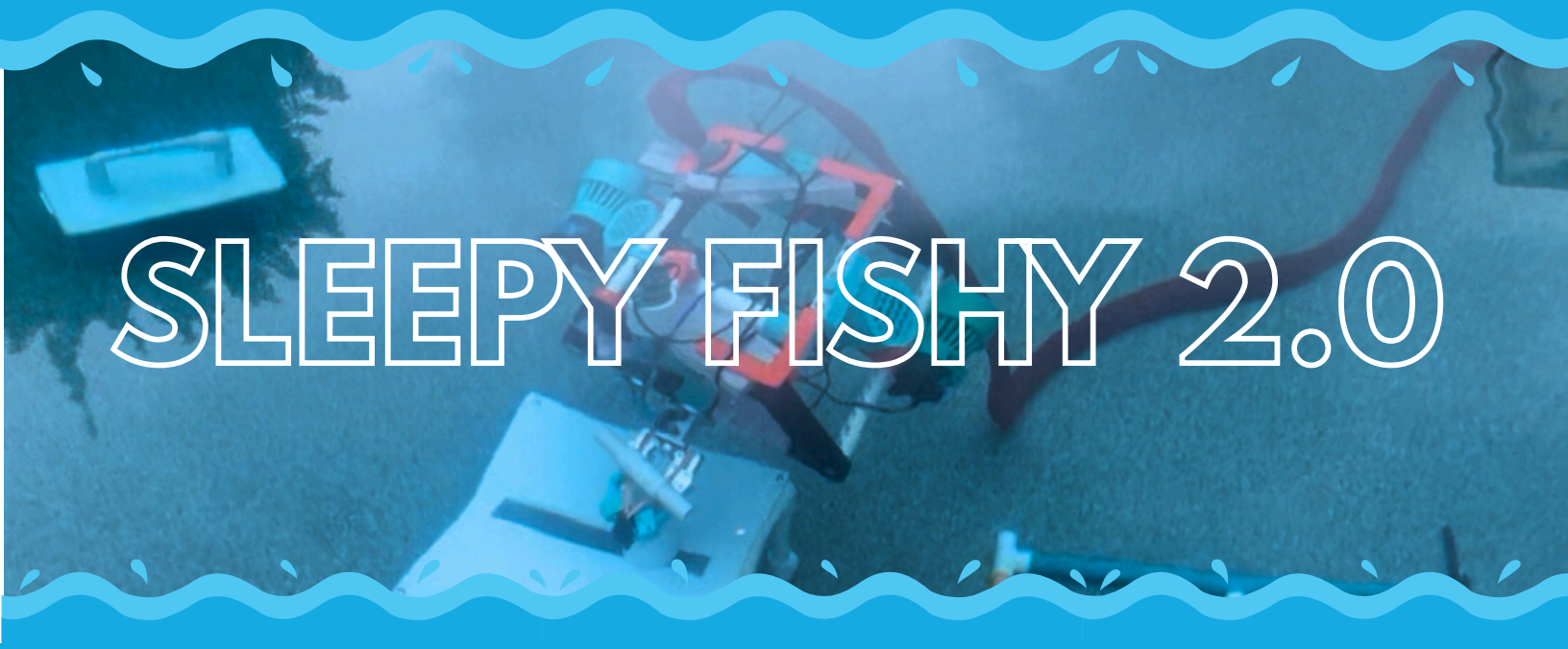
MATE ROV WORLD CHAMPIONSHIPS PIONEER

San Diego Miramar College, CA USA
Miramar Water Jets

TECHNICAL DOCUMENTATION 2025



SLEEPY FISHY 2.0

Company Member	Role(s)
Nathan Obermiller	CEO, ROV
Alison Kang	COO, Water Sampler, ROV
Teagan Darling	Software Team, Filming
Rashad Hassan	Pilot, Filming
Carol Braga	Float Team
Aadarsh Devi	Software Lead, Troubleshooting

Britney Ton	Soldering, Filming
Minh Le	CAD
Alexandra Steiner	Electrical Lead
Agustin Romero	Float Team
Jasmin Pyo	Team Scientist
Cao Minh Tri Tran	Water Sampler
Gina Bochicchio	Mentor

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ABSTRACT

Miramar Water Jets is a team of detail-oriented engineering students dedicated to constructing an ROV to evaluate the well-being of aquatic habitats, increase conservation of oceanic resources, and further scientific research about marine life.

