

2014 - 2020 Interreg V-A  
Italy - Croatia CBC Programme  
Call for proposal 2019 Strategic

## MARLESS (MARine Litter cross-border awarenESS and innovation actions)

Priority Axis: Environment and cultural heritage; Specific objective: 3.3 - Improve the environmental quality conditions of the sea and coastal area by use of sustainable and innovative technologies and approaches

### D.6.5.3 – Hardware and software for water drone control

AT 6.5

WP 6

Version: FINAL  
Distribution: PUBLIC  
Date: 23/06/2023

## PROJECT MARLESS

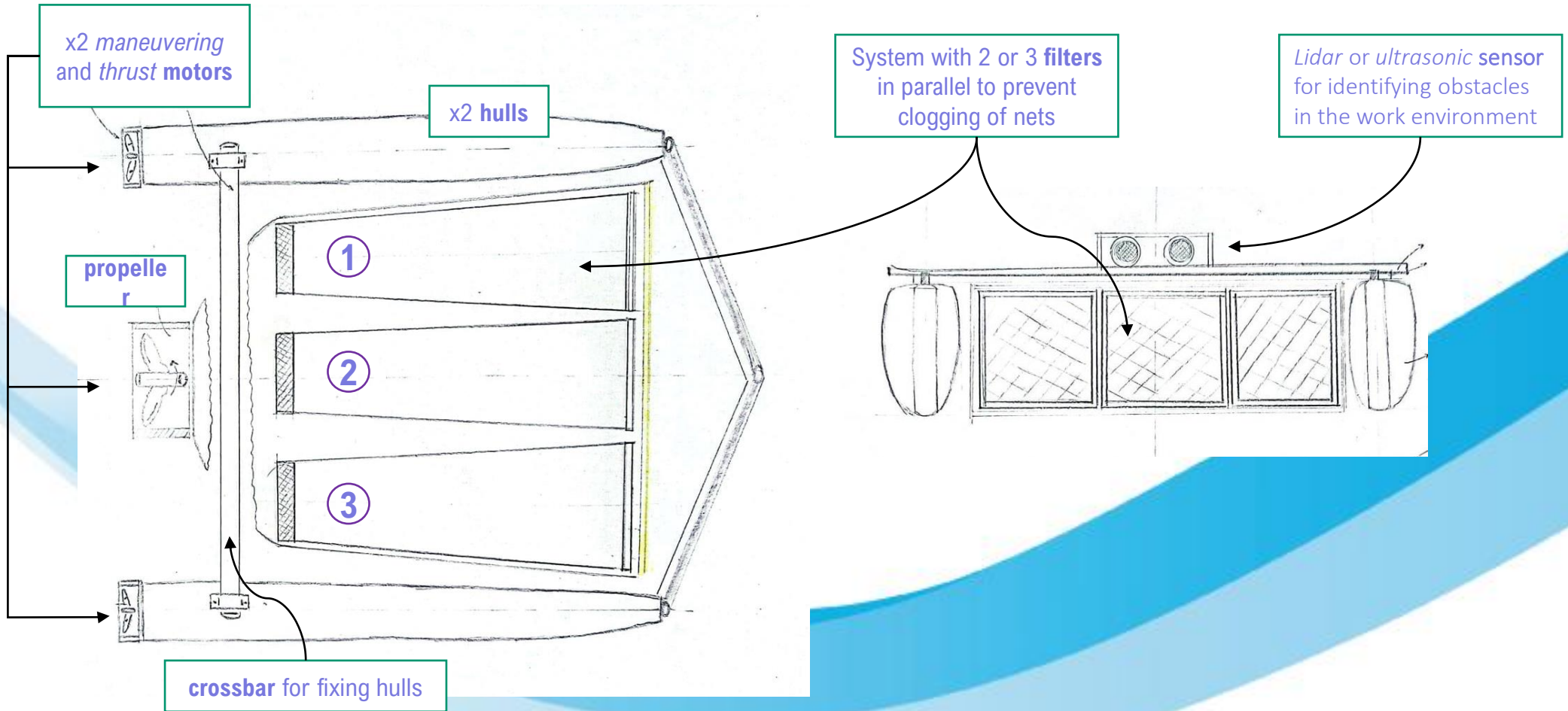
<b>Work Package:</b>	WP6
<b>Activity:</b>	AT 6.5
<b>WP Leader:</b>	PP6 University of Bologna
<b>Deliverable:</b>	D.6.5.3 – Hardware and software for water drone control

