BLANIK L-13

Manual ver. 1.1

Specifications

Wingspan: **2400mm**
Length: **1260mm**
Empty weight: **1100g**
Approximate flying weight: **1400g**
Center of gravity (COG): About **5cm** from the leading edge of the wing. (Better move it more forward if you are not sure, towards the leading edge, as plane has quite a big angle of attack on the wings)

List of required resources and components

Plastic:

- LW-PLA/LW-ASA appx. 830g
- PLA appx. 130g
- PETG/PCTG(alternatively PLA) appx. 135g
- TPU few grams

PETG/PCTG is suggested for wing spar inserts and wing join part due to better layer adhesion and it is less brittle that PLA, which allows to absorb some of the forces.

Electronics:

- 9g servo, 9 of them (8 if you don't need a tow hook)
- Receiver (5 - 7 channels)
- Battery of your choice that suits your setup. In test case 2000mAh 4s NiMh battery was used.

Other:

- 2x 8mm 970mm carbon tube
- 1x 8mm 380mm carbon tube (Main wing tube)
- 1x 6mm 215mm carbon tube (Rear wing tube)
- 1x 4mm 150mm carbon tube
- 6x 2mm 630mm carbon rod (For flaps)
- 2x 1.5 - 2mm steel rod (For elevator and rudder)
- Few 1.5 - 2mm steel rod pieces (For other controls and tow hook)
- Piece of 3 - 4 mm steel, brass, welding wire (For CG hook)
- 1x M3 machine screw and nut for wheel
- 4x M3 machine screw for wing attachment (optionally you can skip this if there is enough friction on carbon tubes)
- Magnets 20x5x2 or smaller

Before you print

Before you start printing, there are a few important things to be aware of.

It is expected that you already have experience with RC airplane modeling. Depending on the accuracy of your printer, you will likely need to make minor adjustments such as cutting, sanding, or enlarging holes and modifying parts as needed.

Please set-up your print settings so the wall is around 0.4 - 042mm thick. I sugggest to print small piece like flap or elevator first, cut it and measure with digital rule.

From the outset, please note that most parts do not include special alignment features to make assembly easier. Accuracy during printing and assembly is essential—the more precise you are, the better the final aircraft will be.

Another important point concerns the servo mounts. There are no dedicated servo mounts included. The servo openings are sized for standard 9 g servos. These can be glued in place (preferred) or screwed into simple PLA mounts if you want them to be replaceable. However, due to the airfoil shape and the servo positioning inside the wings, this can be somewhat challenging. In this case, I chose a simpler approach, as inexpensive 9 g servos are commonly used and easy to replace if needed.

Basic printing instructions can be found in the table at the end of this document.

Tail

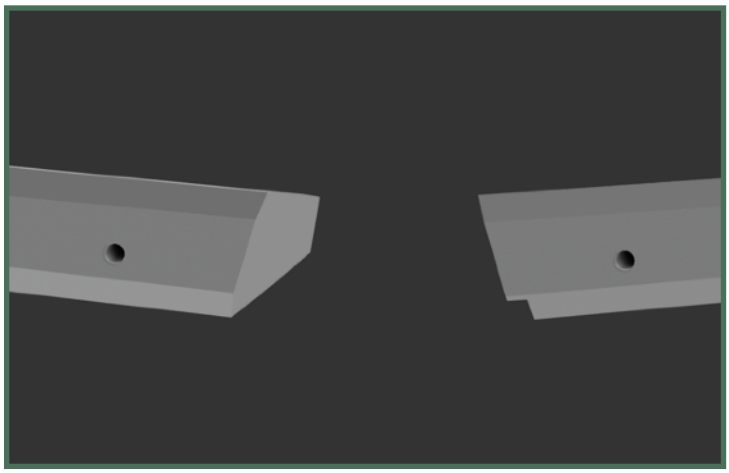
Print all tail parts according to the table. Glue the Tail_Top and Tail_Bottom parts together. Do the same for the rudder.

Elevator

The same rules apply to the elevator as to the tail. Glue the appropriate elevator parts together.Do not glue the carbon tube. The elevator is strong enough without it being glued, and leaving it unglued allows for easier repairs in case of damage.

