Foiling IMOCA "Macif"

A printable RC sailboat by YACHTPRINT, Chris Angelduro Version 1.1, 04/2025

The IMOCA (International Monohull Open Class Association) class features high-performance 60-foot monohulls built for solo or short-handed ocean racing. It is the flagship category of the iconic Vendée Globe, a solo, non-stop, around-the-world race without assistance. In the most recent Vendée, the IMOCA "MACIF" won and cemented its place as one of the most formidable and advanced race boats ever.

The 3D printable RC model of this yacht has been developed in 1:18 scale, as a close replica of the original, with slight modifications to the underwater volume to account for the scale factor. The model features a fixed keel box compatible with the keel of the DF95, as well as hydrofoils. The model boat is capable foiling like the original, lifting the hull halfway out of the water while doubling speed.

TECHNICAL DATA of the model

Scale	1:18
Length	1.000 mm hull / 1.115 mm incl. bowsprit
Width	325 mm without outrigger and foils
Weight	3,2 kg ready to sail incl. battery, thereof 1,1 kg for fin and keel bulb
Print plate	200x150x205 (minimum size for x/y/z)

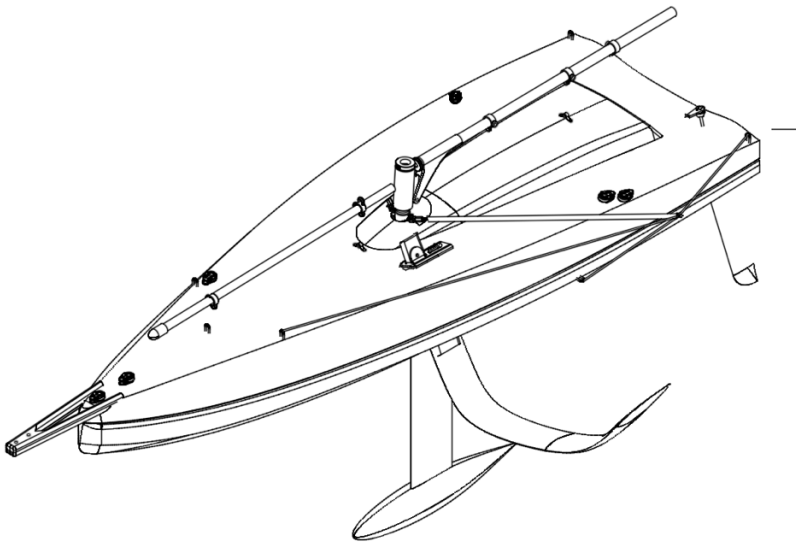
3D PRINTING & additional parts

I suggest printing the hull sections with LW-PLA (eg from ColorFabb at 252 degrees, 48% flow and 30mm/s max speed) with a light cover of glass/epoxy after the sections are assembled. However, you can very well print the hull in other materials such as PLA+, etc. as well. Just make sure to achieve a hull wall thickness of 1,1mm. This is necessary for the flanges to fit in the neighboring segment.

I use a 0.8mm nozzle with an according layer height of 0,4mm to shorten print times. But you can also use a 0.4mm nozzle to achieve higher print quality if you accept the print times. In this case you may have to double up the number of walls to achieve the 1,1mm wall thickness.

All segments should be printed upright with the leading edge pointing upwards. The STL are solid so set the infill to 0% or print in vase mode. The bottom- and top layers are set to 0 for all segments except for “H1 bow”, “H2 sprit” where you need a glueing surface. Also “H6 transom” will be open, so no bottom layers. The transom will be closed by extra parts.

All parts marked with an “L” must be mirrored on the X-axis for the right side. All non-hull parts including the rudders and foils can be printed in PLA, PETG or similar.



Besides the printables, the following parts are needed:

- 2-channel RC transmitter/receiver system incl. battery
- Midi Servo for the rudder, preferably watertight
- Sail winch for sail adjustment, e.g. from RMG, Robbe or Windforce
- 10/12/14mm carbon tube for mast and booms, wall thickness 1mm
- Sails from a Mini40 multihull, IOM or comparable size
- Sheet line (e.g. fishing line 0,5mm) and 1mm rubber line
- Ball bearings: 6x 4/13/4 w. U-groove for blocks, 2x 12/21/5 for gooseneck (hole, outer diam., width)
- Keel & Bulb from DF95, available as spare parts, bulb can be printed and filled with lead as well
- 4mm Stainless steel rod for rudder axis and foils connecting pins
- 4mm inner diameter aluminum tube as rudder stock
- 5mm threaded inserts for the foil rake adjustment, e.g. from Ruthex

