

Robosharks 2026 Technical Documentation

Boulder High School Robotics | Boulder, CO, USA

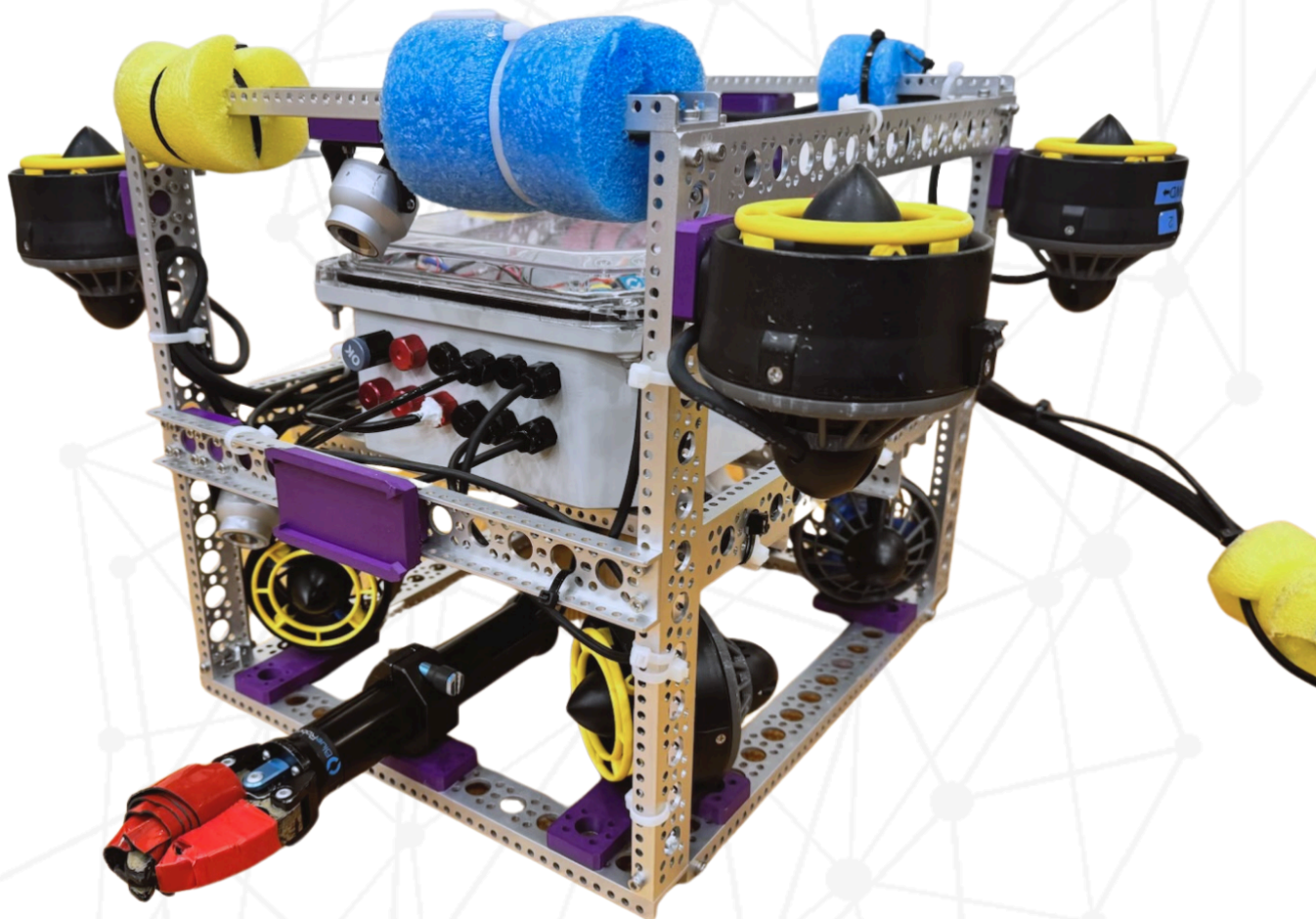


Fig 1: A photo of Wayde-JBZ, our completed ROV

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Abstract

The Robosharks at Boulder High School is a student-led club that competes in the MATE ROV competition. In this document we present the development, design and budget involved in the making of the *Wayde-JBZ*, a remotely operated vehicle (ROV) designed to complete tasks in the 2026 MATE Ranger competition. These tasks include demonstrating offshore wind-powered oil platforms, autonomously identifying invasive species, and retrieving coral samples, among other things.

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Project Management

Company and Personnel

Because our company was quite small, our personnel usually worked together on tasks. While there were official titles to organize and delineate responsibilities, detailed in Table 1, our work environment was very collaborative, with employees often expanding their responsibilities beyond their designated role.

ROLE	RESPONSIBILITIES
CEO	Organizes meetings and employees, establishes long term goals and overall processes
CFO	Keeps track of budget, spending, and income and facilitates communication with sponsors
Technical Leads	Is in charge of their respective team, makes final decisions, and organizes their team
Safety Officer	Ensures and documents safety compliance

Table 1. Company positions and descriptions

Resources and Procedures

We utilized many resources and procedures to aid in the organization and management of tasks and employees. These tools were critical in our ability to manage such a complex project by allowing us to design models, share and collaborate on documents, and communicate effectively.

