Magikarp
Innovation Center Robotics

Chief Executive Officer
Nicholas Weimer

Electrical and Control Systems Designer
Grant Riddle

Structural Designer & Pilot
AdaMae Hart

Electrical engineer & structural support
Sebastian Delgado

Chief Safety Officer
Vanicia Thomas

Founding Team Members

MATE 2023

Table of Contents

Executive Summary	3
Our Team	4
Design Rationale	5
Design Rationale	6
Systems	7
Critical Analysis	8
Budget	9
Safety	10
Future Plans and Milestones	11
Contact	12

Our Team

A collective for the greater good

Grant Riddle
Electrical and Control Systems Designer

I am responsible for the electronics and control system for the robot, including the tether, camera, and, controller.

AdaMae Hart
Structural Designer & Pilot

I am responsible for piloting the ROV, strategy game plan, as well as doing the structural design, and graphics.

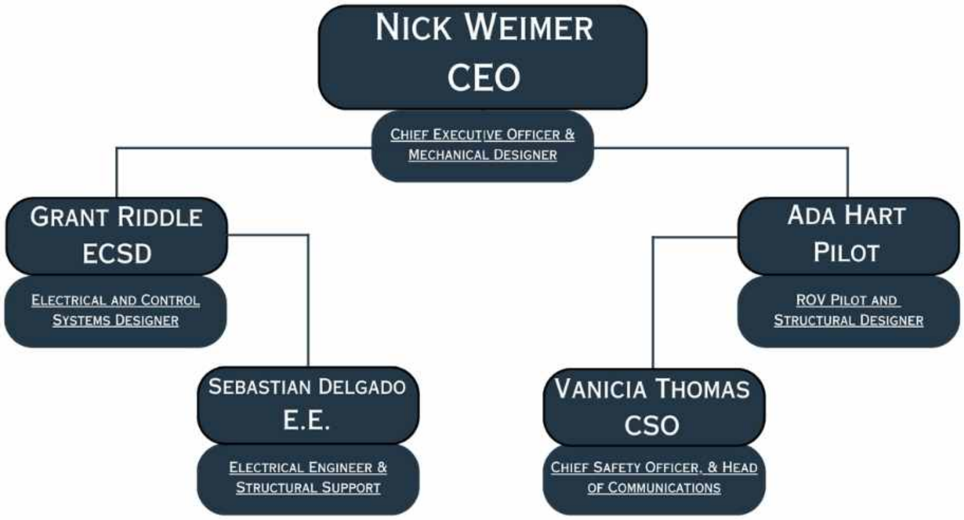
Nicholas Weimer
Cheif Executive Office

I am in charge of the team budget and schedule. I am also responsible for the ROVs movement and buoyancy management.

Recent additions to the team

Vanicia Thomas Chief Safety Officer & Head of Communications

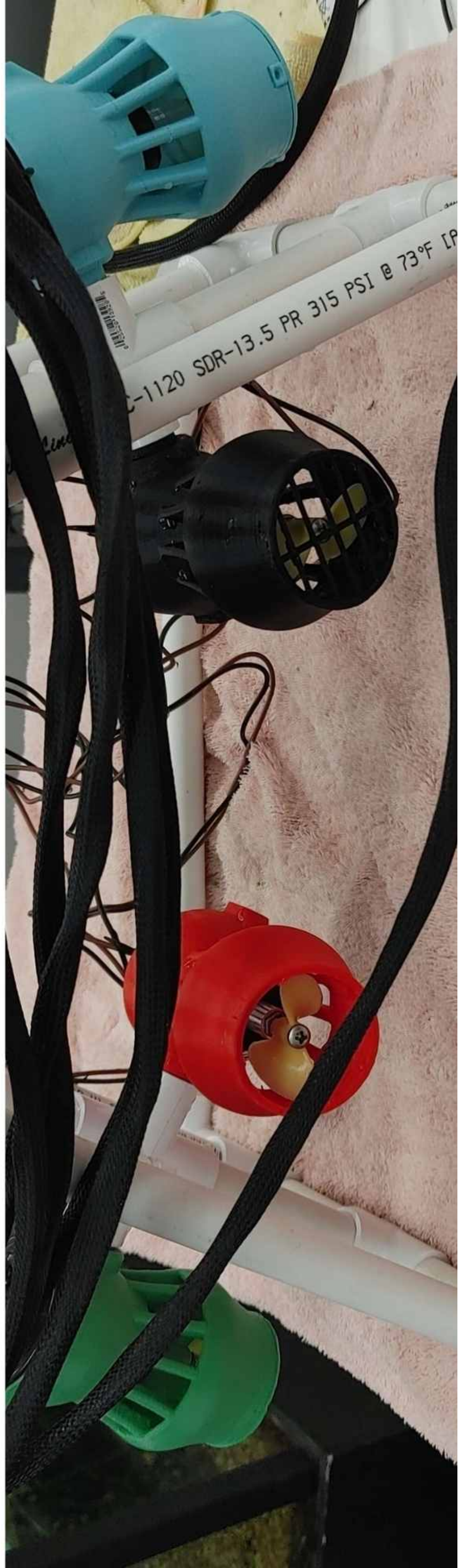
Sebastian Delgado Electrical engineer & Structural support



