marine technology
MORELIA

2024 - 2025
TECHNICAL REPORT

PIONNER - MARINE TECHNOLOGY MORELIA

MORELIA INSTITUTE OF TECHNOLOGY
MORELIA, MICHOACAN, MEXICO

TEAM MEMBERS

Mechanical	Edgar Partida Cruz	5th year	Marco Antonio Villagómez García	5th year
	Félix Omar Soria Novoa	5th year	Ricardo Esteban Villaseñor Conejo	1st year
	Fidelmar Tamayo Pérez	5th year	Roberto Carlos Aguilar Calderón	5th year
	José Eduardo Salazar Neri	5th year	Valeria Muñiz Zarco	4th year
	José Martín Reyes García	5th year	Salvador Zaragoza Maldonado	5th year
	Luis Eduardo Salgado Bataz	5th year	Yosef Dominic Bautista Juárez	1st year
Software	Maximiliano Baruk Moctezuma Rosas	5th year	Jireh Rivera Ayala	5th year
Electronical	Braulio Cesar Vega Medina (CEO)	5th year	Fernando Adrián Gómez Pedraza	1st year
	Cristopher Alonso Gutiérrez García (ViceCEO)	5th year		
Marketing	Daniela Magaña Arana	1st year	Sarahi Monserrat Marroquin Jacobo	1st year
Mentor	Dra. Bertha Isela Gómez Palomares			
Coaches	Dr. Ricardo Martínez Parrales		Dr. Nicolas David Herrera Sandoval	

ABSTRACT

Marine Technology Morelia is a school team formed by 18 engineering students from different areas. Our team was created in September of 2023 and mainly what motivates us to want to be part of this type of project climate change that is happening right now around the world.

Climate change in our country and particularly in our state it´s being more notorious than ever, we are already seeing the effects and issues that climate change brings to the table , since we are in a water crisis and closer to “Día Cero”, which is why we consider projects like this to be of great help and essential to the entire world.

In this document we bring to your different aspects of our journey to create our ROV, from planning, prototype, obstacles to management and safety. By sharing this we hope to motivate and give information that results of interest for the community.

CONTENT

TEAMWORK

Company profile

MTM is a university-based team of engineering students (figure 1) devoted to marine technology and environmental sustainability. Their main focus is the design and development of remotely operated vehicles (ROVs), which they use as practical tools to address environmental challenges, particularly those affecting aquatic ecosystems and linked to climate change.

Beyond their engineering goals, MTM is also committed to improving the health of local lakes and aquatic ecosystems. They promote cleaner, more sustainable fishing practices to help protect regional biodiversity and support long-term ecological balance.

The team is divided into specialized departments such as electronics, software, design, hydraulics, and robotics. Each division is led by a team member responsible for organizing tasks and guiding their group toward shared goals.

A logistics team handles task assignment and planning, giving priority to projects that can be carried out with existing resources. MTM also emphasizes ongoing learning: experienced members actively mentor newcomers to ensure that technical skills and team knowledge are passed down and continuously developed.

Figure 1. Team members

Project schedule

MTM used the Notion application to organize and manage the project schedule, ensuring the entire team had access to track progress. Each task was assigned with details about the activity type, the related component (such as interface, mechanical arm, ROV, or flotation), the delivery timeline, and the task's current status (not started, in progress, or completed).

The 5S methodology (Sort, Set in Order, Shine, Standardize, and Sustain) was implemented to improve efficiency and maintain an organized workspace, as team members worked in alternating shifts. This system helped maintain better control over work areas and ensured a steady workflow throughout the project.

The development process was divided into three phases (figure 2).

Phase 1: Initial ROV construction and development, carried out by new team members following design guides to learn about system components.

Phase 2: Implementation of design improvements to the ROV, such as a new frame, camera system, and updated software, aimed at optimizing its performance.

Phase 3: Development of specialized tools based on mission specifications (RFP), with 50 hours dedicated to mission simulation and preparation for the final product demonstration.

The team followed a systematic approach, applying planning, prototyping, verification, integration, validation, and documentation, ensuring reliable and repeatable results throughout the process.

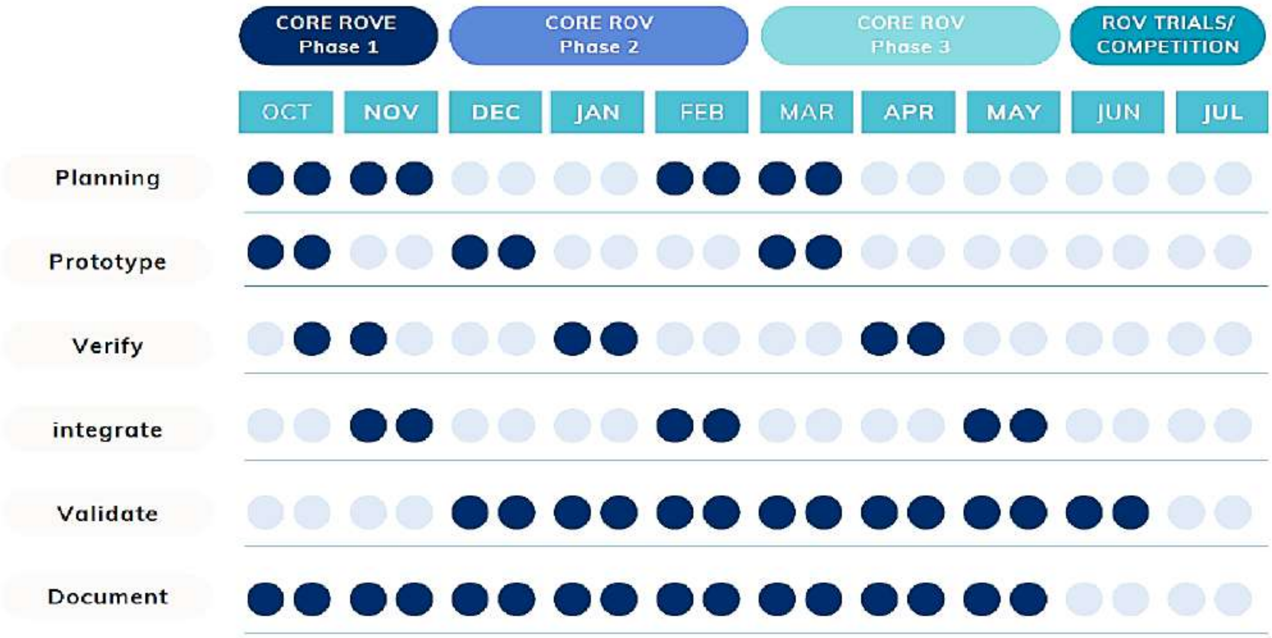


Figure 2. Project Schedule | Marine Technology Morelia.