This is our present members' first time competing in this amazing learning opportunity, and we are very excited to introduce Sleepy Fishy 2.0, our remotely operated vehicle. Sleepy Fishy 2.0 is designed to carefully maneuver around obstacles, meticulously transport items, collect crucial data, and capture video footage.

We invested extensive time and effort in developing and refining Sleepy Fishy 2.0, a process that demanded continuous problem-solving, clear communication, and strong resilience. Miramar Water Jets is committed to ensuring that the ROV efficiently carries out tasks like pH sampling and shipwreck documentation to aid in the protection of marine environments. We aim to raise awareness about aquatic ecosystems and promote deeper learning.

COMPANY OVERVIEW

Leadership Team

Nathan Obermiller
(CEO)
Executive leadership decisions

Alison Kang
(COO)
Created the water sampler

Teagan Darling
(Software Lead)
Designed the claw for the ROV

Rashad Hassan
(Pilot)
Filmed and edited the video demonstration

Jasmin Pyo
(Team Scientist)
Managed public affairs and prop building

Alexandra Steiner
(Electrical Lead)
Led the float and soldered the control boards

Electrical Team:

- Soldering components
- Implementing the control board
- Organizing and routing wiring
- Troubleshoot electrical issues
- Oversee the integration of the camera systems

Mechanical Team:

- Constructing the framework of the ROV
- Adjusting the buoyancy system
- Managing the claw and hydraulic components
- Overseeing the pneumatics system
- Assembling the tether and props

PROJECT MANAGEMENT

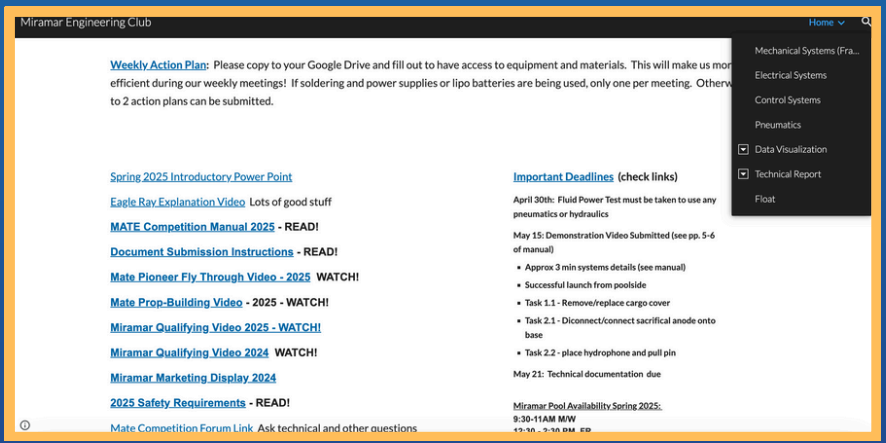
Team Meetings:
We meet every Friday to discuss progress, resolve issues, and vote on buying items. These meetings allow us to openly communicate and plan, ensuring that everyone stays aligned. Additional meetings are scheduled throughout the week as needed to maintain steady progress and keep the project on track.

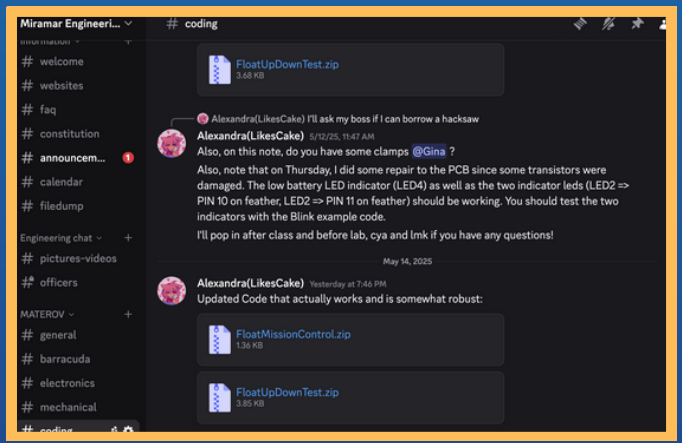
Meeting Documentation:
We document key points and progress during each meeting to keep absent members informed. These records include weekly goals and milestones for completing our ROV. Consistent documentation helps us stay organized and focused, promoting effective teamwork.

