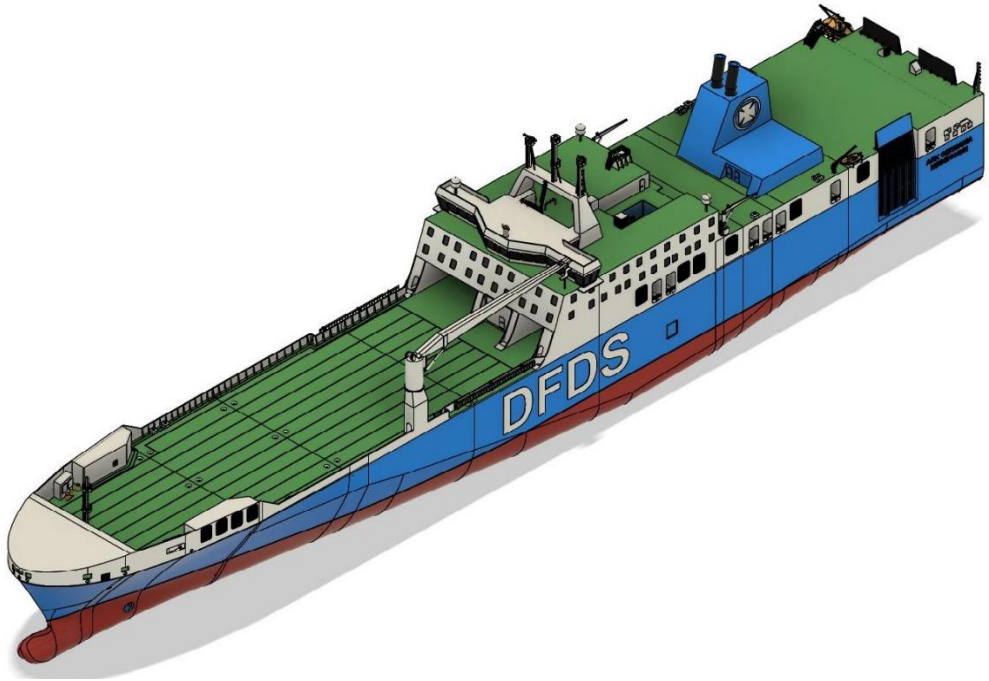
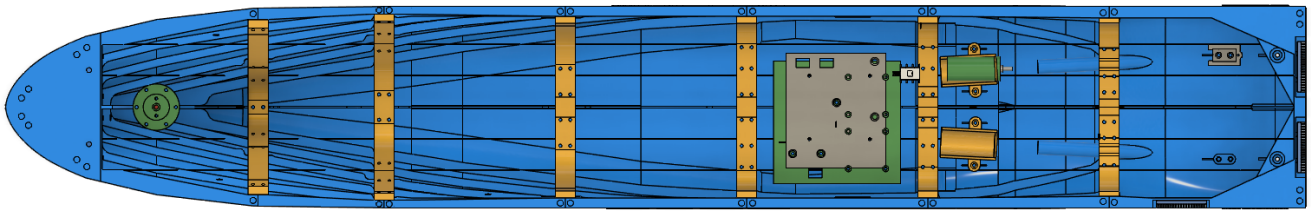
Hello! My name is Matthew. I would like to present my latest model of the ship "Ark Germania", which is a RoRo ship registered in Denmark. It was built in 2014. Its length is 198 m and its width is 30 m. The model was built on a scale of 1:150 So its total length is 132 cm!

https://www.marinetraffic.com/ar/photos/of/ships/shipid:157408/shipname:ARK%20GERMANIA?order=date_uploaded

