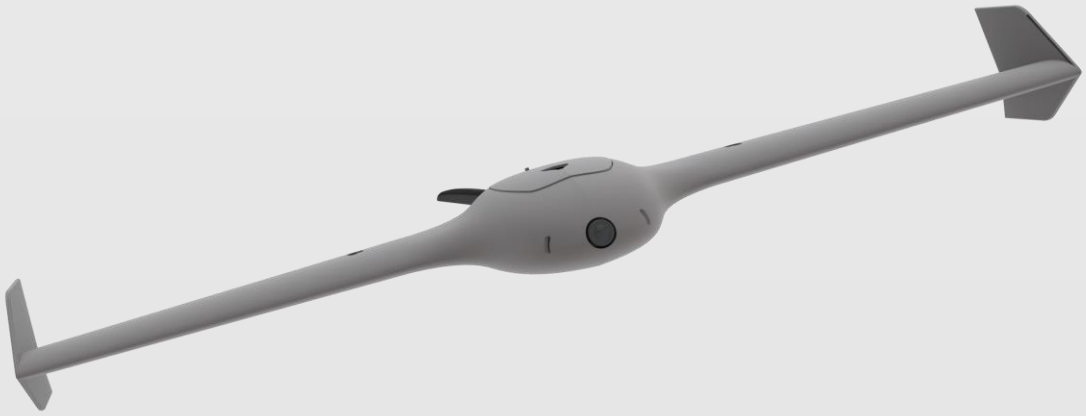
FLIGHTORY

# Mini Plank

# USER MANUAL

**V.1**

# Socials



Join Flightory Tech group on Facebook and create community with us. Share progress of your builds. Any suggestions or questions welcome.
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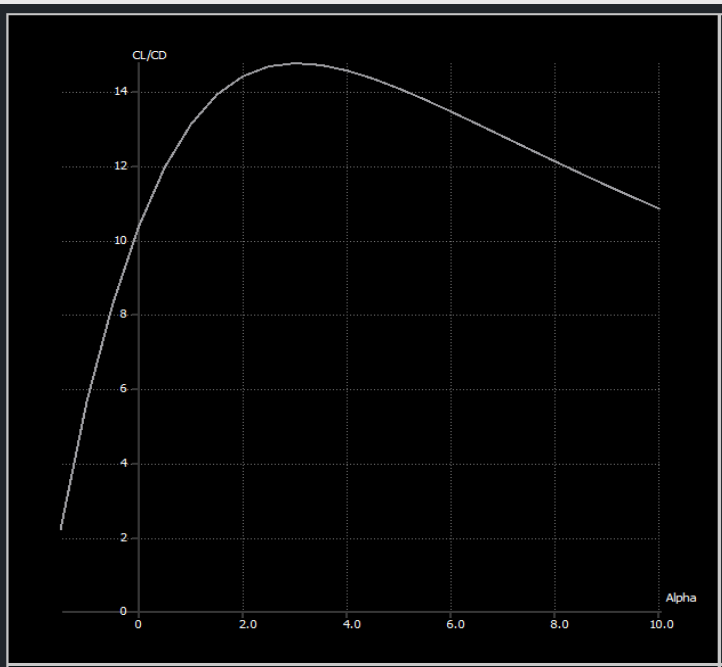
Follow Instagram where I share more footage on a regular basis
www.instagram.com/flightory_

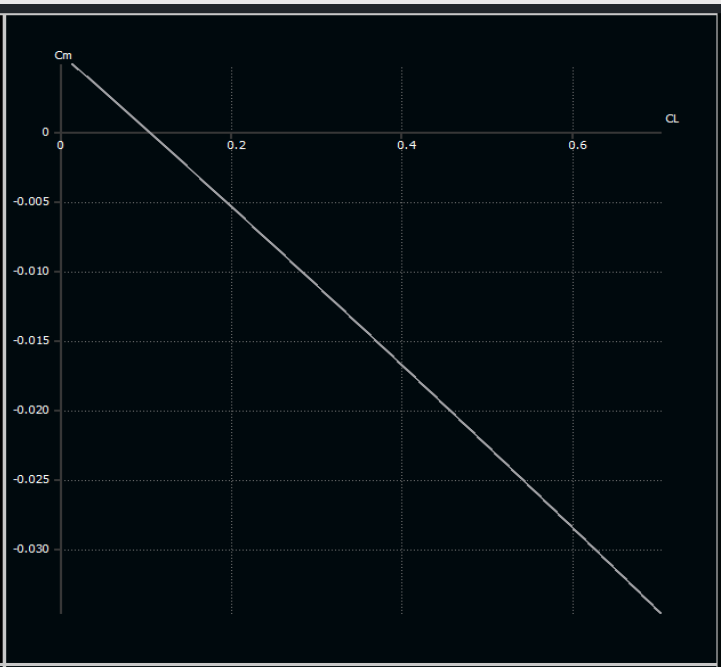
Check out the Youtube channel where you can find videos about my projects: www.youtube.com/@FLIGHTORY

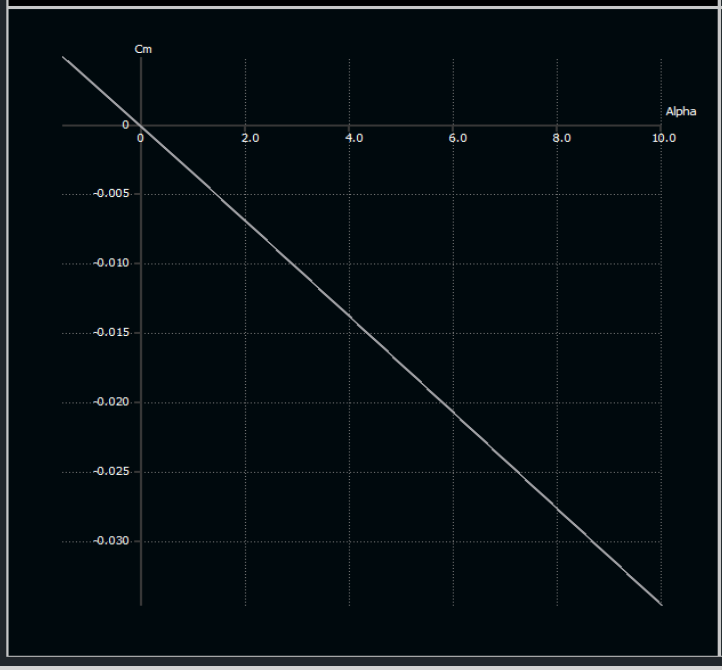
# General Aircraft Data

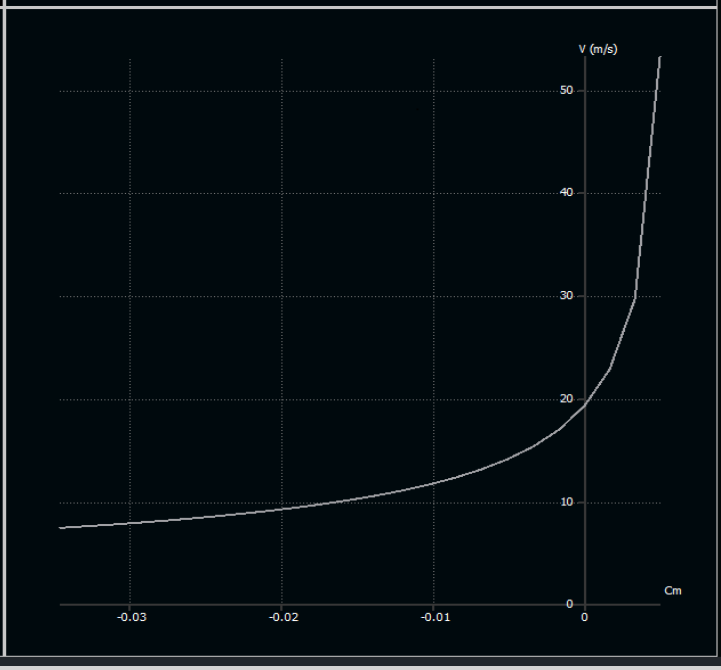
| General data | |
|---|---|
| Wingspan | 650mm |
| Wing area | 12.5 dm² |
| Lenght | 370mm |
| Center of Gravity | 35mm from leading Edge |
| AUW | 300-400g |
| Optimal Cruise Speed | 45-55 km/h |
| Airfoil | PW75 |
| Root Chord | 230mm |
| MAC | 191mm |
| Aspect Ratio | 3.43 |
| Wing load | 24 -32g / dm² |