Team Website:
The Miramar Water Jets website serves as a central hub for information related to the MATE ROV competition. It provides easy access to tutorials and helps us stay organized. Without this tool, accessing essential information would be more difficult and time-consuming.

Discord:
Discord is our primary communication platform outside of meetings. It allows us to quickly share updates, brainstorm ideas, and follow up on tasks. This ongoing communication ensures everyone remains informed and supported throughout the project.

Division of Teams:
We structured our team into two main groups: Electrical and Mechanical. Within each group, smaller sub-team handle specific responsibilities such as control board, development, hydraulics, pneumatics, cameras, CAD modeling, tether construction, and propeller fabrication. This clear division of tasks improves efficiency and helps us meet deadlines effectively.

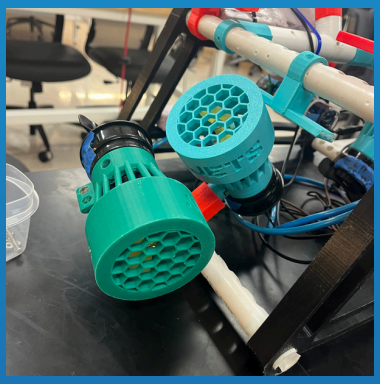




BUILD SCHEDULE

September 2024: Held workshops for new members and taught skills essential to the building of the ROV, such as waterproofing, soldering components, and tool safety.

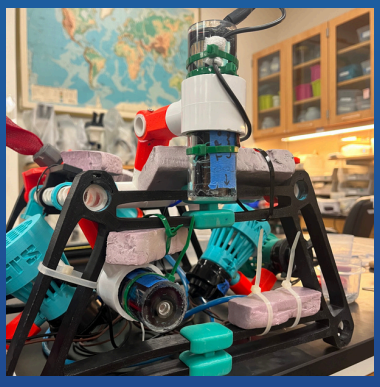
October 2024: Began planning the building process of the ROV by first splitting up company members into three teams: electrical, mechanical, and software, then dividing the tasks



November 2024 - December 2024: Began improvement process of Sleepy Fishy. Focused on resoldering loose components and strengthening any loose connections that have caused the ROV to not work in the past.

January 2025 - February 2025: After securing all loose components, we put our main focus on designing a new claw for Sleepy Fishy. In Sleepy Fishy 2.0, the new claw is designed to better grip onto objects underwater.

March 2025 - April 2025: Waterproofed new cameras with epoxy and attached them onto Sleepy Fishy 2.0. After the cameras were securely attached , we proceeded to pool testing



May 2025: Completed qualifying video for the Mate ROV Competition, then did more pool testing!

SAFETY RATIONALE

The top priority for Miramar Water Jets is safety. Since our meetings are held in a classroom laboratory, we have access to safety equipment, such as an emergency eye wash station, fume hoods, safety goggles, and fire extinguishers.

For tasks that required potentially hazardous equipment, we first received instruction and approval from our team leaders and mentor. Before working on the ROV, we held workshops on how to utilize the tools necessary in a safe and effective manner. This allowed company members to feel comfortable enough with the tools. To provide further safety precautions, company members worked in pairs during the building process of the ROV.

ELECTRICAL SAFETY

Any soldering was completed with magnifying glasses for precision, a soldering mat to prevent damage to lab equipment, fume hoods to prevent the inhalation of toxic fumes, and with the lab door open to promote air circulation.

MECHANICAL SAFETY

Any PVC cutting, drilling, or sanding was done with safety goggles for eye protection and a vice to secure the piece.