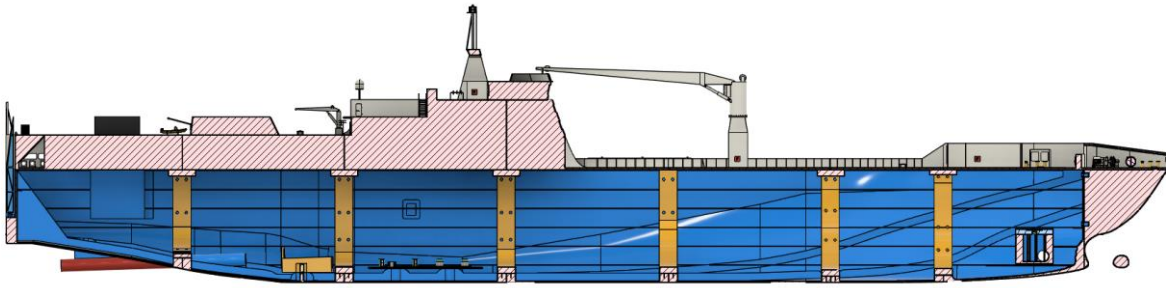
Due to its large dimensions, the model was cut into many parts so that it could be printed using an average printer. I printed using the new Bambu Lab P1S printer. I've had it for two months and I'm just getting to know its capabilities. Interestingly, the whole thing was printed with AMS. Only the underwater part was painted with acrylic spray paint. The visible model is the first prototype and during printing there were a few small mistakes that I corrected on an ongoing basis.



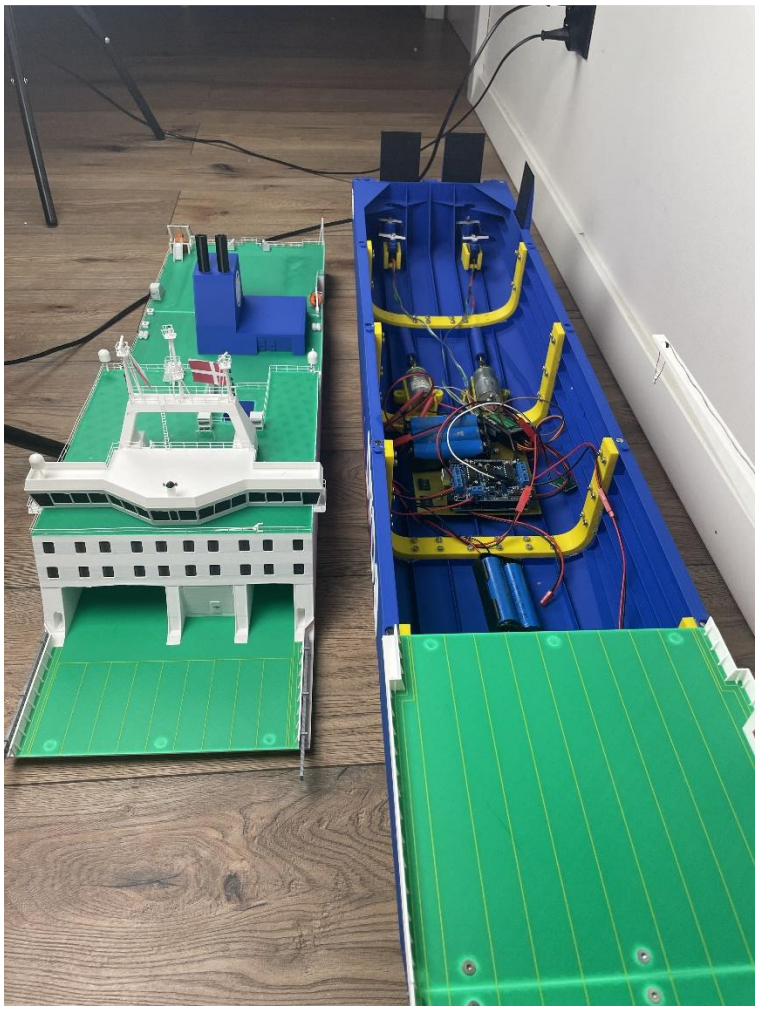
The underwater part and the sides are marked "Hull" and consist of 8 main parts that are screwed together using printed connectors. To make the connection solid, I used brass inserts and m3x10 screws. Additionally, silicone is applied between the gaps to make the model fully waterproof.