Resources

We used a shared google drive to organize and share documents with each other. To manage code, we used GitHub. For fast communication we used iMessages, which was feasible because of our small company size. This platform ensured that everyone would promptly receive and see important team messages. It was chosen over alternatives such as Discord or Google Chat because many employees didn't regularly check those inboxes. For mechanical design we used



Onshape CAD and for electrical design we used KiCAD. These both helped us develop a model for the ROV before beginning prototyping/building.

Procedures

We held all-company meetings every Wednesday where we outlined our weekly objectives, discussed challenges we were facing, and collaborated on solutions. During these meetings we also talked about operational logistics like finding pool testing sites, funds, and more. Having this structured procedure kept us focused and made clear everyone’s responsibilities for the upcoming weeks.

Schedule

We developed a high-level, flexible schedule at the beginning of the year to outline our objectives at the monthly scale (Table 2). This was intentionally broad in order to accommodate any challenges and roadblocks we might face. Week-to-week we held team meetings to establish more specific goals for the upcoming days. These were often small deliverables that we kept track of on a whiteboard and could be achieved within the week (Figure 1).

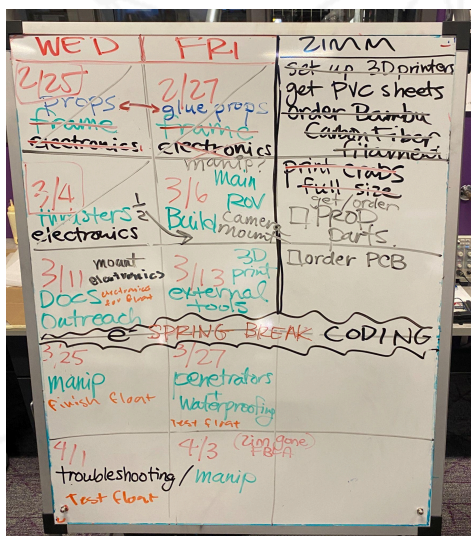


Fig. 2: Weekly Schedule (left)

Date	Phase
November and December	Brainstorm, develop ideas, make preliminary CAD model, and order materials
January-April	Building
May	Testing and troubleshooting
May	Tech docs, marketing display, and other documentation
June	Polish everything for Worlds

Table 2. Monthly Schedule

Design Rationale

Planning and Design Process

The company brainstormed ideas during the all-team meetings, where everyone inside the small company contributed. This was a time when our small size benefitted us, as everyone had a voice. We then evaluated our options by using web resources and consulting experts, and



subsequently made the most informed decision. For instance, when figuring out best the material to 3D print with, we consulted an experienced member of a previous Robosharks team, Gus. He helped us decide on carbon fiber and aided in the setup for printing. An example when we utilized web resources was when choosing a drybox. By weighing price, customer reviews, and specs available online, we were able to select the option that best fit our needs.

Mechanical

The Robosharks' approach to the vehicle this year was simplicity. We strove for as simple a design as possible to make construction, testing, and troubleshooting easier. Since we knew we would have limited access to a lab and pool, this was key to our development process by reducing unnecessary complications. In just our first pool test, the *Wayde-JBZ* worked well, demonstrating the effectiveness of our simplistic vehicle design. However, simplicity never came at the expense of safety, reliability, or competence.

Structure

We used aluminium for the frame in order to maintain a lightweight, but affordable body for optimal mobility. We considered PVC instead for its versatility, but ultimately chose aluminum for its rigidity, accepting the higher cost. The *Wayde-JBZ* has a cubic structure for a simple and modular layout. Doing this enabled us access to a variety of different thruster and camera positions.

Propulsion

We used eight Blue Robotics T200 thrusters, fully-flooded brushless motors with encapsulated windings, coating with magnets, and rotor. Chosen for their balance of speed, efficiency, and proven reliability in competition environments. Eight thrusters gave us full six degrees of freedom. We discussed a six-thruster configuration to reduce power consumption and cost, but determined the reduction in thruster redundancy and lateral control was an unacceptable tradeoff given the task requirements.

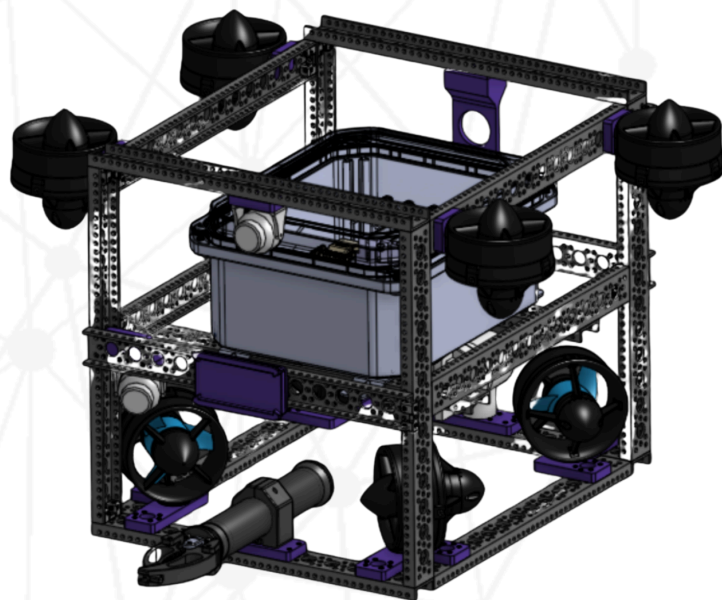


Fig. 3: CAD model showing 8-thruster layout, aluminium bar frame, and positioning of the front and manipulator cameras



To determine optimal placement and angle, we used the Thruster Arrangement Utility (TAU), a tool developed by a past member of our company that models thrust vectors across a given configuration and outputs a performance map across all axes. This allowed us to evaluate multiple arrangements before committing to one, rather than relying on trial and error.