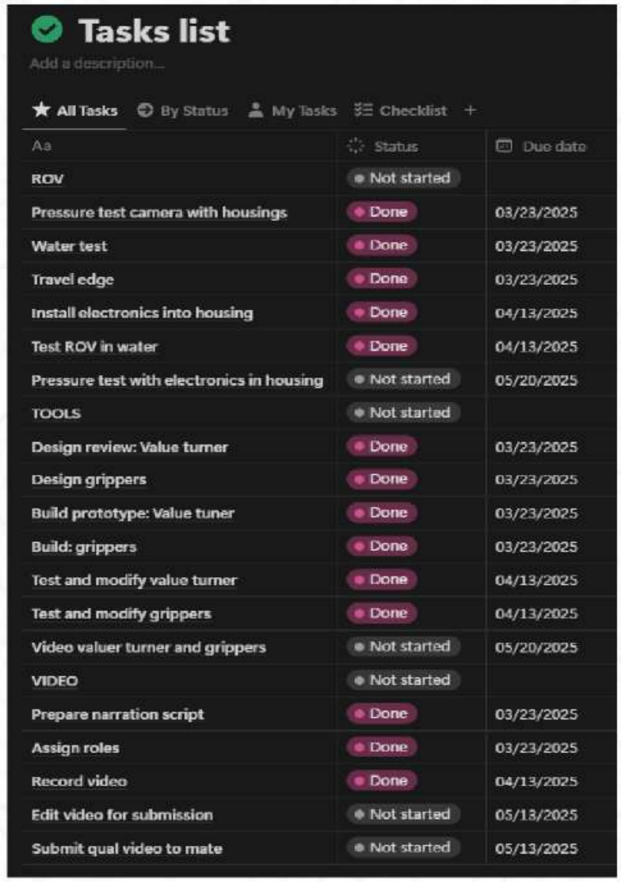
Resource, procedure & protocol management

MTM holds weekly virtual meetings to monitor overall project progress and share updates across all departments. These meetings help align efforts, address material needs, and ensure that timelines are being met efficiently.

At the start and end of each workday, short team meetings are held to organize daily tasks, assess progress, and make quick adjustments to the workflow based on current outcomes.

The project development is divided into three main phases (figure 3):

1. *Prototyping and Foundations (until March 23)*: In this initial phase, the team focuses on testing sensors, creating key design components, and developing basic programs. The goal is to build a functional base system that serves as a foundation for further development. This stage also gives new members hands-on experience and a better understanding of the project components.
2. *Testing and Validation (Until April 13)*: Once a working prototype is in place, performance tests are conducted to evaluate the system's stability, precision, and responsiveness. Based on these results, the team identifies areas for improvement and makes the necessary modifications to refine the design.
3. *Mission Adjustments (May 13 and May 21)*: After validating the system, the team tailors the prototype to meet the specific objectives of the mission. This involves integrating tools, improving control systems or software, and making mechanical refinements. Simulated scenarios are also used to ensure the system performs reliably in realistic conditions.


Tasks list

Add a description...

All Tasks · By Status · My Tasks · Checklist +

Aa	Status	Due date
ROV	Not started	
Pressure test camera with housings	Done	03/23/2025
Water test	Done	03/23/2025
Travel edge	Done	03/23/2025
Install electronics into housing	Done	04/13/2025
Test ROV in water	Done	04/13/2025
Pressure test with electronics in housing	Not started	05/20/2025
TOOLS	Not started	
Design review: Value turner	Done	03/23/2025
Design grippers	Done	03/23/2025
Build prototype: Value tuner	Done	03/23/2025
Build: grippers	Done	03/23/2025
Test and modify value turner	Done	04/13/2025
Test and modify grippers	Done	04/13/2025
Video valuer turner and grippers	Not started	05/20/2025
VIDEO	Not started	
Prepare narration script	Done	03/23/2025
Assign roles	Done	03/23/2025
Record video	Done	04/13/2025
Edit video for submission	Not started	05/13/2025
Submit qual video to mate	Not started	05/13/2025

Figure 3. Tasks list

With this structured and adaptive workflow, MTM can maintain steady progress, respond effectively to challenges, and move efficiently toward the project's goals.

DESIGN RATIONALE

Engineering design rationale

The design of MTM's ROV is divided into three main systems: mechanical, electronic, and software. In the mechanical system, essential components like the modular structure, sealed enclosures for electronics, thrusters, and buoyancy are integrated (figure 4). This modular approach allows for customization and adaptation of the ROV according to each mission's specific needs, enabling the integration of specialized tools and sensors as necessary. Furthermore, the inclusion of robotics in the design allows the ROV to perform precise and controlled movements, improving its efficiency and versatility.

Figure 4. Complete ROV

A special focus was placed on the software, implementing cutting-edge technologies such as 3D environments, which sets us apart as pioneers in applying these technologies. This innovative approach extends to the robotic arm, feature 3 degrees of freedom (figure 5), offering a balanced combination of precision and control. This configuration distinguishes the ROV from others on the market, providing reliable performance with enhanced flexibility and functionality.