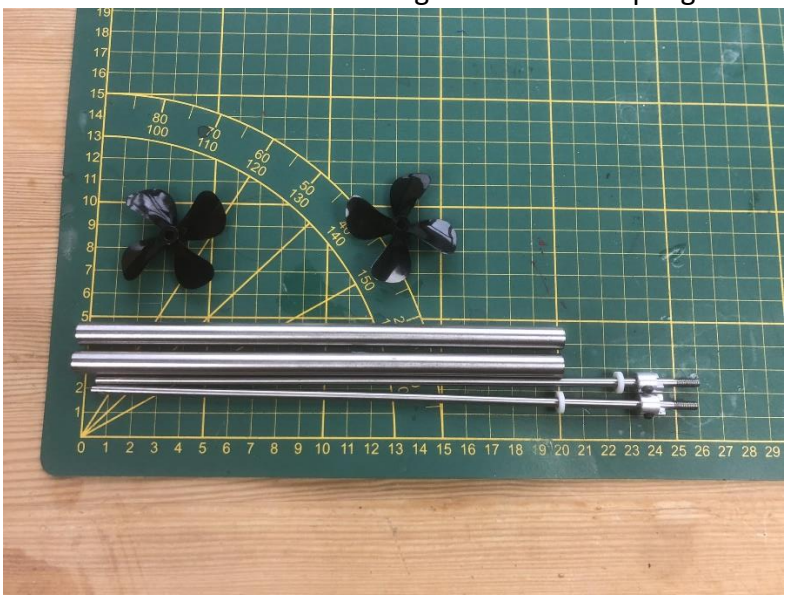
The majority of the plating is 1.6mm thick (4x0.4mm) As my experience shows, this is a good compromise between saving material and durability. The hull is therefore also fully waterproof even without painting. For additional reinforcement, I inserted longitudinal and transverse frames, which also act as built-in supports.



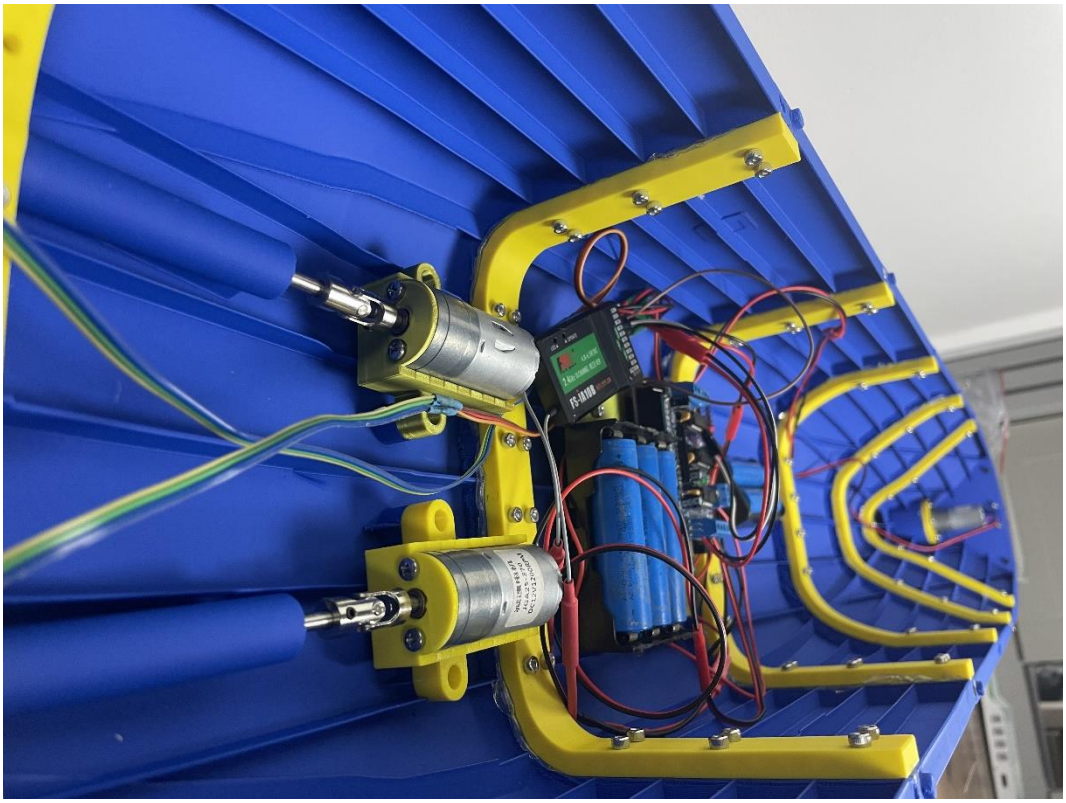
The deck and superstructure also consist of 8 parts. They are connected in a similar way to the underwater part. The parts are screwed together with screws and additionally strengthened with glue. Initially, I planned to make one large connected deck, but eventually I decided to make two parts. The deck and hull are connected using magnets and protrusions, thanks to which we have easy access to the interior of the ship and the equipment located there, and the cover holds securely to the hull.



