Aquabot Technicians

TR4-Stingray

Foy.H Moody High School

Corpus Christi , Texas, United States

Technical Documentation - Mate ROV Competition 2024

Company: 2023-2024 Aquabot Technicians

Albert Mendoza: Buoyancy Engine Specialist & CEO Class of 2025

Deiondra Washington: CSO, CNC Specialist, & Software Engineer Class of 2024

Christian Estrada: Pilot Class of 2025

Jonah Morales: Design Engineer Class of 2025

Emery Johnson: CFO & Technical Documentation Specialist Class of 2025

Zane Hosey: Electrical Engineer Class of 2026

Enyan Perales: Chief Electrical Engineer Class of 2025

Exavier Rodarte: Chief Design Engineer Class of 2025

Alan Castaneda : SOO & Buoyancy Engine Specialist assistant Class of 2025

Audree Alvarado: Technical Documentation Specialist Class of 2025

Layla Chapa: Corporate Responsibility Officer Class of 2025

Jonathan Larado : Electrical engineer Class of 2026

Lorenzo Corpus : Prop Specialist Class of 2025

Erin Gallegos : Safety Officer Class of 2025

Veronica Hernandez: Staff Support Specialist Class of 2026

Chris Sosa : Tether Specialist

Mentors

Mario Bayarena

Kisha Charles

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Abstract

Aquabot Technicians is a 16-member company for the 2024 MATE Competition from Corpus Christi, Texas. Aquabot Technicians is an intellectual class that is a well-structured platform that encourages scholarly engagement. It provides an environment for students to explore diverse ideas, engage in thoughtful debates, and cultivate analytical thinking, as well as to learn the engineering design process. It's designed to stimulate intellectual curiosity, promote leadership, and foster academic growth. It's essentially an environment of scholarly dialogue within the educational institution of our Citgo Innovation Engineering Academy, that allows students the opportunity to become future STEM scholars.

This year our team was tasked to construct and design a Remotely Operated Vehicle (ROV), the TR4-Stingray. The TR4-Stingray is small, lightweight, and durable, capable of completing tasks proposed within the Marine Advanced Technology Education (MATE) consisting of TASK 1: OOI: Coastal Pioneer Array (Relocating ocean observing assets to "answer pressing science questions and gather data) , TASK 2 : SMART Cables for Ocean Observing, and TASK 3 : From the Red Sea to Tennessee (Understanding ecosystems and saving species). Our TR4-Stingray is beyond qualified to complete these tasks presented to us. It has 6 new and efficient T-200 thrusters, a lexan plastic frame good for gliding easily through the water, a digital camera, and the Aquabot Technician blood, heart and soul in our ROV.

Figure 1 Team picture taken by Aaron Preston

Team Profiles

Figure 2 Albert Mendoza Taken By Emery Johnson

CEO -Albert Mendoza is a 17-year old junior at Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank of 2 and a GPA of 4.6. Mendoza has he role of CEO,which requires him to look after his employees and be a good representation of the work ethics of our company. Albert is also our Buoyancy Engine specialist and plans to major in Aerospace Engineering at the University of Texas in Austin.

Figure 3 Alan Castaneda taken by Emery Johnson

Buoyancy Engine Assistant Specialist - Alan Castanda is 17- year old junior Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank 8 and a GPA of 4.2. Alan is the Buoyancy Engine specialist and CTO of the Aquabot Technicians. Alan is a 2nd year underwater robotics student, he wants to major in mechanical engineering at University of Houston.

Technical Documentation - Audree Alvardo is a 17 year old junior at Foy H Moody High school and is part of the Citgo Innovation Academy with a rank 27 and GPA of 4.0. Audree is our Technical Documentation employee Audree is a 2nd year underwater robotics student and plans to major in architectural engineering at A&M Kingsville.

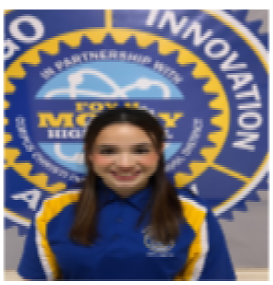

Figure 4 Audree Alvarado taken by Emery Johnson

Figure 5 Emery Johnson taken by Audree Alvarado

CFO- Emery Johnson is a 17 year old junior at Foy.H Moody High School and is part of the Citgo Innovation Academy with a rank 13 and a GPA of 4.2. Emery is the Chief Financial Officer but also helps with the Technical Documentation. Emery is a 2nd year employee for the Aquabot Technicians. She plans to continue this pathway into Texas A&M Galveston, majoring in Marine Engineering Technology.

Figure 6 Erin Gallegos taken by Emery Johnson

Safety Specialist - Erin Gallegos is a 16 year old junior at Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank 37 and a GPA of 3.9. Erin is the heart of the team making sure everyone is safe and doing what they are told.. She is a 1st year underwater robotics student and plans to major in Nuclear Engineering at Texas A&M University.