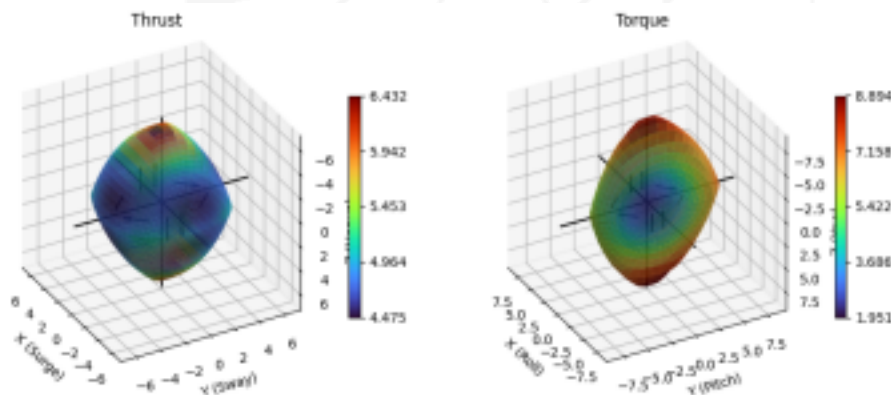


Figure 4: TAU graph of Wayde-JBZ's thrusters

Although eight T200 thrusters can theoretically draw up to 92A at full power, our MATE supply is capped at 25A. Our software manages this by limiting the simultaneous thruster output, keeping total amp draw within budget during normal operations. We placed our thrusters at the top and bottom of the bot so they weren't in the way of accessing the drybox, and angled the bottom ones to achieve strafe.

All eight thrusters were reused from previous years, saving approximately \$1,840 compared to purchasing new. T200's continued to meet our performance requirements, so replacement was not justified.

Buoyancy

Because the drybox was full of air, which is less dense than water, it displaced a large amount of water relative to its weight, making our ROV positively buoyant. To counteract this, we added a dense, 2.25kg weight and then fine-tuned the buoyancy with pool noodles until reaching a neutrally buoyant state. At this point, our up-down thrusters wouldn't have to work to maintain the ROV's depth.

Cameras

Our philosophy regarding cameras was to effectively position them to simplify the job of our pilot during deployment. We wanted one forward looking camera to see approaching objects and have a broad view of the pool. However, we also knew that a close-up camera focused on the front manipulator would aid our pilot in completing tasks that required fine movements. In



addition, a downward facing camera helped us see the bottom of the floor and assess the layout of the tasks, allowing us to plan out a strategic route. This camera angle would also make task 1.3, which requires looking directly at the pool floor. Finally, a fourth camera facing backwards helps us when backing up, and importantly it sees our back manipulator. In this way, we tailored the *Wayde-JBZ* to the 2026 Ranger tasks by strategically placing our cameras in positions that would simplify our pilot's job during complex tasks. Another notable feature of our cameras was that they were bought from another company to ensure waterproofness and clear vision.

Manipulators

Our front manipulator is a Blue Robotics Newton Subsea Gripper. We decided to use a commercial manipulator because of our small company size. With a small team, we valued the time we could gain by using a ready-to-use Newton over the benefits of a custom one. However, we realized that this manipulator alone would not be able to perform one of the tasks. To solve this, we changed our design to include a motorized attachment at the back of the bot that was made specifically for a task that required rotational movement. This was our back manipulator, which we custom designed and built so we could achieve a simple, rotating claw. This two manipulator system—one versatile and one specialized—allowed the *Wayde-JBZ* to be able to complete most tasks with ease while being a relatively simple system.



Fig. 5: Blue Robotics Newton Subsea Gripper

Sensors

We only have two sensors on our ROV: a Blue Robotics high resolution depth sensor and an Adafruit 9-DOF IMU. The depth sensor is necessary for our depth-hold software that helps the ROV maintain a stable altitude, used for task 1.3. In addition, depth measurements are required for task 2.2. The IMU reports angular velocity and linear acceleration which is used for our automatic stabilization software.

Electrical

When designing our electrical system we decided to prioritize modularity, safety, and serviceability. Power enters the drybox from the MATE-supplied 12V power supply and is split across two voltage rails: 12V for thrusters and other high-draw electronics, and 5V for the Raspberry Pi 5 and sensors. The GoBILDA XT30 Power Distribution Board serves as the backbone of our 12V rail, letting each subsystem connect and disconnect independently. Voltage



conversion to 5V is handled by a GoBILDA XT30 BEC. We chose this part for its 83–93% efficiency, $\leq 300\text{mVpp}$ output ripple, and 6A continuous output, which keeps our logic electronics stable during operation. Output voltage is adjustable via a pin swap, giving us flexibility if requirements change.