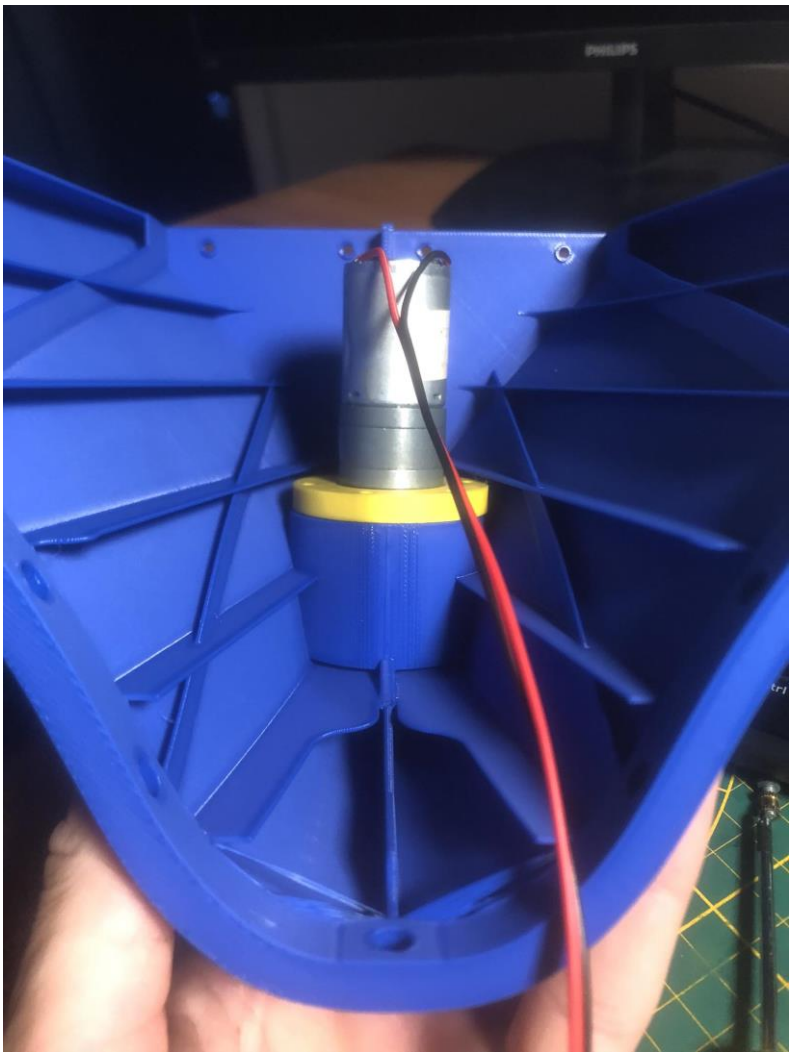
The drive consists of two four-blade propellers with a diameter of 50 mm, which are driven by 2 engines. One screw is clockwise, the other counterclockwise. This eliminates the propeller effect. The engines have a built-in gear and their maximum speed is 1200 rpm. The drive shaft is 250mm long and 4mm in diameter. The shaft housing is 200 mm long and 10 mm in diameter. Shafts and motors are connected using articulated couplings.