Figure 7 Christian Estrada taken by Emery Johnson

Pilot - Christian Estrada is a 17-year old junior at Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank of 48 and a GPA of 3.8 Christian aka (Twinkle Fingers) is the pilot of the Aquabot Technicians. He is a 3rd year Underwater Robotics student, Christian plans to major in marine biology at Texas A&M University.

Figure 8 Zane Hosey taken by Emery Johnson

Electrical Engineer - Zane Hosey is a 16 year old sophomore at Foy H Moody High School and is part of the Citgo Innovation Academy with a rank of 4 and a GPA 4.2 . Zane is the Electrical Engineer of Aquabot Technician . He is a 1st year in Underwater Robotics . Zane wants to major in Civil engineering at A&M Kingsville.

Figure 9 Christopher Sosa taken by Emery Johnson

Tether Specialist - Chris Sosa is 17 years old in the Senior class at Foy H. Moody High School, part of the Citgo Innovation Academy ranked 30 out of his class with a GPA of 3.9. Chris is the Tether Specialist of the Aquabot Technician. He is a 2nd year member in Underwater Robotics**.** Chris wants to major in Marine Biology at Texas A&M Corpus Christi.

Figure 10 Layla Chapa taken by Emery Johnson

Social / Safety Officer- Layla Chapa is 17 years old and a junior at Foy H. Moody High School and part of the Citgo Innovation Academy with a rank of 47 and a GPA of 3.8. Layla is a social officer also known for the corporation responsibilities and helps out our safety specialist Erin Gallegos, Layla is a 3rd year Underwater Robotics student and plans on becoming an Environmental Health and Safety officer at Eastern Kentucky University.

Figure 11 Deiondra Washington taken by Emery Johnson

Deiondra Washington- CSO & Software Specialist - Deiondra Washington is a 18-year old senior with Foy H. Moody High School and part of the Citgo Innovation Academy with a rank of 45 and a GPA of 3.8. Washington operates our shopbot and works without electrical engineers. Washington is a 2nd year employee and plans to countice in his pathway of Mechanical Engineering at Tamcc

Figure 12 Exavier Rodarte taken by Emery Johnson

Prop Specialist - Exavier Rodarte is a 17 year old junior at Foy H Moody High School and is part of the Citgo Innovation Academy with a rank of 10 and a GPA of 4.1 Exavier is our Prop Specialist, a 2nd year employee Exavier plans to major in Industrial Engineering at Texas A&M University.

Figure 13 Enyan Perales taken by Emery Johnson

Electrical Engineer - Enyan Perales is a 16 year old junior at Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank of 6 and GPA 4.4. Enyan is an electrical engineer for the Aquabot Technicians and a 2nd year Underwater Robotics student. Enyan wants to major in Subsea Engineering at Texas A&M University.

Figure 14 Jonah Morales taken by Emery Johnson

Design Engineer- Jonah Morales is a 16 year old junior at Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank 7 and a GPA 4.4. Jonah is the idea behind our ROV, his creativity brought to life TR4-Stingray. Jonah is a 2nd year underwater robotics student, he plans to major in environmental engineering at University of Texas in Austin

Figure 15 Jonathan Loredo taken by Emery Johnson

Electrical Engineer- Jonathan Loredo is a 15 year old sophomore at Foy H. Moody High School and is part of the Citgo Innovation Academy with a rank of 2 and a GPA of 4.2. Jonathan is the electrical engineer of Aquabot Technicians and is a 1st year in Underwater Robotics. He plans to major in Electrical engineering in Texas A&M Corpus Christi.

Figure 16 Lorenzo Corpus taken by Emery Johnson

Prop Specialist - Lorenzo Corpus A 16 year old junior at Foy H. Moody High School Who is a part of the Citgo Innovation Academy With a rank of 156 and a 2.8 GPA . Lorenzo is a 1st year employee for the Aquabot Technicians. Lorenzo plans to go to attend Texas A&M Kingsville and take Mechanical Engineering,

Figure 17 Ronica Hernandez taken by Emery Johnson

Staff Support Specialist - Ronica Hernandez is a 16 year old sophomore at Foy H. Moody High School Who is apart of the Citgo Innovation Academy With a rank of 276 and a GPA of 2.3 . Ronica is a 1st year employee for the Aquabot technician and plans to go the Texas A&M Kingsville to major in Architectural Engineering

Project Management

Company Overview : The Aquabot Technicians is a company run by high school students with the goal of transforming the Global Ocean Observing System to protect and restore ecosystems and biodiversity.

