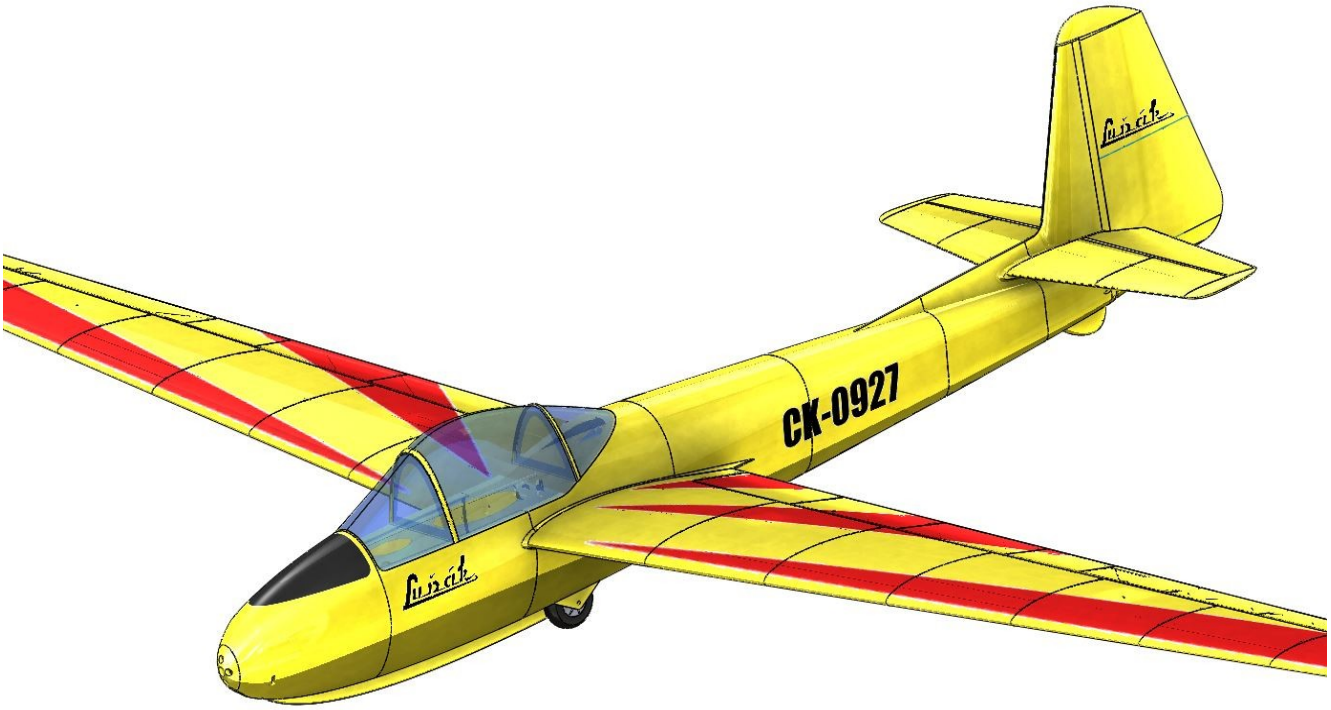
Letov LF-107 Luňák

Julien Watier



The LF-107 Luňák (English: Kite) is a Czech aerobatic glider designed in the late 1940s. The first flight of the prototype took place on June 25, 1948 and a second prototype flew in July. The prototype participated later in the same year in an aerobatic competition in Grenchen, Switzerland, and in Ziar, Poland in 1949, where its good aerobatic and gliding characteristics drew considerable attention.
Unfortunately serial production was disrupted by geopolitical developments, as the factory was charged with production of MiG-15, MiG-19 and MiG-21F aircraft, and access to Western civil export markets was progressively hampered by the emergence of the Iron Curtain. Therefore, only 75 examples of the Luňák were produced in total.
In 1950, a variant with simpler construction and a revised cockpit, among other changes, was developed. This LF-107 Luňák of wooden construction, designated Letov VT-7 under the military training system, was instrumental in the development of gliding and aerobatics in the Czech Republic. The LF-107 was also used for aerobatic training in the Soviet Union, Bulgaria, Romania and Poland.

This printed scale model of Luňák is designed for experienced pilots. It is a particularly strong glider in flight, even behind a powerful tug. You don't have to worry about it to break during transportation or storage neither. With 3D printing we can have a model at least as eficient as an equivalent glider built using traditional techniques .

