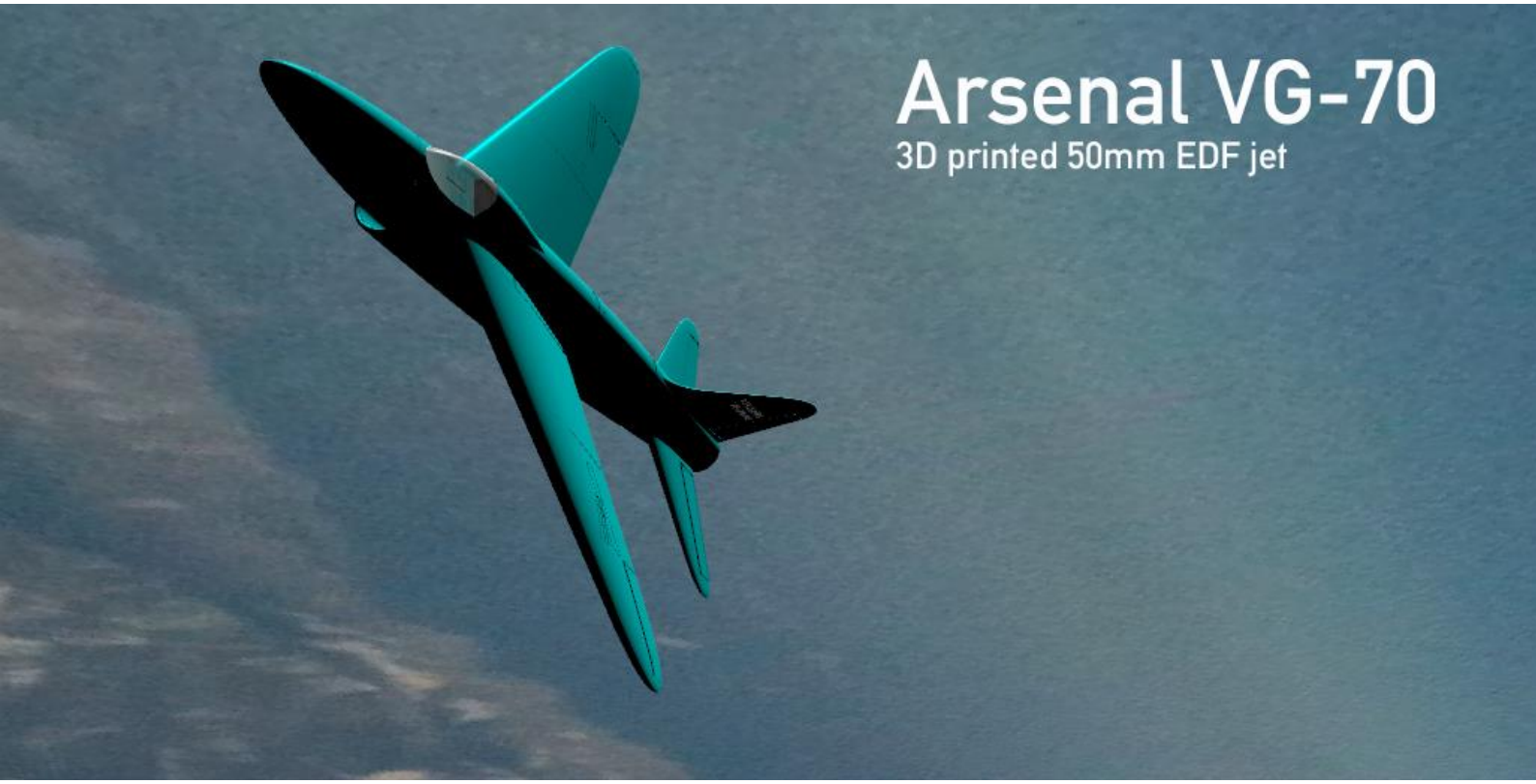


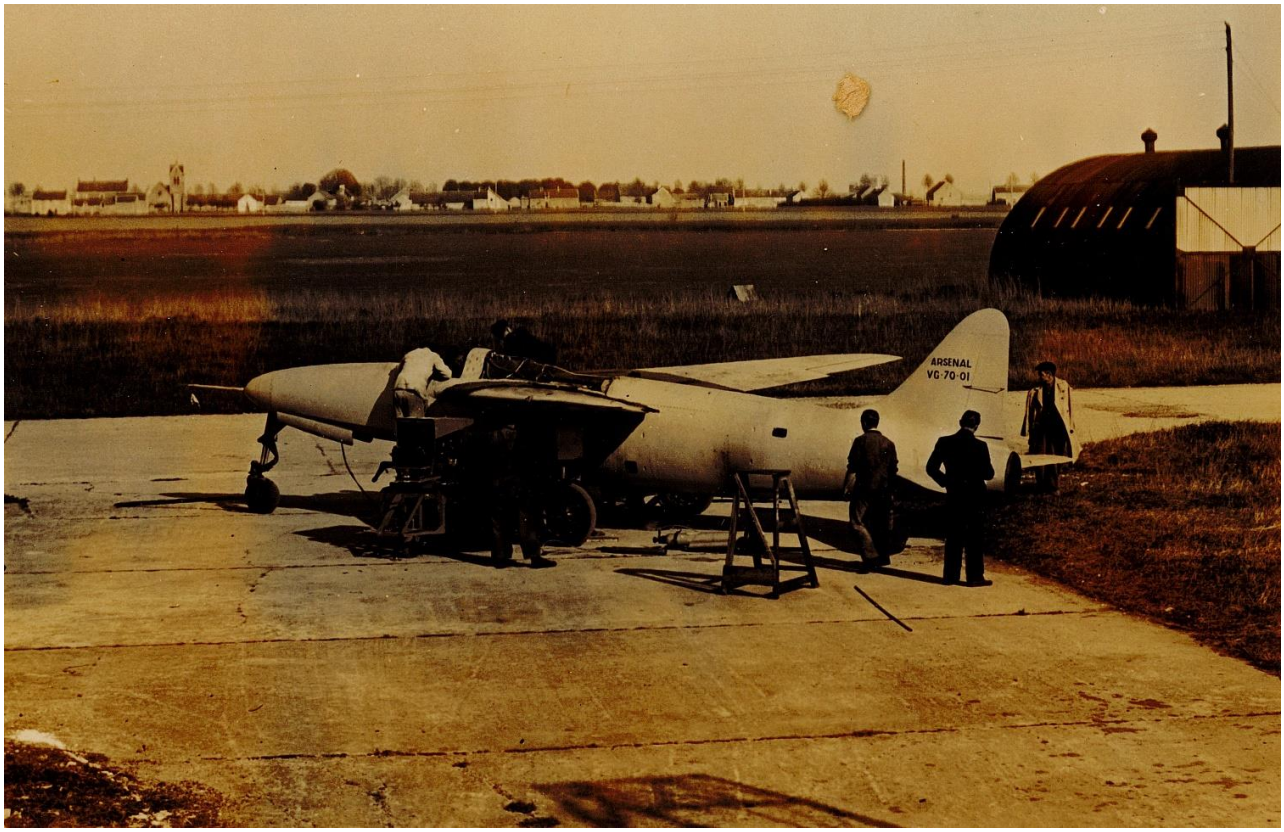
SCALE	1/13 (approximately)
WINGSPAN	687mm (27 inches)
LENGTH	797mm (31.4 inches)
FLYING WEIGHT	640g (22.5 ounces)
WING AREA	160 SQ IN
WING LOADING	20 OZS/SQ FT
EDF	X-FLY Galaxy or FMS 50mm EDF or similar 4S unit
LIPO	4S x 1300mAh

Arsenal VG-70 – history

Shortly after the conclusion of WW2, the French Arsenal company began designing a swept-wing research aircraft that would incorporate wind-tunnel data acquired from former Messerschmitt engineers. The required airframe would be the smallest structure that could fit the Junkers Jumo 004, which was the only available engine at that time.

The result was the Arsenal VG-70, with a fuselage built from metal, along with wooden wings and tail. The nearly complete airframe was displayed at the Paris Aero Show in 1946, and ground testing was completed by the end of 1947.

Wind tunnel testing which indicated some potential problems delayed the first flight until 23 June 1948, when it became the second French jet aircraft to fly. After a brief but successful test-flying career, the VG-70 was retired in early 1949, as it had reached its development potential, and the much-improved follow-on VG-90 was well under way.



NOTES ABOUT THE DESIGN PROCESS AND PRINTING OPTIONS:

The Arsenal VG-70 files include G-code files and .3MF files for all parts, sliced on the free Prusa slicer (version 2.5.2).

In the first instance, the G-code files should be generic enough to give acceptable results when loaded directly on a cartesian printer with at least a 200 x 200 x 200mm build volume, with direct drive or Bowden extruder, but individual results may vary.

Alternatively, the Prusa slicer is easy to use to load the corresponding part .3MF file as a project, and to change any applicable settings that are not working for your specific print job. These parts have not been tested in other slicers and Prusa slicer should be used. Except for the motor mount, canopy and auxiliary air intake which are in normal PLA, all parts are printed from LW-PLA.

The LW-PLA components were printed with 3DLabPrint PolyLight 1.0 LW-PLA which gave excellent results. E-Sun PLA+ was used for PLA parts and can be recommended. Other filaments may require a small adjustment to print temperatures and/or extrusion multiplier to give similar results.

Design methodology:

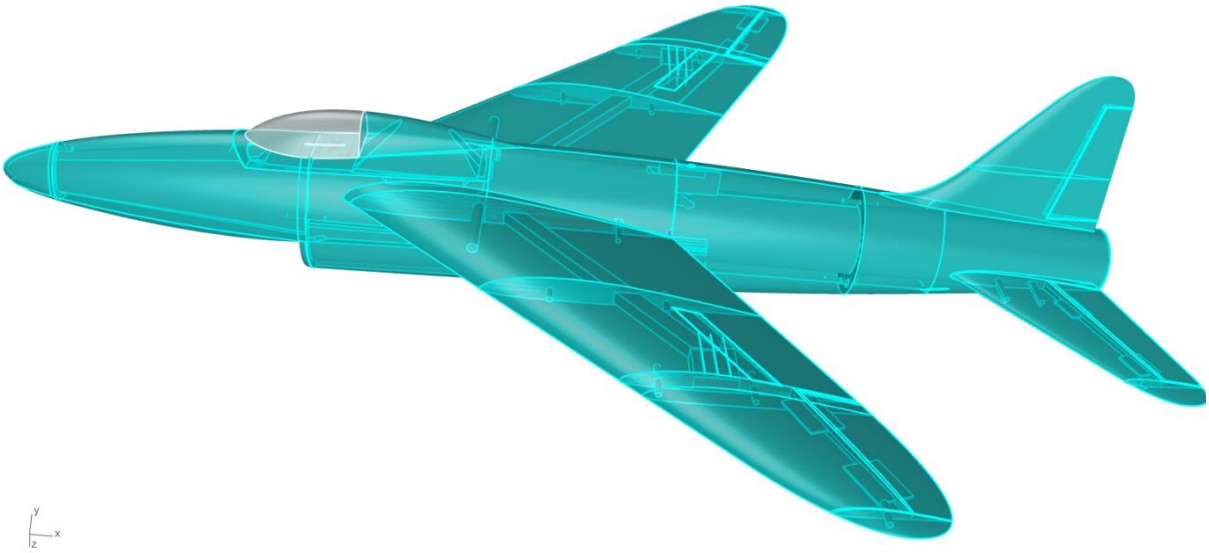
This model has been designed so that all components are solids and are printed with an outer skin and internal infill. Depending on variables such as nozzle condition, extruder condition, bed temperature sensor accuracy, filament condition etc. it may be necessary to tweak some of the print settings to give the best results. The .3MF files when loaded as a project into Prusa slicer will populate the Print Settings, Filament Settings and Printer Settings with the generic values generated by the designer, as well as loading the component STL file.

