



Shark Tech - Siku

Labrador Straits Academy

L'Anse Au Loup, Newfoundland and Labrador, Canada
Technical Documentation Report



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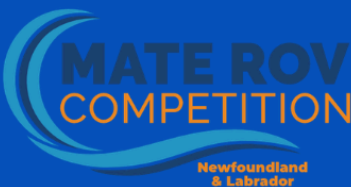


TABLE OF CONTENTS

1. Abstract	3
2. Project Management	4
A. Company Overview	
B. Company Organization	
C. Operational Challenges	5
3. Design Rationale	6
A. Design Evolution	7
B. Innovation	
4. Systems Approach	
A. Vehicle Structure	8
5. Vehicle Systems	
A. Pneumatic System	
B. ROV Electrical System	
C. Topside Control System	9
D. Tether and Tether Management	
E. ROV Software Design	10
F. Propulsion	
G. Buoyancy	11
6. Payload and Tools	
A. Cameras	
B. Claw	12
C. Water Sampler	13
D. Jellyfish Collector	
E. Specialized Mission Specific Hook (SMSH)	
F. Vertical Profiling Float	14
G. Build Vs. Buy	15
7. Problem Solving	16
8. Safety	
A. Safety Philosophy	
B. Safety Features	
9. Critical Analysis	
A. Troubleshooting	17
B. Testing Methodology	
C. Propulsion Testing	18
D. Pneumatics Testing	
E. Vertical Profiler Testing	
10. Budget and Accounting	19
A. Budget	
B. Project Cost	20
11. Acknowledgements	
12. Appendices	21
13. References	25

1. ABSTRACT

Shark Tech, based in L'Anse au Loup, Newfoundland and Labrador, is a fourth-year MATE ROV team focused on the advancement of underwater Remotely Operated Vehicles (ROVs). For the 2026 MATE ROV competition, Shark Tech refined and improved last year's ROV, Siku, engineering it for reliable offshore operations and diverse underwater tasks.

To meet this year's mission requirements, Siku is equipped with a pneumatic claw system controlled by a foot pedal, allowing the pilot to operate the claw while maintaining full control of movement and cameras. The company also improved last year's claw design through 3D printing to increase efficiency and durability. Additional tools include a star hook, built in-house with our 3D printer, and a buoy hook, constructed from a carabiner with a custom 3D-printed handle for a more secure grip. Shark Tech designed many of Siku's custom components using Onshape and fabricated parts through 3D printing. Safety remains a top priority, with leadership enforcing strict procedures during design, testing, and operation. The company also developed a vertical profiling float called the Shark Fin. Using Arduino UNO R4 Wi-Fi technology, a TD7 motor, and a Blue Robotics Bar30 pressure sensor, and Shark Fin (the company's vertical profiler) autonomously collects and records underwater depth data while wirelessly communicating with the surface station.

Siku completed missions involving coral garden sampling, iceberg surveying, invasive green crab counting, biofouling removal, and 3D model creation. Through innovation, teamwork, and continuous improvement, Shark Tech remains committed to developing practical solutions for real-world underwater exploration.



Figure 1: The Shark Tech Company and Mentors - Photo taken by Shark Tech Parent
Back row (l-r): (Mentor) Riley Regular, Jerry Cabot, James Penney, Yashveen Gunput, Marcus Flynn, (Mentor) Kate Burden

Front row (l-r): Maria Barney, Madison Cabot, Olivia Normore, Belle Gibbons

2. PROJECT MANAGEMENT

A. Company Overview

Shark Tech is a fourth - year, student-run company with a mission to “Protect the Blue with Green Technology.” This year, the company downsized from 13 members to 8, due to several employees graduating. Rather than expanding, Shark Tech felt that the experience, skills, and knowledge already within the company would allow for a successful competition season.

To ensure the long-term sustainability of Shark Tech, the company also focused on mentoring younger STEM students, allowing valuable knowledge, technical skills, and experience to be passed down to future members. All employees were assigned clearly defined roles that were discussed collaboratively between the CEO, crew, and mentors during the company’s first meeting in September. Employees either retained their roles or were reassigned based on the evolving needs of the company. Meetings begin with a full-company briefing to outline tasks, goals, and objectives. Project progress is tracked in a shared Google Document with real-time updates to ensure accountability and an organized workflow. Mentors contribute by sharing knowledge, encouraging members to problem-solve and collaborate effectively throughout the season.

Shark Tech promotes teamwork, positivity, and a safe, inclusive environment where all members can contribute and grow.

B. Company Organization

Roles are assigned based on individual strengths under the leadership of CEO Marcus Flynn, who has guided Shark Tech for the past three years. To maximize efficiency within the company, the project management group has members split off into four groups according to their roles:

- The mechanical group is responsible for constructing and testing the ROV's props, tools, and parts. This group ensures that everything is safe and ready for competition runs.
- The electrical group codes the ROV and vertical profiler's components. They are responsible for ensuring that the ROV can respond to the controls while in the water.
- The marketing group is responsible for maintaining Shark Tech's documentation and keeping everything up to date to reduce mistakes and increase efficiency.

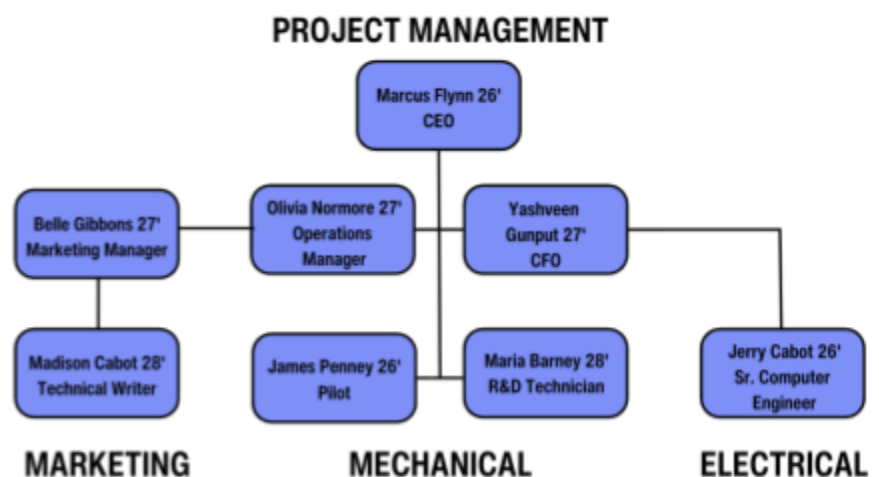


Figure 2: Shark Tech Company Organization Diagram -
Made by Madison Cabot

C. Operational Challenges

Shark Tech is a company that maintains organized procedures when completing objectives. As seen in the Order of Operations Schedule in Figure 3, members planned and organized when certain tasks were to be started and completed within time frames ranging from a month to multiple months, depending on the weight of the task. Daily meetings throughout the week for up

to two hours were organized to ensure that members could work on objectives such as *Siku*, the vertical profiler, and technical writing. During these meetings, the team's out-of-province mentor called to check in on progress, while the in-school mentor supervised work to ensure all safety measures were followed and maximum efficiency was maintained.

Shipping delays were one of the biggest challenges Shark Tech faced throughout the season. To navigate this obstacle, the team built flexibility into the Design Schedule by allowing additional time for major objectives and by adjusting task assignments as needed. If members were unable to continue work on one project while waiting for parts to arrive, they shifted focus to other objectives such as coding, technical writing, tool development, or testing procedures. This allowed progress to continue in multiple areas while preventing setbacks from delaying the overall schedule. Weather closures also had a major impact on productivity. Several scheduled meetings during the competition season were canceled due to inclement weather. To compensate for the lost time, Shark Tech organized additional meetings whenever possible. These extra work sessions allowed employees to stay on track with deadlines and continue testing and development, despite frequent interruptions. In addition, over half of Shark Tech employees participate in extracurricular activities, meaning some meetings did not always include all members. Even with these challenges, Shark Tech maintained steady progress by consistently following the Design Schedule, communicating effectively, and redistributing tasks when necessary. As a result, all major objectives were completed on time.