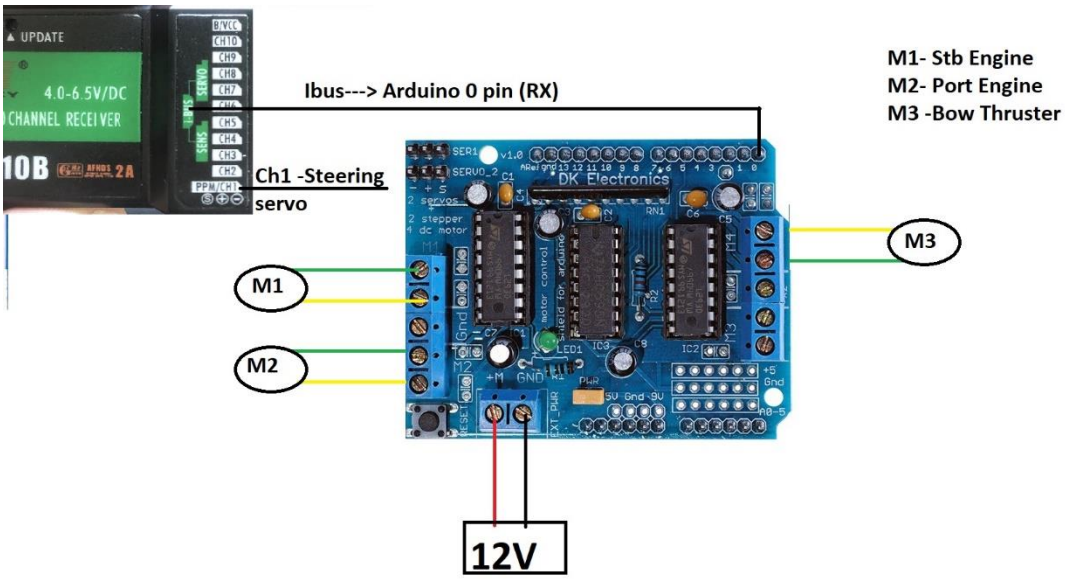
I made the controls in a way proven in previous projects. The rudder column has a diameter of 9 mm and ends high above the waterline. There are two bearings inside. The rudder pin passes through the bearings and is screwed into the rudder blade. At the top, the pin connects to the sg90s servo.



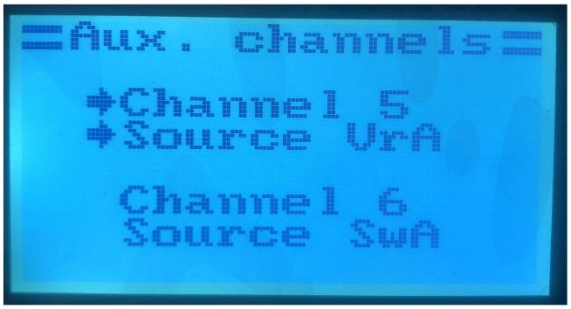
The engine mount is modular. We can easily dismantle it. If we wanted to use a different engine, simply replace the mounting.
The model is equipped with a thruster. A thruster is basically a simple, double-acting water pump located just below the water line. The same engine was used here as in the main drive. Even though the cover attachment is above the waterline, the hull joint must also be sealed with silicone.