# CFD Analysis



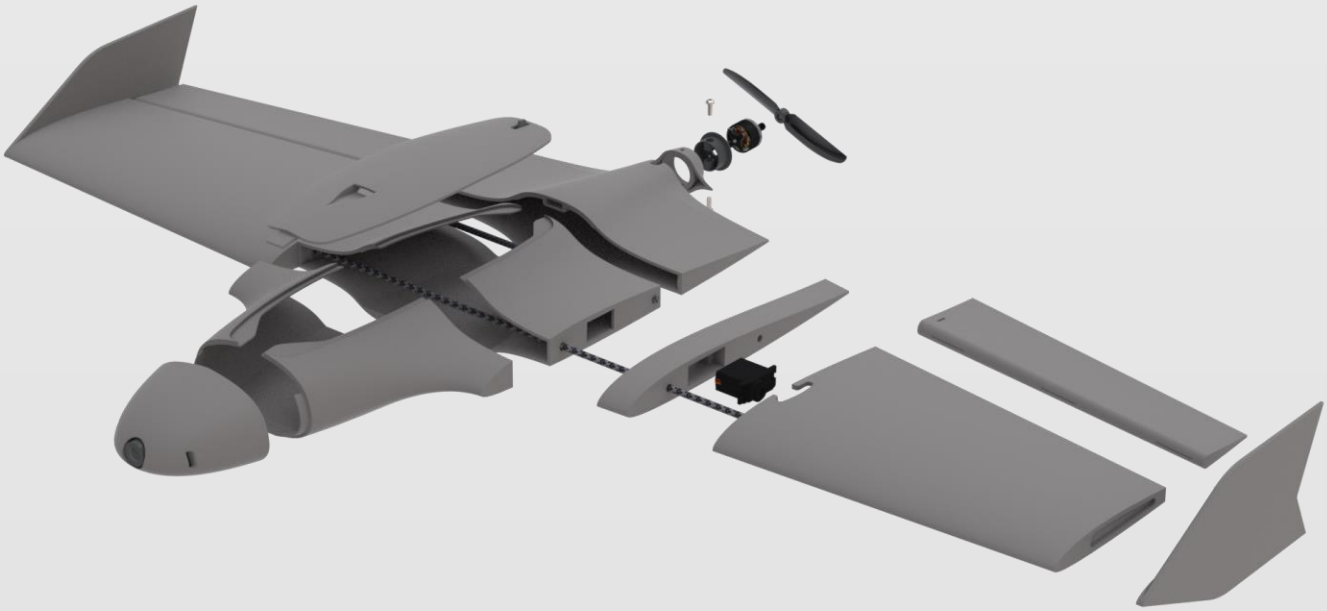



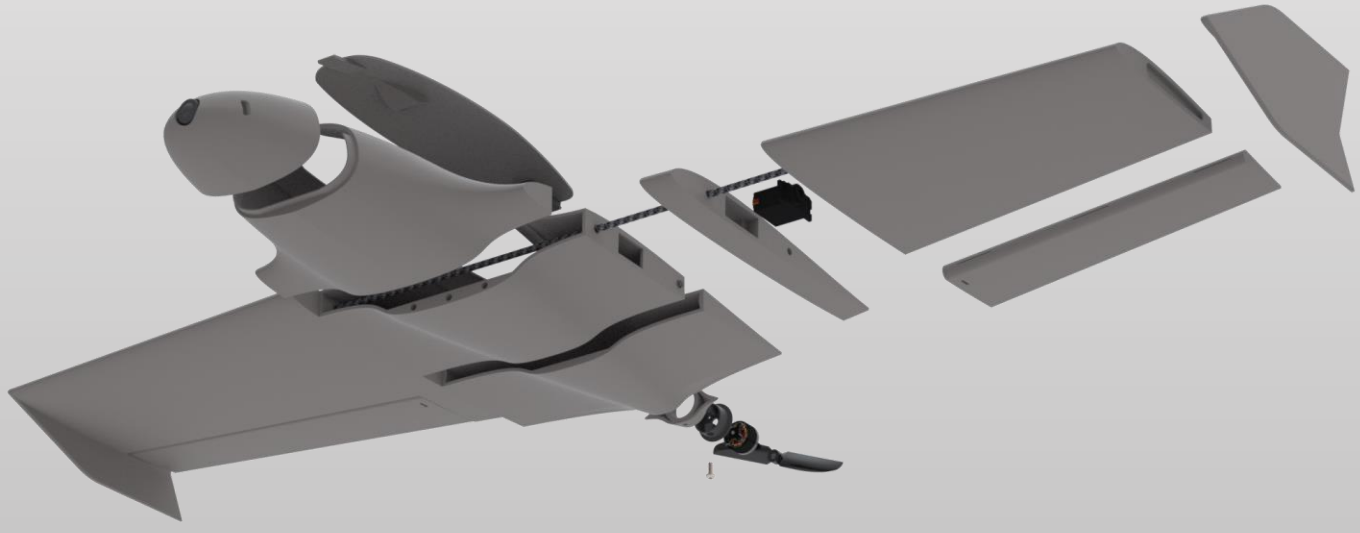



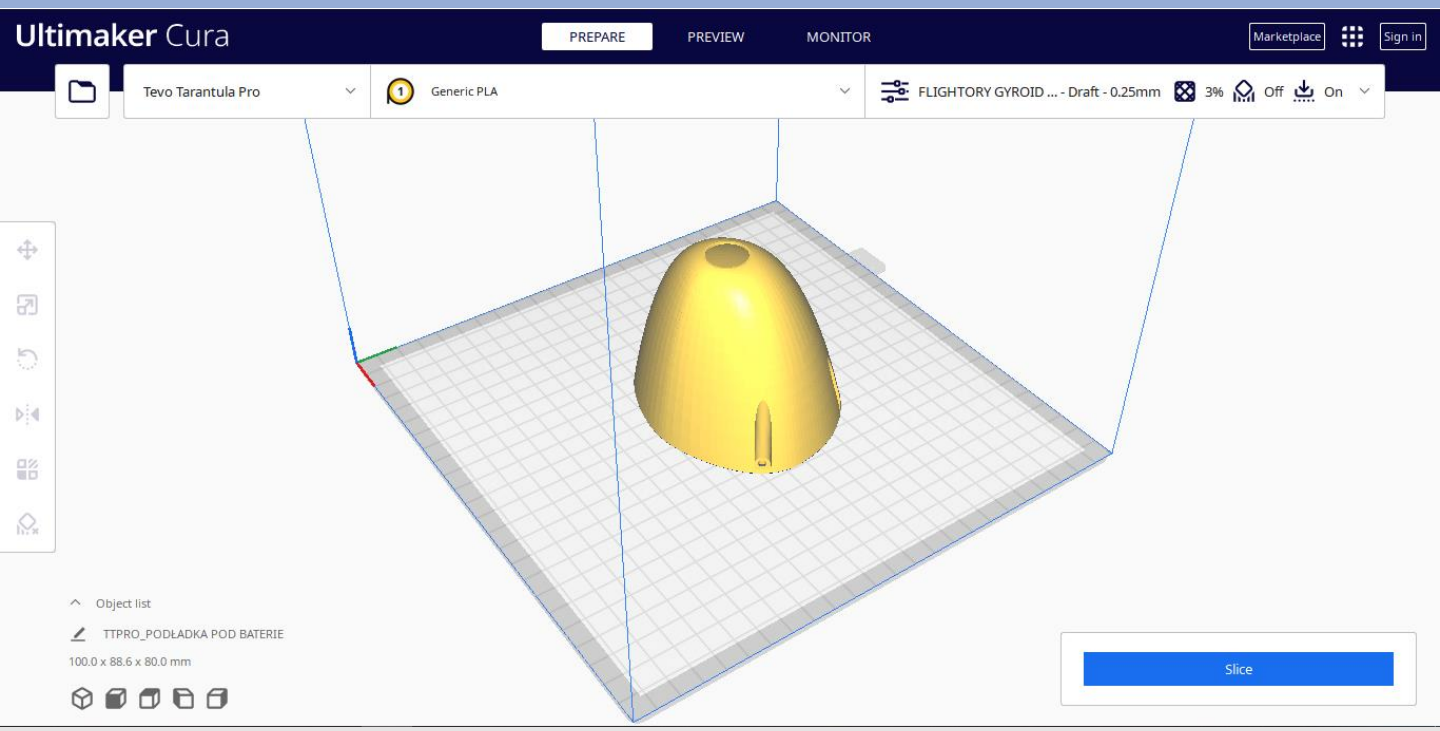

Geometry is designed to provide the best possible characteristics. Excellent and well-tested PW75 airfoil was selected for this project. It is a reflex airfoil designed specifically for planks. With the center of gravity located 35mm from the leading edge, stability and the zero pitching moment at zero angle of attack is maintained. Angles of attack for optimal CL/CD distribution are in the range of 2 to 4 degrees. The optimal cruising speed is between 45 and 55 km/h.

# Exploded view





# Print Settings




Slicer software you need to use is Ultimater Cura. All elements from **LW-PLA** are best printed with ready-made settings prepared in a profile that you can download. Settings are prepared a standard 0.4mm nozzle. Download link is available on Flightory Blog. Infill in this profile is set to 6%. For this project I recommend changing it to 3%. This is sufficient filling

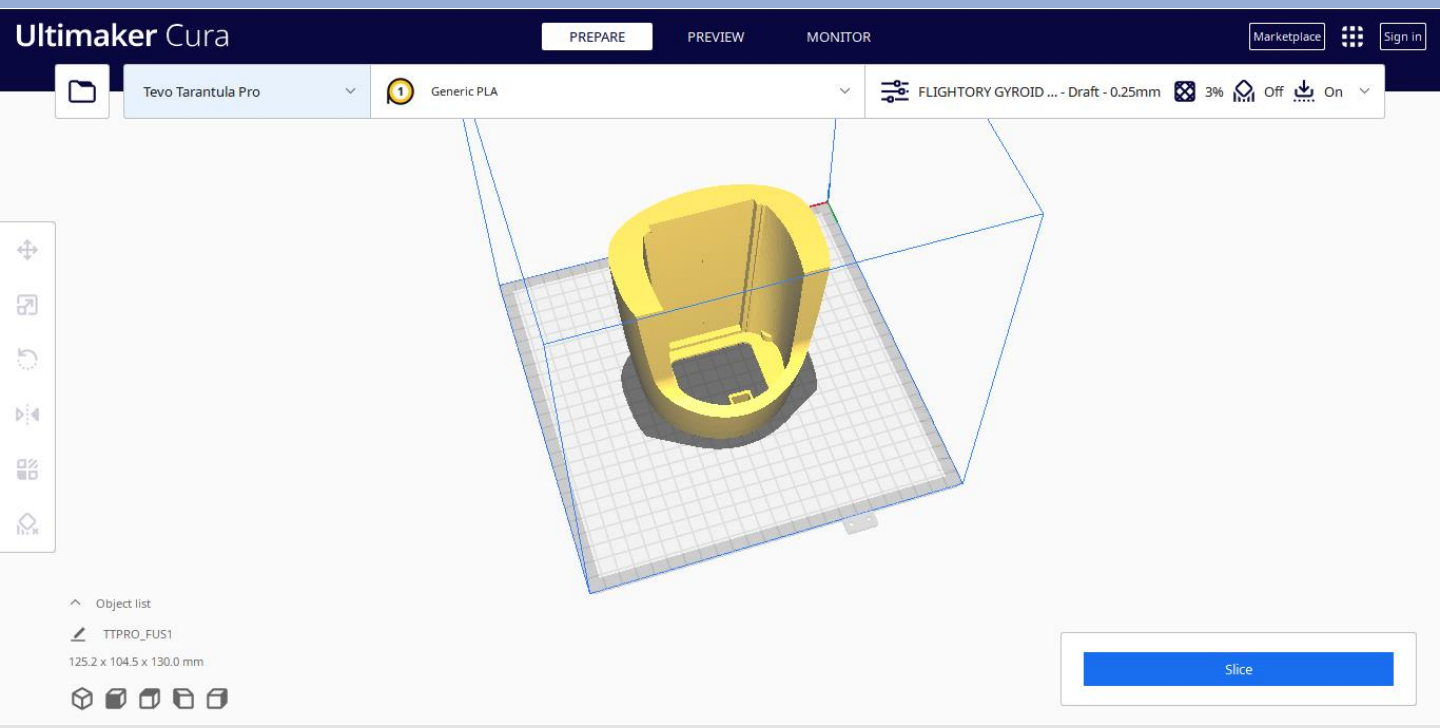
Main features of slicer LW-PLA profile

- layer height: 0,25 mm
- single wall 0,4mm thickness
- 3% Gyroid infill.
- Temperature: 235 degrees,
- flow 60%
- fan speed: 0%

The rest of the detailed settings are saved in the profile.

To print hard **PLA or PET-G** parts, use a default profile in CURA called Draft. **Layer height is 0.2 mm, infill is 20% Grid pattern.** Set the temperature around **220 degrees.** You can fine-tune these parameters to suit your needs and your printer.

# Parts Orientation

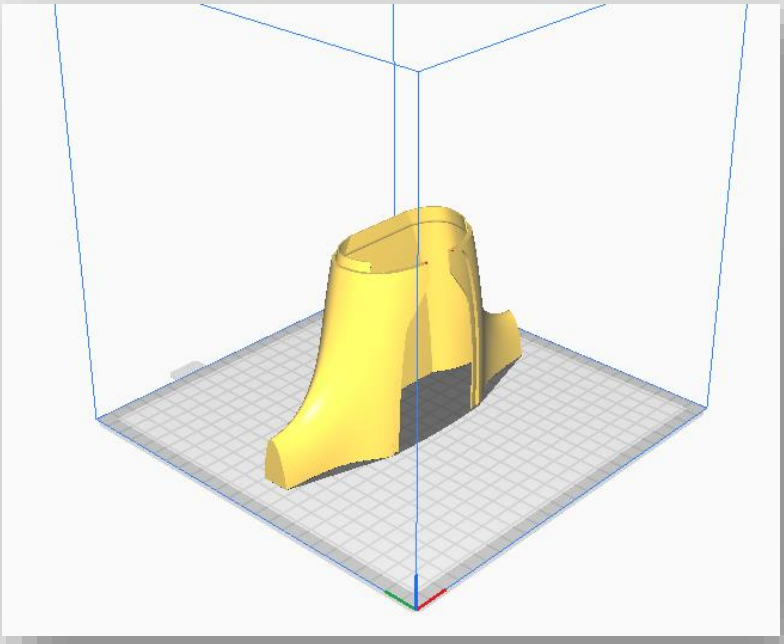



All parts are suitable for printing on any standard printer with a small working area. I printed all parts on a 200 x 200mm area. The settings are just a base that you can change and adjust as needed. The following pages will list my recommended infill settings for each part.

