

Progress Report #5

AUV Project

Phase II



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10/28/2023

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This fall 2023 phase II independent study project constitutes the continuation of the design and development of a proof-of concept autonomous underwater vehicle (AUV) from the spring 2023 phase I independent study with the intention of constructing a secondary AUV in the spring 2024 semester. This proof-of-concept AUV will be capable of meeting all technical requirements to participate in the *2024 International Robosub Competition* [1]. Progress reports #4, #5, and #6 will document the technical development of the project. Progress report #5 is part of milestone #2 out of the five milestones that constitute the project.

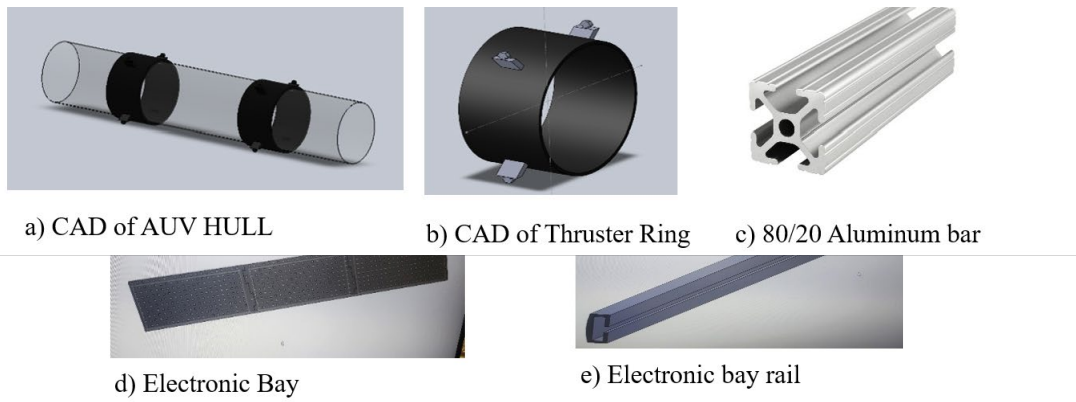
Executive Summary

The project is currently in between Milestone #1 and Milestone #2, prototype concept design and a unified prototype concept design, respectively. Completed tasks consist of submission of the parts list, completed prototype concept designs, and a preliminary draft of the electronic block diagram. Current tasks underway consist of the creation of an Advanced Robotics sponsorship brochure for formal distribution and opening an account with a credit union for the organization to begin purchasing equipment. Next month's tasks include finalizing tasks from milestone #1 and #2 and beginning the tasks of milestone #3. These tasks consist of finalizing prototype concept designs as well as the final draft of the electrical block diagram for physical build of the model prototype. The physical build of the AUV will consist of ordering parts, 3D printing of all subsystems, and the hardwiring of all electronics.

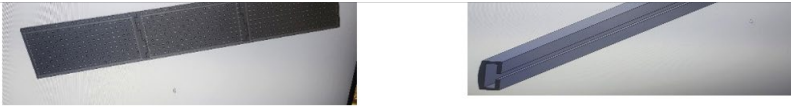
Completed Tasks

All sectional leads have completed their respective Gantt charts. Initial prototype concept designs from milestone #1 have been undergoing design change iterations with an expected final design iteration set for November 10th to begin 3D printing of prototype concept designs. The

AUV hull prototype concept design is shown below in *Figure 1*. The hull uses thruster rings with an extrusion of a t-shaped latch that hooks onto 80/20 aluminum t-slot bars that will form a boxed cage that will allow the robotic arm and torpedo/marker system to latch onto. The hull will be 3D printed for prototyping and use aluminum as the final product. The latest electronic bay prototype concept iteration is also shown and will utilize a rail system that will be held to the hull with magnets. The electronic bay slides securely into place within the rail and has holes for cable management and to allow for electronics to be screwed into various locations across the bay.



a) CAD of AUV HULL b) CAD of Thruster Ring c) 80/20 Aluminum bar



d) Electronic Bay e) Electronic bay rail

Figure 1: Components of the AUV hull and electronic bay with rail

The latest torpedo/marker system iteration and inspiration for a new robotic arm design is shown below in *Figure 2*. The arm will be 3D printed and have three 360-degree gears with a motor for each gear located at the base, elbow joint, and gripper. The torpedo system will use 3D printed components, PVC tubing, and four commercial off-the-shelf toy torpedoes. The torpedo system will be modified to include two markers and will function using a torpedo magazine and a 12V solenoid.



a) CAD inspiration of robotic arm b) Torpedo/marker system

Figure 2: CAD models of Robotic arm and torpedo system

A parts list has been created for both the mechanical section and the electrical and computer engineering/science team. Progress has been made on creating a computer simulation of the competition using Gazebo, a 3D robotics simulator. The inertial measurement unit sensor has been programmed and tested to read data and testing of the LIDAR unit has begun. A preliminary draft of the electrical block diagram has been constructed and is shown in *Figure 3*.

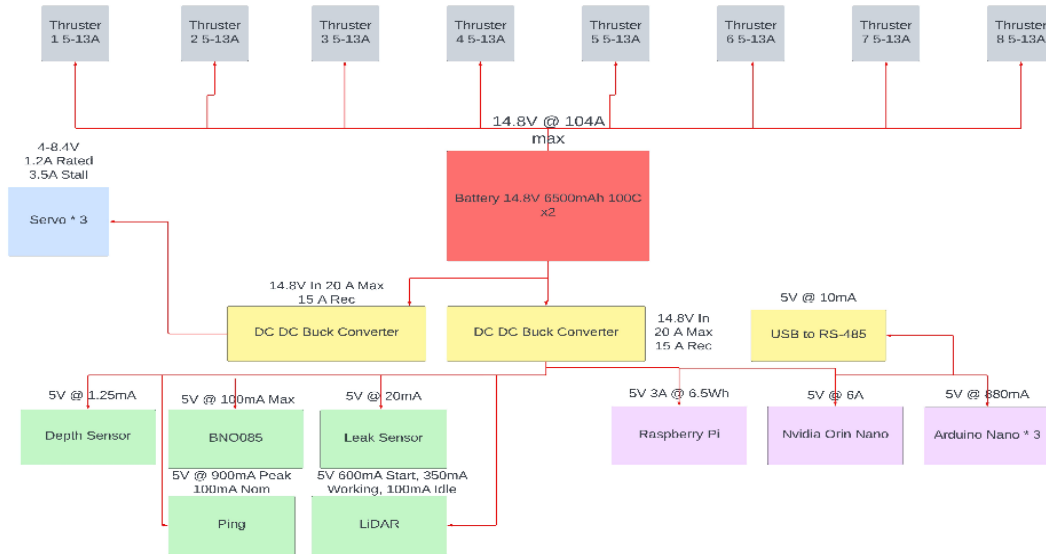


Figure 3: Preliminary Electrical Block Diagram

Current Tasks underway

The creation of an Advanced Robotics sponsorship brochure for formal distribution and opening a credit union for the organization to begin purchasing equipment are tasks that are currently being worked on. Additionally, networking and securing sponsorship of the appropriate contacts from the university and engineering companies for the team is currently underway.

Upcoming Tasks

The construction and physical assembly of the AUV will begin next month. The finalized prototype concept designs and the electrical block diagram will be reviewed for approval of 3D printing. Parts will be ordered from the parts list, 3D printing of all subsystems will begin, and the electronics will be hardwired onto the electronic bay.