Slide the assembled elevator into fuselage part F_2 and glue it in place. Before you glue elevator control to the rest of the elevator, connect both pieces using steel or welding wire rod. Bend 90 degrees on each side, insert into appropriate holes and apply glue.

Only after both the elevator and tail are glued to the fuselage and you have connected both elevators using stel rod should you glue fuselage part F_1 to the rest of the fuselage. Be aware of the angle on elevator controls.



Procedure:

- Glue steel or welding wire to connect both elevator controls
- Glue TPU hinges to the elevator
- Glue elevator control to the rest of elevaotr and glue control horn to it.

Ailerons

There are no special instructions for the ailerons. Print the parts according to the table and glue adjacent parts together (1, 2, 3, etc.). Finally, glue the aileron control horn into place.

Flaps

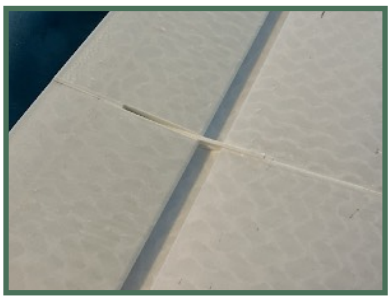
When assembling the flaps, first insert the rearmost 2 mm carbon rod through all flap parts. Then glue the adjacent flap parts together.

After, insert the remaining two carbon fiber rods. Do not forget to place the flap mount parts between the flap segments.

- The inner mount is the largest and should be installed toward the wing root.
- The outer mount is the smallest.

Do not glue the flap mount parts to the flap itself. These parts must be glued to the wing.

Finally, glue the two flap control horns into their predefined locations. It is recommended to drill the control horn holes before gluing them in place.

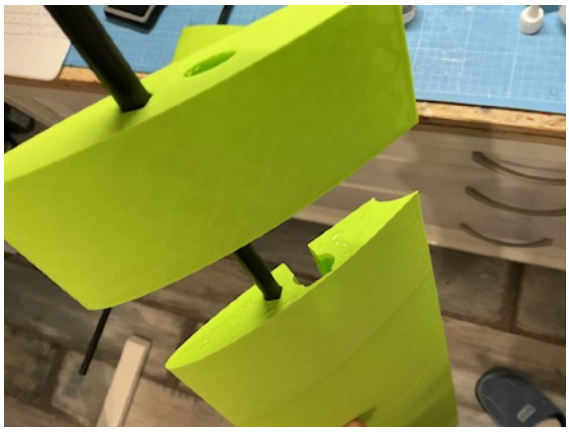


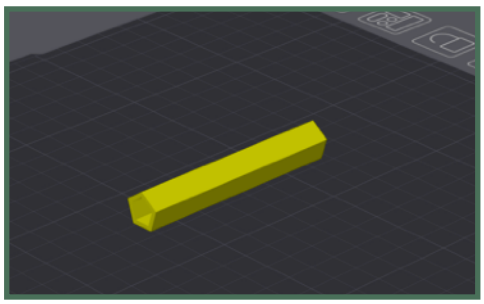
Wings

First, remove any stringing that may have formed inside holes. It is recommended to glue the wing parts together incrementally, one part at a time, rather than all at once.

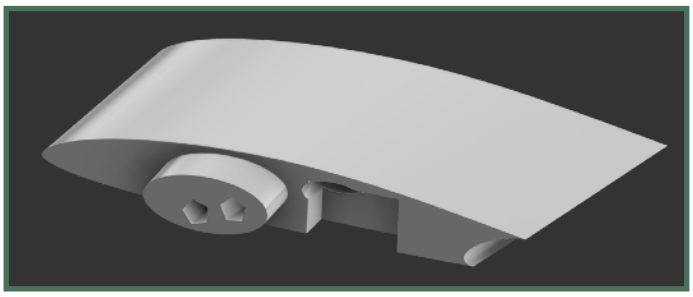
For the carbon tube, I strongly recommend using two-component epoxy instead of CA glue. CA glue can grab too quickly and may misalign or damage printed parts. Optionally, you may leave the carbon tube unglued, but this will result in more wing flex and reduced overall strength.
Standard pultruded carbon tubes are sufficient for this aircraft. Aluminum tubes may also work, but this has not been flight-tested. Always dry-fit all parts before applying glue.

