

ASSEMBLY MANUAL AND USER GUIDE



Supermarine Spitfire **Mk IX**

By 3D AEROWORKS

OVERVIEW:

This replica of the Supermarine Spitfire Mk IX is designed for quick and easy construction and printed using light weight PLA (LW-PLA). For best results the canopy should be printed with clear PLA The motor mount and propeller assembly in regular PLA. A semi scale propeller is included in the plans designed to suit the 2804 2300kv outrunner (5.75x4.5 blade) in 2, 3 or 4 blade configuration. Utilising full 4 channel controls; aileron, elevator, rudder and throttle, this model performs extremely well given its small size and lightweight. Links to components used can be found on the last page of the user guide.

This model has taken many hours of hard work and testing in order to provide a nice flying aircraft. Please do not share it. Please show your appreciation by directing interested parties to the link below.

<https://cults3d.com/en/3d-model/various/supermarine-spitfire-mk-ix-600mm>

GENERAL SPECIFICATIONS

WINGSPAN:	600mm
PRINT TIME:	45 hrs
PRINT WEIGHT:	150g
FLYING WEIGHT:	255g
CENTER OF GRAVITY	26mm aft of L.E at wing root. (Marked with indentation)

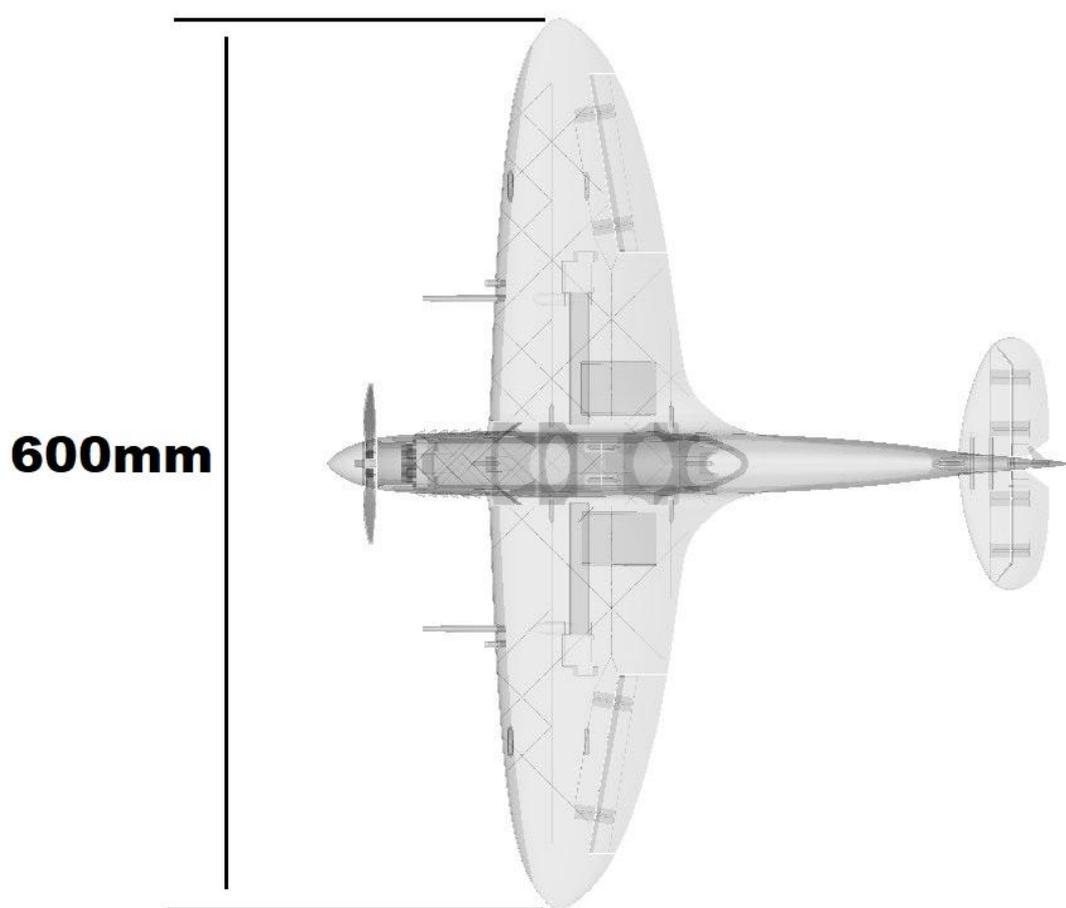
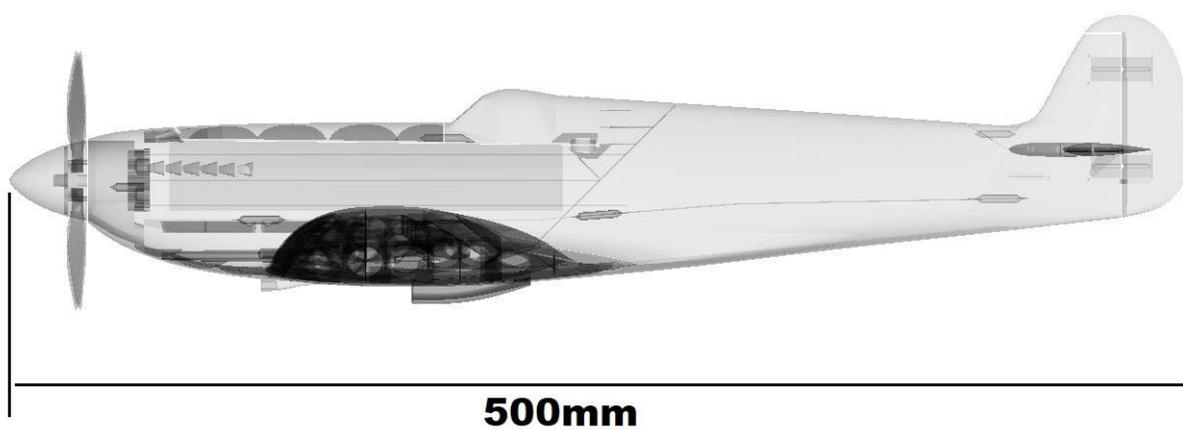
ELECTRICS

MOTOR:	2804 2300KV
ESC:	12amp (min) 20amp (recommended)
SERVOS:	3.7g MICRO
BATTERY:	950MAH 2S (or similar)

INCLUDED:

STL FILES OF ALL COMPONENTS (scale to 1000% if not using S3D)

FACTORY FILES FOR (S3D) SIMPLIFY 3D FOR PRINTERS: 200X200X200



REQUIRED TOOLS:

KNIFE

LIGHTER

SANDPAPER (MEDIUM GRIT)

PLIERS

CA GLUE

SCREW DRIVERS

FILE OR RASP

REQUIRED COMPONENTS:

X1 2804 2300KV MOTOR (or similar)

X1 12AMP or 20AMP ESC

X1 950MAH 2S LIPO OR SIMILAR

X4 3.7G MICRO SERVO

BAMBOO SKEWERS 3MM

HEAT SHRINK TUBE 3mm

X2 10mm X 10mm X 2mm MAGNET (ROUND)

X10 MICRO HINGES (OPTIONAL)

VELCRO

X2 x 200mm CARBON STRIP 3mm x 0.6mm (OPTIONAL)

M2 x10mm SCREWS

1mm PIANO WIRE



ASSEMBLY INSTRUCTIONS

1

After all parts have been printed, some may require to be cleaned as LW-PLA is prone to stringing. Do this by gently sanding back the rough sections with a file, sandpaper or blade until the surface is smooth.