It is an aerobatic model: its mass allows for aggresive acrobatic flight at high speeds. Despite its weight it is also capable of good performance in thermal flight. The four servo wing setup allows for safe short landings. The stall speed is relatively low, but watch out for the stall as it can be fatal. Don't let the speed drop too low.

Lunak in Flight:

With a tug (first flight of the prototype)

https://youtu.be/yKyfpjcVlrI

Electric flight:

https://youtu.be/xsq-l9O6UpM

The printing takes about 200 hours. If available, multiple printers can be used for faster production. Once all the parts are printed, a basic assembly takes only a couple of days. The model has been designed to require minimum assembly time: no additional fiber glass coating, painting, hinges required but a nice smooth paintjob can be achieved with sanding.

The Lunak can be equipped either with a tow hook or powered by an electric motor according to your preference. In case of using just a tow hook, expect about 400g of balast weight in the nose to balance the plane! Even the motorized Luňák can be towed by a tug, just remove the propeller.

Luňák, being an aerobatic model, expect it to be heavier than a conventional glider by almost a 1 kg. This is intentional to have enough innertia for maneuvers, however, you can take advantage of printing some parts from LW-PLA to reduce the weight and improve the thermal flight.

Don't leave the plane standing on direct sunlight for too long.

Features:

- Wings reinforced by 2 carbon rods (4mm each), outer skin (0.8mm)
- Fuselage reinforced by 1.5 mm fiberglass rods
- Printed hinges integrated inside the parts.
- 2 servos per wing allows crow configuration for short and safe landings
- Optional motor for hand launching and a tow hook.

Parameters

Wingspan :	297 cm
Weight :	4,5kg
Wing surface	55,3 dm^2
Wing Load	81g/dm^2
Airfoil	SB 95/11.5
Center of gravity	10 cm from leading edge (at the main spar)

Control surfaces:

Elevator	+/- 20 mm
Rudder	+/- 80 mm
Ailerons	+20/-15 mm
Flaps	+0 /- maximum

Requirements

3D Printer : recommended Prusa MK3S : 250 x 210 x 200 mm,
minimum diagonal for wing chord is 290 mm

Slicing software Prusa slicer and Simplify3D (required for surface body parts)

PLA : 3 to 4 kg
4x carbon rods 4 mm x 1500 mm (can be obtained in kiting stores)
5x fiberglass rods 1.5 mm x 1000 mm (fuselage reinforcements)
1x carbon rod 3mm (elevator control)
1x carbon rod 5mm for the stabilizer spar
1x carbon rod 12 mm for the wing spar
1x brass tube 13 mm outer, 12mm inner diameter as a fitting for the main wing spar
1x pull-pull cable assembly for rudder

Radio:
8 ch transmitter / receiver
4x flat wing servos: Turnigy TGI 813
3x standard sized servos for rudder/ elevator/ tow hook
Receiver battery (2S LiFePo, Li-Pol or Ni-MH depending on used equipment)

Motorized version:
ESC 80 amp (in case of using BEC in the ESC, the receiver battery is not required)
Lipo 4S 4500mah
Dualsky XM3844EG-10 motor (161g, 970Kv, 720W)
13x6 folding prop.

Print settings

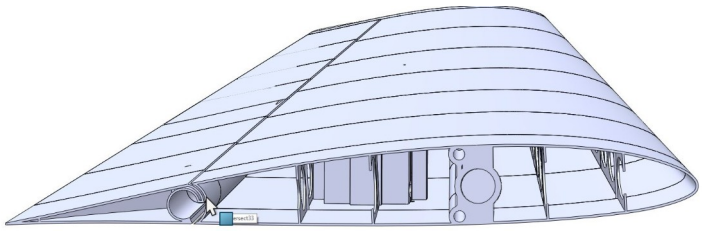
All the default parameters for standard PLA in Prusaslicer

Part	Layer height	Top/bottom layers	Perimeters	% infill	Note
Wing 1 to 8	0,3	7/7	4	25,00%	
Wing tip	0,3	2/2	2	5,00%	Need supports
Ailerons Flap	0,3	3/3	2	30,00%	
Fuselage 1 to 8	0,3	2/2	2	20,00%	
Nose Skid Gear	0,3	10/10	7	15,00%	
Tire	0,3	4/4	3	10,00%	Pla Flex
Horizontal stabilizer	0,3	2/2	2	10,00%	
Rudder surface	0,3	0/0	1	0,00%	Sliced with Simplify 3D (surface body)
Elevator surface	0,3	3/3	4	20,00%	

Assembly instructions

All the parts are glued using Cyanoacrylate. Use a grazing light to reveal any imperfections in alignment of sections and for sanding.

