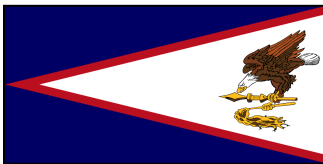


American Samoa Navitechers

Mate ROV World Championships 2026

Fetu Lolo



2



MATE ROV RANGER DIVISION

Pacific Horizons School, AS 96799

Chief Executive Officer:

Evan Zou (G11)

Chief Operations Officer:

Evan Zou (G11)

Chief Financial Officer:

Alana Joserose (G10)

Safety Officer:

Logan Chen (G11)

Mechanical Systems Lead:

Yuchen Bai (G11)

Electrical Systems Design:

Evan Zou (G11)

Damin Pyo (G10)

Human Interface Design:

Yuchen Bai (G11)

Evan Zou (G11)

Dive Operations:

Yuchen Bai (G11)

Chief Technical Translator:

Tautasi Sauvao (G10)

Marketing Lead:

Tora Jones (G10)

Marketing Specialist:

Tora Jones (G10)

Photographic Lead:

Selena Tan (G9)

Presentation Board Design:

Yoon Seo Pyo (G11)

Damin Pyo (G10)

Creative Consultant:

Logan Chen (G11)

Ida Underwood (G12)

Software Lead:

Yuchen Bai (G11)

Mentors:

- Jenward Montalbo

Sponsors:

- Tool Shop

- Manu'a Store

- Happy Mart

- NOAA

- All-Star Signs

- Manu'a Chen

- Michelle Chen

- Pacific Horizon
School



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Abstract

Talofa from Navitechers Robotics. Here at Navitechers Robotics, we aim to serve the untapped Polynesian market with high-quality and ongoing innovation in ROVs. Our company's core values include collaboration, ongoing innovation, environmental sensitivity, and a strong commitment to quality in everything we produce. Our purpose is to aid and help the American Samoan marine wildlife, where our operations take place, and much more, as we wish to expand to other parts of the Pacific Ocean.

In the “Fetu Lele” ROV, we created an enduring product. The propeller guard helps to protect the propeller and prevents sea creatures from getting stuck inside of it. The thruster motor is upgraded to the Johnson 1000 GPH Pump Motor from our previous ROV. The upgraded pump is more effective for hooking up power cables, attaching solar panels to offshore power generators, and documenting underwater wrecks using a built-in camera system. And this is all connected to an arduino mega, with our custom proprietary code.

With Fetu Lele’s array of utility and tools, it is a proficient and reliable remotely operated vehicle, ready for operations and missions in any type of environment. Its tools allow it to perform precision based movements and record high quality footage of said movements and operations.

This technical document will go over the construction, problems, management, and teamwork that went into the making of the Navitecher’s two years in the making ROV, Fetu Lele. Detailing and explaining each meticulous part, and how it would benefit the Pacific Island communities.

ROV Development

During the development of our ROV, we brainstormed ideas and shared designs as a team. Each member brought unique strengths and perspectives to the table, which helped us separate our team members into different groups. In these groups, we all put our ideas together to create our ROV. When designing different components, we looked at different ideas that were given to us, either from the internet or from our previous mentor, Mr. Michael, along with our



current mentor, Mr. Jen. We also used our own ideas and inputs, testing them out and seeing which were best suited for us.

Our team looked at the pros and cons of each design that was brought up, and from the data that we gathered, we made the final decisions for our ROV's design. We tried keeping it as eco-friendly as possible, recycling and reusing materials we had to the best of our abilities. Starting from the ground level, sustainability was an important value throughout our build. By making our own devices and components from scratch instead of buying them. With this, our whole ROV consists of careful tradeoffs; we've had to design and manufacture the majority of the parts we used. A great example of our ever-growing innovation was our claw. We've had many changes in the design of our claw; we went from a manually opening and closing claw to an electrical system powered by motors and gears.

Alongside the technical aspects, we also aimed to incorporate our island's culture into our design. Adding on traditional Samoan patterns as a representation of our island. We remodeled the frame of the ROV to a more drone-like design, unlike our previous year's octagonal shape. Our new drone-shaped model is more hydrodynamic, allowing us to move through the water more quickly. Along with a new design, we also used HDPE plastic, which is positively buoyant and very durable. In different fields, we conducted extensive research, seeing how other people took their approaches in creating different components. In some designs, we took a combination of ideas to make our final design. For example, when we first began making our claws, we had three different designs. Last year, Tasi, Yuchen, and Slava each made their own designs, and out of them, we chose one that would be most compatible. Over the course of a few days, we made modifications to it in order to mold it to our liking.

Material Management

Many of the parts on our ROV are 3D printed or reused. We recycled and repurposed components from our old ROV and scavenged usable parts from other electronic devices. Due to the remoteness of our island, we do not have readily available access to electronic resources, so

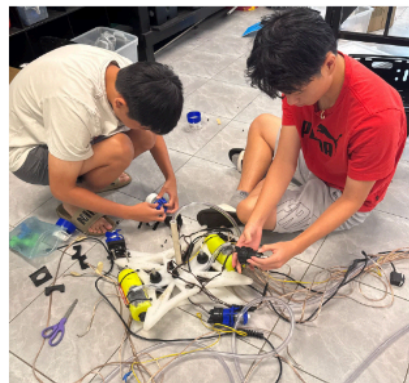
we have learned to innovate with the materials that were locally available. For our frame, we chose to use a thick HDPE cutting board and our 3D printed items were made of PLA, which is biodegradable, limiting concerns for testing our ROV outdoors. When selecting our building materials, we had to take into account different things. Since we are an island with very little exposure to different stores and resources, we had to make the most of what little we have. On our control box, we have a plexiglass covering that separates our components. We chose plexiglass due to it being clear, allowing us to better manage our control box, while having a more presentable look.

