AUV Team Final Presentation

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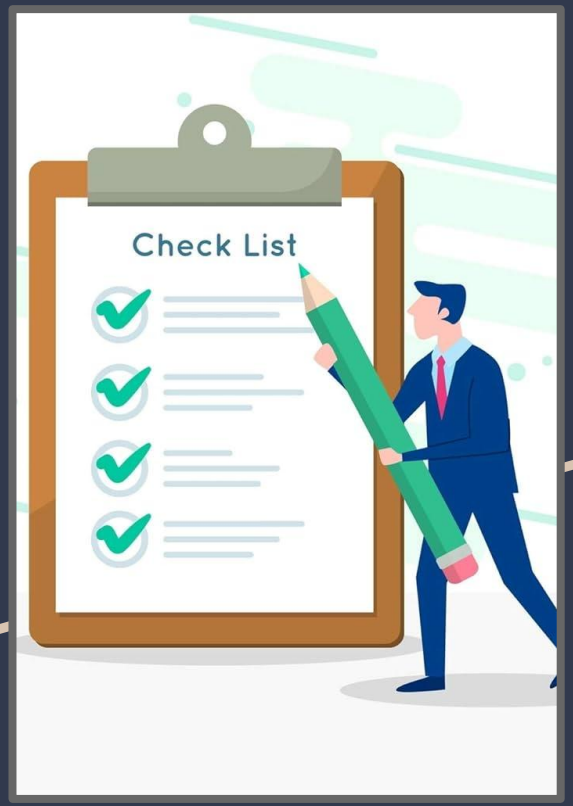
Introduction

- AUVs come in various designs for various purposes.
- Most AUVs are used for research.
- Our AUV is a testbed for near shore research and swarming technology.

Problem Definition: The team was given the task of improving the design of the AUV that the previous team worked on

Semester Goals

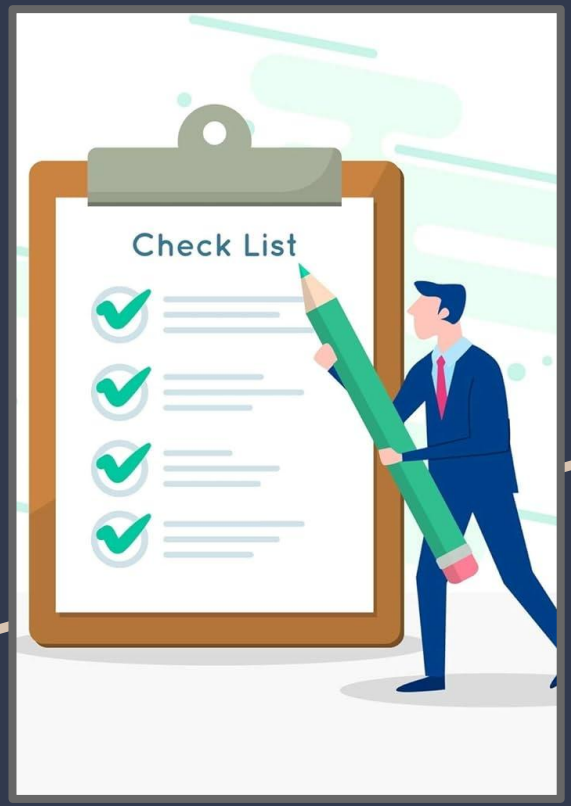


- Improve waterproofing and reduce water ingression
- Improve control system
- Improve buoyancy characteristics
- Make AUV fully operable underwater while tethered
- Lay groundwork for autonomy

Engineering Standards

- ASME Y14.5: Geometric Dimensioning and Tolerances
- Parker Manual: O-ring usage
- ASTM D570-98(2018): Water absorption of Plastics
- ASME BPVC Section X: Hydrostatic pressure design and testing

Completed Goals



- AUV fully waterproof and material completely sealed
- Improved control system
- Completed ballast system
- Made AUV operable underwater while tethered
- Laid groundwork for autonomy