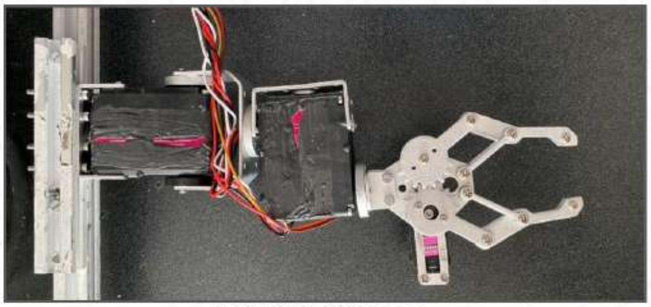


Figure 5. Gripper

Our ROV does not use hydraulic or pneumatic systems; instead, we rely on electric mechanisms for manipulation, which simplifies the design and reduces risks associated with leaks or complex maintenance. The electronics provide power to the thrusters and, through the software, control the ROV's movements, stream video, and collect sensor data, allowing for precise and efficient operation under the pilot's control.

The modular design is a fundamental aspect of MTM's approach, enabling efficient use of resources and easy integration of new components without requiring a complete system redesign. The aluminum profiles, which are standardized, allow us to make changes more efficiently and provide ease of disassembly and maintenance. This modular design also enables the mounting of tools, such as cameras or grippers, at different points on the ROV.

This modular approach not only simplifies maintenance and customization but also reduces development costs by allowing for the reuse of components from previous ROVs to test new designs (figure 6). As a result, MTM can quickly adapt its systems, speeding up the development process and improving operational efficiency in each project.

Criteria	Weight (1-5)	Pump	Score	Syringe	Score	Inverted Syringe	Score
Battery Life	3	5	15	1	3	1	3
Cost	2	3	6	3	6	3	6
Length	3	4	12	2	6	1	3
Manufacturability and Simplicity	5	5	25	2	10	1	5
Reliability	5	4	20	4	20	4	20
Serviceability	4	5	20	3	12	2	8
Stability	4	4	16	2	8	4	16
Totals			114		65		61

Figure 6. Float Design Decision

Design process and decisions

At MTM, the ROV design was selected through an internal challenge where each member of the design team presented a proposal. A vote was held to choose the model that offered greater stability, lower cost, better component distribution, and ease of construction. This design served as the foundation for development, although some aspects were modified, such as the size, arm length, and shape of the enclosure.

MTM's design process focuses on leveraging previous experience by reviewing past projects to identify what worked well and what can be improved. This approach allows for the reuse of effective components, optimizing resources, and reducing both development time and costs. When adapting a previous design is not feasible, different alternatives are analyzed to select the most suitable one based on functionality, cost, and manufacturability.

Problem solving, innovations

During the development of the project, it became necessary to modify the aluminum profiles used in the structure, primarily due to the high cost of these materials and recurring issues with shipping. This situation forced the team to make significant adjustments to the original design, seeking more viable alternatives in terms of both cost and logistics, without compromising the integrity or performance of the system.

Regarding the buoyancy system, one of the main limitations identified was the lack of financial support, which made it difficult to implement more advanced solutions or specialized materials. As a result, the team had to adapt the design using the available resources, aiming to strike a balance between functionality, efficiency, and budget.

Another technical challenge arose with the microcontroller, which did not provide the necessary voltage for the proper operation of the servomotors. This issue was resolved by integrating a logic level converter that boosted the signal to 5V, allowing for proper communication between the microcontroller and the actuators, and ensuring precise control of the system's moving components.

Additionally, water leakage was detected in the early designs of the Orange Pi5 enclosures. To protect the onboard electronics, the team reinforced the sealing mechanisms, improving waterproofing and overall system reliability during underwater missions (figure 7).

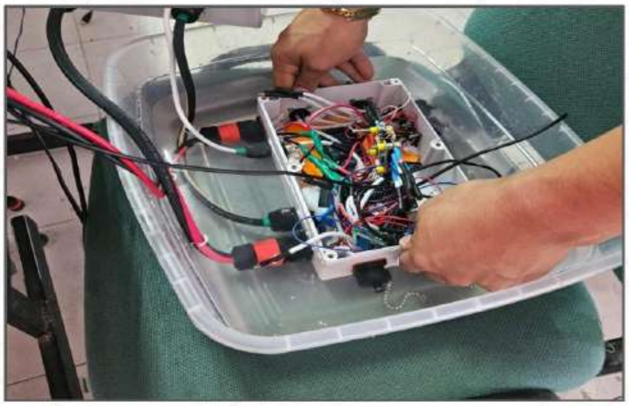


Figure 7. ROV sealing issue

System approach

The ROV uses Python as its main programming language (figure 8), taking advantage of its modular architecture to develop and test each subsystem (thrusters, the arm) independently. This simplifies integration, improves error detection, and speeds up the validation process, optimizing development time and enhancing software reliability.

The design follows a modular strategy, both physically and in terms of programming. Python allows the vehicle's functions to be separated into reusable modules, making it easier to implement quick adjustments based on the mission's needs. The CORE-ROV platform includes the essential components (frame, propulsion, buoyancy, and the camera), with the ability to add programmable tools like the adaptable gripper, also controlled via Python scripts.

Mechanically, the ROV uses reliable and high-quality components, ensuring stability and strong performance. The buoyancy modules maintain balance, and the gripper can perform a variety of tasks without compromising the vehicle's structure, making it efficient across a wide range of missions.

Figure 8. Python programming

The electronic system was designed to integrate efficiently with Python via microcontrollers. To address voltage limitations, 5V logic converters are used to ensure proper power supply to the servomotors. Protective measures were also implemented for sensitive components, such as the temperature sensor, which was coated with resin to ensure functionality in wet environments. All data is processed in real time using Python scripts.

This Python-based approach improves the ROV's operational efficiency and makes it easier to adapt the system for future missions.

Vehicle Systems

The ROV measures 30 x 44 x 35 cm and weighs 11.6 kg. Its compact and robust design is the result of a development process filled with trial, error, and continuous improvement. Throughout its construction, various technical challenges required constant adjustments, which led to an increase in overall costs, reaching approximately $6,653 USD. Each setback became a learning opportunity, and every improvement contributed to the creation of a reliable and adaptable vehicle, ready to take on underwater missions with precision and efficiency.

Electrical Systems

The ROV's control system is organized into functional modules to ensure precise and stable operation during missions. The system is divided into two key sections: Topside and Bottomside (figure 9).