	MACIF, 3D printing parts list						Version 1.1, March 2025
	10 Hull	Material	Nozzle	Infill	Quantity	Mirror?	comment (all hull parts printed upright, bow up)
1	H1 bow.stl	PLA	0.4	15%	1	no	2 walls, ca. 3 bottom- & top layers
2	H2.stl	LW-PLA	0.8	0%	1	no	1 wall 1,1mm thick, ca. 3 bottom- & top layers
3	H3 L.stl	LW-PLA	0.8	0%	1	yes	1 wall 1,1mm thick, no bottom- or top layers
4	H4 L mast.stl	LW-PLA	0.8	0%	1	yes	1 wall 1,1mm thick, no bottom- or top layers
5	H5 L.stl	LW-PLA	0.8	0%	1	yes	1 wall 1,1mm thick, no bottom- or top layers
6	H6 L transom.stl	LW-PLA	0.8	0%	1	yes	1 wall 1,1mm thick, no bottom- or top layers
7	KEEL BULK H4 L.stl	LW-PLA	0.8	0%	1	yes	1 wall 1,1mm thick, ca. 3 bottom- & top layers
8	TRANSOM COVER L.stl	PLA	0.4	na	1	yes	alternative to below
9	TRANSOM COVER w cut outs L.stl	PLA	0.4	na	1	yes	alternative to above
	20 Cabin	Material	Nozzle	Infill	Quantity	Mirror?	comment
10	CABIN HATCH fix.stl	LW-PLA	0.8	15%	1	no	2 walls, ca. 3 bottom- & top layers
11	CABIN HATCH front.stl	LW-PLA	0.8	15%	1	no	1-2 walls, ca. 3 bottom- & top layers
12	CABIN HATCH rear.stl	LW-PLA	0.8	15%	1	no	1-2 walls, ca. 3 bottom- & top layers
	30 Fin and Rudder	Material	Nozzle	Infill	Quantity	Mirror?	comment
13	BULB 1000 o.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
14	BULB 1000 u screw.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
15	FIN DF95.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
16	KEEL BOX DF95.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
17	KEEL NUT 130%.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
18	RUDDER HORN simple (1).stl	PLA	0.4	100%	2	no	either infill 100% or high # of walls for rigidity
19	RUDDER Macif.stl	PLA	0.4	100%	2	no	either infill 100% or high # of walls for rigidity
20	RUDDER NACA 0012.stl	PLA	0.4	100%	2	no	alternative to above
21	Rudder SERVO MOUNT mount MACIF.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
	40 Rig	Material	Nozzle	Infill	Quantity	Mirror?	comment
22	BASE OUTRIGGER.stl	PLA	0.4	100%	2	no	either infill 100% or high # of walls for rigidity
	Blocks	Material	Nozzle	Infill	Quantity	Mirror?	comment
23	block band.stl	PLA	0.4	100%	dep.	no	if needed
24	block bottom (thick).stl	PLA	0.4	100%	2	no	alternative to below
25	block bottom.stl	PLA	0.4	100%	6	no	alternative to above
26	block top.stl	PLA	0.4	100%	6	no	either infill 100% or high # of walls for rigidity
	Boom parts	Material	Nozzle	Infill	Quantity	Mirror?	comment
27	Boom band 10mm 1 ring.stl	PLA	0.4	100%	dep.	no	either infill 100% or high # of walls for rigidity
28	Boom band 10mm 2 rings.stl	PLA	0.4	100%	dep.	no	either infill 100% or high # of walls for rigidity
29	Boom band 12 1x ring.stl	PLA	0.4	100%	dep.	no	either infill 100% or high # of walls for rigidity
30	Boom Band long 10mm.stl	PLA	0.4	100%	dep.	no	either infill 100% or high # of walls for rigidity
31	Boom Band long 12mm.stl	PLA	0.4	100%	dep.	no	either infill 100% or high # of walls for rigidity
32	Boom cap.stl	PLA	0.4	100%	dep.	no	either infill 100% or high # of walls for rigidity
	Gooseneck	Material	Nozzle	Infill	Quantity	Mirror?	comment
33	Gooseneck boom part.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
34	Gooseneck mast part.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
35	Gooseneck stopper ring.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
36	Gooseneck thumb screw.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
37	SHEET POSTline.stl	PLA	0.4	100%	2	no	either infill 100% or high # of walls for rigidity
38	Std Servo Mount wide.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
39	Std Servo Mount.stl	PLA	0.4	100%	1	no	either infill 100% or high # of walls for rigidity
	50 Foil	Material	Nozzle	Infill	Quantity	Mirror?	comment
40	FOIL CASE MACIF L (in one piece).stl	PLA	0.4	100%	2	yes	either infill 100% or high # of walls for rigidity
41	FOIL CASE MACIF L (print lower).stl	PLA	0.4	100%	2	yes	alternative to one piece
42	FOIL CASE MACIF L (print upper).stl	PLA	0.4	100%	2	yes	alternative to one piece
43	FOIL CASE SKID Macif L.stl	PLA	0.4	100%	2	yes	either infill 100% or high # of walls for rigidity
44	FOIL SHAFT.stl	PLA	0.4	100%	2	no	either infill 100% or high # of walls for rigidity
45	FOIL V2.0 L(1).stl	PLA	0.4	100%	2	yes	either infill 100% or high # of walls for rigidity
46	FOIL V2.0 L(2).stl	PLA	0.4	100%	2	yes	either infill 100% or high # of walls for rigidity