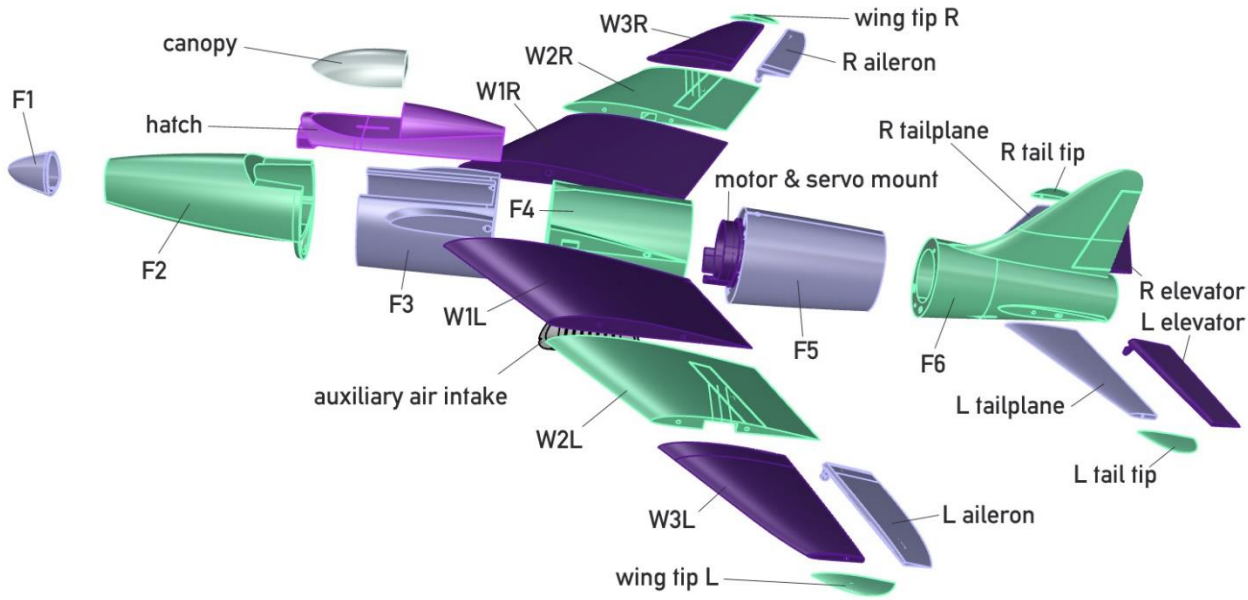
The drop down “Printer Settings” menu can be used to load the default settings specific to your printer (such as prime line G-code etc.) Additionally, any changes that you make in the Print Settings menus or Filament Settings menus can be saved (if desired) under another name from the “Save current….” icon option adjacent to the drop-down menu boxes at the top left of the Prusa window.

For this model, gyroid infill seems to work best on fuselage components, and cubic infill for the wings and horizontal tail. Feel free to play around with the settings to achieve the balance of strength vs skin support that you are comfortable with!

By default, a small amount of part cooling fan is used on all parts. If necessary, better layer adhesion may be achieved with the fan off, if the print result is acceptable in other respects.

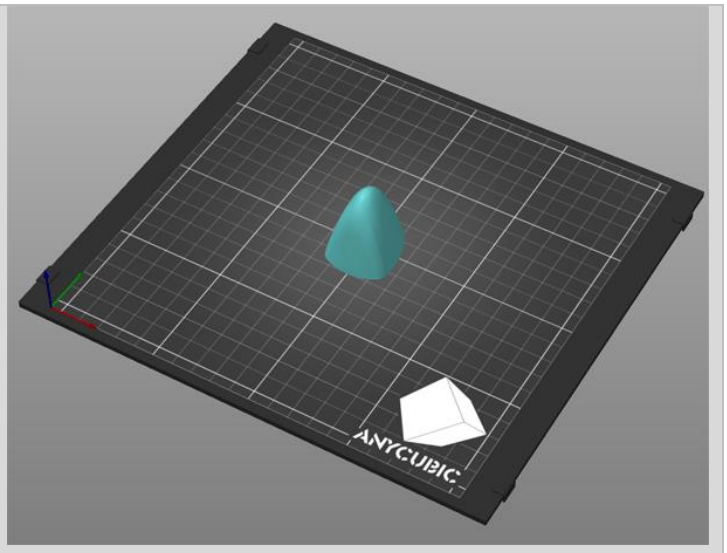
LW-PLA parts should be printed one at a time. Weights and times are just a guide, but should be close to default file values, and are conservative giving strong parts. Weight saving may be achieved at the discretion of the builder. In practice extrusion multipliers down to 0.45 and infill down to 4% may be achieved on a good printer giving a suitable weight saving. The default setting (for most parts) is an extrusion of 0.5 and infill 6% (Gyroid for the fuselage and Cubic for the wings and tail).




canopy
F1
hatch
F2
W3R
wing tip R
W2R
R aileron
W1R
R tailplane
R tail tip
motor & servo mount
F4
F3
W1L
F5
F6
R elevator
L elevator
auxiliary air intake
W2L
L tailplane
L tail tip
W3L
L aileron
wing tip L