The Topside setup consists of a laptop, a 48VDC power supply, and a network switch that links the surface to the vehicle through an Ethernet tether. The laptop acts as the main control hub and runs a Python-based application that translates user inputs into commands for the ROV (Appendix A).

A standard Xbox controller is connected via USB, giving the pilot full control over navigation, thrust levels, and tool operation. The user interface displays live data such as camera feeds, depth readings, temperature, and system status, offering real-time feedback for informed piloting decisions.

The control software also includes precision movement modes that modify the

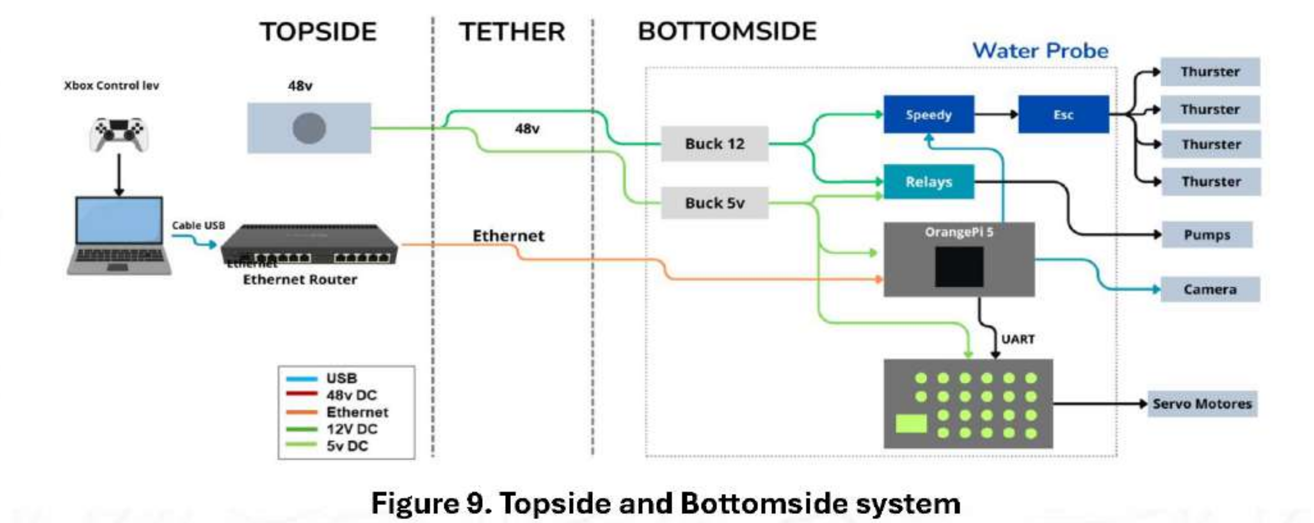


Figure 9. Topside and Bottomside system

response curve of thrusters, allowing smoother handling during delicate tasks like sample collection or object positioning.

All ROV-side processing is handled by an Orange Pi5, a compact but powerful single-board computer housed inside a sealed electronics enclosure. Communication between the Orange Pi5 and the Topside laptop is established via Ethernet, with data packets exchanged using a custom protocol written entirely in Python. This simplifies integration and debugging, while maintaining flexibility for system upgrades.

Power Conversion & thruster control

MTM has implemented an efficient voltage conversion system to safely and reliably power the various components of the ROV. Two Buck converters are used to step down the main 48V input to lower voltages required by different onboard systems:

- One converter steps 48V down to 5V, used to supply power to the Orange Pi5, cameras, and other low-consumption electronic modules.
- The second converter reduces 48V to 12V, delivering power to higher-demand systems such as the thrusters and auxiliary tools.

Both converters are equipped with built-in protection against overvoltage, undervoltage, overheating, and short circuits, ensuring the safety of the electronic system at all times. For motion control, Electronic Speed Controllers (ESCs) are used to precisely operate the ROV's four thrusters. These controllers are mounted on custom adapter plates, designed for easy integration into the vehicle's electronic housing, with a compact layout that optimizes space.

In addition, the system includes two dedicated drivers for NEMA-17 stepper motors, which are essential for controlling mechanisms that require precise and repeatable motion, such as tool actuators or positioning systems.

Vision System

The ROV is equipped with a single fixed camera that provides clear and detailed vision during operations. This 1080P HD camera is mounted at the front of the vehicle, optimized for autofocus, and offers a wide but fixed field of view. It enhances the ROV's ability to observe and navigate underwater environments. This level of resolution is essential for monitoring and controlling the ROV's tools during missions, providing precise, real-time feedback (Figure 10).

Figure 10. ROV Camera

Tether Design

MTM's tether, with a length of 12 meters, provides power, data, and compressed air to the ROV while allowing for movement (figure 11). It was digitally modeled to ensure the required reach both in-water and on the surface, with buoyancy devices added to prevent interference.


Figure 11. Tether

The tether is covered by a flexible, brightly colored sheath for improved visibility. Data is transmitted via a Cat 6A Ethernet cable, and power is delivered through low-resistance 12 AWG, optimizing flexibility and stability under heavy loads.

Tether Management Protocol

MTM's Tether Management Protocol covers the pre-operational, operational, and post-operational phases, based on over ten years of experience, with a focus on crew safety, mission efficiency, and effective implementation. Before each mission, the tether is inspected for any damage or wear (figure 12). The tether manager ensures its proper deployment, tensioning, and storage.

At the beginning of the mission, the tether manager instructs non-essential personnel to leave the work area. The tether is then removed from its carry bag, uncoiled, and laid out on the deck, with one end connected to the surface control unit (TCU) and the other to the ROV. The tether is connected following a specific order for each component. During the deployment process, two deck crew members manage the lowering of the ROV into the water using the tether's anchoring and strain relief points.

While the ROV is operating, the tether manager ensures there is enough slack to allow the ROV to move without interference. Upon completing the mission, the tether manager disconnects the tether from the ROV, starting with the strain relief and then disconnecting from the TCU. Once fully detached, the tether is coiled appropriately to prevent damage and facilitate storage.

