Hephaestus Robotics
NON-ROV Design Document
Glauscus I Float

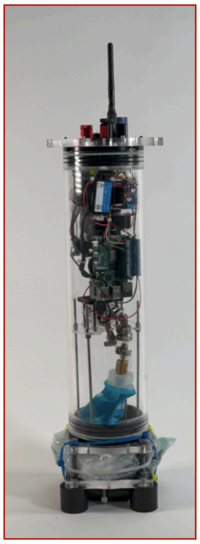

Figure 1: Glaucus I. Credit: Nate Hofmann.

The autonomous profiling float, *Glaucus I*, is designed to consistently submerge itself to 2.5 m and hold its depth while collecting data. Since the float is constrained to a max height of 1 meter and a max diameter of 18cm, the design of *Glaucus I* involved creating a CAD model to optimize the space within the tube and ensure modularity and compactness. The team put substantial thought and consideration into all engineering decisions. We selected a 4” Blue Robotics water-tight enclosure

Name of Pump	15 ft check	Time(to 15 ft)	Power Draw(15ft)	Additional Notes
Goso GB37-530	☑	13.93s	14.11W	1st choice: works well, reversible, small
Kamoer KHPP260-HB-B22	☐			dysfunctional
Kamoer KPHM600-SW3B17	☑	12.12s	14.1W	2nd choice: works well, reversible, big
Seaflo SFSP1-L016-01	☑	2.36s		pumps too fast; would need solenoid
CrocSee CRS-A016	☑	7.14s	14.14W	nonreversible

for its reliability, sufficient space, and 10m depth rating. Additionally, we tested 5 pumps through 15 ft of tubing to ensure they could adequately withstand water pressure. We evaluated their performance on the basis of suitability and reliability, monitoring power draw, speed, and size. Ultimately, the team chose the Hyuduo GB37-530 as it fit our criteria, as shown in the table above.

Glaucus I uses custom acrylic end caps that were designed in Fusion 360 and laser cut. The top end cap has a 25 mm hole with a rubber stopper for pressure relief. The float has four rubber feet on the bottom, allowing it to stand upright and protecting the bottom of the float from the pool floor. *Glaucus I* employs a Raspberry Pi 4B for buoyancy engine control, which directly interfaces with an L298N H-Bridge over GPIO, providing easy control via Python. This H-Bridge motor controller drives a Hyuduo GB37-530 peristaltic pump, which was chosen for its precise fluid displacement and reversibility, enabling fine-tuned buoyancy adjustments. The Float measures pressure with a Blue Robotics Bar02 pressure sensor, which is subsequently converted to depth. These data metrics are then visualized after each profile using Python’s MatPlotLib. The float is powered with a 12V NiMH Battery, providing 12V to the pump, and stepped down to 5V with a buck converter for the Pi. *Glaucus I* uses a PID controller to maintain a desired depth underwater. This control system constantly adjusts the motor output based on pressure sensor feedback, allowing the float to hold a specific depth with high precision. To tune the PID controller, our team conducted thousands of simulations, testing various parameter combinations to achieve the most ideal responsive behavior.

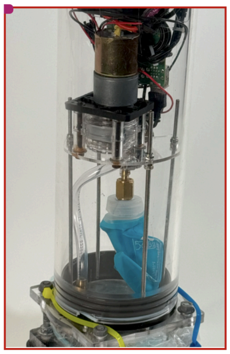

Figure 2: Buoyancy engine. Credit: Nate Hofmann.

To determine the required ballast and ensure neutral buoyancy for *Glaucus I*, we first calculated its total mass and volume. Using Archimedes’ Principle, we calculated how much water *Glaucus I* needed to displace to equal its weight. Since water has a known density, we used the mass of the float to figure out how much mass and volume it needed to displace. This process ensured that the buoyant force matched the weight of *Glaucus I*, allowing it to maintain stable underwater positioning.

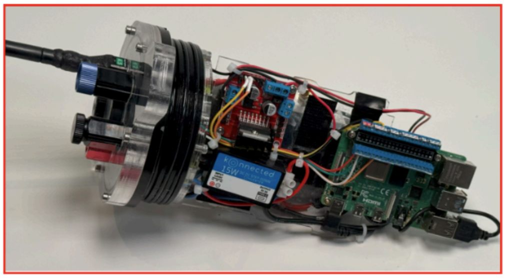

Figure 3: Electronics tray. Credit: Nate Hofmann