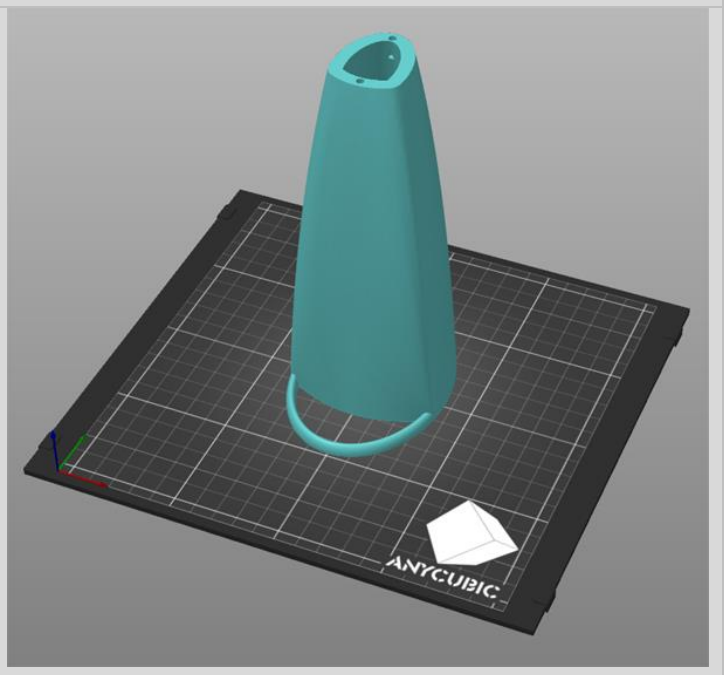
PART F1

- LW-PLA
- Print weight: 1.98g
- Print time: 34 mins



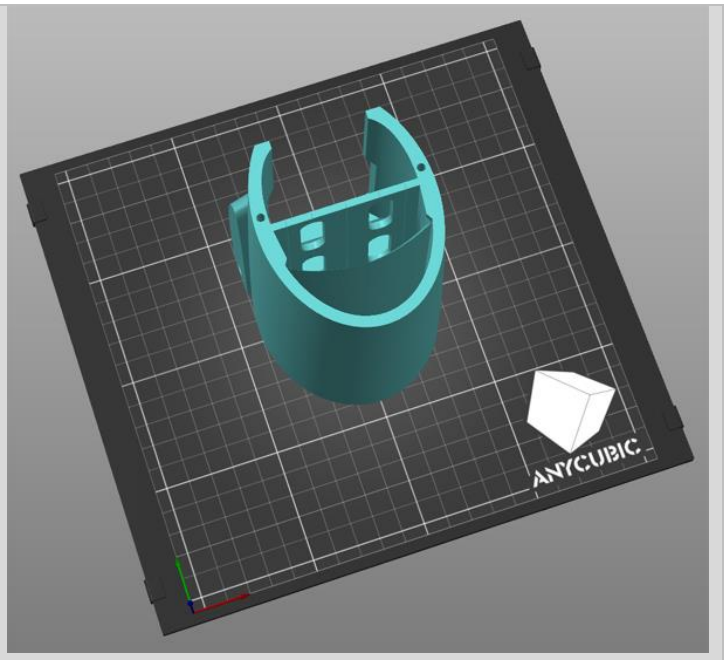
PART F2

- LW-PLA
- Print weight: 23.48g
- Print time: 4hr 14min



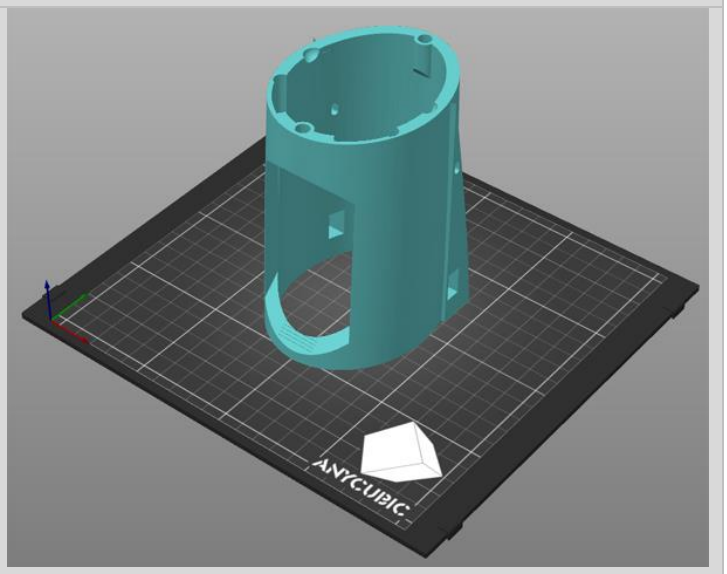
PART F3

- LW-PLA
- Print weight: 31.55g
- Print time: 6hr 13min



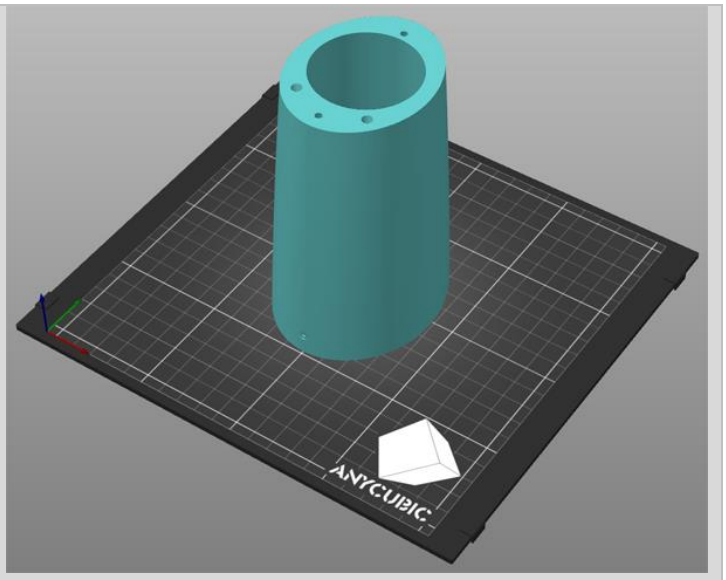
PART F4

- LW-PLA
- Print weight: 23.57g
- Print time: 4hr 23min



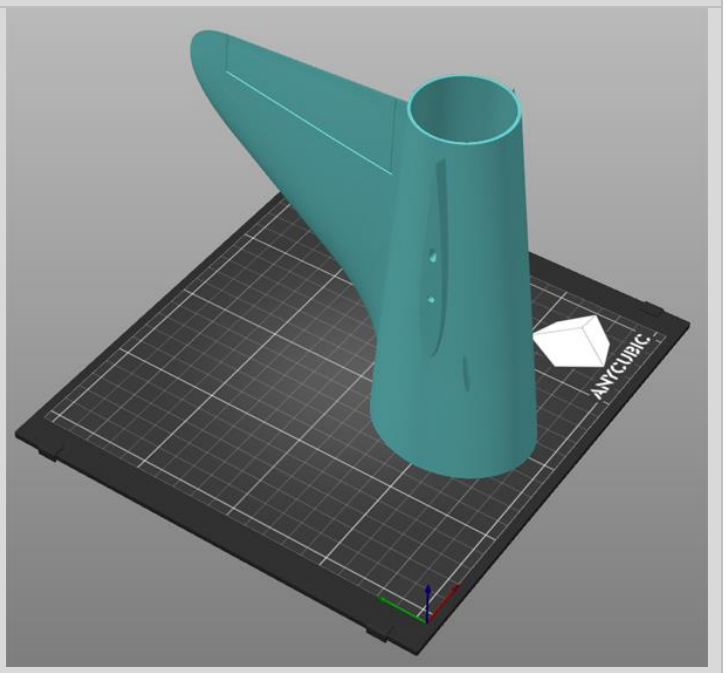
PART F5

- LW-PLA
- Print weight: 32.24g
- Print time: 5hr 59min



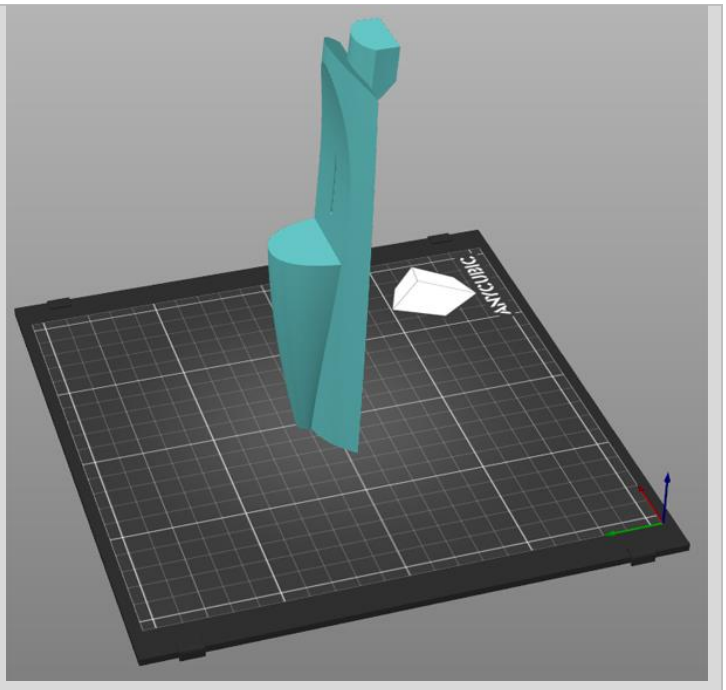
PART F6

- LW-PLA
- Print weight: 25.51g
- Print time: 4hr 51min
- 4% gyroid infill preset in G-code and .3MF files



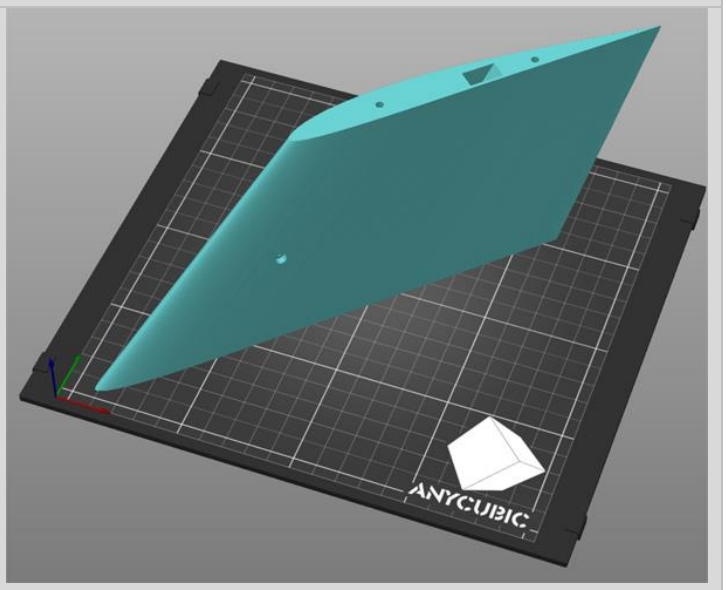
PART hatch

- LW-PLA
- Print weight: 9.55g
- Print time: 2hr 35min
- A brim may be necessary if print bed adhesion is not good



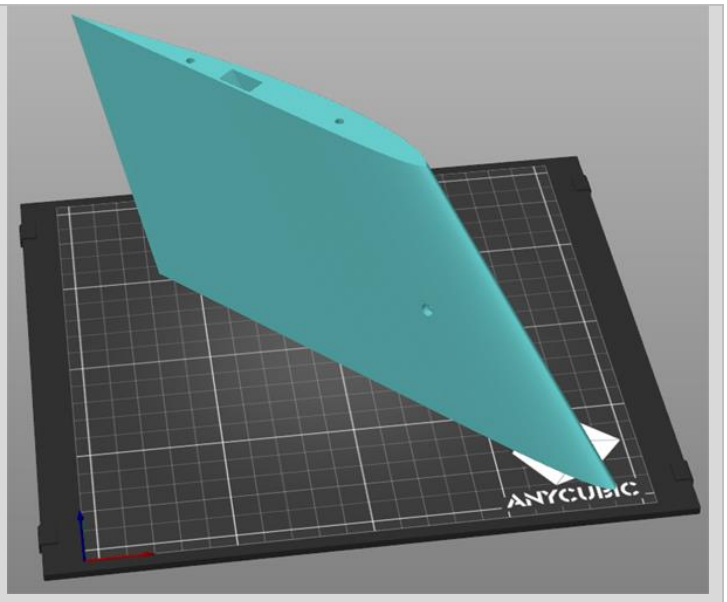
PART W1L

- LW-PLA
- Print weight: 20.13g
- Print time: 3hr 49min



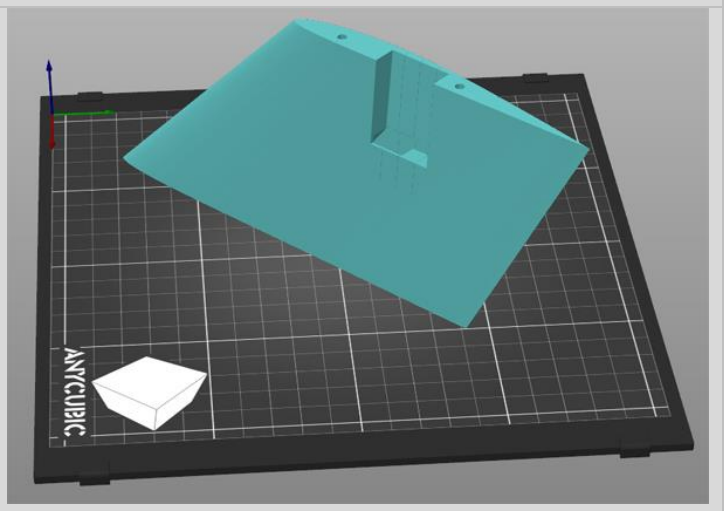
PART W1R

- LW-PLA
- Print weight: 20.13g
- Print time: 3hr 49min



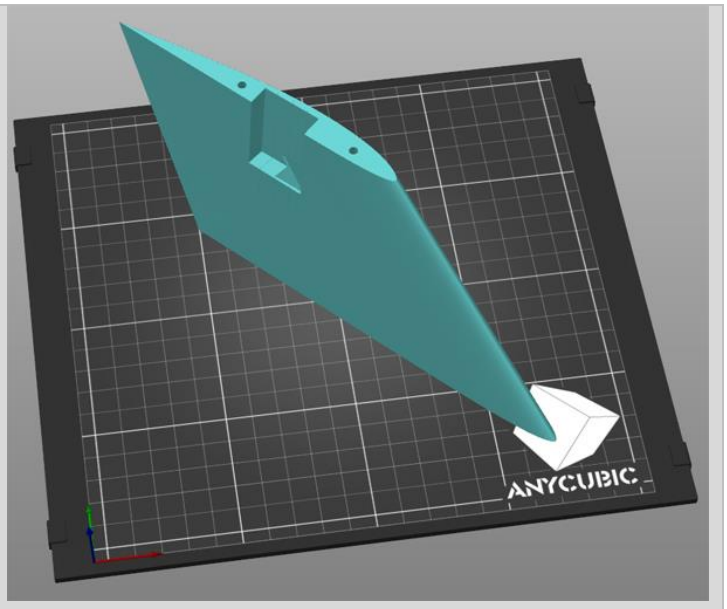
PART W2L

- LW-PLA
- Print weight: 12.01g
- Print time: 2hr 21min



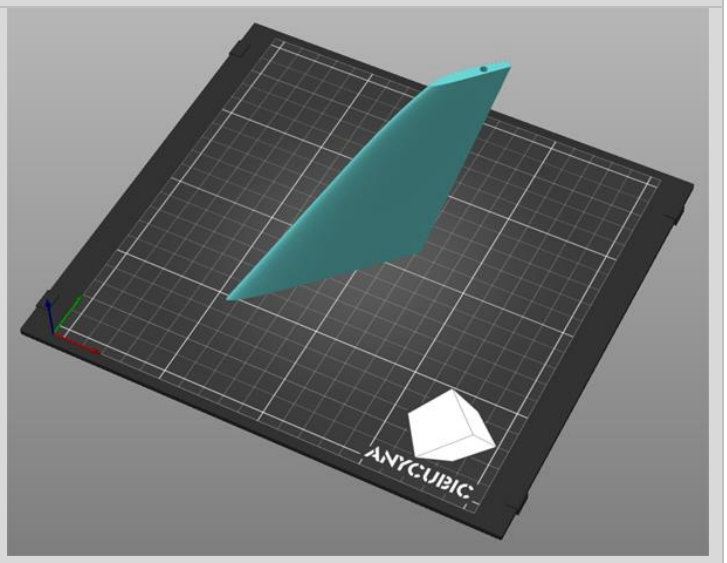
PART W2R

- LW-PLA
- Print weight: 12.01g
- Print time: 2hr 21min



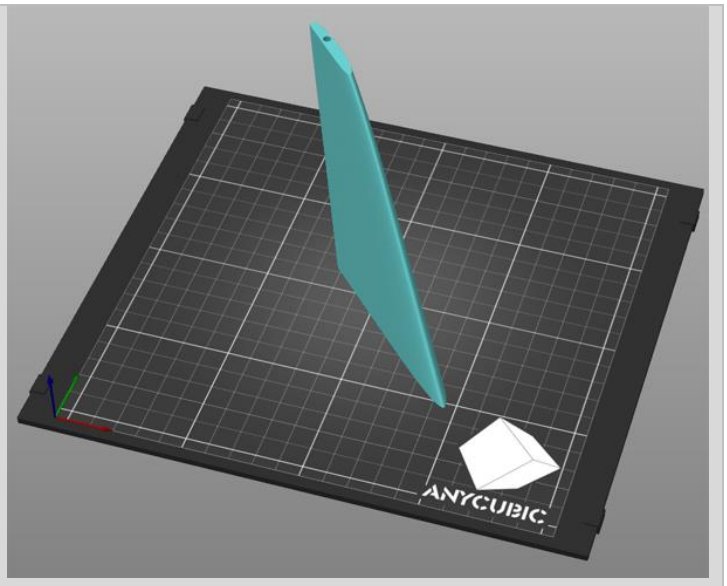
PART W3L

- LW-PLA
- Print weight: 6.11g
- Print time: 1hr 32min
- A brim may be necessary if print bed adhesion is not good