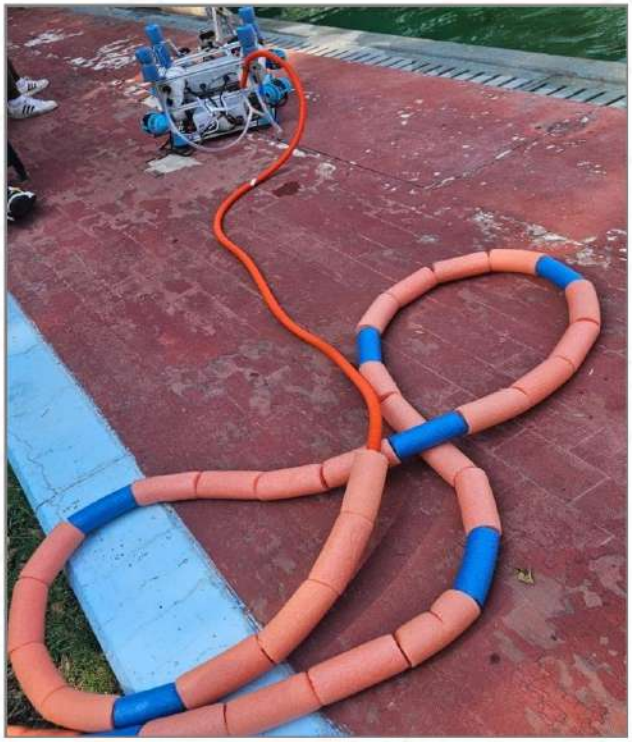


Figure 12. Tether Management

Propulsion

The propulsion system of the MTM ROV is composed of four T200 thrusters from Blue Robotics. These thrusters were selected for their reliability and ability to operate in underwater environments, as they are fully waterproof. During the selection process, both the T100 and T200 thrusters were considered, and after analyzing their features, the T200 thrusters were chosen for their higher thrust capacity. Although the T200 thrusters consume more power than the T100s, this did not significantly affect the ROV's performance, as the available power is sufficient for mission operations.

The decision to use T200 thrusters was also influenced by the need to ensure optimal performance during missions, as the MTM ROV requires precise movements. To ensure operator safety, all thrusters are equipped with metal guards to prevent contact with mission tools or the operators' hands. The ROV features a thruster arrangement on its frame that allows for full movement, with four thrusters mounted horizontally to provide stability and control for lateral, rotational, ascent, and descent movements. This configuration not only enhances the ROV's maneuverability but also optimizes energy consumption and operational costs. (Figure 13).

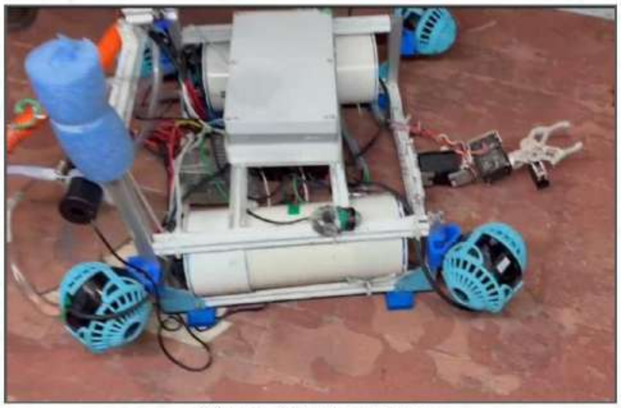


Figure 13. Propulsor

Buoyancy & ballast

The ROV weighs 11.6 kg, and it was calculated that 113.796 N of buoyant force were required to achieve neutral buoyancy, meaning the ROV would neither sink nor rise spontaneously in the water. To meet this requirement, the buoyancy system was divided into two components: static and modular (Figure 14).The design of this buoyancy system was based on the previous year's prototype, which was tested and refined to improve its efficiency and adaptability for current mission needs.

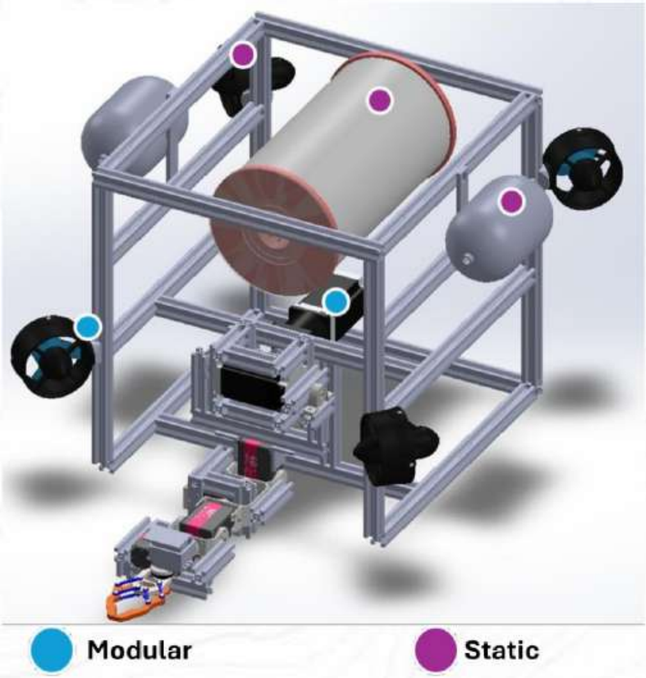


Figure 14. Components: Static and Modular Buoyancy

The static buoyancy system provides the majority of the buoyant force and consists of incompressible stainless steel housings along with other structural elements. This system ensures consistent buoyancy to keep the ROV balanced during operation. The modular buoyancy system, on the other hand, allows for fine adjustments to the ROV's stability. Hydrostatic foam blocks can be added or removed at various points on the ROV to fine-tune its balance, making the system adaptable to changes in payload configuration during different missions.

To enable these adjustments, two peristaltic pumps were used, where one fills while the other empties, through a system of transparent tubes. This allows precise control over the ROV's density. This system provides flexibility and ensures the ROV remains neutrally buoyant throughout its operations, offering stability and versatility for varying mission requirements.