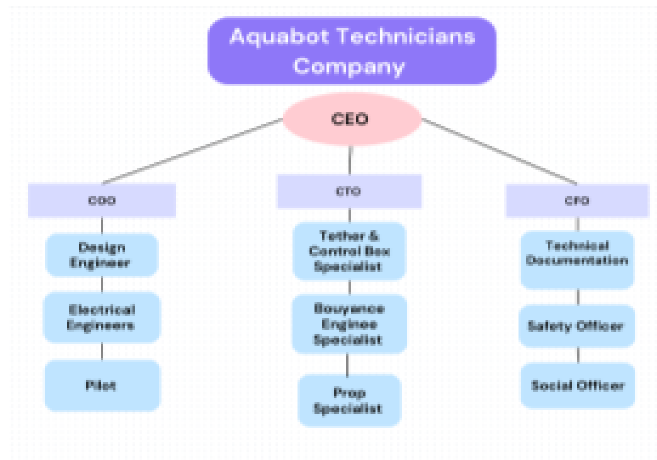

Figure 18 Company Flow Chart

Build Planning & Scheduling : This year our biggest challenge was planning our scheduling of our building time, with each student being very busy and having other commitments we really had to put our heads together and brainstormed. Some things we had to put into consideration were that we had to meet at least twice a week not including class time. Almost every one of our students is involved in sports and extracurriculars so we came up with a schedule where we meet two times a week for one and a half hours. Groupchats were made and messages were getting sent out via Band App, email, or iMessages and members were required to actively communicate.

Figure 19 Company Scheduling Chart

Challenges : As a company we face many new challenges everyday, but one of our biggest challenges was company sustainability. As a company we plan to keep it going through many generations, but in order to do so we need to come up with a plan asap. The previous year we had taken interns but not as many as we would have liked. This year we decided to take 4 girls and 4 boys on our regional trip, helping them learn about our company and what we do, encouraging them to join the class and the club to continue our legacy.

Team Protocols and procedures: Throughout the years the Aquabot Technicians have developed a protocol for problem solving called the 15 minute rule. When a problem occurs the person will brainstorm for 15 minutes and if the problem is not solved they will ask other people. This has helped increase our problem solving skills immensely, and helped us increase our time to meet our everyday mission objectives.

Design Rational

Overall Vehicle Design & Systems Approach : When our team first began production of our ROV in fall of 2023, the 2024 MATE ROV Ranger Competition Manual had not been released. However, we knew we needed a huge improvement in design based on results in the previous 2023 competition. We looked to our predecessors' designs for inspiration as well as brainstorming everyday and planned to adjust once we knew the constraints set by the manual. We set out to create a frame design which improved upon the design of TR4-Stingray. We created several cardboard prototype designs. The ROV will be designed to operate efficiently in aquatic environments, capable of maneuvering in various directions with precision and stability. The addition of a claw enables it to perform tasks such as object retrieval, manipulation, and sample collection.

Figure 20 Prototype of the TR4-Stingray

Innovation: The Aquabot Technicians places a strong emphasis on innovation. The team defines innovation as a relentless pursuit of incremental modifications that enhance functionality while driving down costs. In order to keep costs low the team created a shop inventory system that would help sort out items that we already had or can make, this helped cut down on our cost effectively. In addition this system increased our functionality as a team allowing for better organization. As well as increase our productivity the team created a new innovative frame, the team engineered it to allow for better airflow and greater maneuverability.

Problem Solving / Design Evolution : Aquabot Technicians, second-generation ROV, features design improvements and innovations from prior generations, which were further refined throughout the season. Valuable insights from the prior year, Aquabot Technicians ’ design philosophy emphasizes iteration, with employees conducting numerous design reviews and producing multiple iterations of tools and main ROV components , resulting in a highly robust and specialized ROV. Through ongoing identification of areas for enhancement, TR4-Stingray’s design underwent continuous refinement, adapting its camera, frame, and tool configurations

Figure 21 Picture of the TR4-Stingray

Mechanical Design and Fabrication : The ROV’s body will be streamlined and durable, constructed from lightweight yet robust materials such as Lexan Plastic to withstand underwater pressure. It should also incorporate watertight seals to protect internal components. This was done by creating a Carve, a program which programs cutting paths for CNC machines. Our plan was to transfer the V-Carve file to our CNC machine, the ShopBot, and then create a prototype using plywood. However, this plan proved to be very difficult, as the ShopBot was at first very hard for us to navigate. Our company was fairly new to operaterating the ShopBot. The manual which we had for the ShopBot was not even connected to the model which we owned, and so we had to learn via the internet and a process of trial and error. After we had effectively learned how to use the ShopBot we had successfully accomplished building the TR4-Stingray frame.

Camera: Using a backup camera from a vehicle onto an underwater robot offers enhanced navigation in murky and dark underwater environments. It's also officiant because it only takes up to 1 to 5 volts which is crucial because we need to minimize the amount of power distributed in the robot so we manage the power along with the thrusters and claws. With its

Figure 22 Low Light HD USB Camera

high-resolution imaging , the camera provides real-time clarity, improving situational awareness for safer maneuvering and obstacle avoidance. Getting this leverage of this existing technology, this combination is cost effective and streamlines development, enhancing the robots functionality for underwater exploration and expectation tasks show in

Electronic Enclosure : We used a Blue Robotics ROV Watertight Enclosure (4" Series) and Blue RoboticsElectronics Tray (4" Series) to hold all the wiring for our thrusters, claw, and cameras.The size of the electronics tray increased this year because of our utilization of the Fathom X and Pixhawk. We fit the power, ground, and thruster wires through the back holes of the capsule into a 12-meter tether. The team then filled the back holes of the capsule with a 24-hour cure epoxy to guarantee maximum security against water. The clear capsule allows us to easily observe any problems with the wiring inside and to detect any leaks.