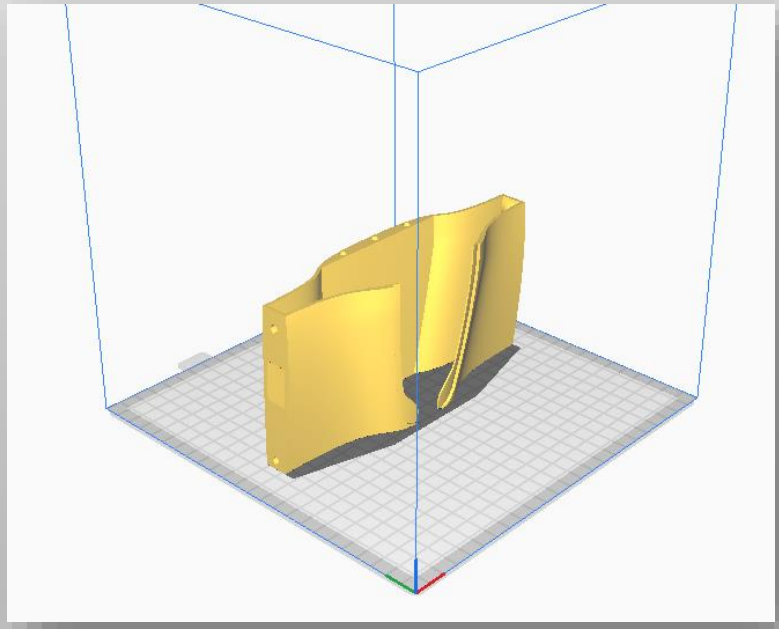
All elements can be printed without supports, but your printer may have a problem with some horizontal surfaces in some places. Depending on the effects, you may then consider turning on supports for some elements and cleaning the printed elements afterwards.

# Parts Orientation

Important thing is the correct orientation of the printed parts
to avoid overhangs, and not have to use supports.
Below is the recommended orientation of parts and infill settings.