Our main power connection uses XT90 connectors at 12V 25A, with XT30 for lower-current runs. Standardizing connectors eliminated the confusion of mixed types and made component swaps fast. Our previous screw terminals often needed two people just to change one wire and were prone to loosening under vibration. XT30/XT90 solved both problems.

Control System Software

Our control system runs between a surface station and an onboard Raspberry Pi 5, communicating over Ethernet via a Python socket connection. The Pi operates as a DHCP server, so our system connects to any Ethernet-enabled laptop without network configuration.

On the surface, our PyQt5 GUI reads pilot inputs from any connected controller and packages them into commands. Commands represent ROV actions, moving along an axis, activating a manipulator, holding depth, and are scheduled based on time, user input, or the completion of a prior command. Each command targets a specific subsystem (thrusters, sensors, manipulator), and only one command can control a given subsystem at a time, preventing conflicts.

The Pi forwards commands via USB serial to a Teensy 4.1, which translates them into PWM signals for our thrusters, sensors, and manipulator. After each cycle, the Teensy sends sensor data back to the surface for the co-pilot to monitor in the GUI. Critically, every cycle begins with a handshake, the Teensy confirms system state and checks that no emergency stop is active before executing any movement. If the handshake fails, the ROV won't move until the condition clears. Stabilization runs through PID controllers on the Teensy using IMU data, correcting for rotational drift and maintaining depth during precision tasks.

Tether

Our tether runs two 6 AWG power conductors and a single CAT5e Ethernet cable, bundled in a braided sheath for abrasion resistance. We chose 6 AWG to keep resistive losses low, at our tether length of 6.1 meters and maximum draw of 25A, voltage drop is only 0.38V (3.2%), leaving 11.62V at the ROV, well above our minimum operating threshold. Power efficiency sits at 96.8%.



At 6.1 meters, our tether comfortably exceeds MATE's maximum pool depth of 4 meters while staying short enough to limit tangling. Pool noodle foam attached at regular intervals makes the tether neutrally buoyant, preventing it from dragging on the ROV or messing up task elements on the pool floor.

Blue Trail Engineering Cobalt penetrators make the tether fully removable from the vehicle, simplifying transit, storage, and hull maintenance. On the surface side, power runs through an Anderson SB50 with an adapter to MATE-specified Anderson Powerpole terminals.

Control Station

Our control box has two monitors: a primary display for forward and manipulator cameras, and a lower monitor dedicated to the downward camera so the pilot never has to look away. A co-pilot on a side laptop handles coral modeling, data logging, and other processing tasks without breaking the driver's focus.



Fig. 6: Control Box With Co-Pilot Laptop

Float Design

Our profiling float is designed around two primary goals: reliable depth-controlled profiling and accurate pressure data transmission.

The float uses a lead screw driven by a NEMA 17 stepper motor to push and pull a 500mL syringe, changing the float's displaced volume and therefore its buoyancy. A custom 3D printed coupler converts the rotational output of the motor into linear motion along the lead screw, driving the syringe plunger up and down. This mechanical approach gives us precise, repeatable control over buoyancy changes without relying on pumps or valves. A limit switch at the end of syringe travel provides a hardware failsafe against overextension, preventing the syringe from being driven past its physical limits and potentially flooding the enclosure.

All electronics are mounted on a custom PCB designed. The PCB integrates a Heltec ESP32 LoRa V3 microcontroller, a TMC2209 stepper motor driver, and an MP1584EN step-down converter to regulate voltage for logic-level electronics. Combining these onto a single board simplified wiring, reduced the chance of loose connections during deployment, and made the internal layout compact enough to fit cleanly inside the enclosure. The Bar02 pressure sensor communicates with the ESP32 over I2C and provides depth measurements with 0.16mm

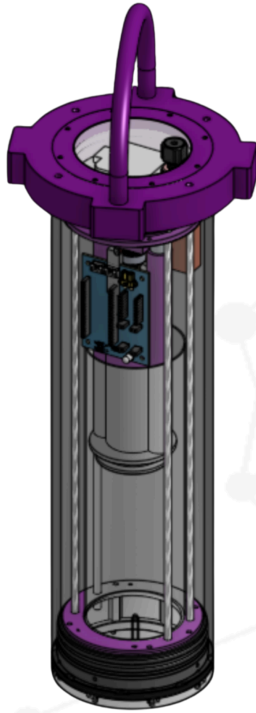


Fig. 7: CAD Of Float

accelerate quickly between depth targets and respond aggressively to PID corrections during depth-hold tasks. Depth control is handled by a PID controller running on the ESP32, using Bar02 pressure readings as the feedback signal. The PID loop drives the stepper motor to adjust syringe position until the measured depth matches the target setpoint, continuously correcting for overshoot and steady-state error. This allows the float to hold a precise depth without manual adjustment, which is directly required by the MATE depth-hold task.

The Heltec V3's integrated LoRa module [12] transmits depth, pressure, and temperature data to a topside receiver wirelessly after each profile cycle. The surface computer logs the incoming packets and plots depth vs. time in real time, allowing the team to monitor profile behavior, verify the float has reached its target depth, and confirm task completion from the surface.

resolution [3], which is more than sufficient for the precision required by the MATE float tasks. JST PH connectors are used for low-current sensor and signal connections, with XT30 for power, keeping the connector standard consistent with the rest of our electronics ecosystem. The float is powered by two Tenergy NiMH 6V 2000mAh battery packs wired in series, providing a 12V supply to the system. A Blue Robotics pressure-rated switch mounted on the enclosure allows the float to be powered on and off without opening the housing, reducing the risk of o-ring damage from repeated opening during competition.

