Profiling Float Documentation

The profiling float is built separately from the ROV, tasked with sinking to and rising from the bottom of the pool to 'gather' data. This data (UTC time and the company name) is sent to the control station whenever the float surfaces. The following sections detail the design and functionality of the profiling float.

Buoyancy Engine

The primary focus of the vertical profiling float is the buoyancy engine. The buoyancy engine is able to alter the density of the float itself; this controllable buoyancy functionality allows the float to accelerate upwards or downwards. The engine consists of three (3) 150mL syringes, whose motion is driven by a continuous servo motor. The servo is attached to a lead screw via a PLA coupling. The lead screw nut is affixed to a custom 3D-printed syringe plunger, which travels linearly along the shaft as the lead screw is rotated.

The body of each syringe is held stationary using shaft collars and custom-cut profiles. To access the environment, the ends of each syringe are connected by hose to barbed tube fittings, which are permanently affixed through the bottom end cap.

Chassis and Mounting

The external chassis of the float consists of a section of acrylic tube — 60.96cm (24”) in length, 10.80cm (4.25”) inner diameter, and 12.07cm (4.75”) outer diameter. The ends of the tube are terminated by piston seals created by delrin end caps. The bottom end cap possesses four through holes: three for barbed fittings and one more for a 2.5cm diameter pressure relief plug. For stability on the pool floor, a PLA boot was 3D-printed and secured to the bottom end cap. On each end cap, two grooves are made to hold O-rings, which creates a water-tight piston seal with the acrylic tube.

All internal components are secured to a mounting frame, consisting of two 3D-printed PLA plates and three steel rods. Components connecting to the plates, including the steel rods, are fastened by screws to create a rigid skeleton for the float. Components attached to the steel

rods are secured using aluminum shaft collars. Electronics are either mounted directly onto the plates, or are mounted onto PLA frames that are fastened onto the plates.

Electronics

The following electronic components are utilized for the float:

- 1x DS1307 RTC (real time clock)
- 1x HC-05 BT module (Bluetooth)
- 1x SPT5325LV-360 continuous servo
- 2x 9V batteries
- 1x 9V-5V buck converter
- 1x Arduino Uno R3

At the heart of the profiling float is an Arduino Uno R3. A DS1307 RTC module is used to accurately keep time throughout the task, which is then communicated through a HC-05 bluetooth module. The message is received by the topside through the Arduino IDE Serial Monitor. After receiving a signal from topside, the Arduino commands the servo to perform a vertical profile.

The servo and Arduino are powered by separate 9V batteries to provide satisfactory current to both devices. As such, independent fuse calculations are performed. The servo requires 5V input, so a buck converter is used to reduce the voltage of the 9V battery.