To meet different mission specs, we made many subtle changes to our claw and frame. With the claw, we made it multifunctional, which was fit to complete the many tasks that were presented in this mission. We added a rotational element so we can turn certain parts of the claw according to certain tasks. But, to meet this year's mission specifications, we made many subtle improvements. The claw, for instance, was made multifunctional to handle a large range of tasks. Our thrusters were also placed carefully so our ROV can have a holonomic drive and move in different directions. Besides our thrusters, we constructed our ROV to be positively buoyant. With our ROV being positively buoyant, it does not float completely, but slowly drifts upward when submerged underwater.

Being from an island that is so environmentally rich, we wanted to lessen the use of toxic materials. We resorted to 3D printing many of our parts as they fit our designs and ideas ideally. Choosing to buy materials was done only when we could not create the part ourselves. To prevent us from purchasing more and more, we made the choice to reuse certain parts from a previous year's ROV. These parts had remained in optimal condition, which was useful as they were already prepared and needed minimal adjustments.

Project Management

When we started building, we wanted to have an outline of our progress with respect to time. Unanimously,



Damir and Nuri working on wiring the ROV.
Photo by: Selena Tan



we decided to form a timeline. We first looked at our final goal and broke it down into four different fields with experience from the past and insights from our experienced mentors. We set an achievable time-space for each step of the process. We made it our top priority to follow and match our set timeline, having check-ins and monthly progress checks to update and ensure steady progress. This not only kept us grounded and met deadlines, but everyone on the team knew what they had to do, along with what everyone else was developing or designing, keeping the team in sync.

We met up for workshops at least once per week for everyone to work with partners in their field. We also take great advantage of holidays and school breaks, as those are our most productive times together. We also ensure to have our mentors or an adult present as a safety precaution with our machines and electrics.

When any field or individual faces problems that can not be solved initially and require additional assistance, they are advised to first turn to other members who have more knowledge on that topic. If the problem still remains, then we turn to our experienced mentor or any outside help that is available.

Our ultimate goal is to make our ROV functional, structurally sound, and appealing while still keeping it as affordable as possible. Recycling has become our main way of acquiring material; an example of this is our frame, which comes from worn-out cutting boards. If any additional material needs to be purchased, it is noted in a shared spreadsheet, where we not only track spending, but also our funds in order to ensure we are conscious of our budget. Additionally, all spending has to be noticed by either the CFO or CEO.

Problem Solving:

During the development of our ROV, we brainstormed ideas and shared designs as a team. Each member brought unique strengths and perspectives to the table, which helped us separate our team members into different groups. In these groups, we all put our ideas together to create our ROV. For example, we had Logan, Tasi, and Damin, who all specialized in constructing our control box, while Evan and Yuchen led our mechanical engineering efforts.

When designing different components, we looked at different ideas that were given to us, from our former mentor and our current, Mr. Michael (Former) and Mr. Jen (Current). We also used our own ideas and inputs, testing them out and seeing which were best suited for us. Our team looked at the pros and cons of each design that was brought up, and from the data that we gathered, we made the final decisions for our ROV's design.

Timeline

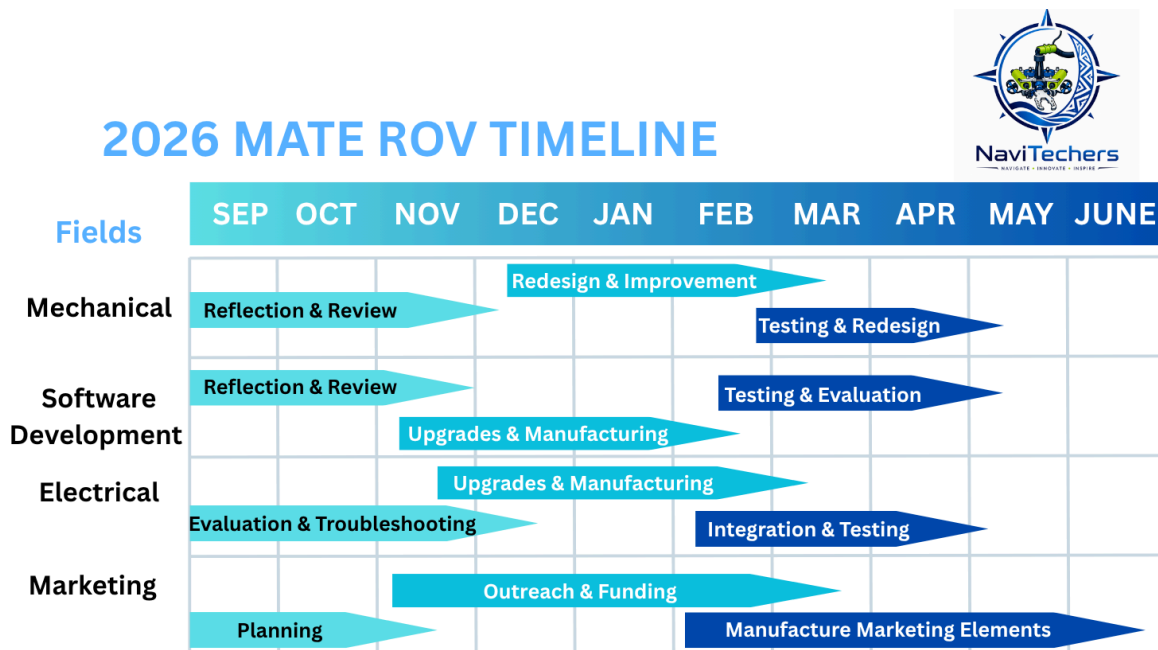


Figure 10. Activity Timeline. Graph By Tora Jones.