HULL ASSEMBLY

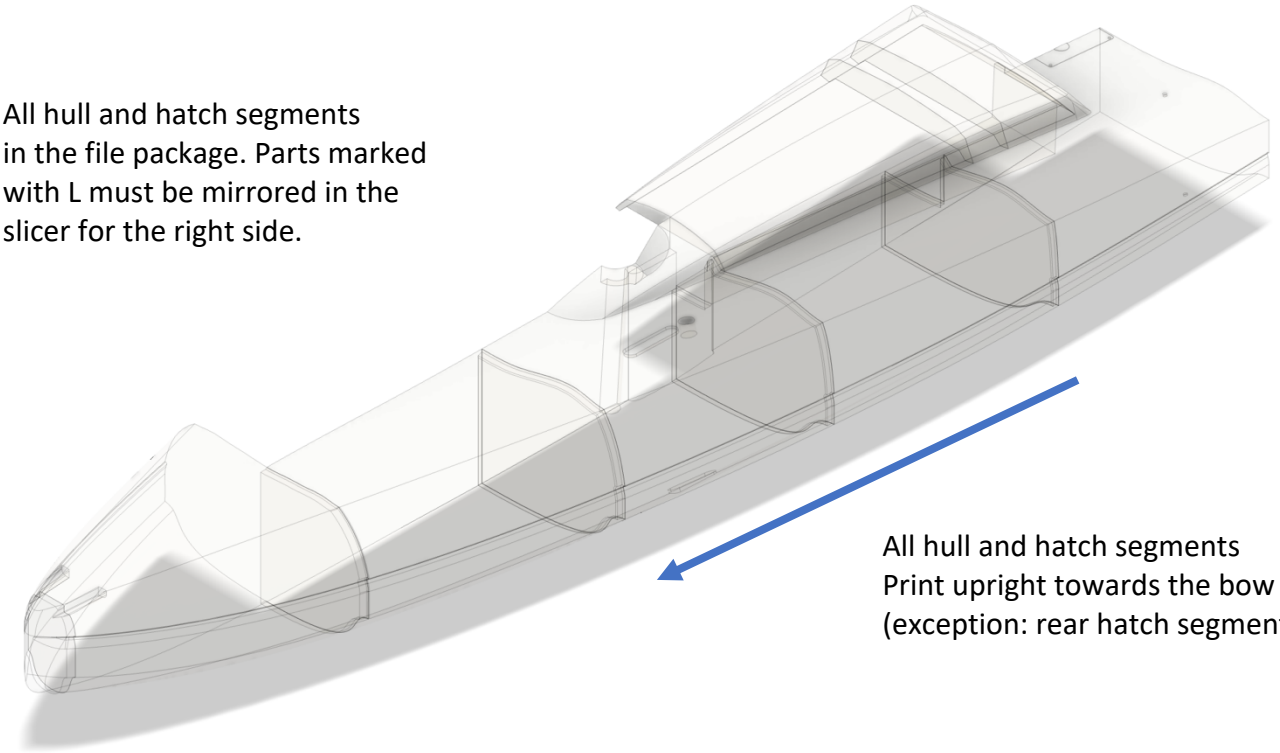
The assembly is straight forward. Just make sure to complete all steps where you need to access the inside before glueing the segments. Examples are the deck eyes for the forestay and side stays, the keel, mast step, foil cases and the rudders. Always try to build as light as possible to ease foiling later.

Pay extra attention to water seal the mounting points of the foil cases, the case of the keel fin and the rudder stocks. Water in the boat will heavily affect sailing performance. You should also foresee some water drainage holes that can be closed or taped.

The fixed (middle-) part of the hatch needs to be glued or screwed to the hull as it is the mounting point for the mainsheet eye. You can leave the rear part as hatch or glue it down as well. Only the front part contains the receiver, battery and sail winch.

I recommend covering the hull with thin glass (100-160g) and epoxy to increase stiffness and durability against heat. You. May want to slightly sand the hull before applying epoxy.

All hull and hatch segments in the file package. Parts marked with L must be mirrored in the slicer for the right side.



All hull and hatch segments
Print upright towards the bow
(exception: rear hatch segment)

APPENDAGES

The boat is designed to accept the fin and keel bulb of the Dragon Force 95, DF95. Those parts can be purchased as spare parts in many RC stores. You can also print the bulb in the printing files and fill it with lead and epoxy. It fits the DF95 fin and leads to approx. 550g weight. I suggest using the DF95 bulb.

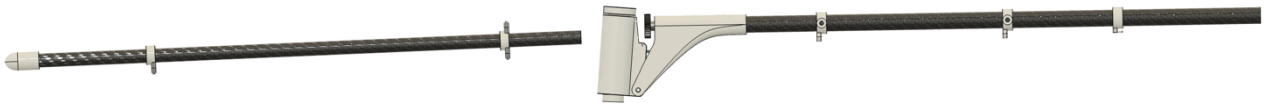
The rudders are printed upright, sitting on their root section secured with a brim. Heat the 4mm rudder axis before pressing it into the rudder. The rudders are steered by one middle servo sized MIDI. Cut out the respective area marked by the slight recess in the two transom hull sections. The rudder horns are prepared for 4mm shaft collars so that you can secure the rudders with a screw.

The foils are printed solid in two pieces using PLA or another rigid filament. The two pieces are joined with two 4mm pins as well as the foil and the foil shaft. Secure the foils in the foil case with a small pin.