<b>Version:</b>	Final	<b>Date:</b>	23/06/2023
<b>Type:</b>	Slide presentation		
<b>Availability:</b>	Public		
<b>Responsible Partner:</b>	University of Bologna		
<b>Involved Partner</b>	University of Bologna		
<b>Editor:</b>	Daniela Francia		
<b>Contributors:</b>	/		

# D.6.5.3 – Hardware and software for water drone control

MARLESS | PP6 | UNIBO

# Product Architecture



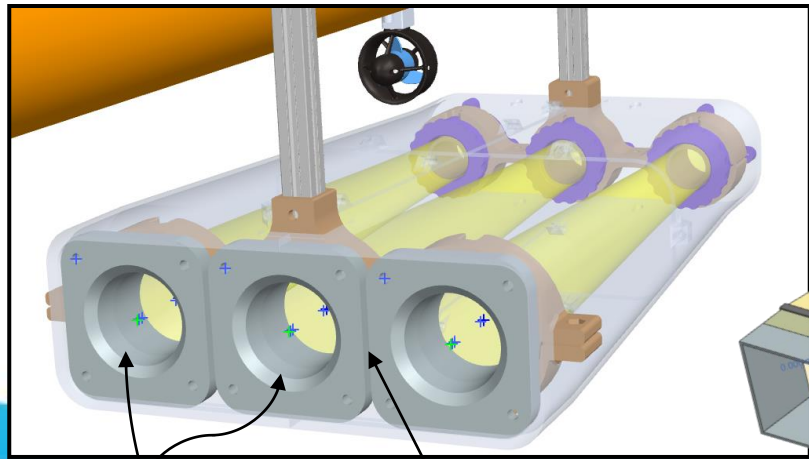
Platform for electronic components

Hull molded in parts + fiberglass / putty / gelcoat

Wider mesh to ward off macro-plastics

Thrust + filter efficiency increase

Maneuvering motors



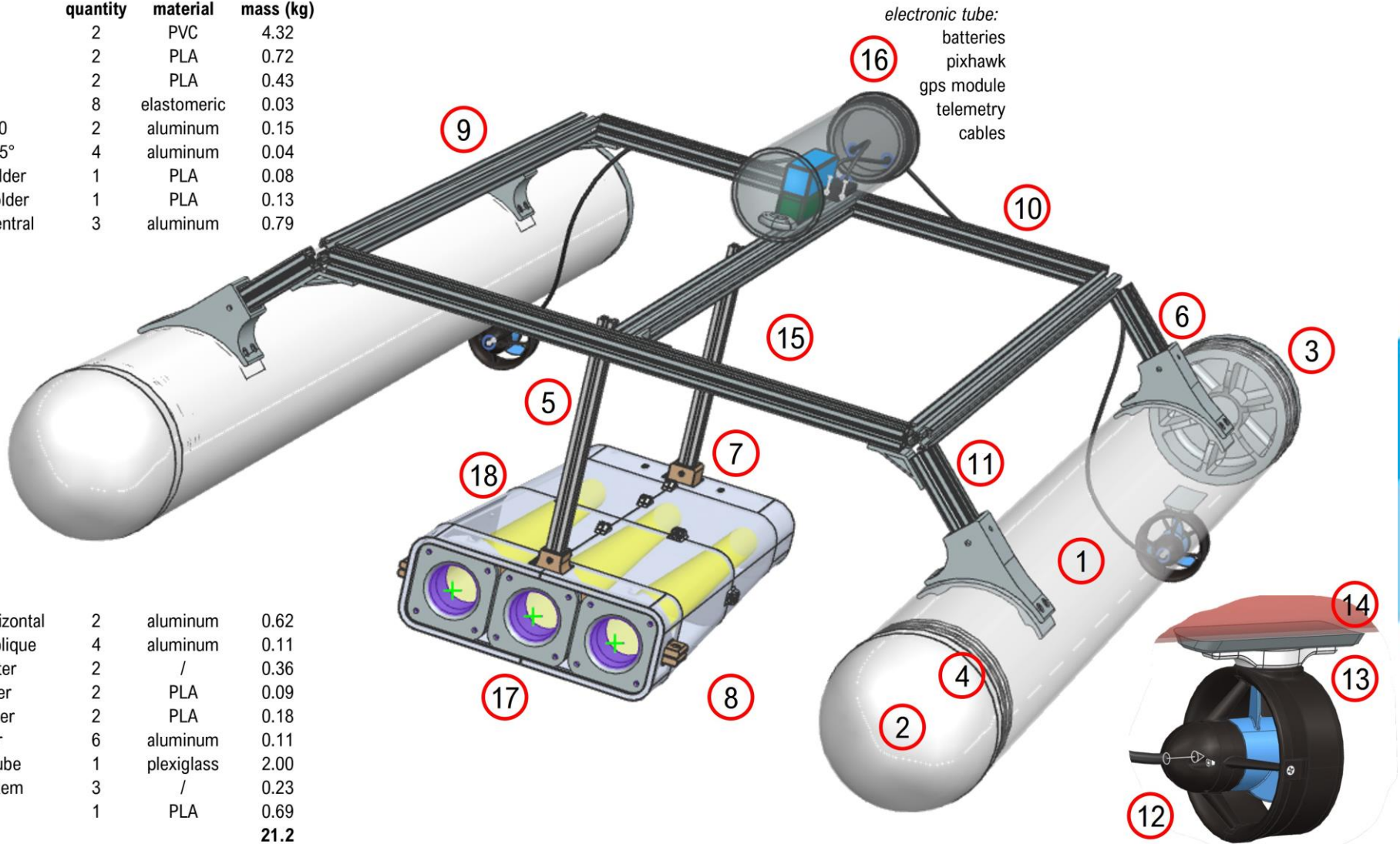
System with 2 or 3 filters in parallel to prevent clogging of nets