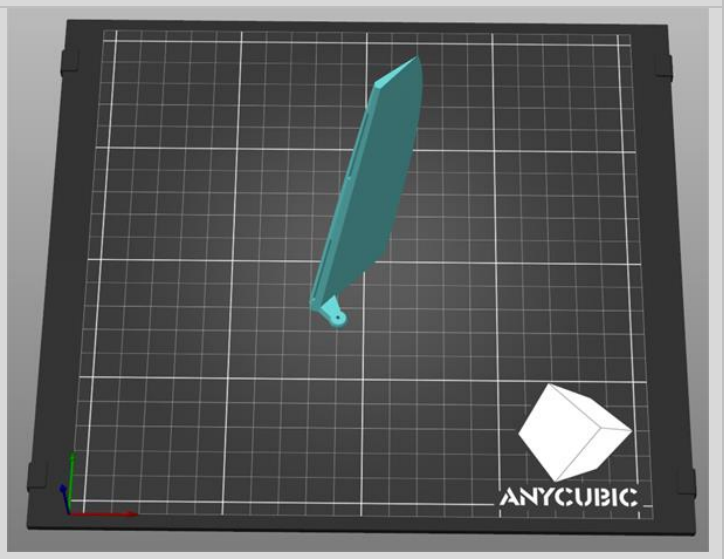
PART W3R

- LW-PLA
- Print weight: 6.11g
- Print time: 1hr 32min
- A brim may be necessary if print bed adhesion is not good



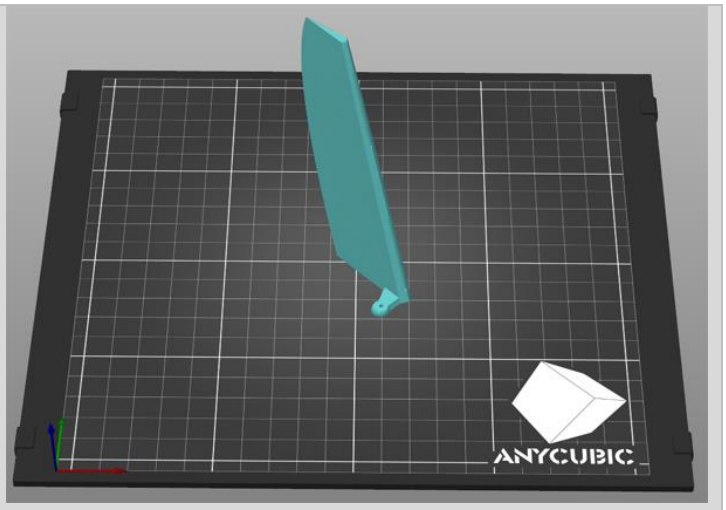
PART L aileron

- LW-PLA
- Print weight: 3.22g
- Print time: 45mins
- 8 bottom layers + extrusion multiplier of 0.7 have been preset in G-code and .3MF files
- A brim may be necessary if print bed adhesion is not good



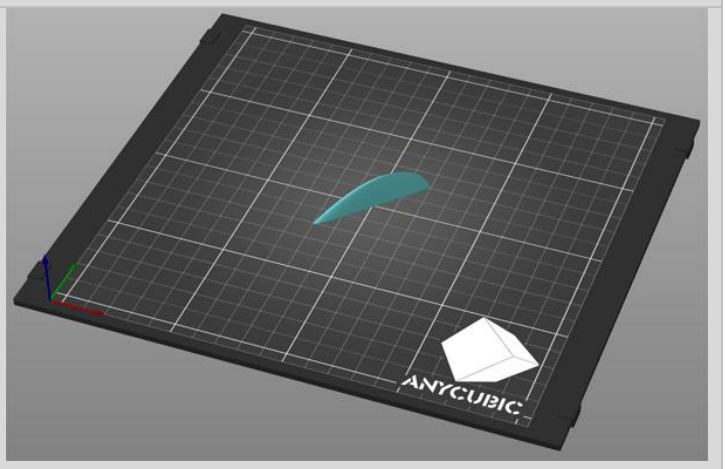
PART R aileron

- LW-PLA
- Print weight: 3.22g
- Print time: 45mins
- 8 bottom layers + extrusion multiplier of 0.7 have been preset in G-code and .3MF files
- A brim may be necessary if print bed adhesion is not good



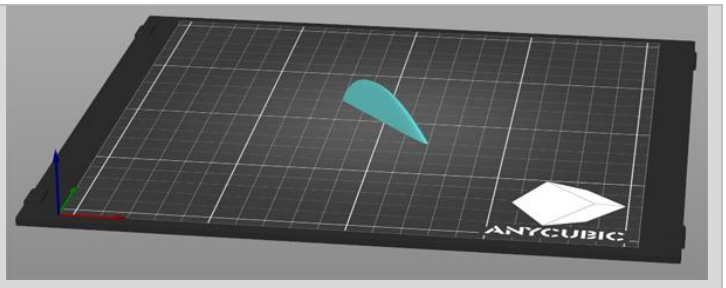
PART L wing tip

- LW-PLA
- Print weight: 0.43g
- Print time: 8min



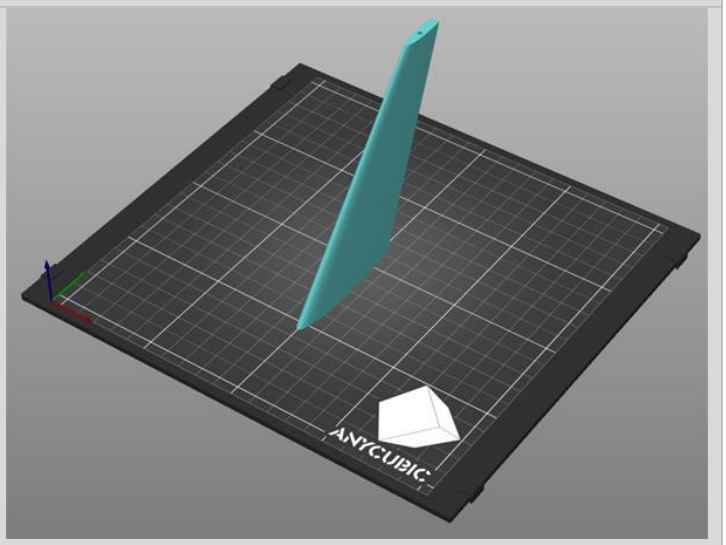
PART R wing tip

- LW-PLA
- Print weight: 0.43g
- Print time: 8 mins



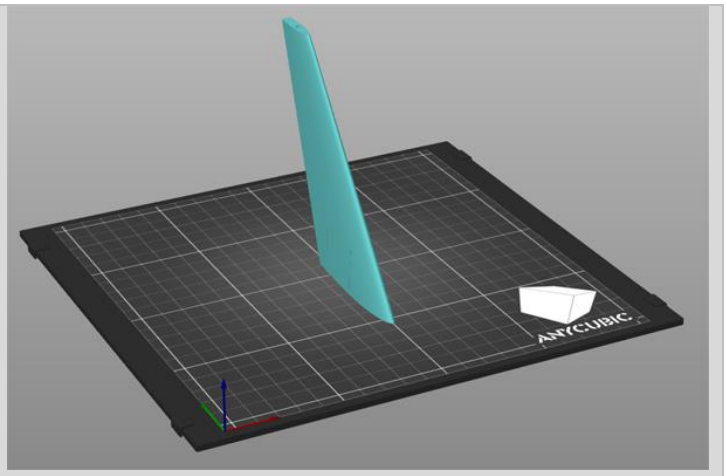
PART L tailplane

- LW-PLA
- Print weight: 6.26g
- Print time: 1hr 20min
- A brim may be necessary if print bed adhesion is not good
- An extrusion multiplier of 0.7 is preset in G-code and .3MF files



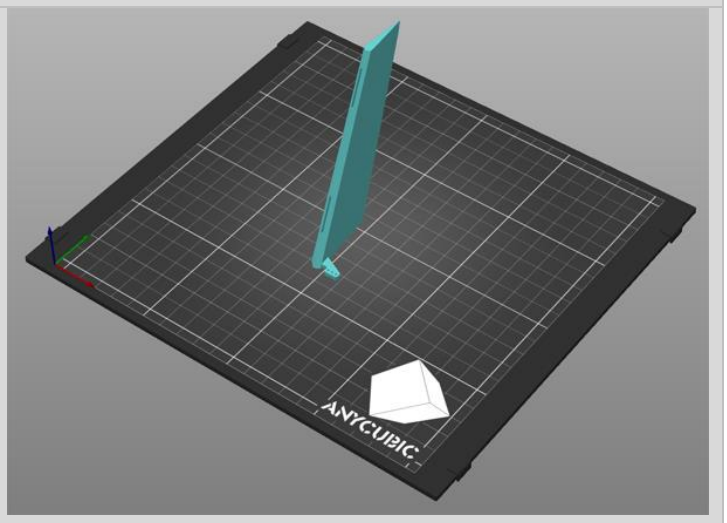
PART R tailplane

- LW-PLA
- Print weight: 6.26g
- Print time: 1hr 20min
- A brim may be necessary if print bed adhesion is not good
- An extrusion multiplier of 0.7 is preset in G-code and .3MF files



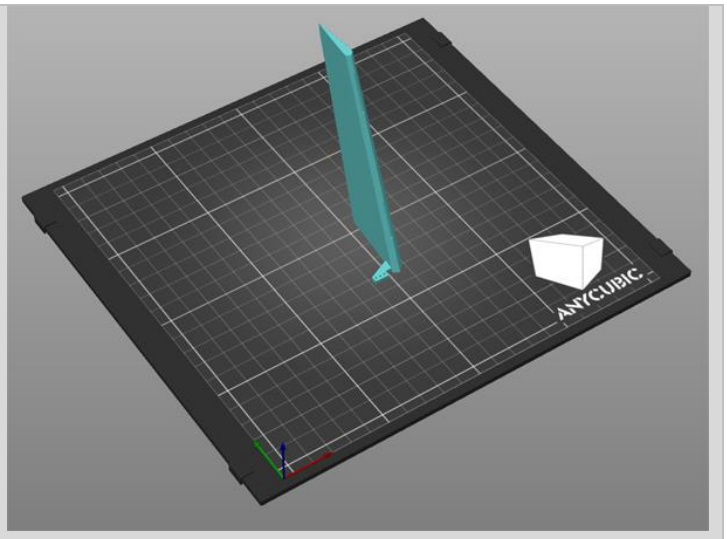
PART L elevator

- LW-PLA
- Print weight: 3.36g
- Print time: 47min
- A brim may help if print bed adhesion is not good
- 8 bottom layers + an extrusion multiplier of 0.7 is preset in G-code and .3MF files



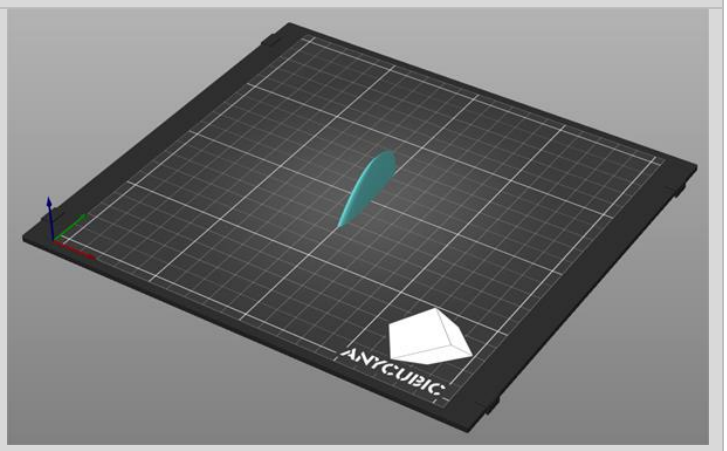
PART R elevator

- LW-PLA
- Print weight: 3.36g
- Print time: 47min
- A brim may help if print bed adhesion is not good
- 8 bottom layers + an extrusion multiplier of 0.7 have been preset in G-code and .3MF files