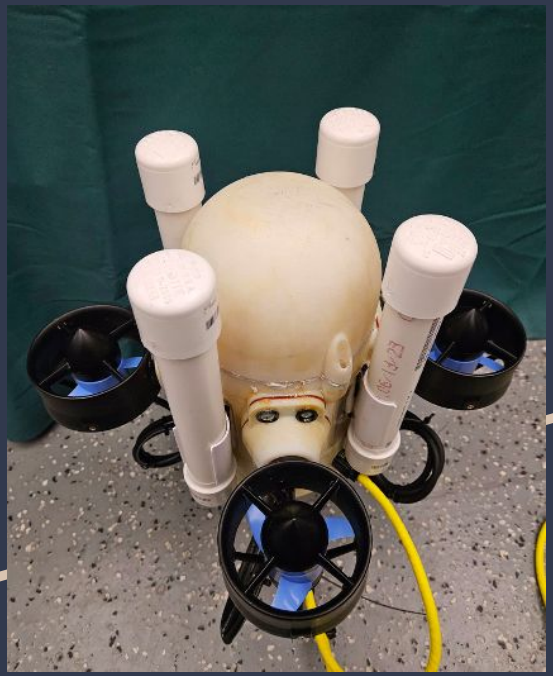
Waterproofing Results

- Multiple sealing methods were tested with a variety of results
- A clay seal was the best solution to completely sealing the pre-existing o-ring cross section.
- Applying contact concrete around motor mounts was an additional waterproofing solution.
- Pre-operational checks to ensure connection security

Response

- AUV is completely waterproof after withstanding a multitude of tests.

Ballast System Results



Buoyancy Force Calculation:

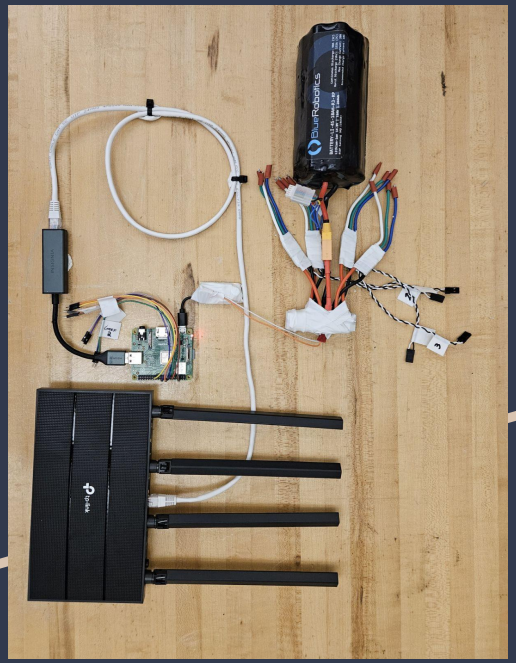
- $F_{\text{buoyancy}} = \rho_{\text{effective}} g V_{\text{total}}$
  - $\rho_{\text{effective}} = \rho_{\text{material}} - \rho_{\text{water}}$
  - $V_{\text{total}} = V_{\text{cylinder}} + 2V_{\text{dome}}$

- PVC clips were attached to the AUV, with PVC pipes filled with 575 grams of lead per pipe.
- These ballast rods make the AUV neutrally buoyant when all attached.
- Approximately 540 grams from all of the PVC pipes were discarded to make the AUV neutrally buoyant.

Response

- AUV neutrally buoyant while underwater.

Control System Results

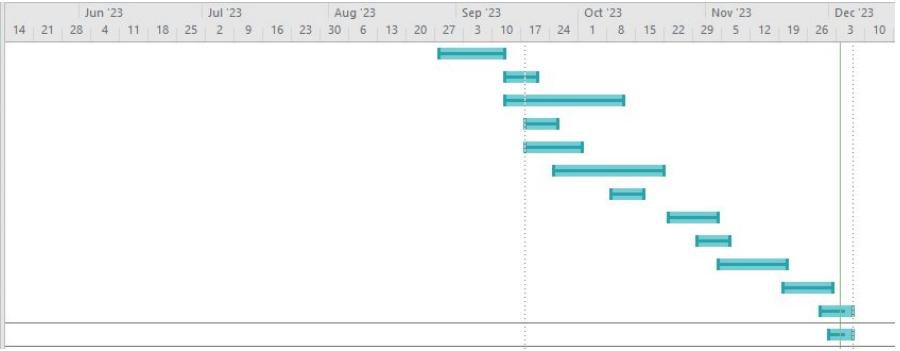


- Raspberry Pi has been successfully connected to the four Motor modules with a PWM signal.
- To initiate a connection between the Raspberry Pi it was required to modulate the frequency of the PWM signal Up and Down.