WATERPROOFING SAFETY

Any waterproofing completed with epoxy and acrylic was completed with safety goggles, gloves, and the lab door propped open to prevent physical contact with harmful substances.

SAFETY FEATURES

Control System: The control board is equipped with fuses (15A from power supply to control board) to protect from overloads, ensuring the safe operation of the electrical system.

Tether Management: The tether includes a strain relief system to prevent cable stress and potential damage during deployment and retrieval. All solder connections inside are waterproofed with Seal and Solder connections, and electrical tape. All wires are covered with wire abrasion protection.

Thruster Protection: The thrusters are fitted with IP-20 standard 3D-printed shrouds/guards to prevent injury and damage.

Pneumatic System: The pneumatic system features a shut-off valve and regulator and all pneumatic elements including the valve, air line, air hose fittings, and gripper are rated for a minimum pressure of two and a half (2.5) times the maximum supply pressure (40 psi)

Frame Design: The ROV's frame is designed with no sharp edges or protrusions to reduce the risk of injury during handling and operation.

SAFETY PROCEDURES

SET UP

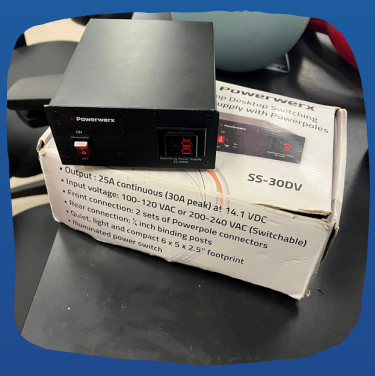
- Fill up air compressor and regulate to 40 psi
- Unroll the tether and detangle any knots
- Plug tether strain into control box
- Alert company members of ROV deployment to prevent them stepping on any wires
- Ensure that there exists no loose parts and all connections to the ROV are secure
- Ensure all electronic equipment/topside technology is far away from the water

ON DECK

- Connect control box to 12V power supply
- Before turning on power supply and control box, announce that power is being turned on to the company members
- Test both cameras and connection to monitor and computer
- Test thrusters and pneumatic gripper
- Upon release of ROV into the water, check for any air bubbles/leakage
- Before pilot begins moving the ROV, pilot calls out “3, 2, 1, start!”

POST RUN

- When taking out the ROV, announce to all company members
- Turn off 12V power supply and control box
- If driven in a saltwater pool, rinse off the ROV with freshwater to prevent wire corrosion
- Safely unplug tether from control box by gently wiggling around connection until loose
- Roll up tether neatly into cable reel
- Place topside tether and camera wires into waterproof bag
- Set ROV on surface away from water or any potential hazards to dry
- Clean up work area of all props, supplies, and trash



DESIGN RATIONALE PT. 1

Engineering Design Rationale

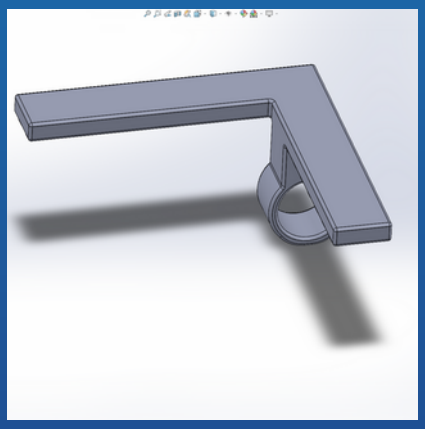
Since we decided to use the same ROV from last year's team, we poured our focus into making improvements and fixing issues. To improve functionality and reliability, we made the gripper rotatable, allowing it to approach tasks from optimal angles for better precision. We also installed new cameras to replace the previous ones, which had stopped working.