Shark Tech employees also established advanced operational protocols to ensure mission task objectives were completed efficiently. These protocols outlined detailed step-by-step operations, procedures, and team member roles for each task. Trial runs were conducted before the competition to test and refine these procedures under realistic conditions. This preparation ensured Shark Tech members remained organized, improved accuracy and efficiency during ROV testing, and increased confidence that mission objectives could be completed successfully within the distributed time.



Figure 3: Shark Tech's Order of Operations - Created by Belle Gibbons

3. DESIGN RATIONALE

Goals at Shark Tech 2026	Price Friendly	Reliable	Easily Modified	Determination
Create an effective strain relief to minimize drag on tether	✓	✓	✓	We achieved an effective strain relief by using a sliding system. With this incorporated into our ROV we can move more freely and our tether can be completely strain free
Optimize camera placement and visibility	✓	✓	✓	Careful placement with 4 repurposed analog cameras located around Siku, and 1 high-definition USB camera located in our water tight enclosure, allows for the optimal view, letting Siku complete tasks without blindspots.
Ideal frame design for long term use	✓	✓	✓	Our easily customizable frame was constructed out of high density polyethylene (HDPE) since its known for being light weight and corrosion resistant. We cut our ROV's frame using a CNC machine, keeping in mind our goal of having a wide open design, allowing for water flow through the ROV, reducing resistance while making precise movements and turns.
Create the most effective claw for our system	✓	✓	✓	Siku's claw design created by our CEO shown to be an effective part of our ROV. Since it proved it's excellence during tasks, we decided to just reprint our design from last year, ensuring there was no damage done from the previous season.
Develop the most reliable and effective tools	✓	✓	✓	To complete this years mission tasks we created the helping hand hook; a simple hook created from a camping pin, that can be added or removed from the top left part of the frame. This also led to the devolpment of the buoy hook; a store bought carabiner attached to a 3D printed base, allowing Siku to grip and use it for various tasks.

Figure 4: Goals at Shark Tech - Created by Belle Gibbons

Siku is a serviceable, modular, and durable Remotely Operated Vehicle (ROV) designed to meet the specific mission requirements of the 2026 MATE ROV Competition. Engineered with numerous customized features, *Siku* ensures efficient task execution while aligning with the Marine Advanced Technology Education (MATE) Request for Proposals (RFP) and supporting the UN Sustainable Development Goals. The overall vehicle design was developed in a clear and logical manner, with each subsystem created to maximize reliability, efficiency, and ease of maintenance during competition

operations. Design decisions were carefully evaluated based on performance, durability, cost, and maneuverability to ensure the ROV could successfully complete mission tasks while remaining practical and sustainable. Balanced trade-offs were considered throughout the development process, including selecting lightweight yet durable materials, creating a modular frame for easier repairs and upgrades, and optimizing the vehicle’s size and stability to improve underwater performance.

A. Design Evolution

Siku, the fourth-generation ROV developed by Shark Tech, reflects the company's commitment to producing a safe, serviceable, and reliable underwater vehicle, shaped by years of hands-on experience and iterative design. The journey began with their first ROV, the *Great White 1*, which utilized a PVC frame due to its accessibility and ease of use during initial prototyping. While effective for early learning, this material revealed limitations in strength, precision, and long-term durability. In the second year, the company applied insights from the *Great White 1* to develop *LabraShark*. By

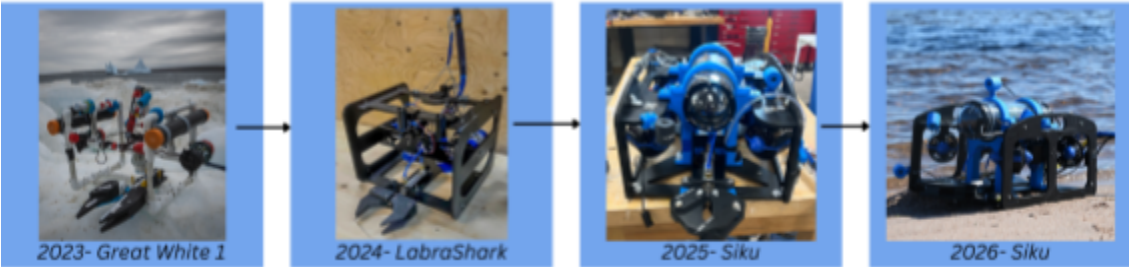


Figure 5: Design Evolution - Created by James Penney

shifting to high-density polyethylene (HDPE) for the frame, the structural integrity and underwater performance were significantly improved. The success of HDPE in *LabraShark* validated the material’s suitability for competitive ROV applications, leading Shark Tech to use it for its third ROV, *Siku*. Rather than completely redesigning the ROV for

the 2026 season, Shark Tech chose to build upon the previous vehicle design and make modifications based on testing, competition experience, and operational performance. Design decisions were carefully evaluated and balanced against factors such as durability, maneuverability, serviceability, and efficiency. After finalizing modifications through detailed trail drawings and CAD modelling, Shark Tech collaborated with the Holy Heart of Mary High School's "Heart Innovators" Robotics team to precisely machine the frame using their CNC router. This partnership allowed high-quality fabrication while reinforcing the organization's focus on building an ROV that is robust, maintainable, and capable of performing in demanding marine environments.

Reusing and refining the previous ROV design proved beneficial, as testing demonstrated effective water flow through the frame, strong underwater stability, and reliable maneuverability during operation. Maintaining the established frame design also allowed the organization to focus more time on improving mission-specific systems and overall reliability rather than rebuilding an entirely new structure. This approach reduced unnecessary material waste and costs while supporting a more sustainable and efficient engineering process.

B. Innovation

Shark Tech has limited resources readily available. Innovation of a high-performance ROV design utilizing easily accessible components was paramount. The vast majority of components found on *Siku* have been 3D printed, allowing for replacements to be made at a low cost and in a fraction of the time. As a result, *Siku* has an innovative, serviceable, and cost-effective design.

The company's most significant innovation was adapting a store-bought carabiner to create an effective buoy anchor recovery tool. This was achieved by modifying the springs within the carabiner and securing it to a PVC pipe using zip ties and a custom 3D-printed holder attached to the end of the pipe, allowing it to integrate seamlessly with *Siku*. The company successfully developed this addition as a highly functional and reliable tool while keeping costs extremely low. The recovery tool is used to retrieve the buoy anchor, attach the rope, and return the rope to the surface. Through extensive testing, Shark Tech determined this strategy to be far more successful than alternative methods, such as using the claw.

Shark Tech made several software innovations to improve both pilot performance and mission accuracy. Our underwater measuring code allows the pilot to use the main camera view to measure lengths underwater by placing points along a desired distance, helping determine the size of objects and structures more accurately (Figure 6). We also implemented an AI-powered crab counter that uses the camera feed to scan, analyze, and count green crab populations. Together, these tools make our software more useful during missions by helping the team collect accurate data and

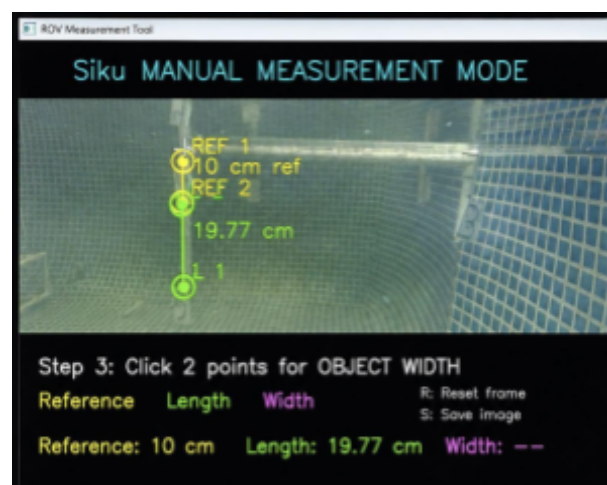


Figure 6: Screenshot of Siku's manual measurement tool - Image by James Penney

complete tasks related to environmental monitoring and invasive species mitigation, such as Task 2.1, without increasing project costs.