Payload & Tools

Thanks to its modular design, the ROV can be upgraded from 3 degrees of freedom (DOF), significantly enhancing its maneuverability. This added flexibility allows for more precise and complex movements, which is essential for carrying out delicate tasks in challenging underwater environments. The vehicle is equipped with various tools and systems, including a multipurpose gripper, a mechanism to activate the probiotic irrigation system, and an autonomous control program designed for transplanting brain coral without the need for constant pilot supervision.

To ensure optimal visual feedback during operations, the ROV features a single primary camera located in the Main Electronics Housing (MEH) facing forward, providing the pilot with a clear view of the ROV's path. This camera placement was tested and validated during mission simulations, ensuring optimal visibility and enhancing the pilot's ability to carry out complex tasks efficiently.

Multipurpose grippers

The gripper was designed with modularity in mind, using a quick-release system that allows the fingers to be easily swapped depending on the task at hand. This adaptability makes it possible to prepare the ROV for different missions quickly, lowering costs and increasing operational efficiency (figure 15).

Its applications include deploying SMART cables and repeaters that collect essential ocean data such as temperature, pressure, and seismic acceleration.

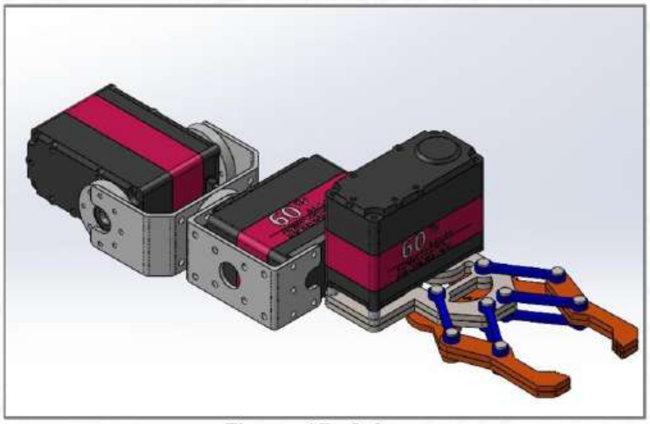


Figure 15. Gripper

Float

The autonomous device designed for environmental monitoring in aquatic environments without the need for a tethered ROV. The system is built around a LilyGO T-Beam microcontroller with LoRa communication, which transmits data from pressure and voltage sensors to a surface station. This station, equipped with an ESP32, receives the information and displays it on a computer.

Buoyancy control is achieved using a NEMA-17 stepper motor that drives a screw mechanism connected to six 50 ml syring es, managed by an A4988 stepper driver (figure 16).

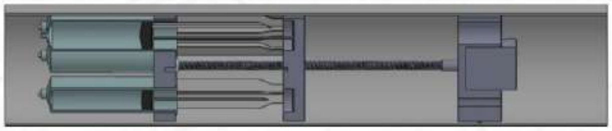


Figure 16. Float

The device is powered by internal NiMH 12V battery pack, regulated through 5V and 12V buck converters, and protected by a 3-Amp fuse. This setup ensures safe, stable, and efficient operation during underwater missions (Appendix B).

SAFETY

Safety is a fundamental aspect of MTM's operations, especially during the use of the ROV. To ensure the physical well-being of all team members, the use of personal protective equipment (PPE) is mandatory at all times. Protective gear includes items such as helmets, safety glasses, and gloves. Each team member must be properly trained to use this equipment correctly, ensuring its effectiveness in preventing accidents.

All activities were supervised by a specialized manufacturing consultant, responsible for ensuring compliance with safety standards throughout the entire process. Constant supervision is essential to identify potential risks and to address any situation that may endanger operators.

Designated spaces were assigned for each activity, creating an organized work environment and reducing the chances of accidents caused by clutter or disorganization. These defined areas allow operations to be carried out efficiently and safely.

Vehicle safety

The ROV is designed with several built-in safety features to protect both the equipment and its operators during use. Key safety elements include fuses that cut off electrical supply in case of overload, engine coating for damage prevention, and fixed components under pressure to ensure stability during operation.These measures are intended to provide a more secure and controlled operation, preventing technical failures that could compromise the equipment's performance or the safety of its users. The ROV's design prioritizes accident prevention and offers a more reliable and efficient user experience.

CRITICAL ANALYSIS

Testing

At MTM, we ensure that each component is thoroughly tested before being integrated into the complete ROV system. We follow a systematic approach to verification and validation to ensure that all subsystems and parts of the ROV perform their functions correctly and efficiently. Verification focuses on ensuring that each component works as expected, while validation ensures that the ROV meets the mission requirements.

Troubleshooting

At MTM, the troubleshooting process follows a data-driven approach, focusing on accurately identifying problem areas. We start by collecting information to understand the context of the issue and then formulate hypotheses about the potential causes. Through detailed testing, we gather data that helps validate or adjust our hypotheses until we find a viable solution.

During the ROV development, both design and implementation issues were identified in some systems. To improve reliability and reduce overall failures, we decided to implement a PCB (Printed Circuit Board) for each area. This way, if a failure occurs, it only affects the specific area corresponding to the PCB, preventing the failure from spreading throughout the entire system. This strategy significantly helped to pinpoint the origin of the problems quickly.

A problem was identified with the thruster system, which experienced sudden shutdowns during certain direction changes. Testing revealed that, during rapid thrust changes, the power system would disconnect, causing a loss of propulsion in the ROV. Further analysis determined that the abrupt changes in thruster acceleration created instability in the motors, which directly affected the power system.

To resolve this issue, two solutions were designed: limiting the rate of acceleration change in the thrusters and improving the stability of the power system by adding capacitors. Both solutions were tested in a simulated environment, and after final testing, it was confirmed that the issue was effectively resolved.

BUDGET & ACCOUNTING

The participation of the MTM team in this year's competition required not only technical effort but also significant financial commitment. As part of a public institution, the Instituto Tecnológico de Morelia, we do not have a fixed source of funding for these types of projects. Therefore, most of the expenses were covered directly by the team members.

