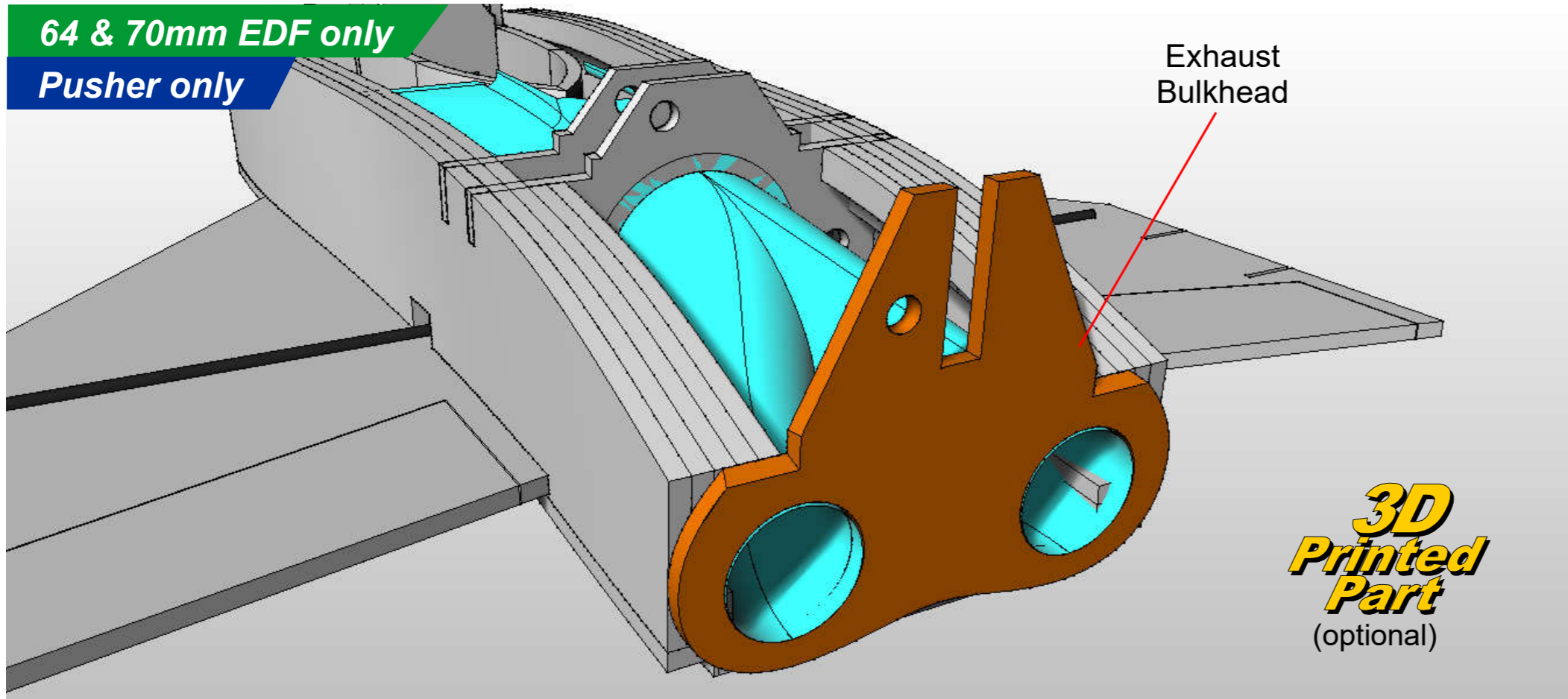
Using a sharp blade, shape the forward reinforcers with a 45 degree angle to improve airflow.

Glue in place.



64 & 70mm EDF only

Pusher only



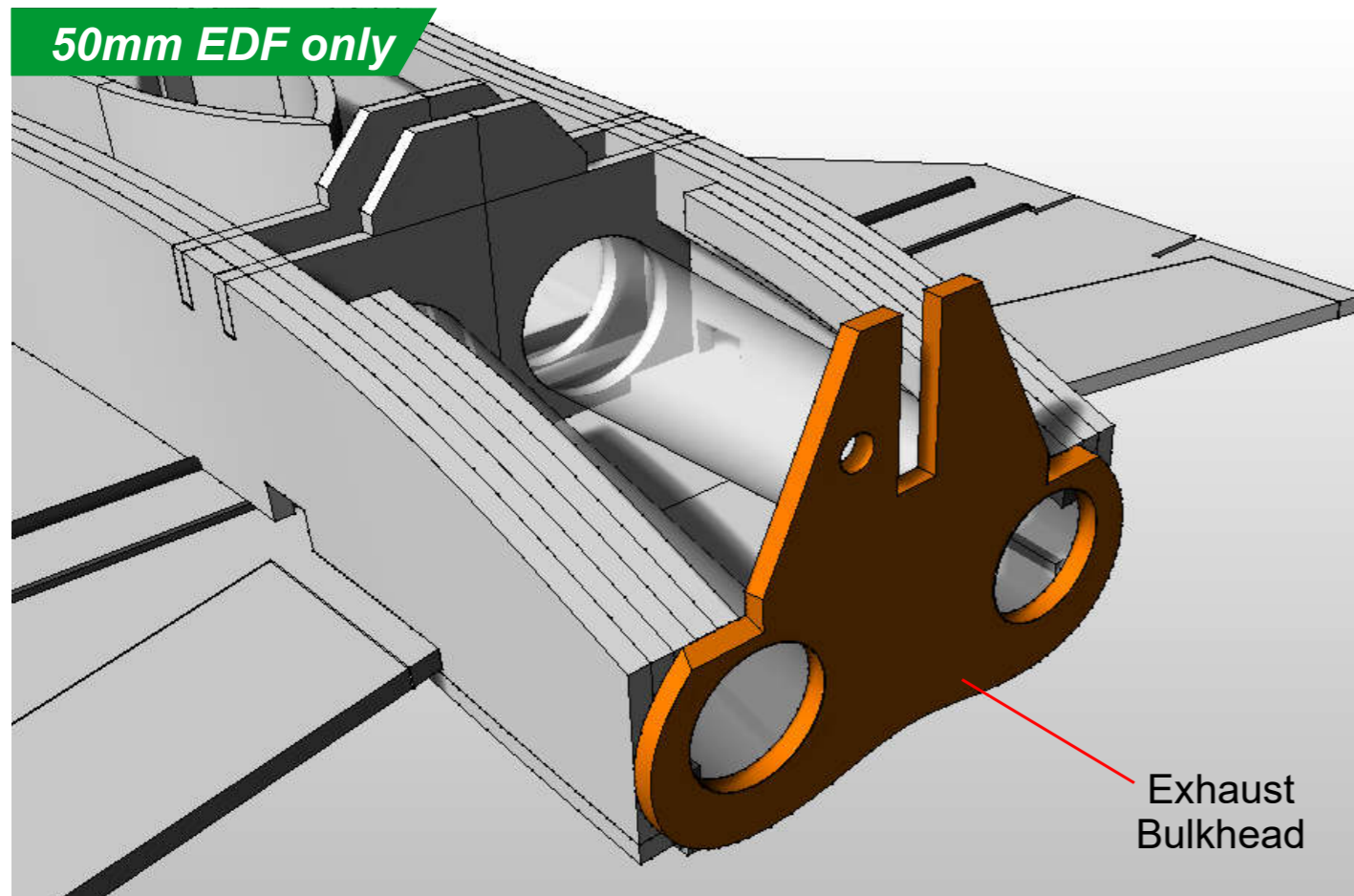
EDF versions - Glue your 3D printed bifurcated thrust tube in place, sanding back the lower corner reinforcers where they clash.

then

All Versions. Glue the exhaust bulkhead in place.



50mm EDF only



Either use 3D printed thrust tubes or create some plastic tubes using plastic sheet <0.4mm.

Create supports for the tube at the EDF bulkhead using scrap depron. Glue in place using hot melt glue.

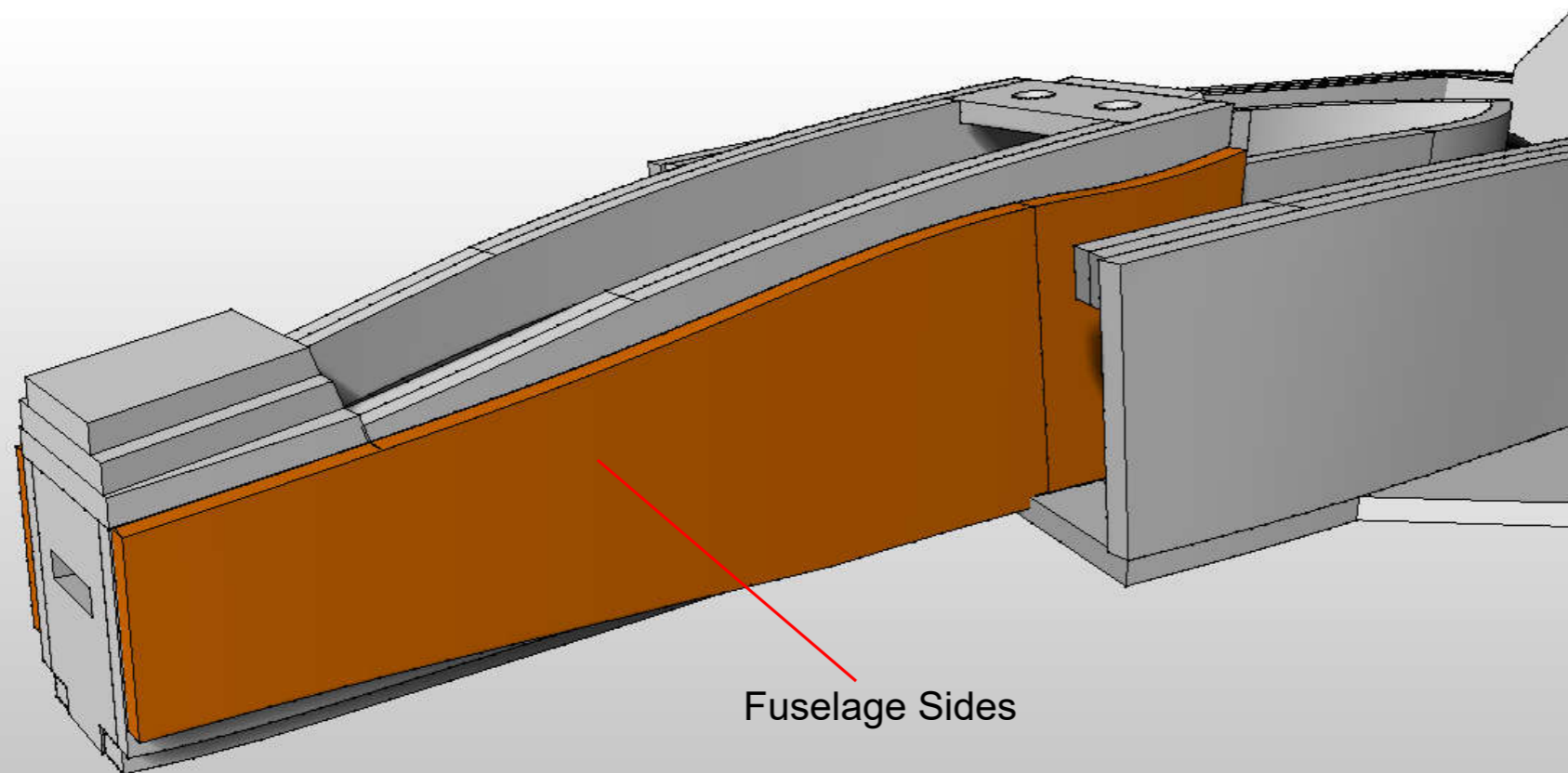
Sand away where the corner reinforcers intrude into the Thrust tube paths.

Due the limitations of a straight tube, the 50mm EDF exhaust outlet / bulkhead is higher on the non-3d printed version. The 3d printed version (not shown) maintains the scale outlet and correct thrust angle.

Glue the Exhaust bulkhead in place.



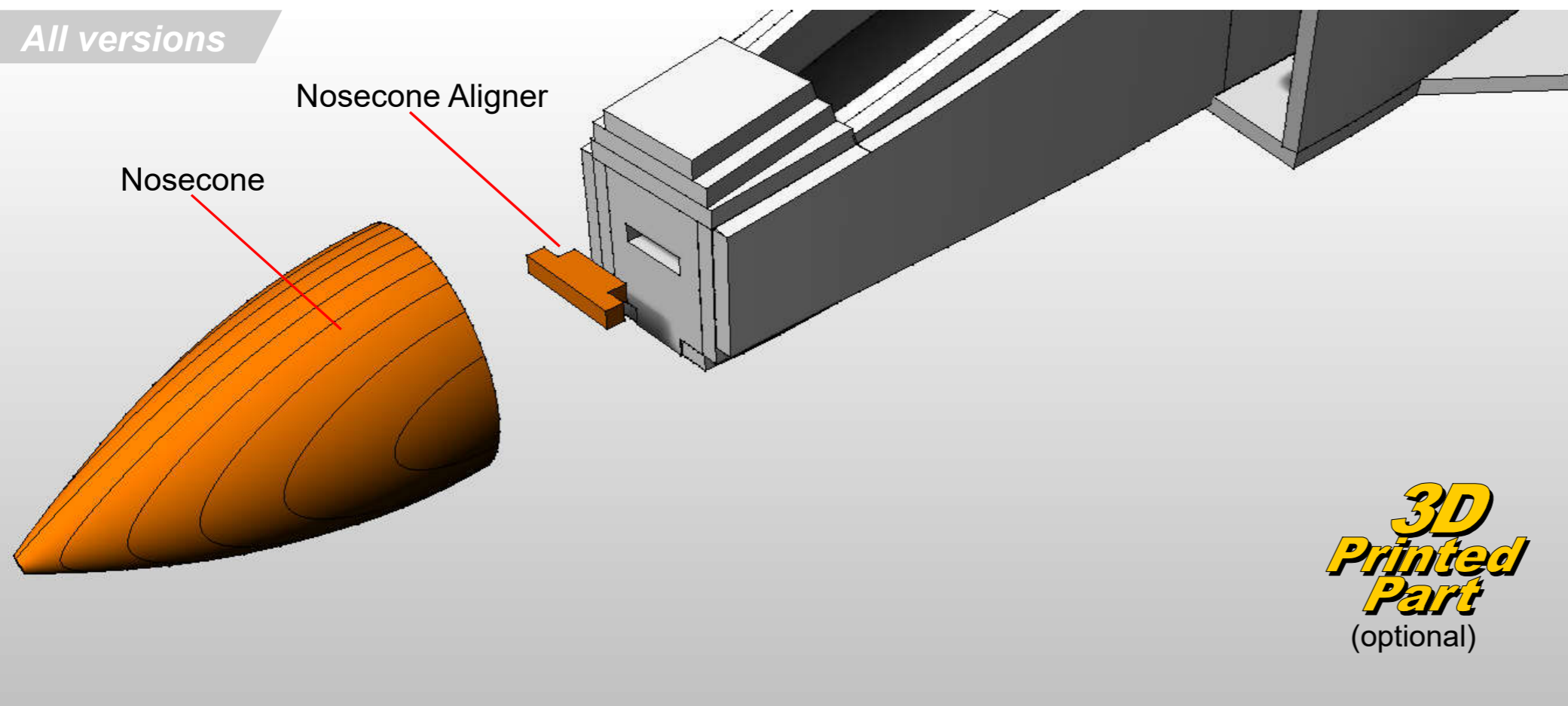
All versions



Glue the **Fuselage sides (outer)** in place.



All versions



Glue the **Nosecone Aligner** to the assembly, then Glue the **Nosecone** also.