4. PROBLEM SOLVING

Shark Tech is composed of a close-knit group of students united by a shared goal: to design and build the most effective ROV possible. This collaborative mindset fosters high efficiency in both identifying problems and developing timely solutions. Strong cooperation among company members contributes to a positive work environment and a steady stream of innovation.

Despite this strong foundation, the development of *Siku* has presented several challenges. One significant issue has been coordinating meetings following the relocation of mentor Riley Regular, who moved 1500 km away from the company's base. To address this, Shark Tech has relied heavily on digital communication platforms, particularly Google Meet, to maintain regular and productive contact. The use of collaborative tools has played a vital role in project success. Google Classroom and Google Docs have enabled company members to contribute simultaneously across all areas of development, while providing a platform for real-time feedback and streamlined collaboration. Additionally, Canva has been employed to coordinate work on the company's visual materials, including the poster, and has improved the overall design workflow. To support communication beyond structured meetings, Shark Tech also utilizes a company-wide message board and group chats for immediate updates and informal coordination.

Throughout each stage of development, from design and production to testing and refinement, Shark Tech has followed a structured and logical approach to problem-solving. This process includes:

1. Identifying the problem
2. Determining the root cause
3. Eliminating alternative potential causes
4. Reducing the issue to its simplest form
5. Evaluating possible solutions based on cost, time, and feasibility
6. Implementing the most effective solution
7. Monitoring the outcome to ensure complete resolution

This problem-solving framework has proven highly effective in overcoming a variety of technical and logistical challenges. For example, during the coding phase, Shark Tech encountered issues where the data would occasionally fail to save properly. Additionally, the motor experienced a period of malfunction, failing to engage as expected. These challenges were addressed through extensive debugging, with the employees adjusting the code to ensure proper data logging and refining the motor driver circuitry to ensure reliable motor operation.

5. SYSTEMS APPROACH

Shark Tech approaches every decision with functionality and simplicity at the forefront, ensuring customers receive the most effective and reliable product possible. Rather than developing a completely new design, Shark Tech's employees spent countless hours modifying and refining last year's ROV design to better meet this year's mission requirements. This iterative development

process focused on maximum performance, efficiency, and system integration while addressing any possible limitations identified in previous iterations of *Siku*. The company determined that the ROV would rely on three fundamental systems: Propulsion, cameras, and pneumatics. Each system was carefully assessed and integrated into the ROV's frame to ensure optimal performance and structural compatibility. This streamlined configuration allows *Siku* to meet the demanding requirements of the product demonstration while maintaining reliability and ease of operation.

A. Vehicle Structure

As mentioned in the design evolution, Shark Tech has constructed *Siku*'s frame out of HDPE. This decision was based on several factors, including cost, availability, density, practicality, and past success. These considerations are outlined in the decision matrix presented below in *Table 1*. In previous ROV projects, the company utilized Polyvinyl Chloride (PVC) piping for the frame due to its low cost and regional availability. However, some challenges were revealed in reliably mounting tools and positioning motors effectively with PVC. Additionally, while the aluminum flat bar was considered for its affordability and high strength, it was ultimately discarded due to its higher weight compared to other materials.

HDPE, with a density of 0.93 g/cm³, is less dense than water (1.00 g/cm³), offering a perfect balance between structural durability and buoyancy to the ROV. Despite it being a higher cost, the company determined that HDPE was the optimal choice to house essential tools such as the claw, cameras, and motors.

The frame's dimensions - 43 cm in length, 38 cm in width, and 27 cm in height - were meticulously chosen to enhance maneuverability in complex Arctic and offshore energy environments, including around ice formations and subsea infrastructure. This compact design facilitates agile navigation and precise control in constrained underwater conditions commonly encountered during offshore inspection and exploration tasks. Additionally, the lightweight construction ensures the ROV remains under 15 kg, aligning with MATE's mission proposal's preference for lighter, more efficient vehicles. Moreover, HDPE imparts *Siku* with a professional, polished appearance while also providing durability suited for cold, high-impact operating environments.

Table 1: Decision Matrix for Frame Materials - Made by James Penney

Material	Availability	Density g/cm ³	Cost per Meter (USD)
½ PVC Pipe	Local	1.44	\$1.60
¾ HDPE 24"X 27" sheet	Order	0.93	\$80.68
1 Inch Aluminum Flat Bar	Order	2.73	\$7.17

6. VEHICLE SYSTEMS

A. ROV Software Design

Our ROV software uses a Python program on the laptop to read Xbox controller input and send commands to an Arduino, which controls the ESCs and brushless motors. This design keeps the motor control system reliable while allowing us to update and test the software easily on the laptop. The software includes several tools to support mission tasks. One tool measures objects using the camera feed by comparing the pixel size of a known object, such as targets found on the coral bed or on the iceberg, to the object being measured. This helps the Pilot make more accurate underwater measurements. Another tool uses machine learning to detect and count green crabs, which reduces manual counting and helps make results more consistent.

Our software was developed in stages. Since we reused our motor and camera feed code from the previous years, we had the basic functions needed to control Siku established. This provided additional time to test both the measurement tool and crab detection programs individually before being added to the main program. For version control, we saved working copies of the code before making major changes so we could return to a stable version if needed. Additionally, to improve the programming structure, Siku's software was reorganized from one large, singular file into a modular software structure to enhance its modularity and improve its readability.

Several features were included to improve system and operator performance. Controller dead zones and motor scaling help make movement smoother and reduce unwanted motor output. The measurement tool helps the Pilot and mission team collect data more quickly and reliably, while the crab counter reduces operator workload during identification tasks. The main limitations are that measurement accuracy depends on camera angle, image quality, and a visible reference object, while crab detection works best when crabs are clearly visible and similar to the training images. Additionally, the crab counting software demands a lot of the computer's working capacity, which can lead to small delays in the camera feeds.

A main focus of this year's software development was the vertical profiler, as it was one of the company's greatest challenges during the previous competition season; this system will be discussed further in the 'Payload and Tools' section of the document.

B. Pneumatics System

Siku's pneumatic system is critical on the ROV, as it provides compressed air to our claw, which allows the ROV to grip onto various objects in the water. The main components of the pneumatic system are located inside the control box. The system features a pressure release valve, an emergency shut-off valve, and a regulator in the system that is connected to the ¼" (6.35 mm) Pneumatic Tubing - rated to 862 kPa, that runs through our pneumatic piston foot pedal (rated to 115 PSI (793 kPa)). The pneumatic lines then run through the tether to the double-acting cylinder, rated to 130 PSI (896 kPa). The top side of the pneumatic system has a pneumatic line running to the ¼" (6.35 mm) M-Style plugs, which are rated to 290 PSI(2000 kPa). The pneumatic system is connected

to the compressor through the 9 mm x 3 m Ultra-light Rubber Whip Hose, rated to 115 PSI (793 kPa). A detailed systems integration diagram of all *Siku*’s pneumatic systems can be found in *Appendix A*.

C. Propulsion

The propulsion system of *Siku* is comprised of six TD7 12V motors, selected by Shark Tech due to their cost-effectiveness and favourable thrust-to-current ratio, enabling efficient power delivery. The company chose these motors over previously used bilge pump motors due to their ability to produce nearly double the thrust at a similar weight and current draw. This upgrade provides improved directional control, enhancing the ROV’s ability to navigate complex underwater environments with precision and stability. These thrusters come pre-shrouded to meet IP20 safety standards and feature integrated mounting brackets, simplifying installation.

