AUV Design

Figure 1: AUV profile

Our float-style AUV, Cetacea, is an autonomous vehicle designed to log and transmit universal time and pressure data during deployment. When positioned at the surface, Cetacea will take on water using a linear actuator and ballast system as the buoyancy engine causing her to begin her dive profile. Once a certain depth is reached, water will be expelled from the ballast system and she will rise to the surface to transmit data to our receiving station in the control box.

We use one Arduino MKR WiFi 1010 board within the AUV (client) and a second MKR MCU mounted in our control box (server). The client transmits data to the server via WiFi, while the server receives that data and displays it on the OLED screen. We also use an AdaFruit Precision RTC clock, to track the UTC time. The RTC clock runs continuously, without a switch, unlike the MCU and linear actuator. We utilize AA alkaline batteries as our main powersource, having 4 of them in each of our three battery packs. We also use a pressure sensor from BlueRobotics to read the depth. When Cetacea reaches a certain depth, the linear actuator will activate and expel the water, allowing her to rise to the surface.

Figure 2: Interior of AUV

Our buoyancy engine uses a large syringe and an Actuonix linear actuator to take in and expel water out of the AUV. This changes the density of the AUV causing it to either rise to the surface or sink to the bottom. We utilize buoyancy foam to help provide a stable vertical profile in the water as well as keeping the top of the AUV out of the water for transmission.

Cetacea utilizes a variety of custom 3D prints, ranging from supporting our electronics and buoyancy engine on the inside, to the aesthetically appealing design features on the outside. The majority of the interior is custom 3D prints, designed to hold the electronics and buoyancy engine in a sleek format that braces against the PVC. We also utilize non-custom aluminum disks to separate the electronics from the buoyancy engine and to prevent the interior setup from sliding within the PVC. On the exterior, we utilize custom 3D printed fins for aesthetics and balance in the water, which is connected to a bracket for attaching the battery packs.

We implement a variety of safety precautions on our AUV. On Cetacea, we have an unsealed cap on each of our battery packs to prevent a burst from over-pressurization. We also run three metal tubes along the AUV itself, from end to end, to tightly seal it and keep it under 1 meter. To prevent damage to the cables or to the penetrators on the bottom end cap, we designed spokes extending from the bottom end cap bracket. On the interior, two O-rings wrapped over metallic disks hold the electronics tray and buoyancy engine in place inside the PVC tube, to prevent damage to the sensitive electronics. Internal spokes bracing the electronics tray and buoyancy engine against the end caps, also add an extra safety measure.