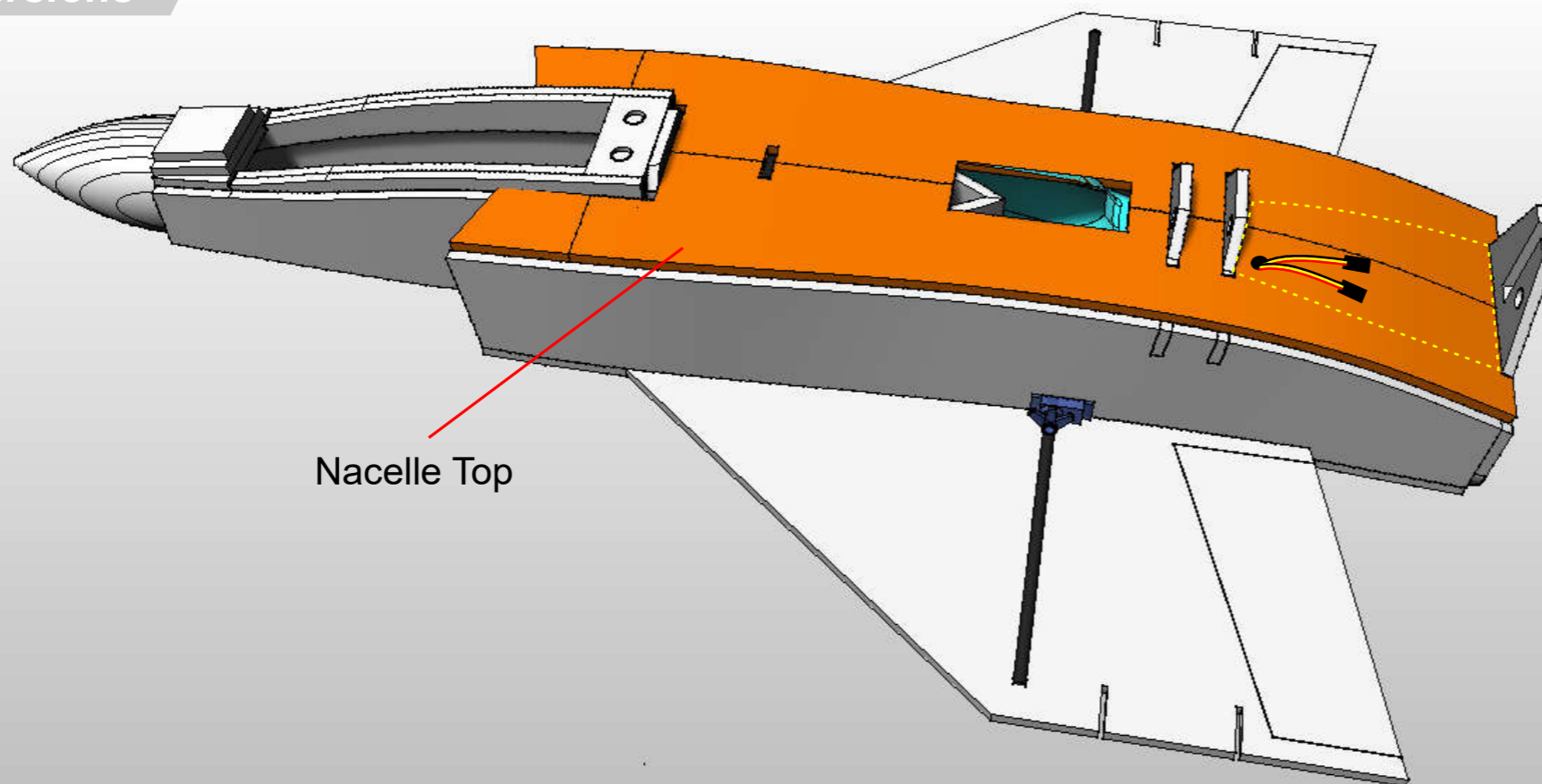
Either fabricate a nosecone using layers of foam sheet, or 3D print one.



Phantom



All versions



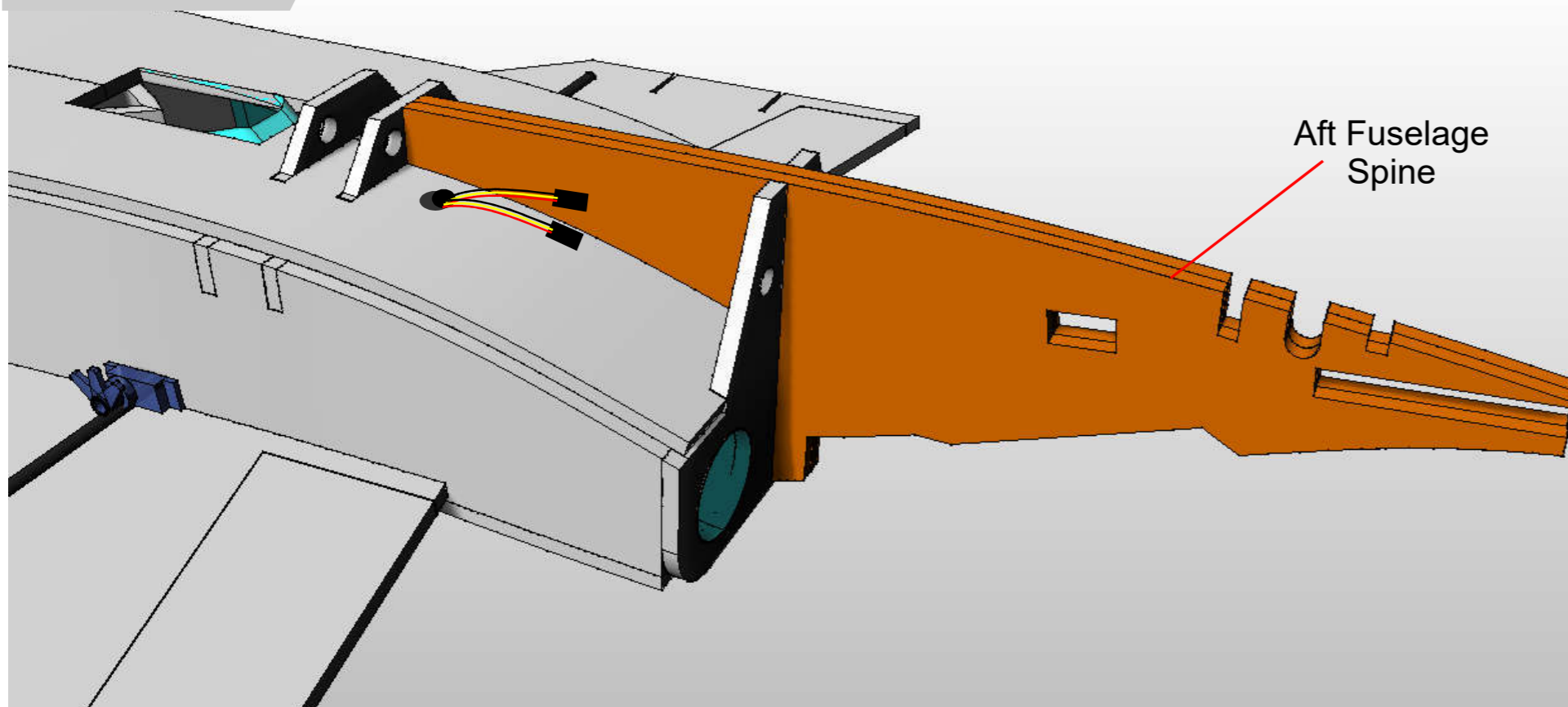
Nacelle Top

Run the Aileron servo wires into the RX area.

Glue the **Nacelle Top** onto the assembly - directly onto the corner reinforcers.



All versions



Aft Fuselage Spine

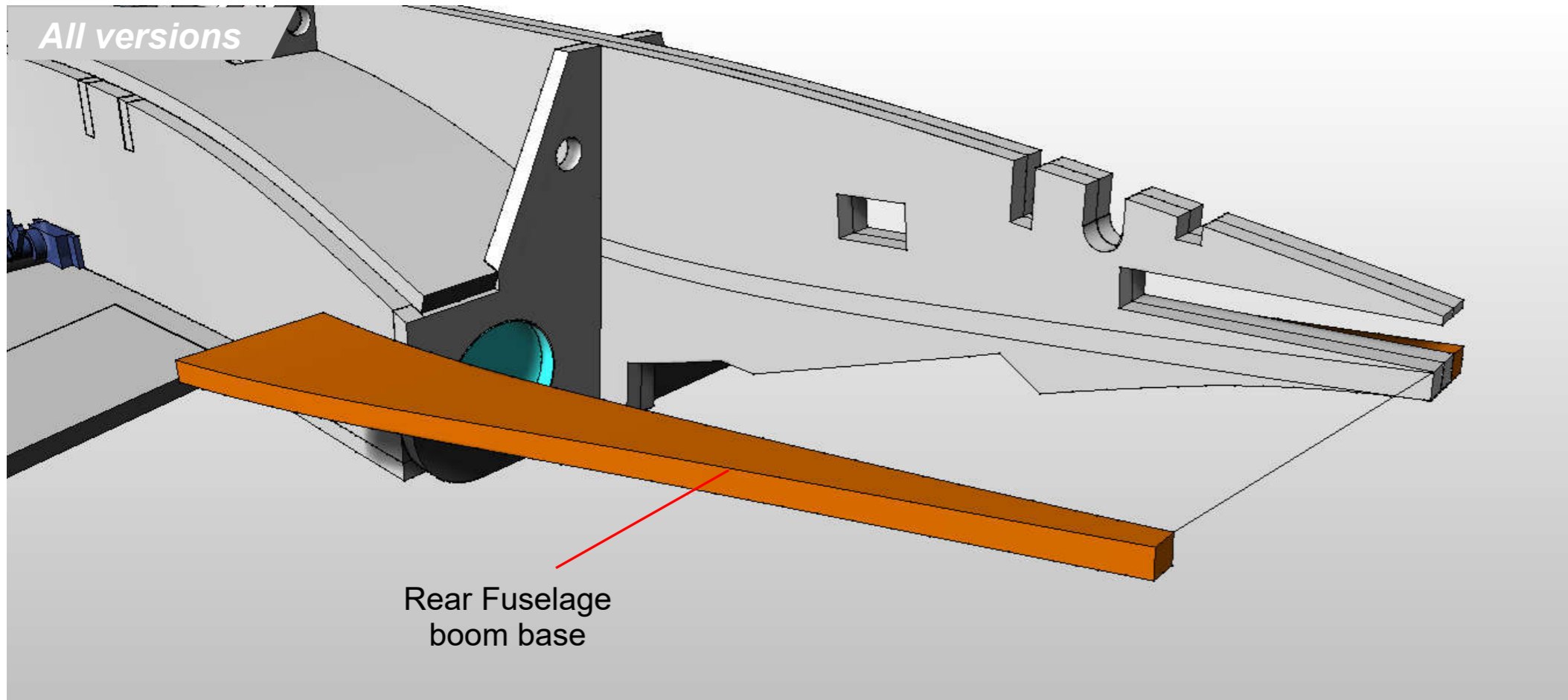
Glue both pieces of the **Aft Fuselage Spine** together then onto the fuselage.



Phantom



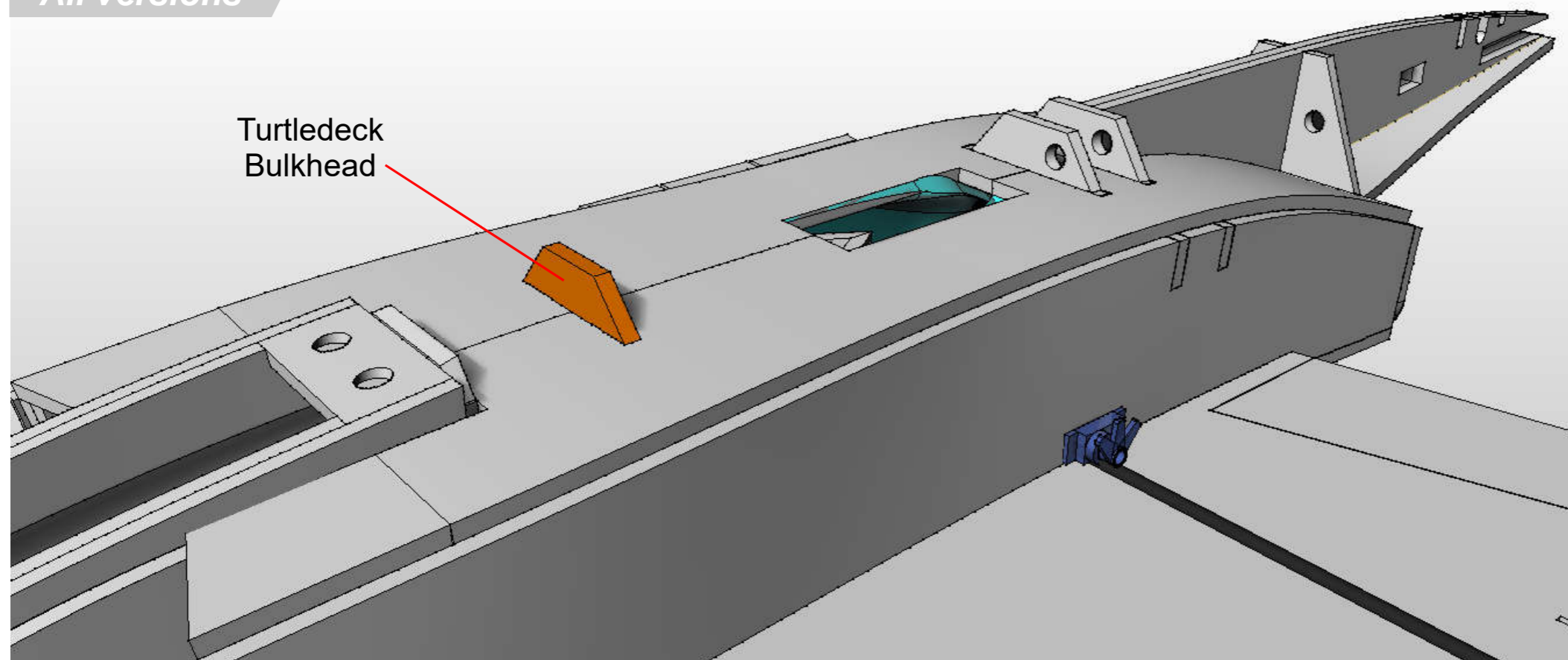
All versions



Mark the location from the plan then glue the two parts of the **Rear Fuselage Boom Base** to the assemble.



All versions

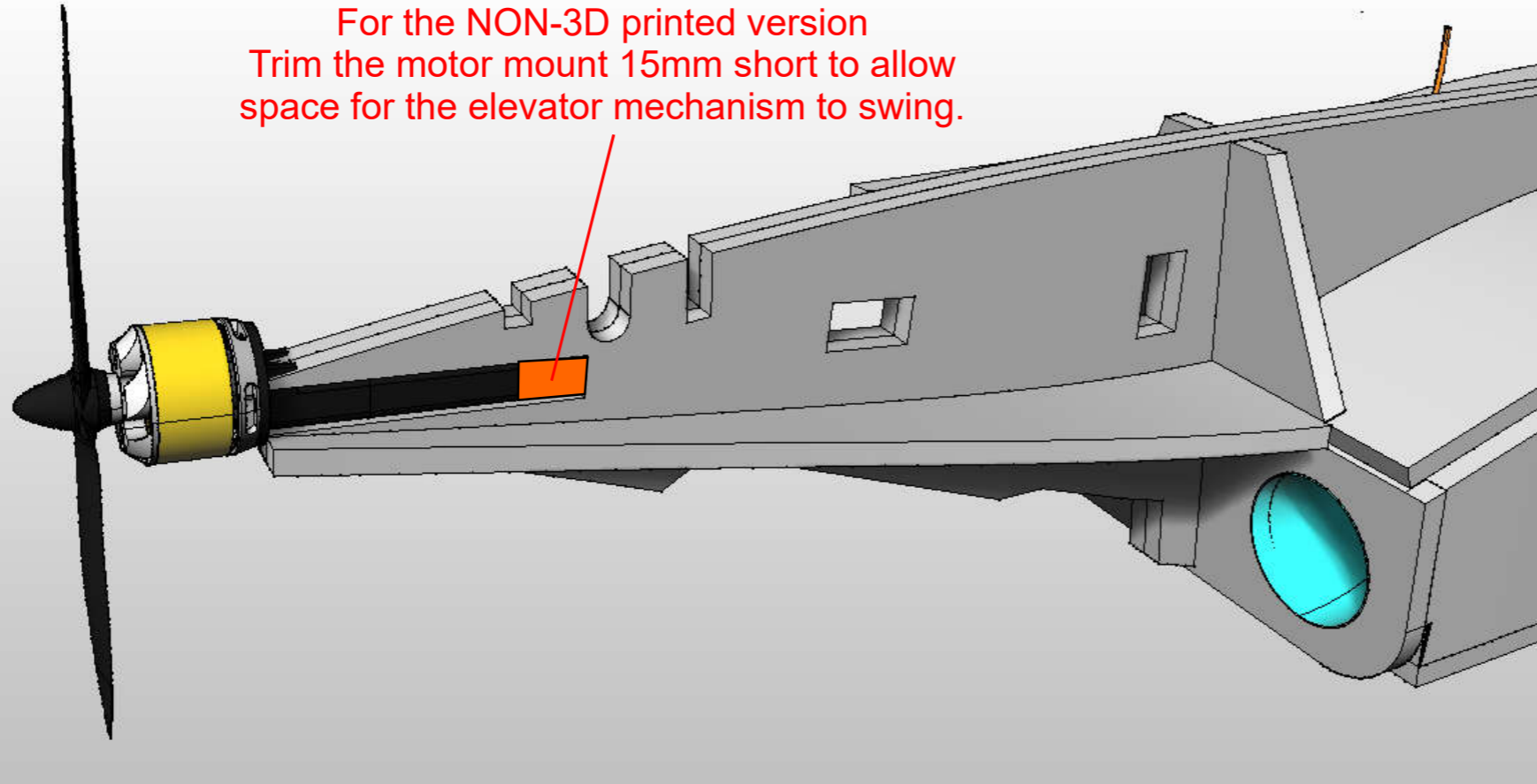


Glue The **Turtledeck Bulkhead** in place aligned in the slot on the Nacelle upper.



Pusher only

For the NON-3D printed version
Trim the motor mount 15mm short to allow
space for the elevator mechanism to swing.



Assemble the motor onto the
Stick mount.