Wing Assembly :



Assembly video: https://youtu.be/TbhOa758gWw

1- Check that the carbon spars slides easily inside the housings. If necessary use a 4 mm steel wire in a drill with sharpened tip to clean the housings if necessary. Careful, not to melt the part.

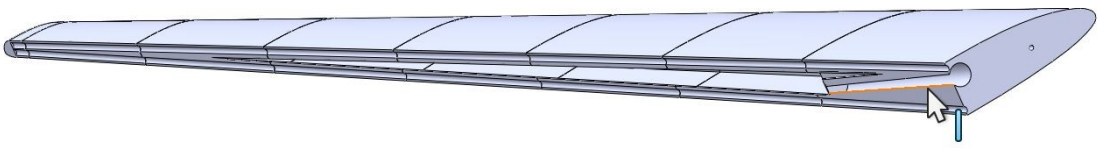
2- Assembly of wing sections: Lightly sand the bonding surfaces, check the alignment pins fit well with the other part, trim it with a blade if necessary, then bond parts together using CA glue. Make sure to use enough glue, any excess will be sanded anyway. Cure the glue with the accelerator once aligned. Avoid pouring glue inside the housing for the spars. Do not glue the wingtip at this moment.

3- Bonding of the spars:

Roughen the surface of the carbon spars with abrasive paper to improve bonding. It can also help with inserting the carbon spars to the wing if the slot is too tight

Check the spar moves easily inside the housing in the assembled wing before glueing. If necessary, clean the housing with a 4 mm steel wire mounted on a drill in order to adjust the diameter.

The spar is bonded with slow cure epoxy resin. Impregnate the spar with resin, gently pour 5 to 10g of resin into the housings of the spars. Hold on the wing vertically so that the resin flows all the way down the wing. Finally insert both carbon spars, keeping 5mm extra lenght from the outer side to fit the wingtip LATER! Wipe off the excessive resin.



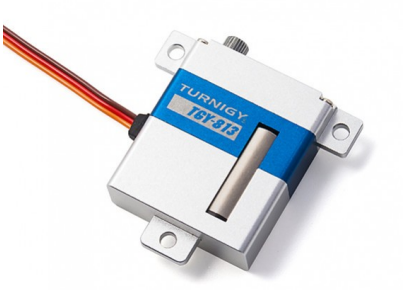
4- Assembly of ailerons and flaps.

Sand the bonding surfaces to improve bonding, then assemble the parts using an aluminum L-profile and a grazing light.

5- General sanding of the wing and control surfaces: use the orbital sander with 80 then 320 grit.

Gently slide the flaps first then the ailerons on the hinges by sliding them from the wingtip towards the root.

Finaly , glue the wing tips.



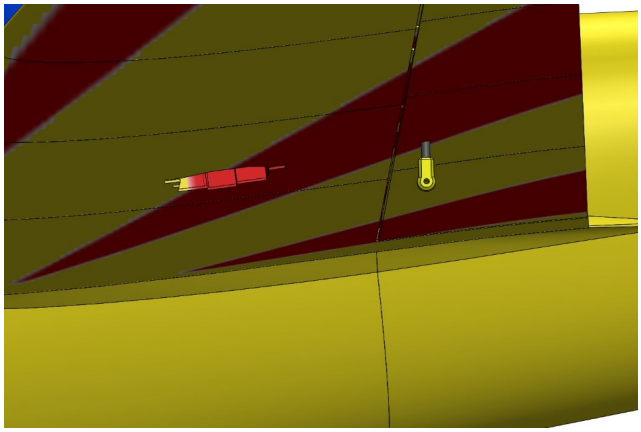
Glue the brass tube of the wing key holder.