Innovation

We tried keeping everything eco-friendly, as our main goal was recycling and reusing materials we had to the best of our abilities. Starting from the ground level, sustainability was an important value throughout our build. Making our own devices and components from scratch instead of buying them. With this, our whole ROV consists of careful tradeoffs; we've had to design and manufacture the majority of the parts we used. A great example of our ever-growing

innovation was our claw. We've had many changes in the design of our claws; we went from a manually opening and closing claw to an electrical system powered by motors and gears. Even with our inductor, we had to salvage the power supply of an old paint mixer.

Vehicle Structures & Systems

Alongside the technical aspects, we also aimed to incorporate our island's culture into our design. Adding on traditional Samoan patterns as a representation of our island. We remodeled the frame of the ROV to a more drone-like design, unlike last year's octagonal shape. Our new drone-shaped model is more hydrodynamic, allowing us to move through the water quicker. Along with a new design, we also used HDPE plastic, which is positively buoyant and very durable. In different fields, we conducted extensive research, seeing how other people took their approaches in creating different components. In some designs, we took a combination of ideas to make our own homemade design.



(Samoan fish scale pattern on ROV. Photo by Mickey)

Many of the parts on our ROV are 3D printed or reused. We recycled and repurposed components from our old ROV and scavenged usable parts from other electronic devices.

Due to the remoteness of our island, we do not have the readily available access to electronic resources, so we have learned to innovate with whatever materials we can find locally. For our frame, we used a thick HDPE cutting board, and our 3D printed items were made of PLA which is biodegradable, removing many of our worries when testing our ROV outdoors. When selecting our building materials, we had to take into account different things. Since we are an island with very little exposure to different shops and resources, we had to make the most of what little we had. On our control box, we have a plexiglass covering that separates our



components. We used plexiglass because it was clear, which helped us manage our control box and made it look more presentable.

To meet different mission specs, we made many subtle changes to our claw and frame. With the claw, we made it multifunctional, which was fit to complete the many tasks that were presented in this mission. We added a rotational element so we can turn certain parts of the claw according to certain tasks. But, to meet this year's mission specifications, we made many subtle improvements. The claw, for instance, was made multifunctional to handle a large range of tasks. Our thrusters were also placed carefully so our ROV can have a holonomic drive and move in different directions. Besides our thrusters, we constructed our ROV to be positively buoyant. With our ROV being positively buoyant, it does not float completely, but slowly drifts upward when submerged underwater.

Being from an island that is so environmentally rich, we wanted to lessen the use of toxic materials. We resorted to 3D printing many of our parts as they fit our designs and ideas ideally. When we decided to buy things, it was only when we absolutely needed them. To prevent us from purchasing more and more, we decided to reuse some parts from last year's ROV. The parts were still in good condition, which was helpful to us as they already came prepared and somewhat ready.

Buoyancy

For our buoyancy system, we repurposed two water gun reservoirs, modifying them by drilling three exit holes on the bottom side for the air to exit out of, and an entry point on the top for air to enter in. After drilling, we sealed off the original and other unnecessary openings on the reservoir, excluding our previously drilled holes. For the actual air system, we used a 70 feet of $\frac{3}{8}$ " tubing to maximize airflow and overall system efficiency. For the assembly, we first connected one end of the tubing to a plastic L-shaped barb hose attachment. Then, we attached the other end of the barbed hose to the fourth hole on the water gun reservoir, with the tube facing the ROV. This connection is then reinforced and waterproofed with underwater epoxy.



This is all repeated with the second reservoir. Afterwards, the two reservoirs are connected to the ROV by three zip ties each, and the tubing on both reservoirs is then connected to a T-shaped barb hose attachment. The top of the T-shaped barb is then connected to our main tube, which would be the transporter of air for our reservoir. The air itself would be provided by a foot pump, so that we can change the buoyancy of the ROV anytime we desire.

Motor Shrouds

In designing our motor shrouds, we had to examine the physical structure of our bilge pump motors. As part of this year's design, we chose to clamp the motors between the two plates of our frame. Therefore, we were inspired to use a similar mechanism to clamp the guard onto the cylinder of the motors. We also came up with the idea of using self-amalgamating tape to add grip to the clamping surface, as it was slippery. Using this idea, we could develop a 3D printed motor shroud made out of polylactic acid (PLA) filament. A cylindrical wall was designed with approximately 2-5 millimeters of free space regarding the motor blade's diameter. We implemented a drainage design on the top of our motor shroud to ensure that water would flow seamlessly, while staying within the size guidelines. Lastly, we wanted to make an easy and simple way to detach and attach the motor shrouds, in case of troubleshooting or changes. Therefore, we decided to make it into three individual parts: the attacher that stuck onto the motor permanently, the cylindrical body that easily snapped onto the attachment piece with a simple snap socket, and the top guard, which would be attached to the body via Gorilla glue.