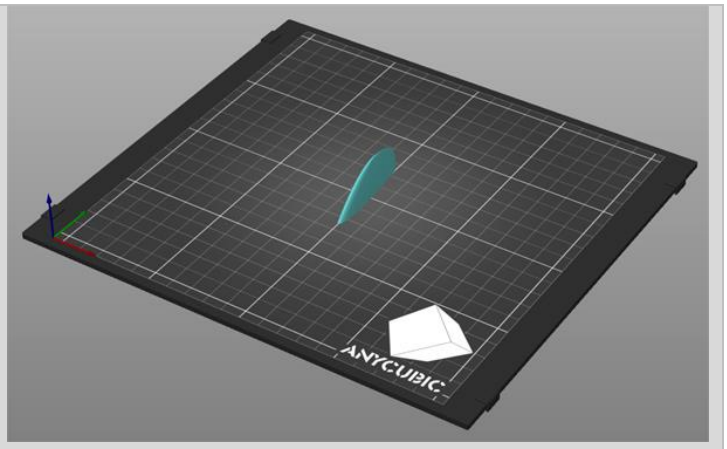
PART L tail tip

- LW-PLA
- Print weight: 0.51g
- Print time: 10m



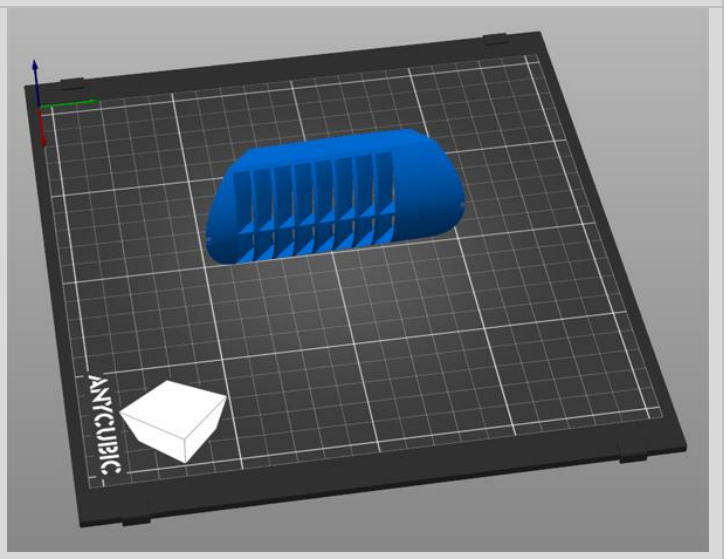
PART R tail tip

- LW-PLA
- Print weight: 0.51g
- Print time: 10m



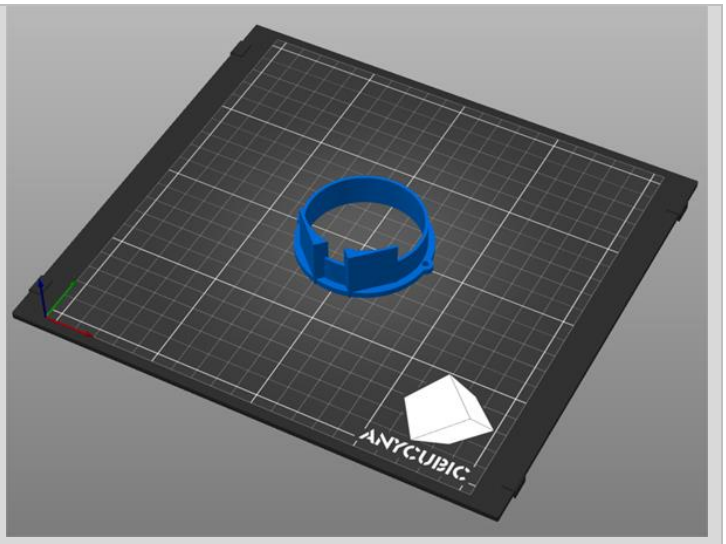
PART auxiliary air intake

- PLA
- Print weight: 9.73g
- Print time: 1hr 2mins
- A brim may be necessary if print bed adhesion is not good
- Arachne perimeter generator has been preset in G-code and .3MF files



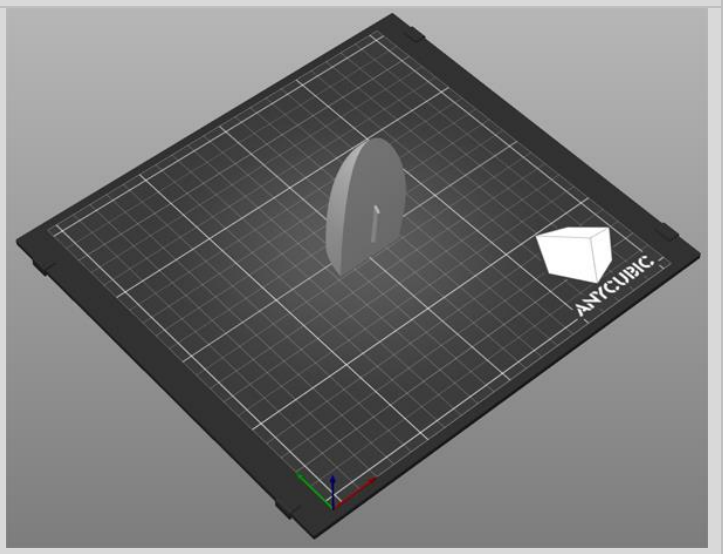
PART motor & servo mount

- PLA
- Print weight: 10.43g
- Print time: 51min
- Arachne perimeter generator has been preset in G-code and .3MF files



PART canopy

- Natural (clear) PLA
- Print weight: 4.28g
- Print time: 24min



PREPARING THE PARTS FOR ASSEMBLY

LW-PLA parts will need a little cleaning up in places with a sharp blade and/or sandpaper before assembly. Note that the colour of the material changes (goes lighter) when sanding deeply and can highlight the underlying structure. At the expense of a slight increase in weight, a coat or two of water-based polyurethane evens out the colour and gives a significant increase in strength to the skin.

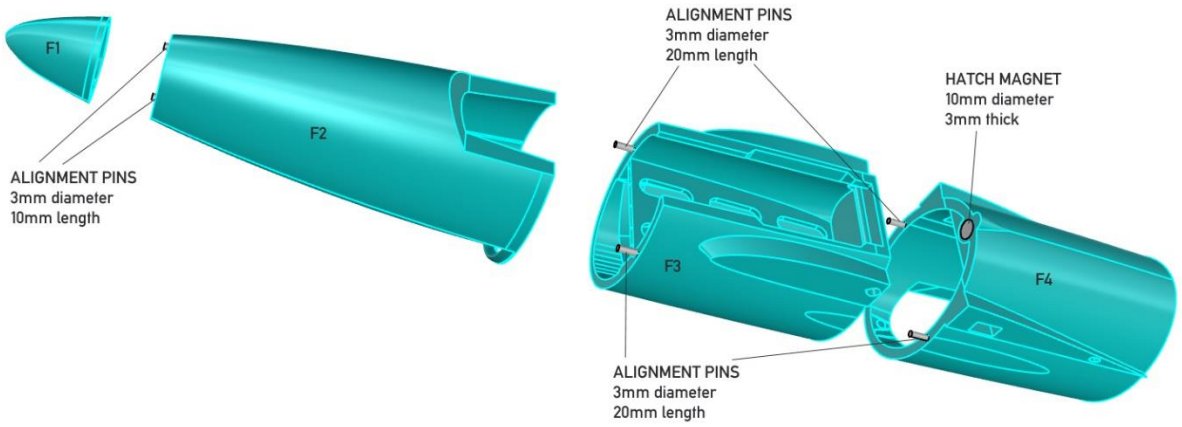
Medium cyanoacrylate glue used with accelerator is the preferred adhesive for all parts of this model. As an alternative, Gorilla Clear Polyurethane Glue (the non-expanding kind) has been used interchangeably on this and several other projects with great success. The beauty of this latter glue is that you have many minutes of positioning time as opposed to just seconds with CA. This can be very helpful especially on wing panel alignment or even on control surface hinges. A paper towel used dry or with isopropyl alcohol removes any residue before the glue sets.

The assembled model is in 6 parts: The forward and rear fuselage sections which are screwed together and can be separated for fan and servo installation and removal; the hatch which is magnetically attached for electronics access, and a detachable auxiliary air intake which gives day to day access to the fan. Finally, two wing halves sit on a carbon spar and are held in place by screws.

FORWARD FUSELAGE ASSEMBLY

- Cut fuselage alignment pins to the lengths shown on the diagram below from 3mm dowel or carbon rod and insert into formers as shown. Check that all parts fit together snugly. Separate parts again then apply glue in turn to the front and rear of F2, and the front F4 where it contacts F3. Carefully reassemble parts and clamp until dry.

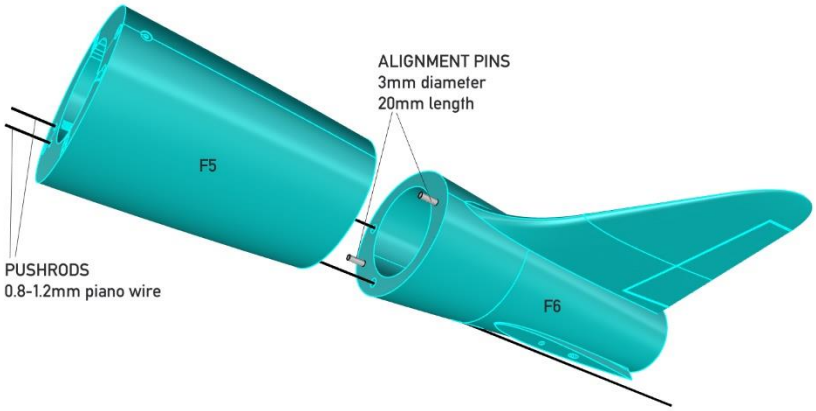
- Glue 10mm diameter x 3mm thick hatch magnet into the hole in the front of F4.



REAR FUSELAGE ASSEMBLY

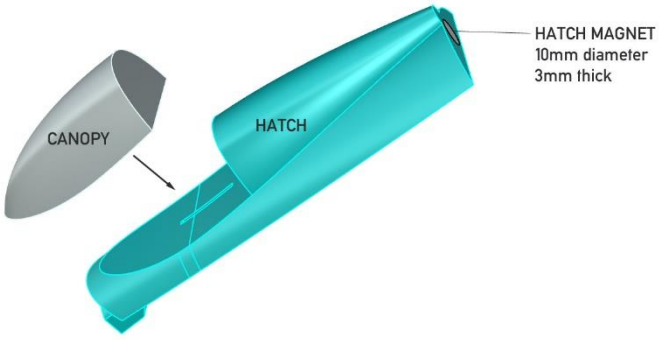
- Take two lengths of elevator piano wire pushrods and push through the pushrod channels in F5 and F6 until they slide freely. The channels will take up to 1.2mm (0.047in) diameter wire (optimum), but 0.8mm (0.031in) has been used on one prototype and works OK.

- Cut fuselage alignment pins to the lengths shown on the diagram below from 3mm dowel or carbon rod and insert into formers as shown. Check that all parts fit together snugly. Separate F5 and F6 again then apply glue to the front of F6, ensuring glue does not get into the pushrod channels or on the pushrods . Carefully reassemble parts and clamp until dry.