2

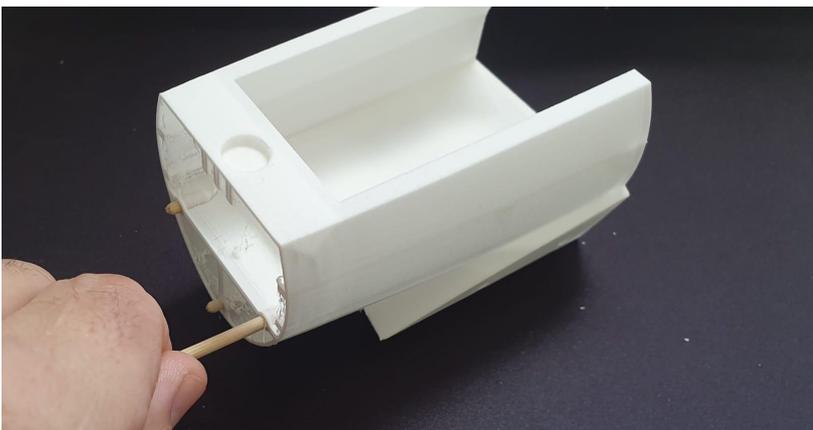
All faces which are to be glued to other parts need to be given a light sanding (scuff the surface) to assist with glue adhesion.

3

Cut 15mm sections of skewer and place into alignment holes in the fuselage sections.

NOTE - It may be required to open up the holes a small amount if the fit is too tight. Do this by using a 3mm drill bit. Gently spin it in reverse as you insert it into the hole. This will ensure the bit does not tear the print.

Test fit the sections of the fuse before gluing to ensure a clean fit.

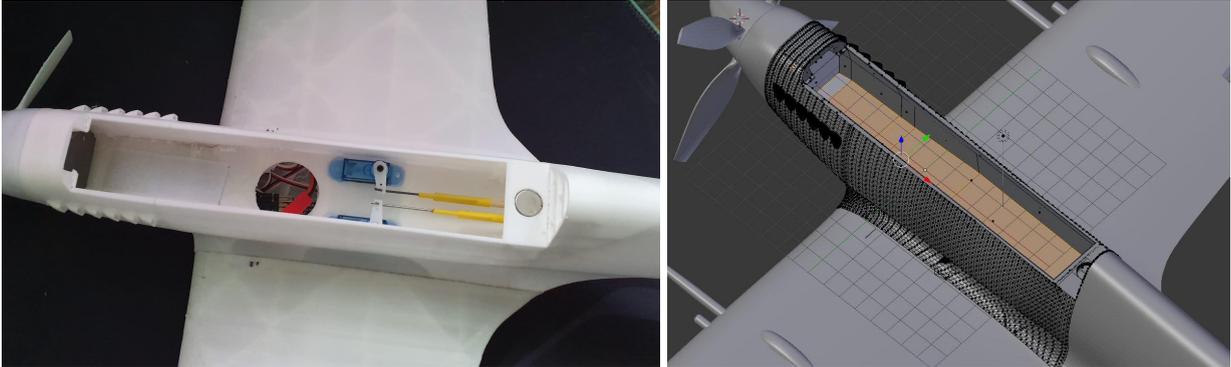


4

Glue all sections of the fuse together except fuse 1. This will be glued on last in order to allow for cg balancing.

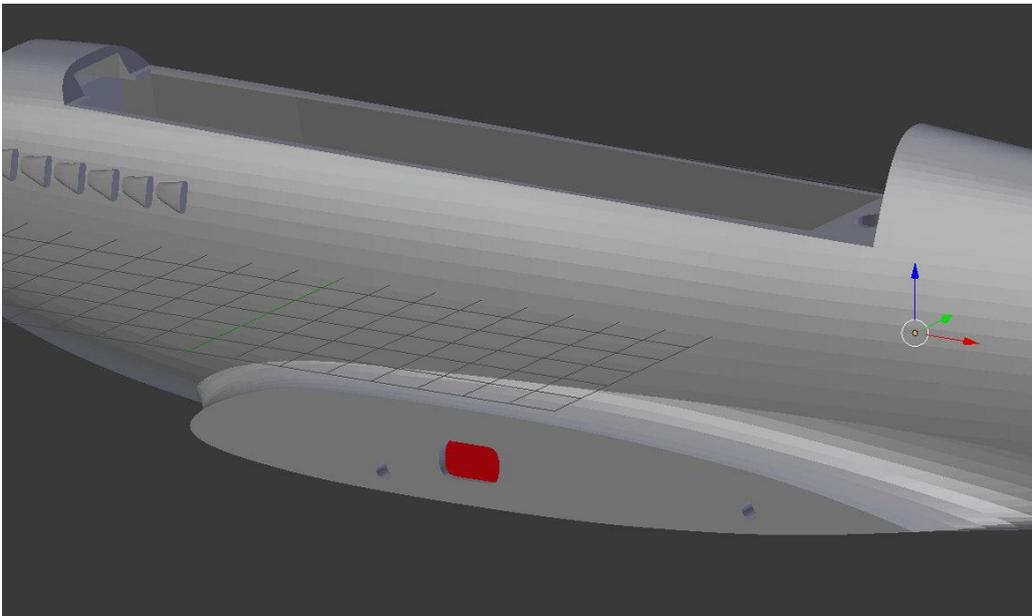
5

Once glued, with a sharp knife, remove the false floor of the battery hatch. (see pic/ highlighted faces) NOTE: The removed sections of LW-PLA that is the false floor will be used as hinge pieces later. **Do not throw away.**

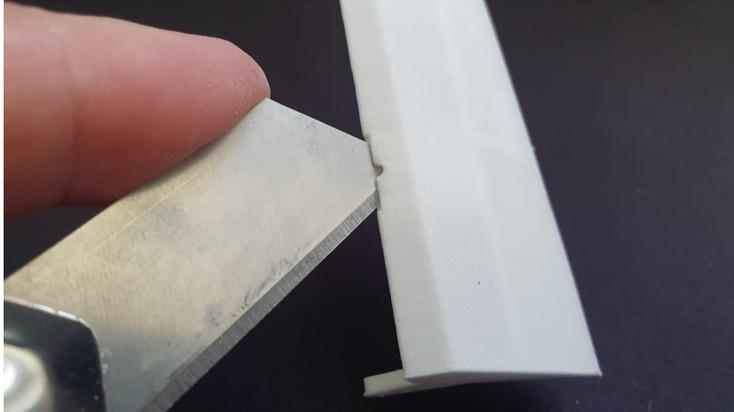


6

From part "fuse 3" remove the inner section of the lead tunnel with a knife or heated metal rod to allow the servo lead for the aileron to pass through. (marked red)

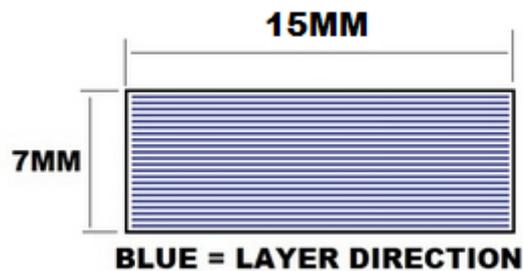


Test fit the hinges in the hinge slots for each control surface and its parent part, this will make gluing the control surface easier when the time comes. **NOTE**- Do not force the hinge if it is too tight. Loosen the slot by gently inserting a stanley knife.