In the end, using environmentally safe materials and learning from past mistakes, we were able to develop a motor shroud that was troubleshoot-friendly and reliable. While in production, numerous technical difficulties halted our progress, but we did not let that stop us. Our determination led us to a complete product that we can call our own, such as the motor shroud.



Testing & Troubleshooting

Troubleshooting is a critical aspect of engineering our ROV. It allows us to test certain parts to ensure they will work as designed in the competition. When issues arose, we consulted one another in their respective fields. We received input from professionals, such as Mr. Michael, our former mentor, to learn more in the field of engineering.

The first way we utilized troubleshooting was when Yuchen was calibrating the servo motor on our manipulator. He had to find the exact rotational angle when assembling the claw so that the 270-degree restriction didn't stop the claw from opening all the way—it was a matter of testing different angles as the zero point.

In designing the frame, our CEO (Evan Zou) reviewed past experiences and consulted Mr. Michael (our former mentor) to design a frame that is made from HDPE (High Density Polyethylene) using the CNC (Computer Numerical Control) machine. Jiawei began by drawing a sketch of his design on Fusion360, and measuring all of the sides of the frame. Initially, he tested the CNC machine on a sacrificial piece of cutting board. Once the test was successful, Jiawei, with assistance from Mr. Michael, began cutting out the frame from the plastic. A major problem arose when the G-code for the CNC machine was set on the wrong Z-axis (height)—this led to the machine cutting through the frame itself. Although this was devastating, Jiawei quickly delegated to his team to fix this mistake. Eventually, they decided to fix the frame by welding it with the scrap plastic that remained from the previous cuts. This successfully sealed the fracture, and the frame turned out sleek and efficient.

Financials

<u>Source</u>	<u>Item</u>	<u>Quantity</u>	<u>Unit Measure</u>	<u>Price (full retail)</u>	<u>Extended Price</u>
Purchased	Waterproof Pelican Case	1	each	\$89.99	\$89.99
Purchased	Braided Cable Cover	1	each	\$22.99	\$22.99
Purchased	Underwater USB Cameras	2	each	\$53.99	\$107.98
Purchased	20KG Servo Motors	1	each	\$11.00	\$11.00



Purchased	USB Active Extension Cable	1	each	\$54.99	\$54.99
Purchased	3A Resettable Fuse	6	each	\$0.49	\$2.93
Purchased	300 mA Resettable Fuse	6	each	\$0.28	\$1.70
Reused	Arduino Omega	1	each	\$48.70	\$48.70
Purchased	Jumper Cables (pkg/10)	2		\$11.95	\$11.95
Reused	Joystick	2	each	\$19.95	\$39.90
Purchased	2x7A Motor Driver	2	each	\$21.00	\$42.00
Purchased	Assorted Heat Shrink Tubing	1	each	\$54.03	\$54.03
	14 AWG Wire	300			
Purchased	Strain Relief (5-Pack)	2	each pack	\$13.99	\$28.00
	Stainless Bolts				
Purchased	60cmx60cm HDPE Cutting Board	2	each	\$50.95	\$101.90
Purchased	0.100x2x4" Acrylic Sheet	1	each	\$29.39	\$29.39
	1x1" Hinge	1	each	\$4.19	\$4.19
	PLA	1	each	\$25.99	\$25.99
	Terminal Block Shield Board	1	each	\$17.90	\$17.90
	20 AMP ATC Fuse	1	each		
Donated	Volt Amp Meter	1	each	\$9.89	\$9.89
Donated	Powerwerx Cable w/ ATC Fuse to Powerpole Connector	1	each	\$18.00	\$18.00
Purchased	NRF24 Transceiver	2	each	\$3.60	\$7.20
	SMA Bulkhead Plug	1	each	\$7.99	\$7.99
Purchased	M/M Coax Cable	1	each	\$8.61	\$8.61
Purchased	M/F Coax Cable	1	each	\$13.70	\$13.70
Donated	3 Cell Battery Holder	2	each	\$6.76	\$13.52
Reused	Arduino Mega	1	each	\$13.70	\$13.70
	2X7A Motor Driver	1	each	\$14.90	\$14.90
	3" PVC Coupling	2	each	\$31.53	\$63.06
	"C" Battery	6	each	\$3.55	\$21.29
	3">2" PVC Reducer	1	each	\$3.28	\$3.28
	3" PVC Cleanout	1	each	\$7.53	\$7.53
Reused	½" PVC Elbow	1	each	\$0.59	\$0.59
Reused	Fuse Holder				
Reused	Amp Fuse				

Purchased	Joysticks	3	each	\$13.99	\$41.97
Purchased	Temperature Sensors	2	each	\$8.99	\$17.98
Donated	Epoxy Clear 5 Min Syringe	2	each	\$5.21	\$10.42
Donated	Tape Electrical Self Bonding	1	each	\$9.56	\$9.56
Donated	J-B Waterwield 2oz	2	each	\$8.98	\$17.96
Donated	Liquid Tape 4oz Green	1	each	\$10.90	\$10.90
Purchased	Long Nose Pliers 6"	1	each	\$16.99	\$16.99
Purchased	USB Underwater Camera HORUS-S20	1	each	\$118.00	\$118.00
Purchased	USB Underwater Camera HORUS-T20	1	each	\$95.00	\$95.00
Purchased	Hatchbox Filaments	7	each	\$28.00	\$196.00
Purchased	Hatchbox Filaments Orange PLA	1	each	\$26.00	\$26.00
Purchased	HobbyPark Waterproof RC Servo	3	each	\$35.97	\$107.91
Purchased	Oball	1	each	\$4.74	\$4.74
	Total Materials Cost				\$1572.22
Investors	Labor Cost	845	man-hour	\$5.38	\$4546.1
	Total Cost				\$6,118.32