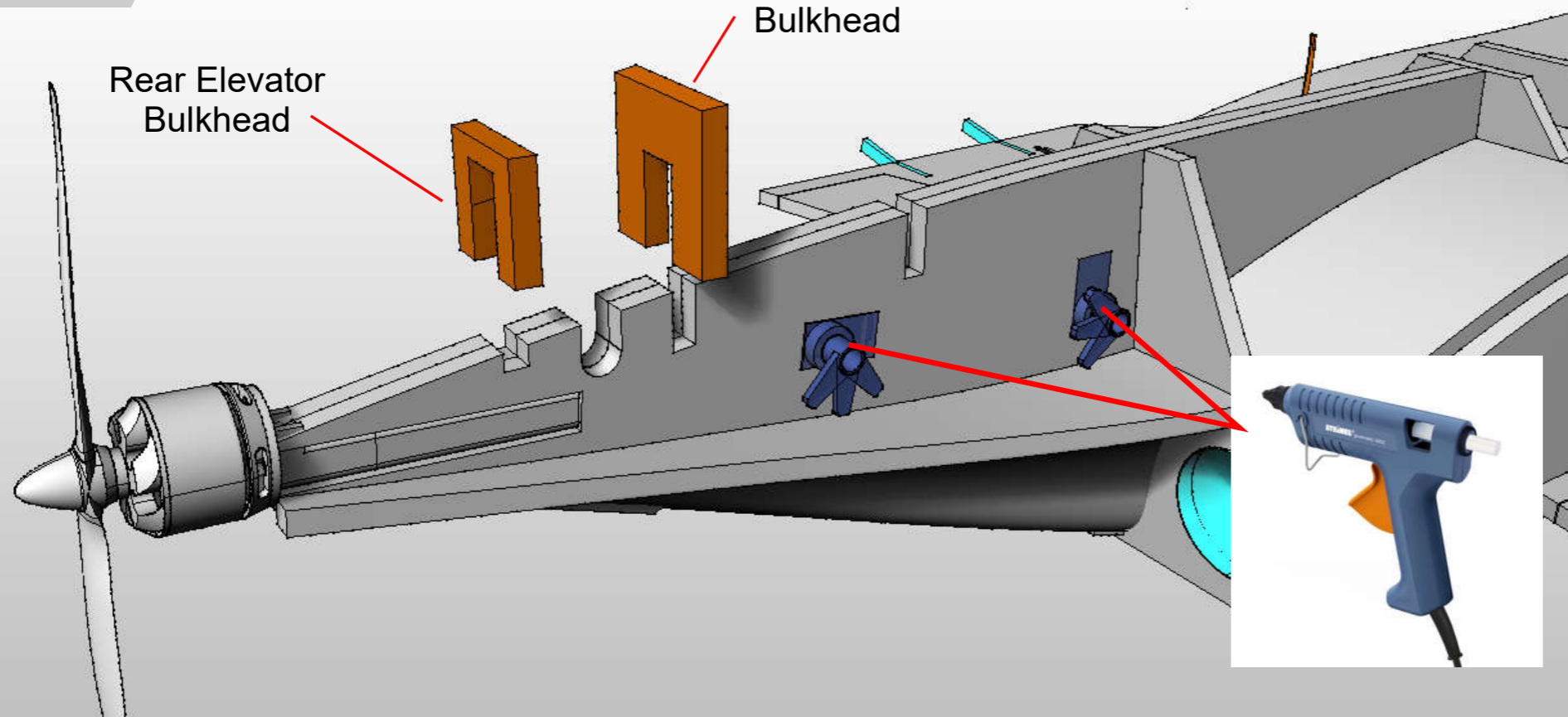
Glue the stick mount into the
slot using Hot melt Glue



All versions

Rear Elevator
Bulkhead

Forward Elevator
Bulkhead

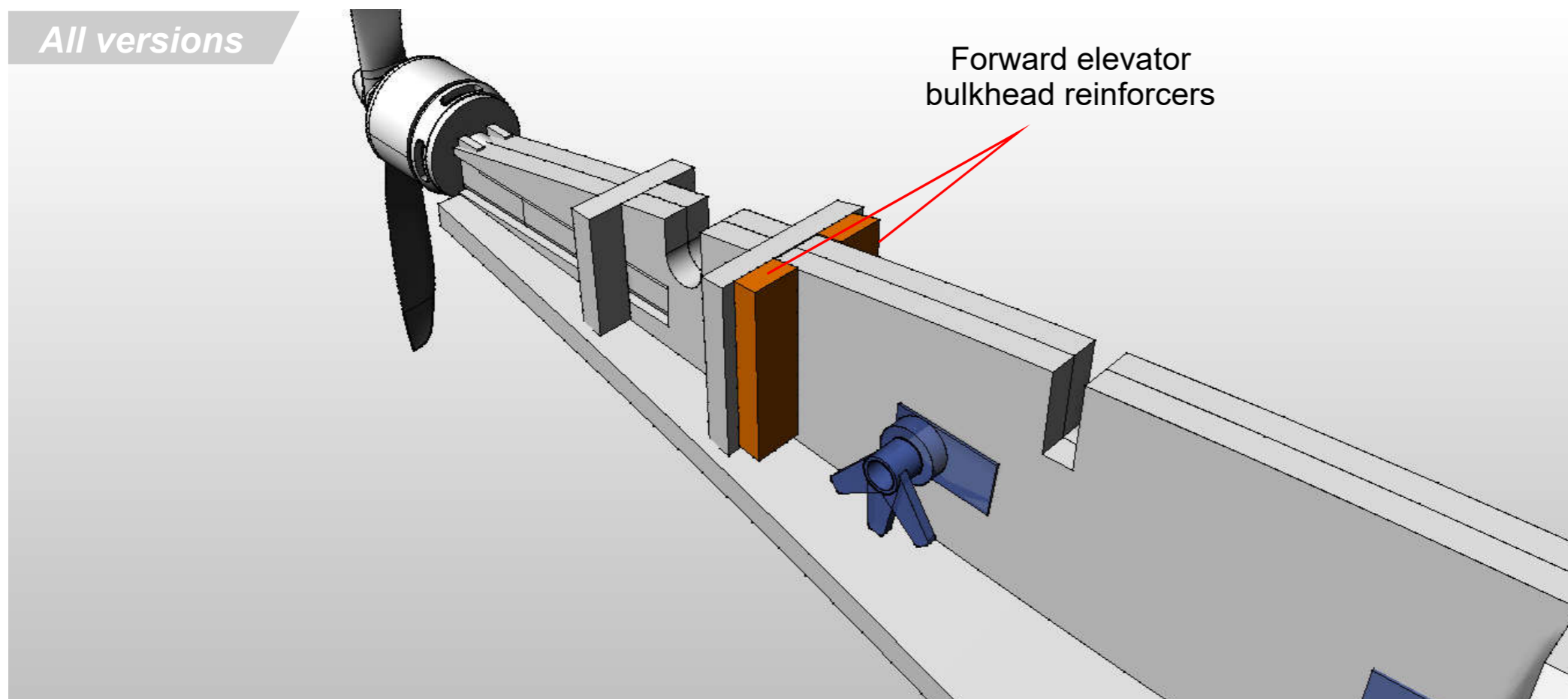


Glue the **Forward and Rear
Elevator Bulkheads** in place
using epoxy sparingly.

Glue the Elevator servo and
optional Arrestor hook servo in
place using Hot melt glue.



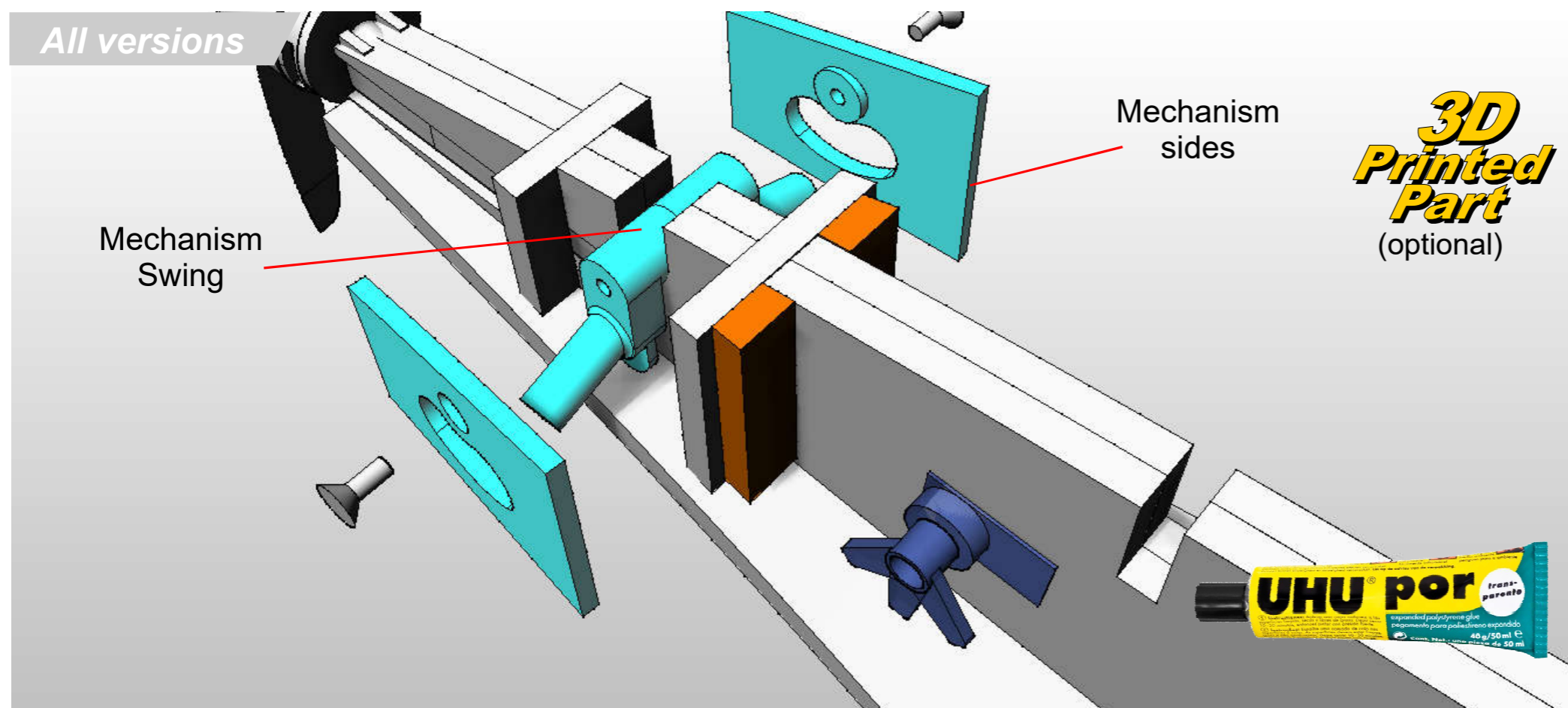
All versions



Glue the **Forward Elevator bulkhead reinforcers** in place as shown.



All versions



If you have a 3d printed, print out the **Elevator Swing Mechanism** and assemble as shown.

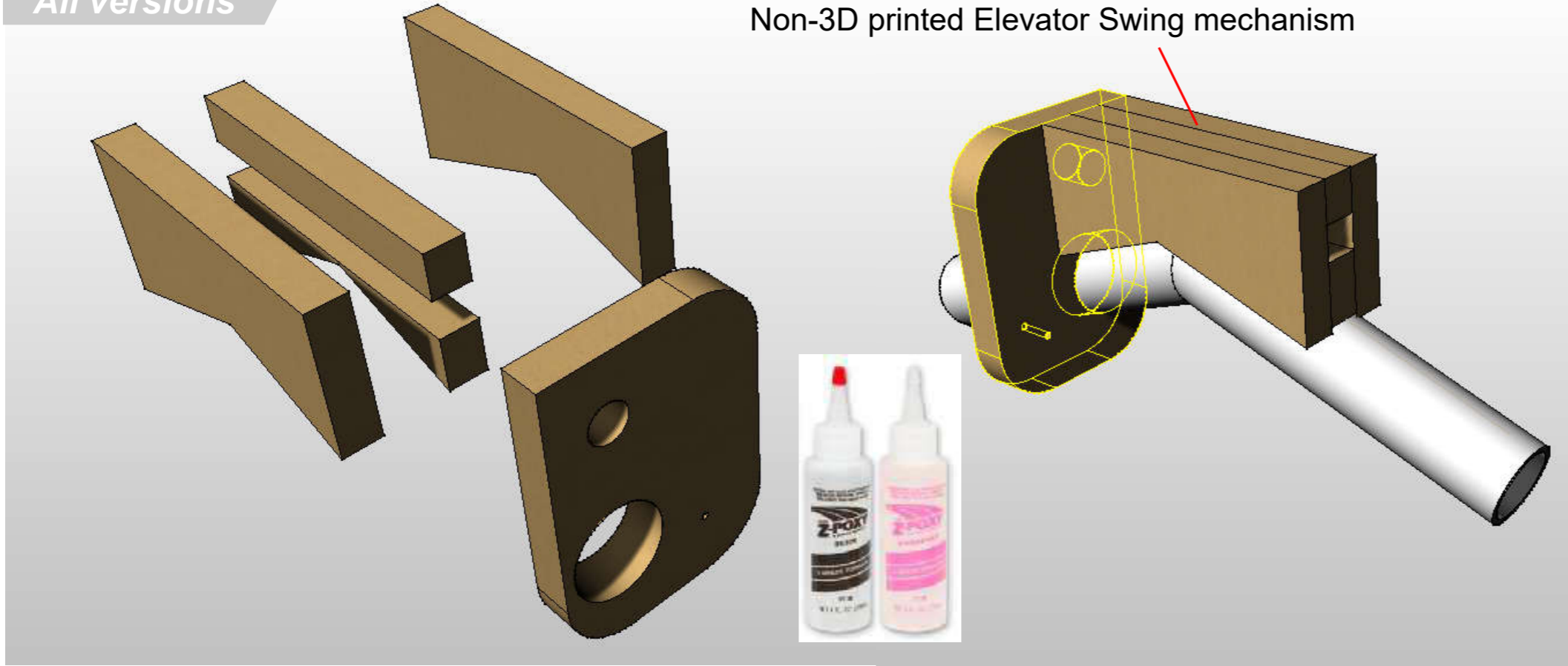
you will need to cut a hole for your pushrod to go through the forward bulkhead/retainer.

Glue both mechanism sides to the bulkheads and pin using 3mm countersunk screws tapped into the swing, but not fully tightened to allow freedom to swivel.



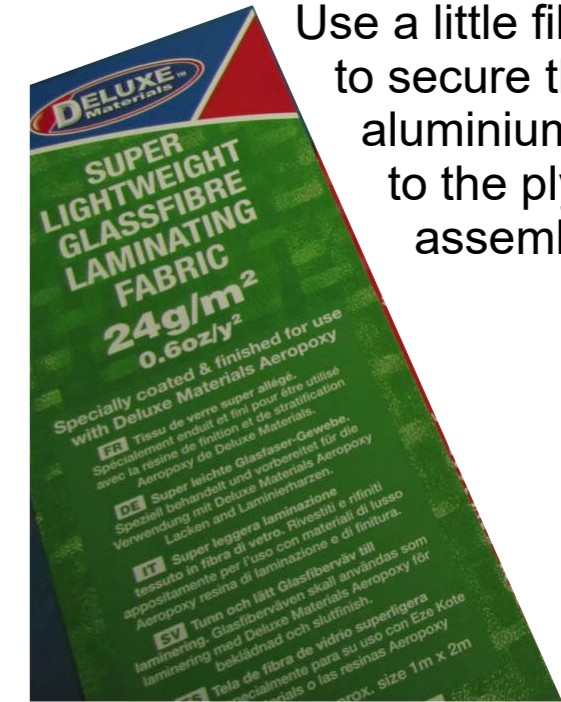
All versions

Non-3D printed Elevator Swing mechanism



Glue together the 3mm liteply **Non-3D printed Elevator Swing mechanism** using epoxy.

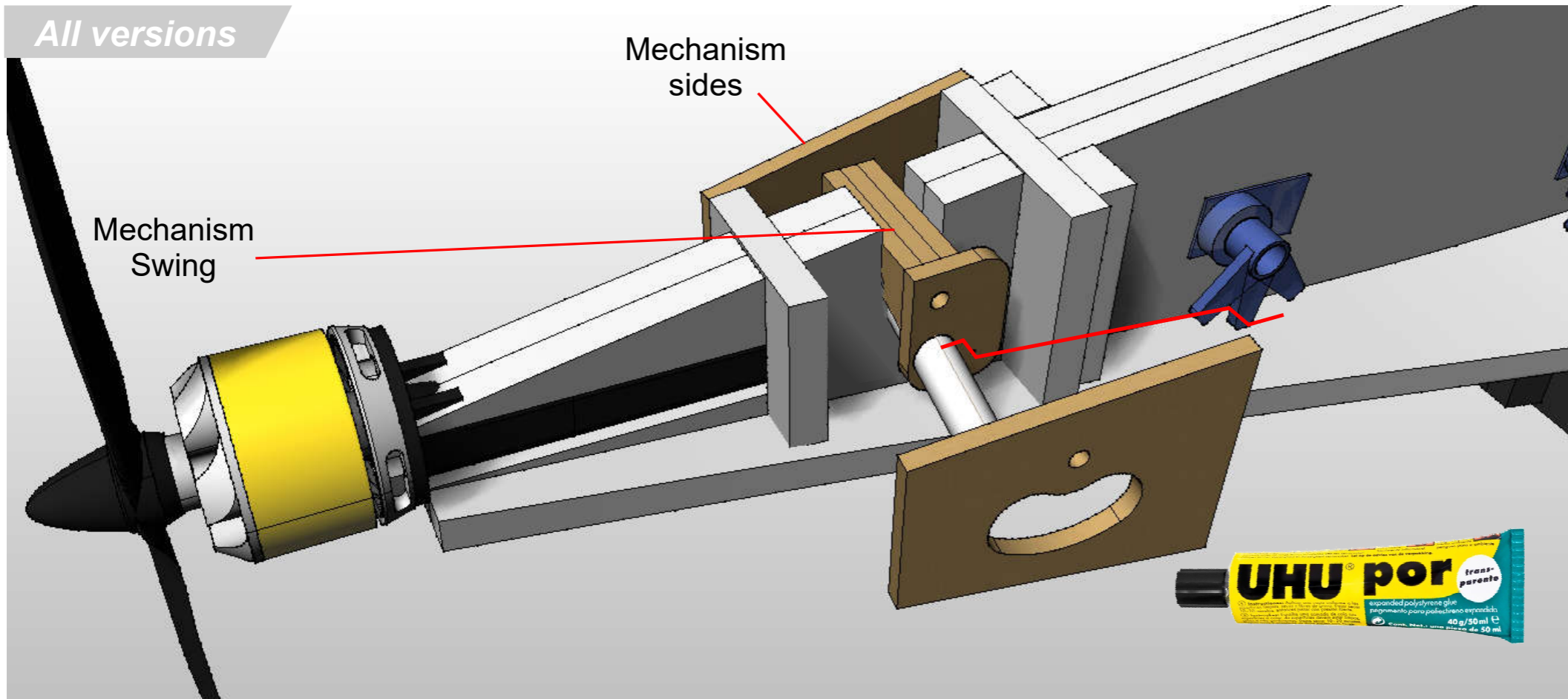
Use a little fibreglass to secure the aluminium tubes to the plywood assembly.