Organizational Leadership

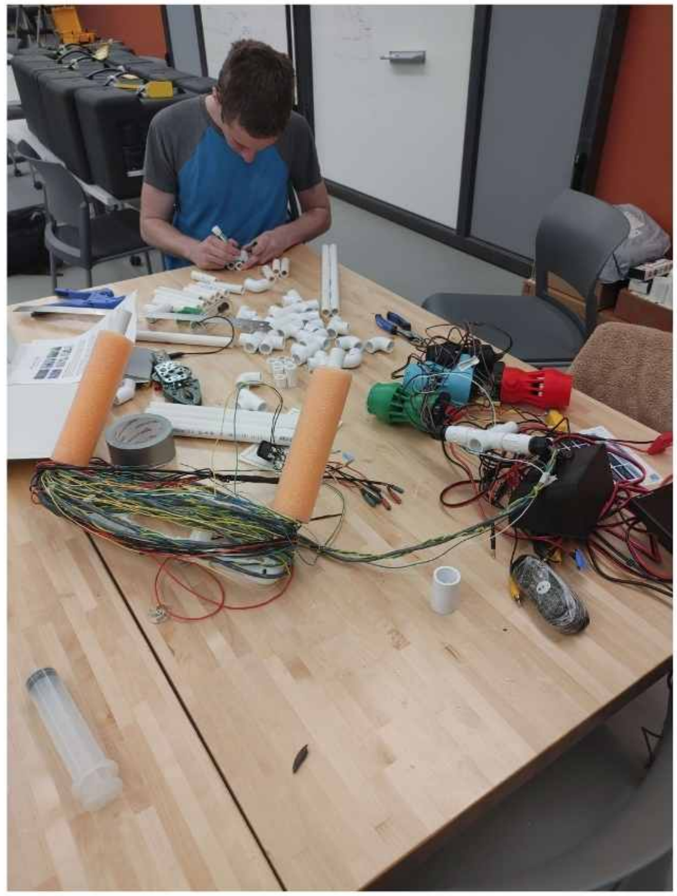
Abstract

Magikarp Industries has designed and constructed an ROV to accomplish the objectives put forth by Mate Robotics. This ROV is Magikarp. Magikarp was designed to complete a plethora of tasks. Magikarp is intended, and effectively constructed, to conduct repairs on important underwater infrastructure, collect data on marine life, and engage in detailed inspections of equipment. With these goals in mind, Magikarp has been outfitted with equipment. The various manipulators on Magikarp are as follows: four motor configuration for optimal maneuverability, two camera system for navigation and transects, a motorized claw, and hooks for versatility in object manipulation. Thus, through the production of a quality ROV, our company is prepared to excel at completing the tasks before us with efficiency



Design Rationale

Overview



Thruster Configuration and vehicle structure

The motors are arranged in a way that provides four axes of movement: surge, heave, sway, and yaw.

2 motors are oriented horizontally providing yaw and surge control. Another 2 are oriented vertically, angled towards the center of the ROV, these motors provide heave and sway control.

The vertical thrusters are able to control sway because by using alternate thrust on each of the thruster which, because of the angle of the thrusters, causes a net horizontal force, in addition to a slight rotational moment, which is counteracted by the high center of buoyancy.

The ROV also pitches strongly forward while bearing a load on the claw, meaning that the surge+yaw motors assist in lifting.

Design Rationale

Continued...

Interaction

The ROV features a claw, flashlight, and 2 hooks to assist in completing tasks.