The float is housed in a Blu-Sub 115mm diameter, 400mm length acrylic tube enclosure [13], giving it an outer volume of approximately 4.15 liters. With a 500mL syringe providing the full buoyancy adjustment range, our displacement-volume ratio is 0.120:1. This large ratio means the float can generate substantial buoyancy changes relative to its size, allowing it to

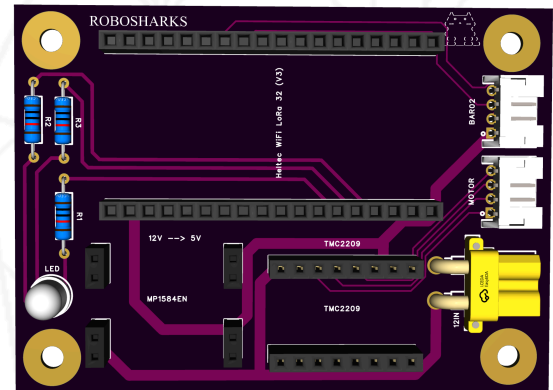


Fig. 8: 3D Model of Float's PCB



Build vs. Buy, New vs. Reused.

Our build vs. buy decisions for the manipulator were described above. We decided to buy waterproof cameras from ExploreHD to simplify their integration into our bot. In past years, we experienced detrimental issues with cameras leaking, causing us to lose vision. This year, we outsourced the waterproofing to minimize this risk, which we deemed to be worth the cost.

We repurposed all eight thrusters from previous years to save significantly on expenses, and our tether was also reused from a previous year. We were able to save massively on the drybox by choosing a cheap option that met our needs but did not have extra. Many of the electronics that went inside the drybox were new, which we decided would improve reliability, as the previous year's electronics were damaged and could be faulty.

Accounting

Budget

At the start of the year we marked out a rough budget estimate for broad categories of spending or income (See Appendix A). Every Wednesday during our company meetings, we checked on how our expenses were compared with the budget. If there were significant discrepancies, we discussed why and worked to stay on budget. The funds left over from last year allowed us to buy more professional equipment, such as the underwater ExploreHD cameras. We re-used as many parts as possible, such as the thrusters, which saved us almost \$2,000 dollars.

Project Costings

See Appendix B.

Safety

Safety was always at the center of our operations and design. As a result, we have a dedicated safety officer to ensure that all safety procedures are followed and all safety requirements are met. In this way, we prevent dangerous situations from occurring well before they happen.

Personnel Safety

All team members were informed of and complied with all safety standards inside the shop. Required PPE includes safety glasses, closed-toed shoes, no loose clothing, no jewelry, and long hair tied back. When novice employees used potentially hazardous equipment, such as drills,



saws, or solders, they were trained by an experienced lead beforehand. At the pool, all poolside personnel remain behind the pool edge while the ROV is powered unless trained beforehand, and no one handles the ROV while the thrusters are spinning. Our designated Safety Officer oversees compliance during both build sessions and competition runs.

Equipment Safety

We strived to eliminate as many hazardous features of the ROV as possible. This meant filing corners of the frame, filing the ends of zip ties, adding thruster guards, and otherwise padding sharp edges. Notably, we ensured that the thruster guards met IP-20 standards. All electrical wires were either connected with enclosed connectors or soldered and covered with heat shrink. Before testing in water, it was ensured that there were no exposed wire connections. In addition, the lid of the drybox was tightened thoroughly, and any sign of leak meant the bot was quickly removed for it to be fixed.

Operational Safety

Before every deployment, our company runs through a before run checklist: all thruster guards secured, all connections verified inside the drybox, vent is closed, tether is laid out and clear of walkways, drybox tighten, and the surface station handshake confirmed active in the GUI. The ROV does not enter the water until every item is checked. A dedicated Tether Manager is assigned for the duration of each run and is responsible for keeping the tether clear of walkways and feeding slack at the pilot's pace to prevent the tether pulling on the ROV or tangling around task structures.

