NON-ROV DEVICE

SEAFOX INVENTIVE 2025

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BUOYANCY ENGINE

Our Float employs a worm-gear–driven syringe as its buoyancy engine. A 12 V DC motor (equipped with an integrated quadrature encoder) is coupled through a worm gear reduction to the lead screw that drives the syringe plunger. By precisely commanding the motor via its driver, the syringe either sucks water into the float's internal bladder —raising its mass to initiate descent—or expels water back into the ambient, reducing its density to ascend. The positive-displacement pump is inherently isobaric, ensuring smooth, repeatable volume changes throughout the profiling cycle.

COMMUNICATIONS SYSTEM

Data and command links between the Float and the shore-side receiver are handled by a LoRa SX1278 transceiver over the 915 MHz ISM band. Every pressure and attitude measurement is packetized by the ESP32-C3 microcontroller and sent via LoRa to a ground station with automatic ACK and retransmit. If a command (e.g. "abort profile" or "surface now") is issued after deployment, it is uplinked over the same LoRa link; the Float then decodes and executes it in under 200 ms. A real-time-clock module stamps each transmission with year, month, day, hour, minute, and second, allowing post-mission synchronization with other oceanographic assets.

SENSOR SUITE & CONTROL ELECTRONICS

- **Microcontroller:** ESP32 Super Mini C3 running FreeRTOS, handles motion control, data logging, and radio.
- **Pressure Sensor:** Blue Robotics BAR02 for depth measurement via pressure displacement.
- **IMU:** MPU-6050 (3-axis accelerometer + gyro) to stabilize descent and detect attitude perturbations.
- **Real-Time Clock:** DS1307 RTC module to timestamp each packet.
- **Motor Driver:** H-bridge driver (capable of 5 A peak) for bidirectional control of the 12 V motor.
- **Timekeeping & Telemetry:** On-board RTC + LoRa gives precise, time-aligned vertical profiles.

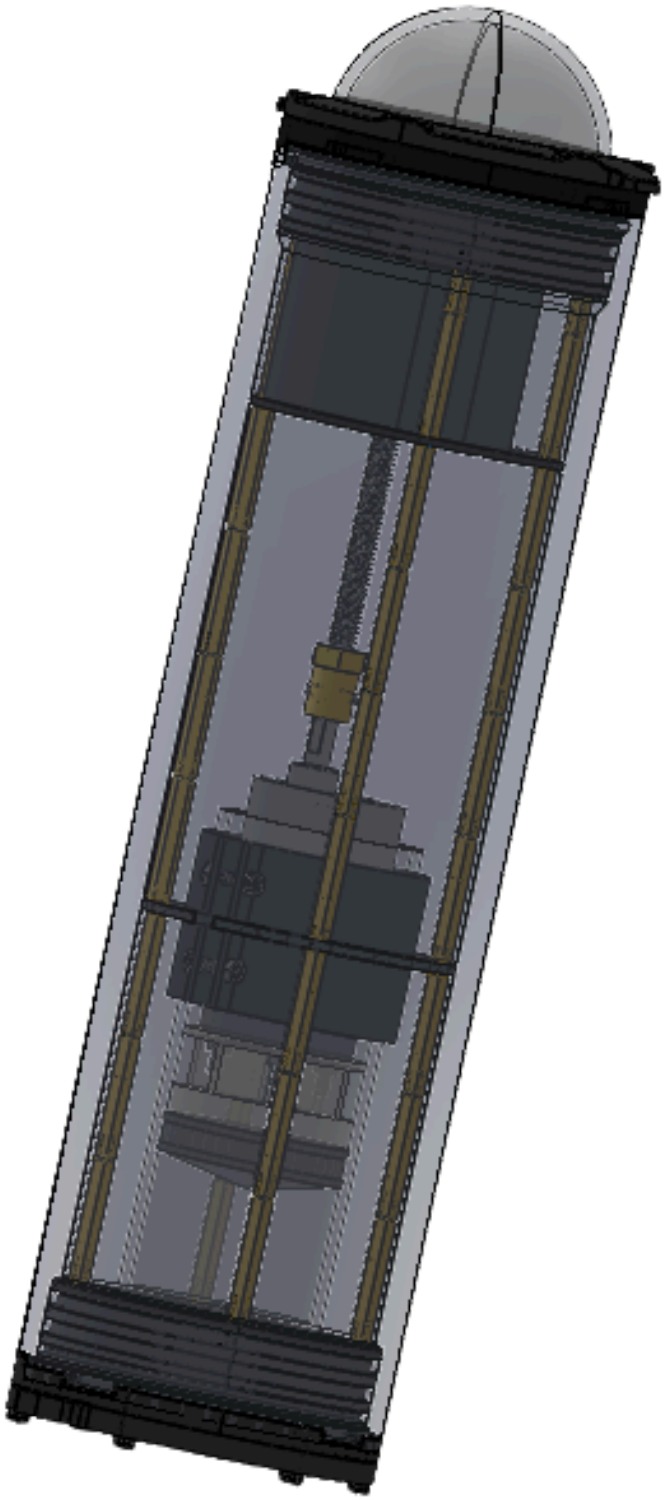

Fig. 1: SeaFox Inventive's Non-ROV device

POWER SYSTEM & FUSE

The Float is powered by seven AAA alkaline cells wired in series for a nominal 10.5 V pack. Typical cell capacity is 1 000 mAh, and total pack energy is 10.5 Wh. At full load (motor startup surge up to 4 A, plus electronics ~150 mA), the pack delivers safely for the duration of a profile.