Wing assembly:

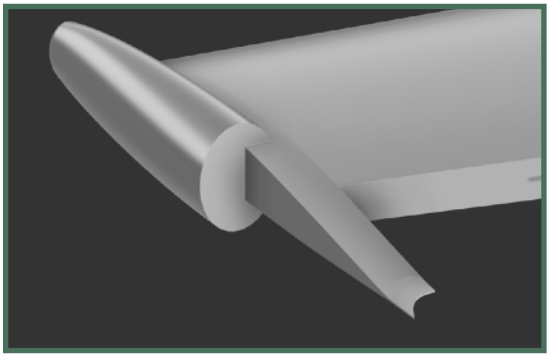




Important.... Print wing spar inserts flat, not vertical ! Use PCTG/PETG if possible as it is less brittle. PLA is alternative.



Recommended assembly order:
1.Start with wing part 1
2.Glue in the wing spar inserts
3.Glue the wing join part
4.Continue with wing parts 2, 3, and so on and after each part apply glue onto carbon rod



For the wingtips, glue the front half of the wingtip to the wing first, followed by the rear half. Do not glue both wingtip halves together beforehand, as this makes fitting them to the wing difficult.

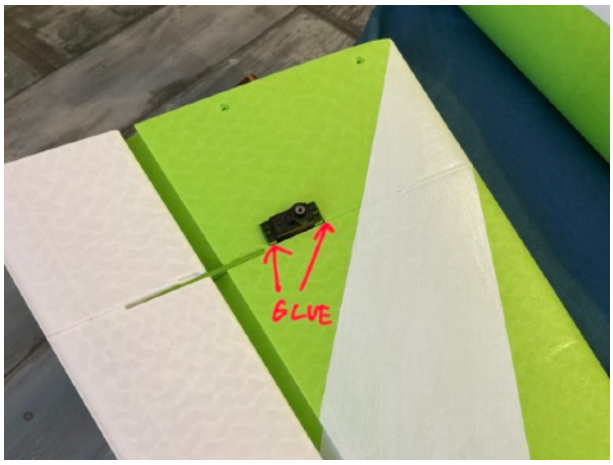
Servo installation can be done during wing assembly or later. If installing later, use a steel rod or raw filament to help pull the servo cables through the wing.

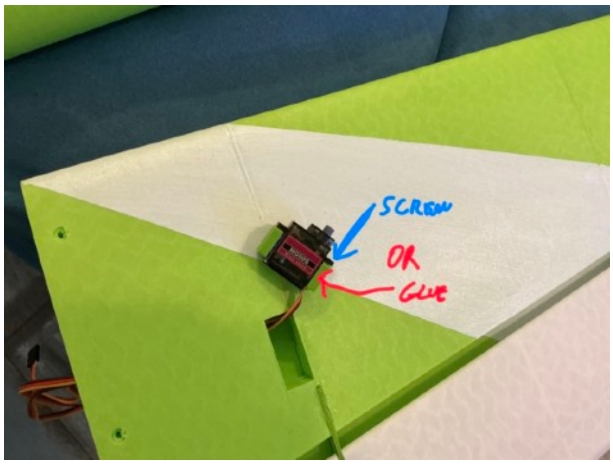
Glue the TPU aileron hinges into the wing and attach the ailerons

For the flaps, glue the PLA hinge parts into the wing. Do not use excessive glue in case you need to remove them later in case of crash.

Finally, connect the servos to the ailerons and flaps using steel rods and your preferred linkage method. A Z-bend is the simplest but least precise option; using a clamp on at least one side is recommended.

This is how wings and maximum angle of flaps should look like after assembly.