Filtering system: Mesh + collection cup

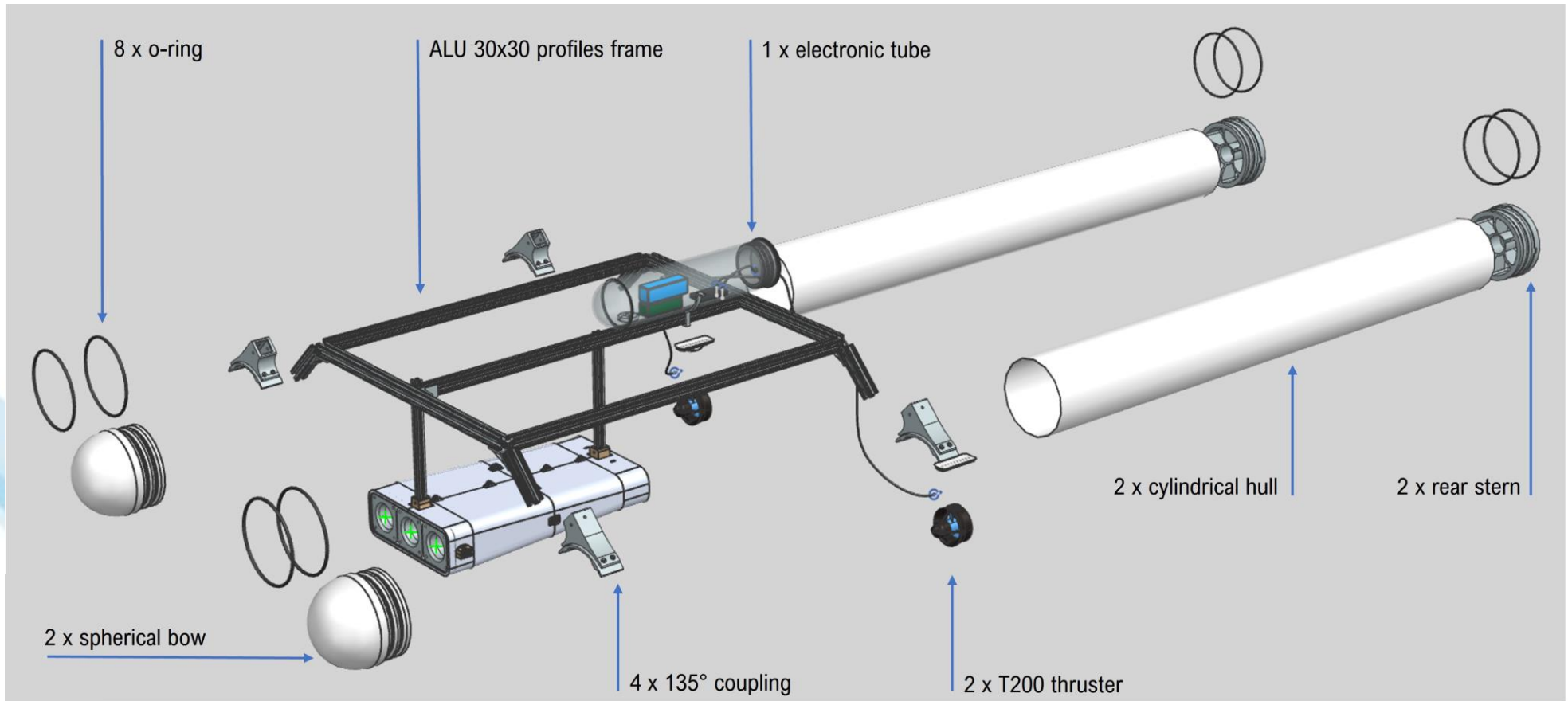
# Drone Assembly and Bill of Materials

n°	part	quantity	material	mass (kg)
1	hull	2	PVC	4.32
2	bow	2	PLA	0.72
3	stern	2	PLA	0.43
4	o-ring	8	elastomeric	0.03
5	ALU 20x20	2	aluminum	0.15
6	support 135°	4	aluminum	0.04
7	rear filter holder	1	PLA	0.08
8	front filter holder	1	PLA	0.13
9	ALU 30x30 central	3	aluminum	0.79

10	ALU 30x30 horizontal	2	aluminum	0.62
11	ALU 30x30 oblique	4	aluminum	0.11
12	T200 thruster	2	/	0.36
13	motor linker	2	PLA	0.09
14	motor holder	2	PLA	0.18
15	90° linker	6	aluminum	0.11
16	electronic tube	1	plexiglass	2.00
17	filtering system	3	/	0.23
18	carter	1	PLA	0.69
				<b>21.2</b>