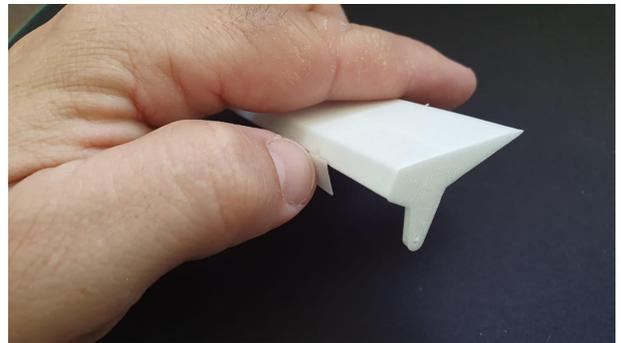
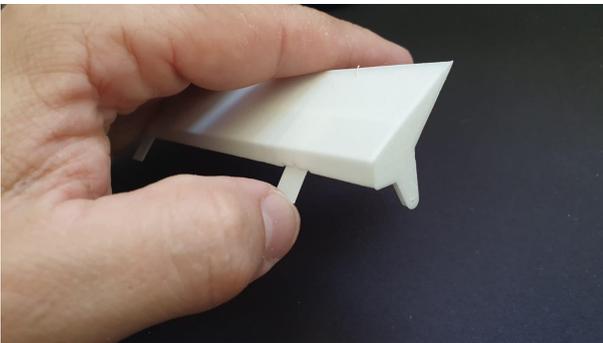
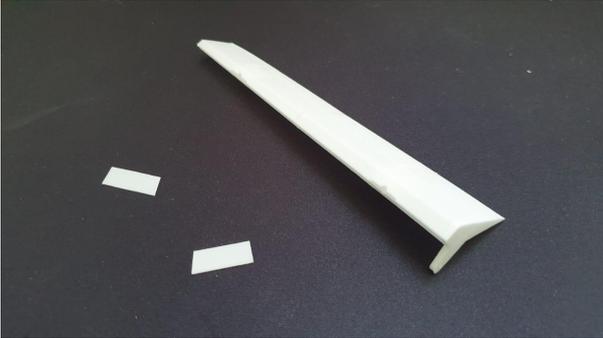
Using the LW-PLA as a hinge:

From the off-cuts from the fuselage false floor, cut small sections of 15mm x 7mm with the 7mm side being against the grain of the layers. Test fit the pieces into the hinge slots of the control surface and stabiliser or wing.



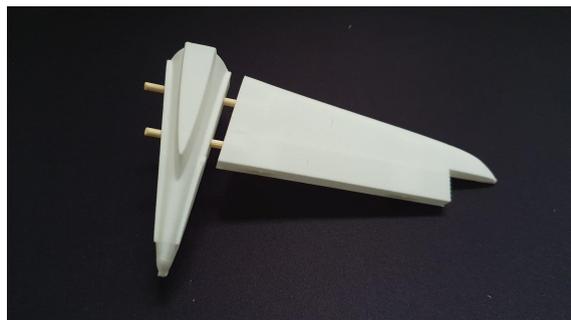
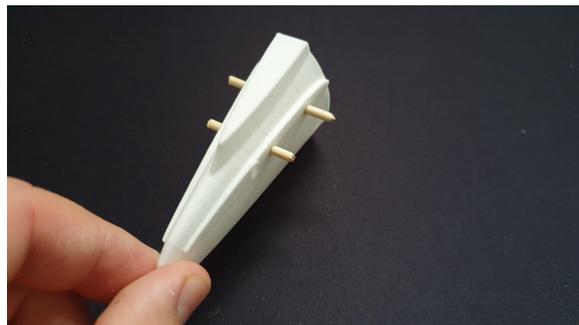
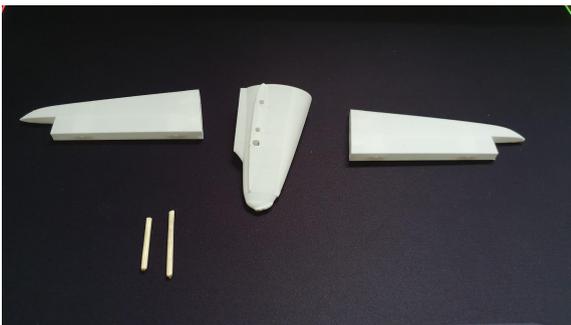
8

Place a drop of CA in the hinge slot of the control surface and insert the hinge. Be sure that the hinge is perpendicular to the control surface. Then bend the hinges to 90deg back and forward a few times to make sure they are appropriately loose. (the outer aileron and elevator hinge may need to be trimmed). **See below**



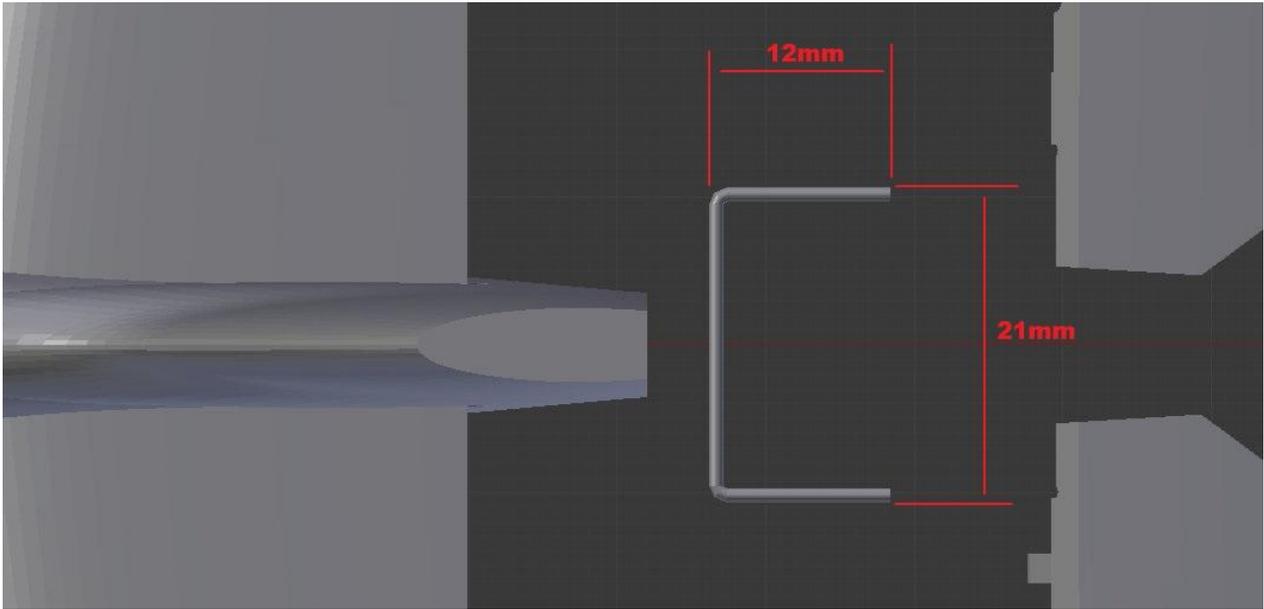
9

Fit the horizontal stabilisers to the fuselage using small sections of 3mm bbq skewers to align the stabilisers and glue with CA.

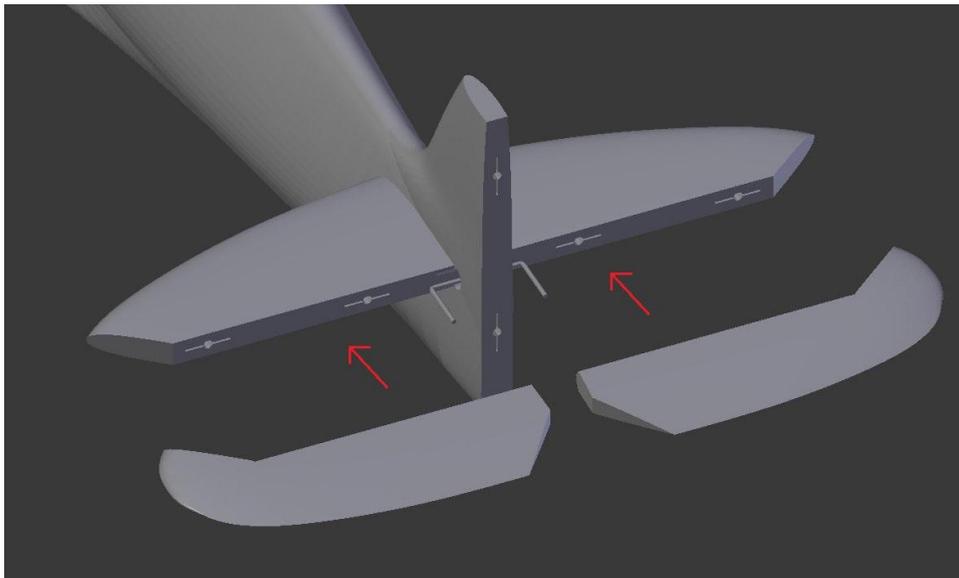


10

Bend a section of 1mm steel wire to connect the elevators together.