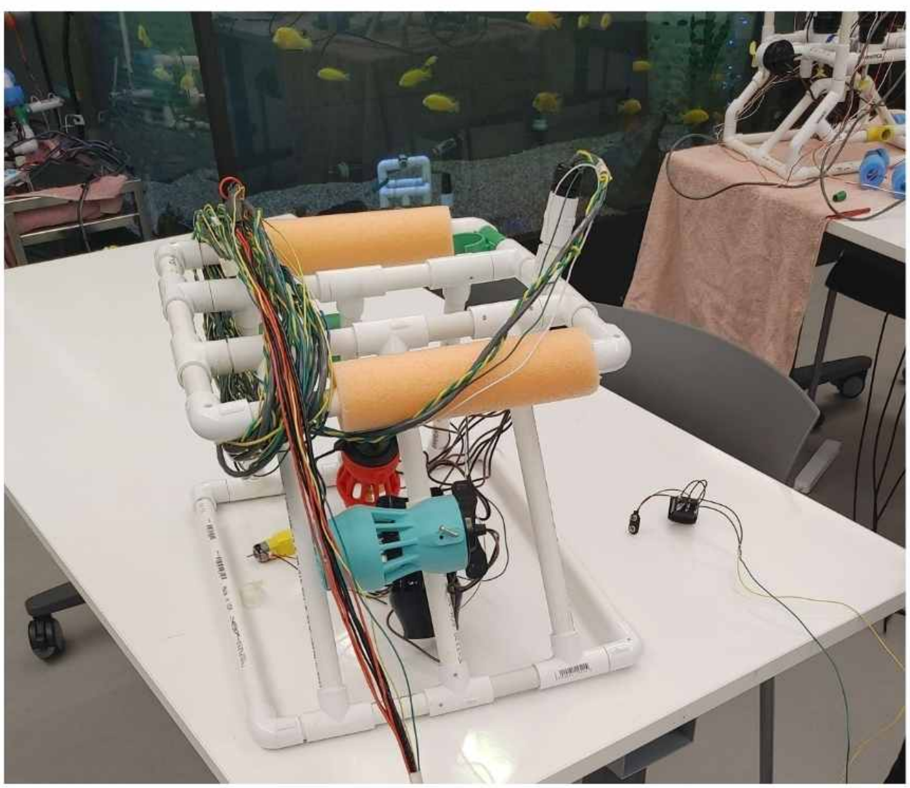
The hooks are passive tools used for things like removing debris from the buoy cable, and lifting things, as aligning it is easier than with a claw.

the claw is used for gripping larger objects, and completing tasks like removing the solar panel plugs.

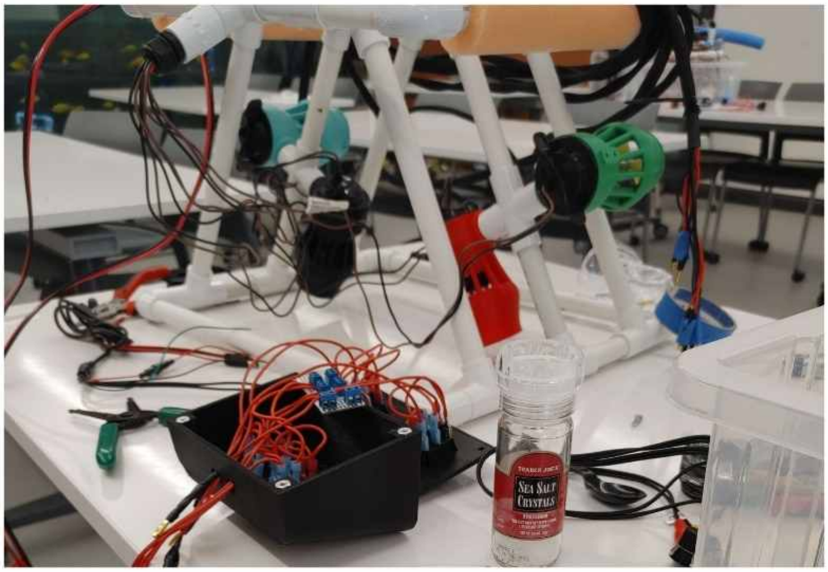
The flashlight is used for the coral treatment, it's power is connected on the same line as the claw, to simplify the control system.

Camera

The ROV has 2 cameras, 1 is fixed above the main claw, and is used for the majority of navigation and manipulation tasks, another camera can be moved between multiple mounting points and can be changed for each task that needs to be accomplished.