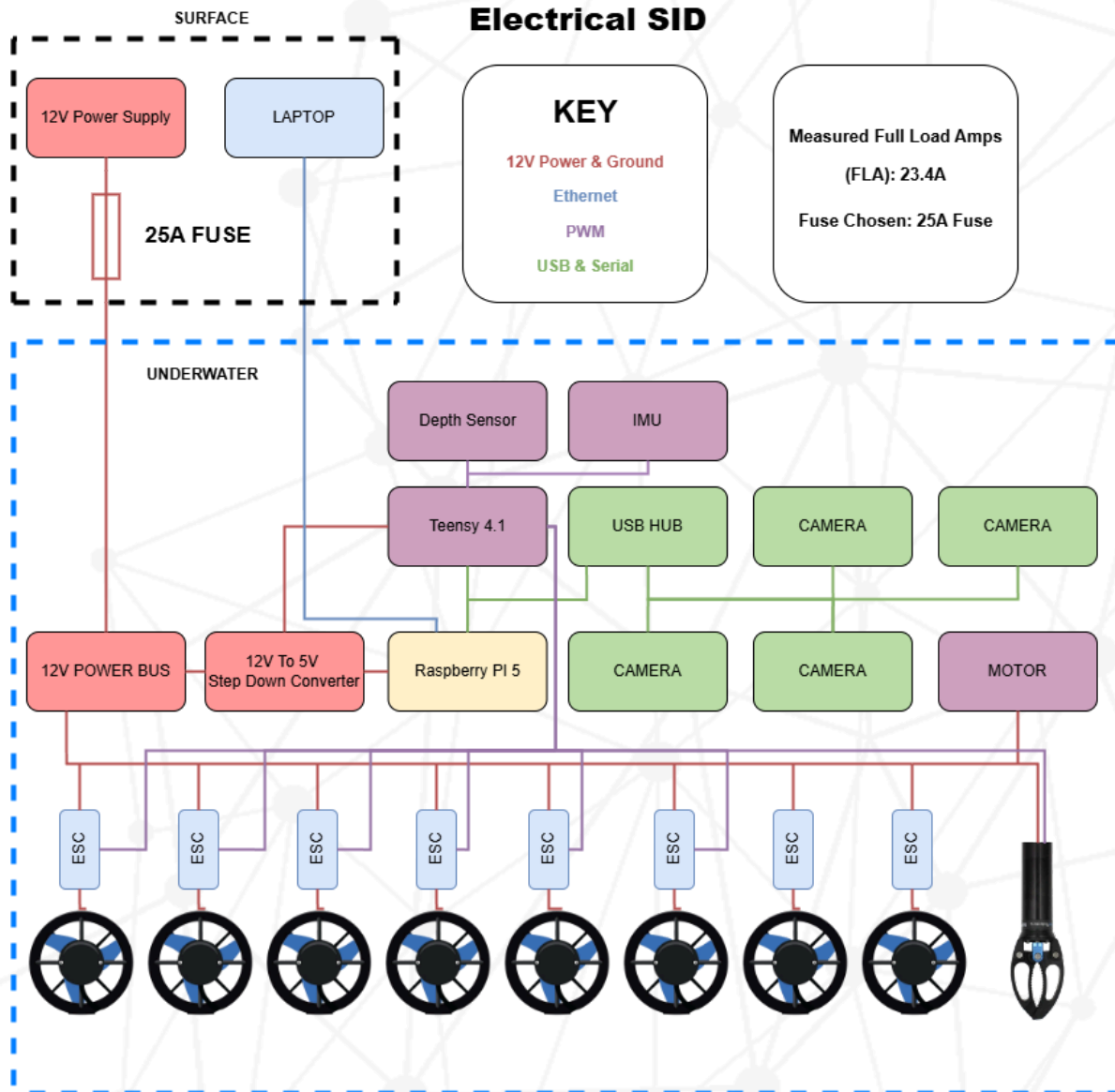
Our Teensy handshake safety check means the ROV cannot execute movement commands until the system confirms no emergency stop is active. If the handshake fails at any point during operation, the ROV stops responding to input until the condition is cleared.

When operating near reef structures, the pilot reduces thruster output and engages depth-hold mode to minimize the risk of accidental contact with task elements or the environment. An inline 25A fuse on the power line protects against overcurrent faults.

After each run, if the ROV was operated in saltwater, all connectors and the frame are rinsed with fresh water before storage to prevent corrosion. Our full pre-deployment and operational safety checklist is documented in Appendix C, which is reviewed by the team before every run.

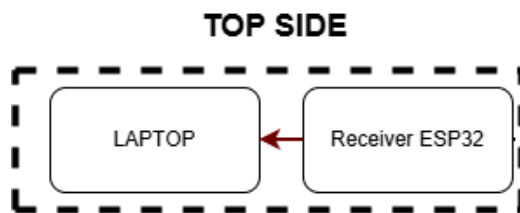


System Integrated Diagrams (SID)