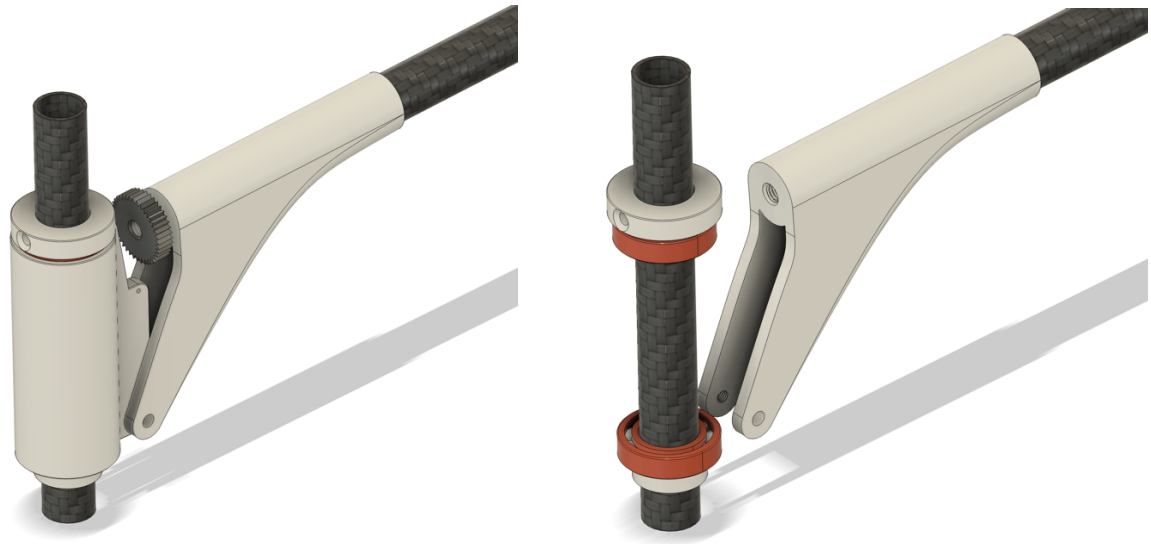
RIG AND SAILS

You can use the provided printable rig parts to build a custom rig using 10-16mm carbon tubes. Please refer to common resources on the internet for sail making. I use the B- and C-rig of my Mini40 trimaran. The B-rig is quite scale to the original IMOCA (ref. sail plans below).

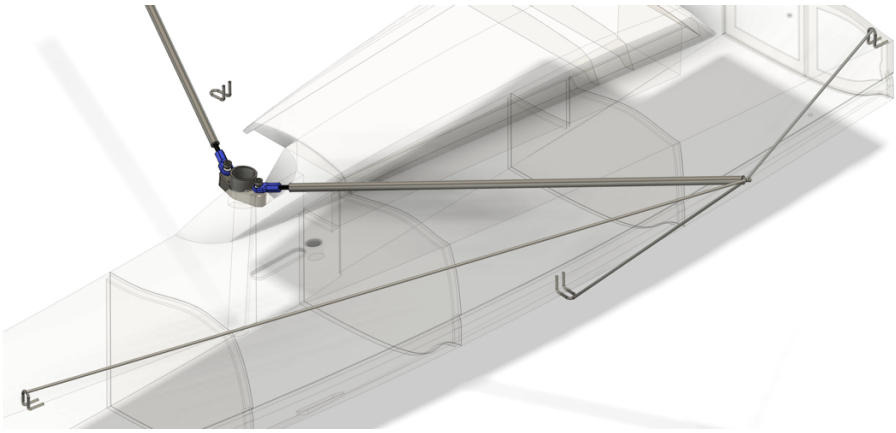
The mast step is 16mm diameter and accepts a 14mm mast foot. The mast itself is 12mm and can be tapered to 10mm at the top for the last 20%. The booms for jib and main can be 10 and 12mm. All carbon tubes should be pultruded rather than laminated tubes because pultruded tubes are stiffer.

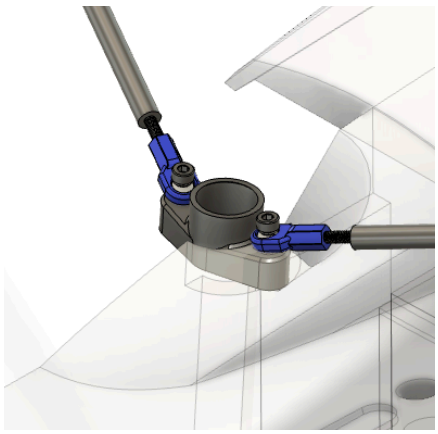


The gooseneck can be printed as well. For the assembly you need two ball bearings of the dimension 12/21/5 (inner hole, outer diameter, width). They are marked red in the picture below.