Systems



Control System

The control system is comprised of 5 3 position switches, each switch is wired so that the top and bottom position sends opposite polarity currents to the motors they control. each swich is then wired to the component it controls (one of the thrusters or the claw & light) through the tether. the thruster switches are all contained in a control box that is operated by the pilot, while the claw switch is in a separate housing, and operated by another person.

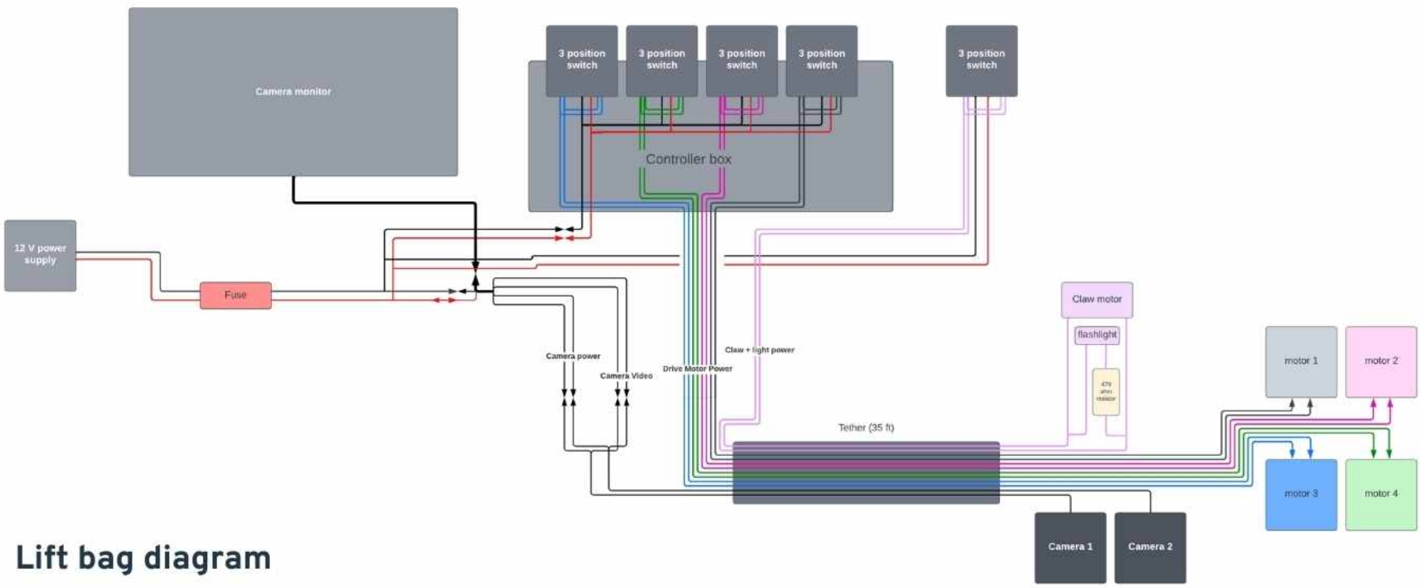
Camera system

The camera power is connected to the 12V main power line. going down the tether to both cameras. Coming up from the cameras is the video cable, providing video to the monitor above water. We switch between either camera view by pressing the input button on the monitor.