SID For Non-ROV Device



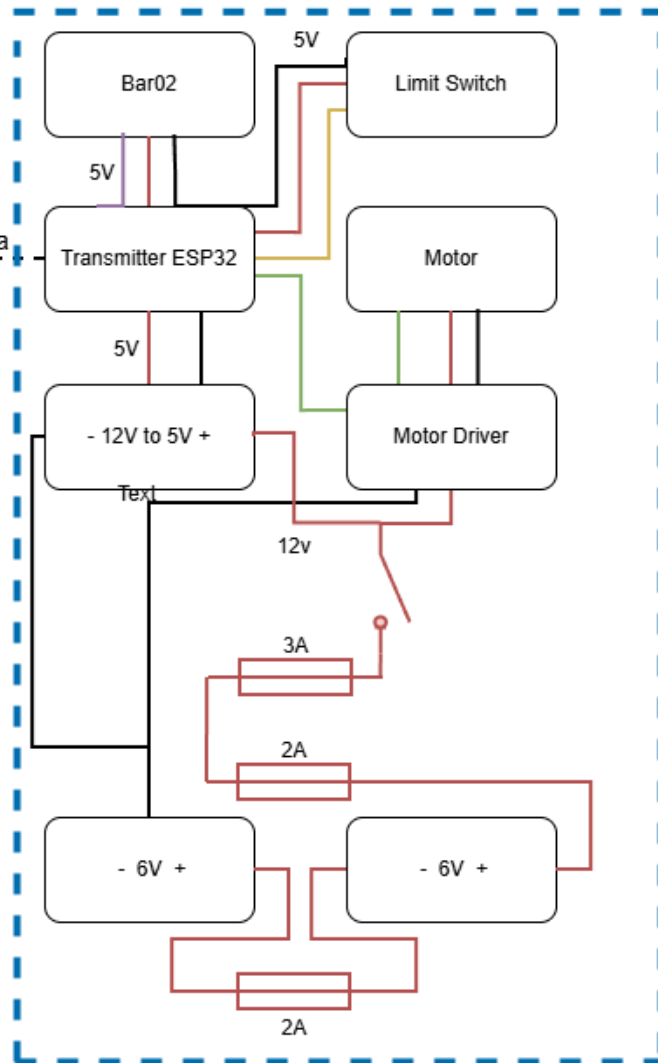
Fuse Calculations

ESP32 & Sensors: 650mA max
Motor: 2000mA max
Waiting Mode: 650mA max
Buoyancy Change Mode: 2.65A Max

KEY

Power
Ground
USB
PWM
I2C
Analog Signals

FLOAT CONTROL SYSTEM



Testing and Troubleshooting

Testing & Troubleshooting

We were challenged by the fact that we had no access to a pool until May. However, we did preliminary waterproof testing on the drybox by filling a sufficiently large bin with water. Once we got to a pool, in addition to fine-tuning the ROV's buoyancy, we were able to test and refine



the controls, like changing input curves. We were fortunate that the *Wayde-JBZ* was fully functional the first time we tested it in a pool.

Our approach to troubleshooting was to systematically narrow down sources of failure to quickly solve problems as they arose. Changing one variable at a time allowed us to isolate potential causes of failure. One example of a troubleshooting technique was when our drybox leaked during the initial testing. We placed paper towels inside to see where exactly the leak was coming from. This isolated the source of the leak for us to promptly fix. Here, our strategic approach to troubleshooting helped us save time.

Prototyping

The Robosharks highly value prototyping before full development as a tool for evaluating options before committing to one. After the threaded inserts in the drybox came out, we had multiple ideas about how to secure the lid. This was a scenario where we utilized prototyping. We modeled a version of each solution, and then chose the one we thought worked best. Our flexible, problem-solving mentality allowed us to prototype, troubleshoot, and test in an iterative way, smoothing out the challenges we faced.

Acknowledgements

We would like to acknowledge and greatly appreciate Jim Bartlett, who has contributed to this club with his generous donations throughout the years. Without his support, this would not have been possible. We would also like to thank our mentor, Jessica Klauzer-Zimmerman, for her tireless support of the team. We thank the Devil Thumb Home Owners Association for allowing us to use their pool for testing throughout the summer. Finally, thanks to everyone else who helped us reach this point, whether it was through their advice, moral support, time, or donations.

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Appendix A: Budget

Budget:

School Name:	Boulder High School	Reporting Period:	
Instructor:	Jessica Klauzer-Zimmerman	From:	11/1/25
		To:	5/21/26
Income:			
Source			Amount
Left over from			\$8,500.00



previous year				
Jim Bartlett Foundation				\$10,000.00
Expenses:				
Category	Type	Description	Projected Cost	Budgeted
Mechanical	Purchased	Frame, screws, drybox, pvc	\$800.00	\$800.00
Mechanical	Re-Used	Thrusters, weights, penetrators, manipulator	\$3,000.00	-
Electronics	Purchased	Raspberry pie, wires, cables, cameras	\$2,000.00	\$2,000.00
Electronics	Re-Used	Cables	\$250.00	-
Control Box	Purchased	Monitor, xbox controller	\$250.00	\$250.00
Control Box	Re-Used	Control box	\$150.00	-
Travel	Purchased	Flights, housing, food	\$18,500.00	\$18,500.00
			Total Income	\$18,500.00
			Total Expenses	\$24,950.00
			Total Expenses-Re-used	\$21,550.00
			Total Fundraising Needed	\$6,450.00



Appendix B: Project Costings

Project Costings:

Category	Type	Item	Description	Amount	Running Balance
General	Cash		Left over funds from last year	\$8,500	-\$8,500
Electronics	Purchased	IMU	Adafruit 9-DOF	\$24.95	-\$8,475.05
Electronics	Purchased	Depth Sensor	Blue Robotics depth sensor	\$80.00	-\$8,395.05
Electronics	Purchased	ExploreHD	Waterproof Cameras	\$1,300.00	-\$7,095.05
Mechanical	Purchased	ZQ-100804 Waterproof Outdoor Enclosure	Drybox	\$72.48	-\$7,022.57
Mechanical	Purchased	ZX-1008K-04	Drybox Platform	\$23.32	-\$6,999.25
Mechanical	Purchased	1143 U-Channel;	1143 Series Mini Low-Side U-Channel	\$284.81	-\$6,714.44
Mechanical	Purchased	Block Mount	1205 Series Dual Block Mount	\$83.88	-\$6,630.56
Mechanical	Purchased	L-Bracket	Threaded Steel L-Bracket	\$5.99	-\$6,624.57
Mechanical	Purchased	M4 Screws	M4 x 6mm	\$9.49	-\$6,615.08
Mechanical	Purchased	M4 Screws	M4-0.7 x 8mm	\$6.89	-\$6,608.19
Mechanical	Purchased	M4 Screws	M4 x 12mm	\$8.82	-\$6,599.37
Electronics	Purchased	XT30 Power Distribution Board	XT30 Power Distribution Board (XT30 Input, 8 x XT30 Outputs)	\$35.98	-\$6,563.39