Test fit the wire and the elevators connection to the horizontal stabilisers before gluing the wire to the elevators, or the elevators to the tail plane. There should be un-obstructed travel.



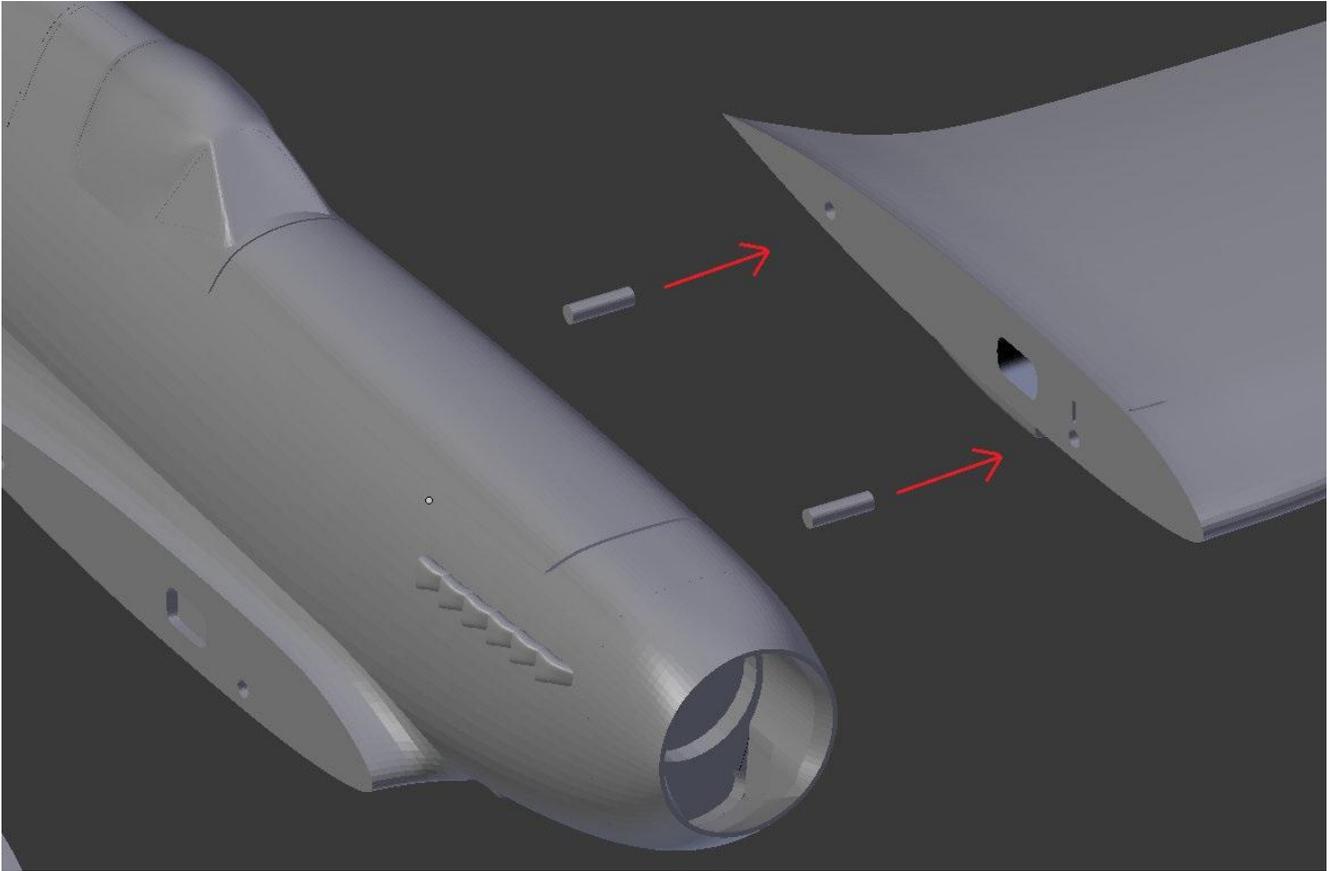
11

Glue the rudder, elevators and ailerons in place. Make sure each control surface has full and free movement.

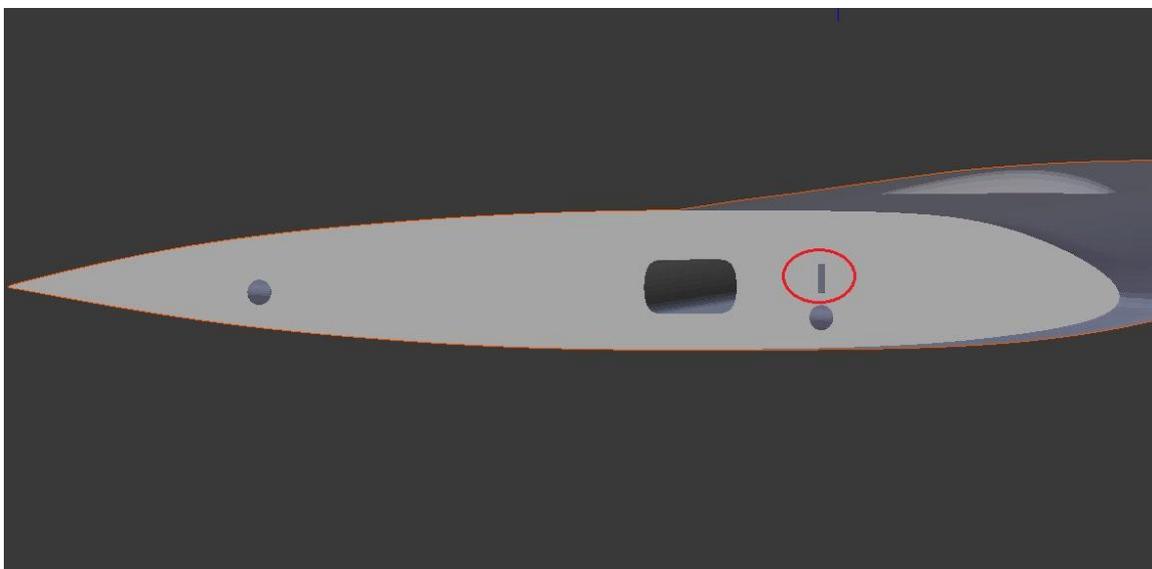
12

Glue the wingtips and tail cone in place (if required).

Cut one 200mm section and four (2 per wing) 15mm sections of skewer. Insert the 15mm sections into the wings and the 110mm section through the fuselage. This is a makeshift spar to assist supporting the landing gear. (not required if not using the gear)



Glue the wings to the fuselage **NOTE** – if using 3mm x 0.6mm carbon strip, now is the time to install it. Simply slide the carbon strip into the slot and cut it so it does not protrude out of the wing (circled in red, see image). The cross structure of the fuselage spreads the load of the wings at the root which negates the need of a connecting spar in the fuselage.