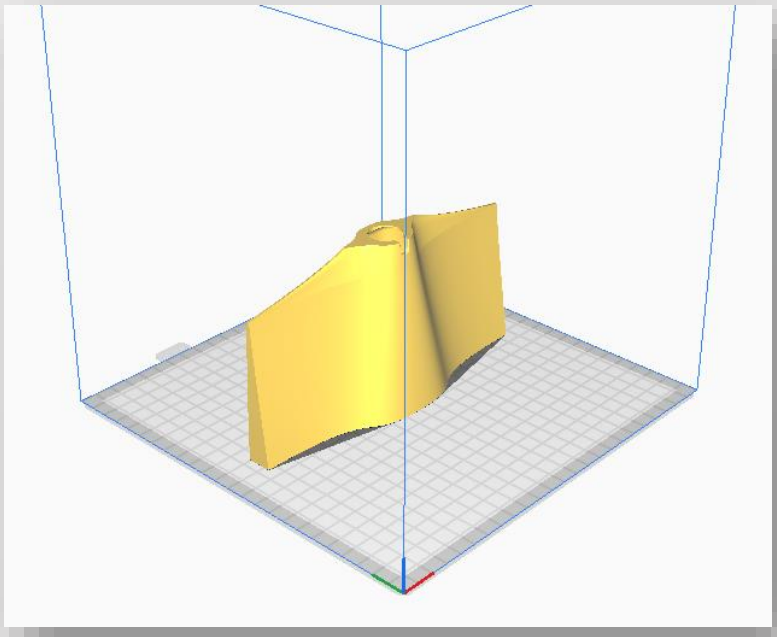


FUS 1 - 3% gyroid infill

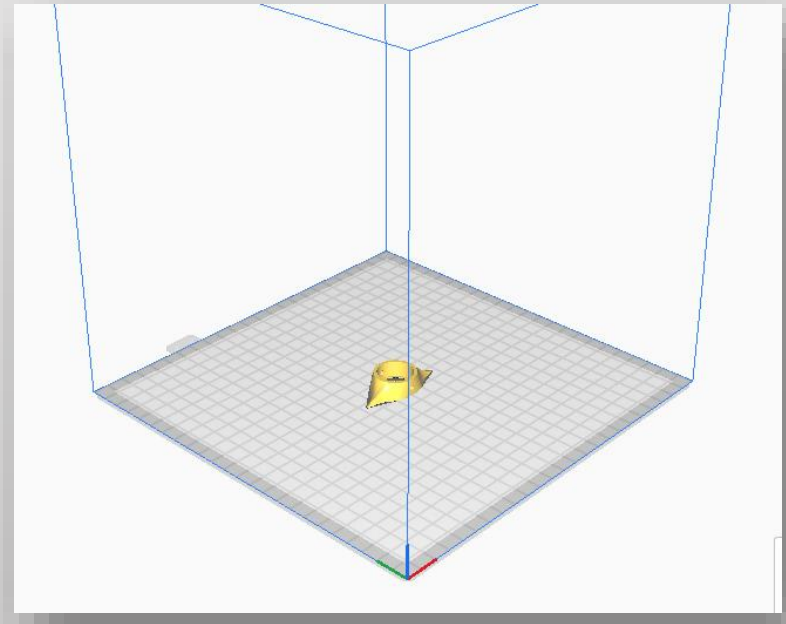


FUS 2 - 3% gyroid infill

# Parts Orientation

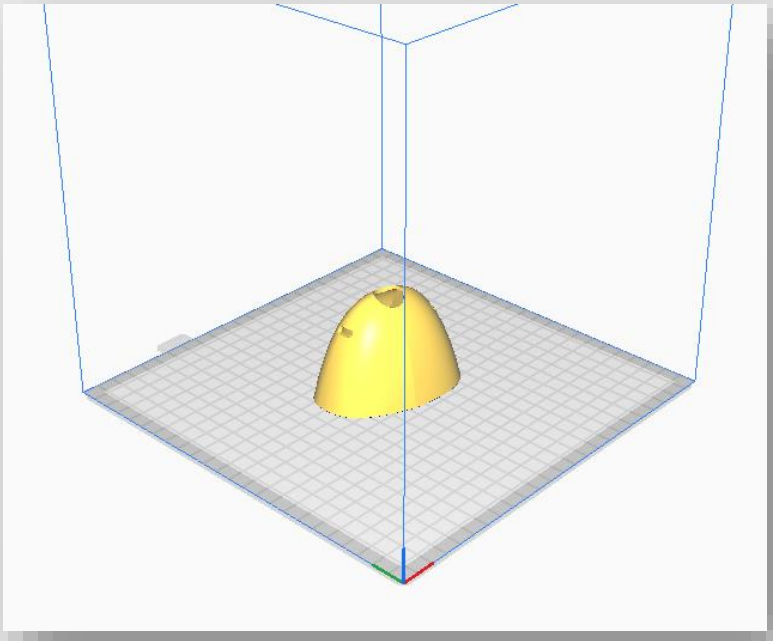


FUS 3 - 3% gyroid infill

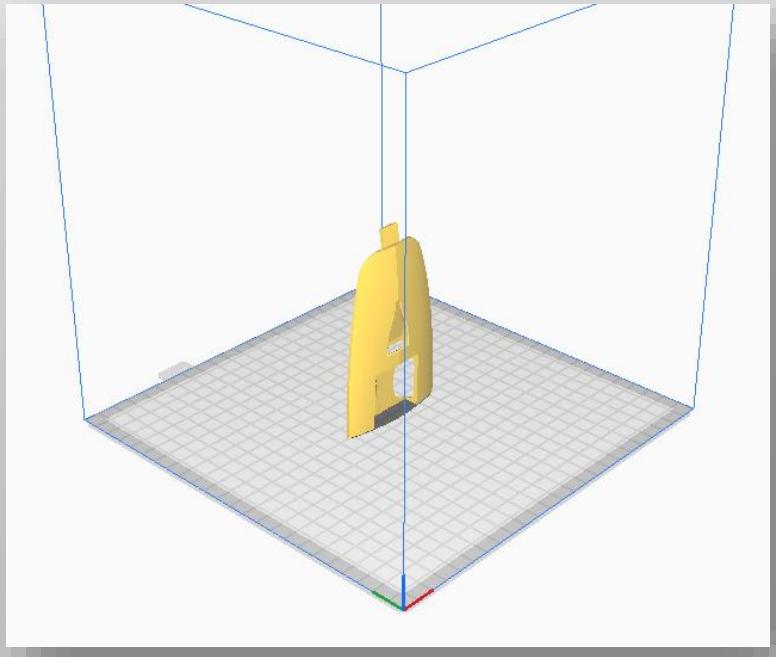


FUS 4 - 6% gyroid infill

# Parts Orientation

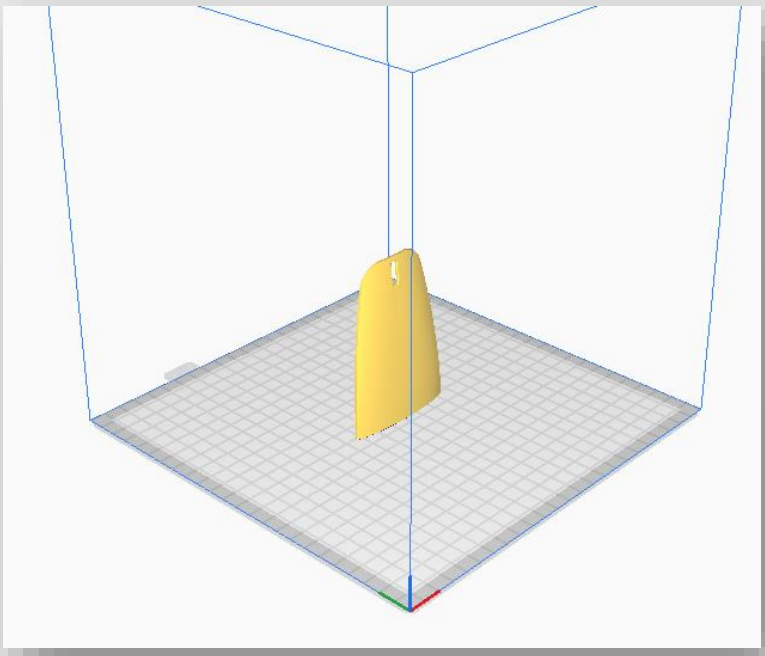


NOSE - 3% gyroid infill

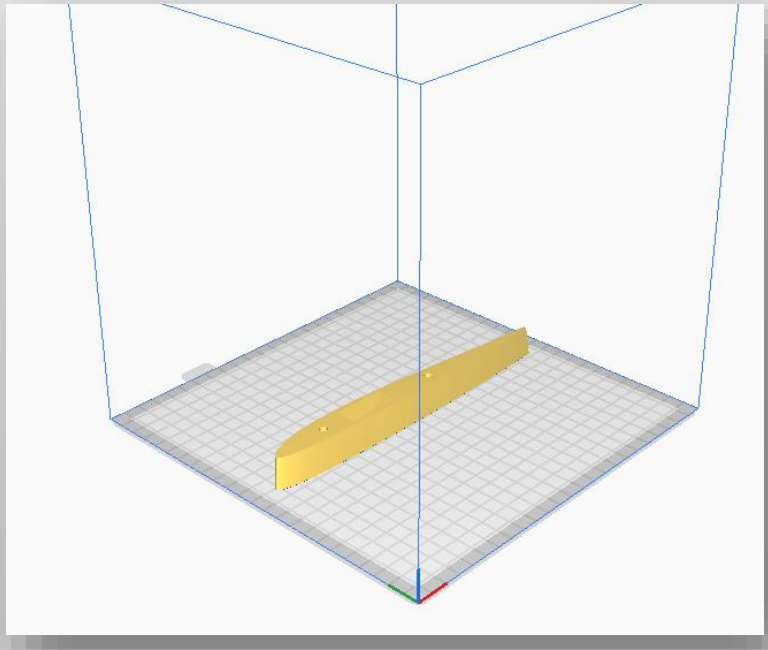


HATCH1 - 6% gyroid infill

# Parts Orientation

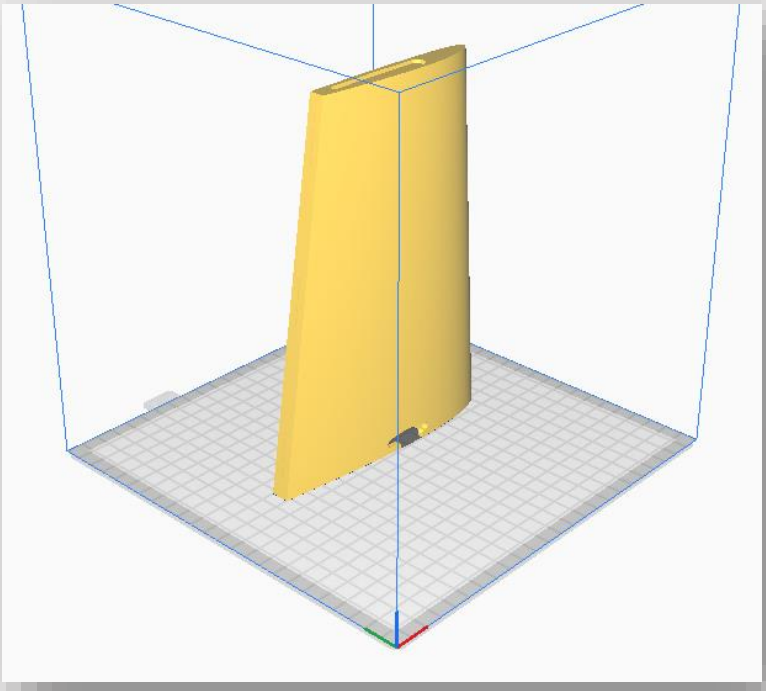


HATCH2 - 6% gyroid infill

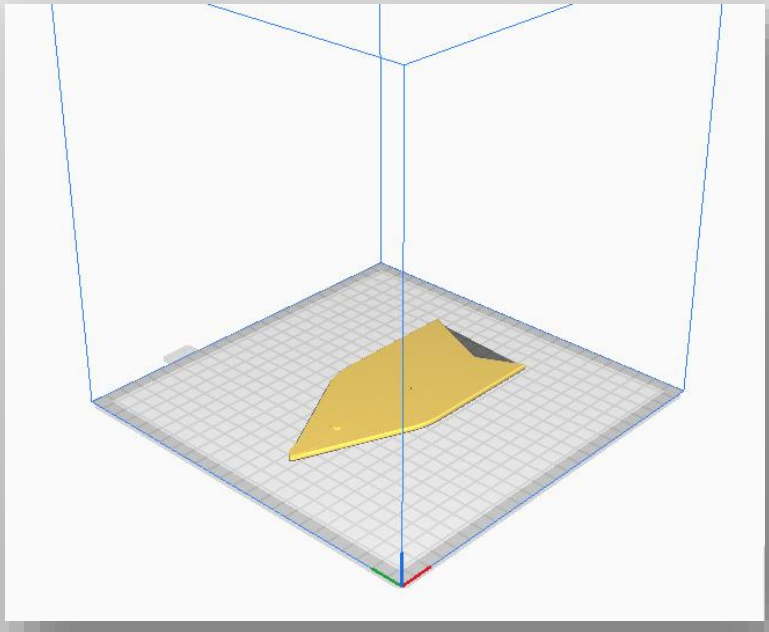


ROOT - 3% gyroid infill

# Parts Orientation



WING - 3% cubic subdivision infill



WINGLET - 3% gyroid infill

# Reccomended RC Equipment

| Reccomended electronics | |
|---|---|
| Motor | T-Motor F1507 3800KV or similar size |
| Propeller | 4x4 |
| Flight Controller | Matek F405 WMN |
| GPS | Matek M10Q or similar GPS with compass |
| Servos | 2x Corona 929MG Metal Gear |
| ESC | Little-Bee 20A BlHeliS |
| Battery | Li-on 3S1P 3000mAh or similar LiPo |
| Receiver | Matek R24-D ELRS |
| VTX | Digital or analog VTX |

# Required accessories

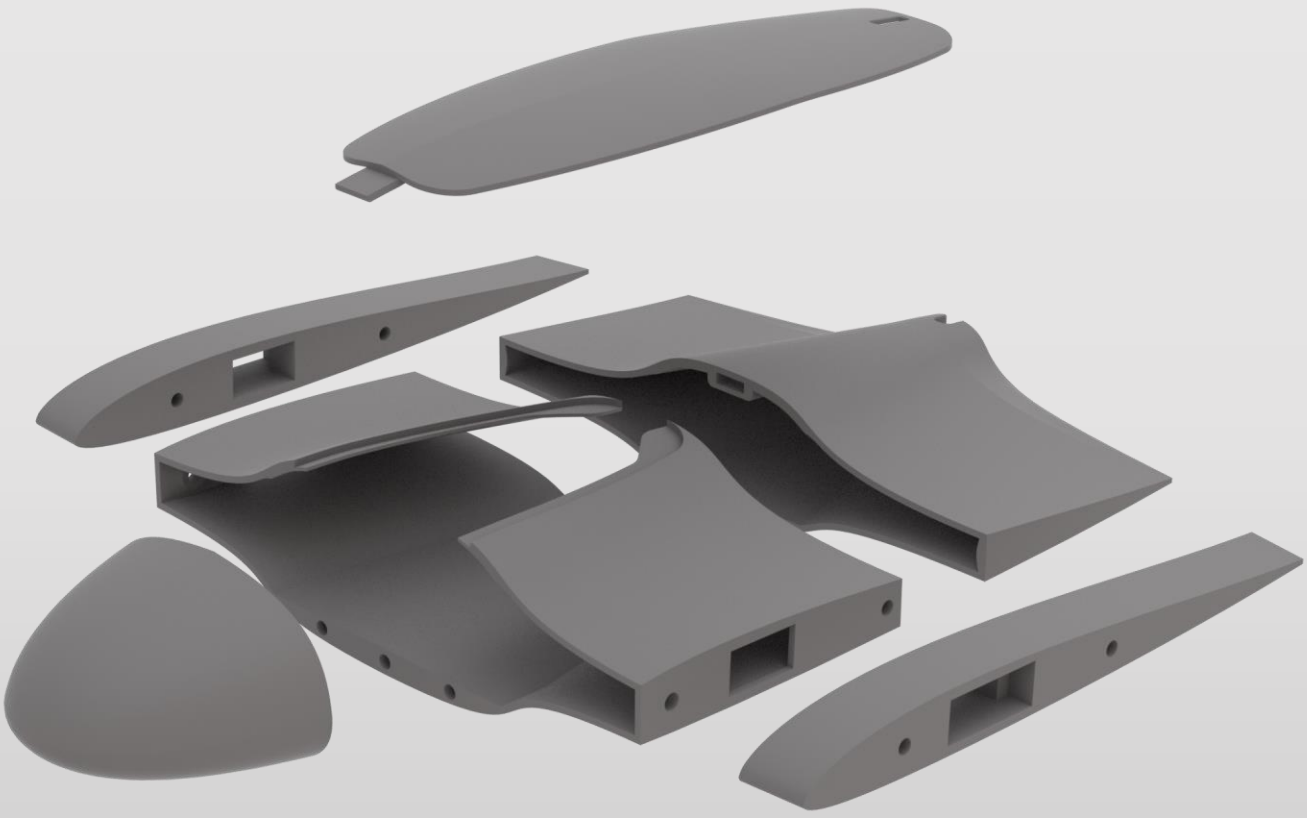
| ITEM | QUANTITY |
|---|---|
| 4x645mm Carbon Tube (MAIN SPAR) | 1 |
| 4x310mm Carbon Tube (SECOND SPAR) | 1 |
| Thin CA Glue | 1 |
| CA Activator | 1 |
| M3 Threaded Insert (Outer Ø5mm, height 5mm) | 2 |
| M3 screw | 6 |
| LW-PLA | About 150g |
| PLA | Small amount |
| Polyester hinge 20x25mm | 6 |
| Pen spring | 1 |
| Adhesive velcro | 1 |

# PARTS LIST - FUSELAGE

| PART | MATERIAL |
|---|---|
| FUS 1 | LW-PLA |
| FUS 2 | LW-PLA |
| FUS 3 | LW-PLA |
| FUS 4 | LW-PLA |
| WING L | LW-PLA |
| WING R | LW-PLA |
| ROOT L | LW-PLA |
| ROOT R | LW-PLA |
| AILERON L | LW-PLA |
| AILERON R | LW-PLA |
| WINGLET L | LW-PLA |
| WINGLET R | LW-PLA |
| HATCH 1 | LW-PLA |
| HATCH 1 WALKSNAIL | LW-PLA |
| HATCH 2 | LW-PLA |
| NOSE FPV | LW-PLA |
| NOSE CLEAN | LW-PLA |
| LOCK 1 | PLA |
| LOCK 2 | PLA |
| FIREWALL | PET-G |

# STEP files

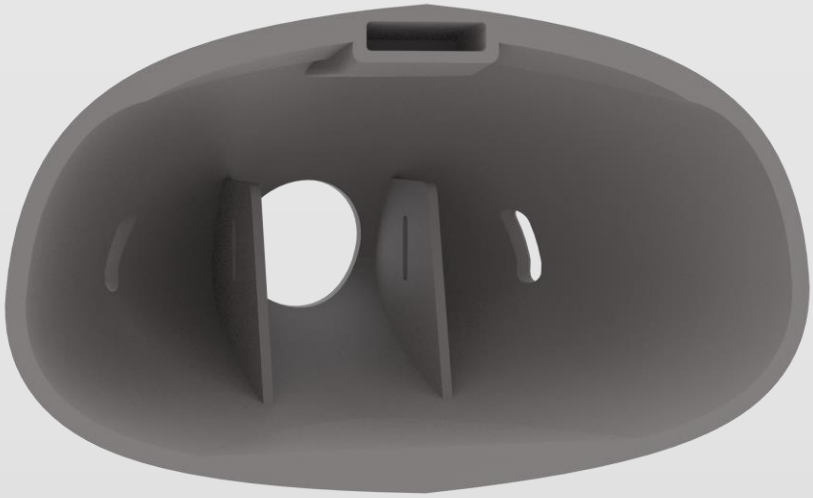
A few airframe parts are also available in STEP format. This way you will be able to customize these items. For example, make a mount for a custom camera, a mount for a VTX, GPS or change the size of the servos used.