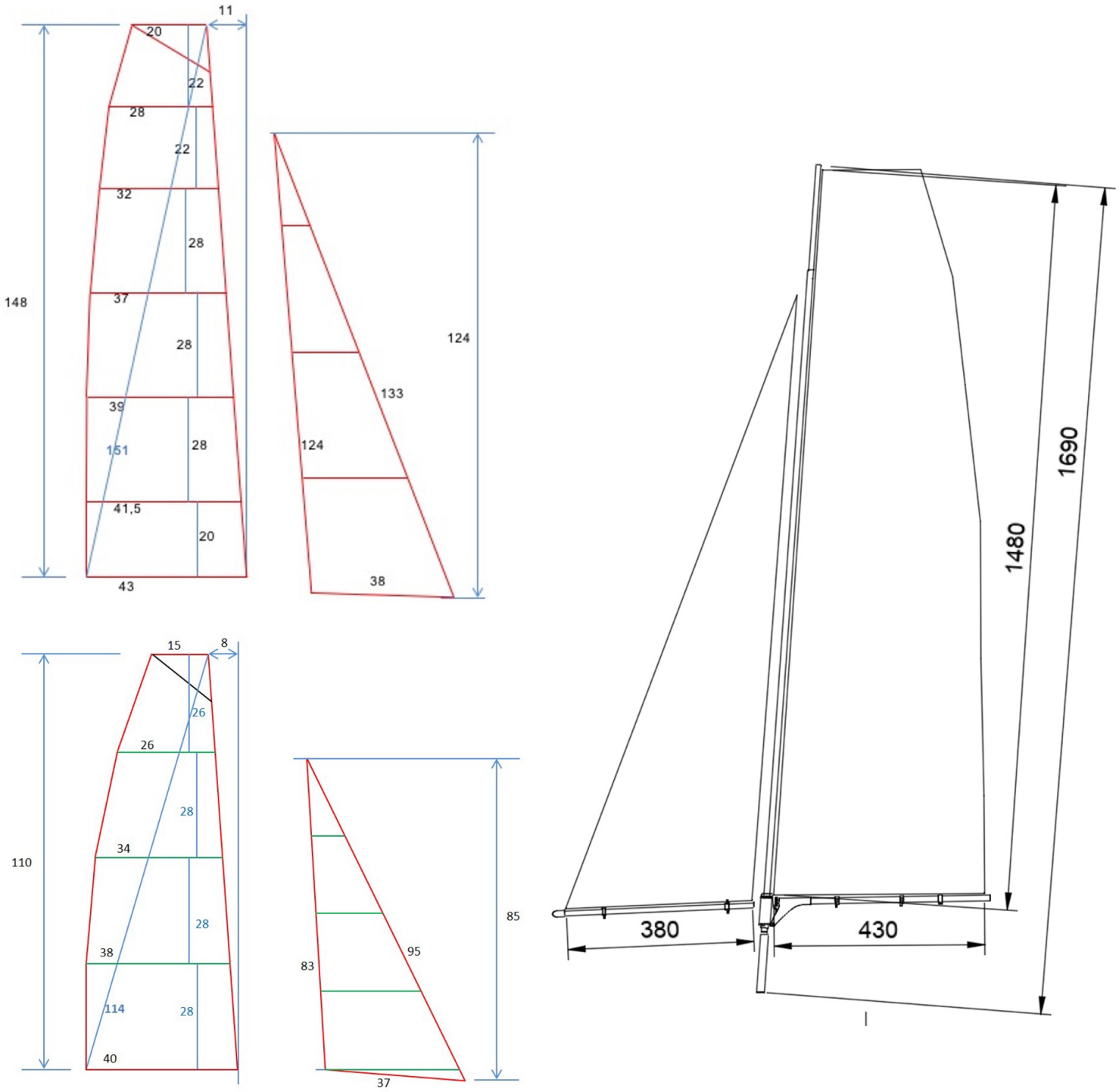


The outrigger poles are secured by two lines/wires going to the deck eyes on deck level. Make the front line a fixed length and the rear line adjustable. One wire goes to the eye at the side of the hull and includes a tensioning device like a shroud tensioner. This eye takes most of the load of the shroud. It must therefore be built very strong, e.g. by reinforcing the area around it with carbon fiber. The outriggers are attached to the mast step just above the deck level using ball joints. I recommend 6-8mm carbon tubes as outriggers.