14

Run a string through the aileron servo wire tube from the mount hole for the aileron servo to the wing root. Leave enough length so that you will be able to feed the string through the fuse later.

15

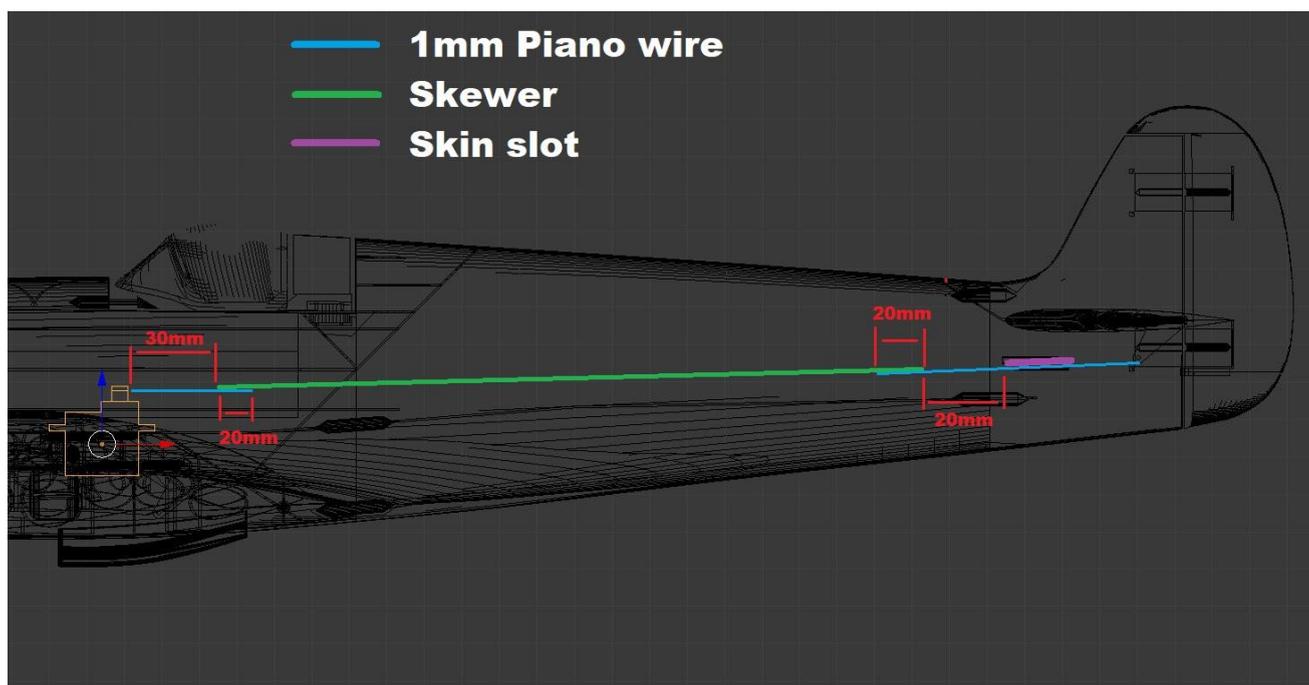
Install all servos using a small amount of hot glue to secure it in place. The aileron servos mounting tabs will need to be trimmed. Connect the ailerons to the servos using 1mm wire and the printed linkage locks.

16

Using an appropriate length of skewer with 1mm steel wire on each end covered in heat shrink tubing, connect the elevator and rudder to their relative servo.

Elevator = left side

Rudder = right side



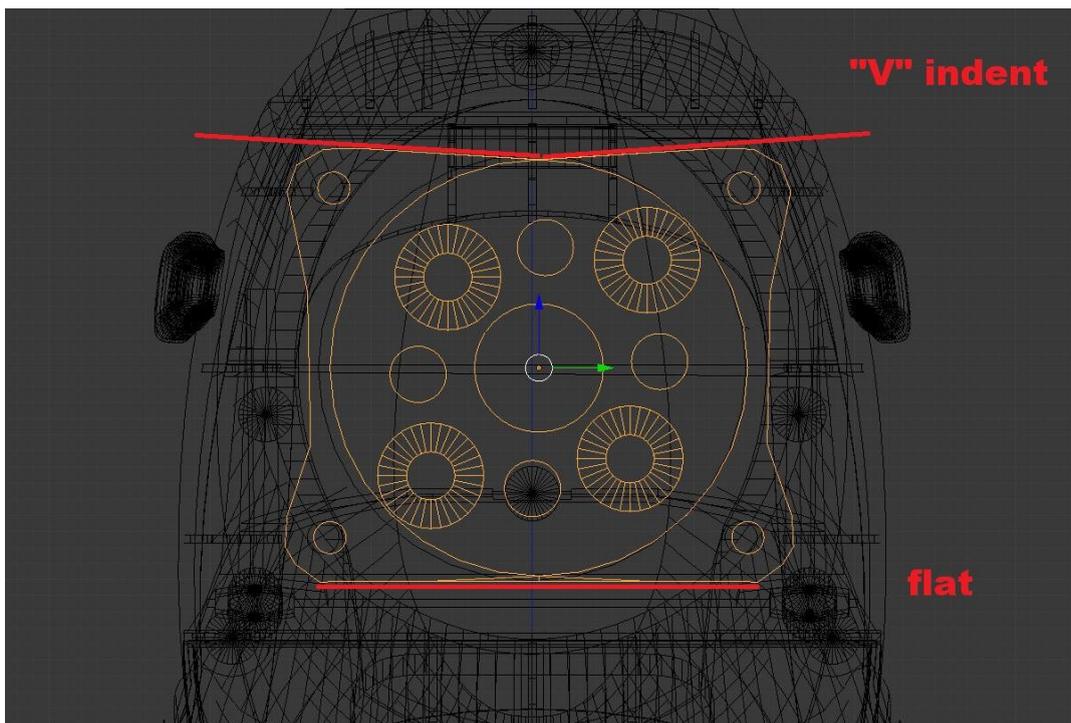
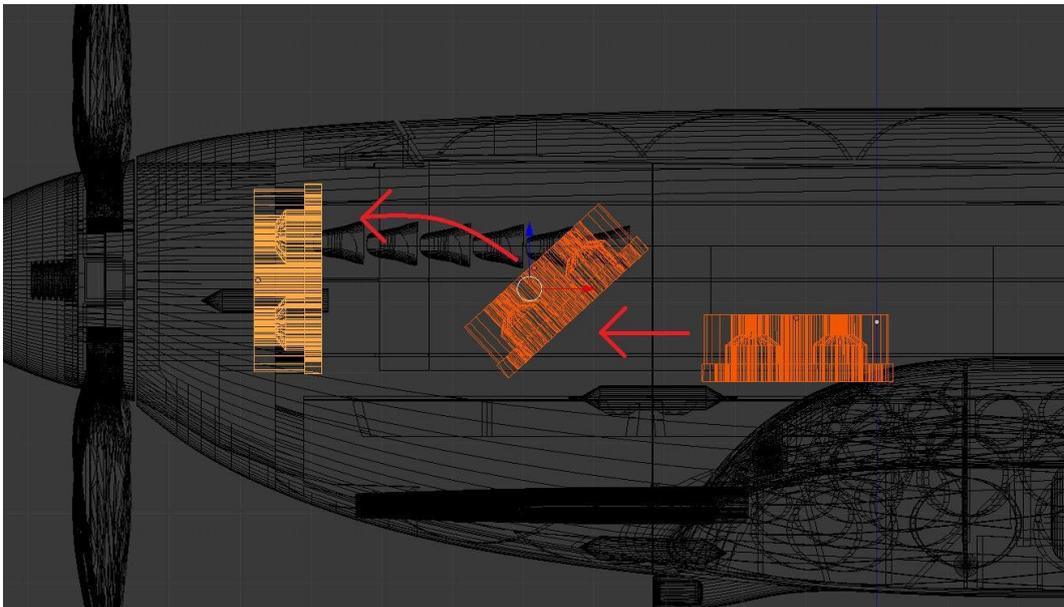
17