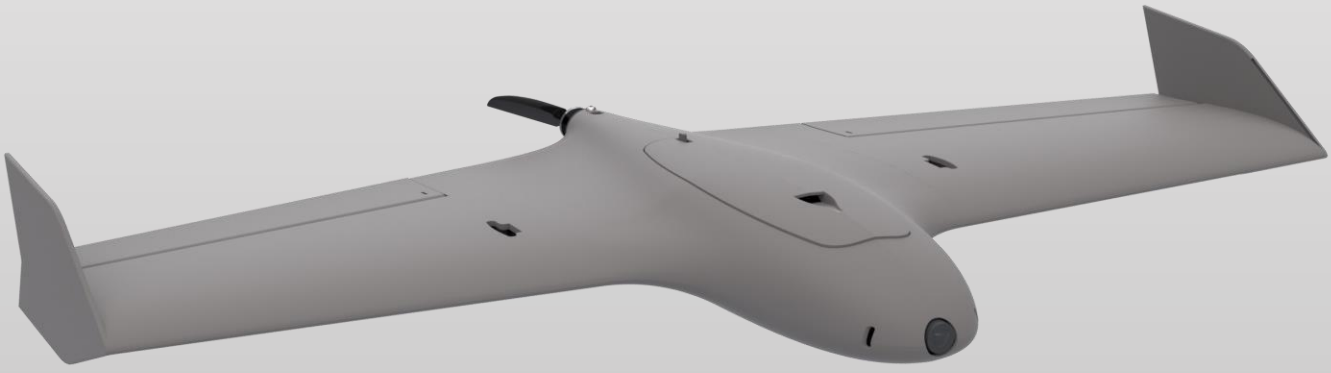
You can find these files in folders labeled STEP

# Nose variants

There are 2 variants of the nose in the files. One of them is adapted for a standard 19x19mm FPV camera. A clean version is relevant if you don't want to mount an FPV camera. The nose file is also available in STEP format for easier editing and customization.



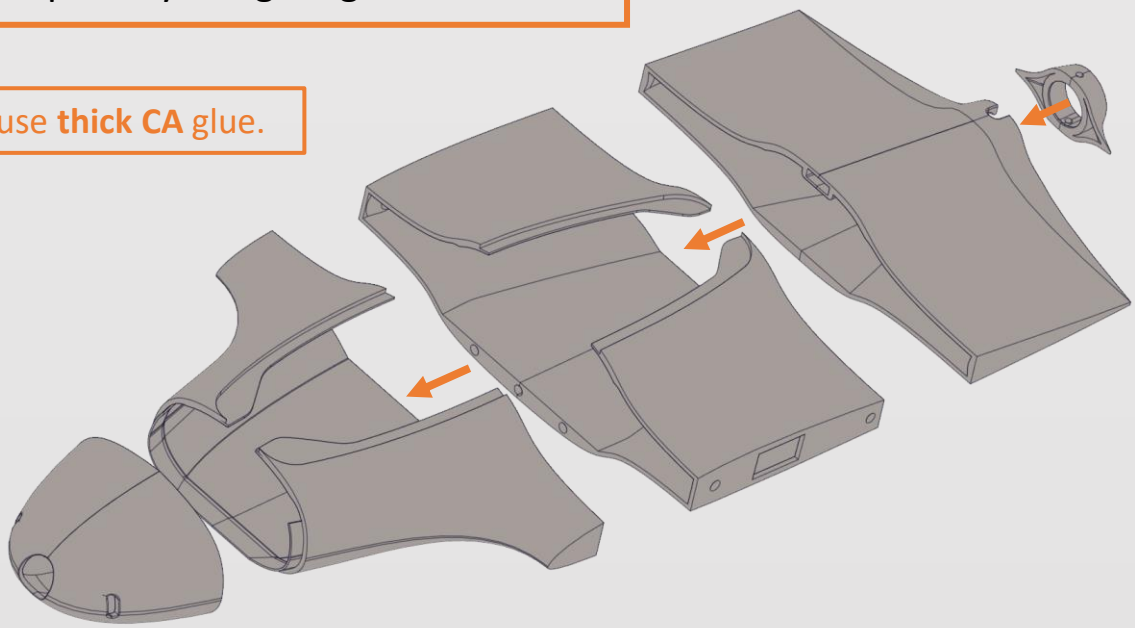
# Variant Selection



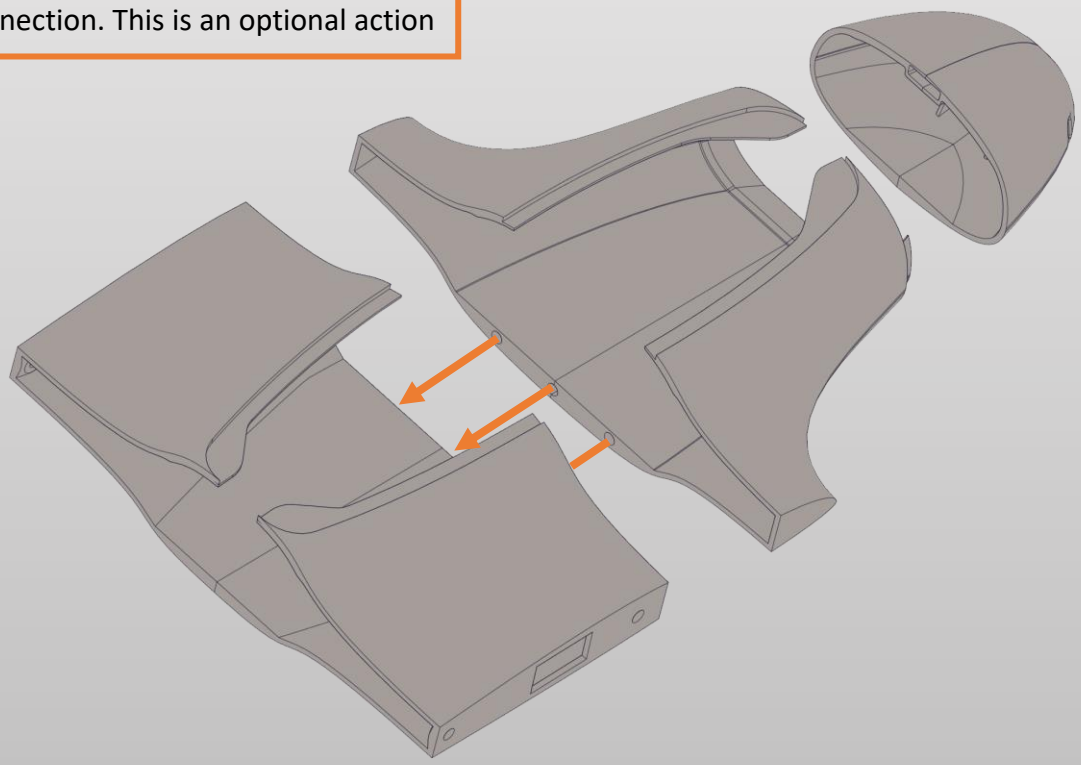
# Fuselage assembly

Prepare all fuselage segments. Before gluing, you can gently sand the surface of all elements, especially the gluing surfaces.

It’s best to use **thick CA** glue.



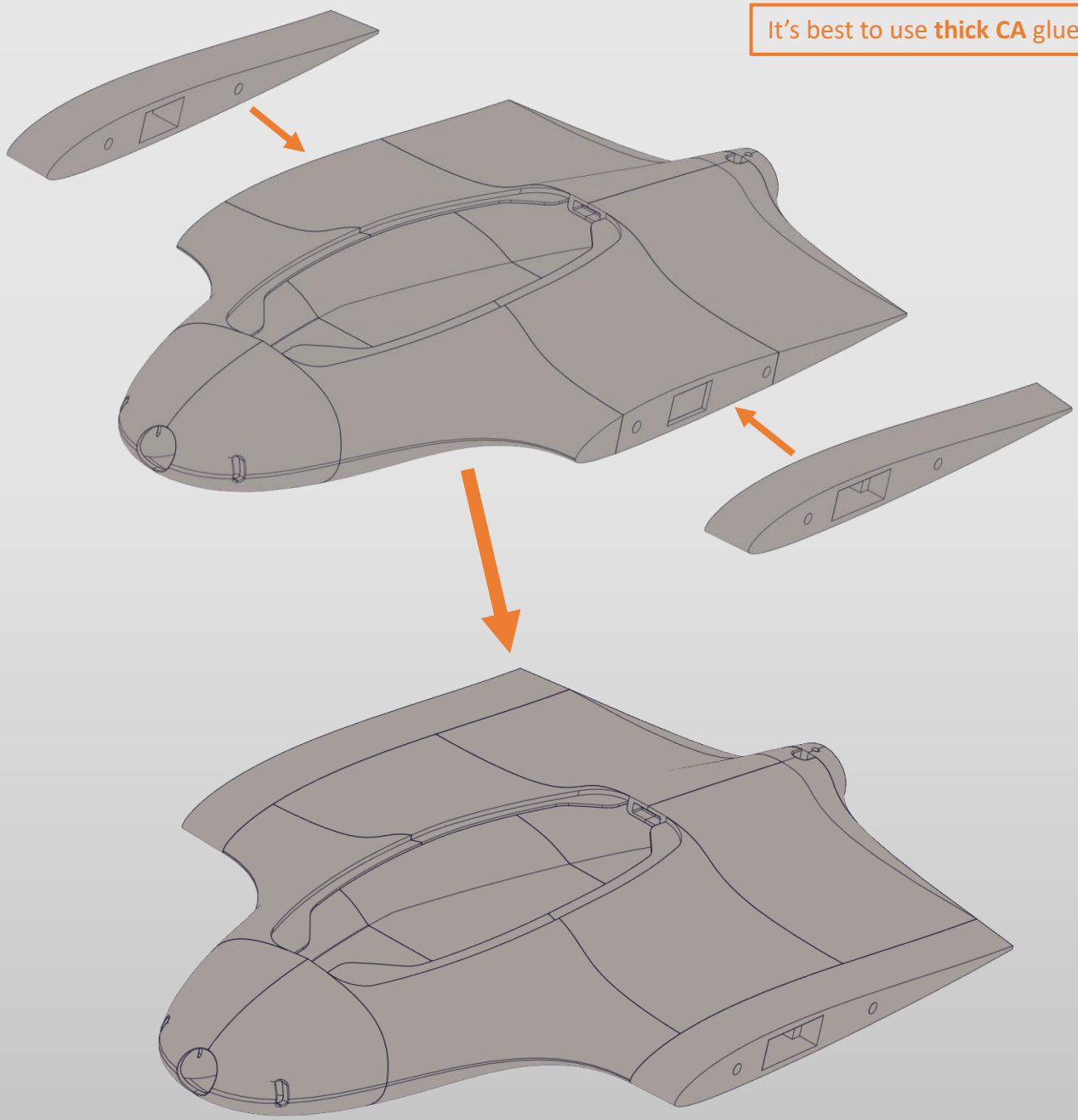
You can use short pieces of 4mm carbon tube as pins to strengthen the connection. This is an optional action