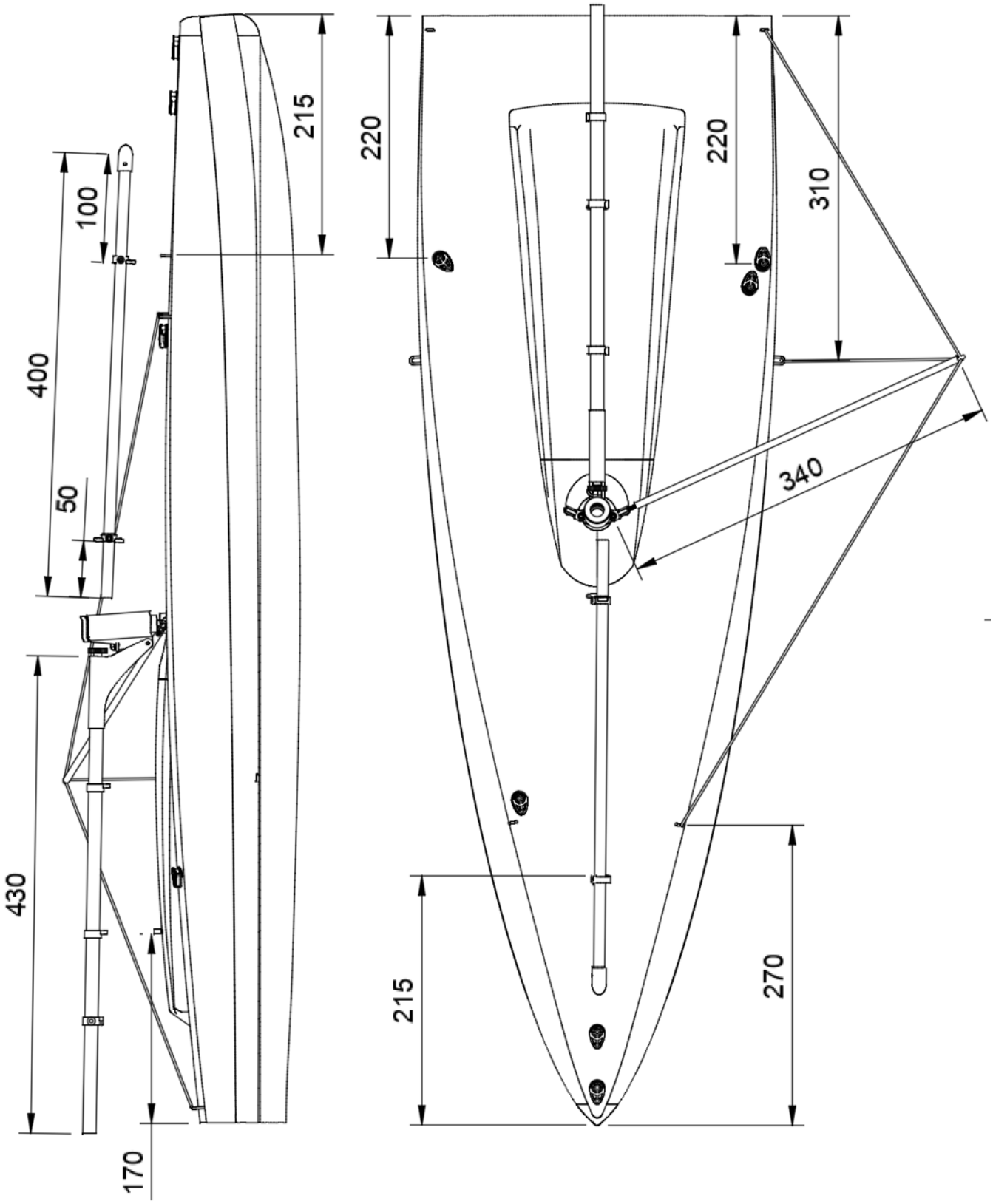




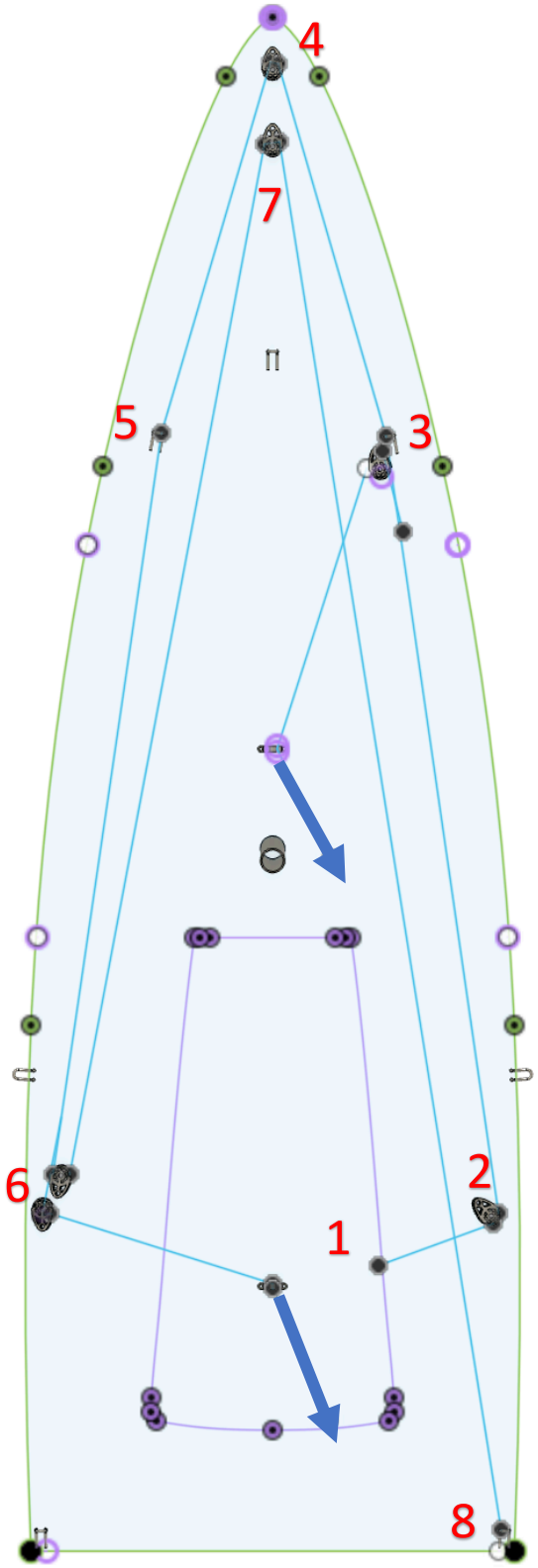
The rigging, shrouds and deck eye attachments should be sturdy. There are quite some forces acting on the little boat, especially when foiling. The overall design considers this and creates quite a rugged boat that you can rock through harsh conditions and push to the limits.



DECK LAYOUT



SHEETING SYSTEM



1 Sail winch pulling in and out. Out is supported by tensioned rubber line

2 first turning block

3 deck eye and attached a jib sheet through the block

4 front block

5 deck eye

6 main sheet block and turning block. After the turning block the line is rubber

7 rubber line front block

8 rubber line attachment

The rubber line must still just be tensioned in the full out/eased position. The winch pulls against the rubber line when sheeting in for upwind sail configuration.