6- Servos installation in the wings:

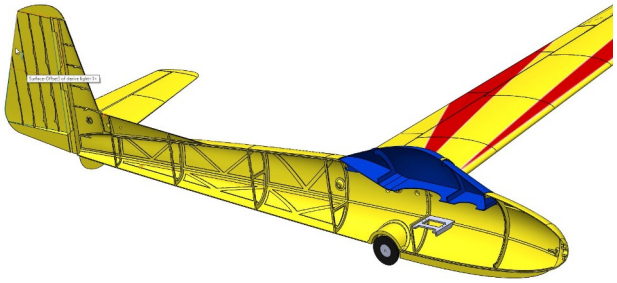
The servo housings are optimized for servos of the Turnigy TGI 813 type or equivalent dimensions.

Cut the print supports in the servo housings with pliers. Use 50cm servo lead extensions for flaps and 80cm for ailerons. Insert the extensions in the wings then secure the servos with 3 screws, finally trim the wing around the horn to allow full movement.

The aileron horns are made of 3mm threaded rod.

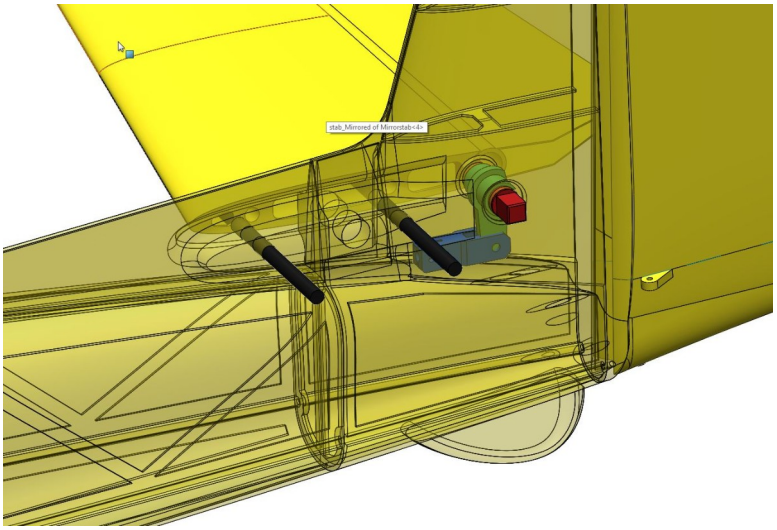


Fuselage assembly :



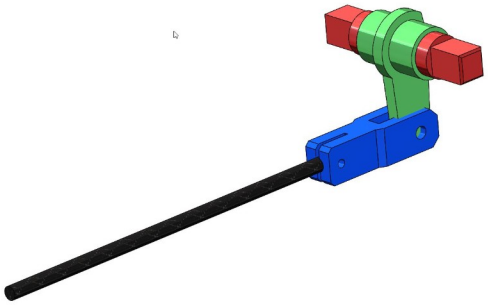
All the parts are glued with cyanoacrylate, the fuselage is reinforced with fiberglass rods. Check the fiber glass spars slide easily inside the fuselage before glueing.

1- glue items 1 to 7. The elevator pushrod and control horn has to be installed before glueing the last part of the fuselage.



2- Elevator pushrod and horn

Insert the 3mm carbon pushrod into the printed clevis and glue it.



Glue the 2 parts of the green horn

Screw the clevis to the control horn (green part)

Insert the red part inside the fuselage, make sure it moves freely

Insert the carbon pushrod into the guides in the center of the fuselage.

Fit the green part into the red part and bond both together using a dab of CA glue.

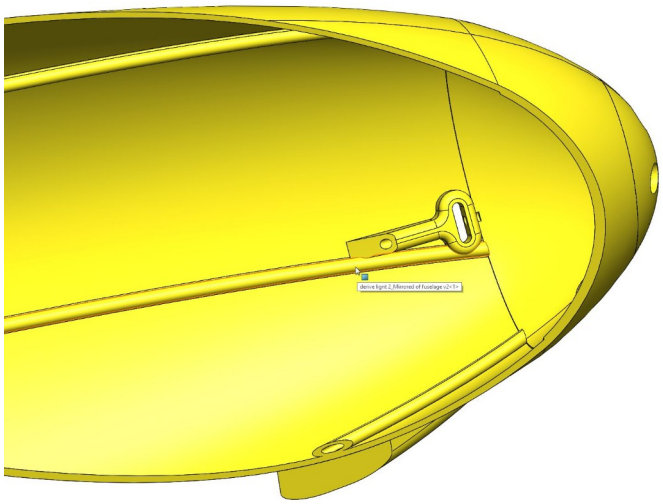
Finally close the fuselage with part 8.

