

Non-ROV Float System

1 System Overview

The profiling float is an independent non-ROV device designed to complete vertical profiling and depth-holding tasks. It uses a modular two-chamber structure, including a main electronics chamber and a separate battery chamber. The main chamber is made from a 400 mm transparent acrylic tube, while the battery chamber uses a 100 mm acrylic tube section. Both chambers are protected by an external PETG 3D-printed shell that can be opened for inspection and maintenance as shown in Figure 1.

A U-shaped retrieval ring is installed at the top of the float so that the ROV manipulator can recover the device after the mission. The battery pack is placed near the bottom of the float to lower the center of gravity and improve vertical stability. The battery chamber also includes a silicone pressure-relief plug to prevent unsafe pressure buildup.

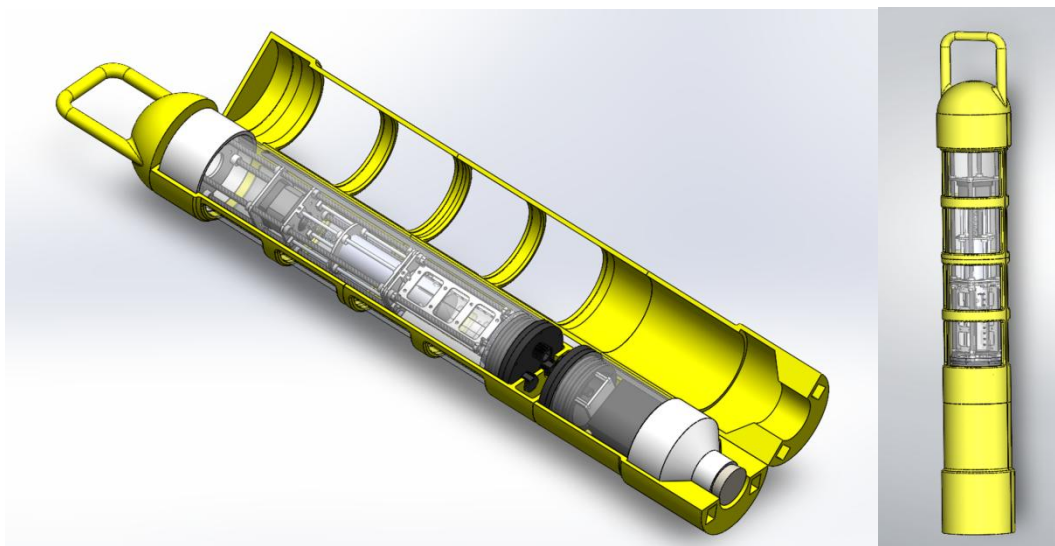


Figure 1. Overall float structure and component layout

2 Buoyancy Engine

The float uses a syringe-based buoyancy engine instead of thrusters or direct propulsion. The system consists of a stepper motor, lead screw, and syringe. The stepper motor rotates the lead screw, moving the syringe plunger forward or backward to control the amount of water inside the syringe as shown in Figure 2.

To descend, the syringe draws in water, increasing the float's total mass and creating negative buoyancy. To ascend, the syringe expels water, reducing the float's mass and

creating positive buoyancy. This allows the float to complete the required vertical profile by buoyancy control only.