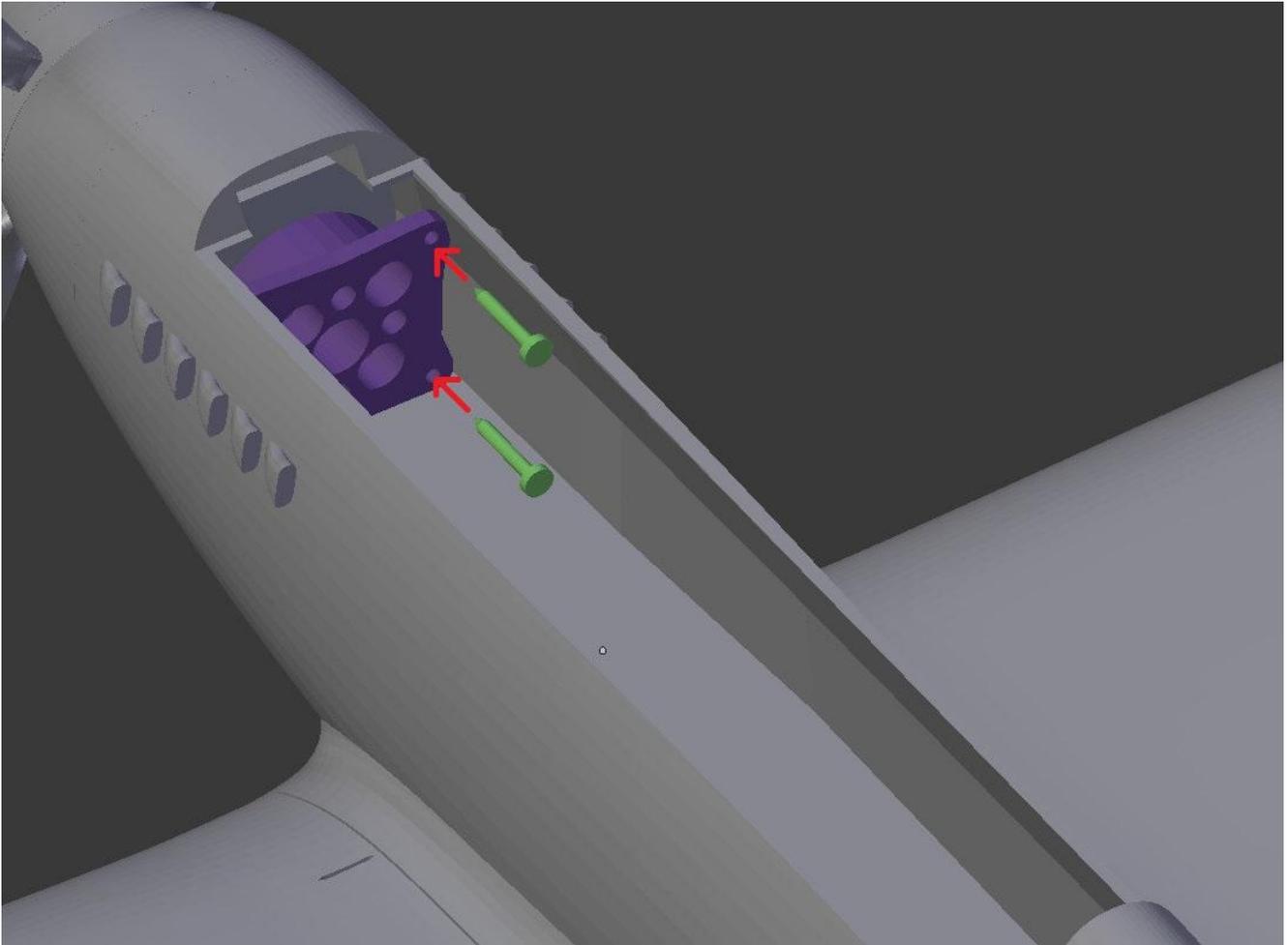
Install the magnets to both the fuselage and the canopy using CA.

18

Install the desired motor mount to the fuselage using m2 screws. The mount holes may need to be pre-drilled with a 2mm drill bit. The fit for the mount is quite tight.

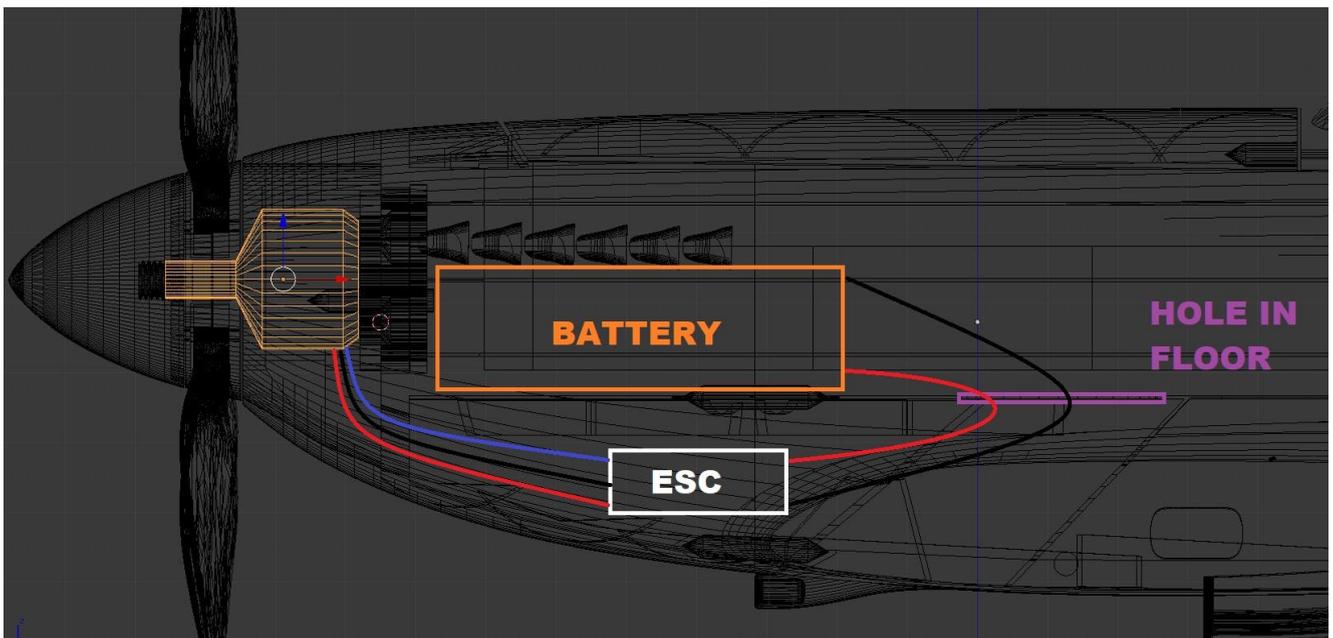
- Lay the mount with the aft face to the floor.
- Slide it along until the mount is almost touch the firewall.
- Rotate the mount up into place
- The slight "V" shape in the mount should be at the top. (see pic)