## Drone exploded view



## Electronics and control system



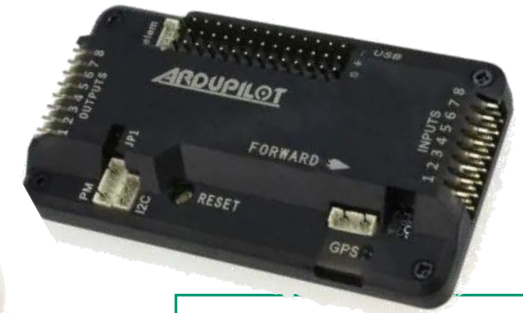
Pixhawk as AutoPilot module's drone



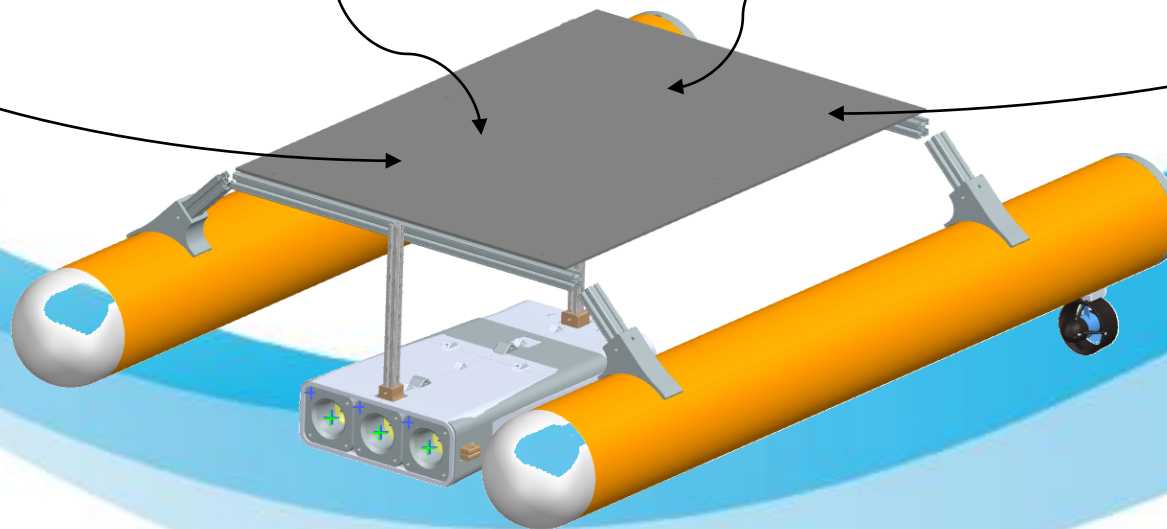
Lidar Sensor for Collision Avoidance



GPS module

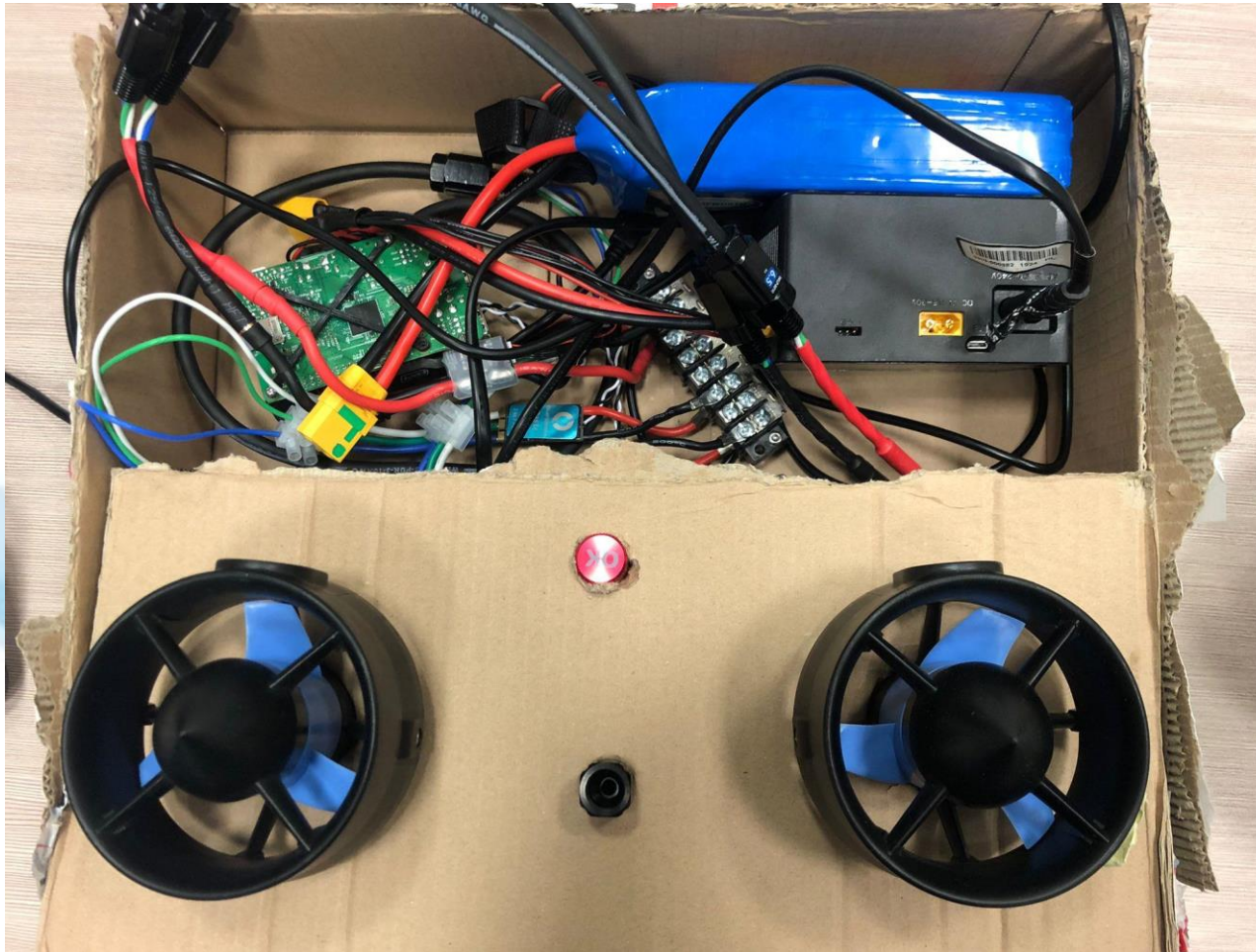


ArduPilot or Raspberry Pi as Computer Board