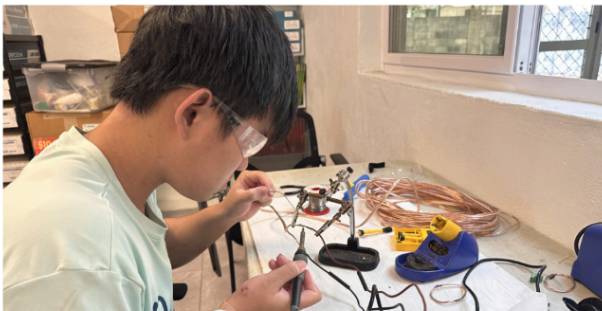
Safety Protocols

Safety protocols are taken very seriously in the Navitechers ROV workshop. Things such as safety wear, large electric tools, large machinery, and 3D printers, are all taken very seriously. The safety protocol section of the Navitecher's technical report will cover what we wear, make sure of, and how we use things in order to maintain the absolute safety of each member.

Safety Gear

Safety Glasses:

Safety glasses are the most common and necessary piece of safety equipment in any workshop



Evan soldering the motor wire to the tether wire
Photo taken by: Mikey Shi

environment, including the Navitechers' workshop. They are worn by members whenever they begin operation with any type of tool. They protect the member's eyes and areas next to the eyes from any ricocheting material. They are also worn whenever members need to work with something that isn't a non-solid material, like fumes from a soldering iron. If unprotected, eyes that come in contact with soldering fumes will start to water and become irritated, causing the eye to become red. With safety glasses, members can avoid these unpleasant experiences and work with safe proficiency.

Respirators:

Respirators are worn for the same reasons as safety glasses, except they provide respiratory protection instead. Tasks such as the previously mentioned soldering and others, such as sanding, are extremely dangerous to a member if inhaled over long periods of time. Microscopic pieces of plastic from tools such as the electric sander or Dremel, and the lead fumes of a soldering iron should not be inhaled. This is the first thing a new member is taught. Respirators are required for members who wish to conduct these types of tasks.



Evan preparing the control box wires to be soldered
Photo taken by: Selena Tan

Face Shields:

Face shields are essentially bigger safety glasses. Instead of protecting just the eyes, they also protect the member's whole face.

These are worn while using heavy electric tools such as drills, saber saws, and the previously mentioned electric sander and dremel. These tools present the danger of



Evan and Yuchen using the soldering iron to weld together the 3D printed claw screws.
Photo by: Selena Tan

even larger shrapnel. Face shields are always required and given to a member when dealing with heavier applications in the Navitecher workshop.

Safety Precautions

The first requirement for a new Navitechers member is to become accustomed to the dangers that the workshop and applications bring. An experienced member or advisor will always have a safety run-through of any application for a new member. Whether it'd be the tedious but necessary actions for a soldering iron, or the simple and minute screwdriver.

Box Cutters:

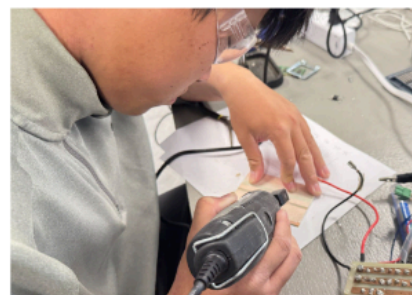
Blade cutters are the most convenient and readily available tool in the Navitechers workshop. However, that does not mean a member shouldn't handle it with care. Members are always advised to cut with the blade away from themselves. This is to ensure that if the member were ever exerting excessive force on the item they are cutting, the blade would go in a direction away from the member, instead of towards. Additionally, members are always told to retract the box cutter immediately after use as to prevent any potential future accidents.

Soldering Irons:

Members will always ensure that soldering irons are heated up before use. As well as making sure that the member knows what objects they are soldering together. A minimum of two openings are made in the workshop to the outside to ensure proper ventilation of harmful fumes.

Dremel:

The Dremel is a tool often used by the Navitecher members to smooth and cut areas with precision. Advisors constantly remind



Evan dremeling the copper plated board for the control box.

Photo by: Selen Tan



members to make sure the drill bits of the Dremel are safe and secure to avoid damaging the Dremel and to ensure no injuries are inflicted on themselves.

Drills:

Drills can be dangerous tools that can cause serious injuries if handled incorrectly. Members are directed to lay the drill flat on its side when not in use, and to make sure that the turning direction is correct. These are one of the important reminders from advisors to members to ensure safety and proper care of the drill.

CNC Machine:

The Navitechers workshop has their own CNC machine built by the advisor which is only handled by the advisor, CEO, and COO. Other members may absolutely not operate the CNC under any circumstance, even in the presence of the advisor. Instead, the CNC is used as a learning tool for newer and inexperienced members. Every time that the CNC was used, the advisor would gather all available members around to teach them about how the CNC operates. This is so that the members would be prepared to operate the CNC in the future if they chose to participate in the Mate ROV competition again.

3D Printers:

3D printers play a huge role in the construction of the ROV. A large portion of the ROV that are not donated or recycled are 3D printed. Notable parts are motor shrouds, the claw, and the propellers. Unlike the CNC, most members know how to operate the 3D printer, so only new members require guidance and education from the advisor or an experienced member. However, it is still preferred that members have more experienced members or advisors watch over them while in the use of a 3D printer.