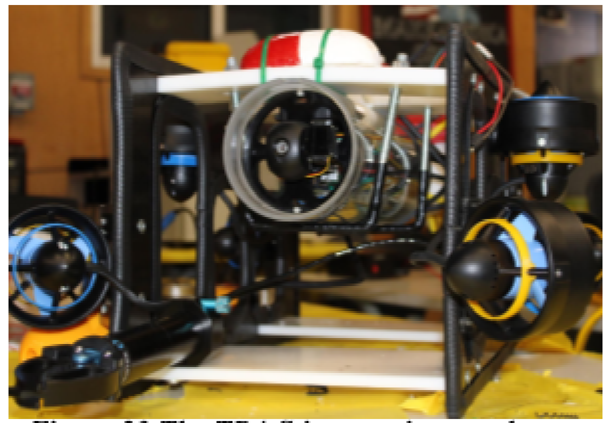

Figure 23 The TR4-Stingray picture taken by Christian Estrada

Figure 24 Tether being measured

Tether: The tether connects the control box to our ROV. The tether is a plastic threaded sheathing concealing our cables. The tether contains 3 cables. The 3 cables are color coded Black, Yellow, and Gray. Black supplies power to the ROV using 2 wires: a red, power, and black, ground. The Yellow cable is a 4 conductor 14 gauge cable for digital signal, feeding to our fathom x, pixhawk, raspberry pi, 6 thrusters, and digital camera. While the Gray supplies power to our payload.

Buoyancy & Ballast : With buoyancy and ballast being the hardest task, incorporating buoyancy and ballast considerations into the design of a six thruster underwater robot made from lexan plastic is crucial for achieving optimal performance and stability. lexan plastic, known for its lightweight and buoyant properties, offers inherent buoyancy, which can be increased with strategically placed buoyancy modules or chambers within the robot's structure to ensure proper buoyancy control. Additionally, integrating ballast mechanisms, such as adjustable weights or water tanks, allows for precise adjustment of the robot's buoyancy to achieve neutral buoyancy or desired diving and surfacing capabilities. By carefully balancing buoyancy and ballast, this underwater robot can effectively navigate various depths, maintain stability, and execute tasks with efficiency and precision in aquatic environments.

Figure 25 CEO & SOO working on Vertical Float

PayLoad:

Our payload engages the probiotics irrigation system which at scheduled intervals administers probiotics to corals.

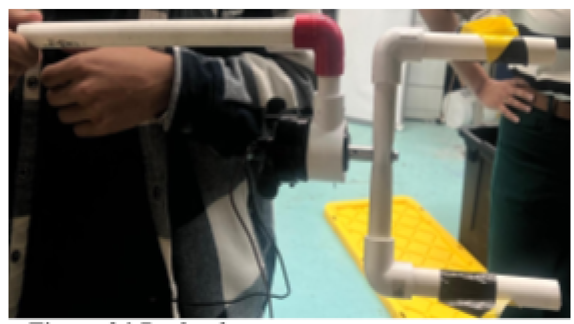

Figure 26 Payload

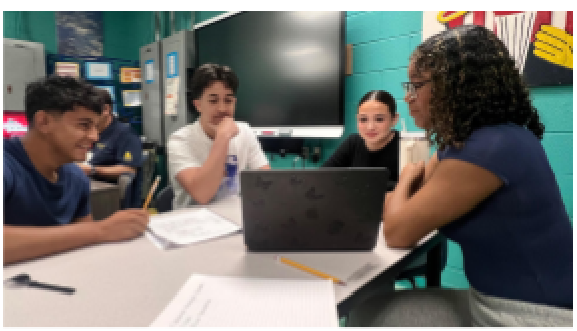

Figure 27 Employee's discussion on building vs. buying

Build Vs. Buy, New Vs Used: Aquabot Technicians ROV Team operates as efficiently and as organized as possible, which includes *Buy vs. Build* and *New vs. Used* decisions, following a distinct process. If we can build it based on the materials, tools and skills we have, we typically build it, as Aquabot Technicians first preference is always to custom build to meet specific customer's needs. We make these collaborative decisions by having discussions and analysis, and the team evaluates the long term implications of each option, examining aspects like cost-effectiveness, scalability, and customization.