Electronics	Purchased	Voltage Regulator	6A BEC / Voltage Regulator (5-30V Input, 3.3V, 5V, 6V, 8.4V, 12V Output, XT30 Connectors)	\$27.99	-\$6,535.40
Electronics	Purchased	XT30 Power Distribution Board	XT30 Power Distribution Board (XT90 Input, 8 x XT30 Outputs)	\$24.99	-\$6,510.41
Electronics	Purchased	Tenergy NiMH Receiver	Tenergy NiMH Receiver RX Battery with Hitec Connectors 6V 2000mAh High Capacity Rechargeable Battery Pack for RC Airplanes/RC Aircrafts and More	\$24.00	-\$6,486.41
Mechanical	Purchased	WetLink Penetrator	M10 4.5 mm LC	\$26.00	-\$6,460.41
Electronics	Purchased	MT30	Amass MT30 Plug Connector	\$11.99	-\$6,448.42
Electronics	Purchased	Raspberry Pi 5		\$128.89	-\$6,319.53
Electronics	Purchased	Teensy 4.1		\$31.50	-\$6,288.03
Electronics	Purchased	Teensy 4.1 Breakout Board	Screw Terminals	\$13.99	-\$6,274.04
Electronics	Purchased	BNO055	Adafruit 9-DOF Absolute Orientation IMU Fusion Breakout - BNO055	\$24.95	-\$6,249.09
Electronics	Purchased	XT90H	Amass XT90H XT90 Wire	\$11.99	-\$6,237.10
Electronics	Purchased	16 Gauge Wire	16 Gauge Wire 60ft	\$17.99	-\$6,219.11
Control system	Purchased	Monitor	InnoView 4K 18.5 inch	\$119.99	-\$6,099.12



Control system	Purchased	Wall mount	Ultra Low Profile Fixed TV Wall Mount	\$16.99	-\$6,082.13
Props	Purchased	Materials for props	PVC, rope, screws, etc	\$359.82	-\$5,722.31
Travel	Purchased	Flights	Total cost for all round trip tickets from Denver to Canada	\$9,000.00	\$3,277.69
Travel	Purchased	Housing	Total cost to house team	\$4,000.00	\$7,277.69
Travel	Purchased	Food	Total cost for food during the trip	\$720.00	\$7,997.69
Travel	Purchased	Rental vehicle	Total cost for renting van for the trip	\$3,000.00	\$10,997.69
Travel	Purchased	Travel insurance	Total cost of travelers insurance	\$1,000.00	\$11,997.69
Mechanical	Re-used	Thrusters	T200 thruster	\$1,840	\$13,837.69
Electronics	Re-used	Ethernet cable		\$12.99	\$13,850.68
Mechanical	Re-used	Manipulator	Blue Robotics Newton	\$720	\$14,570.68
Mechanical	Re-used	Penetrators	Blue Robotics Potted Penetrators	\$100.00	\$14,670.68
Mechanical	Re-used	Pool noodles		\$8.00	\$14,678.68
General	Cash donated		From the Jim Bartlett Foundation	\$13,500	\$1,178.68
				Total Raised:	\$22,000
				Total Spent:	\$23,178.68
				Final Balance:	\$1,178.68



Appendix C: Safety Checklist

Build/Construction:

- ☐ Work surface is clear of debris and water before beginning
- ☐ Required PPE is worn (safety glasses, closed-toed shoes, no loose clothing)
- ☐ No power tools used without lead supervision
- ☐ Soldered connections are fully cooled and insulated before the next step
- ☐ Workspace is cleaned and tools are returned after each session

Opening the Drybox:

- ☐ The surrounding area is clear of water and debris

Closing the Drybox:

- ☐ All wires are connected and not exposed
- ☐ O-rings are clean, undamaged, and greased
- ☐ Vacuum test performed if drybox was opened since last deployment and no major pressure drop over 15 minutes
- ☐ There is no water inside

Before Operation:

- ☐ There is proper strain relief on topside
- ☐ There is proper strain relief on the ROV
- ☐ There is a proper fuse and verified rating
- ☐ All thruster guards secured and meeting IP-20 standard
- ☐ There is no hazardous debris in the pool
- ☐ All parts of the ROV are sufficiently affixed; there are no dangling or loose parts
- ☐ There is someone managing the control box
- ☐ There is someone managing the tether to ensure it doesn't tangle
- ☐ Handshake confirmed active in GUI
- ☐ The control box and power supply is far away from water

During Operation



- ☐ Someone is managing the tether
- ☐ A poolside handler is present and able to retrieve the ROV manually if needed

Disconnecting Tether

- ☐ The surrounding penetrators are dry, and no water might enter the drybox.

Appendix D: Shop Safety Policy

1. Always, at all times, wear safety glasses
2. Only use a tool if you are comfortable and familiar with it
3. Ask for help if at any time you are unsure
4. Don't leave hot or sharp objects in an area where they pose a danger
5. Any incident must be reported immediately to the mentor
6. Wear proper masks when dealing with fumes or smoke
7. Ensure shop ventilation is on when soldering or creating other fumes
8. Turn shop power off when done
9. Clean up after done to maintain a safe environment