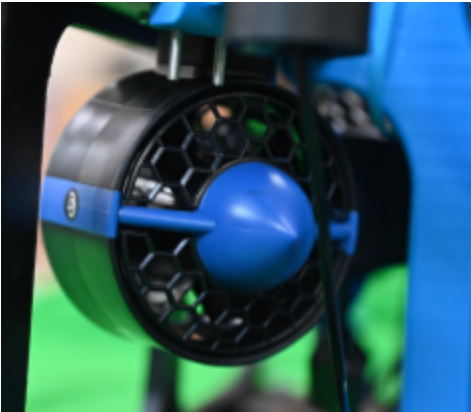


Figure 7: Picture of a TD7 12V motor | Photo taken by Olivia Normore

The design incorporates two front and two rear thrusters mounted at 45 - degree angles in a vectored configuration, allowing for maximum water flow through the frame while enabling precise multidirectional movement and improved handling. This arrangement is complemented by two centrally-positioned vertical thrusters for lift and depth control. Together, this configuration provides an optimal balance of maneuverability, stability, and propulsion efficiency.

Table 2: Decision Matrix for Propulsion Motors - Made by James Penney

Motor Type	Cost	Current Draw (Amp)	Control Method
1250 GPH 12V Bilge Pump ¹	\$50.00 USD	19.2	Analog
Diamond Dynamics TD7 Thruster ²	\$150.00 USD	13.1	Digital
Blue Robotics T200 Thruster ³	\$240.00 USD	17	Digital

D. Buoyancy

Siku is engineered to be slightly positively buoyant in water, with an elevated front profile to improve stability, maneuverability, and precision during mission tasks. Shark Tech modified the ROV’s buoyancy system after identifying that a slightly raised front end would improve the vehicle’s ability to safely retrieve delicate coral specimens during Mission Task 1, Seabed 2030: A Kaleidoscope of Corals in Cold Water. This design adjustment allowed the ROV to approach and recover objects with greater control while reducing the risk of distributing or damaging the surrounding underwater environments. The raised front profile also improved *Siku*’s precision and visibility during Mission Task 2, SmartAtlantic Reliance, while navigating and observing the iceberg structure. To further support this task, Shark Tech designed and constructed a custom lift bag system (see ‘Payload and Tools’ section below). When filled with air, the lift bag increased the overall buoyancy of attached objects, allowing the ROV to safely transport the lobster pot toward the shore while reducing strain on the vehicle and improving operational efficiency. To achieve and maintain a slightly positive buoyant ROV, Shark Tech applied the principles of buoyancy when selecting materials with densities lower than water’s, which is why HDPE was chosen for the frame due to its density of 0.93 g/ml, which is

slightly lower than water's density of 1.000 g/ml. Once all components and tools were installed, high-density foam was added to balance how the ROV sat in the water and to finalize its positive buoyancy. High-density foam was specifically selected for its ability to better withstand increased water pressure at a specific depth. Additionally, our 4" (100 mm) x 12" (300 mm) watertight enclosure was calculated to have a buoyant force of 23.1 N. When compared to its downward force of 7.36 N, it was able to support an additional 15.74 N (or approximately 1.6 kg) of weight, helping to offset the additional components mounted on Siku.

7. Electrical Systems

A. ROV Electrical Design

The electrical control systems onboard *Siku* are all housed in a watertight enclosure to protect sensitive components and ensure reliable underwater operation. *Siku*'s onboard systems are powered using 12V DC power supplied from the surface through the tether system. The power is routed through a distribution bar to all on-board components. *Siku*'s control system was designed to provide reliable communication and efficient integration between onboard electronics and the surface control station. Custom - written Arduino code, written in Python and C++, allows the Arduino to process control inputs and support mission operations during competition tasks. Communication between the pilot station and the ROV is achieved using an Ethernet cable running from the surface computer into the USB Extender, where the signal travels through the tether to a second extender box onboard the ROV, where commands are relayed to the onboard ROV systems. A detailed Systems Integration Diagram (SID) can be seen in Figure 19 in Appendix A.

B. Tether and Tether Management

The tether connects the topside control systems to the ROV through a 15 m neutrally buoyant tether, which consists of an Ethernet cable, two pneumatic airlines, four camera feed wires, and a power wire. A protective self-tightening weave covering is used to shield wires and tubing from potential damage to both the vehicle and the surrounding environment, including sensitive marine organisms, such as coral

heads. In addition, the protective covering helps minimize the risk of entanglement and abrasion from environmental hazards, including ice formations, during mission operations.

Previous versions of the ROV utilized a fixed strain relief system, where the tether was secured to a stationary mounting point on the frame. While this configuration effectively protected electrical connections, it restricted tether movement and could introduce unwanted pulling forces on the vehicle during maneuvering. To address this limitation, Shark Tech developed a dynamic strain relief system incorporating a tensioned guide wire. Rather than remaining fixed to a single point, the tether's strain



Figure 8: Cross section of the tether- Made by Belle Gibbons

relief attachment can move along the guide wire as the vehicle changes direction. This design improves Pilot control, reduces external torque on the vehicle, enhances vehicle-to-tether integration, and minimizes mechanical stress on both the tether and the ROV during operations.

Shark Tech recognizes the critical importance of effective tether management. The company Operations Manager and Pilot have established a tether management protocol to ensure the safe and efficient handling of the tether throughout product demonstrations. Designated tether managers, under the supervision of the Operations Manager and CEO, are responsible for maintaining proper tether deployment and organization on deck while remaining in continuous communication with the Pilot. Procedures include preventing kinks, tangles, excessive strain, and unnecessary tension on the tether, while ensuring the deck remains clear of potential tripping hazards. Adherence to these protocols supports operational safety, protects equipment integrity, and contributes significantly to the overall success of the mission.

C. Control System

The control system for the ROV is designed for efficient setup and operation during product demonstration runs. It comprises a hard-shell case and a laptop, facilitating portability and quick deployment.

Hard-shell case components:

- **Electronics Housing:** The case securely contains the electronics responsible for piloting the ROV, ensuring protection and organization.
- **Xbox Controller Interface:** An Xbox controller with dual joysticks is utilized to control the six thrusters, enabling precise maneuvering essential for tasks such as water sampling.
- **Pneumatic System Control:** The foot pedal operates the ROV's pneumatic system, providing responsive control.
- **Integrated Monitor:** A top-mounted monitor displays video feeds from *Siku*.
- **Safety and Regulation Components:** A pressure relief valve, an emergency shut-off valve, and a regulator ensure safe operation by adhering to established safety standards and regulations
- **Protective cover:** A plexiglass cover is secured over all electrical components found in the control box to meet IP-30 safety requirements. This ensures that no large objects can come into contact with electrical components during operation. See figure 9.

Laptop Interface:

- **Main Camera Feed:** *Siku*'s primary camera view is displayed, allowing the Pilot to monitor the ROV's surroundings.
- **Thruster Control:** Comprehensive operational control is provided via tether to control the six thrusters.



Figure 9: Siku control box - taken by James Penney

8. Payload and Tools

A. Cameras

Shark Tech designed *Siku* with a modular system that allows for efficient maintenance, adaptability, and reliable mission performance. To support live viewing during operations, *Siku* is equipped with a five-camera system consisting of one main USB camera and four easily replaceable analog underwater cameras. The main USB camera costs \$110, while the four analog cameras cost \$88 each. By reusing cameras from previous years, Shark Tech maintained a cost-effective and efficient approach while still ensuring clear visibility throughout missions. The modular camera setup also allows damaged or malfunctioning cameras to be quickly replaced with minimal downtime.

Shark Tech developed secure and practical camera mounts with specified angles to maintain full visibility.