3- Finally sand the fuselage: orbital sander, paper 80 up to 400 or more.

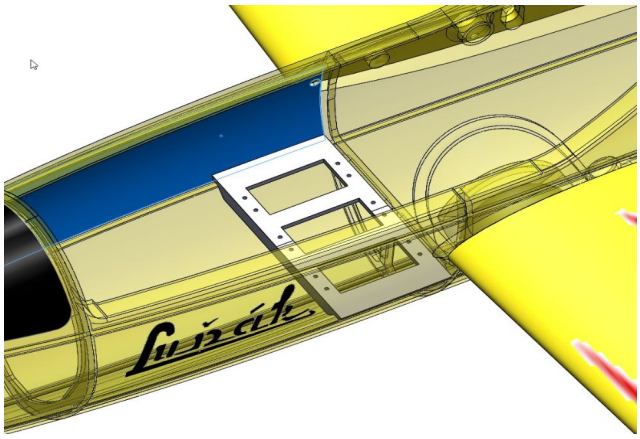
4-Glue the front and rear pads, the wheel support and the nose

5-Glue the radio plate and the battery holder.

The tow hook:



The radio board:

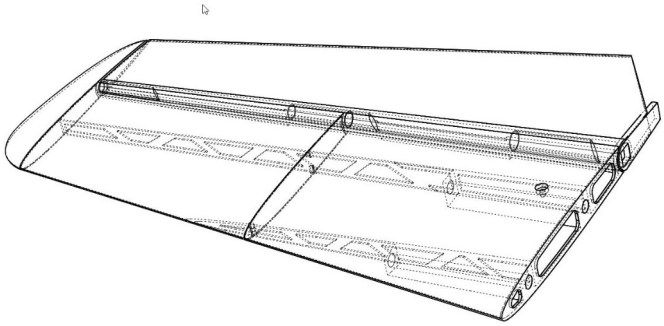


Horizontal stabilizer

The 3 parts of the stabilizer are glued together, as well as both parts of the elevator surface .

The female part with slot for the elevator control is glued to the elevator once everything is nested to reduce friction.

Both 5mm carbon rods are used as a spar. You can use 6 mm (easier to find) by re-drilling the parts.

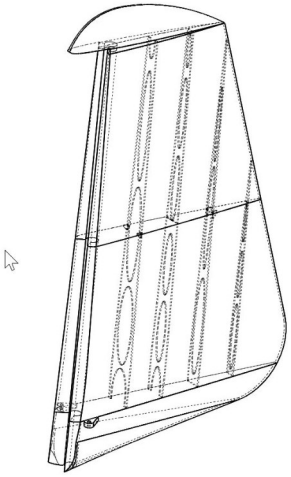


Rudder:

For weight and balancing purposes, it is printed as a single wall. This is why you have to use Cura or Simplify 3D to slice the part, Prusa slicer isn't designed to do this natively.

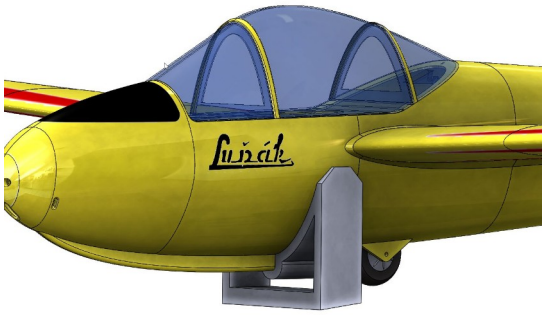
It is made of 4 parts to be glued,

The surface is controlled with a classic pull-pull cable assembly.