Software and Electronics

Command & Control : The TR4-Stingray has an a Watertight enclosure which contains all of the electronic components: PixHawk, Fathom X, Raspberry Pi, Digital Newton Subsea Gripper and Servo, Digital Claw, and 6 ESC's connected to the six Thrusters. The way our ROV is wired is that we have power coming in through one cable which then inside the capsule splits into two wires, positive and negative which goes into a DC/DC converter which then goes into the two 12V Junction Block, one for the positive wire and one for the negative wire. These two junction boxes provide power to the whole ROV, components like our Raspberry Pi, Fathom X, and Digital Newton Subsea Gripper. Raspberry Pi is powered by the 12V junction blocks and Fathom X, the PixHawk and Digital Camera all plug into the Raspberry Pi. Next, the tilt servo is plugged into the Pixhawk to be able to control the camera up and down from the controller in the pilot's hand. Also going into the PixHawk are the 6 ESC's, 1 for each thruster;the ECS's are connected to the six thrusters through terminal blocks. All of these things are what makes our ROV perform the tasks that we are asked to do.

SID : TR-4 Stingray

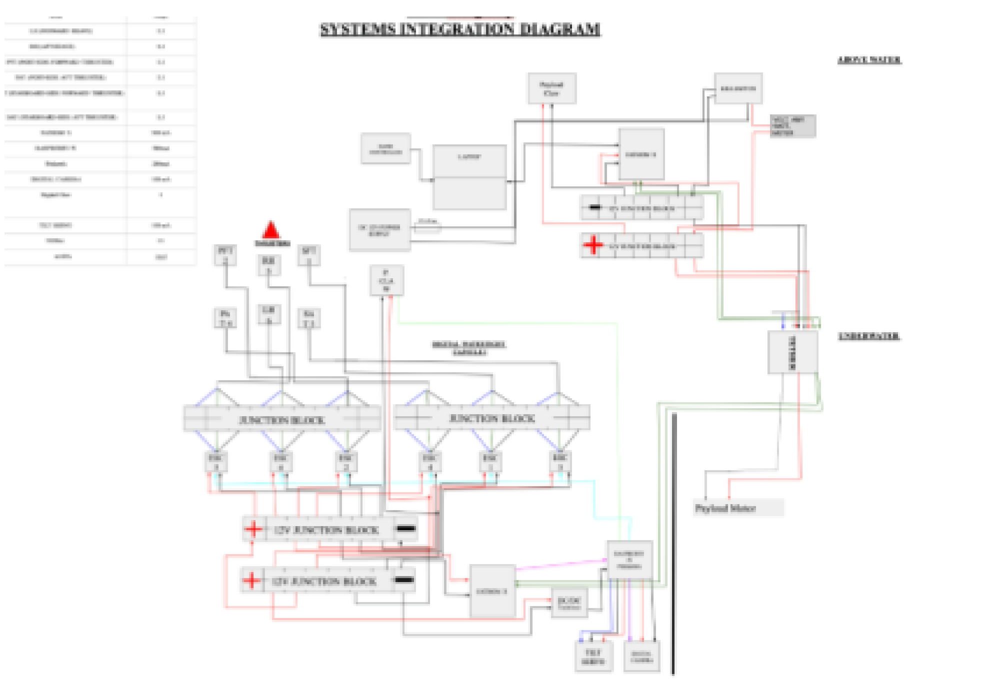

Figure 28 SID of TR-4 Stingray

SID Of Vertical Profiling Float

Amperage calculations	
Load	Amps
Motor	3.5 Amp
Timer relay	300 mA
Pressure depth sensor	1.25 mA
arduino	500 mA
Total amperage	4.31 Amps