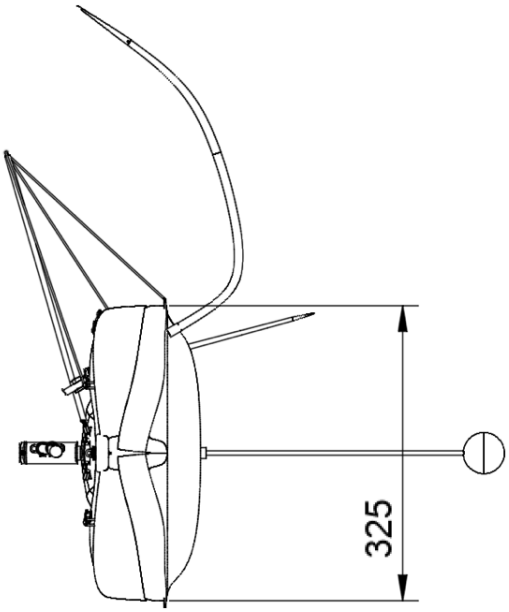
BLOCKS

As blocks you can purchase parts e.g. from “Cap Maquettes” (French store) or “Sailsetc.” (UK store).

Alternatively, you can use the printable parts provided here. To complete the blocks, you need ball bearings with a U groove and a size of 4x13x4 (in mm, inner hole/outer diameter/thickness).

DECK EYES

Bend a 0,8-1mm thick wire in a U that is 4-5mm wide. Then bend the ends 90 degrees upwards towards the U. Drill two holes in the hull and stick the EYE through it and pull it upright. Apply Epoxy to the 90 degrees bent inner ends of the EYE (from the inside of the hull).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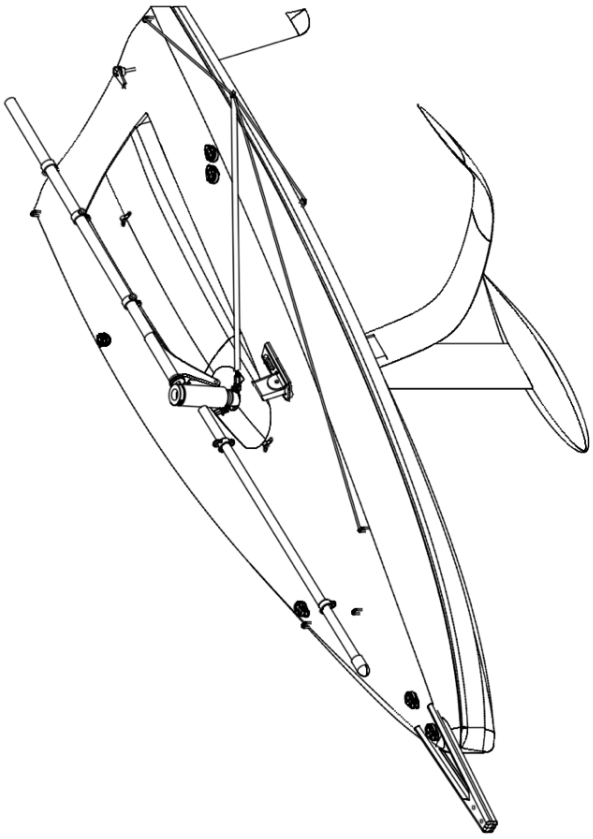

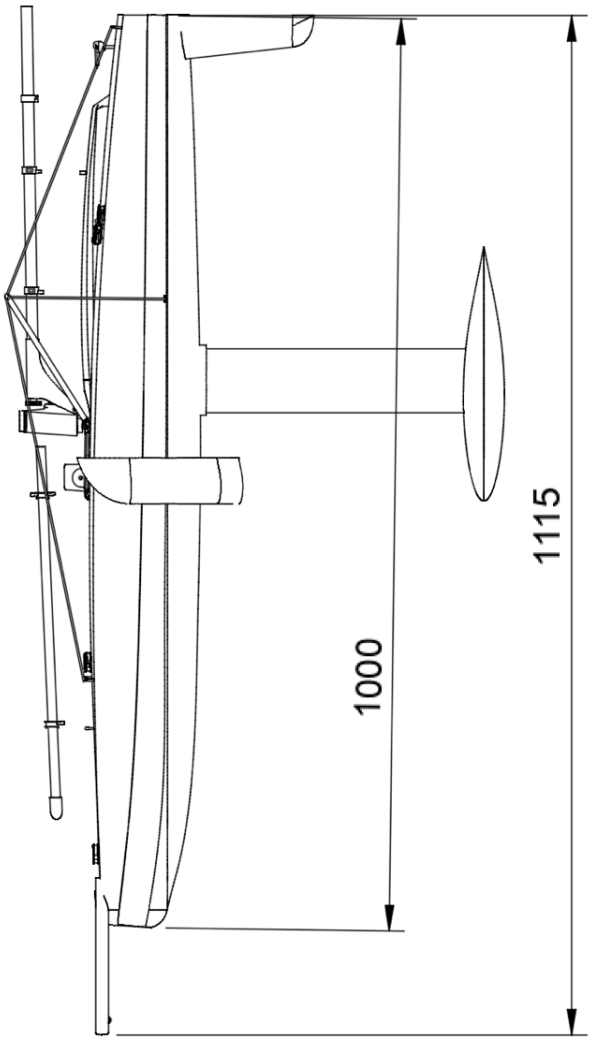
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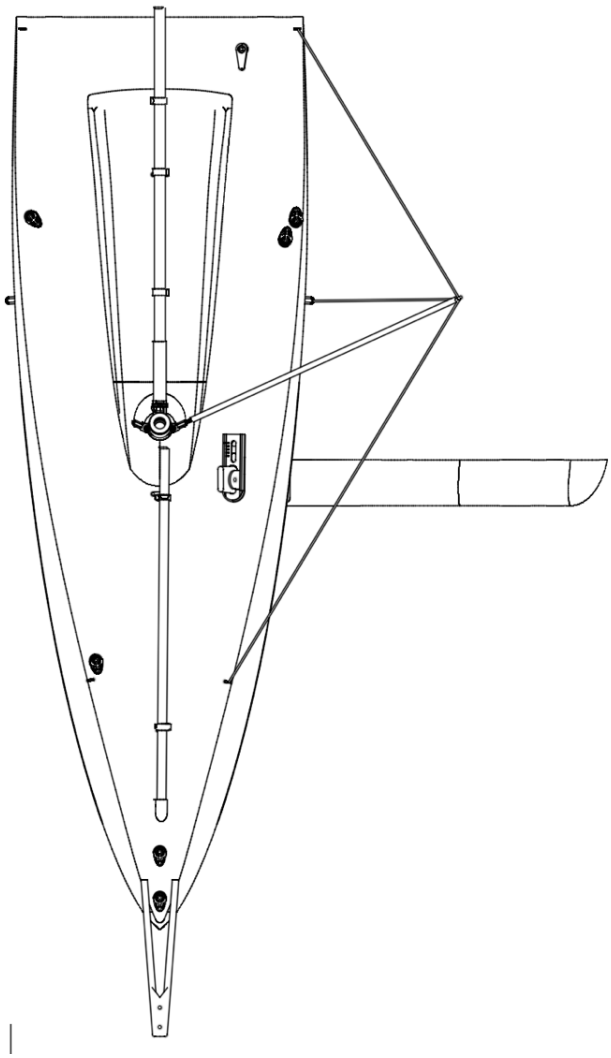