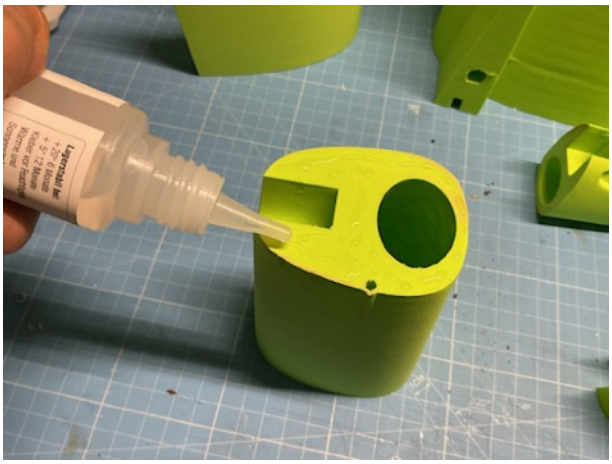




Fuselage

Glue all fuselage parts together except F_1. Medium or thick CA glue works well. It is recommended to start with F_2, then F_3, and continue forward as appropriate. There are no dedicated alignment features between fuselage parts. However, you can use a 1.5–2 mm steel rod inserted into the printed Bowden tube to help with alignment.

Glue fuselage part F_1 only after the elevator has been glued to the fuselage.
If small gaps are visible after joining parts, you can apply a small amount of thin CA glue to reinforce the join.

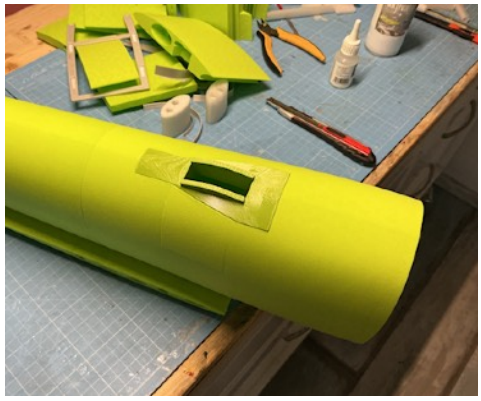


The fuselage sections around the wing are printed with double walls. This provides the necessary strength and allows you to hold the fuselage without risk of damage.
Assembling the fuselage:

Once all main fuselage parts are assembled, insert and glue the main and rear wing spar inserts. Strongly avoid using CA glue here; use two-component epoxy instead.
Make sure to dry-fit everything first, and test-insert the carbon rods before gluing. If they do not fit properly, you may need to reprint the inserts with adjusted settings.

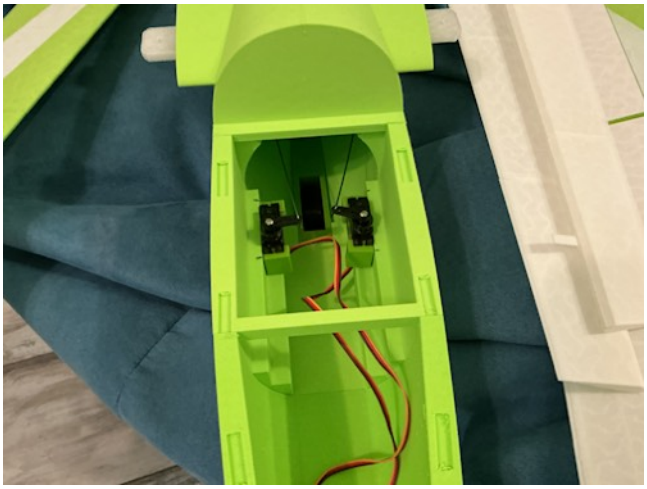
Next, glue the wheel mount and tow hook (if required). If you plan to use a CG hook for bungee or winch launch, drill the hole and glue in the hook (made from steel wire, welding wire, etc.) before proceeding.

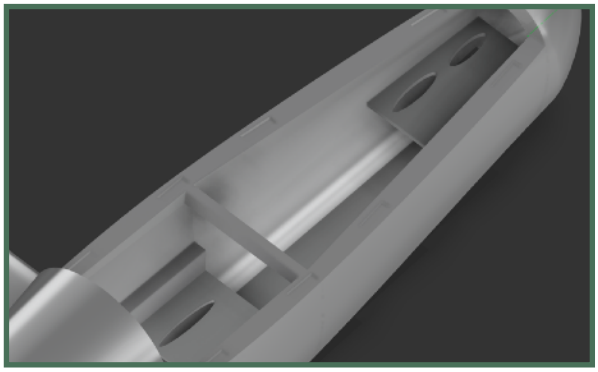
Wheel mount assembly:



Finally place and glue the battery and receiver plate if needed. You can use Battery_plate or Battery_plate_2, however Battery_plate only fits correctly in motorless version.