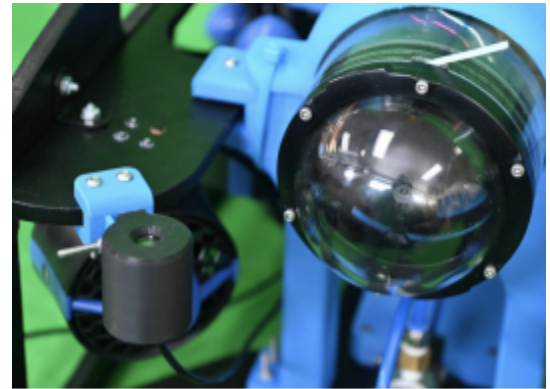


Figure 10: Two of Siku's Cameras | Photo taken by James Penney

Camera 1, *Siku*'s primary USB camera, is mounted inside the watertight enclosure and angled to provide the Pilot with the main control feed and improved situational awareness during operation. Camera 2 is positioned on top of the frame, facing downward, to assist with precise claw grabs, allowing the company to safely interact with objects while minimizing disturbance to sensitive coral gardens. Camera 3 is mounted facing the removable "Star" hook attachment and assists with tool interaction and positioning when specialized mission tasks require additional support. Camera 4 is mounted facing the bottom of the ROV to help prevent collisions or disturbances to underwater environments, including icebergs and surrounding biotic factors. Camera 5 faces upward toward the surface to support docking and navigation, helping *Siku* avoid hazards such as surface ice formations and floating infrastructure, including solar panels. Together, these five cameras provide *Siku* with the visibility and situational awareness necessary to safely navigate environments, complete mission tasks efficiently, and ensure reliable operation throughout competition missions.

B. Claw

Based on this year's mission tasks - *A Kaleidoscope of Corals, Servicing the Holyrood Subsea Observatory, supporting wind and oil fields and the recovery of vertical profiling equipment* - Shark Tech decided it would be beneficial to continue the refinement of their claw for *Siku*. Building on the previous year's design, which proved successful, the company opted to make small changes to its



Figure 11: Image of the pneumatic claw in action | Photo taken by Marcus Flynn

design while refining its functionality for this year's specific challenges. The claw is an original Shark Tech design, 3D printed in-house for precision, customization and repairability.

The claw features two primary gripping mechanisms, powered by a pneumatic piston, to enable it to interlock and securely hold objects. Safety is always our top priority while collecting samples around animals and divers, which is why our claw was constructed with smooth edges. Extensive testing was conducted to ensure that the claw consistently grips objects at the same point every time. This reliability allows the Pilot to approach each task with the flexibility and ease needed for optimal execution.

Figure 11 depicts the testing of *Siku's* claw in the Atlantic Ocean, where it was used to pick up sea urchins from the side of a wharf. Shark Tech successfully brought the sea urchins to the surface and placed them down without damage. Proving the ability of *Siku's* claw to safely pick up objects while still having a tight grip. This example demonstrates how *Siku's* claw can be used to assist in safely recovering delicate cold-water coral species from the depths of the Atlantic Ocean.

C. Buoy Anchor Recovery Tool

The attachment mechanism uses a repurposed carabiner, ½-inch PVC pipe, and a 3D-printed base designed to fit securely into the claw. Its design was based on the successes and failures of similar tools used in past mission tasks. PVC pipes were added to the outside of the carabiner to help guide it onto the U-bolt on the buoy anchor, improving accuracy and efficiency based on feedback from the Pilot and design crew.

The line storage barrel can be attached or removed from *Siku* depending on the mission. It holds up to 20 meters of rope, providing enough recovery line to return to the surface. Once the ROV attaches the carabiner to the U-bolt, the rope is released from the barrel in a controlled manner to prevent tangles with the ROV and the surrounding environment.

D. Lift Bag

The lift bag is a removable pneumatic system designed to assist in recovering objects that exceed *Siku's* direct lift capacity, such as the lobster pot in *mission task 2.3*. The system is deployed using the ROV to attach the lift bag to the target object. Once the ROV has safely moved clear, the Pilot activates a pneumatic valve within the control box, allowing the lift bag to inflate and provide the buoyant force required to bring the object to the surface. The lift bag has a total lift capacity of 14kg.

E. The Star Hooks

The Star Hooks are specialized tools developed for Mission *Task 1.1*, which involves retrieving coral from deep-sea environments. Designed with both efficiency and environmental protection in mind, the Star Hooks consists of custom-designed 3D-printed poles mounted along the lower sides of *Siku*, allowing the ROV to

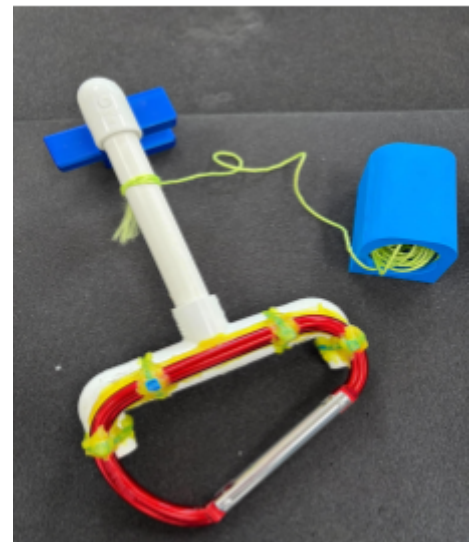


Figure 12: Buoy Hook Tool - taken by James Penney



Figure 13: Star hook - Photo by Marcus Flynn

securely collect multiple Basket Stars simultaneously. The design was specifically tailored to accommodate the size and shape of Basket Stars, improving handling accuracy and operational reliability. By enabling controlled, precise retrieval, the Star Hooks support efficient task completion while minimizing the risk of environmental disturbance and protecting surrounding marine life.

F. Vertical Profiling Float

Shark Tech designed and developed a vertical profiling float known as the *Shark Fin*. This device utilizes a built-in Wi-Fi module to enable wireless communication between the onboard Arduino UNO R4 Wi-Fi and a companion Arduino located at the surface. Arduino microcontrollers were selected due to the company's familiarity with the platform and its user-friendly C++ programming language.

The onboard Arduino is connected to a TD7

Motor via an electronic speed controller. Shark Tech selected the TD7 motor after its strong performance and reliability within the ROV propulsion system proved to be a more effective option than a previously used bilge pump motor. The motor-driven system was chosen for its adaptability to meet the operational requirements established by MATE.

Shark Fin operates using an autonomous depth-control system. Upon receiving a descent command from the surface station, the TD7 motor initiates the float's descent beneath the simulated ice surface. During operation, a Blue Robotics Bar30 pressure sensor continuously sends real-time depth data to the Arduino, which is then stored on an onboard SD card for later transmission and analysis. The float is programmed to descend to 2.5 meters, hold position for 30 seconds, ascend to 40 centimetres below the surface, hold for an additional 30 seconds, and then repeat the profiling cycle twice.

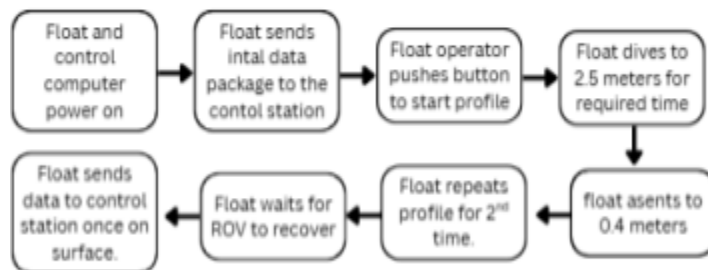


Figure 14: Logic of Shark Fin- Made by Jerry Cabot



Figure 15: Shark Fin Vertical Profiling Float - Image by Jerry Cabot

All electrical components are powered by three 12V NiMH batteries wired in parallel and housed within a 40-centimetre acrylic waterproof enclosure to ensure reliable protection of sensitive electronics during operation. To see the logic of the system, please refer to the flow chart found in *Figure 14* on the page above.