All versions

Mechanism sides

Mechanism Swing

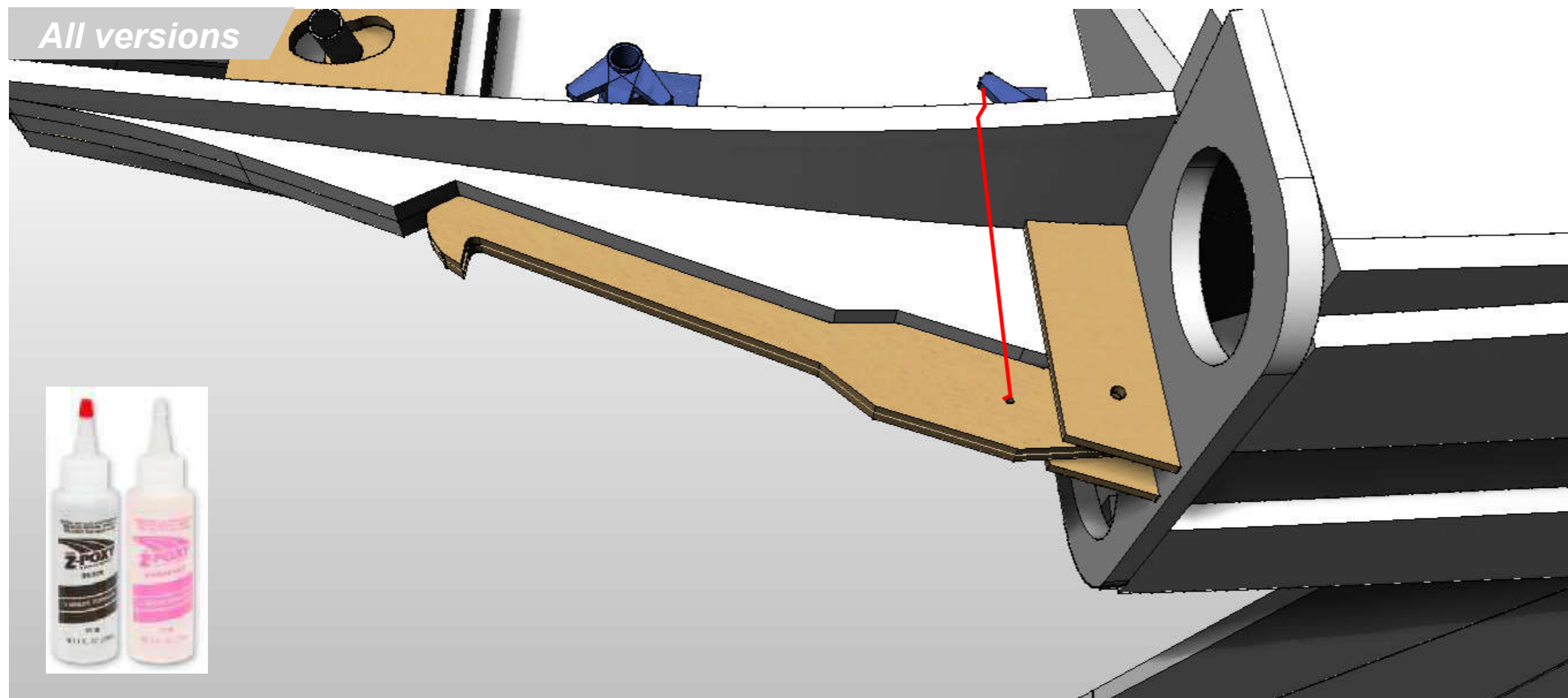


Assemble the **Elevator Swing Mechanism** as shown.

You will need to cut a hole for your pushrod to go through the forward bulkhead/retainer. You will also need to enlarge the slot that the swing sits in to allow it to move properly. (it is optimised for the 3d printed version)

Glue both mechanism sides to the bulkheads and pin using 3mm countersunk screws glued into the swing, but not fully tightened to allow freedom to swivel.



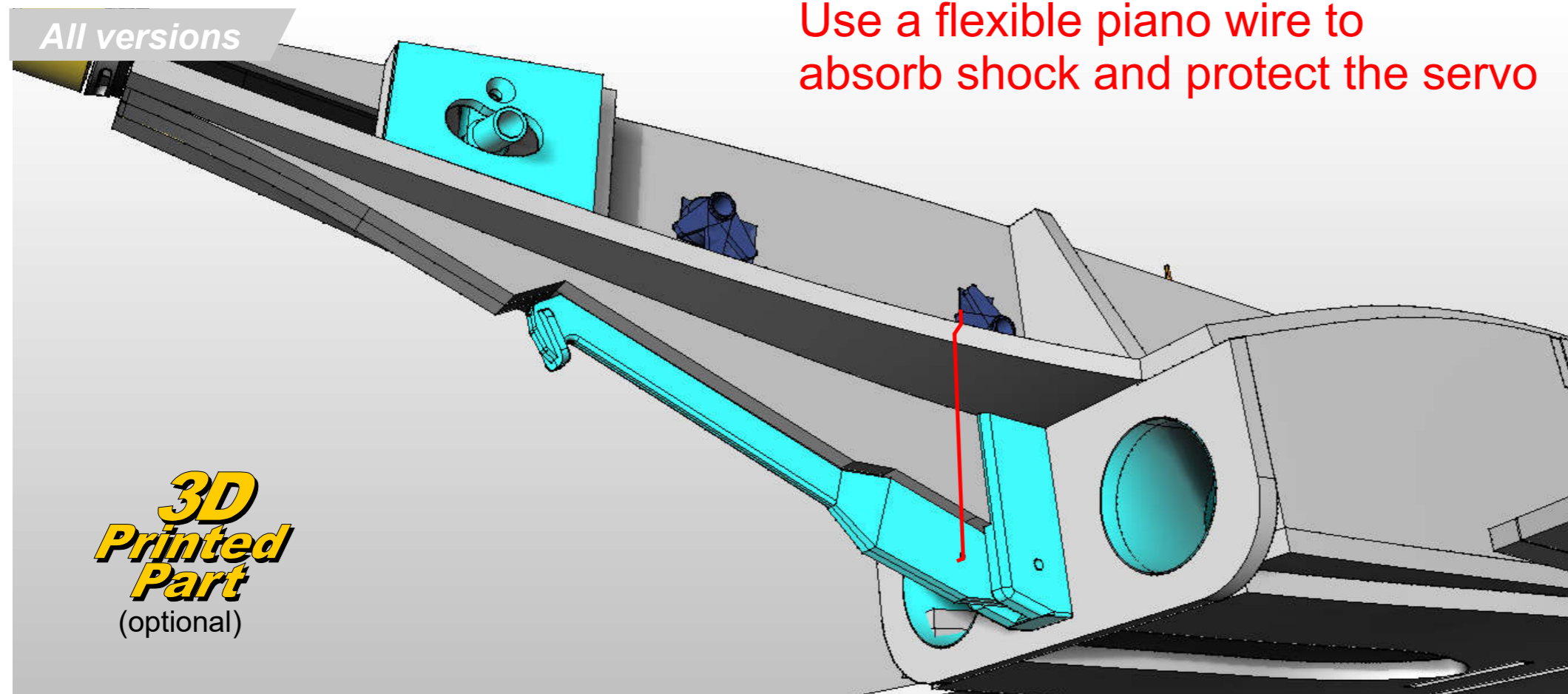


For the optional working arrestor hook, glue the two pieces of 3mm lite-ply hook together.

Glue the arrestor hook bracket onto the fuselage as shown using epoxy.

Create a push-rod and make a hole through the boom base for it to pass through then connect the servo to the hook. I recommend a metal gear servo for this task.

Pin the hook into the bracket using an M3 machine screw nuts and washers.

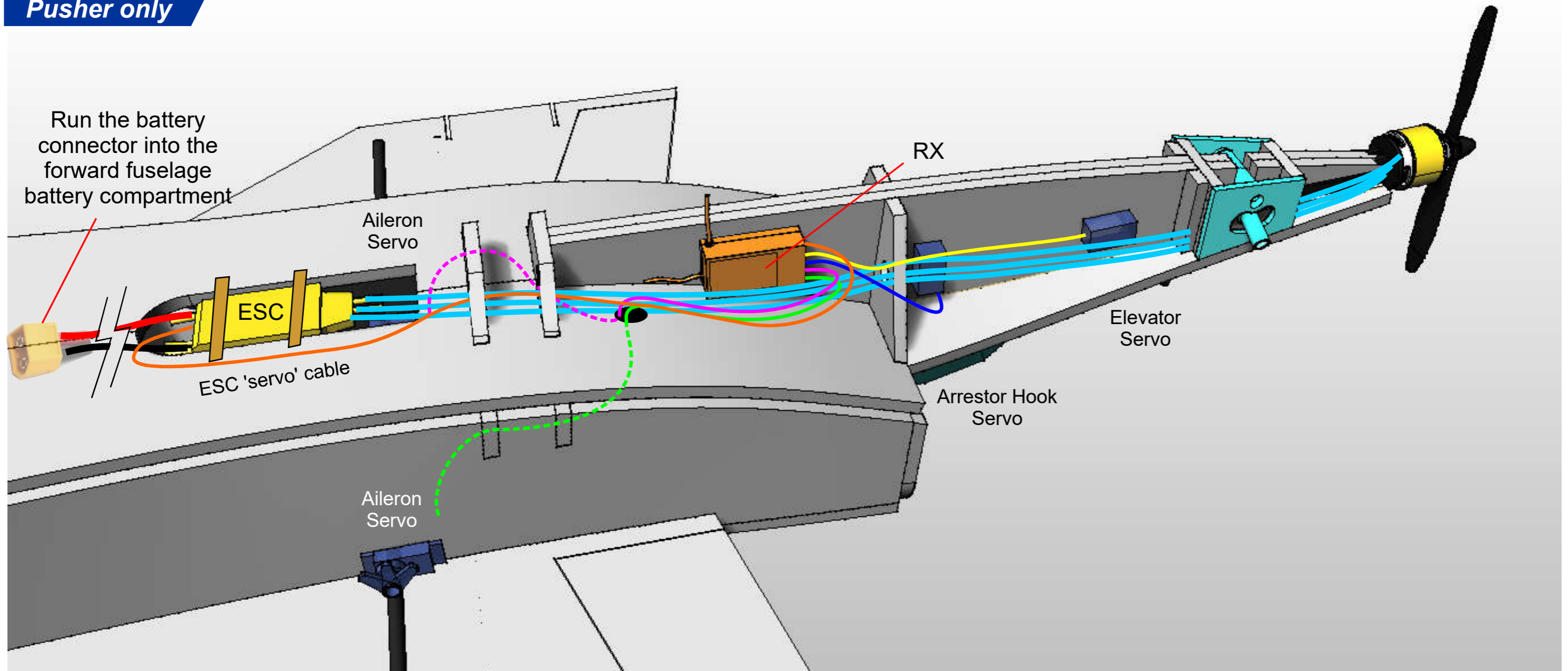


Alternatively use the 3d printed parts in the same manner.

Glue both sides of the arrestor hook together using superglue Gel.



Pusher only



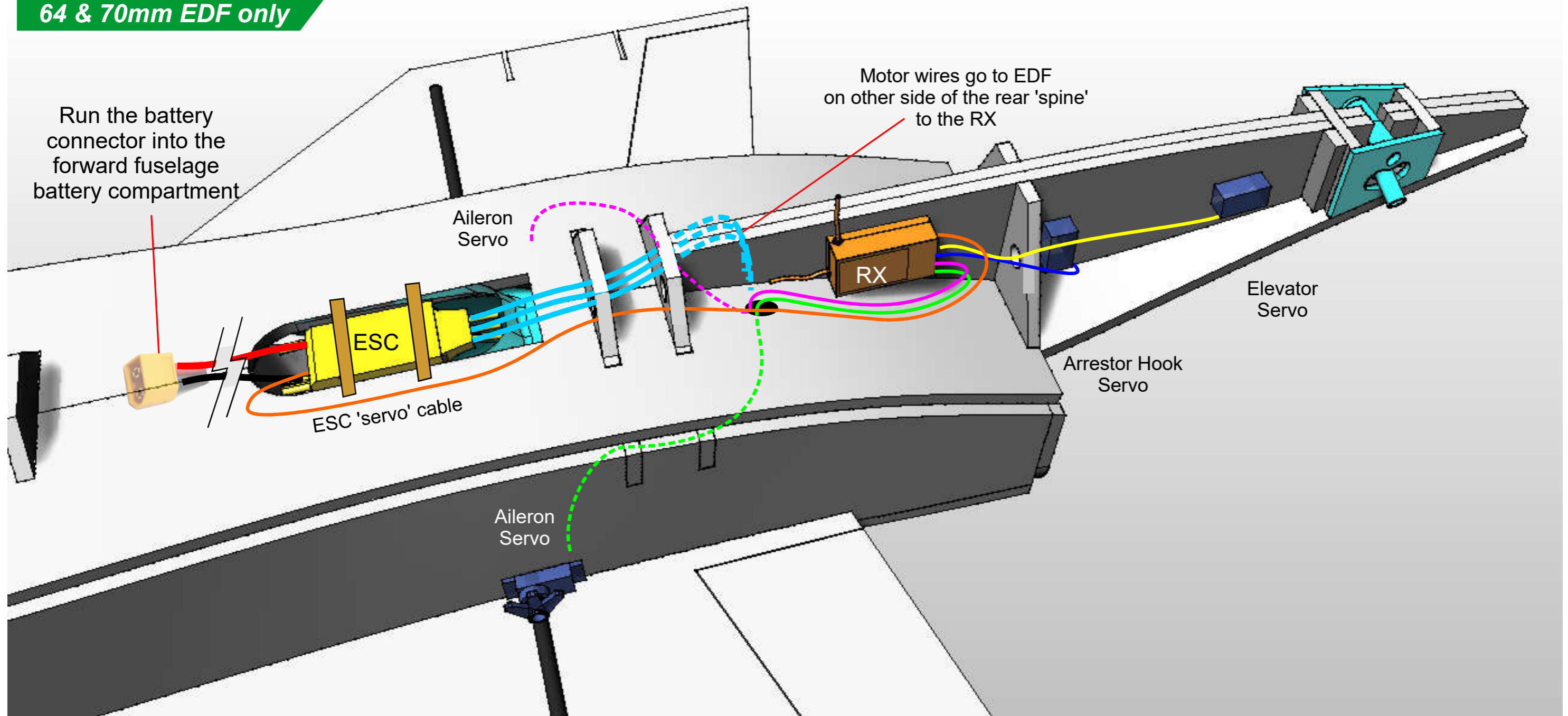
Position the ESC over the top of the ESC cooling hole - Use a lollipop stick or a couple of pieces of wooden coffee stirrers to hold the ESC in position.

use a servo extension cable wherever you need them, and run the servo cables through the Bulkheads (along with the motor cables)

Connect the motor to the wiring and test / set-up the servos.