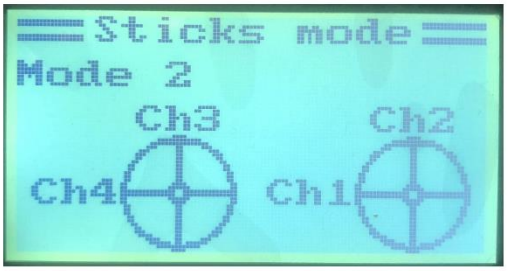


The motors are controlled using the adafruit motor shield module and arduino uno. I have prepared a special stand with matching holes for such a system. The downloadable files include ready-made code to be uploaded to Arduinio Uno.



The electrical diagram is very simple. We put the motor shield on the Arduino. I use IBUS communication to connect the Arduino and the receiver. Just connect the IBus pin from the receiver to Pin 0 on the Arduino board. We connect the servos directly to the RC receiver under Ch 1 and the other one under CH5. We set MIX Ch1&Ch5 in the transmitter. Thanks to this, the servos work in the same way.





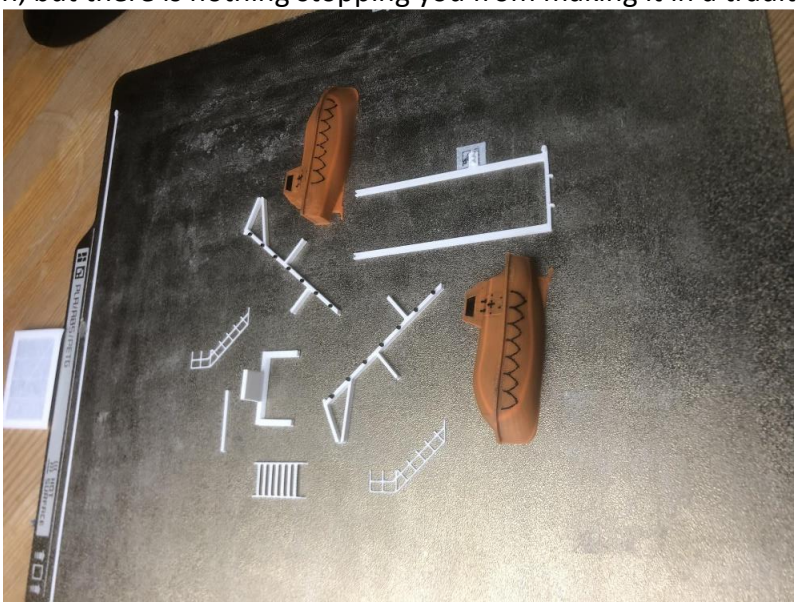
The program I prepared allows for control in 2 modes. We change the modes using the SWA switch on the transmitter. SWA switch It must be connected to CH6 and we do it in the transmitter settings.

In the first mode we control normally

In the second mode, the main engines work in opposite directions, which can be used to effectively rotate the ship.

The entire model, including the electronics, weighs 4,452 g. Additionally, you need to add ballast to make the model stable and evenly submerged. In my case it was 2.5 kg. Without ballast, the ship floated, but without it, sailing would be risky.

I printed small details with a 0.2 nozzle, but the vast majority of them were printed with a 0.4 nozzle and a 0.2 mm layer. Thanks to AMS, I skipped the painting stage (except for the bottom). Ready-made colors somehow forced no sanding. This is my first model using this technique and I must admit that I am very pleased. Experienced modelers probably do not share my opinion, but there is nothing stopping you from making it in a traditional way.