Heat Gun:



Heat guns are very useful heating elements for any workshop, and that doesn't exclude the Navitechers workshop. Used to heat shrink tubes for wires, and bend malleable materials for adjustments. In order to prevent injuries or damage, members are advised to always set the heat gun up so that the nozzle points to the ceiling. This would prevent the heat gun from damaging anything within its vicinity and, more importantly, members.

Electric Sanders:

Before the use of an electric sander, all equipment, tools, and necessities are moved to an outside setting. Before activating anything, the student ensures a secure strap connection of the face shield to the face before use.

Jig Saw:

The jigsaw is a very dangerous tool if not handled correctly. For this tool, the advisor would do a demonstration for members who are using it for the first time. The members would be taught about how to activate and deactivate, how to handle the jigsaw properly, as well as how to load and unload the blade of the jigsaw. As well as the best hand placement that would cause the minimal amount of injury in case something goes wrong.

Other Minor Tools:

Minor tools such as pliers, wire cutters, screwdrivers, wrenches, and many more are always used with proper care and assurance. Even though these tools may not require the same precautionary attention as soldering irons and box cutters. They are still used with correct and preferred handling.

Guidance and Advisor Supervision

Before a member engages in any major procedure, the advisor will always first educate the member on the specifics and precautions the member has to take. Afterwards, the advisor will stay and supervise the member until they are sure that the member has a good understanding



and grasp on the subject. Members are always educated and monitored by the advisor before proceeding in any tasks in the workshop.

Safety Issues

So far, the Navitechers team has had no safety issues. Safety precautions are always taken seriously; no non-professional behavior has ever been conducted during workshop hours. And if an incident were to occur, it would be taken care of until professional medical attention can be provided. Things such as minor burns or cuts would be taken care of with their respective universal safety procedure. For more serious injuries, our advisor and other members will do everything to minimize such a situation with a medkit the Navitechers have on supply. Until medical attention arrives.

Member Timesheet 2025

	<u>Slava</u>	<u>Evan</u>	<u>Logan</u>	<u>Tasi</u>	<u>Yuchen</u>	<u>Jiawei</u>	<u>Ty</u>	<u>Mickey</u>	<u>Amelie</u>	<u>Tora</u>
<u>October 18</u>	60 min	90 min	105 min	120 min	60 min	120 min	0 min	120 min	25 min	0 min
<u>December 16</u>	110 min	100 min	90 min	70 min	106 min	100 min	0 min	100 min	0 min	0 min
<u>December 18</u>	105 min	90 min	0 min	0 min	120 min	90 min	0 min	110 min	0 min	0 min
<u>December 20</u>	106 min	100 min	115 min	0 min	120 min	100min	0 min	85 min	0 min	0 min
<u>December 23</u>	102 min	100min	120 min	96 min	98 min	96 min	0 min	96 min	0 min	0 min
<u>December 25</u>	108 min	104 min	0 min	0 min	98 min	103 min	0 min	89 min	0 min	0 min
<u>January 11</u>	129 min	129 min	102 min	107 min	121 min	129 min	0 min	97 min	0 min	136 min
<u>January 18</u>	124 min	127 min	98 min	128 min	134 min	127 min	130 min	0 min	0 min	93 min
<u>January 25</u>	30 min	0 min	0 min	0 min	0 min	0 min	113 min	0 min	0 min	45 min
<u>February 1</u>	129 min	119 min	0 min	0 min	0 min	124 min	119 min	124 min	50 min	111 min
<u>February 8</u>	132 min	121 min	123 min	123 min	137 min	145 min	127 min	0 min	78 min	137 min
<u>February 15</u>	153 min	121 min	141 min	141 min	143 min	137 min	90 min	131 min	93 min	157 min
<u>February 22</u>	167 min	149 min	158 min	150 min	157 min	165 min	87 min	118 min	107 min	129 min
<u>February 29</u>	0 min	121 min	141 min	141 min	143 min	137 min	90 min	131 min	93 min	111 min