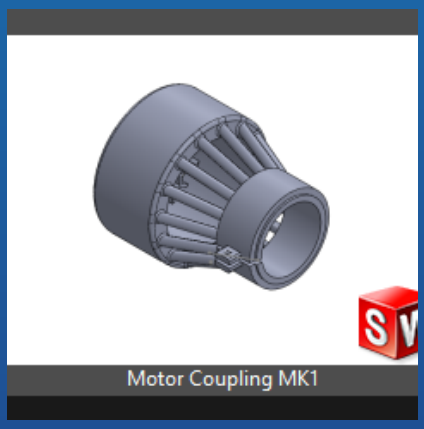
Innovation

Our innovation efforts focused on enhancing the gripper design and improving system reliability. We developed a rotatable gripper that allows for optimal positioning and more precise manipulation of objects underwater, significantly increasing task efficiency. To address previous issues with cord tangling and camera failures, we repositioned and added multiple tiers of strain relief, ensuring better protection of wiring and minimizing the risk of damage during operation.

Problem Solving

For Sleepy Fishy 2.0, we made modifications to the PCB in the control board and found that the black Anderson connector was not completely secure, causing connectivity issues. We remade the back plane and made sure to stick electrical tape on critical parts in order to prevent unintended contact. In addition, we moved the motor power cord to the side of the control box to reduce the chance of short circuits caused by wire movement or contact with other components. Additionally, we added hot glue to the back plane to prevent the camera connector and voltage pin from connecting and causing a short circuit.





DESIGN RATIONALE PT. 2

Vehicle Structure

For this year's competition, we are building upon the foundation of our previous ROV, Sleepy FIshy, which was designed with speed and weight reduction in mind. Last year, we optimized the frame using a trapezoidal shape to minimize ABS usage and reduce overall weight—key factors that allowed SF to move faster through the water. With strict size and weight constraints (under 1 meter and 25 kg), we aimed to keep the ROV as lightweight as possible, targeting around 2 kg. These core design decisions proved effective, and we have retained the same frame and structural approach for this year, while implementing further refinements and upgrades to improve performance and functionality.

Vehicle Systems

The main components of Sleepy Fishy 2.0 include two underwater video cameras, a pneumatic claw, and a temperature probe. These systems were strategically designed to support visual navigation, object manipulation, and environmental data collection. Camera #1 is front-facing and assists with piloting and claw operation, while Camera #2 is positioned for photogrammetry, enabling 3D modeling of underwater structures. The pneumatic gripper, custom-designed for versatility, allows for efficient item retrieval and placement. The integrated temperature probe enables us to measure water temperature at various depths—vital for calibration tasks. These systems allowed Sleepy Fishy 2.0 to successfully complete tasks such as retrieving submerged objects, deploying a SMART repeater and cable, and conducting temperature comparisons. By retaining these proven systems and optimizing their use, we are able to focus our improvements this year on enhancing precision, reliability, and control responsiveness.

Control/Electrical System

We continued using the core electrical setup from last year's ROV, SF, built around the SeaMATE Barracuda ROV kit and powered by a 30A Powerwerx supply. The control system manages power, camera feeds, and pilot interface, all housed in a Pelican case for quick deployment and protection.

This year, we made several key improvements to enhance reliability and task efficiency. We replaced the previous cameras with new, higher-quality models due to performance issues, and added multiple tiers of strain relief to prevent wire snagging—an issue that previously caused camera failure. We also upgraded the pneumatic gripper by making it rotatable, allowing for optimal alignment with objects during tasks and improving overall precision.

DESIGN RATIONALE PT. 3

Propulsion

Sleepy Fishy 2.0 uses four Johnson 500 GPH bilge pump motors from the SeaMATE kit, arranged in a vectored configuration for precise maneuverability and resistance to current. These motors are centrally mounted and secured using custom ABS fittings integrated into the frame.

Last year, we developed custom motor shrouds and guards—named Fins Version 4—to meet IP-20 safety standards while maximizing water flow. This year, we retained that design but refined the fit and assembly for improved durability and easier installation. Each guard features a honeycomb pattern under 12.5mm and shrouds that cover the propellers by 5mm on each side, securely fastened with a nut and bolt system. These enhancements ensure both safety and performance under competition conditions.

Buoyancy and Ballast

Sleepy Fishy 2.0 uses a modular and adjustable buoyancy system built with dense, closed-cell foam commonly used for wall insulation. This material was chosen for its ability to maintain consistent buoyancy at deeper depths, ensuring the ROV remains neutrally buoyant during tasks. The system allows for easy adjustment during pool testing to fine-tune balance and stability without compromising performance underwater.

