EMCC Desert Star Robotics

Vertical Profiler Design

Fig(1). Render of vertical profiler based on design plans

Design Strategy:

For this year's competition, we built upon last year's design with a focus on further reducing size and improving internal organization. While the overall structure remains similar, we optimized the internal layout to make the float more compact and efficient. These improvements simplify assembly, enhance durability, and make better use of space without increasing complexity.

System Overview:

Body

The float body consists of a 1.5-inch polycarbonate tube sealed with resin 3D-printed end caps. The top cap houses the depth sensor and a vent for pressure equalization. The bottom cap holds the PTFE sleeve used by the buoyancy engine.

Power Supply & Regulation

Power is provided by 4 AAA alkaline batteries integrated into the internal frame. These connect directly to a fuse mounted on the custom carrier board, with a voltage regulator stepping the voltage down to 5V for the onboard electronics.

Control System & Sensors

At the core of the profiler is an Adafruit Feather 32u4. The controller communicates with the base station using a LoRa radio system. For depth sensing, this year's model uses an Adafruit MPRLS pressure sensor epoxy-mounted into the cap.

Buoyancy Engine

We retained the proven syringe-based buoyancy engine design for its simplicity and reliability. It features an Actuonix PQ12 high-force micro linear actuator connected to a 3D-printed plunger

inside a PTFE sleeve, which draws in and expels water to control buoyancy. This setup provides precise movement while keeping the system compact.

Weight Distribution

With the new layout and reduced overall volume, achieving neutral buoyancy required fewer tungsten weights than last year. The compact design improves weight distribution and minimizes the need for additional weights.