64 & 70mm EDF only



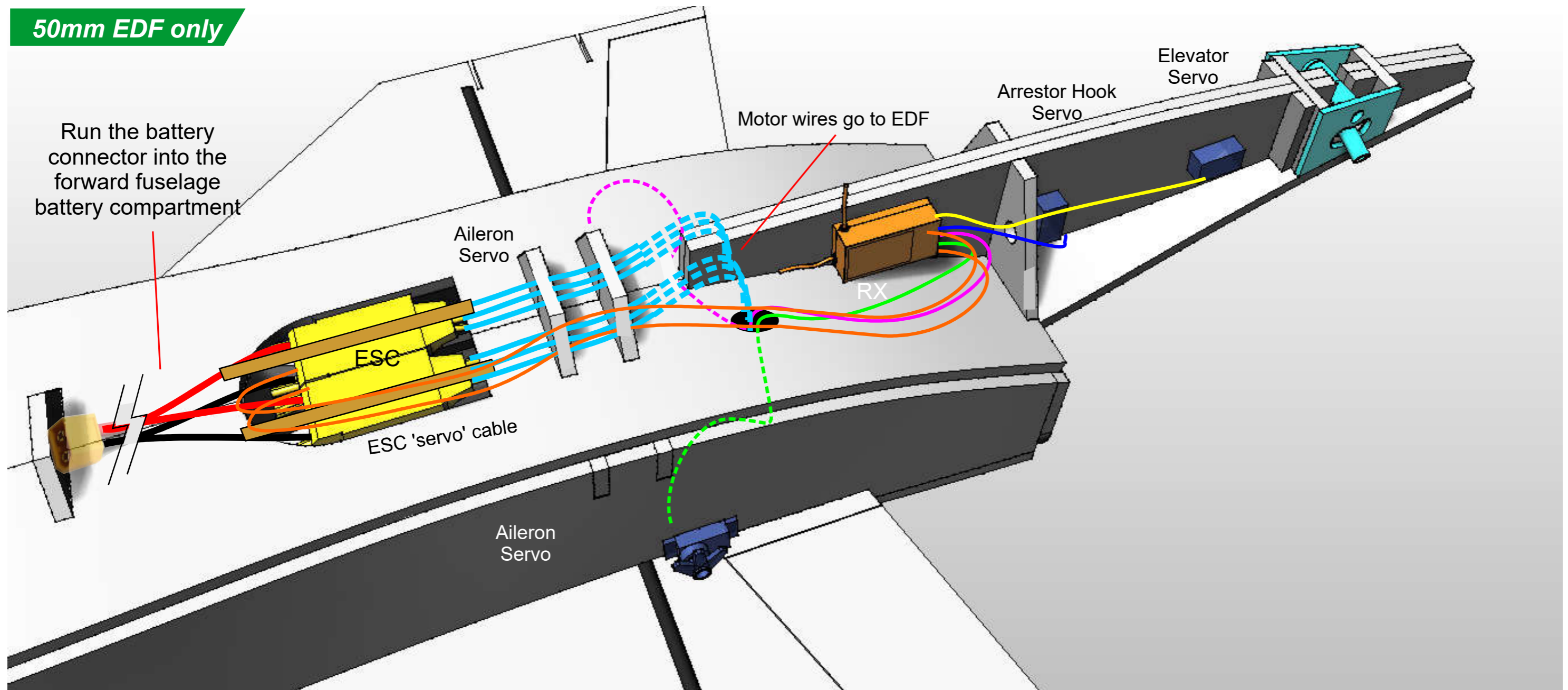
Position the ESC over the top of the ESC cooling hole - Use a lollipop stick or a couple of pieces of wooden coffee stirrers to hold the ESC in position.

use a servo extension cable wherever you need them, and run the servo cables through the Bulkheads (along with the motor cables)

Connect the motor to the wiring and test / set-up the servos.



50mm EDF only

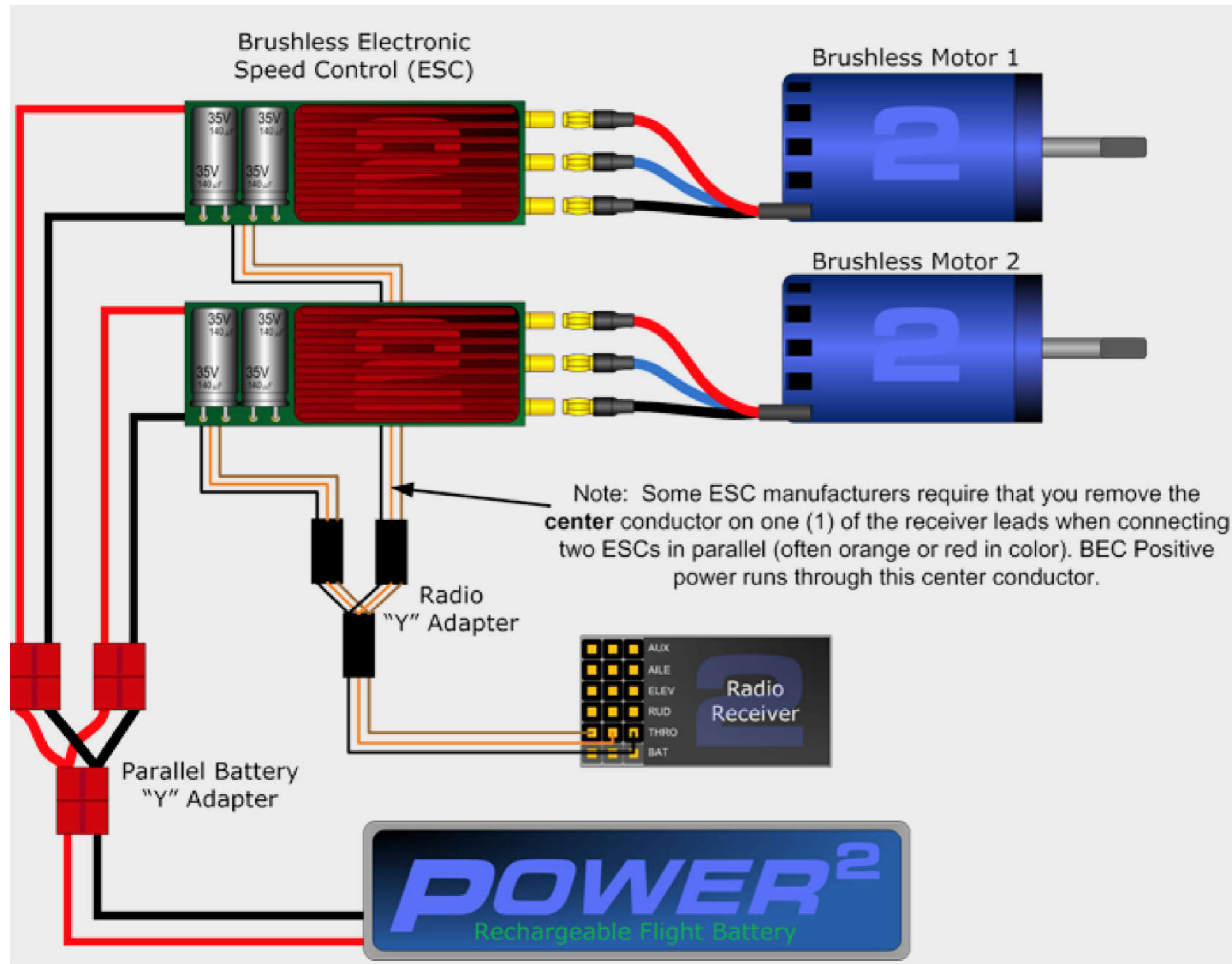


Position the ESC over the top of the ESC cooling hole - Use a lollipop stick or a couple of pieces of wooden coffee stirrers to hold the ESC in position.

use a servo extension cable wherever you need them, and run the servo cables through the Bulkheads (along with the motor cables)

Connect the motor to the wiring and test / set-up the servos.





I found this image on the internet - I am not sure who created it, but it is a clear diagram of how to set up a single battery / twin motor setup.

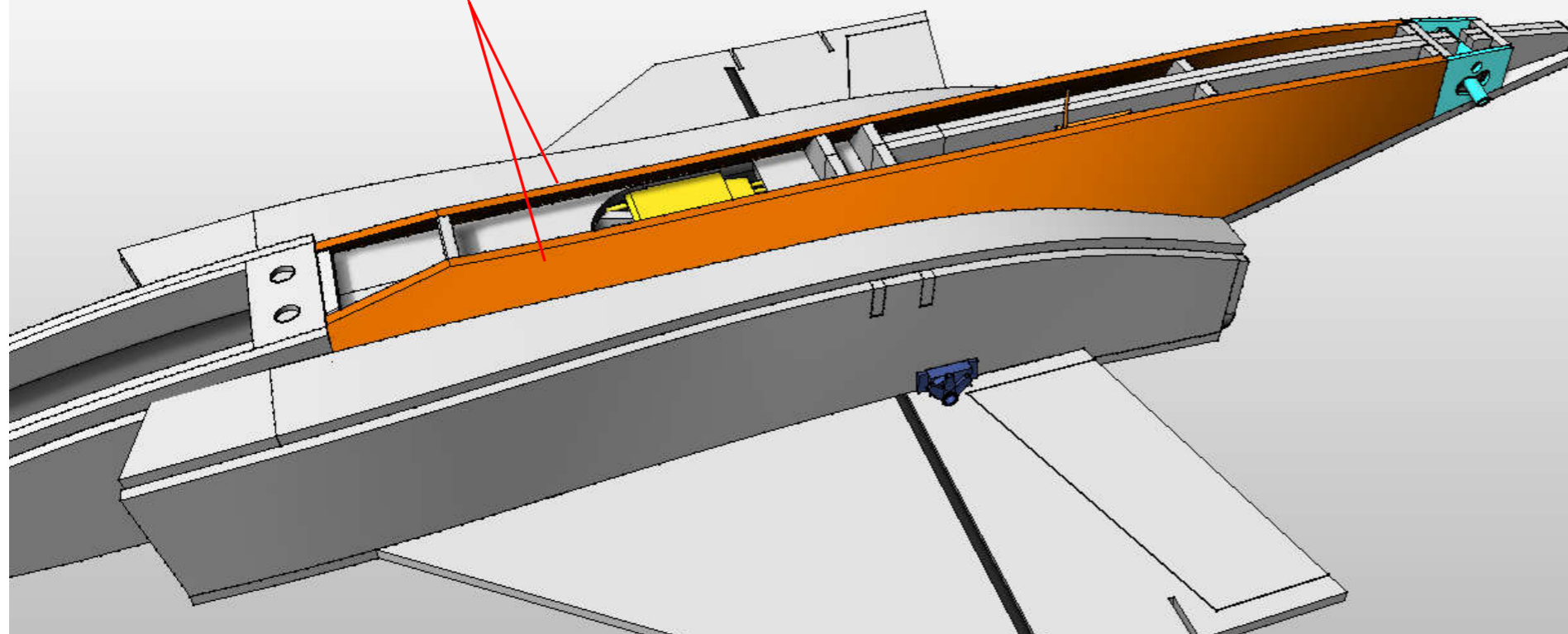
Be sure to investigate with your RX manufacturer whether you need to have a single or can have dual power feeds from your ESC's.

If in any doubt, remove one red wire terminal from the ESC and tape it to prevent it touching anything.



All versions

Turtledeck sides - forward

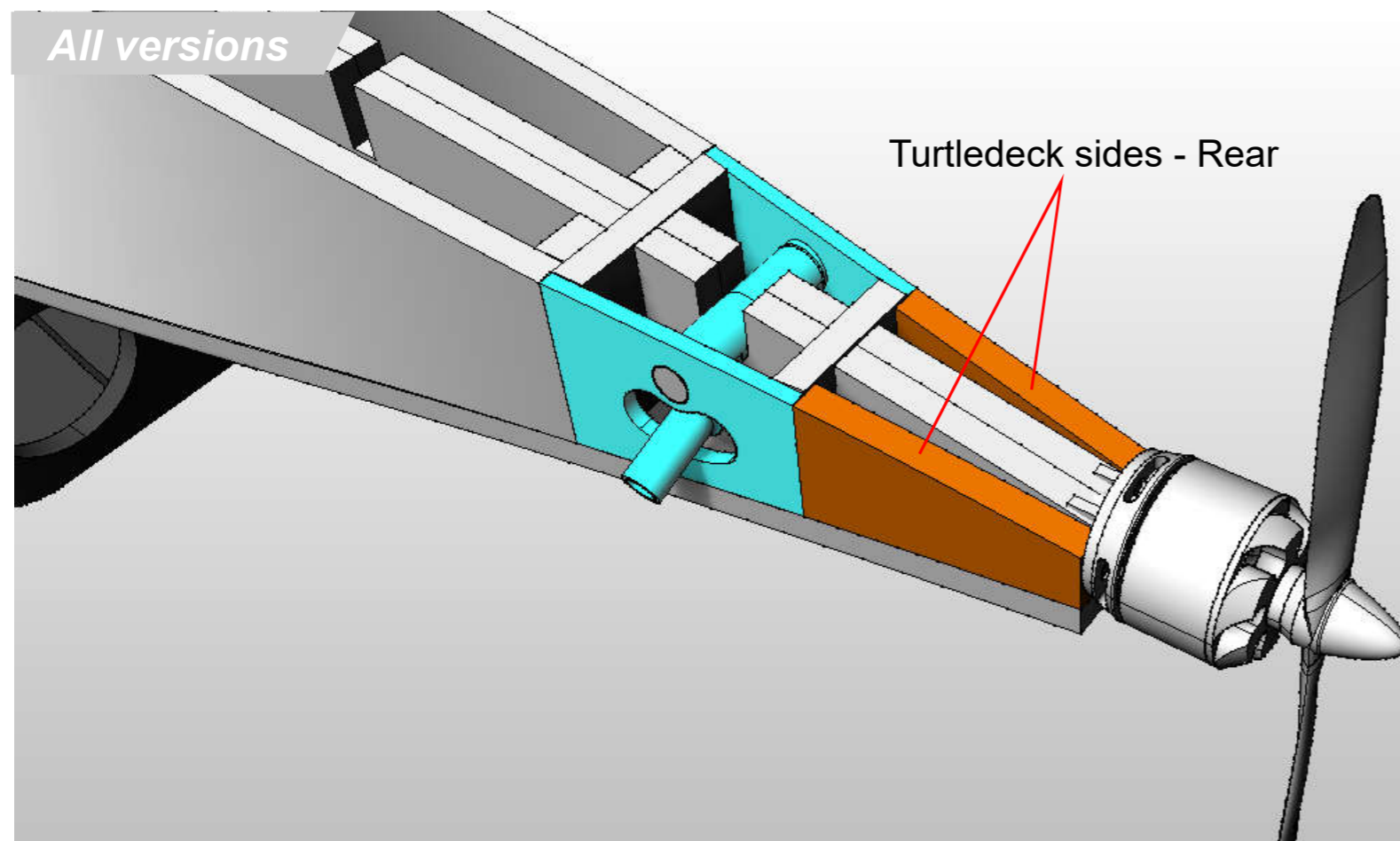


Pre-shape the **Turtledeck Sides (Forward)** then glue to the assembly as shown.



All versions

Turtledeck sides - Rear



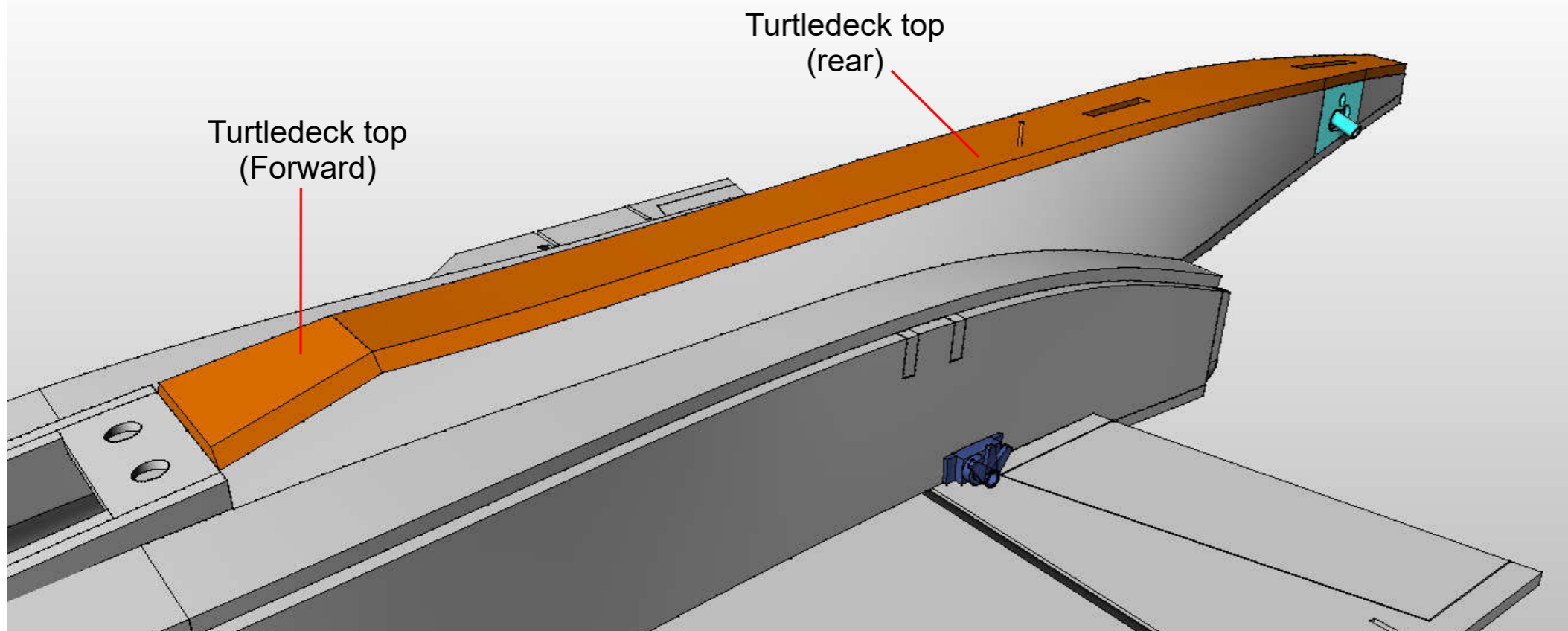
Glue the **Turtledeck Sides (Rear)** to the assembly as shown.