<u>March 8</u>	0 min	149 min	158 min	150 min	157 min	165 min	87 min	118 min	107 min	137 min
<u>March 12</u>	120 min	123min	121 min	119 min	124 min	120 min	0 min	121 min	79 min	0 min
<u>March 15</u>	150 min	120 min	0 min	0 min	163 min	161 min	0 min	0 min	0 min	0 min
<u>March 16</u>	104 min	90 min	0 min	122 min	136 min	134 min	0 min	0 min	0 min	0 min
<u>March 17</u>	180 min	127 min	0 min	93 min	155 min	147 min	0 min	0 min	0 min	0 min
<u>March 19</u>	190 min	137 min	0 min	147 min	168 min	185 min	0 min	132 min	0 min	0 min
<u>March 21</u>	147 min	125 min	0 min	137 min	133 min	151 min	0 min	133 min	0 min	0 min
<u>March 22</u>	184 min	160 min	0 min	0 min	143 min	178 min	0 min	0 min	0 min	0 min
<u>March 23</u>	0 min	123min	0 min	134 min	145 min	147 min	0 min	0 min	0 min	0 min
<u>March 30</u>	153 min	121 min	141 min	141 min	143 min	137 min	90 min	131 min	93 min	157 min
<u>March 31</u>	167 min	149 min	158 min	150 min	157 min	165 min	87 min	118 min	107 min	129 min
<u>April 4</u>	0 min	121 min	141 min	141 min	143 min	137 min	90 min	131 min	93 min	111 min
<u>April 5</u>	0 min	149 min	158 min	150 min	157 min	165 min	87 min	118 min	107 min	137 min
<u>April 11</u>	120 min	123min	121 min	119 min	124 min	120 min	0 min	121 min	79 min	0 min
<u>April 12</u>	150 min	120 min	0 min	0 min	163 min	161 min	0 min	0 min	0 min	0 min
<u>April 16</u>	104 min	90 min	0 min	122 min	136 min	134 min	0 min	0 min	0 min	0 min
<u>April 17</u>	180 min	127 min	0 min	93 min	155 min	147 min	0 min	0 min	0 min	0 min
<u>April 18</u>	190 min	137 min	0 min	147 min	168 min	185 min	0 min	132 min	0 min	0 min
<u>April 19</u>	147 min	125 min	0 min	137 min	1 min	151 min	0 min	133 min	0 min	0 min
<u>April 20</u>	184 min	160 min	0 min	0 min	143 min	178 min	0 min	0 min	0 min	0 min
<u>April 21</u>	120 min	165 min	0 min	163 min	60 min	120 min	143 min	137 min	0 min	163 min
<u>April 22</u>	90 min	120 min	122 min	136 min	106 min	100 min	157 min	165 min	0 min	136 min
<u>April 24</u>	127 min	161 min	93 min	155 min	120 min	90 min	124 min	120 min	0 min	155 min
<u>April 26</u>	137 min	134 min	147 min	168 min	120 min	100min	163 min	161 min	0 min	168 min
<u>April 27</u>	125 min	147 min	137 min	0 min	98 min	96 min	136 min	134 min	0 min	1 min
<u>April 29</u>	160 min	185 min	0 min	143 min	98 min	103 min	155 min	147 min	0 min	143 min
<u>May 1</u>	123min	151 min	134 min	145 min	121 min	129 min	168 min	185 min	0 min	145 min
<u>May 2</u>	121 min	141 min	141 min	143 min	134 min	127 min	132 min	123 min	0 min	143 min
<u>May 3</u>	149 min	158 min	150 min	157 min	234 min	237 min	238 min	231 min	0 min	231 min
<u>May 4</u>	237 min	222 min	238 min	231 min	233 min	241 min	237 min	235 min	120 min	234 min



<u>May 5</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 6</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 7</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 8</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 9</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 10</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 11</u>	75 min	75 min	75 min	75 min	75 min	75 min	75 min	75 min	0 min	75 min
<u>May 12</u>	75 min	75 min	75 min	75 min	0 min	75 min	75 min	75 min	0 min	75 min
<u>May 13</u>	423 min	409 min	417 min	413 min	0 min	427 min	400 min	421 min	0 min	0 min
<u>May 14</u>	75 min	75 min	75 min	75 min	0 min	75 min	0 min	75 min	0 min	75 min
<u>May 15</u>	60 min	60 min	60 min	60 min	60 min	60 min	60 min	0 min	0 min	60 min
<u>May 16</u>	40 min	75 min	75 min	75 min	75 min	75 min	0 min	20 min	0 min	75 min
<u>May 17</u>	160 min	400 min	405 min	347 min	380 min	390 min	360 min	360 min	0 min	360 min

Member Timesheet 2026

	Alana	Tora	Evan	Yuchen	Yoon Seo	Damin	Tasi	Nuri	Mickey	Logan	Selena	Ida	Peme
12/20/25	115 min	115 min	115 min	115 min									
12/23/25		115 min	115 min	100 min	60 min	60 min	110 min	100 min					
12/26/25		115 min	145 min	60 min	160 min	160 min		120 min					
12/27/25			120 min	120 min									
12/29/25			150 min	90 min	130 min	130 min		90 min					
12/31/25		140 min	145 min		60 min	60 min		60 min					



1/1/26	120 min	120 min	55 min		55 min	55 min		55 min	120 min	55 min			
02/14/26		55 min	90 min	90 min	70 min	150 min		120 min			120 min		
02/28/26		125 min	160 min	160 min	160 min	160 min	160 min	160 min		160 min	160 min		
03/14/26		145 min	145 min									145 min	
03/16/26			150 min							60 min		150 min	150 min
03/17/26		120 min	150 min		150 min	150 min		150 min		150 min		150 min	150 min
03/18/26		135 min	135 min							60 min		135 min	135 min
03/19/26		120 min	150 min		150 min	150 min	135 min	150 min		135 min		150 min	150 min
03/20/26		125 min	120 min		150 min	150 min		150 min				150 min	150 min
03/28/26		120 min	140 min	150 min	150 min	150 min		150 min		145 min			150 min
04/11/26		120 min	180 min	120 min		210 min		180 min				180 min	180 min
04/12/26			120 min	120 min									
04/16/26	150 min	180 min	180 min	90 min			180 min			180 min		150 min	3 hour 30 min
04/17/26	180 min	115 min	120 min	85 min	85 min	205 min		180 min		120 min		85 min	210 min
04/18/26			150 min	240 min		240 min				60 min		150 min	240 min
04/24/26	270 min	120 min	130 min	130 min		130 min					130 min	130 min	130 min



05/02/26	180 min	120 min	300 min	300 min	300 min		300 min			60 min	300 min	
05/09/26		120 min	295 min	300 min		240 min	240 min			140 min		

