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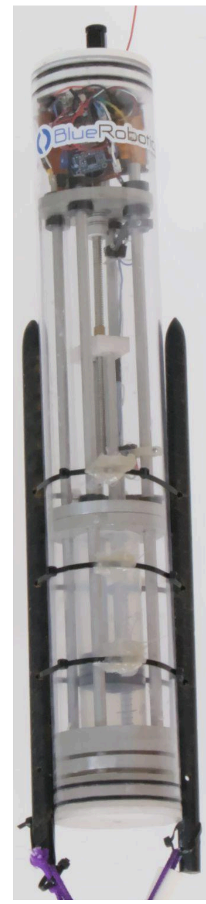

The main body of the vertical profiling float is made out of high-pressure hard polycarbonate tubing with four 6061 aluminum support rods, two end caps with two o-rings each, and 6061 aluminum support plates throughout the tube. Our buoyancy engine is a syringe attached to two plunger rods with a brass nut that is driven by a lead screw attached to our motor. The float has a total volume of 5097±150 cm^3, and so its dry mass is 5.097 kg in order to achieve neutral buoyancy in water. The buoyancy engine thus provides 0.150 kgf, or about 1.47 N, in either direction to either ascend or descend in its vertical profiles.

We built a small perf board for the float electronics based on an Adafruit Feather 32u4 RFM95. This board was chosen for several reasons: as an Arduino with a simple radio module, we would not have to worry about maintaining “pairing” with the surface as we would with WiFi or Bluetooth, and the small footprint and excellent documentation available made it ideal for our use case.

The Feather drives a brushed 99:1 geared DC motor with an Adafruit dual H-bridge module to control the buoyancy engine. The motor was selected to be capable of moving our plunger while running off 8 AA batteries. Two limit switches placed on either side of the syringe allow the Feather to sense when the syringe is at either of its extremes. To accommodate the new pressure measurement requirements, the team added a Blue Robotics I2C pressure sensor, chosen for its integration with a penetrator.

This year, after board failures during the 2023 MATE ROV competition revealed the need for a more connectorized float electronics system, the team added sockets for the Feather and H-bridge modules, as well as JST connectors for the motor, battery, limit switches, and pressure sensor. These connectors made both hardware debugging much easier, allowing for rapid replacement of broken components. CWRUbotix considered integrating the float control electronics into a custom PCB to make those electronics more space efficient, but we decided the added cost, complexity, and manufacturing delay of doing so would be too significant.

To communicate with the rest of the ROV system, another Feather transceiver at the surface control station relays messages to and from the float over a USB serial connection. Due to the attenuation of electromagnetic radiation through water, the two Feathers can only communicate while the float is surfaced. To accommodate this communication restriction, the Feather in the float queues pressure readings and their timestamps while the float is profiling, then transmits the component bytes of these readings to the control station Feather when the float surfaces.

This year, the team added debugging commands to the float, allowing the control station to command the float to temporarily exit its usual profiling schedule and perform specific motor actions, allowing us to reset the buoyancy engine.