Phantom



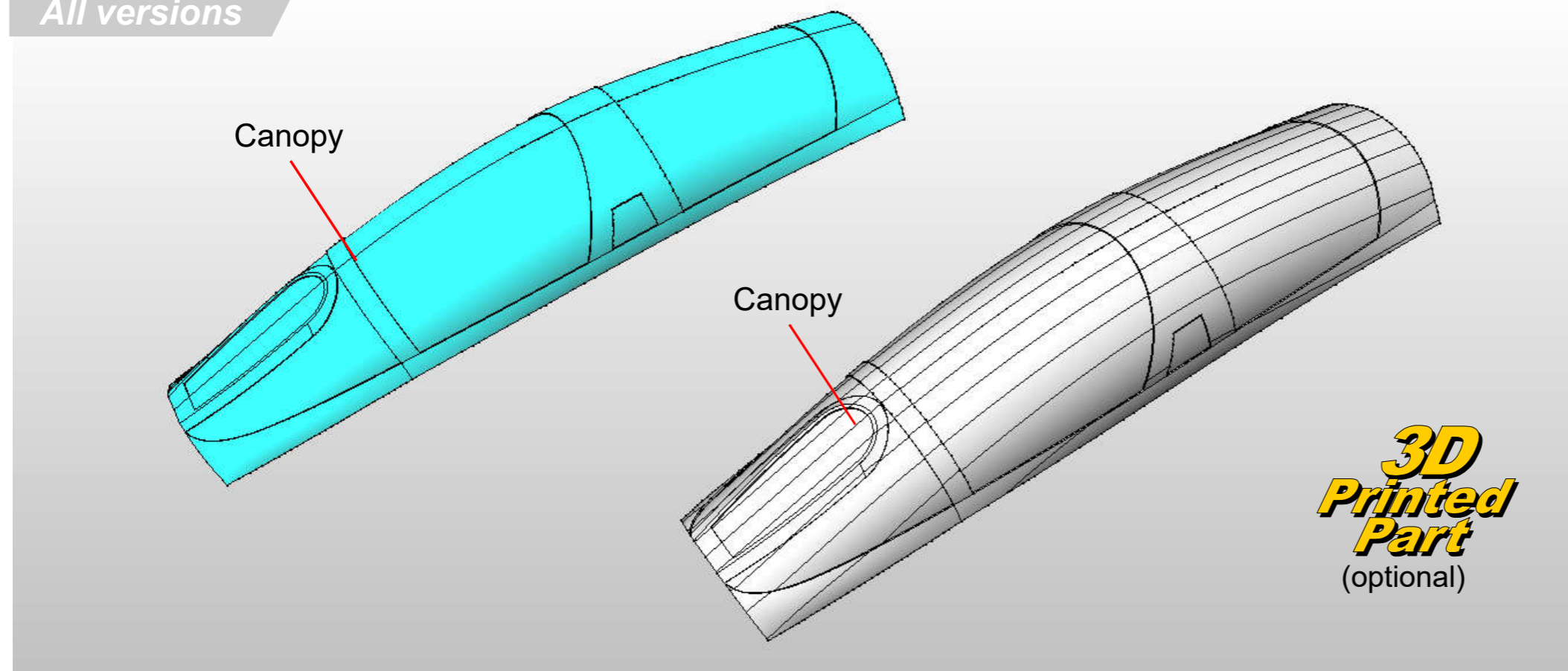
All versions



Glue the **Turtledeck top** pieces to the assembly.



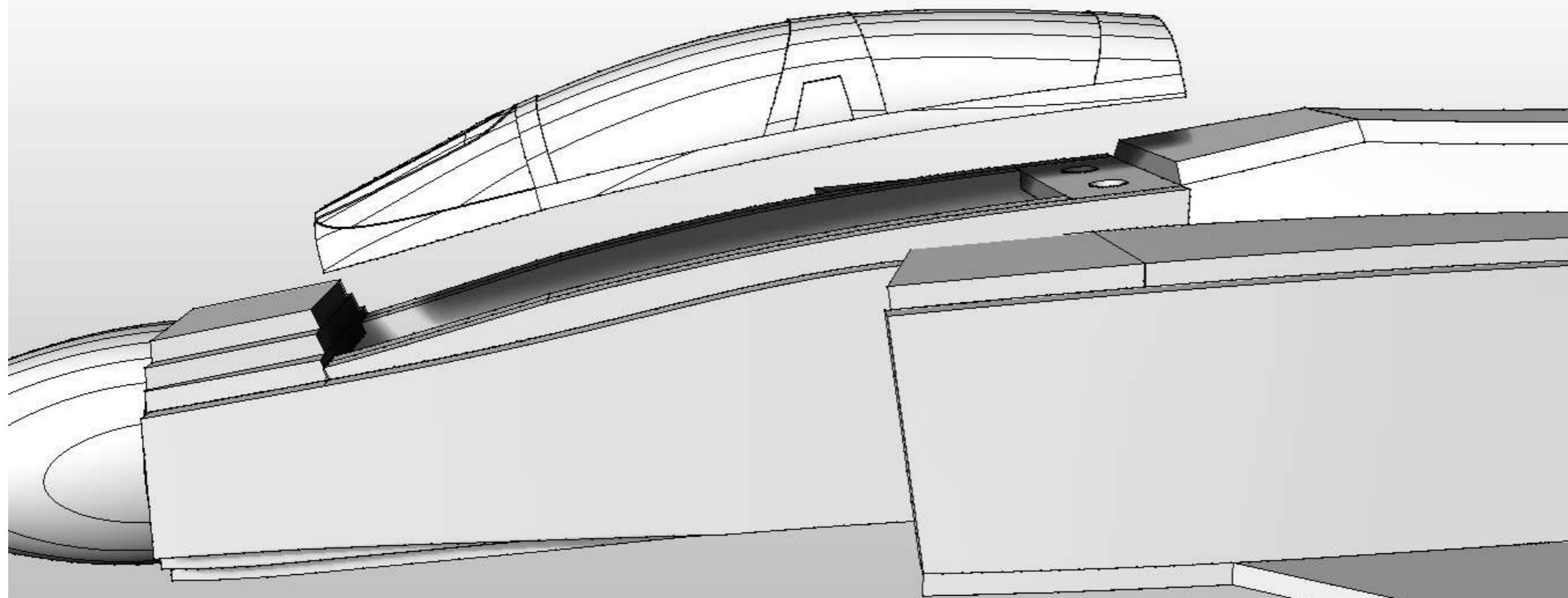
All versions



Either make a canopy using laminated depron, 3D printing or via a vacuum forming.



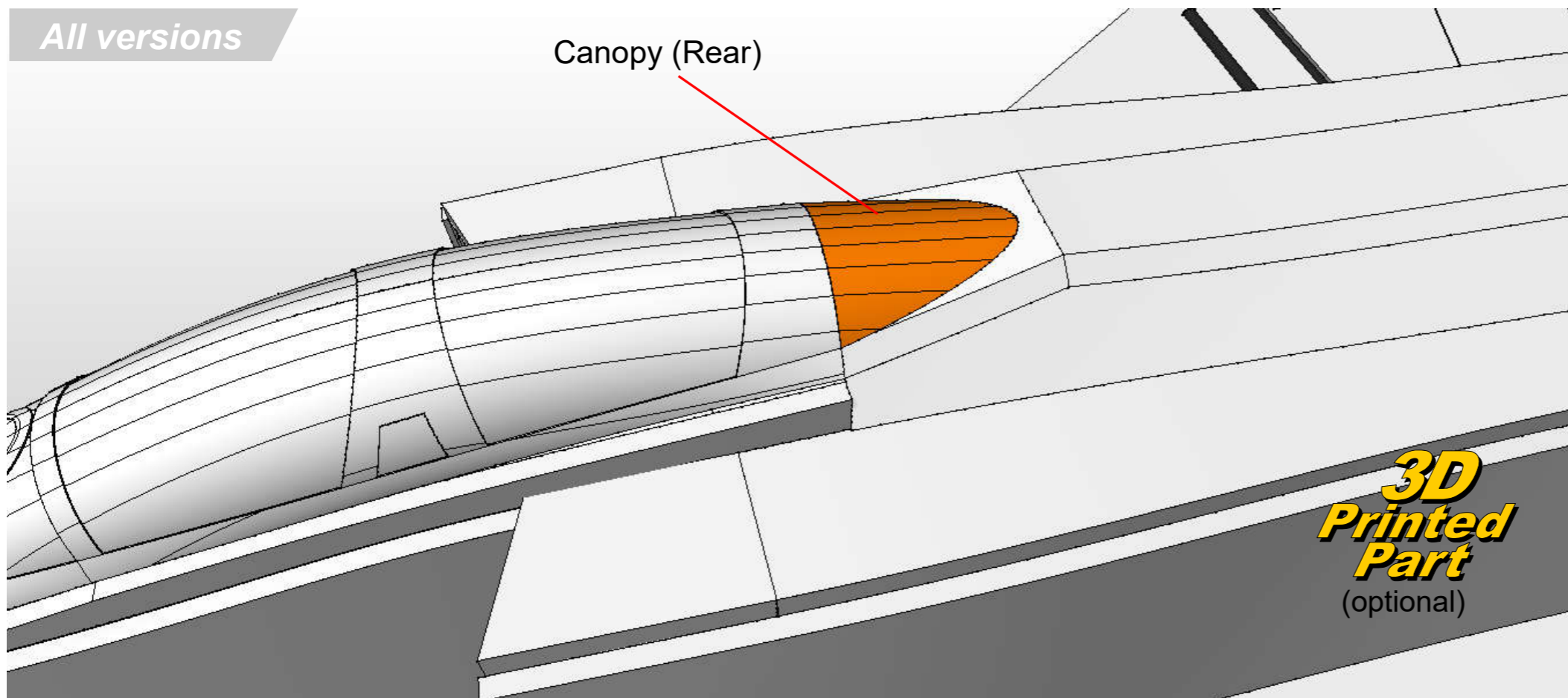
All versions



Glue in Magnets using Epoxy.
Fit a 3mm liteply tongue. fit the canopy to the fuselage.



All versions



Canopy (Rear)

**3D
Printed
Part**
(optional)

Glue the **Canopy (rear)** to the fuselage as shown.

Either fabricate using layers of depron or make one using a 3d printer

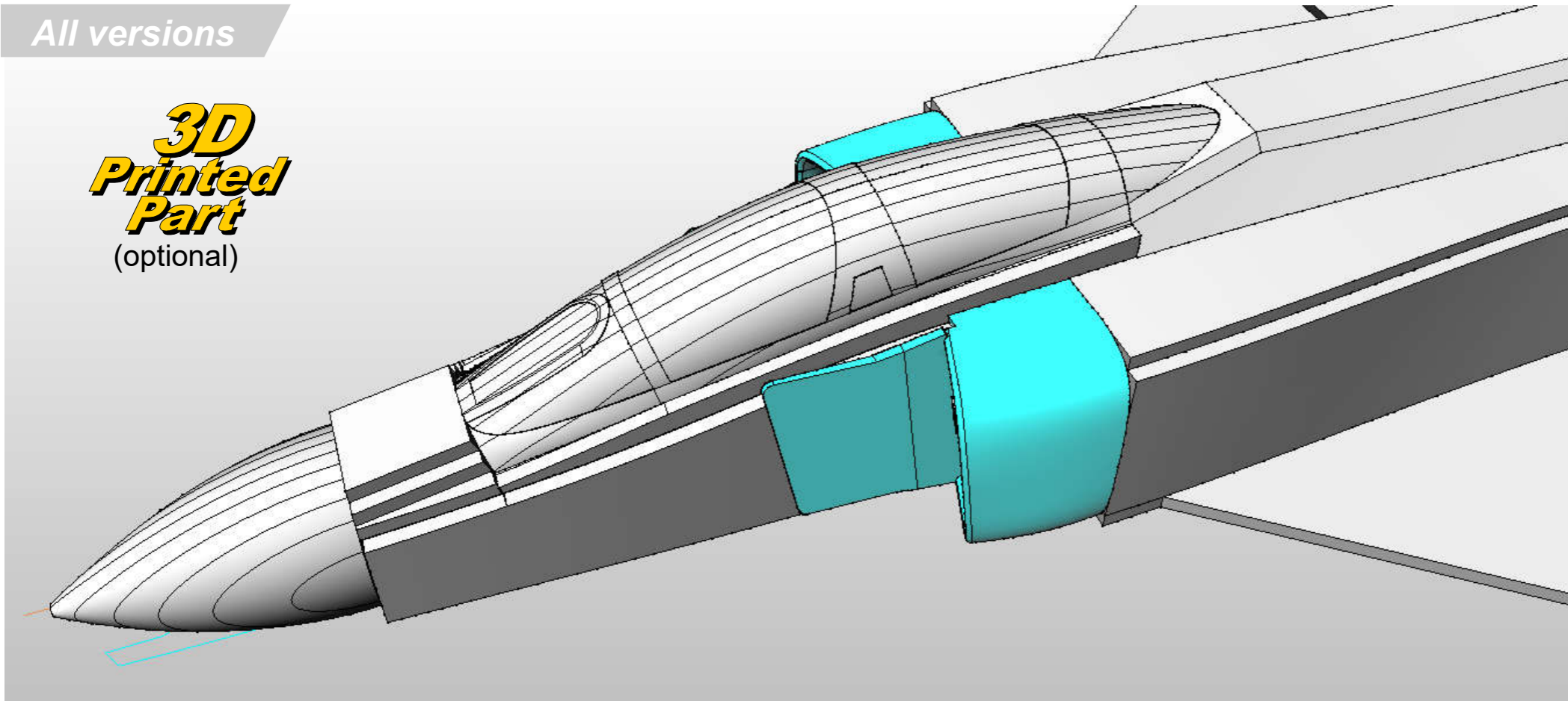


Phantom



All versions

**3D
Printed
Part**
(optional)

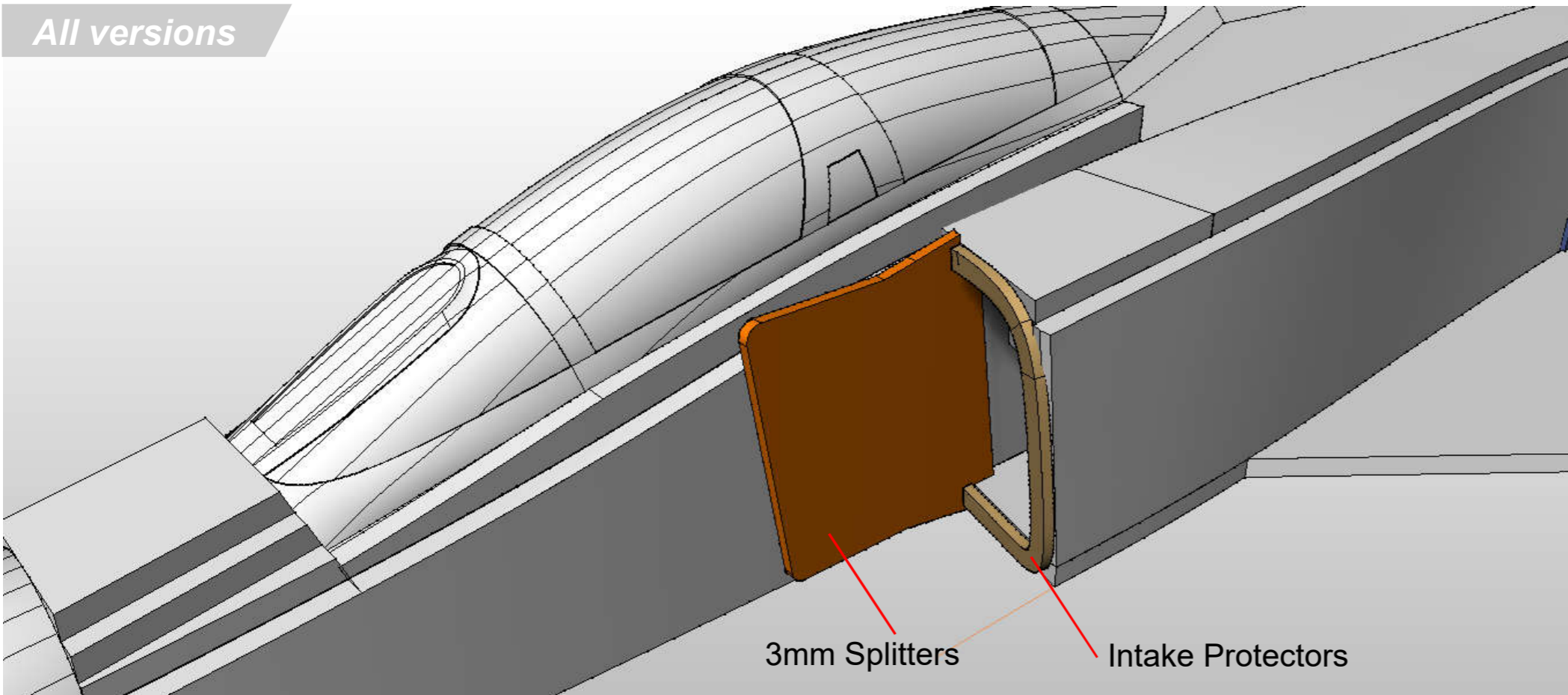


3D Printed version.

Trim away the Nacelle details as indicated on the plans and glue the **3D Printed Intakes** onto the aircraft.