G. New Vs. Reused

Shark Tech prioritizes operational efficiency by carefully balancing whether to build, buy, reuse, or redesign components, with a general preference for in-house fabrication when the necessary tools, materials, and expertise are available. This approach ensures that design decisions are both cost-effective and aligned with mission performance requirements. For this build cycle, the majority of

core components were retained from previous iterations, including the frame, propulsion system, camera and mounting assemblies, claw and pneumatic system, with only minor internal rewiring completed within the enclosure to improve organization and reliability. This decision builds on the success of last season’s design cycle, during which Shark Tech developed and refined a robot that met performance expectations and exceeded internal benchmarks. As a result, rather than dedicating significant time to repeating the design, buy, and build process, the company chose to focus this season on optimization and performance enhancement. This shift allowed for more efficient use of development time to refine an already proven system to achieve maximum capability and reliability. Employees determined that the ROV is well-suited for operation in cold, harsh environments, including under sea ice conditions, as well as tasks such as transporting coral heads and replacing subsea sensors. Overall, this approach reflects Shark Tech’s confidence in its established design. By leveraging a tested and effective platform, the company is able to prioritize improvement and operational excellence, ensuring the system performs safely and to its full potential.

Table 3: Pros and Cons table for *Siku*’s construction: Made by Olivia Normore

Componet	Build		Reuse		*Buy		Final Decision
	Pros	Cons	Pros	Cons	Pros	Cons	
Propulsion	N/A	N/A	Cost-effective	Optimal power and built-in shrouds eliminating the need for additional fabrication	More power	Cost and if something breaks it would require replacing an entire motor	Reuse
Cameras & Mounts	N/A Cost-effective and customizable	N/A Time consuming	Cost-effective and reliable	Wear and tear	Product tailored to mission/task	Extra Expense	Reuse
Claw - Pneumatic System	Customizable	Resource-intensive and more efficient to utilize a proven solution	Cost-effective, efficient and user-friendly	Wear and tear	Eliminate fabrication	High cost and not as customizable	Reuse
Enclosure & Electrical System	Customizable	Time consuming and complex	Experience and knowledge. Cost-effective and reliable	Wear and tear	Made by professionals	High cost and not customizable	Reuse

*Along with shipping delays and availability, any product purchased has an additional cost due to remote location.

10. SAFETY

A. Safety Philosophy

At Shark Tech, the philosophy of protecting people and preserving oceans serves as the foundation for all operations. Proactive preparation through comprehensive training, proper tools, and clearly-defined procedures is considered essential to preventing incidents before they occur. Safety is a critical component of every aspect of work, whether in the workshop, on the pool deck, or during ROV deployment (see Appendix B and C).

Shark Tech has an in-house Operations Manager who is a certified lifeguard, along with three trained First Aiders - the Pilot, the Research and Development Technician, and the Operations Manager. The Operations Manager is present during all construction activities to ensure adherence to safety protocols. If any employee has a safety concern regarding the ROV or another individual, they are instructed to notify the Operations Manager, CEO, or mentor(s). Additionally, all personnel must have a thorough understanding of basic safety practices. By fostering a strong culture of safety, Shark Tech can protect its employees, work efficiently, and stay committed to its mission.

B. Safety Features

Shark Tech prides itself on creating one of the most versatile yet safe ROVS on the market. *Siku* meets all safety guidelines outlined by MATE. A summary of key safety features can be found in *Table 4*.

Table 4: Safety Features of Siku ROV - Made by Olivia Normore

Safety Features	Description
Rounded Edges	Rounded edges prevent injury and reduce the risk of damaging marine or pool environments.
Waterproofed Electronics	A watertight enclosure prevents damage to the electrical system.
Shrouded Thrusters	The TD7 thrusters feature built-in shrouds to meet IP-20 standards, adding protection and efficiency.
Caution Labeling	All potential hazards are clearly labelled to prevent injury. E.g., the claw and thrusters
Power Supply Fuse	There is a 25A fuse within 30cm of the positive end of the power supply.
Strain Relief on Both Ends of the Tether	The tether is secured on both sides by electrical strain relief fittings to ensure that there is no strain on the tether.

11. CRITICAL ANALYSIS

A. Troubleshooting

When troubleshooting the ROV, there were several techniques that Shark Tech used to identify and address any issues (See *figure 16*):

Overall, Shark Tech believes it is important to approach troubleshooting systematically and methodically, starting with the most common and easily fixable issues before moving on to more complex problems. Communication and collaboration among the company members help to identify and resolve issues that may occur.



Figure 16: Troubleshooting Flow Chart- Image by Belle Gibbons

B. Testing Methodology

As part of Shark Tech's testing process, each system is evaluated independently before full integration into the ROV. To minimize variables and isolate potential issues, initial tests are conducted outside of the water whenever possible. Once individual components are verified, in-water testing is performed to ensure that all systems function correctly when operating together. These full-system

tests help identify any existing or potential issues, ensuring that *Siku* performs at its highest possible level. Shark Tech tested the *Siku* in water, alongside each prop, in MATE's mission tasks this year. By being able to test the *Siku* multiple times, Shark Tech was able to become comfortable with their product demonstrations, knowing *Siku* is capable of completing the mission within the given time.

C. Propulsion Testing

When testing the *Siku*'s propulsion system, the motors were initially operated on dry land to check for electrical issues before being mounted on the ROV frame. Once those tests were completed, Shark Tech employees then looked at various motor placement options to maximize efficiency and maneuverability. To evaluate this, the company conducted a series of in-water trials using a pool, closely observing how different motor placements and orientations affected the movement of the ROV. After numerous trials, the company determined the most effective angles for optimal performance.



Figure 17: Testing the Float and ROV the water - Photo taken by Olivia Normore

D. Pneumatics Testing

To test the Pneumatic systems, the company followed procedures similar to those used for the propulsion systems. During the previous season, the claw design progressed from cardboard mock-ups to early 3D-printed models before reaching a fully functional final product. The company's engineers tested various tubing options to determine which configuration would provide the greatest force output for the claw while safely supporting the required operating pressure. This process allowed employees to evaluate which mission tasks the ROV could complete reliably and without issue.

As Shark Tech reused the same claw and pneumatic system for the current season, additional testing was conducted at the beginning of the year to verify that all pneumatic components, connections, and seals remained fully operational following storage and previous use. The company first tested the pneumatic connection to ensure reliable performance with the tether fully deployed, followed by operational testing to evaluate maneuverability and Pilot control with the integrated system.

E. Vertical Profiler Testing

The vertical profiler underwent extensive testing and refinement throughout all stages of development. Initial testing focused on establishing a reliable Wi-Fi connection between the profiler and the on-surface control box, while being submerged. This process involved numerous hours of testing and system adjustments conducted within Shark Tech's



Figure 18: Testing the float outside - Taken by Jerry Cabot

in-house testing facility. Subsequent testing verified the profiler's ability to consistently maintain a target depth of 2.5 meters for 35 seconds, ascend to 0.4 meters for the same duration, and then repeat the profiling sequence autonomously. One of the primary engineering challenges was ensuring the reliability and consistency of this operating cycle. Early testing revealed that minor changes in buoyancy could significantly affect depth accuracy and overall system performance. To address this issue, Shark Tech implemented a two-part solution focused on improving both buoyancy consistency and software reliability. Due to the company's remote northern location, access to suitable deepwater testing facilities was limited. To overcome this challenge, Shark Tech constructed a custom testing apparatus using a large section of sewer pipe capped at one end and filled with water. This setup provided a controlled environment capable of validating the profiler's full operational capabilities. A photo of this testing apparatus can be seen in *Figure 18*.