At the beginning of the season, a financial plan was created to estimate the main costs, including materials, electronic components, tools, transportation, and logistics. To cover these expenses, the team organized fundraising events, applied for student scholarships, and received institutional support from the school, which helped reduce some of the project's operational costs.

All expenses were tracked and managed responsibly, always prioritizing efficient use of the available resources. Despite the financial limitations, the team successfully met its goals, proving that with organization, commitment, and creativity, it is possible to develop a competitive and functional ROV (Appendix C).

ACKNOWLEDGING

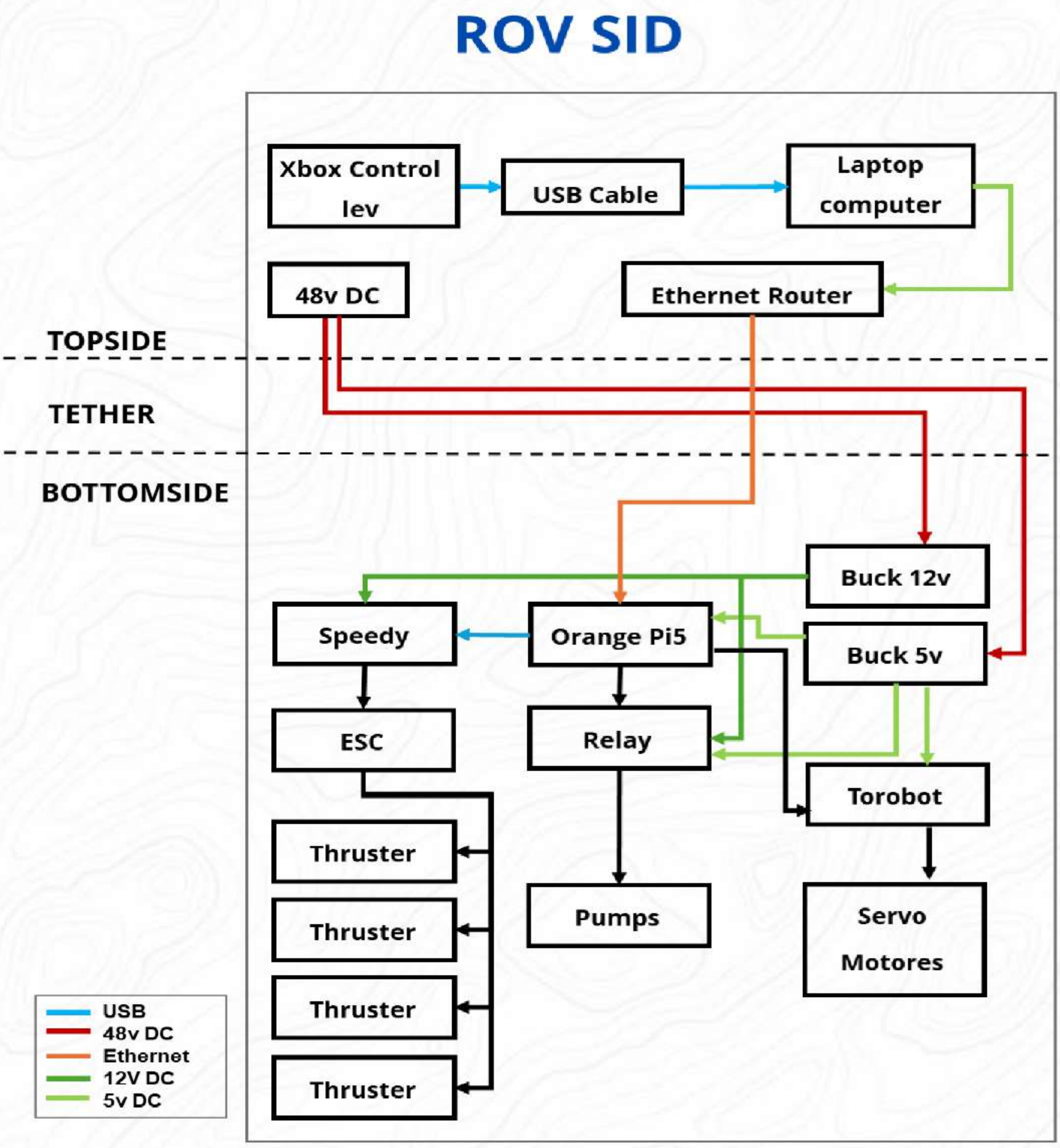
We want to thank the MATE Center for organizing this year's competition and giving us the chance to participate.
Thanks to the Instituto Tecnológico de Morelia for providing the financial support we needed for this project.
We also thank Dr. Ricardo Martínez Parrales, Dr. Nicolas David Herrera Sandoval and Dra. Bertha Isela Gomez Palomares for their help and guidance throughout the development of our ROV.
A big thank you to MATE for allowing us to grow and apply our knowledge through this experience.
Finally, thank you to our families for always supporting us throughout this journey.