All versions



Non- 3D Printed Version

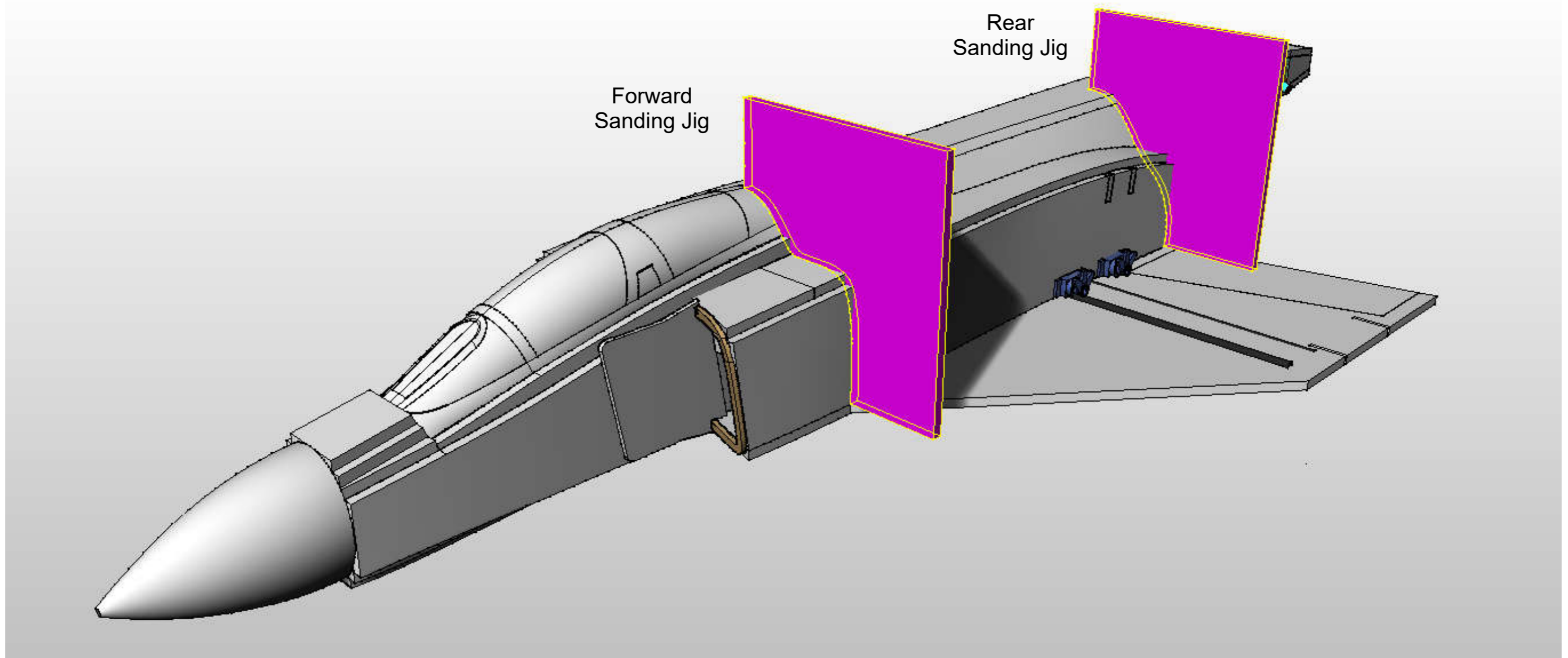
Glue the 3mm foam **Splitters** in place.

Trim out the **Intake Protectors** from 3mm Lite-ply and glue to the leading edge of the intake as shown.



Phantom

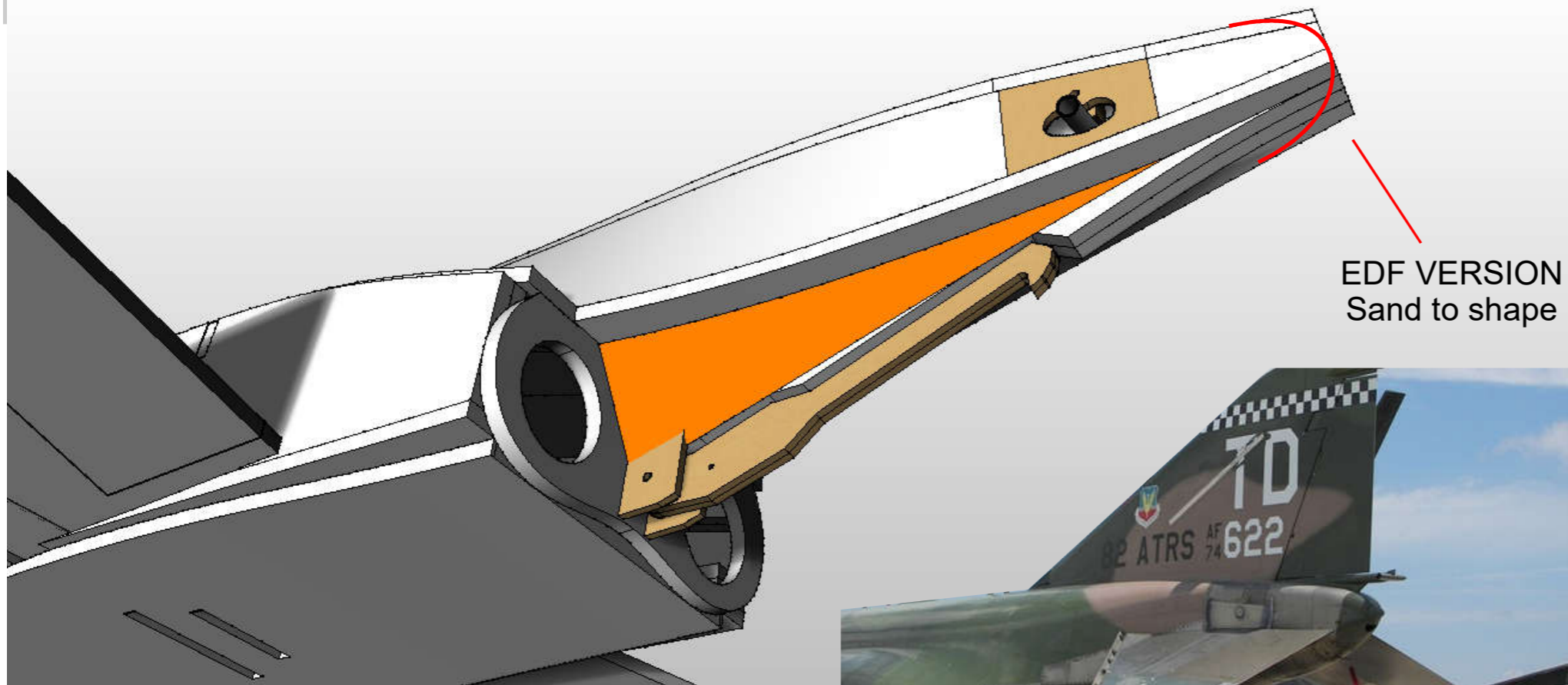




Align the Sanding Jigs to the wing leading edge root, and trailing edge root.

Use extendable craft knives for removing the bulk of the material then use a palm sander to get the correct shape. Hand finish with finer and finer grades of sandpaper (always with block) until you have a smooth finish.

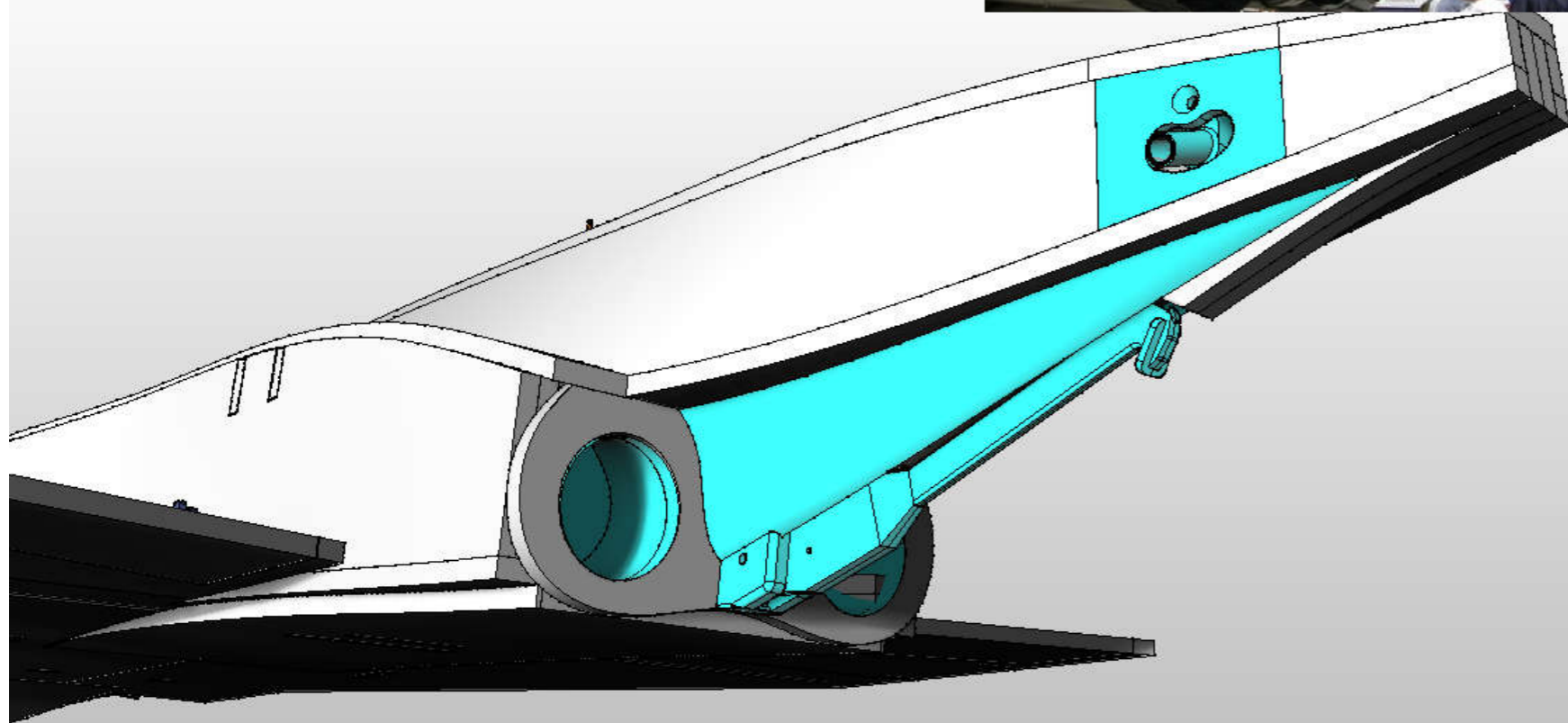




EDF VERSION
Sand to shape



All versions



**3D
Printed
Part**
(optional)

Glue the two 3mm foam **Rear Fuselage Exhaust shields** in place.

For the EDF version of the plane
Sand the end of the fuselage to
match the real plane.



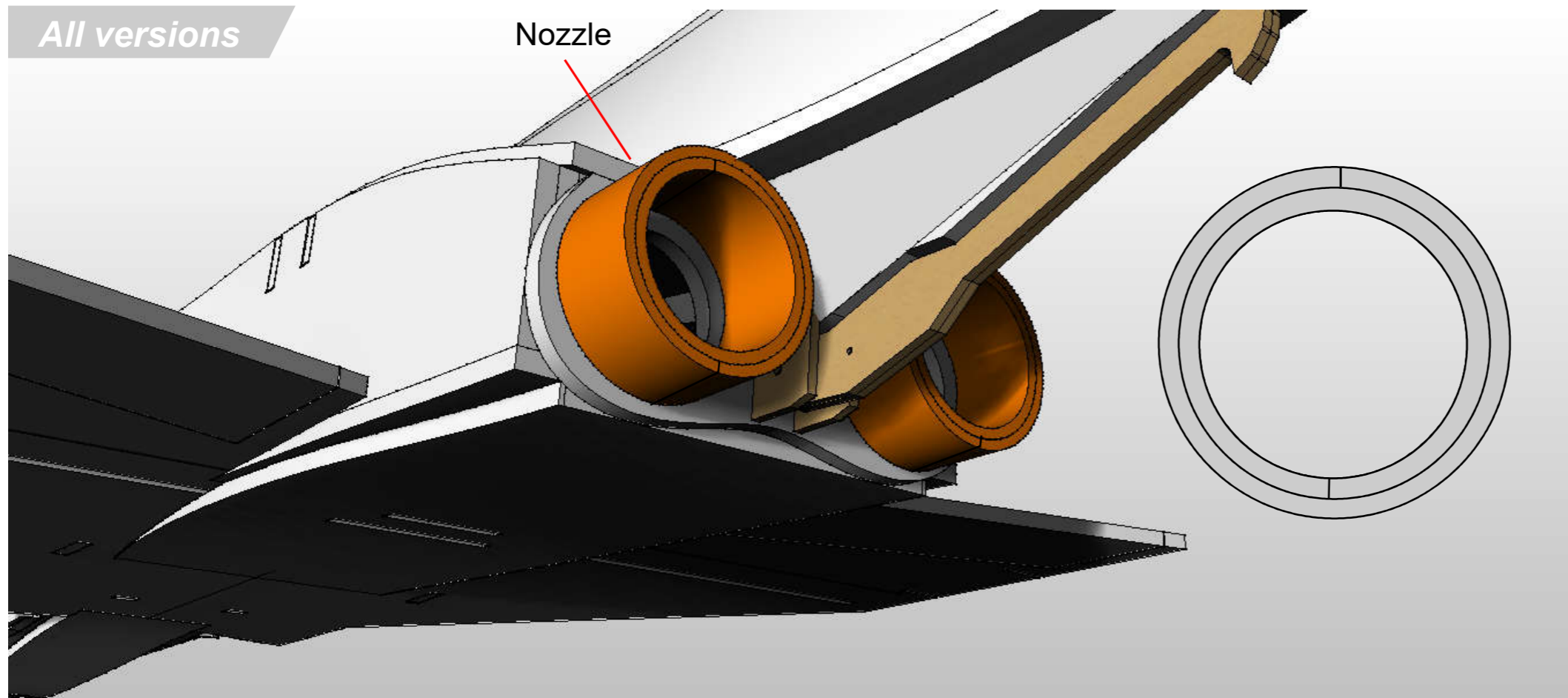
Alternatively use the 3D printed
version.



Phantom



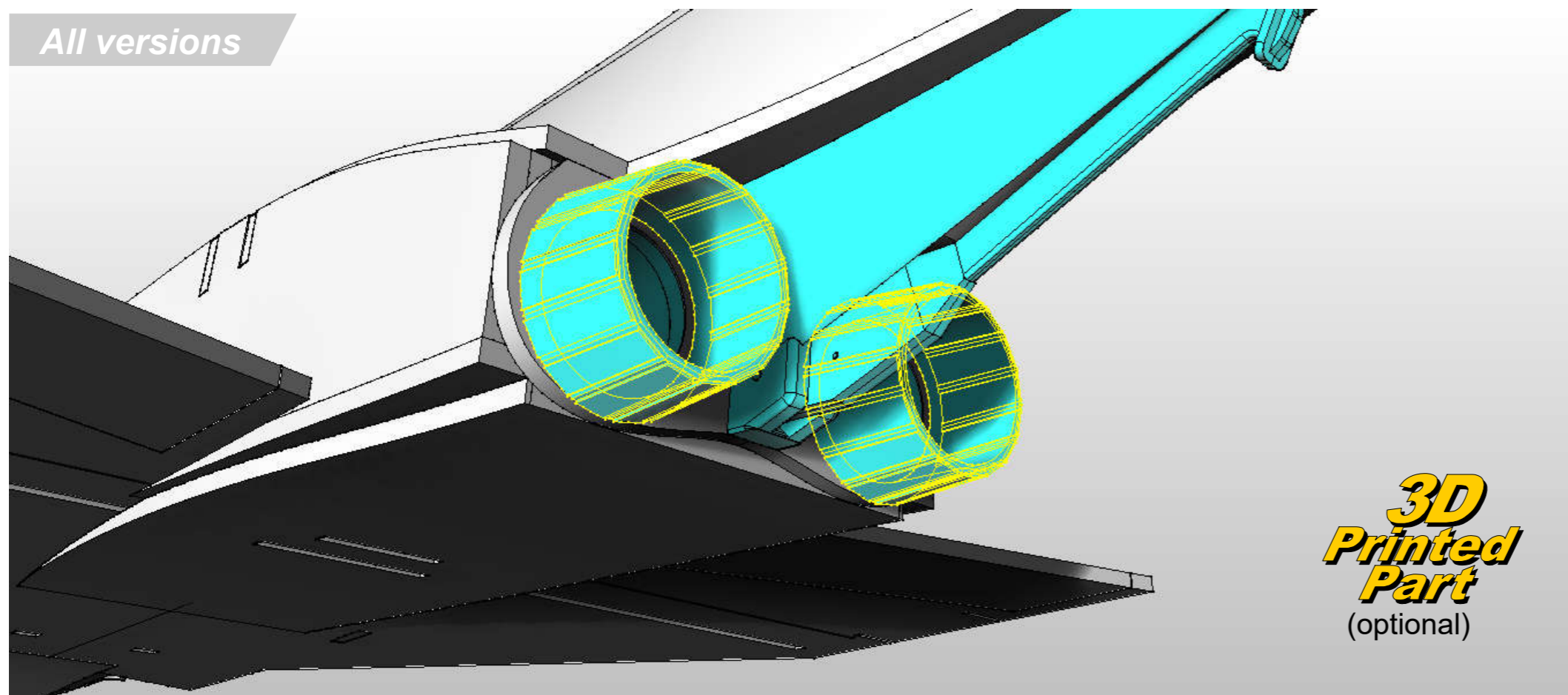
All versions



Create two **Nozzles** by using 2 x 3mm foam sheet rolled into cylinder as shown. Glue in place.



