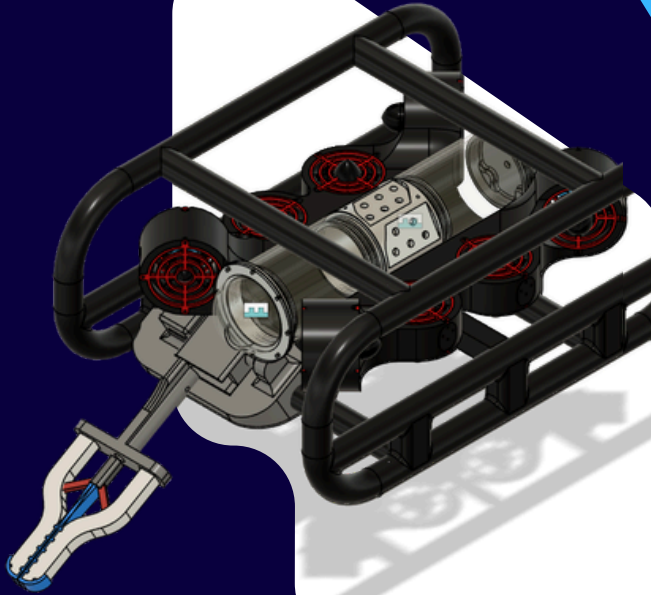




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NON- ROV DEVICE DOCUMENT



10th Grade

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Software

Electronic

Software



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1. System Overview and Operational Concept

- Storm is an autonomous Lagrangian profiling float engineered for tetherless vertical exploration. Unlike conventional ROVs, Storm achieves mobility by manipulating its net density through an internal mass-displacement system rather than power-intensive thrusters. This 2.7 kg vehicle transitions between positive, neutral, and negative buoyancy states to profile the water column with extreme energy efficiency, allowing for long-duration data collection. The finalized external design and 3D render of the vehicle are presented in Figure 1.

2. Mechanical Design and Structural Integrity

The mechanical architecture of Storm centers on a high-pressure hull and a precision buoyancy engine designed for hydrostatic resilience:

- **Hull & Sealing:** The core is a 400 mm plexiglass tube 110 mm sealed with custom-lathed 7075 aluminum end-plugs. A redundant dual-layer O-ring system and press-fit assembly ensure watertight integrity at operational depths.
- **Buoyancy Engine:** Vertical locomotion is driven by a NEMA 17 stepper motor integrated with a power screw and a medical-grade syringe. By drawing or expelling ambient water through a bottom penetrator, the system alters the float's mass without changing its displacement volume.



Figure-1
Rendered Image of Storm

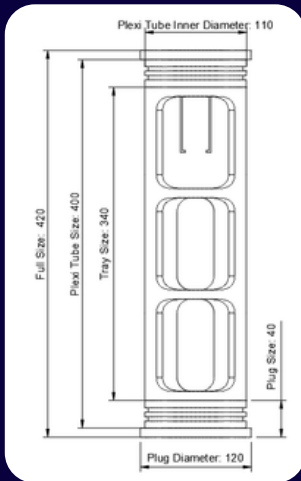


Figure-2

Technical Image of Storm

- **Stability:** To ensure passive vertical alignment, the Center of Gravity (CoG) is aggressively lowered using the heavy aluminum base cap and metal ball-bearing ballasts. This creates a strong righting moment that keeps the vehicle upright during all mission phases. Detailed mechanical dimensions and technical layouts are shown in Figure 2.

3. Electrical Systems and Control Logic

The electrical suite is optimized for autonomous depth control and wireless telemetry, focusing on safety and signal precision:

- **Power Management:** Driven by a 9S NiMH battery pack, the system includes a 3A inline fuse and a custom 3.3V switching regulator. Power is toggled via a contactless magnetic reed switch and relay system, preserving the hull's structural seal.
- **Navigation & Telemetry:** An ESP32 microcontroller acts as the central processor, utilizing a Lenta Marine M300 pressure sensor for real-time depth feedback. It manages a TMC2209 stepper driver to execute precise micro-stepping for buoyancy adjustments. Mission data is transmitted wirelessly via onboard

Wi-Fi to a surface control station. The complete electronic System Interface Diagram (SID) and wiring schematic are provided in Figure 3.

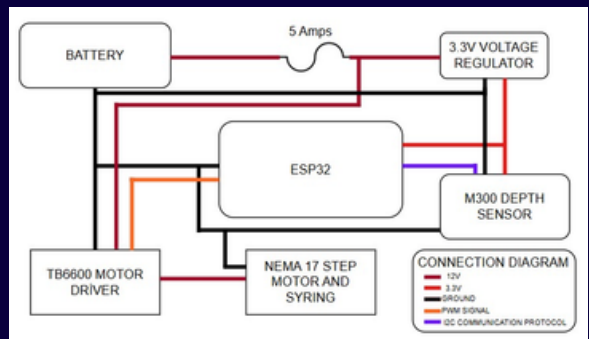


Figure-3

System Interface Diagram (SID)