REFERENCES

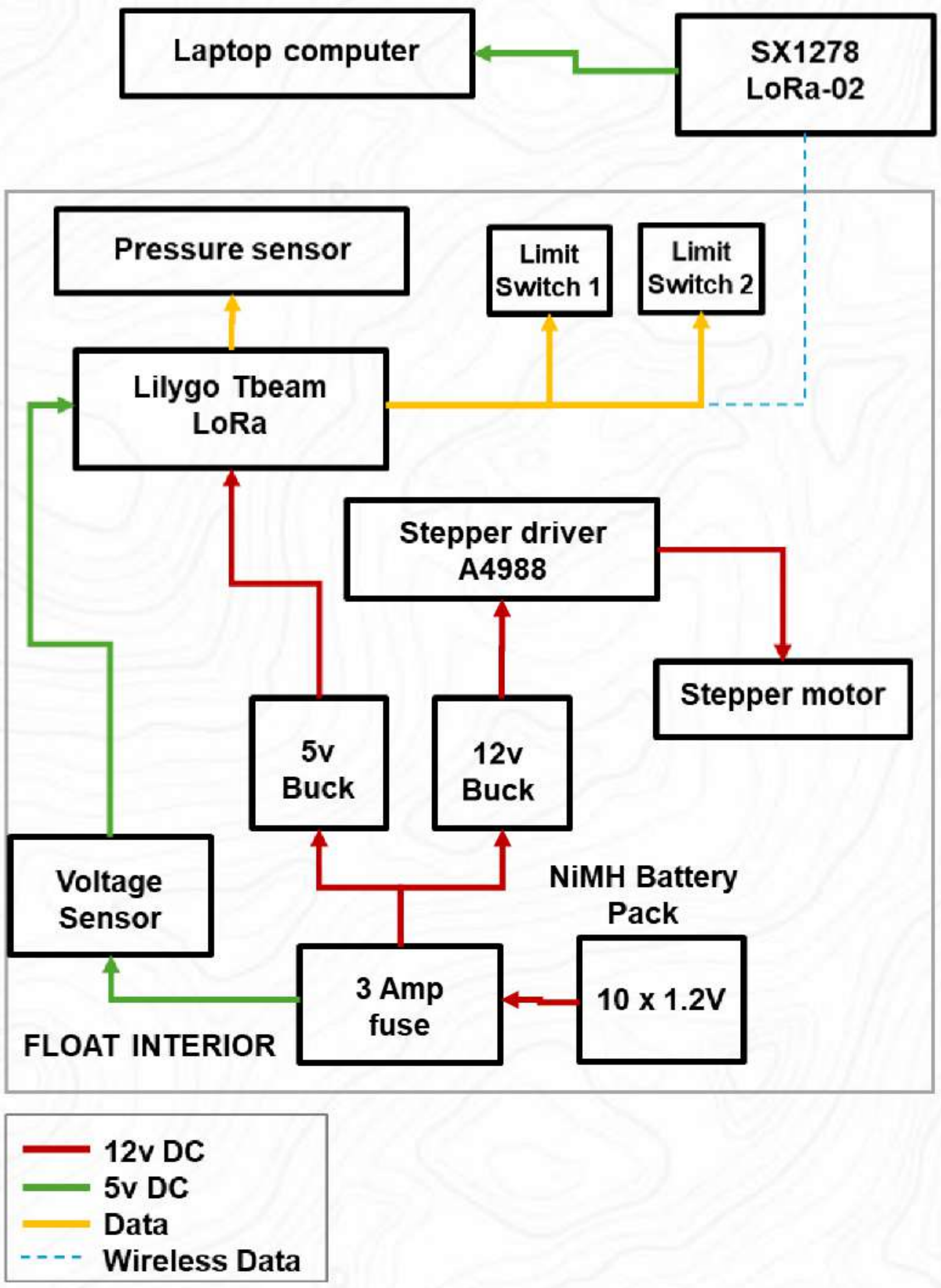
- Surface Power Supply - Back EMF Problem with Basic ESC R3 - Blue Robotics Products / Speed Controllers (ESCs) - Blue Robotics Community Forums
- MATE ROV Competition Website
- Orange Pi - Orange Pi official website - Orange Pi development board, open source hardware, open source software, open source chip, computer keyboard

APPENDIX

Appendix A. ROV SID



Appendix B. Float SID



Appendix C. Budget and project costing

Concept	USD
TEC Donation (total)	$ 3,888.00
Team Contribution	$ 2,000.00
Team Contribution extra	$ 765.00
Total Spent	$ 6,653.00
Budget Total (initial)	$ 6,000.00
Difference	-$ 653.00

Category	Amount (MXN)	Amount (USD)	Paid by
First TEC Donation			
Actual Spending (1st round)	$ 51,708.00	$ 2,871.00	TEC + Team
Covered by TEC	$ 35,000.00	$ 1,944.00	TEC
Covered by Team	$ 16,708.00	$ 927.00	Team
Second TEC Donation			
Actual Spending (2nd round)	$ 40,621.57	$ 2,257.00	TEC + Team
Covered by TEC	$ 35,000.00	$ 1,944.00	TEC
Covered by Team	$ 5,621.57	$ 313.00	Team
Additional Team Expenses	$ 29,345.00	$ 1,525.00	Team
Total	$ 121,674.57	$ 6,653.00	
Travel Costs (per person)	$ 13,000.00	$ 673.34	Team
Travel Costs (Total)	$ 130,000.00	$ 6,733.40	Team

Category	Item	Date	Amount (MXN)	Amount (USD)	Year	Notes
Donations (TEC)	First donation tranche	20-mar-24	$ 35,000.00	$ 1,944.00	2024	
	T200 Thrusters x4 Blue Robotics	20-mar-24	$ 17,073.00	$ 948.00	2024	Thruster motors purchase
	Sensor	20-mar-24	$ 2,000.00	$ 111.00	2024	Basic sensor
	Connectors & 48V power supply	20-mar-24	$ 17,899.00	$ 994.00	2024	Power supplies and connectors
	Aluminum profiles	10-Apr-2024	$ 1,121.00	$ 62.00	2024	Aluminum profiles for structure
	Electronics components	10-Apr-2024	$ 4,879.00	$ 271.00	2024	Wiring and electronic parts
	Customs fees	9-Apr-2024	$ 8,736.00	$ 485.00	2024	Import fees
Donations (TEC)	Second donation tranche	17-Apr-2025	$ 35,000.00	$ 1,944.00	2025	
	Manipulator materials & electronics	17-Apr-2025	$ 25,004.28	$ 1,389.00	2025	Manipulator materials & electronics
	Buoys (various)	17-Apr-2025	$ 1,978.29	$ 110.00	2025	Original and spare buoys
	PCBs & manufacturing	18-Apr-2025	$ 3,315.00	$ 184.00	2025	PCB boards and manufacturing
	Electronics (advanced)	2025	$ 10,324.00	$ 536.85	2025	Advanced electronics
Team Contribution	Miscellaneous (hardware, tools, adhesives, cables, batteries, etc.)	2024-2025	$ 29,345.00	$ 1,525.94	2024-25	Various complementary expenses
Totals			**$ 121,674.57**	**$ 6,653.00**		