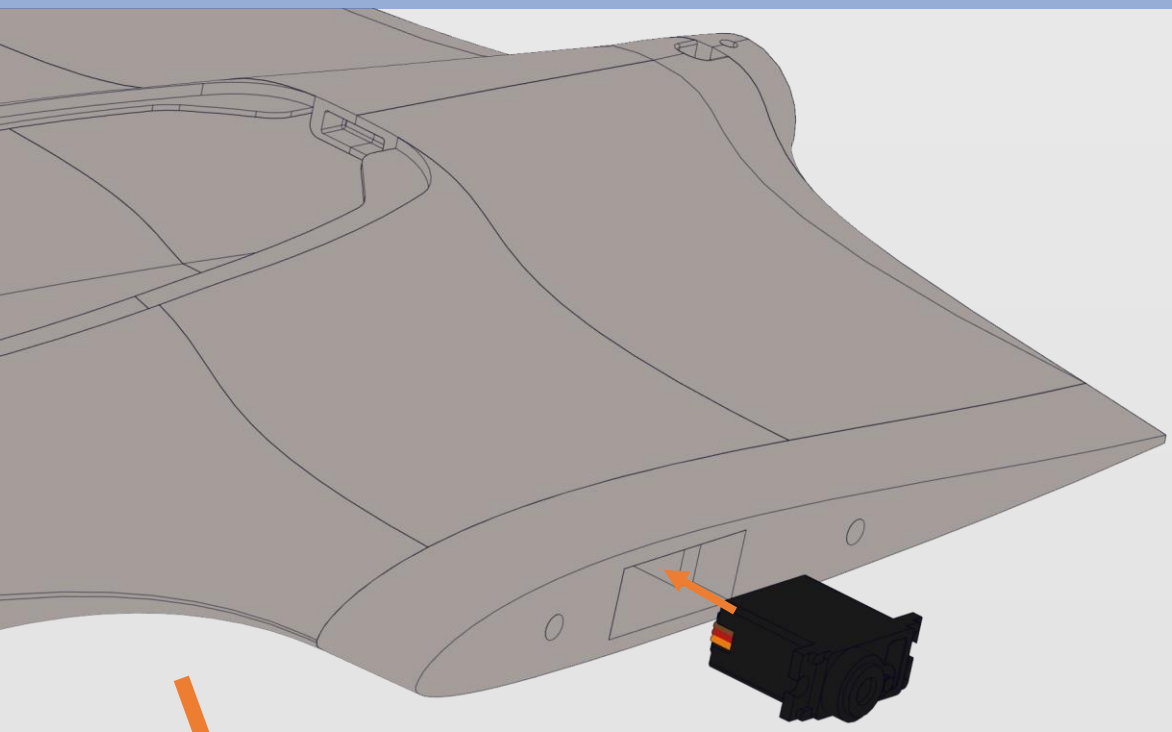
# Fuselage assembly

After gluing all the fuselage segments together, attach the ROOT parts.

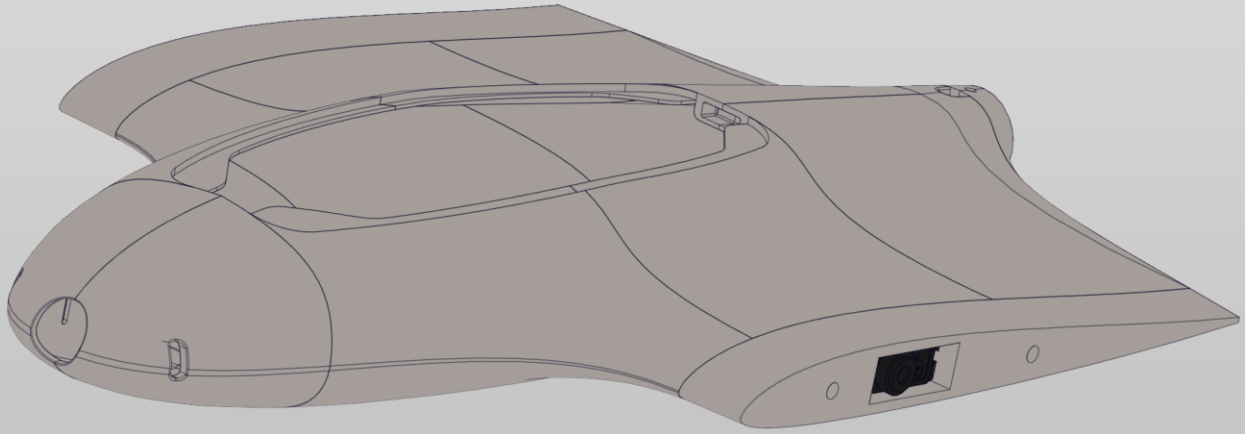
It's best to use **thick CA** glue.



# Fuselage assembly

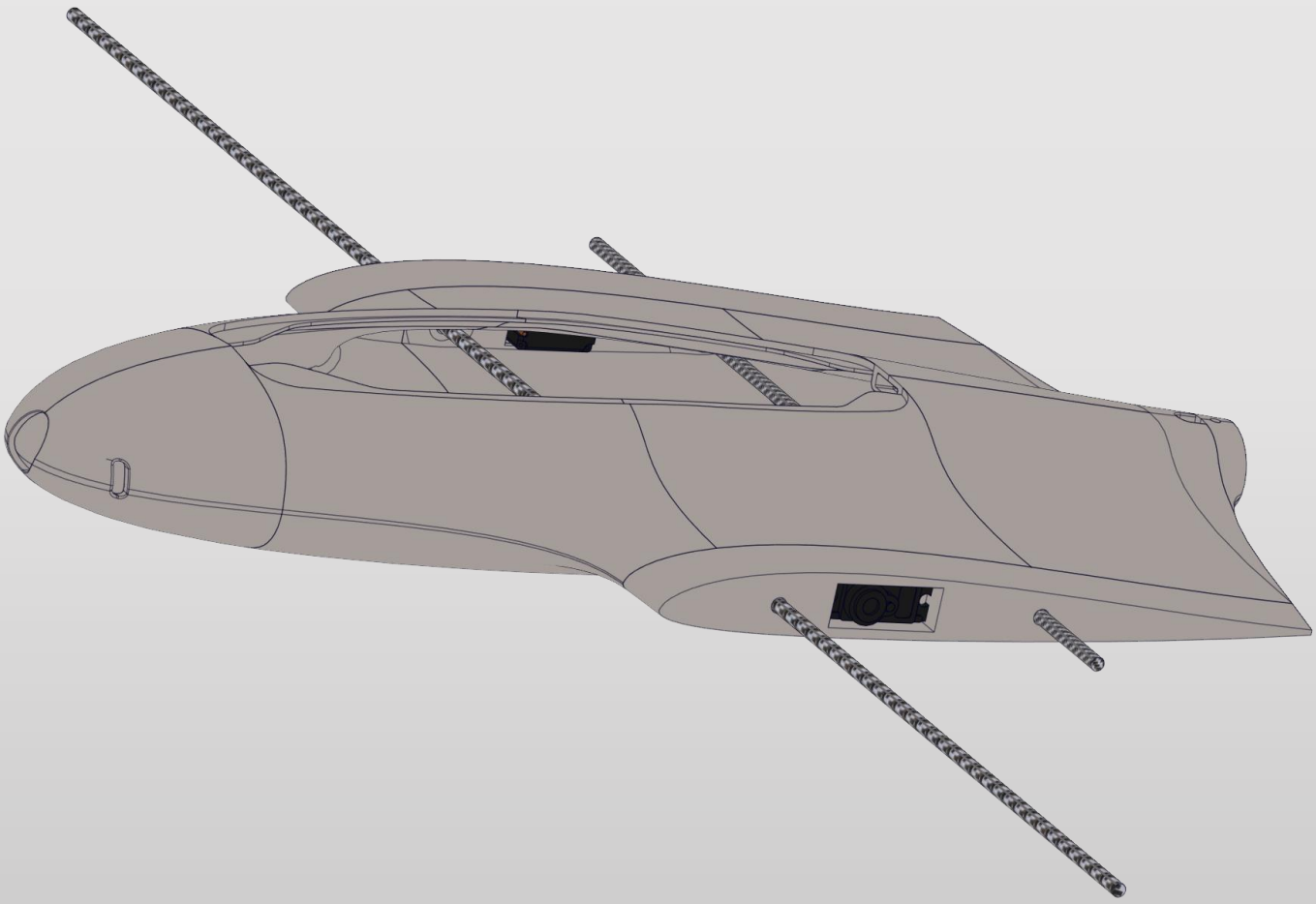


Now you can mount the servos into the designated places. Install the servo arm now. Make sure the servo is in neutral position. You can use a small amount of hot glue to secure the servo.



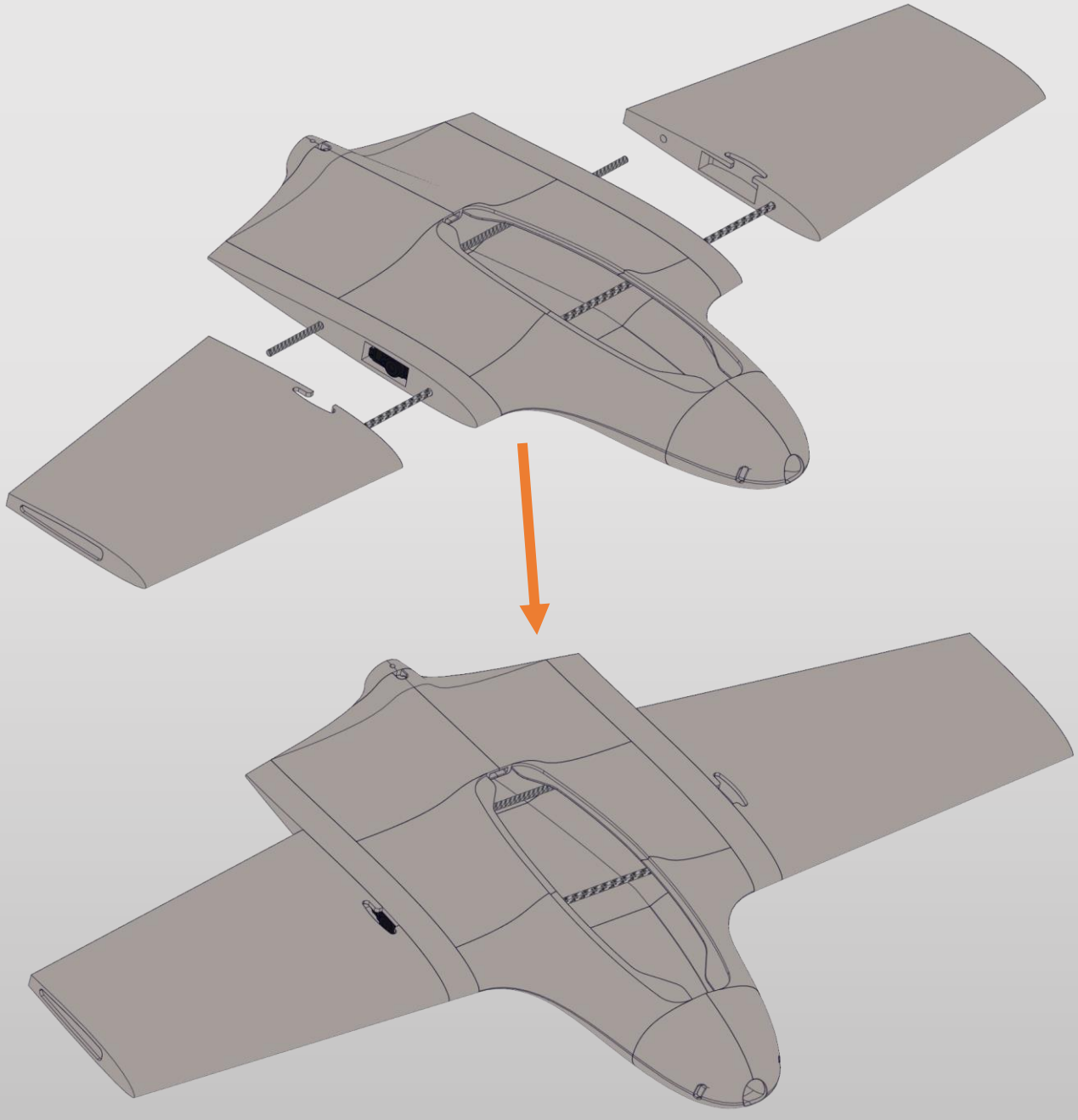
# Fuselage assembly

Now prepare 4mm carbon tubes. Cut them to the appropriate lengths. The longer spar should be 645mm and the shorter 310mm.