Payload and Tools

Sleepy Fishy 2.0 is equipped with two cameras: one front-facing for piloting and precise gripper control, and a side-mounted camera dedicated to photogrammetry, capturing video for 3D image rendering. Both camera placements are optimized for task visibility and spatial awareness during operation.

For object manipulation, we use a pneumatic gripper rated to 135 psi. This system provides a strong, reliable gripping force for underwater tasks and is integrated with the front camera to support precise positioning and control.

Build vs. Buy, New vs. Used

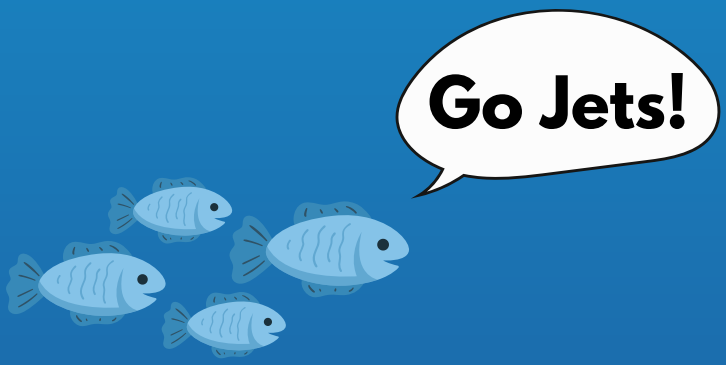
This year, we focused on targeted improvements while reusing reliable components from last year. We purchased new cameras to replace the previous ones, which were damaged due to wire snagging from insufficient strain relief. To enhance task efficiency, we built custom rotatable gripper claws, allowing for better alignment when grabbing components underwater, while continuing to use the proven pneumatic system from last year.

For the water sampling task, we purchased new, bigger syringes (100 ml) to collect a larger water sample to meet sample requirements. Additionally, existing PVC from last season was repurposed to construct practice props, allowing preparation for underwater tasks during testing and training.

CRITICAL ANALYSIS

Vehicle Testing Methodology

Before turning on the power supply and control board, we used a multimeter to test all connections. In addition, we tested the control board components using a multimeter as well. Tested motors on land, particularly our joysticks to check the potentiometer readings to see if it matched motor motion. Then, we tested the cameras. After buoyancy testing in water, we begin testing the ROV underwater.

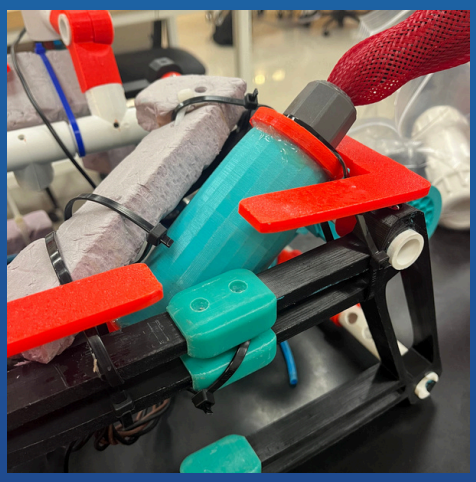


Use of Prototyping and Testing

We made multiple iterations of the gripper attachment system to address issues with rotation, connectivity, and durability. In addition, multiple iterations of the gripper claws were made in order to address the same issues. We also tested different strain relief configurations to address safety and balance.

Troubleshooting Strategies and Techniques

For issues with circuits, we used a multimeter while the 12V power supply was both turned on and off to check for proper connection and to ensure voltage drops were between 0-5V for the joysticks and between 0-12V for the rest of the ROV. Occasionally, we had to resolder to stabilize connections. For buoyancy, we tinkered with foam until ROV was neutrally buoyant, making it easier to navigate underwater.