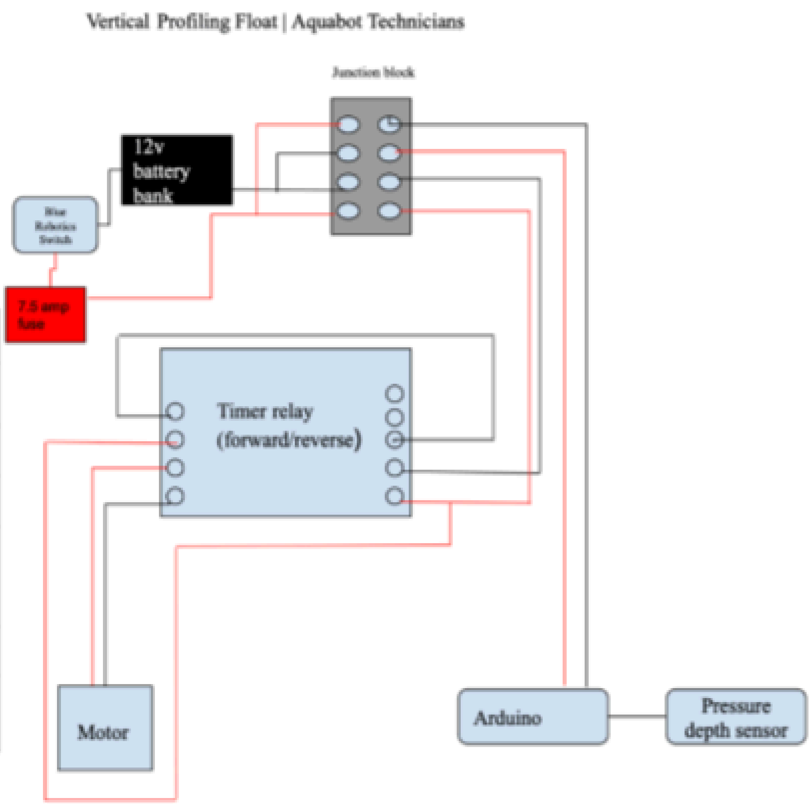

Figure 27 Vertical Profiling Float

OSUG: Open System Underwater Glider

In addition to the TR4-Stingray, our company created an underwater glider that will complete vertical profiles and transmit data back to mission control. The teams came to an agreement to name the vertical float (OSUG). The (Open System Underwater Glider) in figure 30 demonstrates the compartments of the float. These two compartments consist of the motor as well as the watertight electrical enclosure that holds all our devices that run the float. The main idea of the vertical float is to simulate a real world task that consists of measuring information such as temperature, pressure, salinity of water, as well as depth data. In order to accomplish this, the vertical float must complete two vertical profiles. The way the float operates is through communication between a forward/reverse timer relay and motor. Our timer relay is set to operate for 25 seconds descending to the bottom of the pool, stop for 5 seconds and then ascend for 25 seconds until the float reaches the top of the pool. During this process our float will communicate to our mission station through a raspberry pi and a sensor collecting data about pressure, temperature and depth information during the descent of the float and then release that data to the mission station to process.

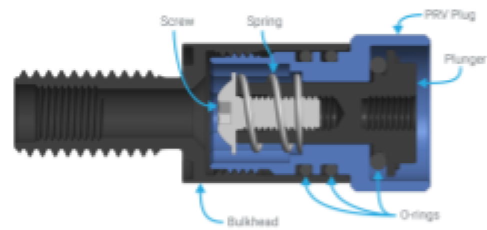

Figure 29 Pressure Relief Valve

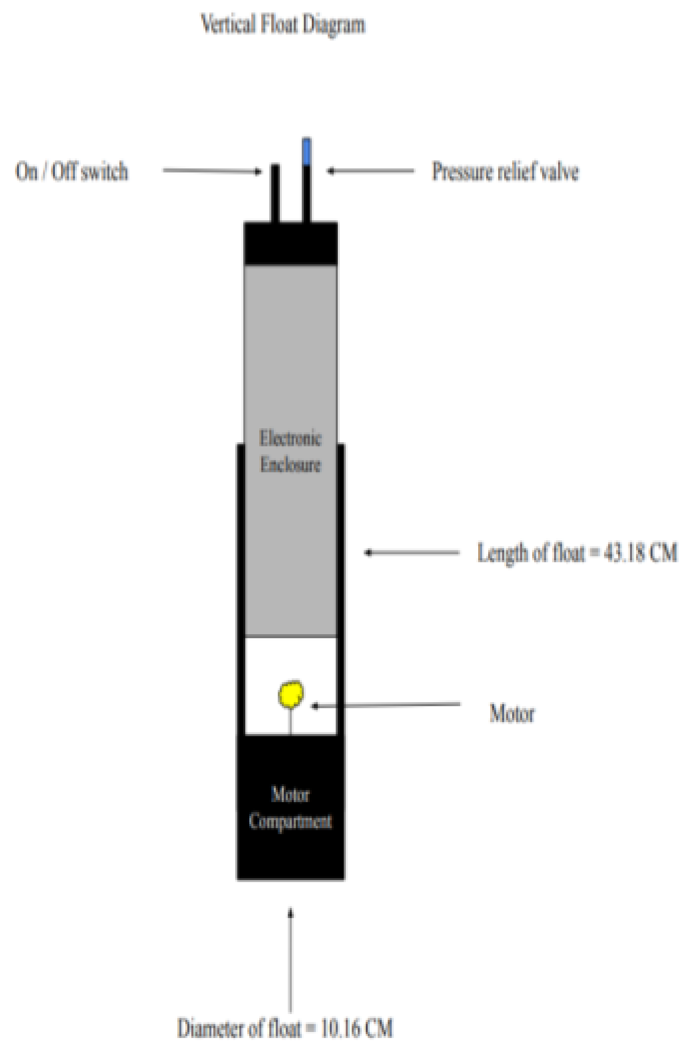

Figure 30 Vertical Float

Adjustments

Our experience at our regional competition helped us realize that we had to make several changes to our ROV if we were to be successful. In task 2 the (Restoration Of The Coral Reef) the SB10 Sea Beam Laser was chosen because of its small size, easy attachment, waterproof nature, DC power, and brightness. to assist us in giving measurements.

The set includes two propelling lasers which may be used to measure set distances.