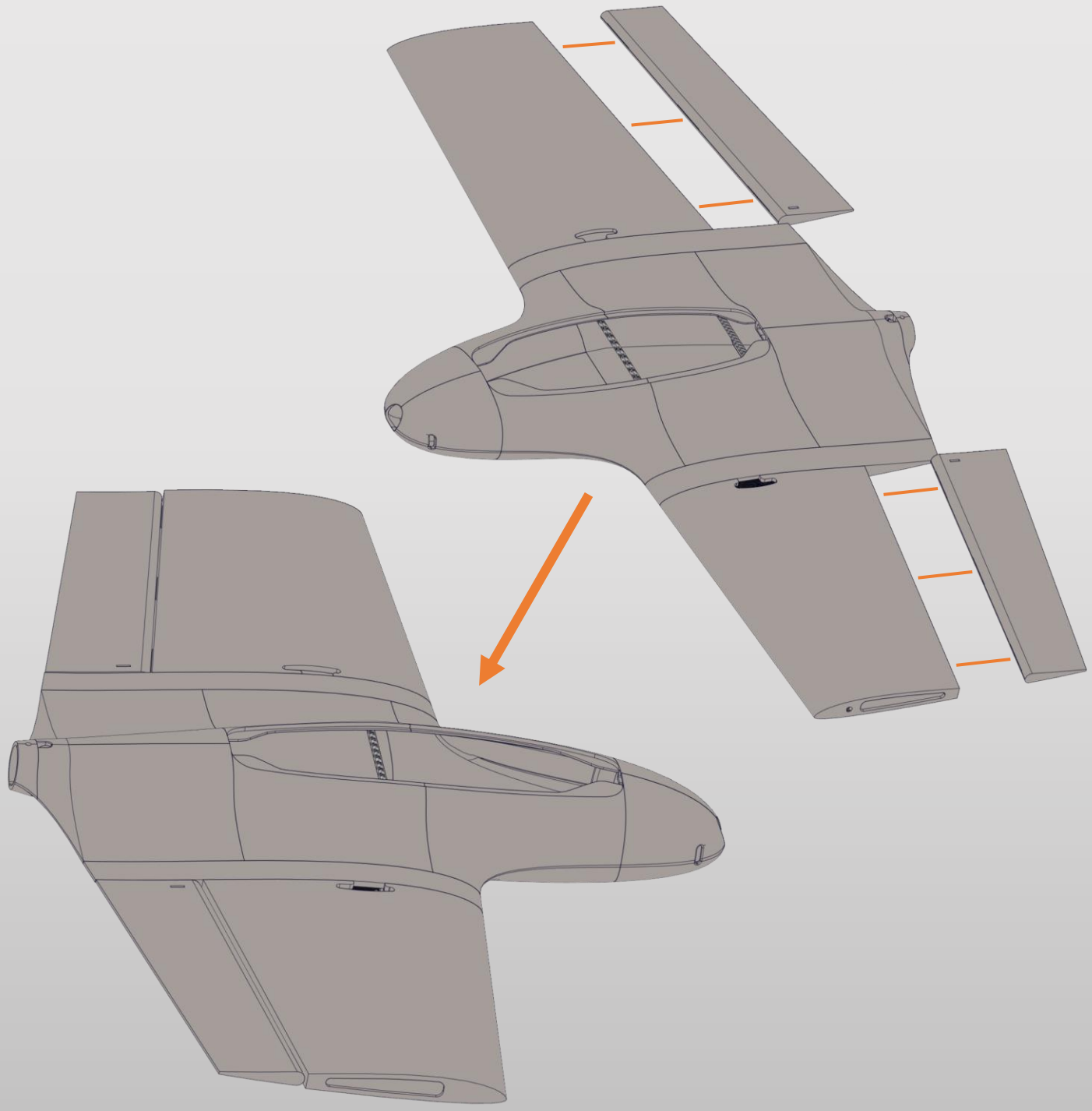
# Wings

Now it's time to install the wings. Glue them permanently into the fuselage. Spars should fit tightly into the designated places. Tubes do not require additional gluing



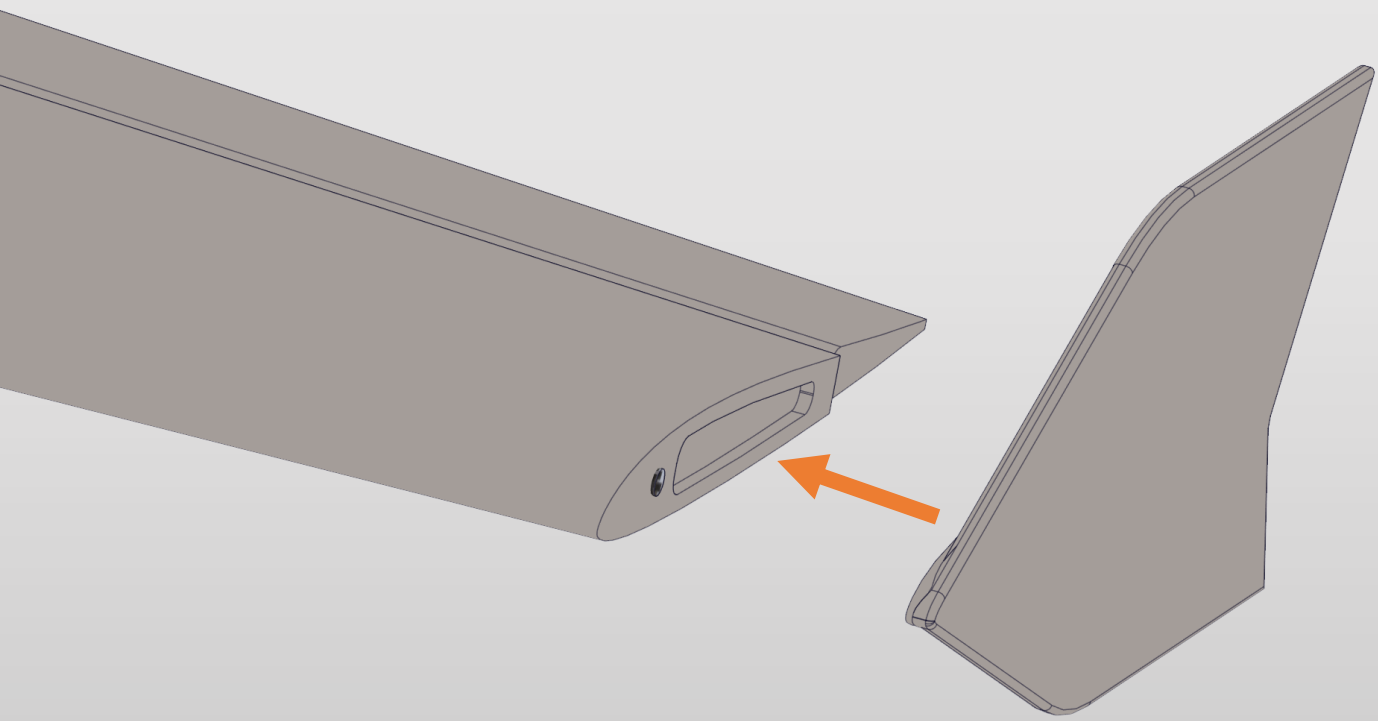
# Wings

Glue the ailerons using 20x30mm polyester hinges. Slide them into the prepared places in the ailerons and wing. Use a small amount of thin CA to fix the hinges. At this stage you can also mount the aileron horns and pushrods. There are prepared holes in the ailerons for small horns.

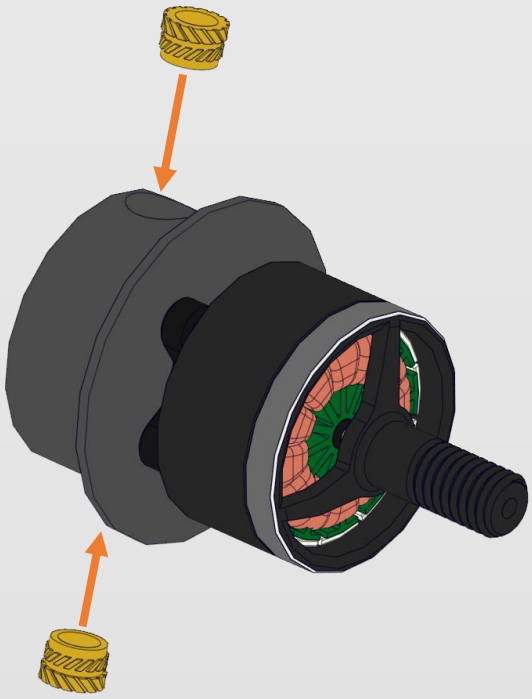


# Wings

Mount vertical stabilizers on the wingtips. There is a large centering pin that will help you get this part well aligned. You can also cut the stabilizers by hand from EPP foam and and increase their strength a little bit during hard landings.