Battery Design: Cells are held in a 3D printed case. Balanced against each cell is an anti-reverse diode to prevent back-feeding.

Voltage Requirements: All electronics (12 V–rated motor & driver) run directly from the pack; the ESP32, sensors, and LoRa module receive 3.3 V via an onboard regulator.

Fuse: A 5 A fast-acting fuse is placed in-line with the main positive feed. This rating exceeds the maximum continuous draw (~2 A) but protects against short-circuit currents above 5 A, ensuring safe discharge and preventing thermal runaway.

Fig. 2: Fuse

MECHANICAL & ENCLOSURE DESIGN

The entire mechanism is housed in two O-ring–sealed modules of UV-resistant acrylic:

Lower Module: Contains the worm-gear drive, syringe assembly, and water inlet/outlet ports.

Upper Module: Houses the electronics, LoRa antenna, and battery pack.

Stainless-steel fasteners with silicone O-rings maintain pressure seals up to 5 bar. Cable glands and potted bulkheads prevent water ingress around sensors. The center of buoyancy is located approximately 30 mm above the center of gravity, yielding a stable vertical profile even under mild sea currents.

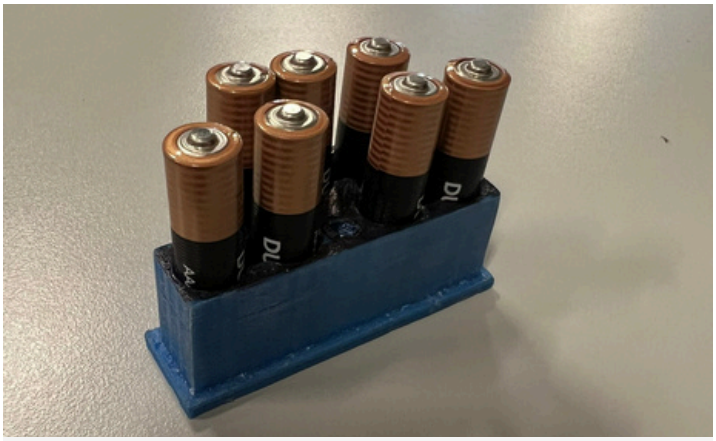

Fig. 3: Battery pack

VOLTAGE REQUIREMENTS

The Float's power system is designed to safely support all onboard electronics under full load conditions.

COMPONENT	VOLTAGE	ESTIMATED CURRENT DRAW
ESP32 Super Mini C3	3.3 V	80 mA
MPU6050 IMU	3.3 V	3.5 mA
BAR02 Pressure Sensor	5 V	10 mA
LoRa SX1278 Module	3.3 V	120 mA (during transmission)
RTC Module (DS1307)	5 V	1.5 mA
Motor Driver (Idle)	12 V	~10 mA
DC Motor (Peak Load)	12 V	Up to 3–4 A

Total Continuous Consumption (excluding motor): ~215 mA

Peak System Load (including motor): ~3.5–4.2 A

This configuration ensures voltage stability and current capacity across all mission phases, including data transmission, active motor control, and real-time sensor logging.

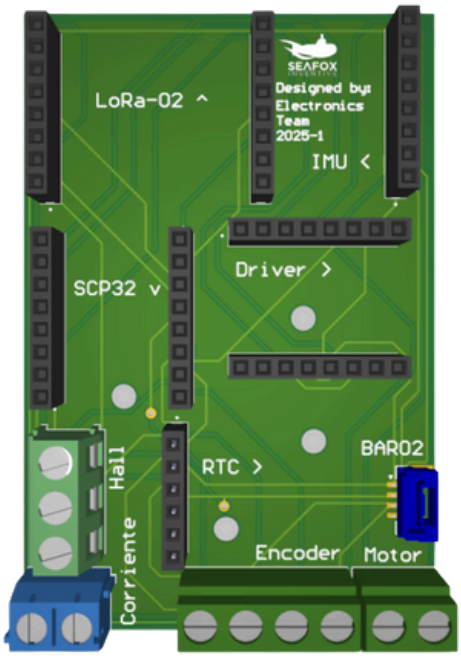

Fig. 4: PCB

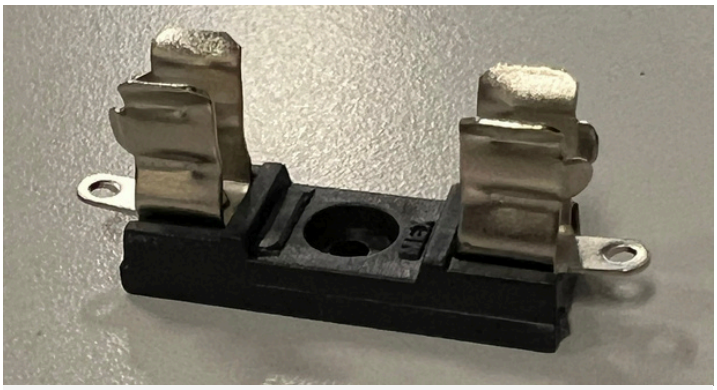

Fig. 5: Fuse holder

SeaFox's non-ROV device

Electrical SID

Fuse calculation:
Systems Full load : 3.5A
Safety factor: 1.5
Fused used: 5A