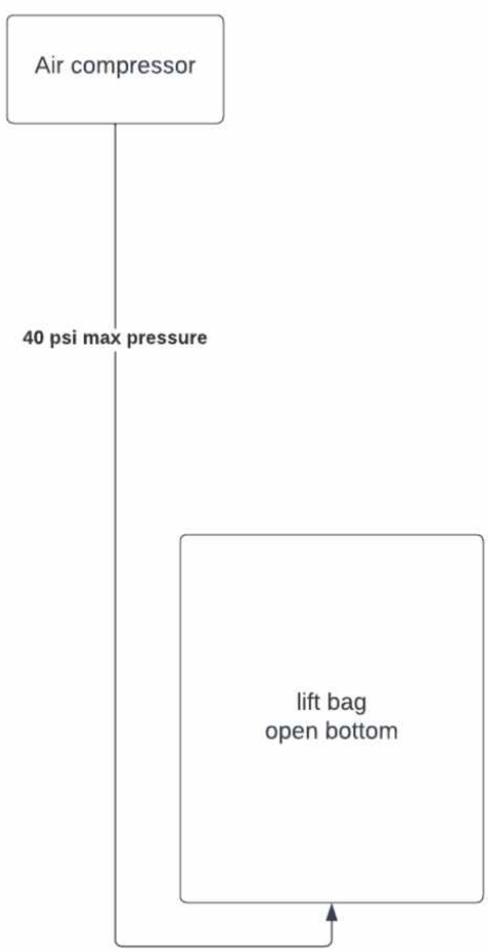
Systems

Continued

ROV Electrical Diagram



Lift bag diagram



Critical Analysis

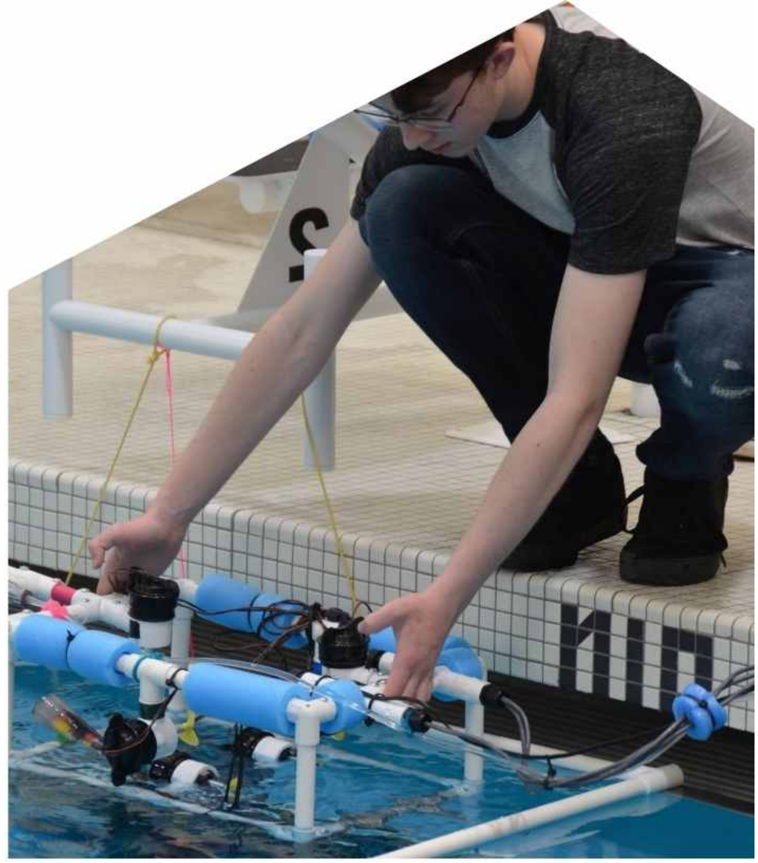
SWOG Table

Strengths	Weaknesses	Opportunities	Growth
• We have two cameras and able to see from strategized angles. • Our robot is equipped with a motorized mechanical claw • Our build design allows us to strafe while having the force of 2 motors pointing upwards	• The robot exhibits a slight roll while strafing • Hindered vertical movement because of the vertical motor setup • PVC body	• Horizontal profiling/ observation because of the strafing • 2 POV's for improving our vision and accuracy • Stronger and more versatile grabbing opportunities	• We could work on stabilizing the vertical strafing ability • Built out of non pvc pieces • Add more motors or different configuration depending on the tasks/problems

Troubleshooting, Decisions and Testing

During the course of constructing this ROV, we continuously tested and fixed it as we added. Such as the flashlight attachment, during the course of adding it, we broke 3 LEDs and eventually landed on a safe working idea. To demonstrate our ability to improve and test, the claw, was originally a hydraulic clamp. The problem with the first iteration of Claw was slow and not strong. Therefore we decided to attempt attaching the hydraulic system to a vex claw, the first problems we had were that the hydraulics weren't strong enough and inconsistent. Immediately after adding the vex claw, we waterproofed an old vex motor and sautered wires down the weather to power it. To add to our decision-making and resourcefulness, all of our motors, cameras, claw, and all the parts were used prior to this and tested to see if they function before being added to the ROV. To test the full capabilities we made mock props and testing structures, submerged them, and practiced.

Safety



Overview

Being safe in an underwater robotics team is crucial to ensure that all team members can work effectively and avoid potential risks. There are several methods that can be employed to promote safety in this context.

Firstly, it is important to have a thorough understanding of the equipment and tools being used. Proper training and education can help team members understand how to use the equipment safely and avoid potential hazards.

Secondly, it is important to establish clear communication protocols and safety procedures. This can include having designated safety officers, setting up safety checkpoints, and implementing emergency response plans.