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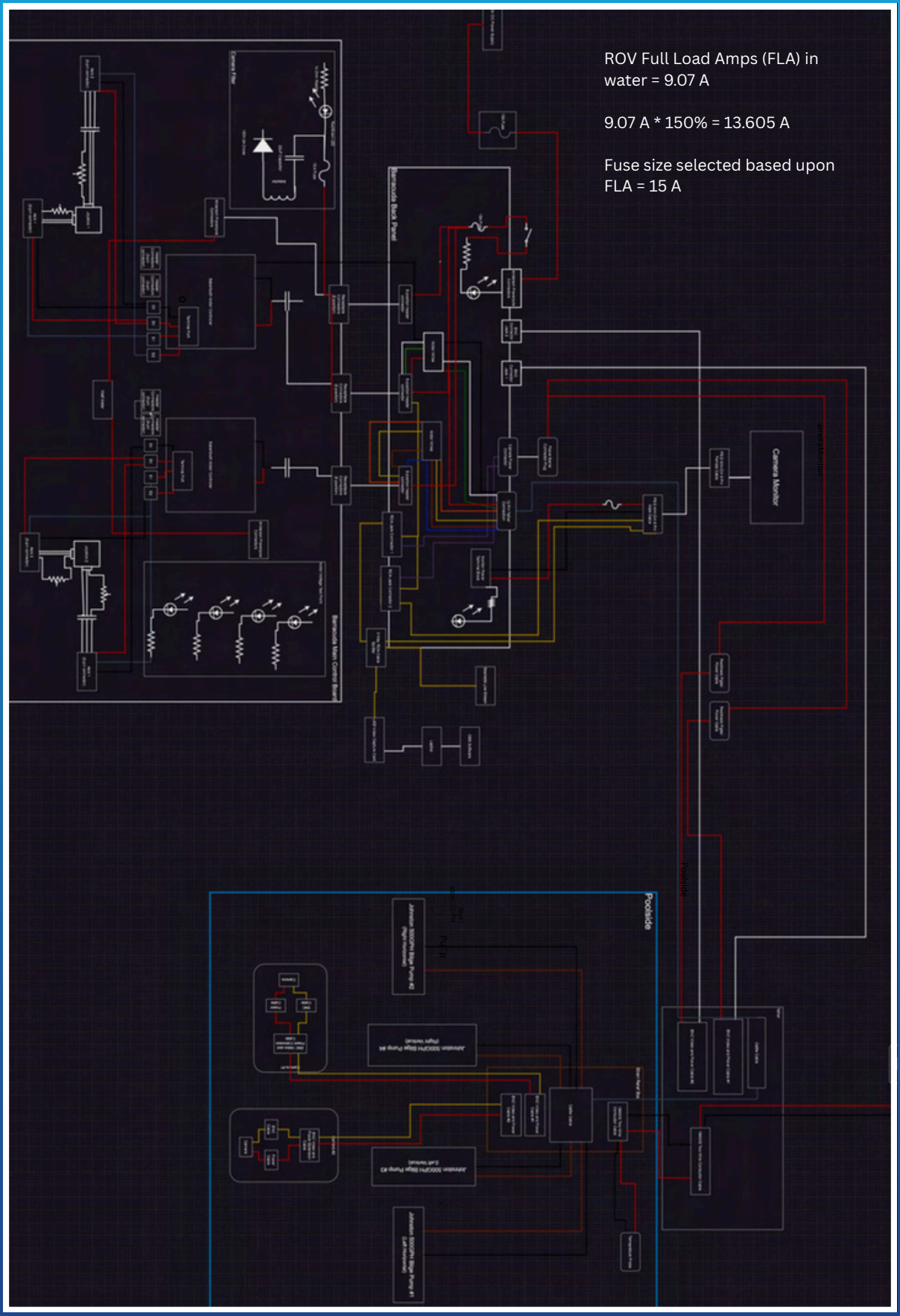
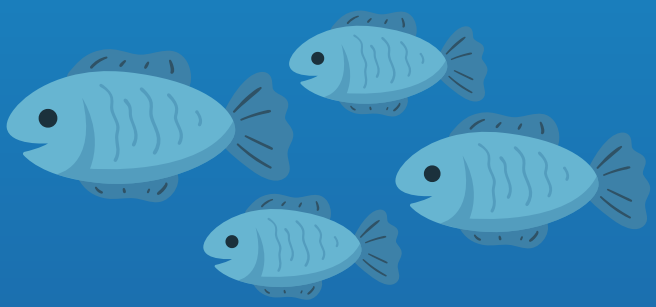