To organize the printing process and control time and costs, I prepared an Excel spreadsheet in which I calculate printing time and approximate costs. About There is also a bill of materials, prices and links to aliexpress. To sum up:

- Printing time - 175h
- Filament - 4311 G
- Printing Costs (Filament + Electricity) – PLN 292 = $75
- Equipment cost – PLN 478 = $120

Part name	Filament (g)	Time h
Hull 1	319	10,10
hul l2	199	6,00
hull 3	198	5,70
hull 4	188	5,40
hull 5	171	5,00
hull 6	111	3,50
hull 7	155	5,00
hull 8	87	2,25
Hull connectors	145	4,60
engine, servo bow truster	45	2,00
funnel	266	13,40
Superst. Connectors	103	3,00
Deck 3	244	10,50
Deck2	58	2,00
Deck 1	86	3,00
Superstructrue 4	328	11,80
Superstructrue 3	600	21,50
Superstructrue 2	293	10,00
Superstructrue 1	365	13,50
Bridge	145	6,42
lifeboat	54	8,62
rescueboat	2	0,93

Filament total (g)	Time total(h	Cost total	Filament cost	$/kWh	Power consumption/ h (kW)
4311,04	174,88	292,76 zł	60,00 zł	0,65 zł	0,3

Printing +Hardware
771,53 zł

TOTAL	478,8

Name	Quantity	Price per piece	Together	Link
M3 x10	120	0,1	11,5	https://www.aliexpress.com/item/32
M3 x8		0,1	0,0	https://www.aliexpress.com/item/32
m3 insert 5x5	178	0,2	31,6	https://www.aliexpress.com/item/10
D50 propeller CW	1	6,9	6,9	https://www.aliexpress.com/item/32
D50 propeller CCW	1	6,9	6,9	https://www.aliexpress.com/item/32
Arduino uno	1	13,0	13,0	https://www.aliexpress.com/item/32
Jga25-370 1200 rpm 12v Dc Motor	3	11,4	34,3	https://www.aliexpress.com/item/32
4x 4 engine coupler	2	5,1	10,1	https://www.aliexpress.com/item/32
6x3 neodymium magnets	32	0,6	20,3	https://www.aliexpress.com/item/10
20x10 sleeve 25x4 shaft	2	27,7	55,3	https://www.aliexpress.com/item/32
l298n motor driver or	2	7,4	14,7	https://www.aliexpress.com/item/10
L293D Motor Drive Shield	1	7,9	7,9	https://www.aliexpress.com/item/10
dc switch	1	0,3	0,3	https://www.aliexpress.com/item/32
mg90s servo	2	8,9	17,7	https://www.aliexpress.com/item/10
connectors	10	0,2	2,2	https://www.aliexpress.com/item/32
m3x6 Flat Countersunk Head	18	0,1	2,2	https://www.aliexpress.com/item/10
Tx&RX	1	198,0	198,0	https://www.aliexpress.com/item/10
12v power supply	3	8,3	24,8	https://www.aliexpress.com/item/10
battery case	1	11,9	11,9	https://www.aliexpress.com/item/33
m3x50	2		0,0	
603 zz bearings	4	2,3	9,1	https://www.aliexpress.com/item/32
			0,0	
			0,0	

I decided to make the model available in two versions. Free at tchingiverse.com and paid at Cults.com Free version includes:

- Stl files
- Photos
- Arduino code

The paid version additionally includes:

- STEP file
- 3MF files
- Spreadsheet (with links to the store)

I recorded the entire construction process on a video that I share on my YT channel. I plan to build more ships in the future and more videos will certainly follow. If you like this project, I would appreciate it if you subscribe to my channel.
https://www.youtube.com/@mateuszmalinowski9885/videos
https://youtu.be/LynBqcEK2n0

My profiles:
https://www.thingiverse.com/malinapl/designs
https://cults3d.com/en/users/MalinaPl/3d-models

I hope you like my model. If you decide to build it, I will be grateful if you share your made. Good words and constructive criticism are welcome. This gives me motivation to start with new designs. I'll be happy to help if you have any questions. Can’t wait to see your versions of the ship done!

Matthew