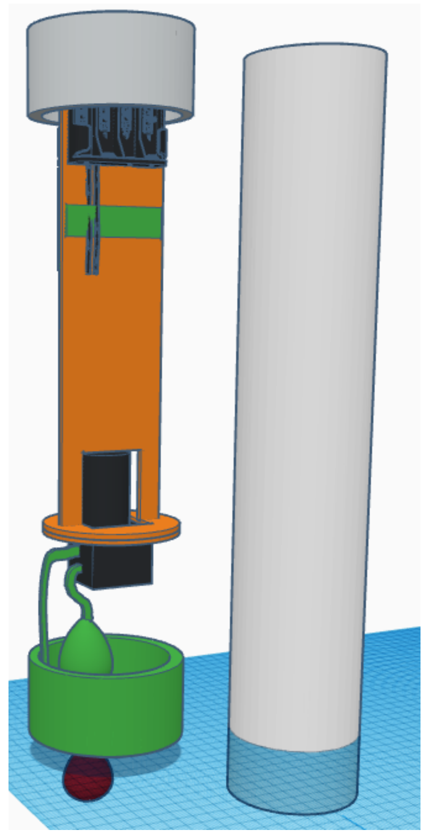
Deep Sea Tactics: GO-BGC Vertical Profiling Float Technical Documentation

Physical Design



This year's GO-BGC vertical profiling float uses a buoyancy engine primarily based around a 12V gear pump that allows it to transport water from an internal balloon, also known as a bladder, to an external bladder and vice versa to alter the volume of the float. As the volume increases, the density will decrease, causing the float to float once the density of the float is less than the density of water. This design does not use a solenoid valve, instead using careful timing to counteract the pressure that both the outside environment and the bladders put on the system. The physical design involves a 3-inch diameter PVC tube, along with two flexible rubber end caps, with one fastened and one not fastened (see section labeled "Safety").

Electrical Design

The entire float runs on eight AA batteries, creating a 12V primary electrical system. This 12V is fed directly to an LM298N DC motor controller, allowing for easy control of both the speed and direction of the water pump. It is also fed to the main PCB, which contains a dual 5/3.3V regulator, a DS3231 real-time clock, and an Adafruit Pro Trinket microcontroller. The 5V section of the regulator powers the DS3231 RTC and the microcontroller. The 3.3V section of the regulator powers the XBee Series 1 Full Duplex transceiver, used for bidirectional RF communication between the base station and the float. Finally, within 5cm of the AA battery bank, there is a 5 amp fuse.

Safety

The primary concern for the safety of the vertical profiling float involves the potential for an unsafe amount of pressure building up within the float housing, which could prove to be dangerous. At the same time, proper construction and sealing of the housing are necessary to prevent water intrusion. Therefore, we decided on using the bottom rubber end cap as a pressure release plug, as it easily pops off the float when the pressure in the housing is too high. This was tested by inflating the bladder on the inside excessively, which resulted in the end cap popping off the float when the displaced air significantly increased the internal pressure. In practice, before deploying the float, the internal bladder is filled with the end cap off, the end cap is then placed and secured without a fastener, and then the bladder is drained to create a slight internal vacuum, which ensures that when the bladder is filled to its normal level, there is no positive pressure built up in the float. Should the bladder fill excessively, however, the end cap pops off to relieve the pressure. Finally, in terms of electrical safety, a 5 amp fuse was chosen to protect the electrical system from potential damage and hazardous situations, as the short-circuit current of the battery bank exceeds 5 amps.