HATCH ASSEMBLY

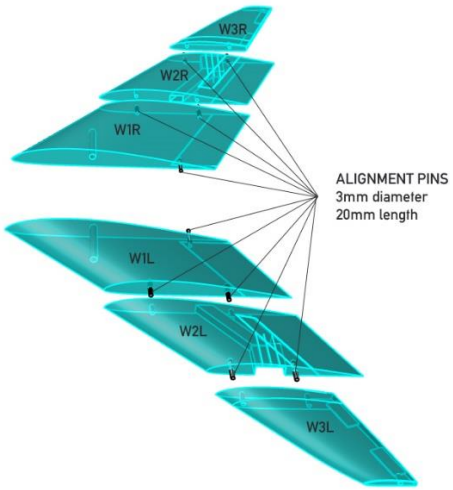
- Glue 10mm diameter x 3mm thick hatch magnet into the hole in the rear of the hatch. **IMPORTANT**! Make sure that the polarity of the magnet is correct so it attracts the hatch magnet in F4.
- Place the hatch on a flat surface then glue canopy in place.



WING ASSEMBLY

- Cut wing alignment pins to the lengths shown on the diagram below from 3mm dowel or carbon rod and insert into holes as shown. Check that all parts fit together snugly. Some light sanding of mating surfaces with a flat block may be necessary. Note that the wing tips are not added at this stage to make fitting the ailerons easier.

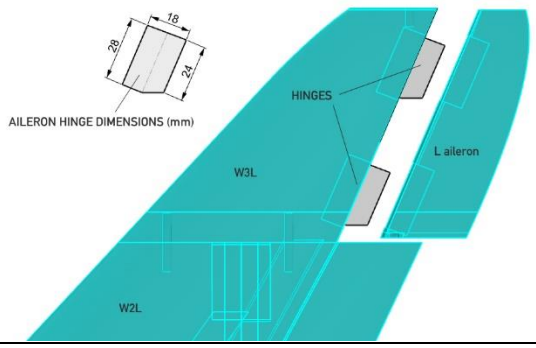
- Glue parts together and clamp until dry.



AILERON ATTACHMENT

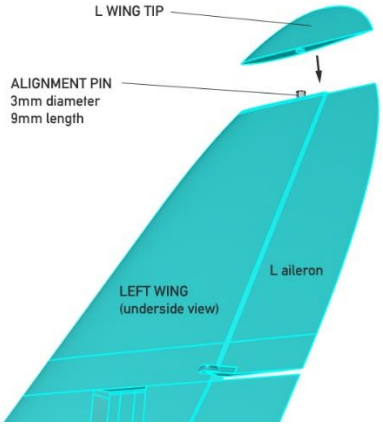
- LEFT Wing underside shown (repeat process for RIGHT wing).

- Cut CA hinge sheet to dimensions in drawing below. Glue to wing first, then aileron.



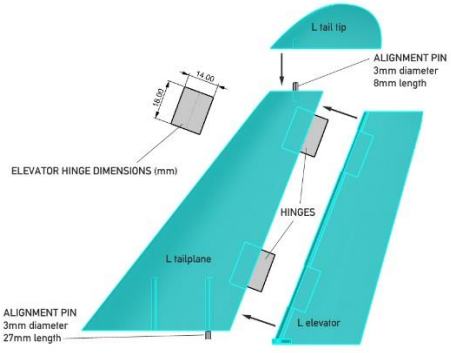
WING TIP ATTACHMENT

- LEFT wing tip shown (repeat process for RIGHT wing).
- Cut wing tip alignment pin to the length shown on the diagram below from 3mm dowel or carbon rod and insert into the hole as shown. Temporarily place L wing tip on alignment pin and ensure there is no binding with the aileron. Remove.
- Place glue on end of wing ONLY (avoiding aileron) and place L wing tip back on alignment pin. Clamp until dry.



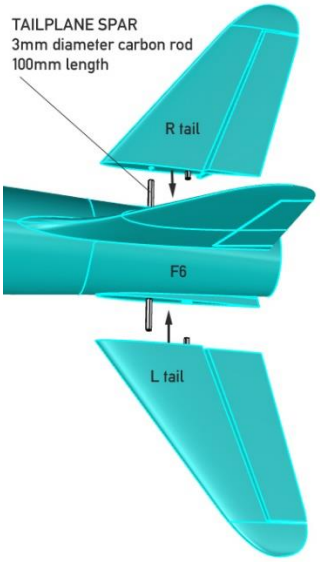
TAILPLANE & ELEVATOR ASSEMBLY

- LEFT tailplane/elevator underside shown (repeat process for RHS).
- Cut wing alignment pins to the length shown on the diagram below from 3mm dowel or carbon rod and insert into holes in tailplane as shown.
- Glue L tail tip to tailplane.
- Cut CA hinge sheet to dimensions in drawing below. Glue to wing first, then elevator..



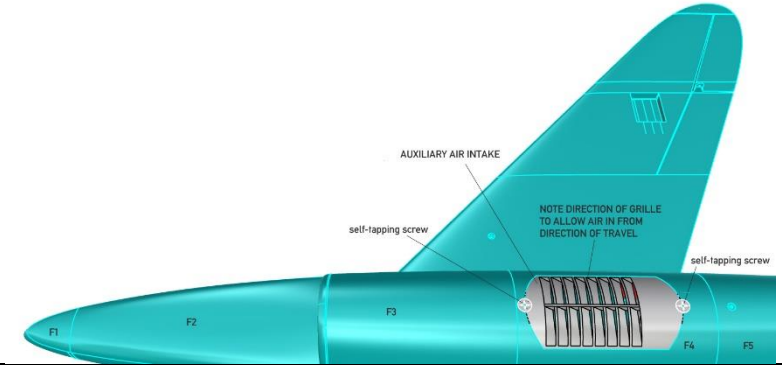
TAIL ATTACHMENT

- Cut tailplane spar from 3mm carbon rod 100mm long, and place centrally through the forward (circular) holes in F6. Do not glue.
- Slide the tailplane assemblies onto the spar then carefully glue L and R tail assemblies to F6, ensuring the elevators are not glued. Clamp until dry.



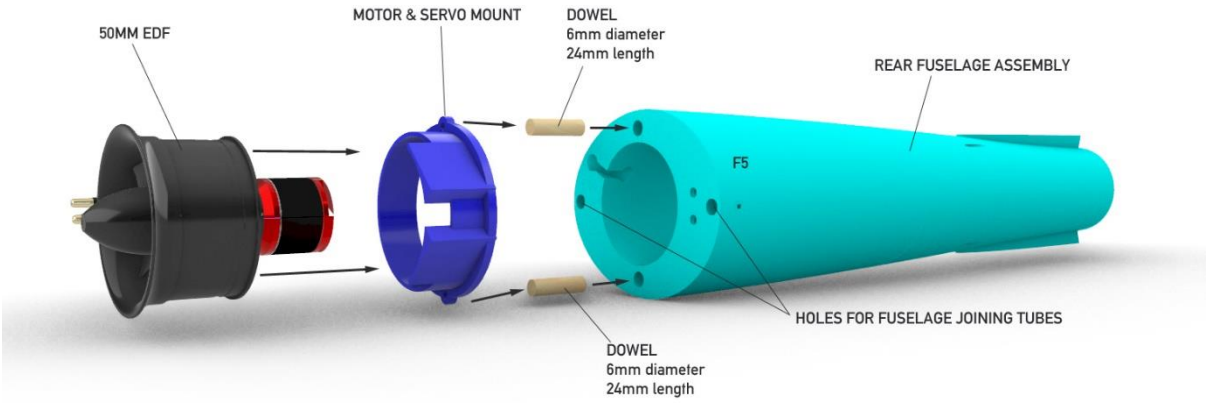
AUXILIARY AIR INTAKE ATTACHMENT

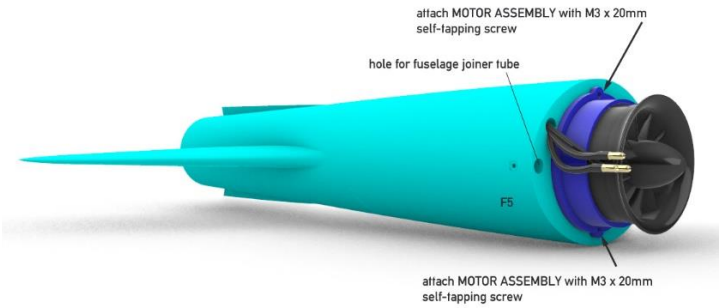
- The auxiliary air intake may need to be sanded to fit the opening in F4, as it is printed with a different axis alignment on the print bed compared to F4.
- Hold in place with small self-tapping servo mounting screws. Ensure the grille is facing the correct way, as it can be installed backwards! See diagram below. This part is easily removed to allow access to fan to remove grass and debris from the duct.

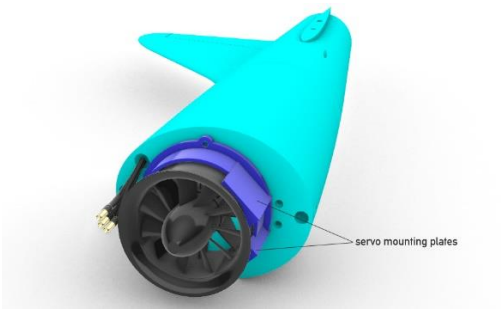


MOTOR & SERVO MOUNT ATTACHMENT

- Cut 2 x 24mm lengths of 6mm diameter dowel and glue into the 2 holes on the left and right side of F5. WARNING: do not glue these into the top and bottom holes in F5 – these are for the fuselage joining tubes.
- Wrap the rear of the EDF shroud in masking tape so that the EDF fits snugly in the MOTOR & SERVO MOUNT, adding a few blobs of hot melt glue on the union for added security. The rear of the EDF sits level with the rear of the MOTOR & SERVO MOUNT.
- Drill pilot holes in the dowels first, then attach the combined fan/mount to the rear fuselage assembly with two M3 x 20mm self-tapping screws. IMPORTANT : Ensure the flat servo-mounting plates are facing the bottom of the fuselage.
- The motor leads exit the tailpipe through the keyhole shaped slot in F5.