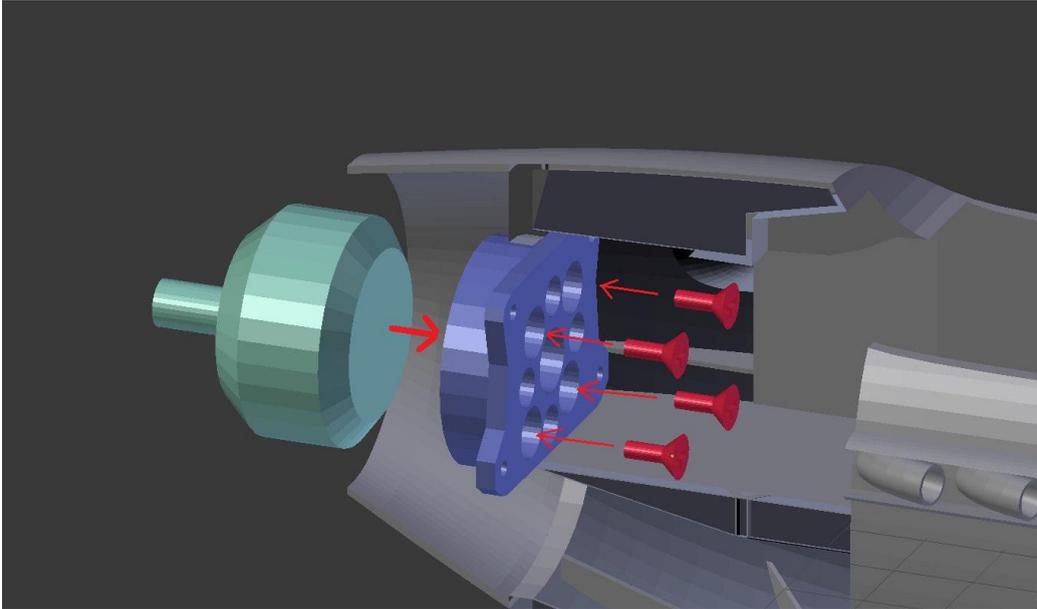
19

Wire up the ESC to the motor. The esc is intended to sit below the battery floor with the wires connecting to the battery through the hole in the mid section of the fuselage floor.



20

Install the motor to the motor mount. The motor mount holes may need to be pre-drilled with a 3mm drill bit.

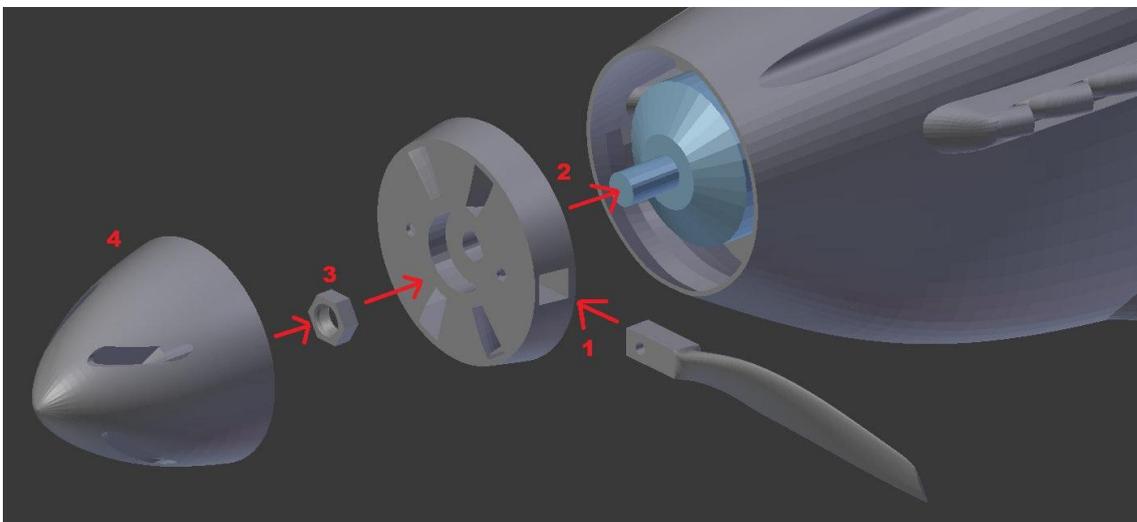


21

Fit the propeller hub to the motor and screw in the blades using m2 x 10mm screws. Then secure the spinner to the hub. The propeller blades will need to be pre-drilled with a 2mm drill bit for ease of fitment.

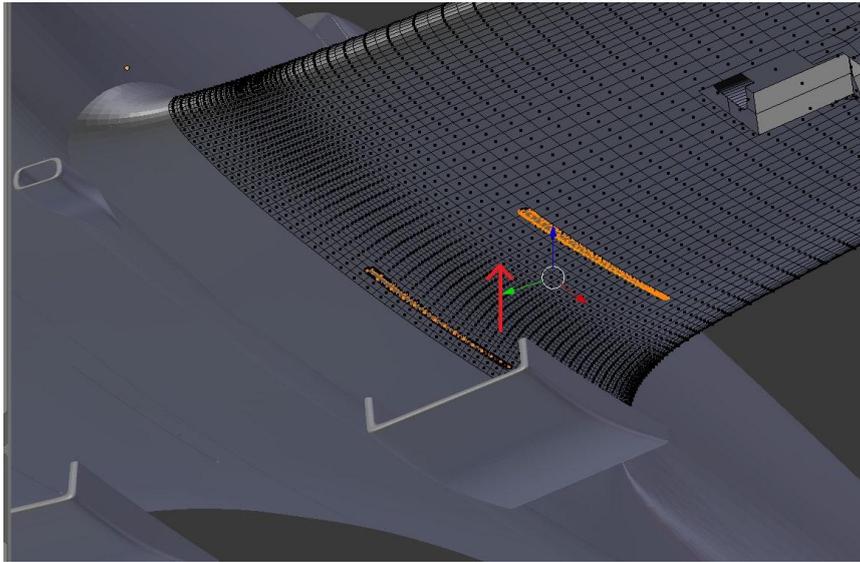
Installing the propeller:

- Install the blade to the hub and secure it with an m2 x 10mm screw. (screw direction towards the back of the hub)
- Install the hub to the motor.
- Secure with either metal nut provided or printed nut.
- Install the spinner. The spinner is designed with an m5 thread to suit most small motors with a regular cw thread.



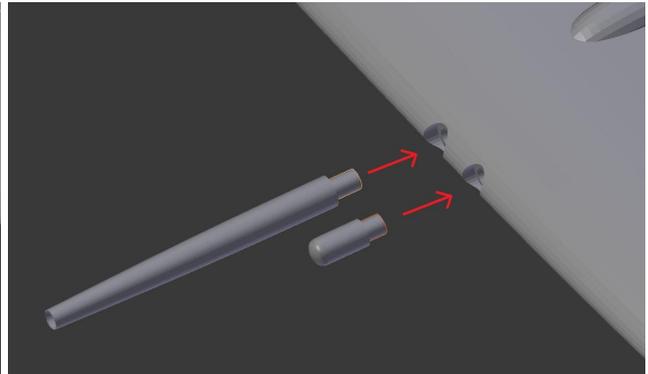
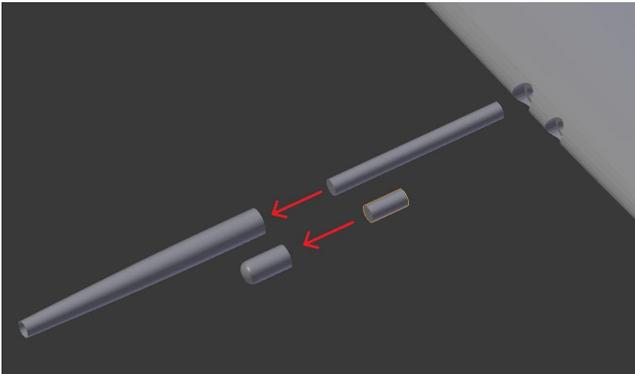
22

Glue the radiators to the wings using the indents on the underside of the wings as guides.