12. Budget and Cost Accounting

A. Budget

As with any growing company, effective budgeting is a critical component of long-term success. At the start of the year, the CEO and CFO, in collaboration with the company's mentors, established the annual budget. The total budget for this year is set at \$39,050 USD. This budget encompasses a range of expenses, including the travel costs for 12 individuals attending competitions, ROV construction, marketing initiatives, and various unforeseen costs that may arise. These expenses may include fluctuations in travel costs due to inclement weather and ice conditions, which could result in temporary diversions of ferry and flight routes and extended hotel stays. A detailed breakdown of the budget is provided in Appendix D. It is important to note that the budget accounts for higher-than-average travel expenses due to the company's remote location. Employees and mentors are required to travel over 1000 km to attend the regional competition in St. John's, Newfoundland, and then travel 1000km again to attend the World Championships in St. John's, Newfoundland, again in June.

To secure the necessary funds, Shark Tech organized a variety of fundraising events, including ticket draws for various items, multiple community barbecues, and weekly lunch fundraisers, during which Shark Tech provided meals at their school. The company engaged with several local businesses and community stakeholders to secure sponsorships in addition to receiving funds from MATE-NL and the government of Newfoundland and Labrador to support our travel to competitions.

Table 6: Main Sources of Income for Shark Tech 2025 - Made by Yashveen Gunput

Source	Notes	Amount (USD)
Balance forward	Funds left over from June 2025	\$9300
MATE-NL Regional Grant	Funds to travel to the Regional competition and other construction of the ROV	\$4865
MATE-NL World Championship Grant	Funds to travel to St. John's, NL, for the World Championship	\$5817
Newfoundland and Labrador Government Support	Funds from the Provincial Government to support our efforts in the competitions	\$5817
Local companies	Various local companies that invested in our project	\$10000

B. Project Cost

Shark Tech remained committed to operating within the established budget throughout the year by maximizing the reuse of major components from the company's previously built ROV in the development of the Siku model. Rather than purchasing entirely new systems, the company focused on refurbishing and repurposing existing equipment whenever possible, making only minor purchases where necessary. Components experiencing normal wear and tear were replaced or upgraded only when it was determined that doing so would improve reliability, performance, or long-term value. In cases where custom parts were required, new components were fabricated in-house using 3D printing technology, further reducing expenses while allowing for efficient design modifications and repairs.

When additional purchases were required, a structured approval process was followed. The CFO was first informed of the required item and then conducted research to compare pricing and availability from both online and local suppliers. Once the most cost-effective option was identified, the findings were presented to the mentors, who proceeded with placing the order on behalf of the company. Through careful financial planning, component reuse, and limited purchasing, Shark Tech was able to avoid any major expenditures this year, resulting in significant cost savings. A detailed breakdown of project costs is provided in Appendix E, while Table 5 outlines the established budget, actual costs, and income. Based on current projections, employees expect to maintain a surplus of \$7809.30 USD to support the company in future competition seasons.

Table 5: Total Project Cost for Siku and Travel in USD - Made by Yashveen Gunput

<i>Budgeted</i>	<i>\$39,050.00</i>
<i>Costs</i>	<i>\$33,083.27</i>
<i>Income</i>	<i>\$35,799.00</i>
<i>Fundraised</i>	<i>\$5093.57</i>
<i>Account Total</i>	<i>\$7809.30</i>

Acknowledgements

Shark Tech would like to thank the following individuals and organizations for their support:

- Mr. Regular, Teacher Mentor, and Founder of Shark Tech
- Ms. Burden, Science Teacher and Teacher Mentor
- Mrs. Chubbs, English Teacher and Teacher Mentor
- Labrador Fishermen's Union Shrimp Company for their donation of a vat to test *Siku*
- Clubhouse Embroideries for making company polo shirts
- William Normore Limited, C&T Enterprises Limited, Cenovus Energy, SubC Imaging, The Government of Newfoundland and Labrador, Seamor Marine, GRI Simulations, eSonar, and Equinor for sponsoring Shark Tech
- MATE Center and the Marine Institute for allowing us to compete in the competition
- Neil Rowsell and family, for letting us use their swimming pool for testing
- Town of Forteau for the use of their septic pipe for vertical profiler practice.

Appendices:

Appendix A - Electrical and Pneumatic SID

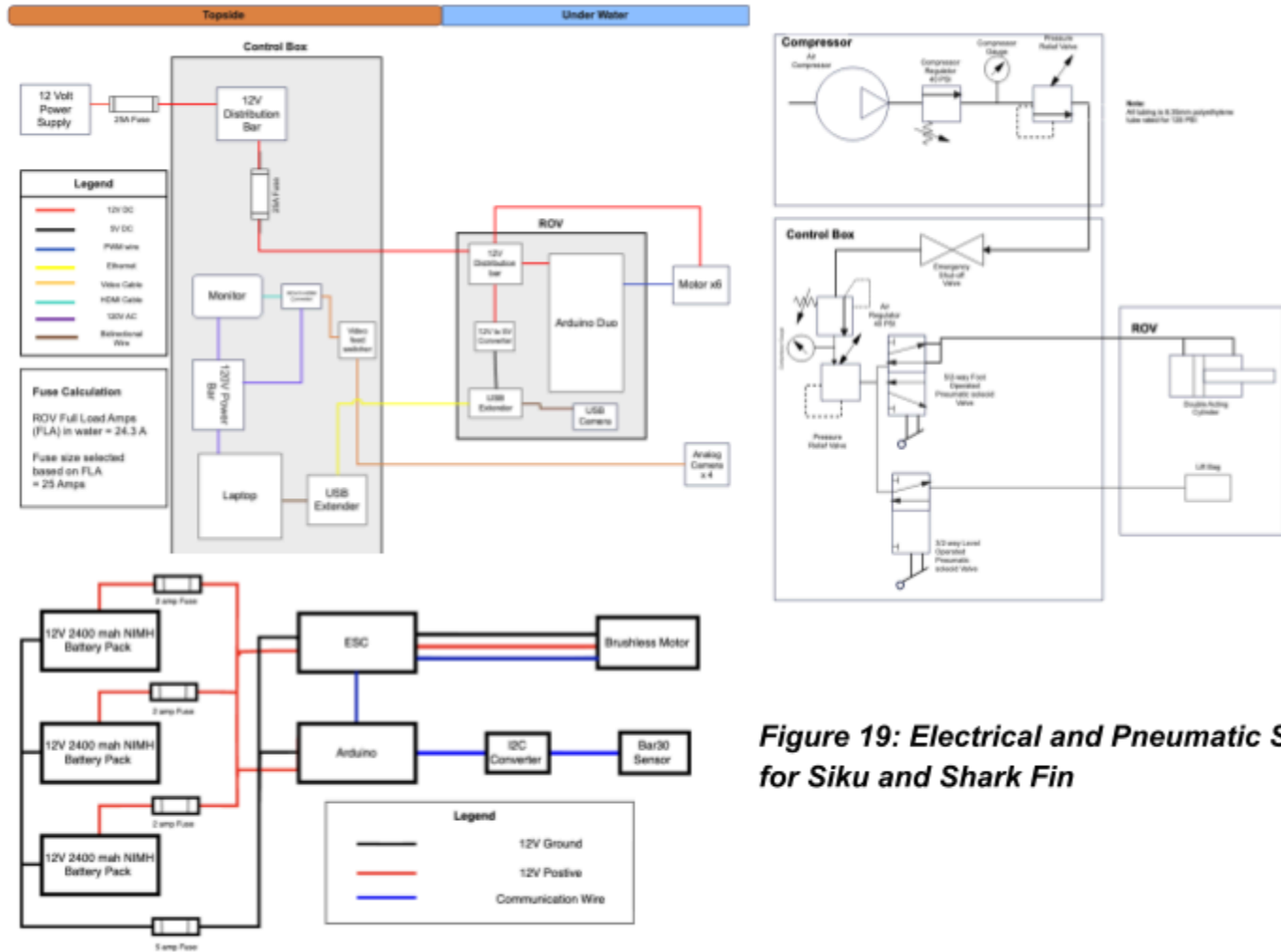


Figure 19: Electrical and Pneumatic SID's for Siku and Shark Fin

Appendix B - General Safety Checklist

- Ensure that all personnel have their hair securely tied up, sleeves rolled up, and earphones/jewelry put away before the use of any tools.
- Verify that all personnel are wearing closed-toed shoes.
- It is crucial to establish clear and effective communication with co-workers.
- Ensure that all personnel are wearing safety glasses.
- Make sure that passageways are clear of objects and wires.
- Hazardous objects and materials should be kept away from members and the ROV when not being used.
- All electronics, except for the tether, should be kept away from water.
- Ensure that all wires are carefully and effectively covered.
- Ensure that the power connection and controller are connected before powering on the control box.
- PFDs are required when around the water.

