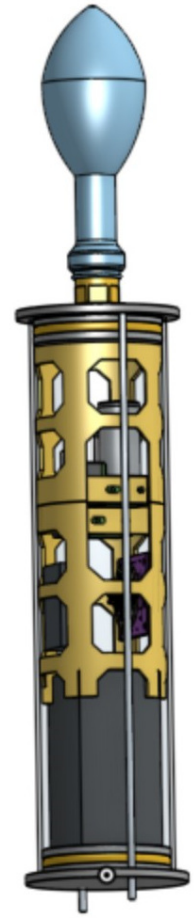
# Float Design Document



## I. Core Functions:

- Operates independently from the ROV but can be held and deployed
- Completes two vertical profiles in the pool using a buoyancy Engine

## II. Float Design:

**Buoyancy engine design:** Two 12V vacuum pumps powered by eight 1.5V D cell alkaline batteries. A custom PCB that acts as a bridge between our microcontroller and the pumps allowing them to be switched on and off. One pump inflates an exterior bladder(balloon) when the float is at the bottom and the other deflates it at the surface.

**Interior float design:** 3D printed frame holds the electronics and pneumatics in place and controls the wire management of the PCB.

**Exterior float design:** The pneumatic and electronic system is held within a 4 in diameter acrylic cylinder with two aluminum endcaps secured with O-rings and fasteners.

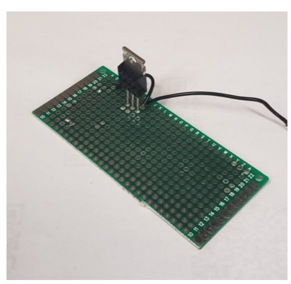
**Safety:** To make sure our pressure vessel is safe we added a ⅜" pressure relief valve to one of the endcaps that will release any pressure buildup over 1 psi on the inside of our float. We also have another opening on the same endcap that is secured with a Schrader valve so that we can manually equalize the pressure if we need to.

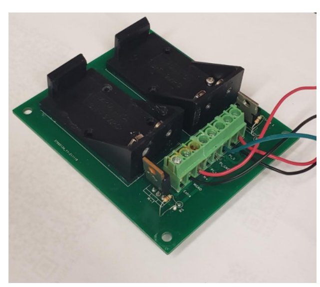
## III. Design Process and Alternatives:

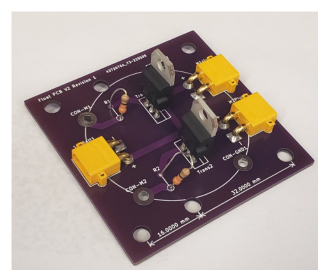
**Weighted trade study:** (categories depicted below) This was used to narrow down the more overarching properties of our float. Some notable alternatives were using oil as a fluid, using a non-elastic bladder, using a linear actuator, and trying to make a much smaller float. The design we chose was the best intersection of simplicity and ease of development, making it both reliable and manufacturable.

| | Simplicity | Reliability ( | Durability/resilience a | Manufacturability | Coolness/i | Ease of developmen | maintainability | SUM | out of 10 | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 20 | 10 | 20 | 10 | 10 | 10 | 100 | 10 | |
| test | 7.5 | 5 | 7 | 6 | 9 | 2 | 8 | 59.5 | 5.95 | |

**PCB and electronics design:** We needed a way for the microcontroller to control the behavior of the float. We chose to design our own PCB board to act as this bridge between the high-powered 12V battery supply and pumps and our low-powered battery pack and microcontroller. We used two transistors as switches for the two pumps but considered relays as well. We went through several PCB variations and microcontrollers before settling on our current design.







**Balloon mounts and handle:** The balloon mount went through multiple prototypes to deal with structural and sealing issues. We used friction to hold the balloon, stretching it over a thick 3D printed wall to seal it. While this worked well, attempting to 3D print male thread for the connection to the end caps resulted in broken parts and trying to use O rings to reduce strain on the screws was ineffective at sealing. Ultimately, we chose to use female threads via an adapter, as this meant that the area around the printed threads could be very thick and dense. The handle also had to change as we realized the static manipulator was more effective than the dynamic manipulator, and it ended up becoming simpler as well, shifting from a 3D printed ring to a hanging rope loop.