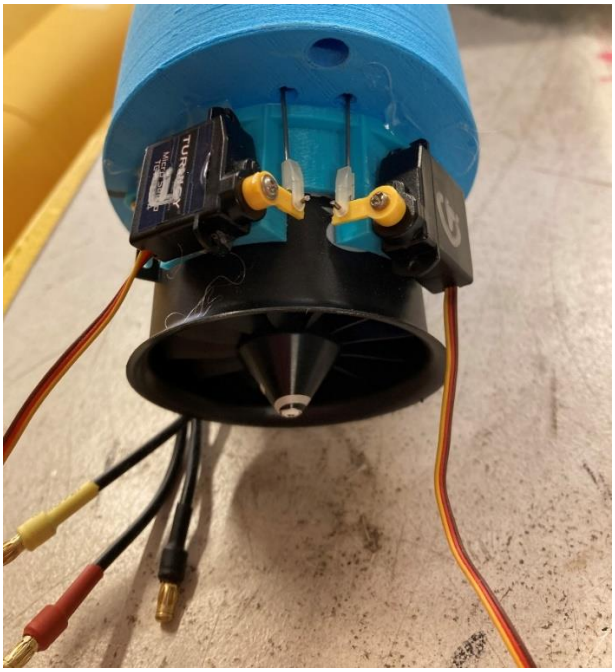






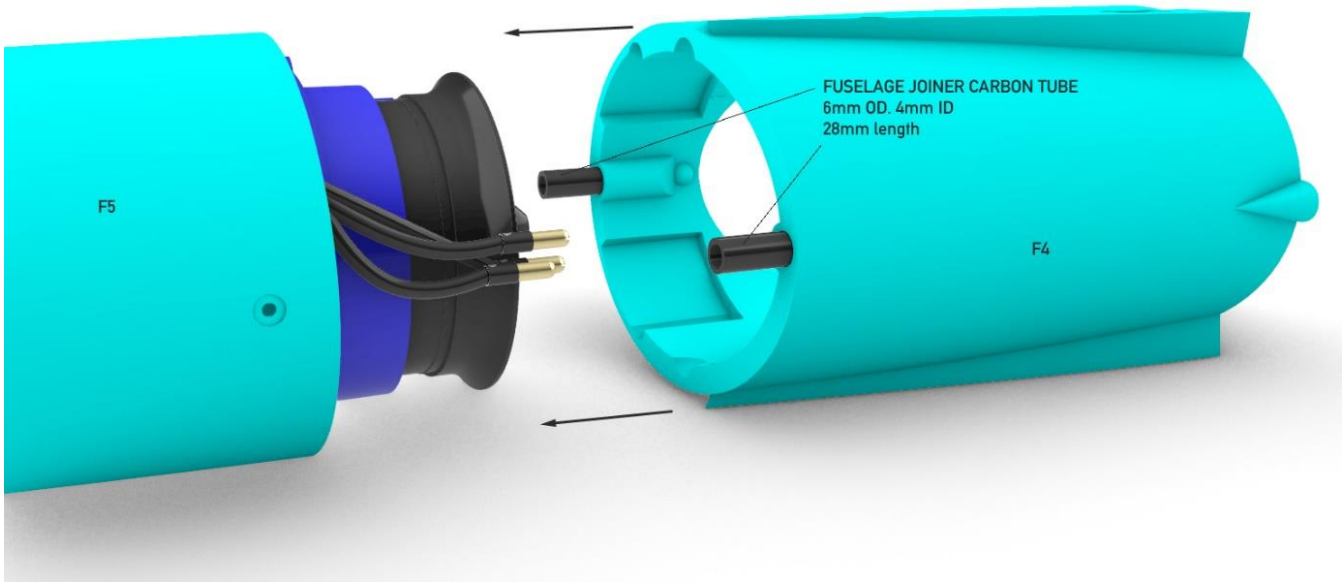
ELEVATOR SERVO ATTACHMENT

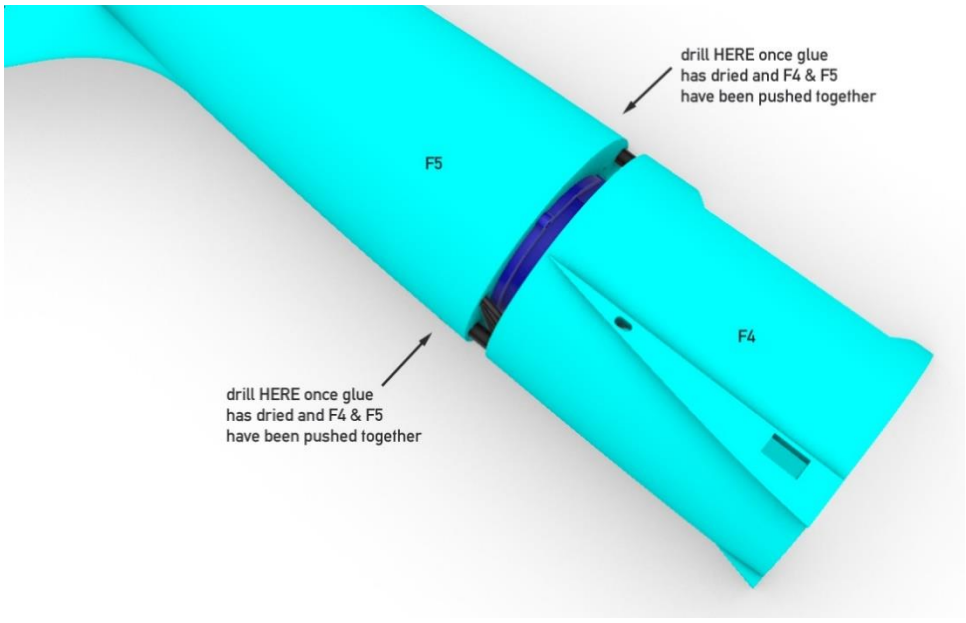
- Each elevator is driven by its own micro servo, one of which is connected to the elevator channel in the receiver, the other needs to be mixed through an auxiliary channel. A servo extension lead of about 300mm will be required.
- Space is very tight, and the Turnigy TGY 1440A servo fits perfectly, and is recommended. Any servo much larger than this (20 x 19.6 x 8.0mm) may not fit. Use hot melt glue to attach .
- Attach 0.8-1.2mm pushrods with clevis to servo end first, then bend, trim and connect at the elevator end last. Adjustments can be made on the transmitter if necessary to zero the trim.



FUSELAGE JOINING

- Cut two 6mm OD/4mm ID carbon tubes to 28mm length for the fuselage joiners.
- Use Gorilla Clear Glue to glue one end of each into F4, locating the other end partly in the holes in F5 while drying to ensure alignment, as shown in the bottom diagram. DO NOT GLUE INTO F5!!!
- When the glued tubes in F4 are set, hold F4 and F5 together snugly and drill a pilot hole for M2.5 x 15mm self-tapping screws in the top and bottom locations (as shown by arrows in bottom picture). Use the screws to join the two fuselage sections together.





AILERON SERVO INSTALLATION

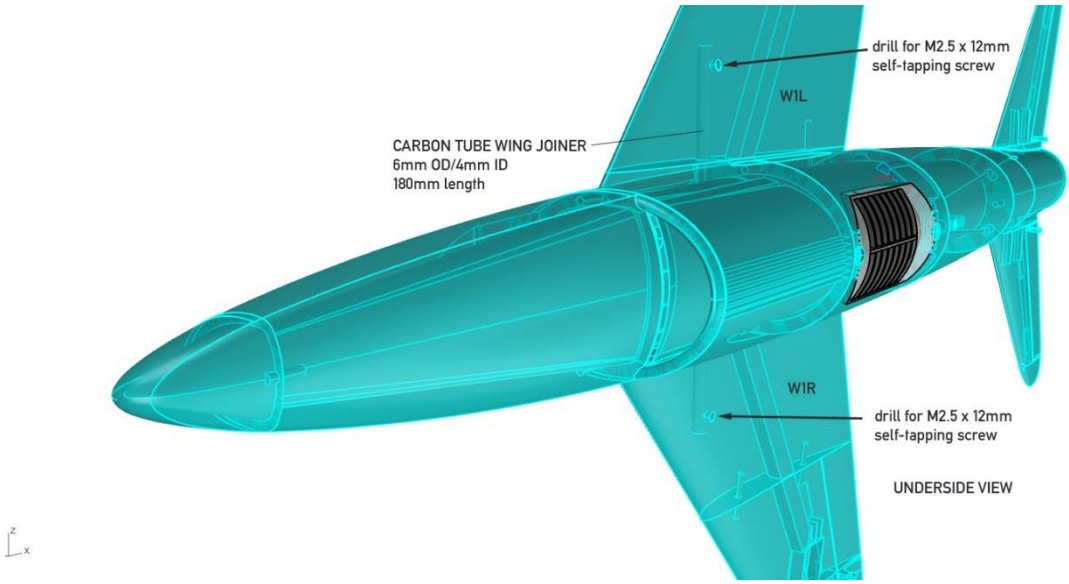
- Tape an aileron extension lead (about 450mm) to each aileron servo and feed through the hole in the wing assembly. Make sure the servo arm is attached and centred, then glue the servo in place with hot melt glue. NOTE: a servo thicker than 8mm will protrude slightly from the wing undersurface.

- Fit the 0.8-1.2mm pushrods with small clevises at each end.

WING ATTACHMENT

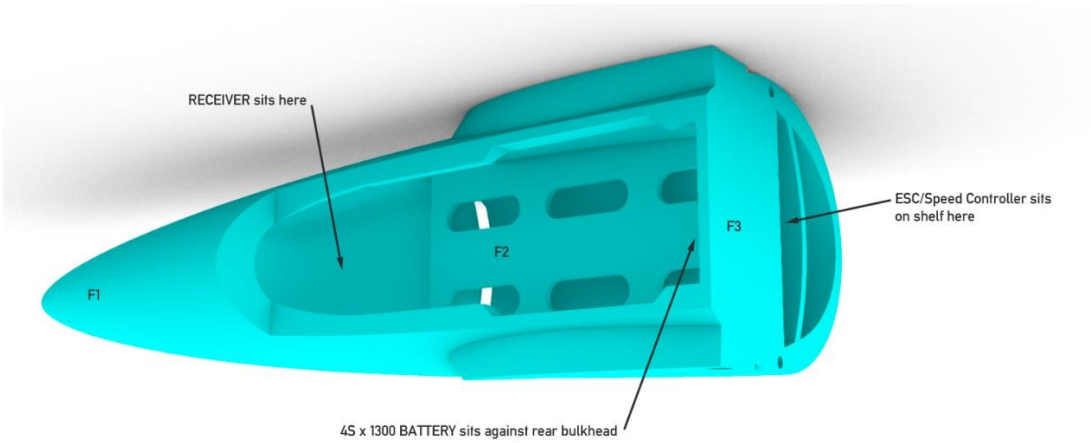
- Cut WING JOINER from 6mm OD/4mm ID carbon tube 180mm long, and place centrally through the hole in F3. Do not glue.

- Slide the wing assemblies onto the WING JOINER , feeding the aileron servo leads into the hole in the fuselage. Carefully drill a pilot hole through W1L and W1R for the M2.5 x 12mm wing retention screws. Join with the screws.