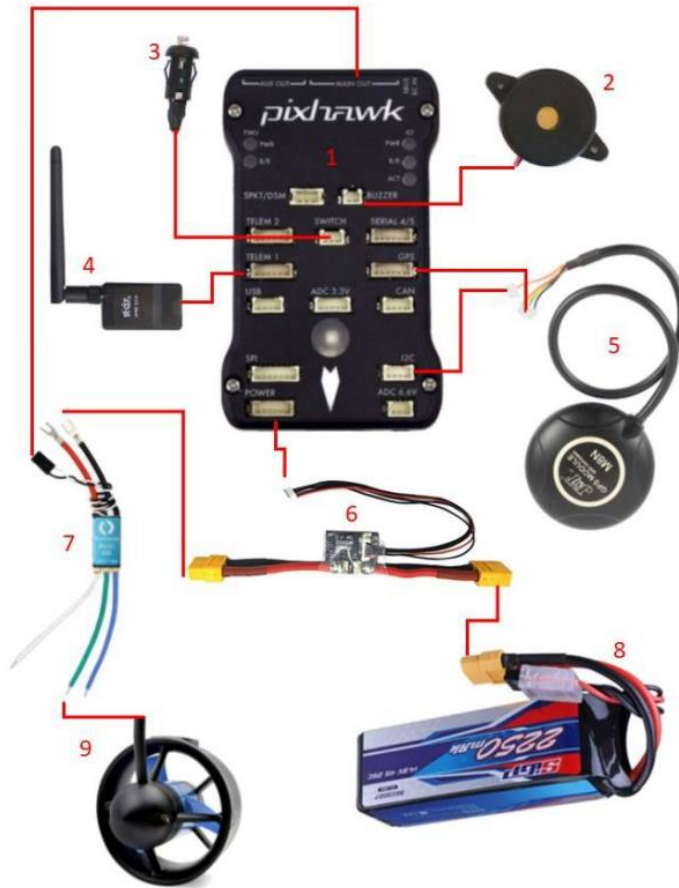


## Testing and setting of the drone thrust motors



- The motors are connected to the drone at the bottom of the hulls
- They work simultaneously under the free surface of the water
- They define the speed and direction of the vehicle