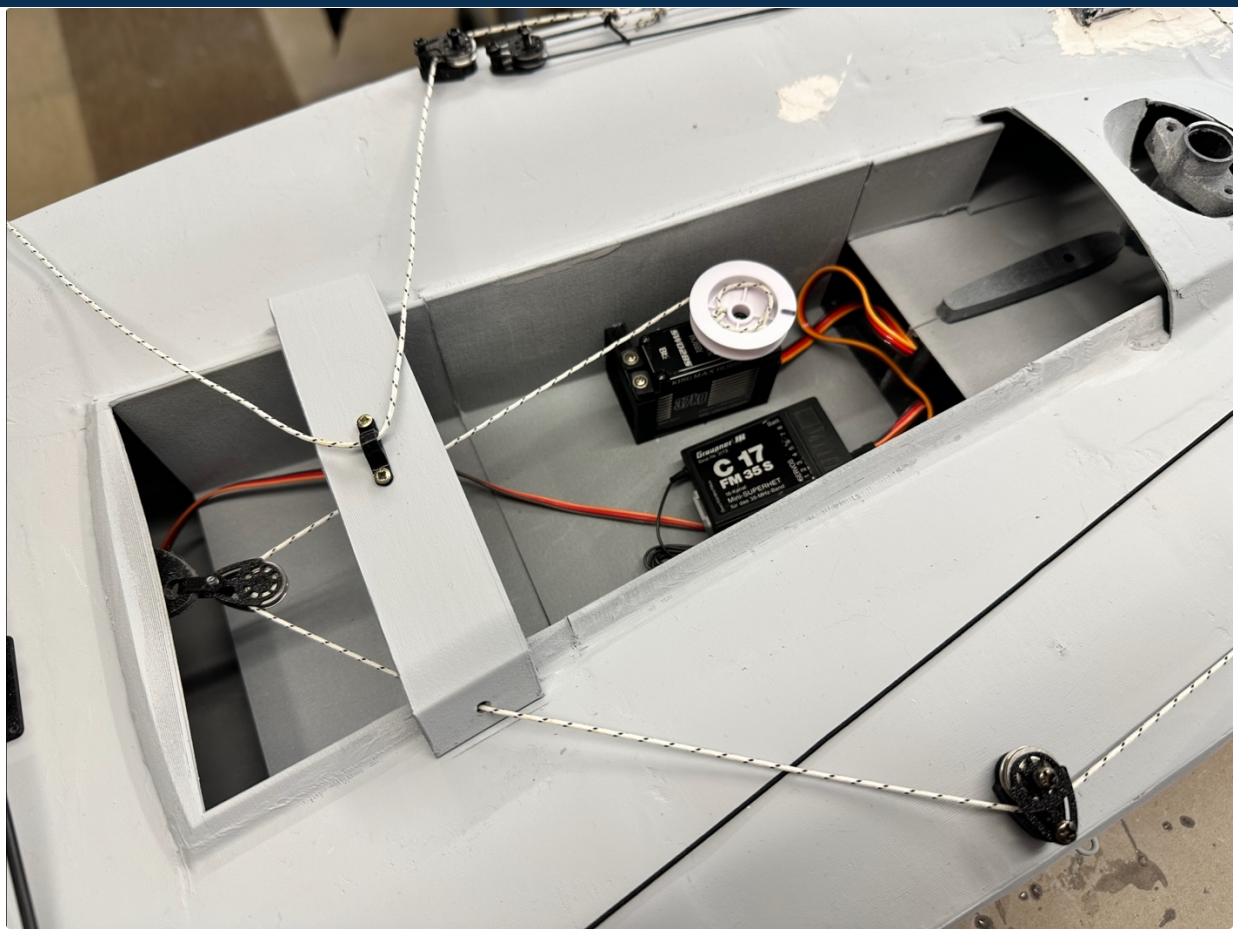
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PRINT IT, BUILD IT, SAIL IT and HAVE FUN!

Your

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