

REDSEA ROVERS

NON-ROV DEVICE DESIGN

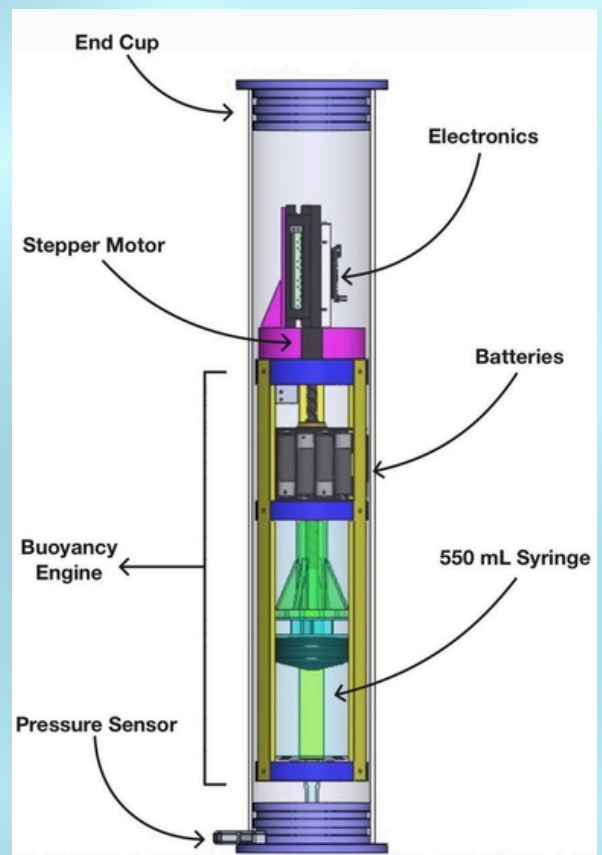
Introduction

The RedSea Rovers Vertical Profiling Float is an autonomous underwater device developed for accurate depth profiling and environmental monitoring. In Task 4, the float completes two full-depth cycles using an advanced buoyancy control system that enables efficient ascent and descent.

Mechanical

The vertical profiling float developed by RedSea Rovers is designed to perform two complete depth profiles as part of Task 4. Buoyancy control is achieved through a stepper motor-driven mechanism that regulates water displacement inside a 550 mL syringe. The motor drives a threaded lead screw connected to a plunger, which controls the intake and expulsion of water from the syringe. This process changes the float's buoyancy, allowing it to ascend or descend accordingly. The system is powered by eight AA batteries and controlled using an Arduino Nano ESP32 module. All electronic and mechanical components are housed inside an acrylic tube measuring 685 mm in length and 100mm in diameter. Aluminum end caps and custom internal components are securely sealed with epoxy to ensure structural strength, durability, and waterproof protection while maintaining a cost-effective design.

During deployment, the float performs a controlled descent while collecting depth data through an integrated pressure sensor. Instead of transmitting data continuously, the collected measurements are stored in the Arduino memory throughout the mission. Once the float is retrieved, the stored data can then be transmitted wirelessly to the surface station for analysis and environmental monitoring purposes.



Electrical

The float's internal electronics are centered around an Arduino Nano ESP32 microcontroller, selected for its integrated Wi-Fi, energy efficiency, and multitasking capability. Serving as the system's central processor, the Arduino Nano ESP32 receives input from onboard sensors and issues command signals to the actuator system. It also supports real-time data acquisition and wireless communication with the topside base station. A stepper motor is used to actuate the profiling mechanism, moving an internal plunger to alter the float's buoyancy. This motor is powered and controlled through a dedicated stepper driver, which receives both control signals from the Arduino Nano ESP32 and electrical power from the main supply. The driver ensures smooth, precise operation of the motor during ascent and descent sequences. A real-time clock (RTC) module is connected to the Arduino Nano ESP32 through digital signal lines to provide accurate timing and data logging. A pressure sensor is also integrated into the system, delivering continuous depth measurements to the Arduino Nano ESP32 for real-time processing and transmission. All electrical components are powered by an 8AA battery pack.

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