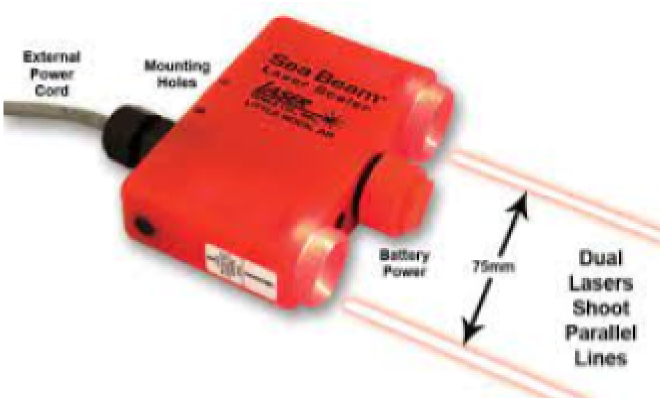

***Figure 31*: Sea Beam laser**
Source: Lasertoolsco.com

Safety

While creating the TR4-Stingray ROV, Aquabot Technicians made safety our top priority. Our safety philosophy is “ Safety doesn’t come first, it comes always”. What we do to ensure the safety of our employees is we require them to take a safety test before they are even allowed to step into our shop. We designed the ROV to make it as safe as possible for the environment. How we did this was by having no sharp edges on the ROV and having caution tape the thrusters. When cutting materials, employees always made sure they had safety goggles on and hair up/out of their face. While using shop tools our employees understand how to handle and function the tools with care and know the proper safety precautions they need before using the tools. Here at Moody High School , Aquabot

Figure 32 ShopBot Prepping Taken by Layla Chapa

Technicians have a set of safety rules that are taken seriously and are strictly enforced by our Chief Safety Officer, Erin Gallegos.

Safety Features

Lab Safety	● Hair must be up and out of face ● No Jewelry ● No Baggy/Open Clothing ● Closed-toed shoes ● No Horse Playing ● Safety Goggles and / or safety gloves when needed

ROV Safety	● All sharp edges filed down ● The Lexan frame is surrounded with rubber on the edges to round the sharp edges. ● The thrusters and claws have hazard tape to discourage people from placing their hands near them. ● The thrusters have plastic shrouds above and below them to avoid any harm or injuries to marine life. ● All wires and the control system are labeled

Safety Procedures

Constructions:

- Go over the propper plan with all the employees to ensure everyone is one task
-
- While everyone is working, the safety officer goes around making sure everyone is following proper safety protocols
- When everyone is finished they make sure to unplug tools and put them back and clean whatever mess they made
- When completing each task and an employee is have trouble to prevent mistakes they are you get a second opinion is presented if needed

Critical Analysis

Vehicle Testing & Troubleshooting :

Throughout the building process of the TR4 Stingray, there were several issues that had to be fixed. At first, there was trouble with mounting the thrusters. This year, the thrusters would be placed in a 45 degree angle on the outside of the frame. This required there to be special thruster mounts that had to be created from scratch. There were several different versions of the thruster mount before we settled on the final version which is present on the robot. The final mount allows the thrusters to easily be removed and create a solid efficient mount.

Figure 33 Employee's seen working on watertight enclosure in TR4-Stingray

The next issue that occurred was connection. Once the robot was completely assembled, we began testing it. Everytime the robot went over 13 amps, the connection became unstable and would frequently disconnect. This would mainly occur when the claw would open and close which was believed to be due to the excessive draw of power. Since the claw was analog, the open/close switch went through the capsule and wired into the control box on deck, it caused the connection to become weak. To resolve this, we added a new digital claw that would take less power to open and close and was significantly faster.

The final issue was the camera. This issue was one of the more simple fixes. Throughout the year, our camera would lose connection at random times but the servo was still connected. This meant that the issue was between the camera and the Pixhawk. We decided to switch out cameras and clean out the connection on the Pixhawk which fixed our problem.

Accounting

Spending: We follow a procedure to purchase materials. First, we research on the internet. We put the chosen parts into a form on Google Sheets. The order form gets sent to our Director for approval and ordering. We maintain a spreadsheet to record everything purchased. Using this spreadsheet, we are organized in our purchasing method and can easily keep track of our parts and spending.

Budget :