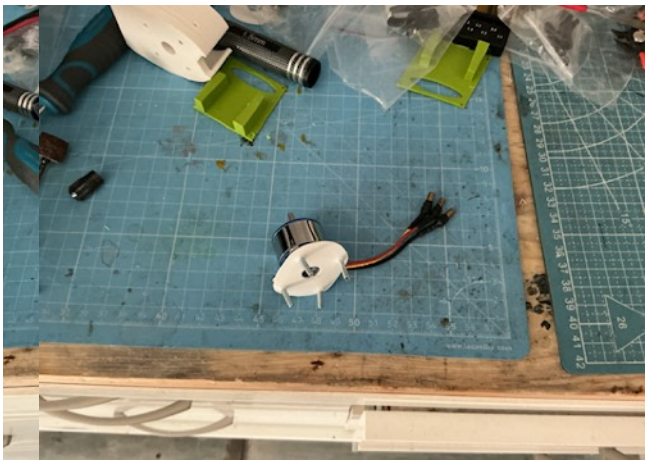
Glue servos either directly or use improvised servo mount pieces and glue those instead accordingly.

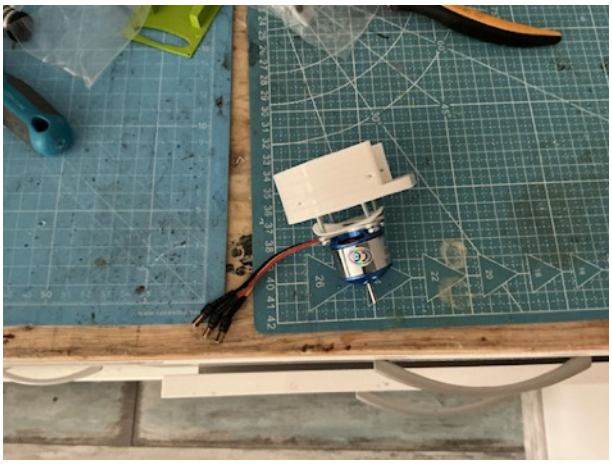




Motor

With motor mount printed, mark and drill holes that fit your motor of choice on the motor mount and heat block parts. Heat block part made from TPU prevents fast heat transfer from the motor to PLA mount which would soften and damage it. Heat block part is optional but highly recommended. Place it between your motor and PLA motor mount part.





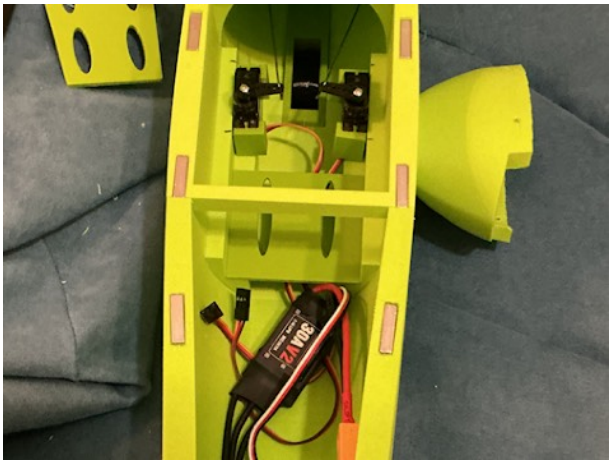
Cabin

Print the transparent parts using a suitable material of your choice. Transparent PLA, PETG/PCTG, or PC work well. You may post-process these parts to improve clarity. Use PLA for the frame.

First, print and glue the bottom frame parts together. Then glue the transparent parts onto the frame, ensuring the transparent parts sit inside the frame edges. Be careful not to install the transparent parts backwards.