Thirdly, it is important to prioritize the health and well-being of all team members. This can involve setting limits on the amount of time spent underwater, providing adequate rest breaks, and monitoring the physical and mental health of all team members.

Safety features

System 1- Fuses	**System 2-** Disconnects
Included: • Two 10 amp fuses on the main power line 	Features: • Quick disconnects to the controller, and switches • Disconnects to the camera • Another set of disconnects to the power for each circuit

Future Plans & Milestones

Fine grained motor control

We are working on creating a motor control system with more specificity than foreward/off/reverse

Vertical profiling float

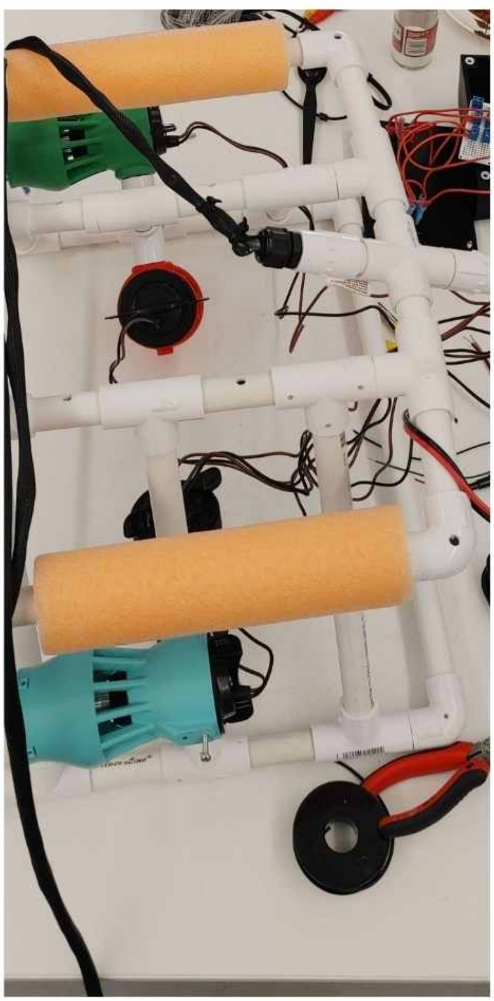
We are developing a vertical profiling float using dynamic buoyancy

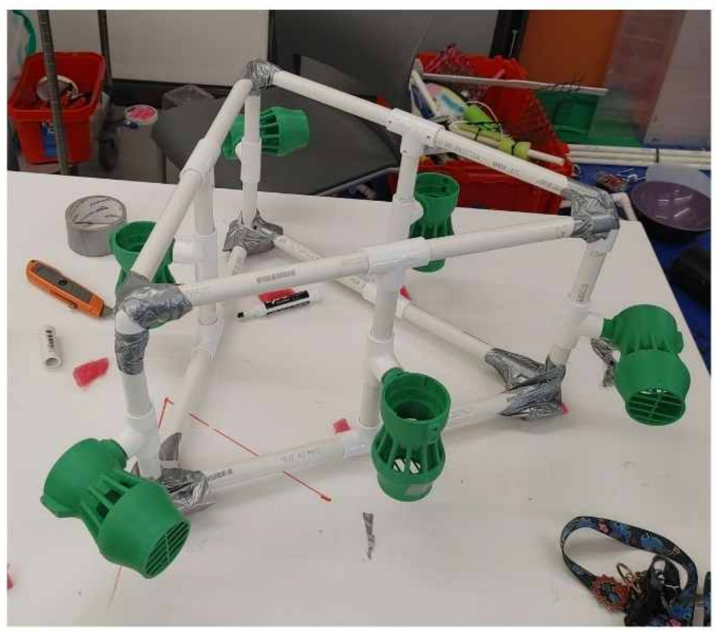
6 motor design

by improving our design and adding 2 more motors we can increase the number of degrees of freedom our ROV is able to move in

Compete in future tournaments

Our ROV serves as a versatile base that could be easily repurposed in the future.





Our prototype motor configuration

Budget

	Value	Percentage
Angelfish Kit (incl thrusters & tether)	$220	40%
PVC Pipe & FIttings	$40	7%
Additional Thruster & Components	$45	8%
Two-Camera System	$180	32%
3D Printed Plastic & Services	$20	4%
Misc. Electronics Components	$50	9%
Total:	$555	100%

Innovation Center of St. Vrain Valley Schools
33 Quail Rd. Longmont CO
303-702-82000

Contact Us