ROV Full Load Amps (FLA) in water = 9.07 A
9.07 A * 150% = 13.605 A
Fuse size selected based upon FLA = 15 A
Barracuda Main Control Board
Barracuda Back Panel
Camera Monitor
Poolside

BUDGET AND COST

BUDGET

Each semester, the engineering club, along with other Miramar clubs, get an allowance of $150. To request more, we provide an itemized budget list to the Associated Student Government (ASG), to have it be voted on. Before the list goes to ASG, we as a club vote on what items to purchase, as shown in the documents to the right. As a result, we had a flexible budget to accommodate what was needed at the time.



Miramar College Engineering Club

Meeting Official Agenda
03/28/25
1:00 pm - 5:00 pm
S6-205

Meeting start time: 1:00 pm
Attendance: 10
Advisors(s) Present (y/n): Yes

Announcements:

- Next Meeting, vote to buy a trifold for poster
- Next Meeting, group photo

Discussion:

- New roles were decided:
  Mechanical Lead- Minh
  Electrical Lead- Alexandra
  Programming Lead- AD
  Outreach Manager-Jasmin
  Secretary-Britney, Rashad

Action Items:

- Vote to purchase: 2 camera kits, 2 cables, acrylic cement, some nuts, camera potting kit, and JB weld.
  Total: $151.36
  - Yes - 10
  - No - 0
- Vote to purchase a second camera, cables for Eagle Ray, and other supplies
  Total: $46.02
  - Yes - 10
  - No - 0

Miramar College Engineering Club

Meeting Official Agenda
04/18/25
1:30 pm - 5:00 pm
S6-205

Meeting start time: 1:30 pm
Attendance: 9
Advisors(s) Present (y/n): Yes

Announcements:

- We tested the barracuda in the pool

Discussion:

- The cameras had fuzzy lines when the motors were moving. We are working on fixing it.
- The claw works fine and the motors works fine

Action Items:

- The club voted to purchase $101.43 of water sampling supplies for the ROV

Meeting End Time: 5:00 pm

COST

Provided below is a summary of the year in terms of costs and expenses. Since we mainly made improvements to last year's ROV, Sleepy Fishy, most of the budget went into replacement parts. However, we were able to significantly minimize the expenses by using existing supplies from last year.

Engineering club Expense Report Spring 2025

Type	Date	Num	Name	Memo	Account	Class	Clr	Split	Amount	Balance
Check	05/05/2025	4110	Regina Bochicchio	2 Camera's & Supplies Spring 2025	28059 · Engineering Club			10100 · Associated Students Checking	-196.84	-196.84
Check	05/05/2025	4110	Regina Bochicchio	Water Supplies ROV Srping 2025	28059 · Engineering Club			10100 · Associated Students Checking	-101.43	-298.27
Check	03/20/2025	4098	Regina Bochicchio	Engineering Club Supplies	28059 · Engineering Club			10100 · Associated Students Checking	-20.56	-318.83
Check	03/20/2025	4098	Regina Bochicchio	Engineering Club Supplies	28059 · Engineering Club			10100 · Associated Students Checking	-45.92	-364.75
General Journal	03/20/2025	Club Fund		Funds Given to Engineering Club	28059 · Engineering Club			65615 · Club Suppport	500.00	135.25
Total									**135.25**	**0.00**

ACKNOWLEDGEMENTS

The team would like to acknowledge Gina Bochicchio, our mentor, who has been extremely helpful in the building process of the ROV.

We also want to thank the following institutions for their generous support: Cal Coast Credit Union, Math Engineering Science Achievement (MESA) Program, Miramar College Associated Student Government (ASG), and the School of Math Biology Exercise Physical Sciences (MBEPS).

REFERENCES

MATE ROV Competition. (n.d.). 2025 Competition Manual Pioneer Class. https://20693798.fs1.hubspotusercontentna1.net/hubfs/20693798/2025%20EXPLORER%20Manual_withCover_11_27.pdf

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