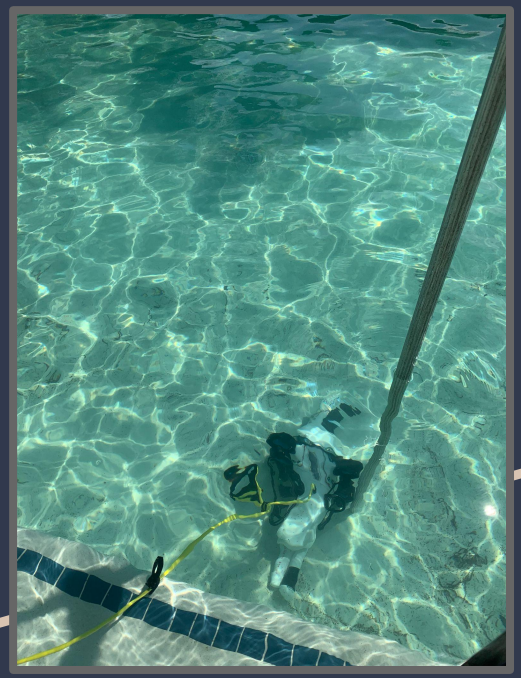
Administration

- Project has remained on schedule for a majority of the semester; only setback was waterproofing.
- With unexpected setbacks with waterproofing, this resulted in minimal time to fully test the AUV and it's control system while underwater.

	Task Mode	Task Name	Duration	Start	Finish
1	✓	Initial Team Meetings	12 days	Mon 8/28/23	Tue 9/12/23
2	✓	Intial Advisor Meetings	6 days	Wed 9/13/23	Wed 9/20/23
3	✓	Gather Materials	21 days	Wed 9/13/23	Wed 10/11/23
4	✓	Prepare and Present Oral Presentation 1	6 days	Mon 9/18/23	Mon 9/25/23
5	✓	Research and Implement Engineering Standards	11 days	Mon 9/18/23	Sun 10/1/23
6	✓	Begin Design Improvements	21 days	Mon 9/25/23	Sat 10/21/23
7	✓	Prepare and Present Mid Term Oral Presentation	6 days	Mon 10/9/23	Mon 10/16/23
8	✓	Test Design	10 days	Mon 10/23/23	Fri 11/3/23
9	✓	Prepare and Present Oral Presentation 2	6 days	Mon 10/30/23	Mon 11/6/23
10	✓	Iterate Design Improvements	12 days	Sat 11/4/23	Mon 11/20/23
11	✓	Final Design Testing	10 days	Mon 11/20/23	Fri 12/1/23
12		Prepare and Deliver Final Presentation and Poster	6 days	Wed 11/29/23	Wed 12/6/23
13		Prepare and Deliver Final Product	4 days	Fri 12/1/23	Wed 12/6/23

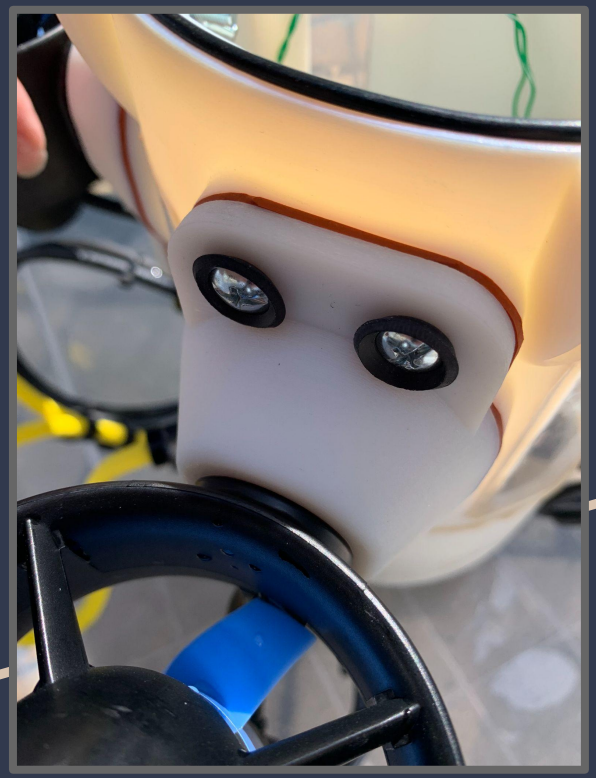


Conclusion



- Waterproofing complete and operable.
- Ballast system complete and operable.
- Material degradation problem solved.
- Control system improved significantly since start; raspberry pi and code written to fully control AUV.
- Control system operable but must be stabilized through coding.
- The future group has groundwork laid for autonomy; a wireless router connected to the raspberry pi is the best prediction made for a fully autonomous vehicle.

Conclusion



Completed Methods

- Problem with the material of the AUV disintegrating when in the water
- Figured out where we are having water infiltration
- Calculated and appropriately ballasted AUV
- Some control system instability

Future Improvements

- Work on coating the AUV with a clear epoxy
- Improve Water Resistance by inserting a latex gasket to keep water from infiltrating the inside of the AUV
- Improve control system

Questions?