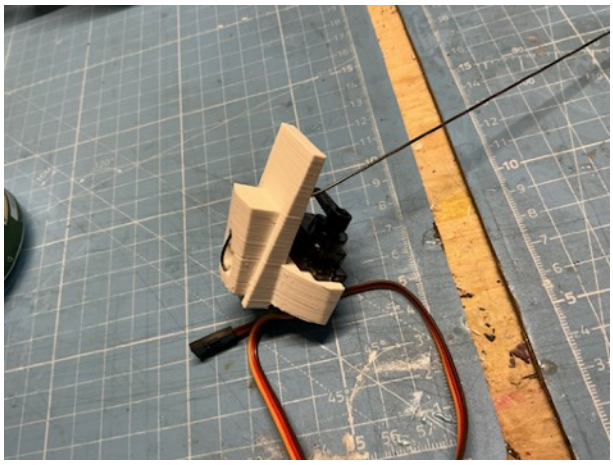
Before applying glue, test-fit the entire cabin assembly onto the fuselage.
Finally, glue the remaining frame parts on top of the transparent sections: two parts over the side gaps, one at the front, and one at the rear.

Place magnets into their slots on cabin and the other polarity on fuselage.



Tow hook

For tow hook, you have to bend the steel rod almost in U shape, and attach it to servo handle on the other side. Similar to what is shown on the following image. I suggest assembling steel rod and servo before placing tow hook into the fuselage.



Flying tips and set-up

First of all I suggest combining cables of each individual flap with Y-cable.
Plane has qute a high angle of attack on the wings, therefore it needs CG to be maximum 5cm from the leading edge of the wing.
Important, always first set servos to neutral and set maximum allowed angle, especially on flaps.
For motor version, I used 2212 1000kv motor with 3s 1500mAh LiPo. This gives model very slow rate of ascent, so for general use I suggest same size with more kV or slightly larger motor.

Basic print instructions table

For LW printing, I suggest printing slowly at around 40 - 50 mm/s.
Few settings that apply to all prints, they may be named differently depending on the slicer you use:

- Avoid crossing walls (true)
- Top/bottom layers: 3
- Detect thin walls (true)

PART	Infill	Wall	Other settings	Material	Weight
TAIL					
Rudder_Bottom	6% gyroid	1	Tree support(optional)	LW-PLA	8g
Rudder_Top	6% gyroid	1		LW-PLA	5g
Rudder_Handle	100%	2		PLA	1g
Tail_Bottom	6% gyroid	1		LW-PLA	10g
Tail_Top	6% gyroid	1		LW-PLA	5g
ELEVATOR					
Elevator_Handle	100%	2		PLA	1g
Elevator_Left_1 / Right	6% gyroid	1		LW-PLA	8g
Elevator_Left_2 / Right	6% gyroid	1		LW-PLA	6g
Elevator_Left_Control_1 / Right	6% gyroid	1		LW-PLA	4g
Elevator_Left_Control_2 / Right	6% gyroid	1		LW-PLA	3.5g
FUSELAGE					
Rear_Spar_Fuselage_Insert	100% lines	2		PETG/PLA	7g
Main_Spar_Fuselage_Insert	100% lines	2		PETG/PLA	8g
F_1	6% gyroid	1		LW-PLA	2.5g
F_2	6% gyroid	1		LW-PLA	7g
F_3	6% gyroid	1		LW-PLA	6g
F_4	6% gyroid	1		LW-PLA	14g
F_5	6% gyroid	1		LW-PLA	20g
F_6	6% gyroid	1		LW-PLA	25g
F_7	6% gyroid	2		LW-PLA	80g