All versions

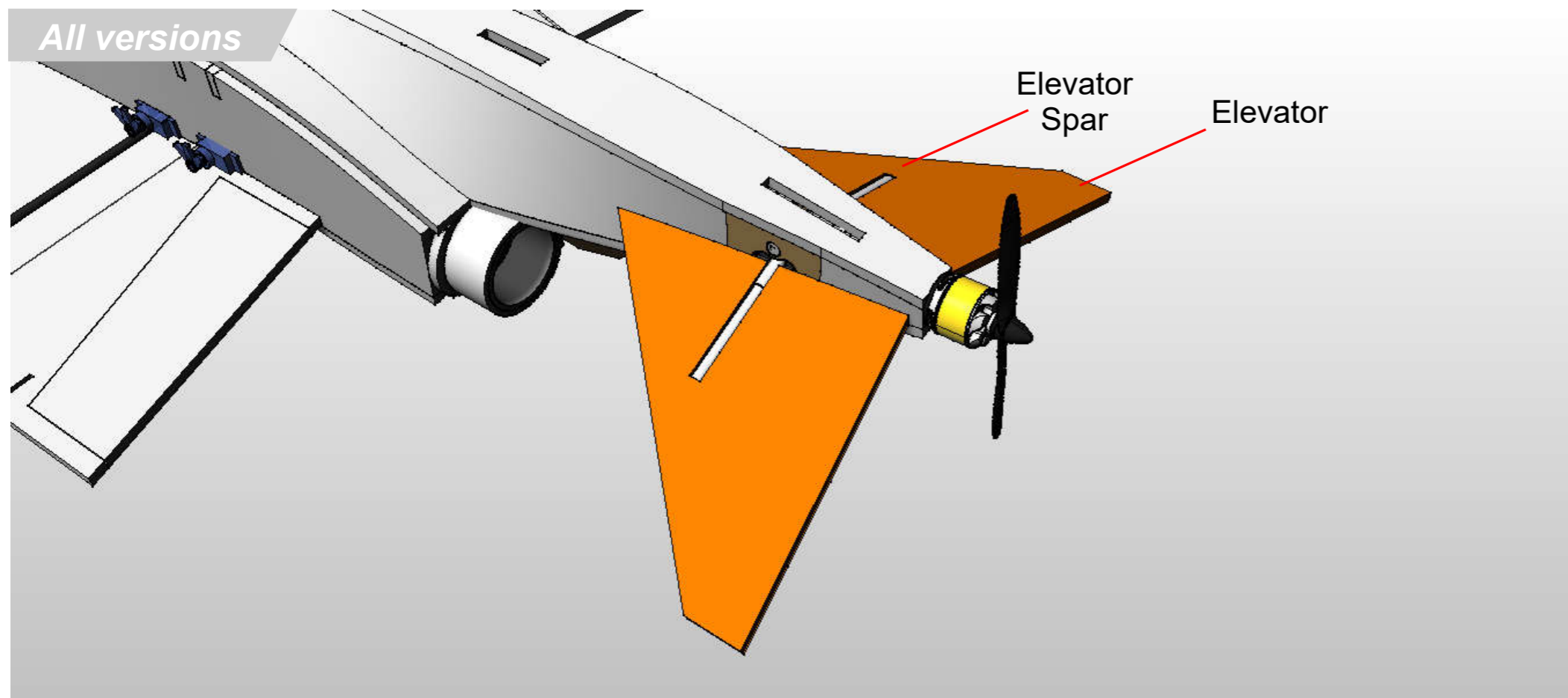


Alternatively - 3D Print out the Nozzles and glue in place.

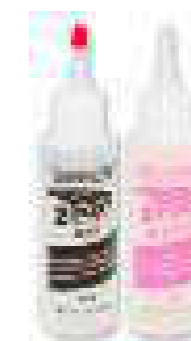
**3D
Printed
Part**
(optional)



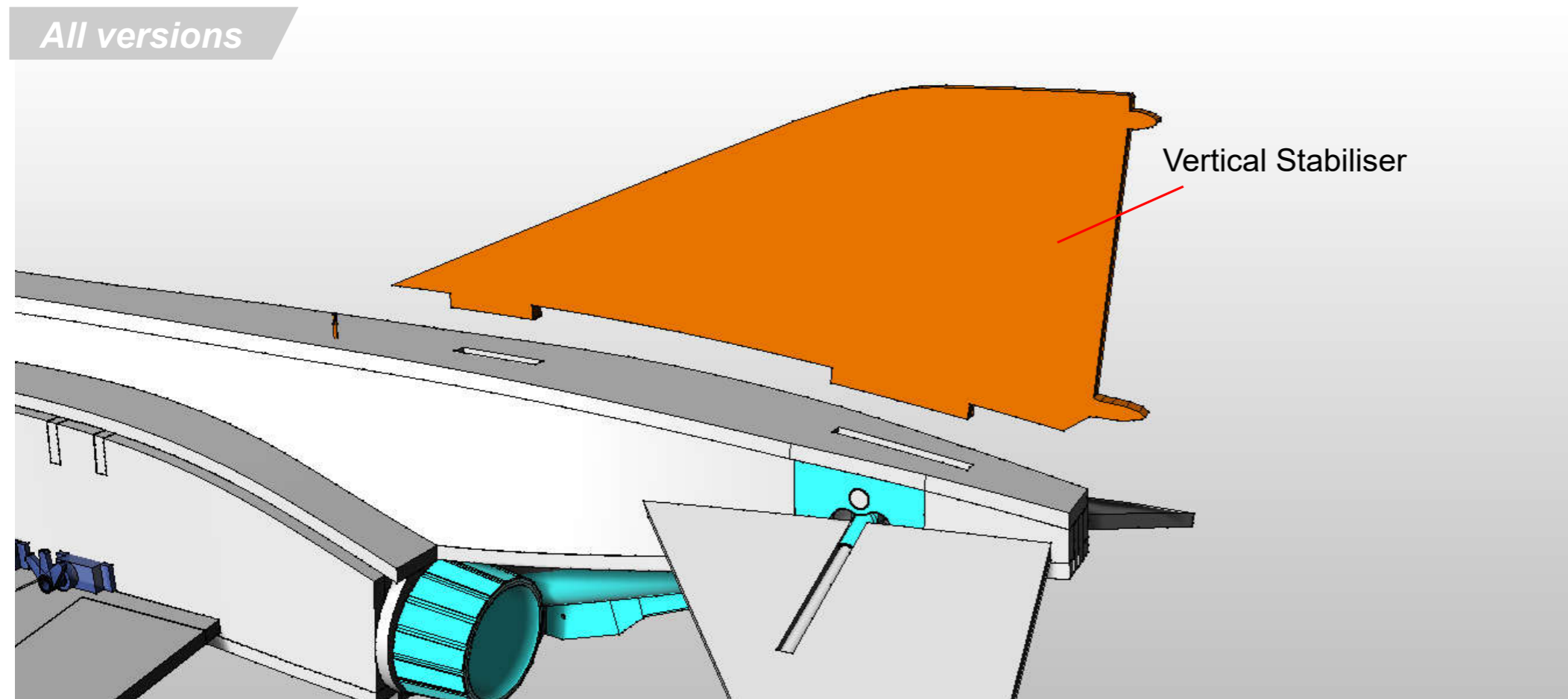
All versions



Glue the Carbon Elevator spars and **Elevator** pieces together.



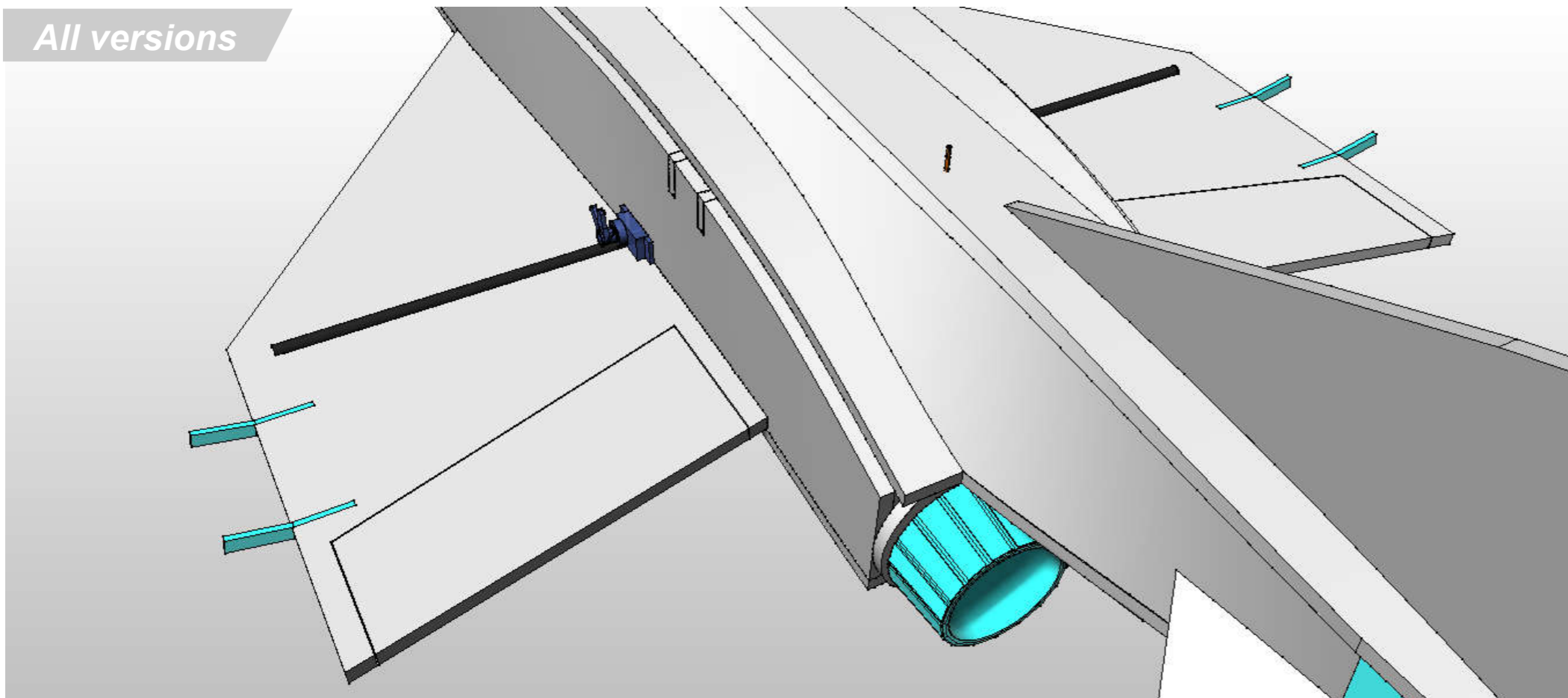
All versions



Glue the **Vertical Stabiliser** in place with epoxy. Ensure it is held vertically until the glue has set.



All versions

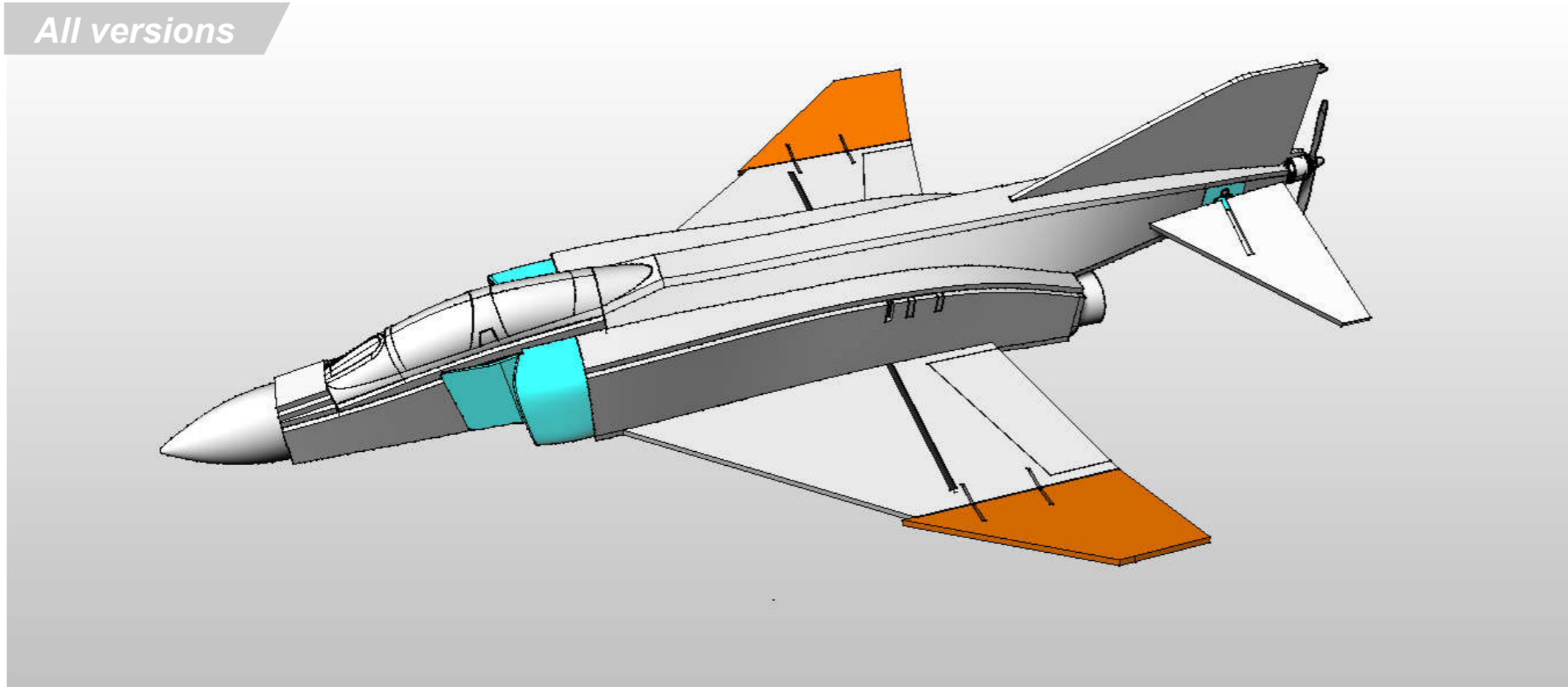


Glue the wingtip stabilisers into the slots on the wing as shown.

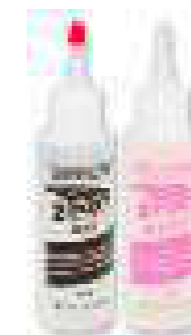
Use either 2mm lite-ply or 3Dprinted parts.

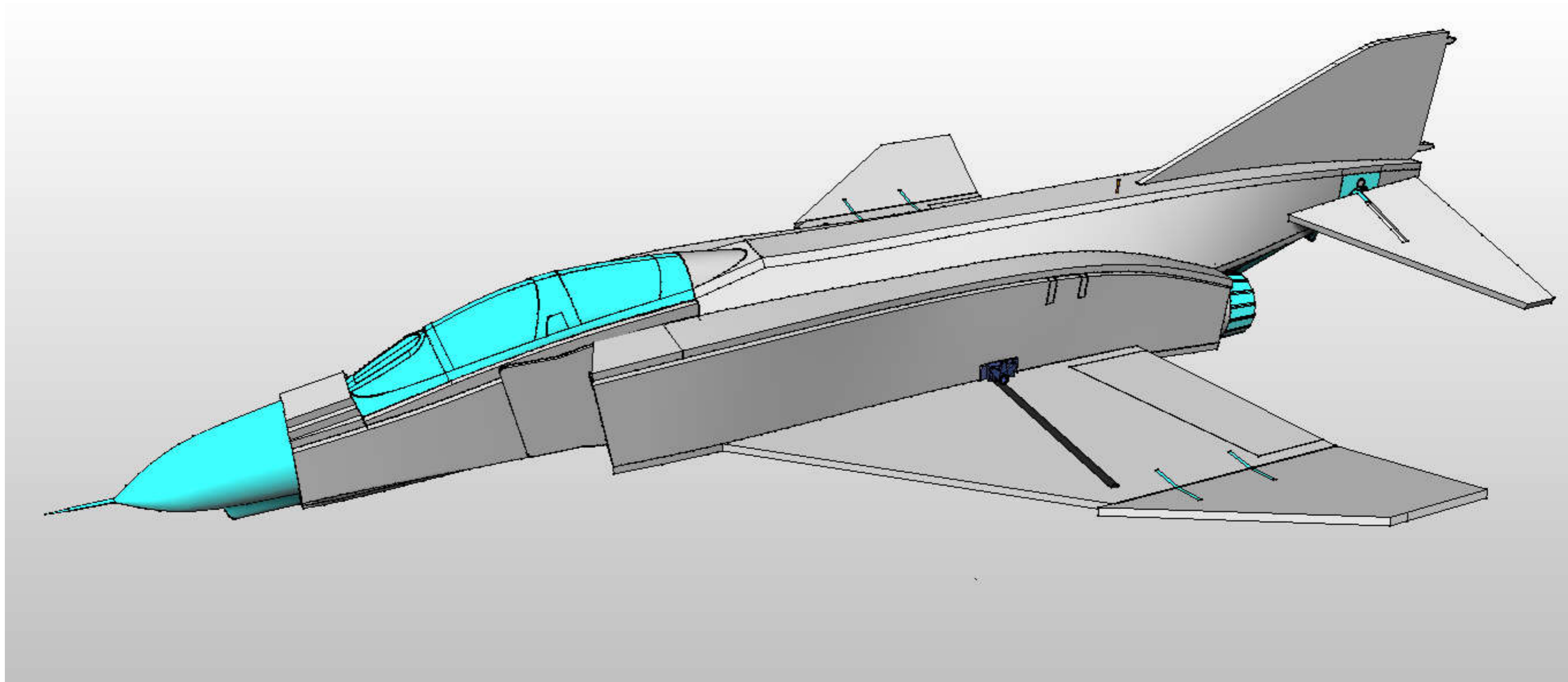


All versions



Glue the wing-tips onto the wings, securing in place until the glue has set.





Congratulations! Your model is now complete. Either fly it as it is, or paint it in your favourite colour scheme - remember to use non-solvent paints!

Phantom