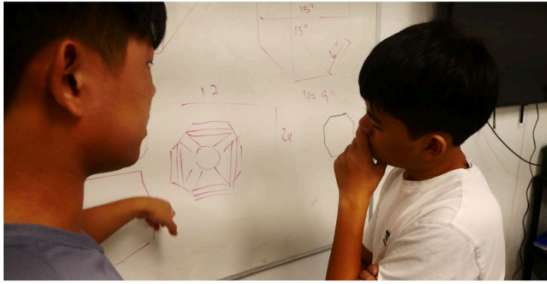


Figure 1: Brainstorming ideas for our frame and talking about holonomic drive
Photo taken by: Logan Chen

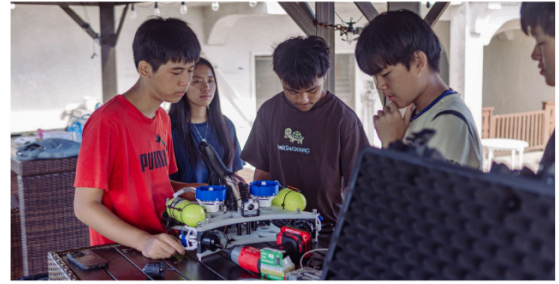


Figure 2: Team troubleshooting during testing of ROV
Photo taken by: Jenward Montalbo

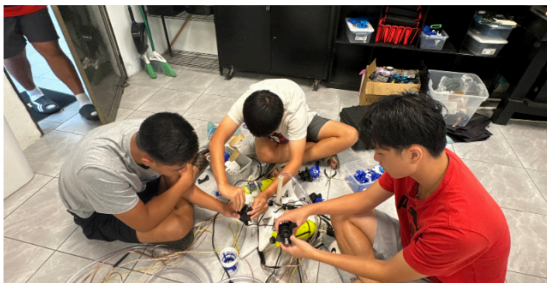


Figure 3: Damin, Nuri, and Peme working to attach the propellers.
Photo taken by: Selena Tan

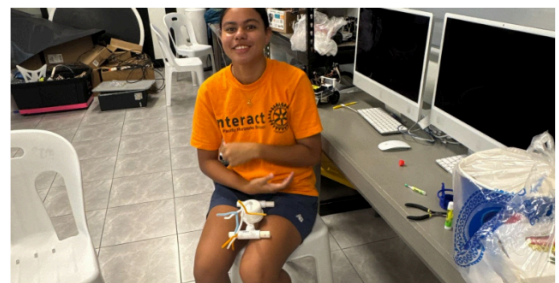


Figure 4: Ida Underwood handling coral prop.
Photo taken by: Selena Tan

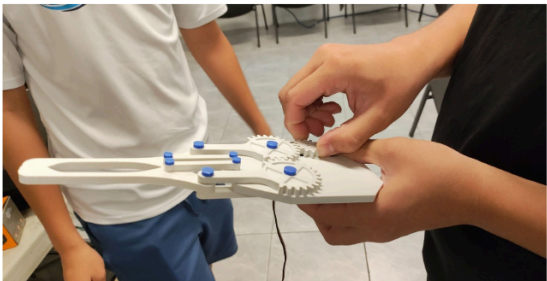


Figure 5: Yuchen Bai and Jiawei Zou testing our claw
Photo taken by: Evan Zou

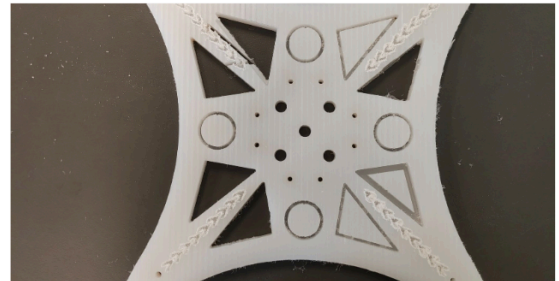


Figure 6: Frame of Fetu Lele part way through sanding and polishing.
Photo taken by: Evan Zou

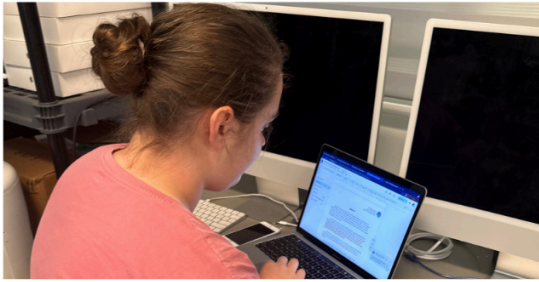


Figure 7: Tora working on technical report.
Photo taken by: Selena Tan



Figure 8: Fetu Lele on the poolside before testing.
Photo taken by: Jenward Montalbo



Figure 9: Jiawei Zou working on cutting our frame
using the CNC mill/machine
Photo taken by: Evan Zou

Acknowledgments

We want to express our gratitude to everyone who has invested their time in us during this project. Above all, we would like to thank The Tool Shop for supplying all the materials we needed for this prototype, by providing the materials required or at a greatly reduced price. We are grateful to our former mentors, Mr. Michael Homsany, Ms. Kendra Pinsker, and our current mentor, Mr. Jenward Montalbo, for their unwavering support and direction over the whole endeavor. We sincerely appreciate the ongoing support from Pacific Horizons School. Finally, a huge thank you to our family, friends, and supporters for believing in us before this happened.



Resources

“Hubspot User Content-Na1.” 2025 Competition Ranger Class Manual, Nov. 2024,
20693798.fs1.hubspotusercontent-na1.net/hubfs/20693798/2025%20EXPLORER%20Manual_w
ithCover_11_27.pdf.