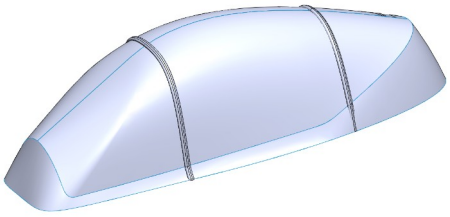


Accessories

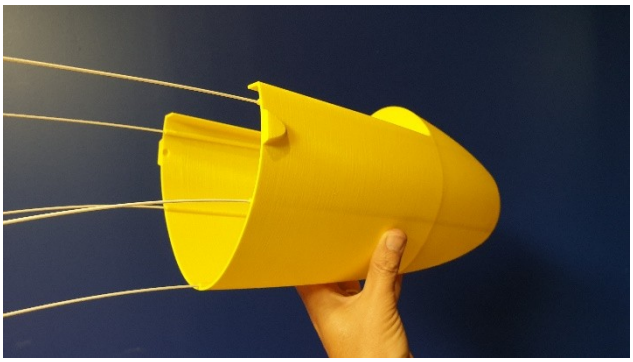
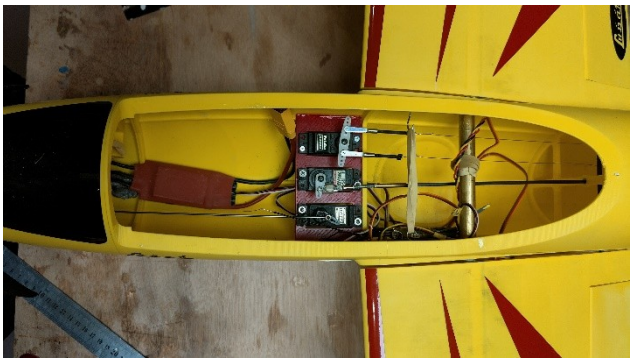
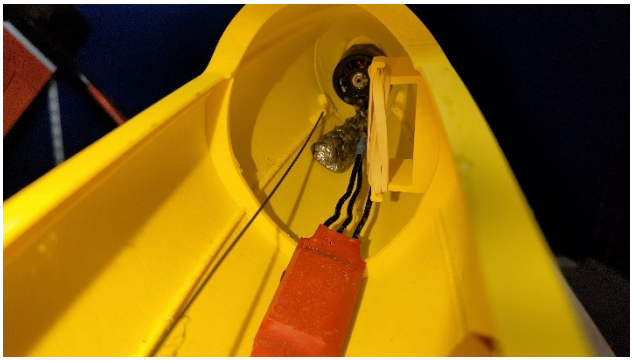
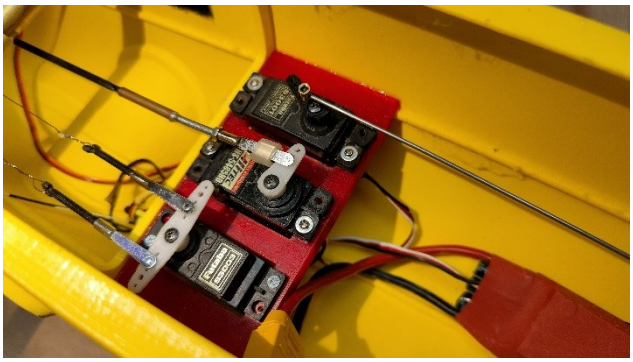
An stl file for fuselage support (stand)



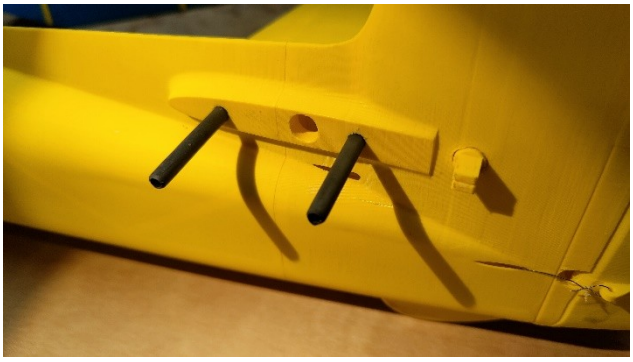
As an option for the canopy, there's thermoforming mold available, if you are equipped to make one. it needs a very smooth surface finish and must be fully filled with a plaster before thermoforming.

