WhaleTech Robotics

NON-ROV DEVICE DESIGN DOCUMENTATION

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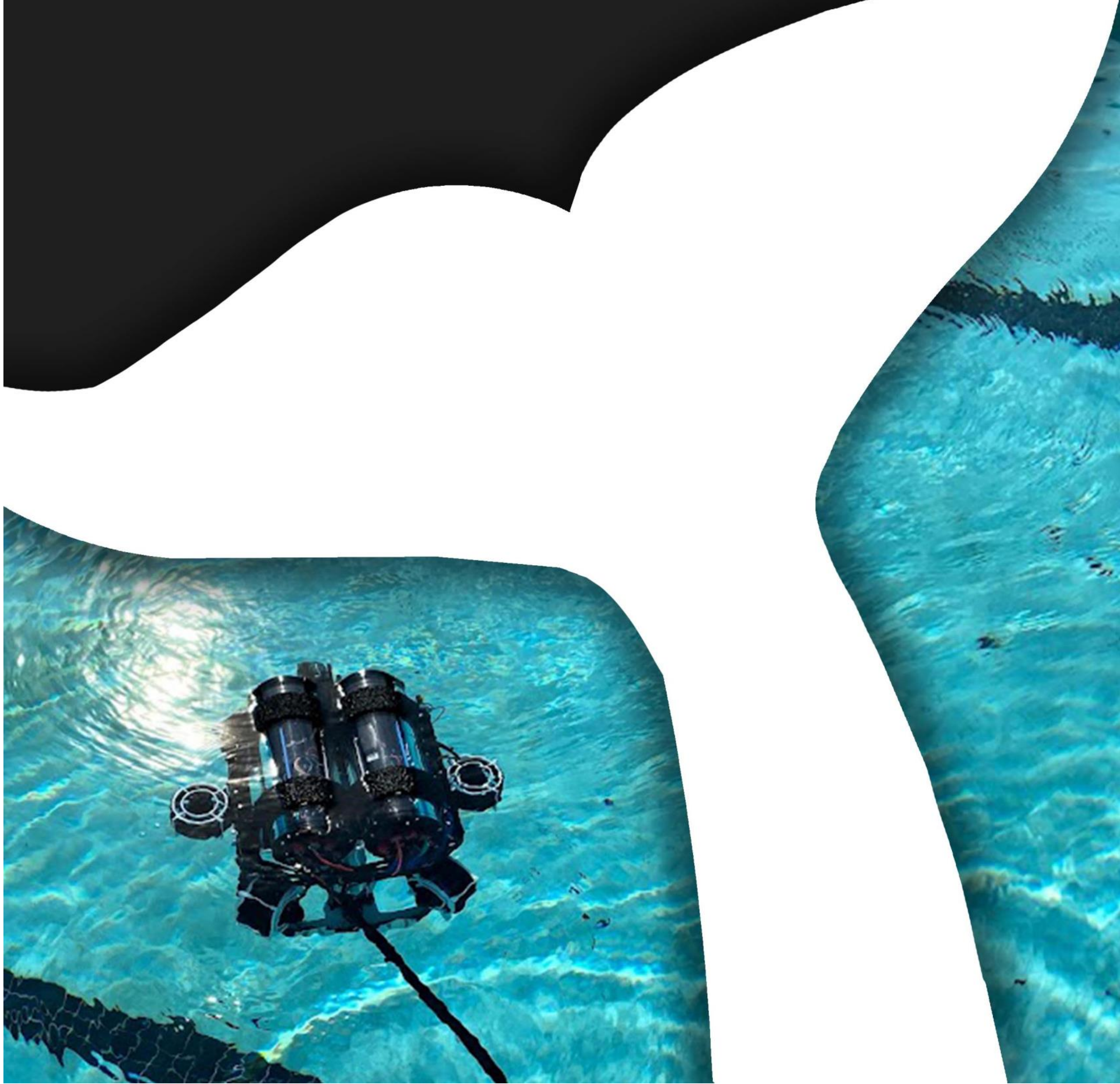


Non-ROV Device Design Documentation

GO-BGC Float

One of the missions tasked by MATE Robotics this year requires teams to replace an existing Go-BGC Float with one prepared by the company. Whale Tech Robotics created the replacement float, which has been dubbed “Remora” by the company. Remora is equipped with a Blue Robotics acrylic cylinder with O-ring flanges with fitting caps measuring 22 cm in length. The cylinder houses all the electronic components needed for its operation. The electronic components are neatly mounted on a custom 3D printed board that fits securely within the housing. These components include an Arduino nano, one relay switch, two 9V batteries for power, and step-down transformer. This housing serves as the command center for the float, the code programmed on the Arduino instructs the float to complete two vertical profiles after a designated time as lapsed.