## Drone Electronics



1. Pixhawk 1 PX4 is an open-source control device designed for use in drones and unmanned aerial vehicles: it is the main control unit that controls all the functions of the drone and controls its inputs and outputs. In its SD slot is a microSD card that contains firmware and settings data.
2. The Buzzer connects to the Pixhawk via a 2P connector plugged into the 'Buzzer' input.
3. Safety Switch disables the outputs to the thrusters.
4. Telemetry Module is a device that enables wireless communication between the Pixhawk device and a laptop or other ground control station.
5. GPS Module: is primarily used to provide accurate position information required for navigation and trajectory control. The GPS module provides the drone's accurate position coordinates.
6. 3DR Power Module is a component of the drone's power supply system that serves mainly to transmit power from the batteries.
7. BlueRobotics ESC are electronic devices used to control the speed of the thrusters and to regulate the current supplied to the thruster to keep it at the desired speed.
8. SIGP 4S Lipo are 14.8V 25C 2250mAh lithium polymer batteries with XT60 plugs, connected to the 3DR Power Module via extension cables and parallel cables with XT60 connectors.
9. BlueRobotics T200 thrusters are underwater thrusters designed to provide reliable and precise thrust to underwater vehicles.

## Mission Planner

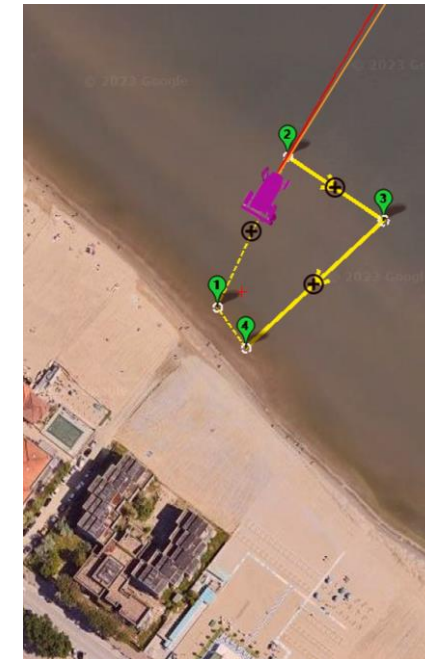
The Ground Station software can be installed on portable devices that can communicate with the drone via wireless telemetry, shows real-time information on the position and performance of the drone and allows the drone to be controlled either manually in real time or by previously planned missions.



This application use the Ground Station Mission Planner, installed on a laptop for ease of use.



## Mission Planning



Raggio WP		Raggio Lorier	Alt di default	Relative	Verify Height	Aggiungi Sotto	Alt Warn	MAVFTP								
5		0	0	Relative			0									
	Comando	Delay				Lat	Long	Alt	Frame	Cancel	SU	Giù	Grad	Angle	Dist	AZ
1	WAYPOINT	0	0	0	0	44.1699385	12.4437547	0	Relative	X			0.0	0.0	46.5	96
2	WAYPOINT	0	0	0	0	44.1702541	12.4439961	0	Relative	X			0.0	0.0	40.0	29
3	WAYPOINT	0	0	0	0	44.1706311	12.4437332	0	Relative	X			0.0	0.0	46.9	333

The Home Position is usually the position to which the drone was armed and the position to which the vehicle will return in case the signal is lost or other failsafes are triggered. Open the "Plan" section navigate the map and select the location where to place the Home Position. To add Waypoints simply click on the place on the map where you want to add it, the programme independently numbers them in ascending order, you can move them later by dragging them with the cursor.

## Drone tank test



## Drone working at sea




# Contacts

**Daniela Francia**  
**University of Bologna – UNIBO – PP6**

 Viale Risorgimento 2, Bologna (BO)

 d.francia@unibo.it

 +39 0512093352

 <https://www.italy-croatia.eu/web/marless>