Income:				**Amount**
Citgo				$3,000.00
MTS				$2,400.00
Corpus Christi Indepedent School District				$2,500.00
Student Dues				$1,600.00
Exspenses:				
Catagory	**Type**	**Description/Examples**	**Projected Cost**	**Budgeted Value**
Electronics	Purchased	Hp laptop	60$	$60.00
Electronics	Purchased	Power Switch	5$	$5
Electronics	Purchased	120 RPM 12 Volt DC Motor	$12.67	$13.00
Electronics	Purchased	Digital Camera Servo	$64.00	$64.00
Electronics	Purchased	SOS Leak Sensor	$32.00	$32.00
Electronics	Purchased	Thruster Commander	60	$60.00
Electronics	Purchased	Dc/DC Converter	$11.99	$12.00
Electronics	Purchased	Timer Module DC	$19.35	$19.50
Electronics	Re-Used	Logitech Hand Controller	$0.00	-
Electronics	Re-Used	Phathom X	$0.00	-
Electronics	Re-Used	Low-Light HD USB Camera	$0.00	-
Electronics	Re-Used	Gripper Claw	$0.00	-
Electronics	Re-Used	Digital Camera	$0.00	-
Electronics	Re-Used	ESC(6)	$0.00	-
Electronics	Purchased	T200 Thurster x 6	$833.94	$850.00
Material	Donated	Lexan Sheet	$0.00	-
Material	Donated	Camera Enclousure	$0.00	-
Material	Purchased	Power wire	$40.24	$40.50
Material	Purchased	Tether	$30.24	$30.24
Material	Purchased	Control Box	$41.56	$42.00
Material	Purchased	4" Acrylic Tube	$90.00	$90.00
Material	Purchased	Penetrating Bolts	$31.75	$31.75
Material	Purchased	Nuts/Bolts/Screws	$41.69	$42.00
Material	Purchased	Electronic Tray Terminal	$45.00	$45.00
Material	Purchased	Wet Link Penetrator	$95.00	$95.00
Material	Purchased	Gutter Guard	$7.17	$7.00
Material	Purchased	Seal Wire Connections	$39.99	$40.00
Material	Purchased	M10 Encoulsure event	$20.00	$20.00
Material	Purchased	Double A Batteries	$18.10	$20.00
Hardware	Purchased	SD Micro Card	$8.94	$10.00
Hardware	Purchased	Electronic Tray	$55.00	$55.00
Hardware	Purchased	Waterproof NPT Cable Glad	$17.30	$18.00
Hardware	Re-Used	Power supply	$0.00	-
Travel and Meal	Purchased	Hotel and food	$5,000.00	$3,500.00
			Total Income	$9,500.00
			Total Expenses	$6,615.00
			Income Leftove	$2,885.00

Figure 34 Budget By Audree Alvarado

Projected Costs : Re-Used Items

Projected Costs (Reused Items)

Name	Manager	Department
Emery Johnson	Albert Mendoza	Finaces
School Name	Foy. H Moody High School	
Instructor	Mario Bayarena	

Type	Category	Description	Amount
Electronics	Re-Used	Phathom X	$196.00
Electronics	Re-Used	Low-Light HD USB Camera	$99.00
Electronics	Re-Used	Gripper Claw	$219.00
Electronics	Re-Used	Digital Camera	$19.99
Electronics	Re-Used	ESC(6)	$216.00
Hardware	Re-Used	Power supply	$68.99
Electronics	Re-Used	Logitech Hand Controller	$16.69

Figure 35 projected costs of reused items

Projected Costs : Purchased Items

Projected Costs (Purchased Items)

Name	Manager	Department
Emery Johnson	Albert Mendoza	Finaces
School Name	**Foy. H Moody High School**	
Instructor	Mario Bayarena	

Type	Category	Description	Source Notes	Amount
General	Donated	Funds donated by Citgo, MTS, and Employees	Used for hotels, food, gas, materials etc	$ 7000-
Electronics	Purchased	Hp laptop	Used for running software	$60.00
Electronics	Purchased	Power Switch	Used to give power	$5.08
Electronics	Purchased	120 RPM 12 Volt DC Motor	Used for the payload	$13.00
Electronics	Purchased	Digital Camera Servo	Camera	$64.00
Electronics	Purchased	SOS Leak Sensor	Detects if water in capsule	$32.00
Electronics	Purchased	Thruster Commander	Used to help Power the thrusters	$60.00
Electronics	Purchased	DC/DC Converter	Used for Circut	$11.90
Electronics	Purchased	Timer Module DC	Bouyance engine timer relay	$19.35
Electronics	Purchased	T200 Thrusters 6x	Used for the ROV	$850.00
Electronics	Purchased	Sea Beam Laser	Used for the ROV	$2,652.92
Electronics	Purchased	Power Wire	used to give power	$40.50
Materials	Purchased	Tether	used to supply power	$30.24
Materials	Purchased	Control Box	Contains the rasberry pi	$42.00
Materials	Purchased	4" Acrylic Tube	Capsule that seals electron	$90.00
Materials	Purchased	Penetrating Bolts	Contnects wires to capsule	$31.75
Materials	Purchased	Nuts/Bolts/Screws	Helps put materials in place	$42.00
Materials	Purchased	Electronic Tray Terminal	Organizes electronics inside cpasule	$45.00
Materials	Purchased	Wet Link Penetrator	Connects wires to capsule creating a seal	$95.00
Materials	Purchased	Gutter Guard	Protects ROV's sharpe edges	$7.00
Materials	Purchased	M10 Encoulsure vent	Removes pressure from capsule	$20.00
Hardware	Purchased	Double A Batteries	Powers Bouyance Engine	$18.10
Hardware	Purchased	SD Micro Card	Stores data in pixhawk	$10.00
Hardware	Purchased	Electronic Tray Terminal	Orangizes Bouyance Engine	$55.00
Materials	Purchased	Seal Wire Connections	Connects Wires to capsule creating a seal	$40.00
		Total Raised	**$7,000**	
		Total Spent	**$4,334.84**	
		Total Expenses		**$4,334.84**

Figure 36 Projected Costs of Purchased Items

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