The second housing at the bottom of the GO-BGC is home to the peristaltic pump, also referred to as a roller pump. As fluid passes through the tube, the roller compresses the tube as it rotates by, this part of the tube under compression is closed, forcing the fluid to move through the tube. Vice versa when the tube is open, it allows fluid to be drawn into the tube. The pump is housed in a watertight enclosure mounted to the base of the float. Tubing runs from the pump to the custom-made water displacement devices functioning as bladders. The external bladder is constructed from a syringe with a balloon attached inside. The other end of the tubing runs to a small IV bag which serves as the interior bladder housed in a sealed container located under the electronic housing.

Figure 1: GO-BGC Float

Remora functions as a buoyancy engine, pushing water from an inner bladder to an outer one using a reversible peristaltic pump, changing the density of the float, causing it to rise. The Arduino constantly receives values from the depth sensor, and when it detects that the value is no longer changing, it toggles the relay, reversing the polarity of the pump. This brings the water from the outer bladder back to the inner bladder, once again changing the density, only this time, causing the float to sink. Remora will repeat this process until it successfully completes two vertical profiles.

The GO-BGC measures 41 cm in length and weighs 0.9 kg out of water. During testing of the float, a weight was added to the base of the float to create a slightly positive buoyancy. This weight also aided in keeping the float in an up right position during its movement in the pool.

Below is a sketch that shows how the balloon located in the exterior bladder expands and deflates as fluid is pushed in and out by the pump.

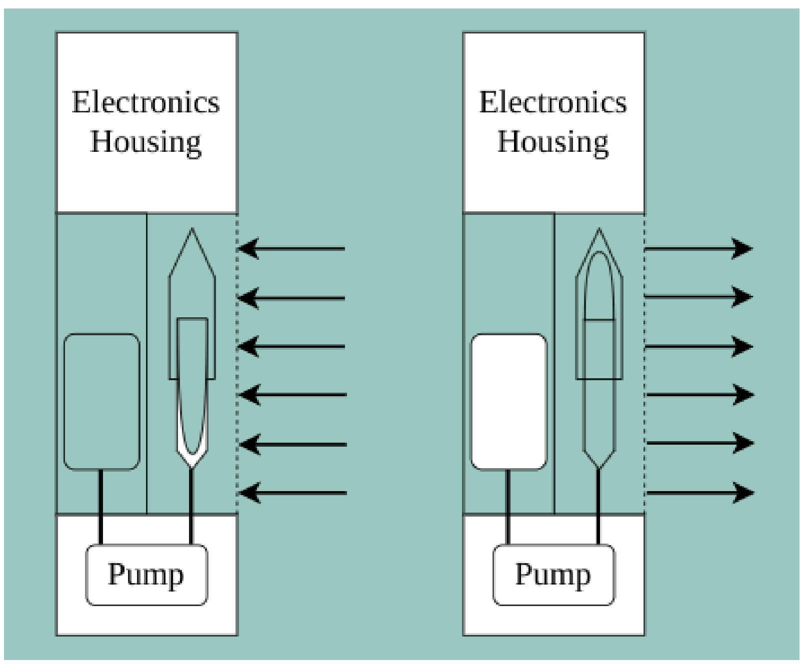


Figure 2: Illustration of how the fluid moves in and out of the external bladder.

To meet the safety requirements for the MATE 2022 competition the Non-ROV device was designed and constructed meeting the following safety requirements:

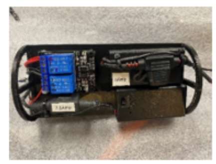
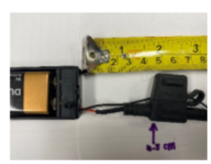
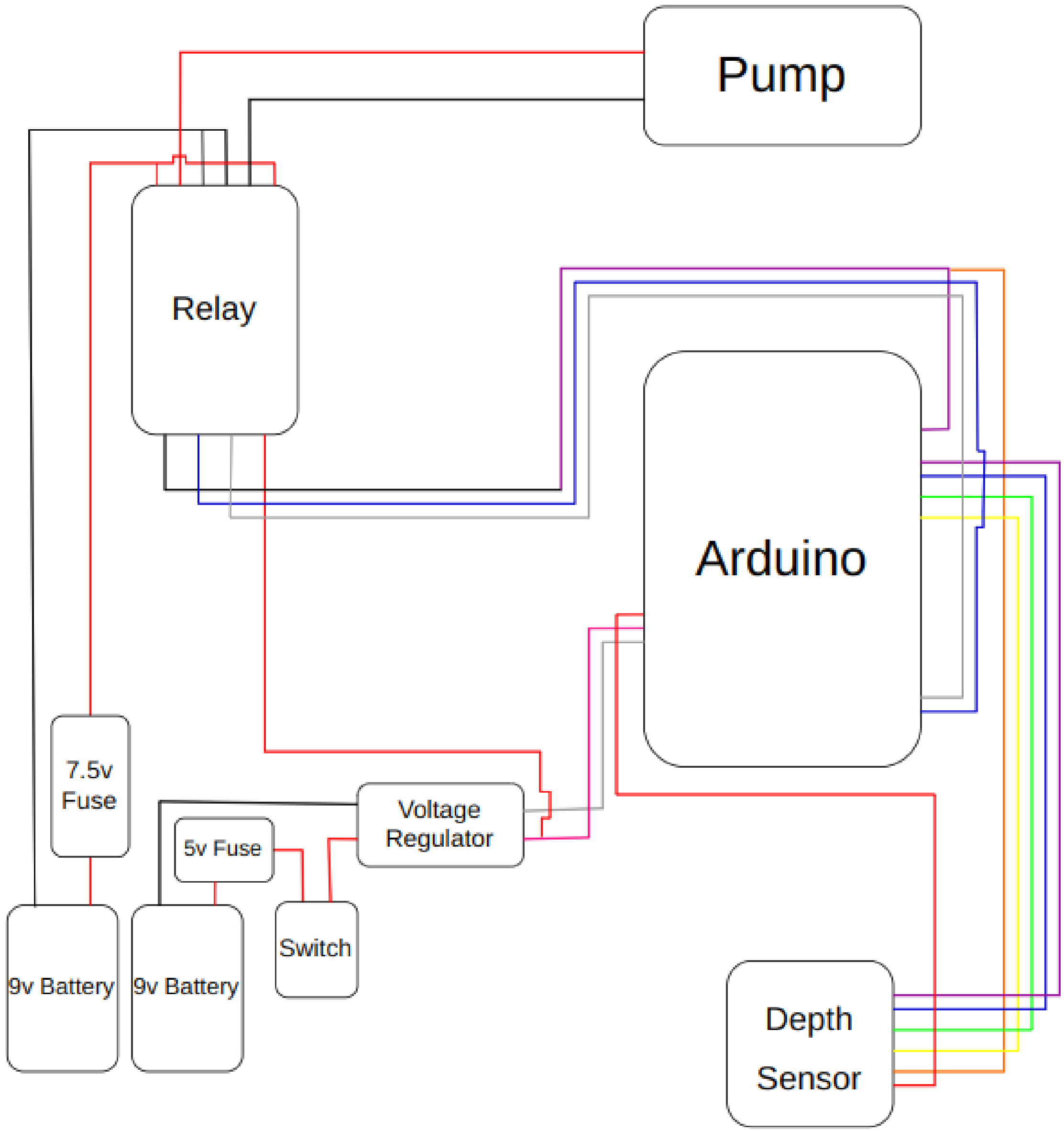
Any Non-ROV Device	**GO-BCG Float:**	
ELEC-NRD-001: Non ROV devices cannot be powered from the surface. Power is limited to 12 VDC maximum and 6 amps maximum. ELEC-NRD-002: The device may not utilize cameras or thrusters. ELEC-NRD-004: Onboard power is allowed for non ROV devices. If onboard batteries are used, they must: * Batteries must be primary (non-rechargeable). * AAA, AA, A, A23, C, D or 9V alkaline batteries are allowed. Alkaline batteries only. * Batteries are mounted in a manner that they are not loose inside the container. * A fuse (7.5 amps max) must be installed within 5 cm of the battery positive terminal.	* Powered by two 9V batteries, completely independent from the control box. * Batteries are securely mounted in battery case and mounted to base plate within the housing. * 7.5 Amp fuse is mounted within 5 cm of the positive terminal of the battery. * No Anderson pole connectors required. * No sharp edges found on the float. * Float does not need a tether restraint. * No copper wire is exposed on the float system or in the control box. * All wiring protected by heat shrink and liquid dip. *Housing is sealed with caps and O-rings. This will serve as	 Figure 3. Float batteries securely mounted.  Figure 4. Onboard control box neat, no exposed wires.
* The enclosure housing must be designed so that it will open if the pressure inside the housing is greater than the outside pressure. * Any pressure relief plug MUST be at least 2.5 cm in diameter. * **DOC-001**: SID provided	a pressure release on the housing if pressure builds up beyond threshold point. * The housing is designed to withstand pressure up to 146psi and was tested by Blue Robotics to a depth of 100.5 meters. **Reference:** docs.bluerobotics.com.watertight.enclosures. * **SID** submitted.	 Figure 5. Electronic housing equipped with end caps and O-rings.  Figure 6. A 7.5 Amp fuse is installed within 5 cm of the battery positive terminal • SID for float submitted.

Table 1: Shows the safety requirement and how the GO-BGC meets each requirement.

GO-BGC SID


Pump
Relay
Arduino
7.5v
Fuse
Voltage
Regulator
5v Fuse
Switch
9v Battery
9v Battery
Depth
Sensor