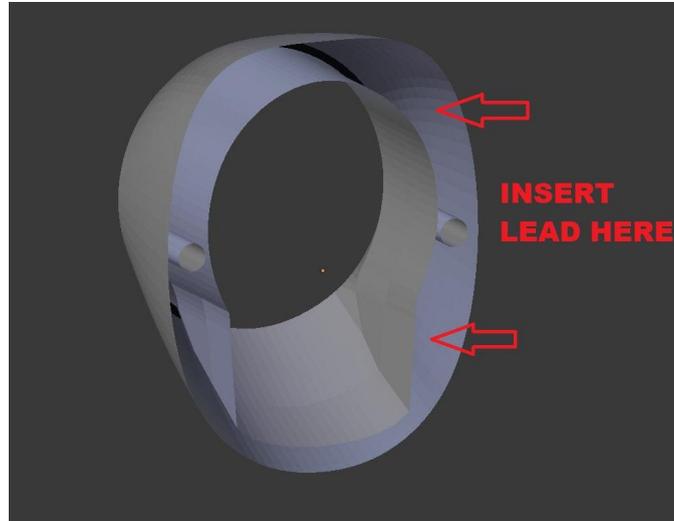
23

Cut sections the length of the cannons plus 3mm. Insert the skewers into the cannons and fit them to the wings using CA or hot glue.



BALANCING AND CG

The ballast lead required should be placed in the hollow section of fuse 1. During testing this was done by cutting the lead into small “rice grain” sized pieces and dropped into the hollow section. Once balanced appropriately, CA was applied to the lead to lock it in place. **NOTE!** Balancing needs to be done with the propeller attached. See *below*



Once balanced appropriately, glue Fuse 1 in place with ca.

Fit the battery using Velcro as required and balance the aircraft inverted on the CG marking points located **34mm aft of the leading edge at the wing root.** **The maiden flight of this aircraft should be performed with the 2 blade propeller configuration due to the increased torque effects of the 4 blade option.**

RANGE OF TRAVEL:

MAIDEN / NORMAL FLIGHT:

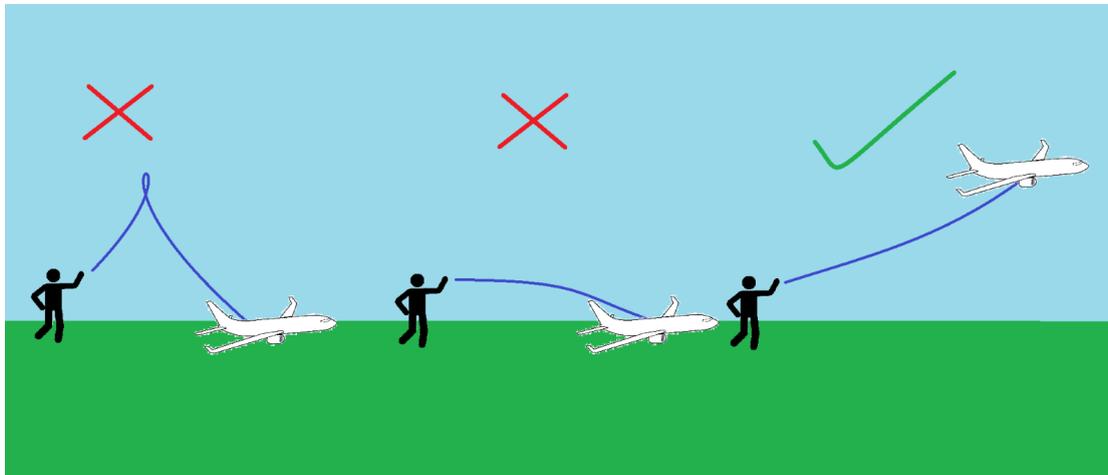
Elevator	+/- 5mm
Rudder	+/- 10mm
Aileron	+/- 10mm

AEROBATIC:

Elevator	+/- 8mm
Rudder	+/- 15mm
Aileron	+/- 15mm

LAUNCHING:

It was found that the safest and most successful launch technique for this model was the under-arm style. The aircraft should be launched at approximately 20deg nose up at 50% to 75% power. Too steep and the aircraft will stall, too shallow and it will contact the ground.



PARTS LINKS:

X1 2804 2300KV MOTOR

https://de.aliexpress.com/item/32880887286.html?spm=a2g0o.productlist.0.0.138a29f3Y7bXF4&algo_pvid=95040ddc-7eca-4d17-b061-ba5ed52d7eac&algo_exp_id=95040ddc-7eca-4d17-b061-ba5ed52d7eac-3

X1 20AMP ESC

https://www.aliexpress.com/item/32905632543.html?spm=a2g0o.productlist.0.0.293536aecwu7yT&algo_pvid=09b70550-d77e-46d3-b25e-621167aaeef6&algo_exp_id=09b70550-d77e-46d3-b25e-621167aaeef6-0&btsid=0b0a556616077433274567589e7b03&ws_ab_test=searchweb0_0.searchweb201602_0.searchweb201603

X1 950MAH 2S LIPO OR SIMILAR

<https://www.aliexpress.com/item/32907577121.html?spm=a2g0s.9042311.0.0.30714c4dJd4dZG>

X4 3.7G MICRO SERVO

https://www.aliexpress.com/item/32965734270.html?spm=a2g0o.productlist.0.0.57d95e97aWNNAJ&algo_pvid=4824ea1c-06ed-43e8-b6c7-9737d1226dbe&algo_expid=4824ea1c-06ed-43e8-b6c7-9737d1226dbe-0&btsid=0bb0623415991458444523660eb7bd&ws_ab_test=searchweb0_0,searchweb201602_,searchweb201603_

X2 BAMBOO FOOD SKEWERS (3mm diameter)

HEAT SHRINK TUBE 3mm

https://hobbyking.com/en_us/turnigy-3mm-heat-shrink-tube-black-1mtr-1.html?queryID=c16c094bb26b18e39fabcb12a93a96cb&objectID=46911&indexName=hbk_live_magento_en_us_products

X4 10mm X 10mm X 2mm MAGNET (ROUND)

https://www.aliexpress.com/item/1005001362617359.html?spm=a2g0o.productlist.0.0.5da3607dAATH5j&algo_pvid=b9e32b8a-0d4f-469a-b838-b478442dda50&algo_expid=b9e32b8a-0d4f-469a-b838-b478442dda50-0&btsid=0bb0623a15991797178681785e1811&ws_ab_test=searchweb0_0,searchweb201602_,searchweb201603_

X10 MICRO HINGES

https://hobbyking.com/en_us/super-light-pivot-round-hinges-d2xw8xl24mm-12pcs.html

VELCRO – (local hardware store)

X2 x 200mm carbon strip 3mm x 0.6mm (optional)

https://www.aliexpress.com/item/32576381076.html?spm=a2g0o.productlist.0.0.4e922cc3nR6757&algo_pvid=500714e5-ce74-4e52-a1b0-e349cac3f595&algo_expid=500714e5-ce74-4e52-a1b0-e349cac3f595-7&btsid=0bb0623e15991463277515177efc08&ws_ab_test=searchweb0_0,searchweb201602_,searchweb201603_

m2 x10mm screws

<https://www.ebay.com.au/itm/400PCS-M2-M2-6-Pan-Head-Self-Tapping-Screws-Assorted-Kit-Stainless-Steel-Black/254399626404?hash=item3b3b663ca4:g:CLEAAOSwQLZdsqkd&frcectupt=true>

Thank you for supporting us! We hope you enjoy many hours of flying your micro Spitfire Mk IX. If you have any questions regarding the build process or set-up of your model, please contact us at:

Aeroworks3d@outlook.com