

SEAFOX INVENTIVE'S NON-ROV DEVICE DESIGN & SAFETY COMPLIANCE

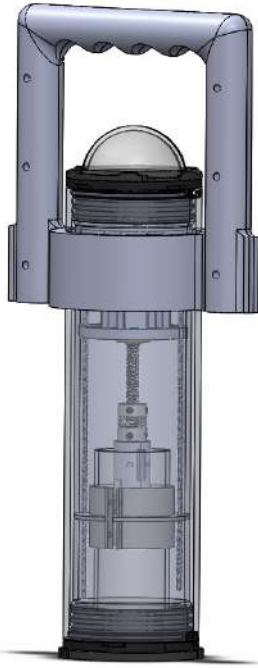


Fig. 1. SeaFox Inventive's Non-ROV device.

I. BUOYANCY ENGINE

The non-ROV device uses a lead screw mechanism as its buoyancy engine. A 12 V Pololu DC motor with an integrated encoder is coupled to a syringe plunger through a custom 3D-printed mount attached to the motor shaft. By controlling the motor direction, the syringe either draws water into the device to increase its mass and descend, or expels water to reduce its mass and ascend. This system provides smooth and controlled buoyancy adjustments throughout the profiling cycle.

II. COMMUNICATIONS SYSTEM

Data and command exchange between the Non-ROV Device and the surface station is handled through ESP-NOW on the ESP32-C3 over the 2.4 GHz band. Pressure and attitude data are packaged into data packets and wirelessly transmitted with acknowledgment and retransmission support. Commands such as "abort profile" or "surface now" can be transmitted after deployment and executed in under 200 ms. An RTC module timestamps each

transmission for accurate post-mission synchronization.

III. SENSOR SUITE & CONTROL ELECTRONICS

Microcontroller:	ESP32-C3 Super Mini is responsible for system control, sensor communication, motor management, and wireless data transmission.
Depth Sensor:	Blue Robotics BAR02 pressure sensor used for underwater depth measurement through I2C communication.
Wireless Communication:	ESP-NOW wireless communication system responsible for transmitting data between the Non-ROV Device and the surface station through WiFi-based transmission.
Motor Driver:	TB6612FNG H-bridge motor driver provides bidirectional control of the Pololu 12 V DC motor.
Motor & Feedback System:	Pololu 12 V DC motor with integrated encoder that actuates the buoyancy engine while providing real-time positional feedback to the ESP32-C3 microcontroller.
Voltage Regulation:	LM7805 voltage regulator provides stable 5 V power distribution to the electronic components and communication system.

Fig. 2. Sensor suite and control electronics table.

IV. POWER SYSTEM & FUSE

The Non-ROV Device is powered by seven NiMH AA rechargeable cells connected in series, forming an 8.4 V nominal battery pack with a capacity of 2000 mAh (16.8 Wh). The batteries are secured in a custom 3D-printed holder designed to maintain stable electrical contact and proper polarity alignment during operation. All onboard electronics are regulated through 5 V and 3.3 V power systems, while the motor driver receives full pack voltage for buoyancy control. Based on measured Full Load Amperage (FLA) values and MATE safety regulations, a 2 A ATO fuse was selected and installed.



Fig. 3. Fuse.



Fig. 4. Battery pack.

V. MECHANICAL & ENCLOSURE DESIGN

The Non-ROV Device is housed in two O-ring-sealed acrylic modules designed to protect internal systems during underwater operation.

Lower Module: Contains the 12 V Pololu DC motor with integrated encoder, the lead screw mechanism, syringe assembly, and the water inlet/outlet ports used for the buoyancy engine.

Upper Module: Houses the ESP32-C3 control electronics, ESP-NOW communication system, battery pack, and a custom 3D-printed U-handle recovery feature that protrudes more than 5 cm and provides a graspable width greater than 5 cm for retrieval by the MATE ROV.

Silicone O-rings, cable glands, and sealed bulkheads help prevent water intrusion around electrical connections and sensors. The enclosure uses a removable pop-off O-ring-sealed end cap designed in compliance with MATE rule ELEC-NRD-006, allowing pressure relief if the internal pressure exceeds the external pressure. The center of buoyancy is positioned approximately 30 mm above the center of gravity for improved vertical stability.

VI. VOLTAGE REQUIREMENTS

The Non-ROV Device's power system is designed to safely support all onboard electronics under full load conditions.

Component	Voltage (Volts)	Estimated Current Draw (Amps)
ESP32-C3 Super Mini	5 V	130 mA
BAR02 Pressure Sensor	5 V	1.25 mA
TB6612FNG Driver	8.4 V / 5 V	600 mA
Pololu DC Motor and Encoder	8.4 V	0.75 A (stall)

Fig. 5. Voltage requirements table.

Waiting Mode FLA (excluding motor): ~ 730 mA. Buoyancy Change Mode FLA (motor active): 1.5 A. These measured values confirm sufficient voltage stability and current capacity across all mission phases, including data transmission, active motor control, and real-time sensor logging.

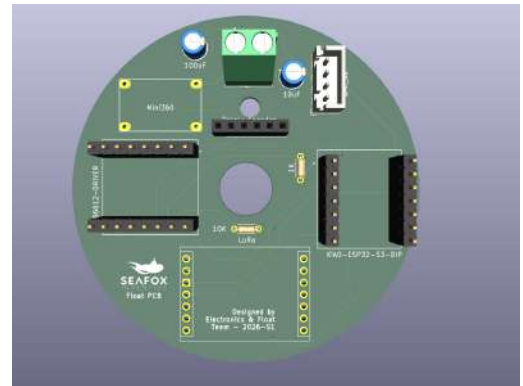


Fig. 6. PCB.



Fig. 7. Fuse holder

NON-ROV DEVICE DESIGN SID