PART	Infill	Wall	Other settings	Material	Weight
F_8	6% gyroid	2		LW-PLA	70g
F_9	6% gyroid	2		LW-PLA	44g
F_10	6% gyroid	2		LW-PLA	45g
F_11	6% gyroid	2	Tree support(optional)	LW-PLA	13g
F_10_motor	6% gyroid	2		LW-PLA	48g
F_11_motor	6% gyroid	6	Bottom layers: 10, Top layers: 5 (This allows this part to be sanded at front, in case you need more space for prop adapter)	LW-PLA	26g
Motor_mount	100% grid	5	Bottom/top: 2	PLA	23g
Heat_block	100% grid	5	Bottom/top: 2	TPU	1g
WING					
Wing_Spar_Join_Left / Right	70% - 100% lines	2		PETG/PLA	30g
Rear_Spar_Wing_Insert	100% lines	2	Print flat not vertical !	PETG/PLA	3g
Main_Spar_Wing_Insert	100% lines	2	Print flat not vertical !	PETG/PLA	6g
Wing_Left_1 / Right	6% gyroid	1		LW-PLA	23g
Wing_Left_2 / Right	6% gyroid	1		LW-PLA	24g
Wing_Left_3 / Right	6% gyroid	1		LW-PLA	19g
Wing_Left_4 / Right	6% gyroid	1		LW-PLA	22g
Wing_Left_5 / Right	6% gyroid	1		LW-PLA	13g
Wing_Left_6 / Right	6% gyroid	1		LW-PLA	9g
Wing_Left_7 / Right	6% gyroid	1		LW-PLA	22g
Wing_Left_8 / Right	6% gyroid	1		LW-PLA	10g
Wing_Left_9 / Right	6% gyroid	1		LW-PLA	9g
Wing_Left_10 / Right	6% gyroid	1		LW-PLA	8g
Wing_Tip_Left_Front / Right	6% gyroid	2		LW-PLA	2g
Wing_Tip_Left_Rear / Right	6% gyroid	2		LW-PLA	2g
AILERONS					
Aileron_Servo_Mount_Left / Right	100% lines	2	Tree support	PLA	6g

PART	Infill	Wall	Other settings	Material	Weight
Aileron_Handle	100% lines	2		PLA	0.5g
Aileron_Left_1 / Right	6% gyroid	1		LW-PLA	5g
Aileron_Left_2 / Right	6% gyroid	1		LW-PLA	4g
Aileron_Left_3 / Right	6% gyroid	1		LW-PLA	2.5g
Aileron_Left_4 / Right	6% gyroid	1		LW-PLA	3.5g
Aileron_Left_5 / Right	6% gyroid	1		LW-PLA	3g
FLAPS					
Flap_Left_1 / Right	6% gyroid	1		LW-PLA	6g
Flap_Left_2 / Right	6% gyroid	1		LW-PLA	7g
Flap_Left_3 / Right	6% gyroid	1		LW-PLA	6g
Flap_Left_4 / Right	6% gyroid	1		LW-PLA	7g
Flap_Left_5 / Right	6% gyroid	1		LW-PLA	4g
Flap_Left_6 / Right	6% gyroid	1		LW-PLA	5g
Flap_Handle_Inner	100% lines	2		PLA	0.1g
Flap_Handle_Outer	100% lines	2		PLA	0.1g
Flap_Mount_Inner	100% lines	2		PLA	2g
Flap_Mount_Middle	100% lines	2		PLA	2g
Flap_Mount_Outer	100% lines	2		PLA	2g
CABIN					
Frame_Parts	100% lines	2		PLA	5g
Frame_Bottom	70 - 100% lines	2	Tree support(optional)	PLA	26g
Glass_Front	100%	1	Vase mode (optionaly use 0.8mm nozzle)	PLA	7g
Glass_Middle	100%	1	Vase mode (optionaly use 0.8mm nozzle)	PLA	14g
Glass_Rear	100%	1	Vase mode (optionaly use 0.8mm nozzle)	PLA	15g
OTHER					
Gear_Mount	100% lines	2	Tree support	PETG/PLA	30g
Tow_Hook	100% lines	2	Tree support	PLA	14g

PART	Infill	Wall	Other settings	Material	Weight
Battery_Plate	100% lines	2		PLA	12g
Battery_Plate_2(motor)	100% lines	2		PLA	17g
Receiver_Plate	100% lines	2		PLA	7g
Servo_Mount_Long	100% lines	2		PLA	2g
Servo_Mount_Short	100% lines	2		PLA	1g
Wheel_Rim	70 - 100% lines	2		PLA	4g
Wing_Connect_Plate	70 - 100% lines	3		PLA	4g
Wheel	5% gyroid	2		TPU	6g
TPU_Hinge	100% lines	2		TPU	1g