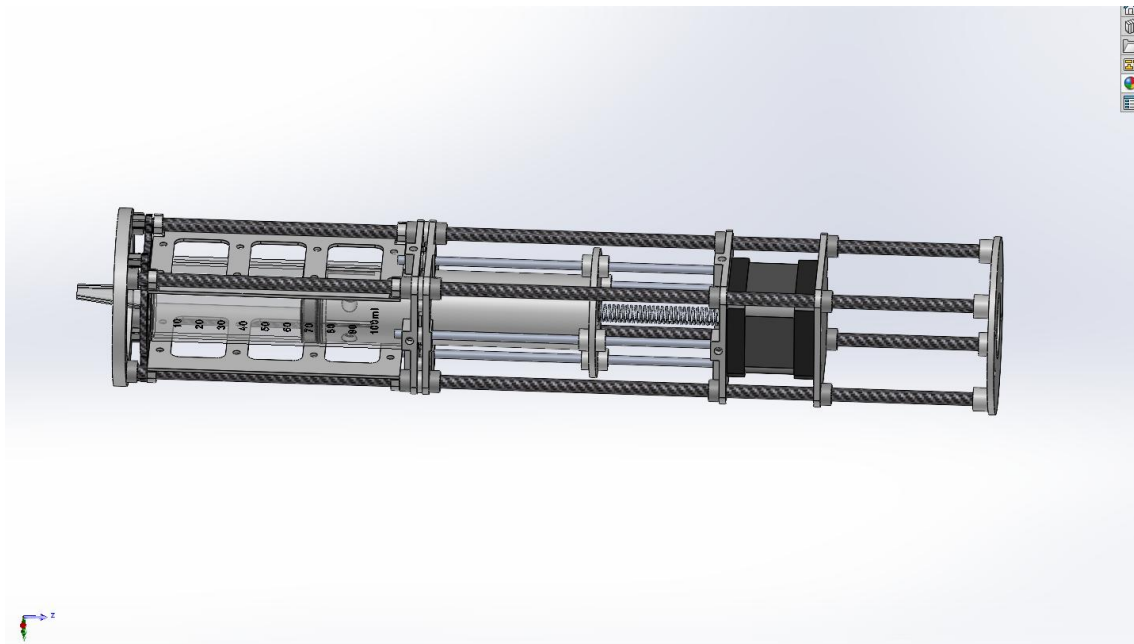


Figure 2. CAD model of Syringe-based buoyancy engine principle

3 Power and Safety

The float is powered by an independent 8-cell series NiMH battery pack. The battery supplies power to the controller, stepper motor driver, stepper motor, pressure sensor, communication module, and SD card system, as shown in Figure 4 and 5.

A single 5 A main fuse protects the entire electrical system. All battery power passes through this fuse before reaching the onboard electronics. The fuse is installed within 5 cm of the battery positive terminal as shown in Figure 4, allowing the system to shut down safely during an overcurrent or short circuit condition.

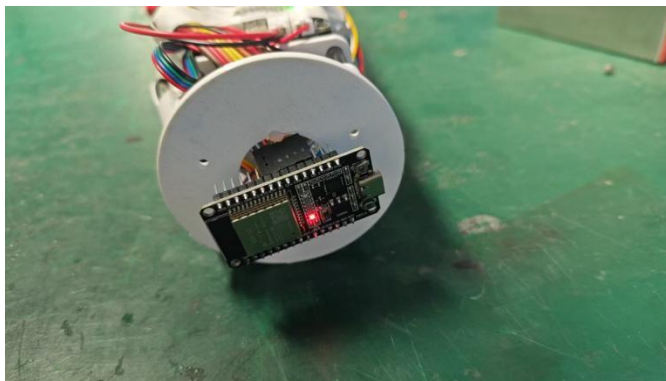


Figure 3. ESP32 boot-up image



Figure 4. Battery and fuse close up

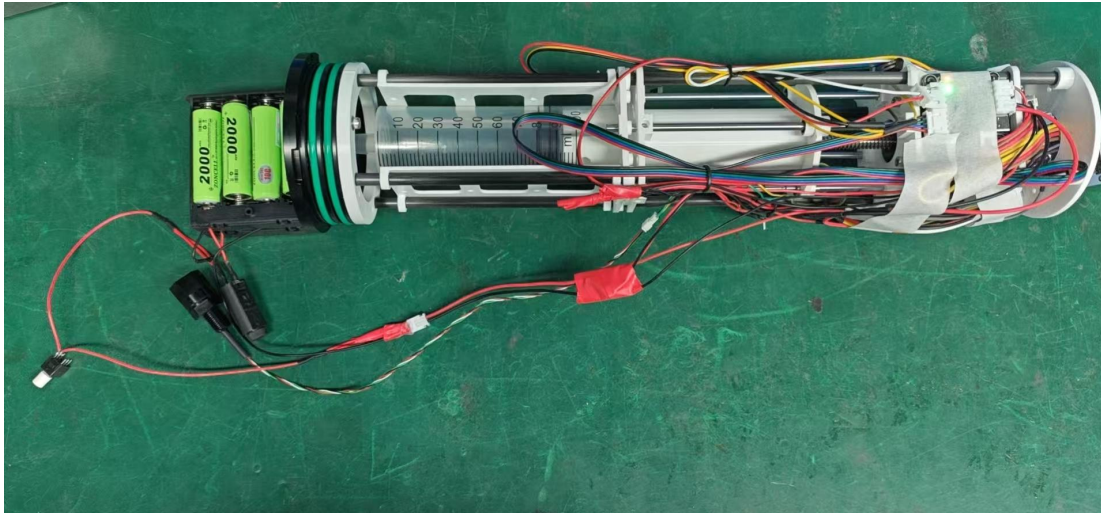


Figure 5. Experimental version of main chamber system

4 Depth Measurement, Data, and Communication

The float uses an MS5837 pressure sensor to measure depth. Before deployment, the controller records the surface pressure as the zero-depth reference. During operation, it records time, pressure, calculated depth, and operating state to the SD card.

The float automatically controls its buoyancy to descend, hold at approximately 2.5 m, ascend, and then hold at approximately 40 cm below the surface. Since wireless communication is unreliable underwater, the float stores data internally during the mission. It sends an initial data packet before descent and transmits stored data after recovery.

The recorded data is used to generate a depth-time graph showing descent, depth holding, ascent, and shallow-depth holding. This graph allows the team and judges to verify that the float completed the required profiling task.