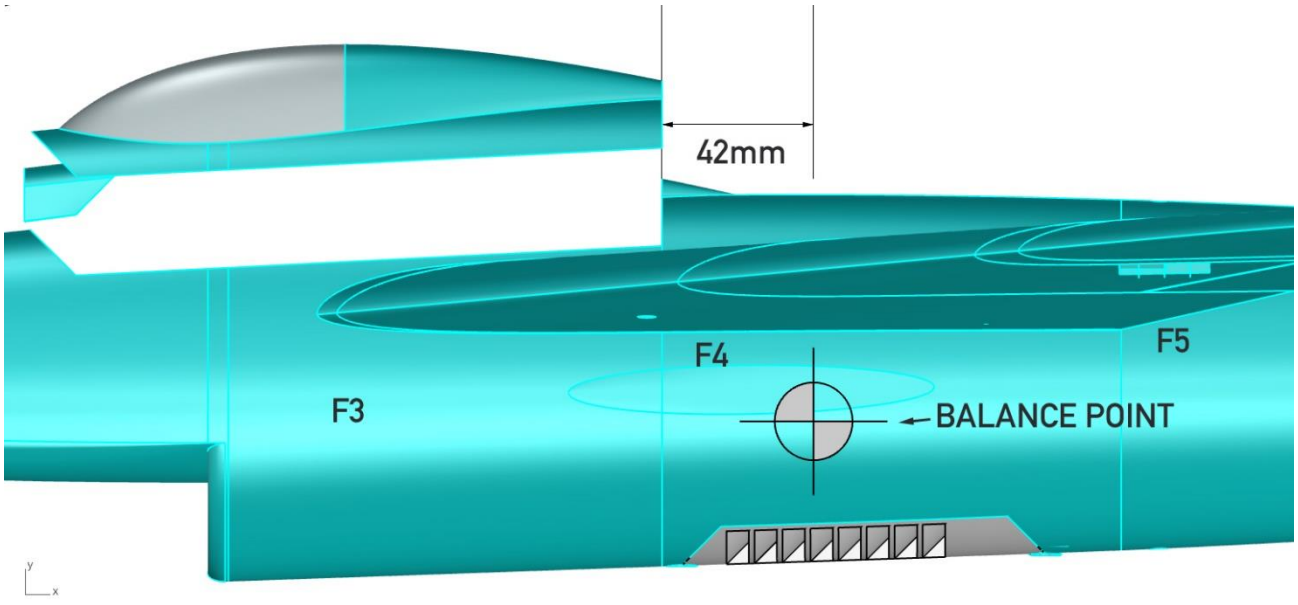
EQUIPMENT LOCATION

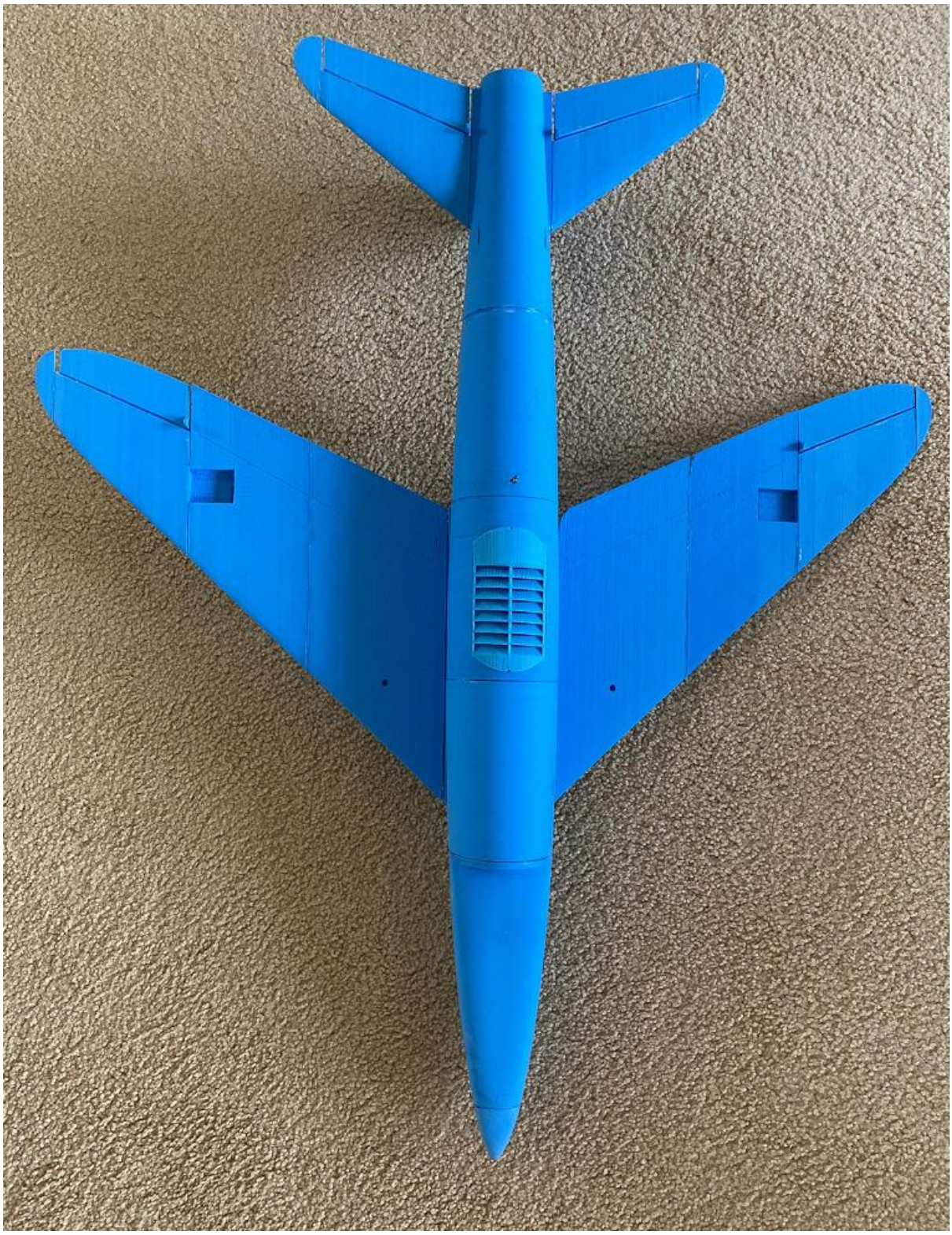
- A compact 4S battery is fitted at the rear of the battery bay for balance on the prototype. Weight 149g and size 73 x 34 x 28mm.
- Sit the ESC on the tray in F3 under the battery compartment. It receives cooling airflow from air diverted from the intake.
- The receiver sits in F2 forward of the battery. Secure elevator servo wires away from the fan if necessary.

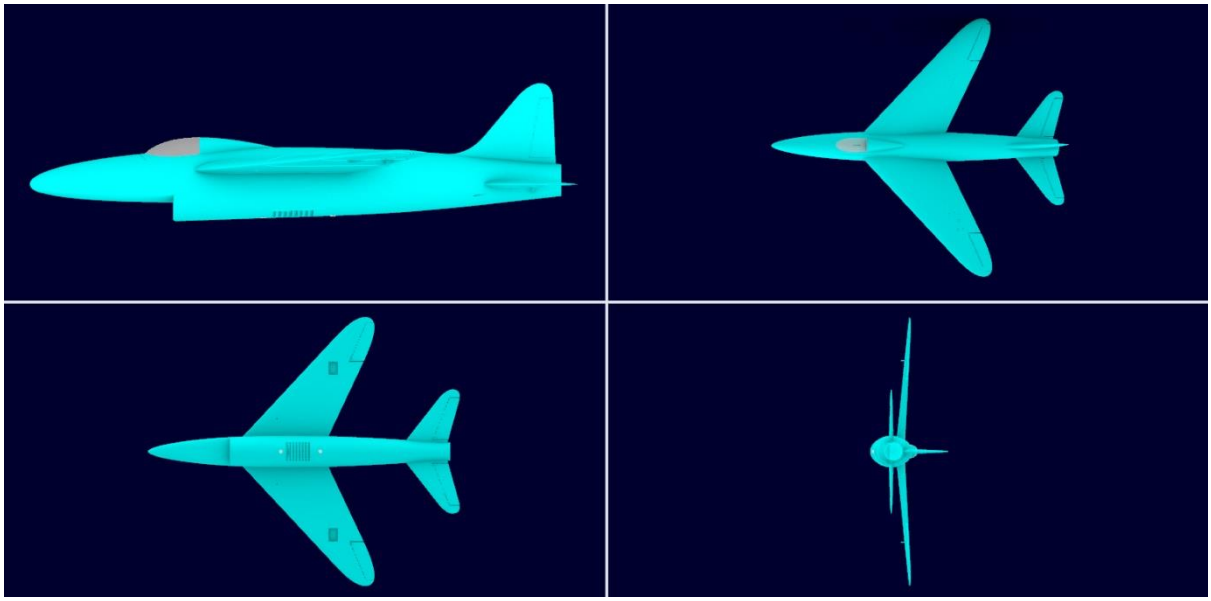


BALANCE POINT LOCATION

- Balance the aircraft 42mm behind the rear of the hatch (42mm behind the F3/F4 join).







COLOUR

In the absence of known colour photographs, the hue of the aircraft has been variously speculated as silver, light grey, blue-grey or light blue. The latter is the most plausible, as the quoted testimony of a former mechanic describes it as being the same as a captured Heinkel 162 which was re-painted in French insignia blue.

For the purposes of this model the light blue colour has been assumed, which is perfectly represented by 3DLabPrint PolyLight 1.0 – SKY BLUE – LW PLA filament.

MARKINGS

Existing photographs show the Arsenal VG 70 wearing two different guises during its lifespan:

1. As first rolled out (prior to final completion) at the Paris Air Salon on 15 November 1946, with lettering on both sides of the fin: “ARSENAL VG-70-01”. These remain the only markings seen in photographs taken during initial testing, where the fuselage has been stained by the effects of engine operation. It is not known whether the aircraft flew or just did ground testing at this time.
2. With additional wing and fuselage national registration lettering added, and a revised framed cockpit canopy, plus forked nose pitot tube. The last letter of the registration on the fuselage is blocked by the main gear leg. “F – WFO(?)” is visible on the fuselage, and “W” on the starboard landing gear door. The last registration letter has been speculated as “H” or “N”, but to this author’s knowledge has not been definitively proven. Common practice at the time would suggest that the markings were probably carried both above and below the wing, with the individual letters upright in planform, staggered along the sweep of the wing.

For simplicity, the first iteration of markings is used on this model. Page 34 has full-size markings to apply to each side of the fin which can be printed on clear self-adhesive vinyl or decal paper.

FLYING

- Set the following control throws (all measured at the widest part of the control surface):

AILERONS – 5mm UP and 5mm DOWN. No differential. EXPO 50%

ELEVATOR – 10mm UP and 5mm DOWN. EXPO 40%

- CG as noted before – 42mm behind rear of hatch
- Battery taped down to secure

Launch at full power in a slightly nose up attitude. A small amount of up elevator will be necessary until the model gathers speed. The prototype of this 50mm version of the VG-70 has about a 1:1 THRUST/WEIGHT ratio so is not lacking power. Like all EDFs though it does not have much airflow over the control surfaces until it has built up some speed.

Half power is more than enough for cruising flight, and the aircraft is nicely aerobatic, with big loops and axial rolls easily achieved.

The Selig 3021 airfoil is very efficient and the model's glide is very flat. A power off approach is usual to prevent long landing distances.

Generous wing washout means the model can be slowed without fear of a wing drop.

Wing sweepback combined with 6 degrees of dihedral gives very good lateral stability.

The chin air inlet and cheater inlet on the VG-70 can pick up debris on landing, depending on the surface. It is advisable to check for debris before powering up the fan after each landing. If necessary the auxiliary air inlet (cheater) can be removed easily by undoing the two screws to clean out the forward duct.

A video montage of the prototype's first three flights can be found here:

https://www.youtube.com/watch?v=ZNNw3YInhFg

Enjoy the Arsenal VG-70!

PARTS and EQUIPMENT LIST

- 3DLabPrint PolyLight 1.0 – SKY BLUE – LW PLA filament (about 260g)
- PLA (about 25g including 5g of clear for canopy)
- 50mm EDF for 4s (XFLY or FMS or similar). Multi-blade fans preferred for the best sound!
- Small 6ch receiver
- 4S x 1300 mAh battery (around 149g weight, size 73 x 34 x 28mm)
- 40A ESC
- 6mm OD/4mm ID carbon tube about 300mm length
- 6mm wood dowel about 50mm length (or equivalent length of above carbon tube filled with epoxy will suffice)
- 3mm diameter carbon rod 600m length (100mm for tailplane spar, remainder for alignment pins. 3mm wood dowel may be substituted for alignment pins if desired)
- 4 x micro servos, 8mm thick
- 2 x servo extension leads about 450mm length each for ailerons
- 2 x servo extension leads about 300mm length each for elevators
- CA hinge sheet
- Pushrod wire (0.8 -1.2mm diameter about 800mm length)
- 8 x small or micro clevises to suit pushrod wire
- Self-tapping screws:
  2 pieces M3 x 20mm
  4 pieces M2.5 x 12mm
  2 pieces M2.5 x 15mm
- Medium CA
- Accelerator for CA
- Clear Gorilla Glue
- Hot melt glue
- 2 x rare earth magnets 10mm diameter/3mm thick

DOCUMENT AMENDMENT LIST

26 JUNE 2023	VERSION 1.0	ORIGINAL ISSUE
27 JUNE 2023	VERSION 1.1	p.4, p.22,p.26 spelling
		P.26 text WING ATTACHMENT should read “F3” not “F6”
28 JUNE 2023	VERSION 1.2	Full-size markings added on p.34
		Note about hot melt glue to attach servo added

CONTACT: admin@timelesswings.com

ARSENAL VG-70-01 ARSENAL VG-70-01