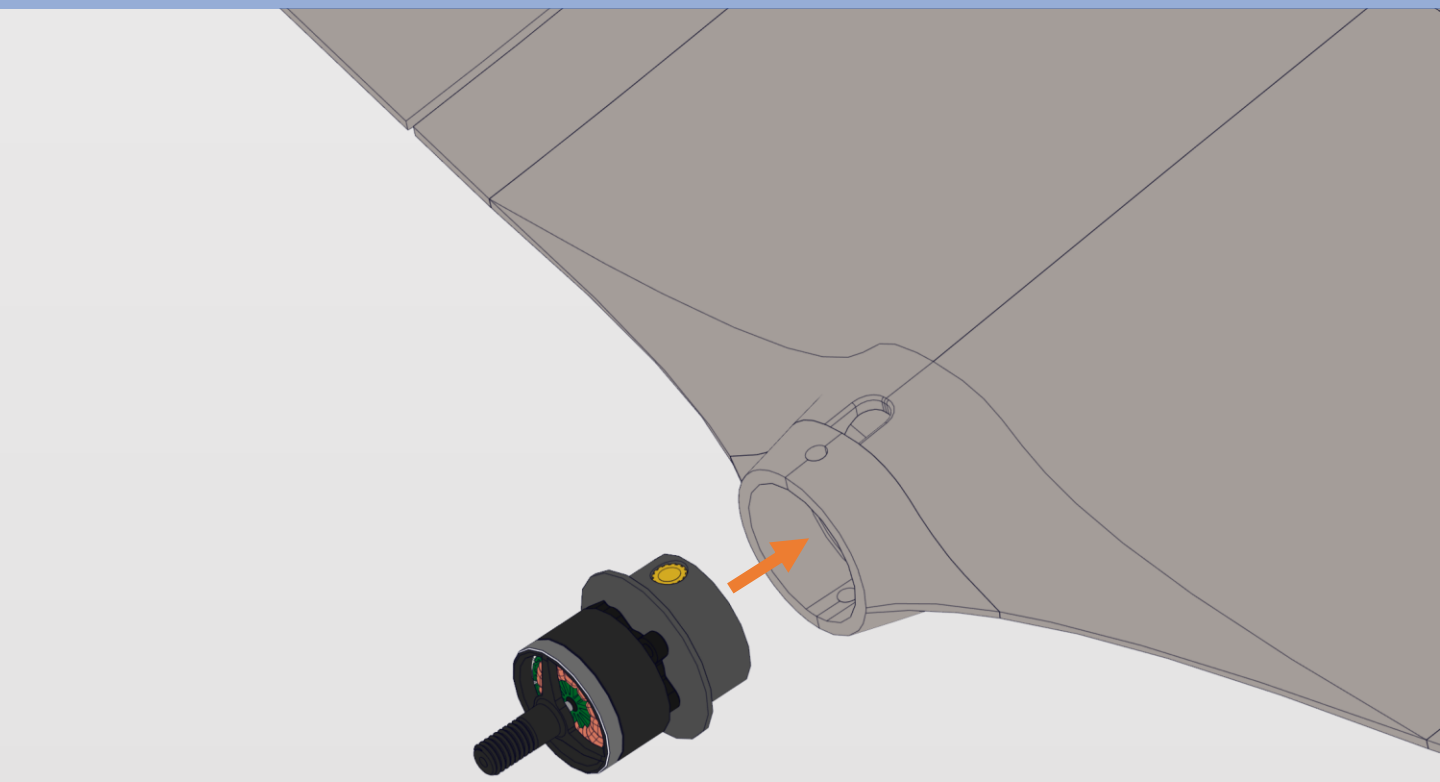


# Motor mount

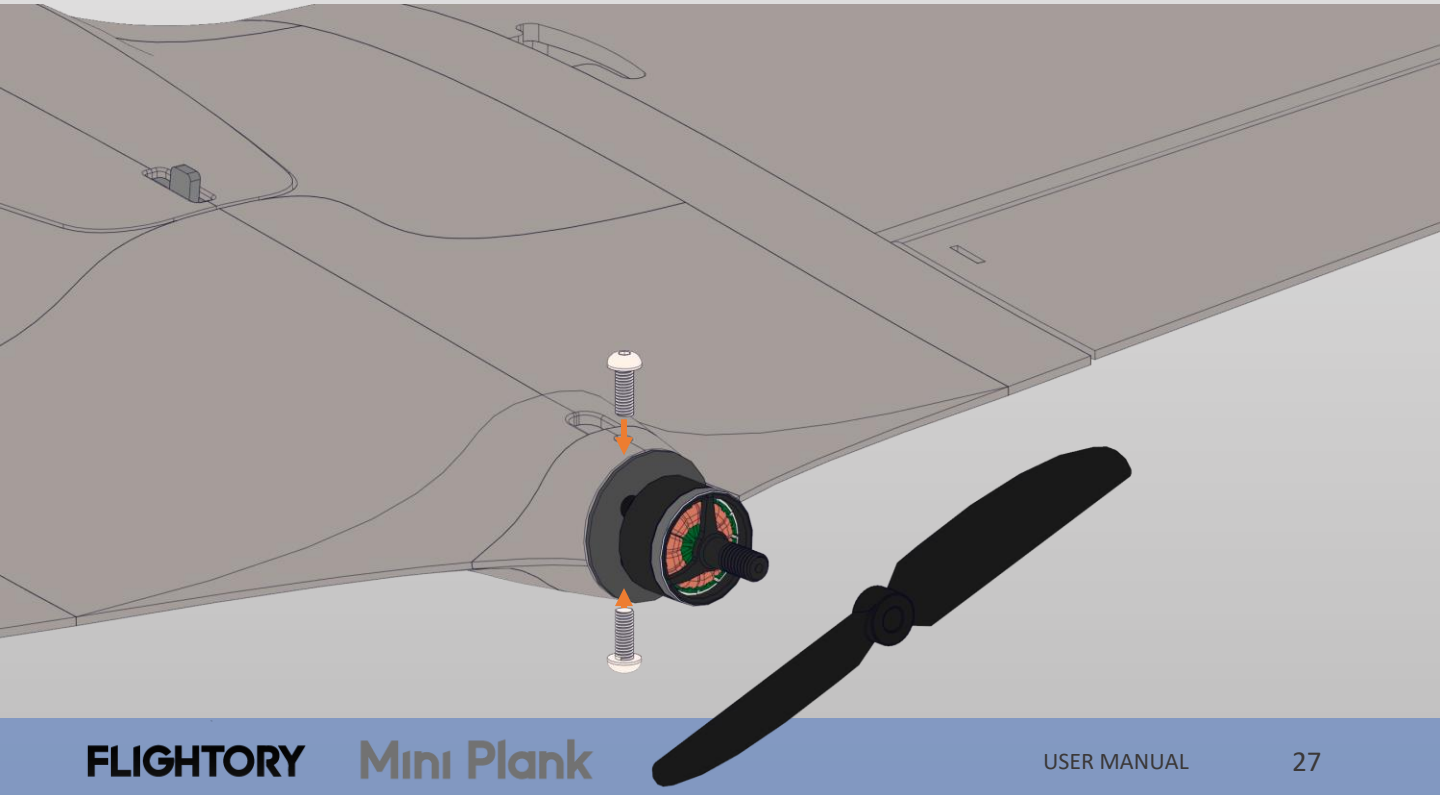


Now take the firewall and install the M3 threaded inserts. Press them into the designated places with a slightly heated soldering iron. Do it precisely, these inserts will be responsible for mounting the motor with a frame in the fuselage.

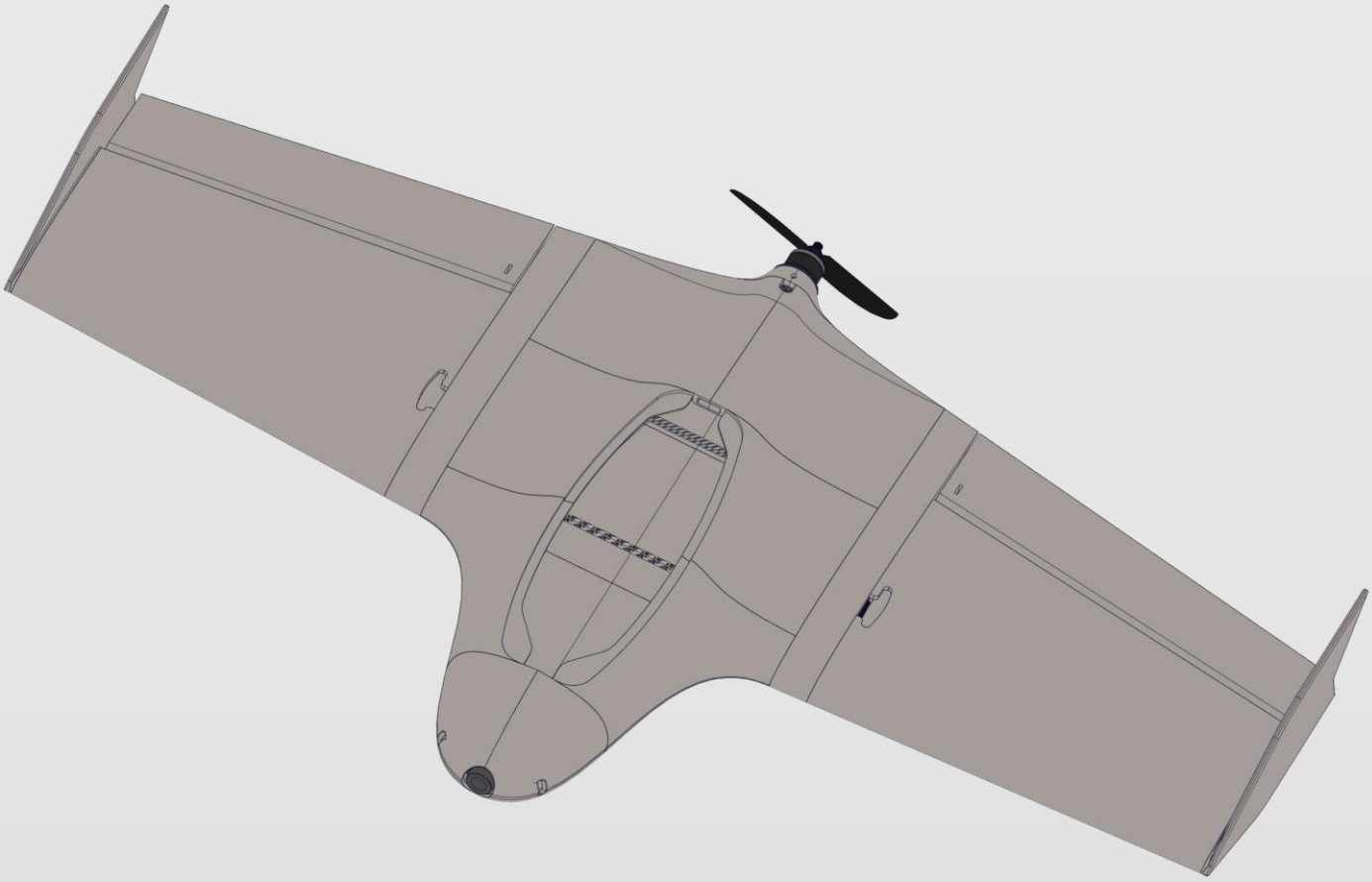
# Motor mount



Slide the motor into the designated place and screw from the top and bottom with short M3 screws. The motor should hold without any play. You can also mount the propeller on right away.



# Equipment layout



You can easily arrange the equipment inside the fuselage. The surface inside is flat. Between the carbon tubes there is a space intended for the flight controller, a receiver or other additional small item. In the front part of the fuselage it is best to place self-adhesive Velcro to which the battery will be attached. In the rear part of the fuselage you can place the ESC. FPV equipment such as the VTX and antennas are best placed on the hatch. If you are using Walksnail, a ready-made solution is available in the files. Remember that most airframe parts are also available in STEP format which allows for easy editing and customization to your needs.

# Finishing build

The model is practically ready. You can add a piece of duct tape on the lower part of the fuselage as well as on the leading edges of the wings, to strengthen the structure. I recommend using Ardupilot software to configure the aircraft. Aircraft doesn't need to be trimmed, but for the first flight you can swing the ailerons up about 3 degrees to provide more stability. If all goes well, return to the neutral position. Before flying, make sure that the center of gravity is in the right place, 35mm from the leading edge. Planks are very sensitive to the position of the CoG, so a few millimeters of difference can make a major impact on stability.

FLIGHTORY

# Mini Plank