Appendix C - Operation Protocols

Pre-Power (Pilot, Co-pilot, and Deck Crew)

- ☐ Area is clear and safe (no tripping hazards or obstructions)
- ☐ All team members are wearing safety glasses
- ☐ Verify RPS power switches are off
- ☐ Tether laid out on the deck and is free of damage
- ☐ Tether is connected and secured top the RPS
- ☐ Tether is connected to strain relief and secured to ROV
- ☐ Power source connected to RPS
- ☐ Verify electronics housing is properly sealed and fasteners are tightened
- ☐ Visual inspection of electronics for damaged wires or loose connections
- ☐ Thrusters are free from obstructions

Power-up (Pilot, Co-pilot, and Desk Crew)

- ☐ Verify RPS is receiving 12V nominal
- ☐ Control computers up and running
- ☐ Ensure desk crew members are attentive
- ☐ The Co-pilot calls out, "power on!"
- ☐ Power on RPS
- ☐ Co-pilot calls out, "performing thruster test"
- ☐ Test thrusters and verify thrusters are working properly
- ☐ Verify video feeds from navigation and mission cameras
- ☐ Ensure cameras are positioned correctly
- ☐ Test electrical and pneumatic components that require pilot input (See Pneumatic System Test)

Inspect and Test Pneumatic System (Pilot, Co-pilot)

- ☐ Verify all pneumatic lines on RPS and ROV are properly connected to the MATE air supply
- ☐ Verify that the compressor is switched on
- ☐ Adjust pressure regulator to 40 PSI
- ☐ Activate pneumatic system and open main valve
- ☐ Verify there are no leaks and pneumatic lines are securely connected while under pressure
- ☐ Activate pneumatic tools and verify the pressure returns to 40 PSI after the tool is shut off

ROV launch (Pilot, Co-pilot, and Desk Crew)

- ☐ The pilot calls out, "ROV surfacing"
- ☐ Desk crew calls out, "ROV on surface. Disable thrusters"
- ☐ Co-pilot calls out, "thrusters disabled"
- ☐ Deck Crew call out, "hands on", and remove ROV from the water
- ☐ Co-pilot calls out, "safe to remove ROV"
- ☐ After securing the ROV on deck, Deck Crew calls out, "ROV secured on deck"
- ☐ Co-pilot powers down RPS
- ☐ Team begins demobilizing

Leak Detection (Pilot, Co-pilot, and Desk Crew)

- ☐ Immediately power down the ROV and RPS systems and remove the ROV from the water if a mission is occurring
- ☐ Visually inspect ROV to identify the source of the leak. Do not disassemble any part of the ROV until the source of the leak is detected
- ☐ Install pressure testing equipment and use soapy water to verify the source of the leak
- ☐ Create a plan and repair the leak
- ☐ Check all systems for damage and verify proper operation
- ☐ Document the source and cause of the leak and detail the corrective actions and design changes made.

Pit Maintenance (All Team Members)

- ☐ Pit is well organized and free of debris
- ☐ All tools, cables, and equipment are safely stored in their designated spaces and there are no tripping hazards
- ☐ Check electrical cords and correct any electrical hazards
- ☐ Check supplies and organize a shopping list if anything is needed for repair RPS, ROV and tether are clean, dry and stored
- ☐ Protective caps for electrical connectors are in place
- ☐ ROV, RPS and tether have been readied for use on the next mission run

Loss Of Communication (Pilot, Co-pilot and Deck Crew)

- ☐ Cycle power on RPS to reboot ROV
- ☐ If no communication, power down ROV, retrieve via tether
- ☐ If communication restored, confirm there are no leaks, resume operations
- ☐ If communication has not been restored, begin troubleshooting procedures and isolate the issue. Determine if the issue is with hardware or software
- ☐ Document the problem and detail the corrective actions made to solve the problem

Appendix D - Project Budget

Shark Tech Budget 2025-2026

Reporting Period: Sept. 2025 - June 2026

School Name: La

Mentor(s): Riley Regular and Kate Burden,
Amanda Anthony-Chubbs

Expenses				
Category	Type	Description	Projected Cost	Budgeted Value
Hardware	Re-used	HDPE Board, Fasteners, PLA	\$300	—
	Re-used	4" Watertight enclosure + Attachments	\$500	—
	Re-used	Pneumatics System	\$400	—
	Purchased	Materials to improve the control box layout	\$150	\$150
Electronics	Purchased	Laptop for Control System	\$1100	\$1100
	Re-used	LCD Screen	\$300	—
	Purchased	Spare Motors	\$800	\$800
	Re-used	Float Electronics	\$730	—
	Re-used	3 Analog Cameras	\$250	—
	Re-used	USB Camera	\$100	—
	Re-used	Power and communication for tether	\$500	—
Travel	Purchased	Travel to Regionals for 12 people for 8 days	\$10,000	\$10,000
	Purchased	Travel to Worlds for 12 people for 8 days	\$25,000	\$25,000
General	Purchased	Marketing Materials for Regionals/ Worlds	\$500	\$500
	Purchased	Company Clothing	\$1500	\$1500
	Re-used	Testing pool	\$250	—
	Purchased	Travel delays due to weather	\$3000	\$3000
Total Budgeted Expenses (USD)				\$39,050

Appendix E - Project Cost

Shark Tech Project Costing 2025-2026	Reporting Period: Sept. 2025 - June 2026
School Name: Labrador Straits Academy	Mentor(s): Riley Regular, Kate Burden, Amanda Anthony-Chubbs

Funds						
Date	Type	Category	Expense	Description	Notes	Amount
	Reused	Electrical	Motors	6 TD7 Motors	Tools and Components	\$894.95
	Reused	Electrical	Control System			\$380.67
	Reused	Electrical	Enclosure			\$378.27
	Reused	Hardware	Frame	HDPE Board	24"x 54" HDPE Sheet	\$143.64

	Reused	Hardware	Mounting	Brackets and Bolts	Brackets and Hardware to Construct the Frame	\$30.35
	Reused	Hardware	PLA+	3D Printed Parts		\$201.00
11/14/2024	Reused	Camera	Cameras	Cameras	USB Camera system	\$176.00
	Reused	Camera	Display	Monitor	Screen and Hardware	\$86.19
	Reused	Electrical	Laptop	Laptop	Screen and Code	\$1100.00
	Reused	Tether	Covering	Protective Covering	Covering for Tether	\$35.23
	Reused	Tether	Wires	Ethernet Cable and Power Cable	Tether wires	\$502.40
	Reused	Pneumatics	Claw System	Required Pieces for Pneumatic Claw	Full Pneumatic System	\$150.36
02/01/2025	Reused	Float	Computer	Hardware for Float	Motor Controllers and Arduinos	\$120.00
	Reused	Float	Enclosure	Blue Robotics Order	Watertight Enclosure	\$475.00
	Purchased	Travel	Travel	Regionals Trip	Travel Expenses for Employees (Labrador to St.John's)	\$8732.32
	Purchased	Travel	Travel	Worlds Trip	Travel Expenses for Employees (Labrador to St.John's)	\$21,830.88
	Purchased	Marketing	Displays and Clothing	Clothing & Marketing Materials for Trip	Polos, Hoodies, Hats, Posters, and Paper Items for Worlds	\$1237.08

Total Spent (USD)	\$33,083.27
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