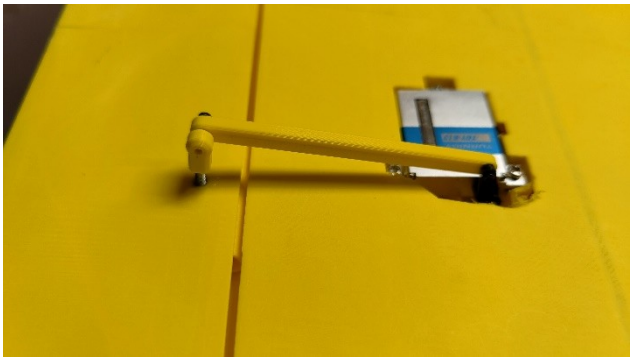
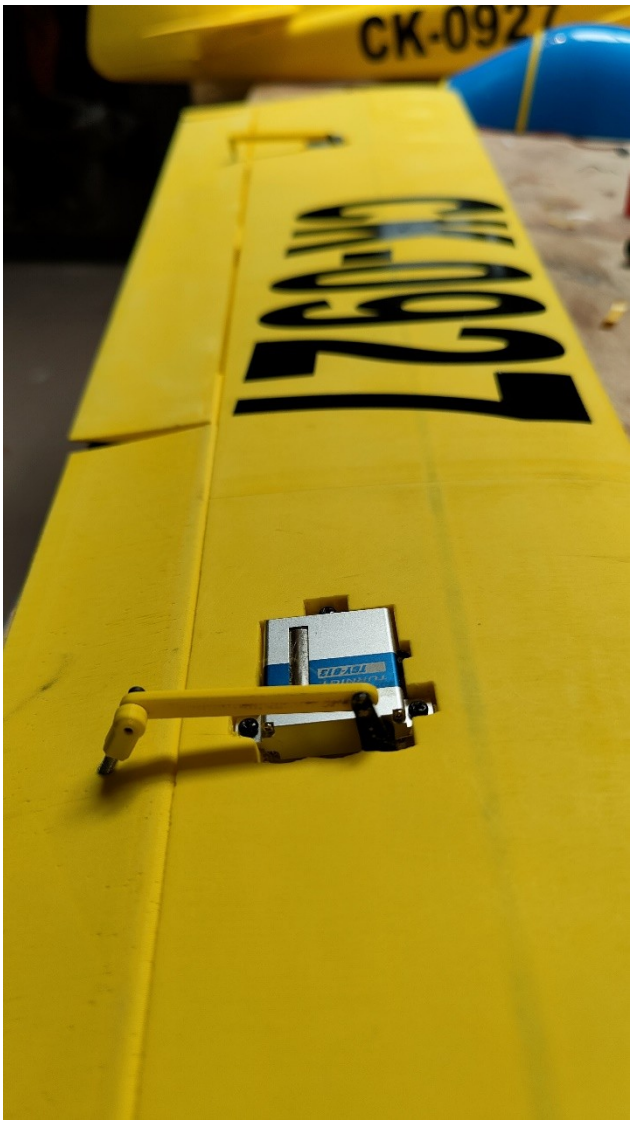


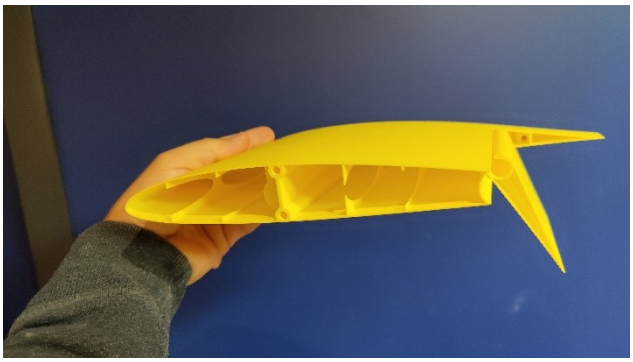
General Assembly pictures

	The 1.5 mm fiberglass spars
	Rudder, elevator and tow hook servos.
	200g of lead under the motor and the tow hook control
	

	A bent metal hook holds the wings using a rubber band. On the rear of the wing the 4mm carbon centering stud.
	a rubber band keeps the canopy, hooked to the wing spar

	The prop can be easily removed
	
	The fuselage support, the 12mm carbon main wing spar and the 4mm centering pin. The wheel is printed from flexible material.
	The stabilizer 5 or 6mm carbon rods and the elevator control
	The rudder control, drill the last fuselage part a bit to allow a full travel.

	the bent metal hook keeps the wings with a rubber band.
	Flap control
	Ailerons control. For ailerons and flap you can print this part and adjust their length with the slicer to fit them. Use 2mm bolts

	Before and after sanding with an electric orbital sander.
	A flap test.
For any questions	Turbi40@gmail.com My youtube channel : https://www.youtube.com/c/JulienWatier My blog http://projetcnc.blogspot.com