Mission Statement

“Our goal is to create our underwater remotely operated vehicle using the various processes involved with different engineering disciplines, such as Computer, Electrical, Mechanical, and Systems. Due to the design of the Michigan Tech Enterprise program, we will learn to manage a budget, delegate tasks, and use resources efficiently. Through the building process, we will learn the tasks and present ideas appropriately.”

Team Goal

Our goal for T.U.R.R.E.T.’s third year was to successfully build a Remote Operated Vehicle (ROV) that would efficiently complete the tasks for the international competition in Hawaii. The main frame of the ROV was improved from last year’s design to be lighter and smaller. This gave us an advantage when trying to maneuver in tight spaces, as well as conserving resources. The smaller size is ideal for the second task which involves navigating in a small tunnel. Overall, we feel our design was a success and we are very proud of what we have accomplished and learned.
MATE’s Objective

The team is a part of the Marine Advanced Technology Education Center (MATE) and is competing as part of the Ranger class. The competition asks that our Remotely Operated Vehicles complete a series of four tasks. The first task involves pulling a pin to release an elevator, identifying a site that is emitting sound, and transporting the elevator to that site. The second task involves entering a cave, touching the back wall of the cave, and retrieving three “crustaceans.” The crustaceans are fishing lures placed on the back and floor of the cave. The third task is to measure temperature at three elevations along a spire and create a temperature vs. height graph. The fourth task is to collect a specific quantity of agar and return it to the surface. There is a fifteen minute time limit to complete all four tasks, and the tasks must be attempted in order.

Timeline

September

Our class split into two groups: the ROV and the Electric Go-Kart.

The new ROV team decided on a name, team colors, a logo, and a mission statement.

October

We began to do rough sketches of our vehicle while deciding on a basic frame shape.

The team chose a design and started implementing heat techniques to bend PVC.
November

After being unsuccessful with the heat techniques, we began to redesign.

We created a new sketch of the vehicle.

December

We learned about the competition.

We implemented the new design with joints.

We completed the Michigan Tech Mid-Year Report.

January

Troubleshooting with the new design was our main priority.

By drilling holes in the PVC, we were able to reduce the weight added by joints.

Based on the holes in the frame, we chose a ballast system.

We attached motors and cameras.

February

We created a brochure to send to potential sponsors.

We did more troubleshooting with the frame.

The team started brainstorming ideas for appendages.

We ran wires through the frame.
March

We began troubleshooting with joystick controls.

After being unable to use the joystick controls, we switched to tank-drive controls.

We prepared a poster and a presentation for the Michigan Tech Conference, and then we attended the Michigan Tech Conference.

We attached the ballast tubes and created a tether.

April

We practiced with the vehicle in the pool.

We prepared the poster and the presentation for the regional competition.

May

We attended the regional competition in Chicago, where we received first place in all categories and qualified to attend the international competition in Hawaii.

Travel expenses for the competition were determined, followed by a massive fundraising campaign.

We created the technical report for the competition in Hawaii.

The team hosted a Spaghetti Dinner fundraiser.

June

We created more ideas for appendages and we tested them in the pool.

The Michigan Tech Year-End Synopsis was completed.

We made final preparations for the international competition.
Accomplishments

Accomplishment I: Teamwork

The least tangible accomplishment was the one of which we are the proudest. Our team was comprised of students from all four schools in our school district. Through the project, we all became close friends and learned to compromise and brainstorm in a productive manner. We learned the importance that every single team member has when completing a project of this caliber.

Accomplishment II: Final Product

We are very proud to have been able to see our designs come to fruition in a functional vehicle. Though we encountered many obstacles, we were able to overcome them and create the best vehicle we possibly could.

Accomplishment III: International Competition Qualification

Not only were we able to create a functional vehicle but one that performed well during competition. The ultimate goal of the entire project was to attend the international competition, and we have achieved this goal. We are very proud to be able to represent our school at the international level.

Problems and Solutions

Problem I: Bending PVC

The initial frame design involved bending the PVC instead of using joints at the corners. By eliminating the joints, we would be reducing the weight of the vehicle. Unfortunately, while trying to bend the PVC, we came across many obstacles. The hot sand we tried cooled too quickly. We tried using a heat gun, but that burned the PVC. We even tried to barbeque the PVC, but this method heated the poles too unevenly. With limited time available to us, we had to abandon the idea.
Solution I: Adding Joints and Drilling Holes

Instead of bending the PVC, we changed our design to the more traditional method of using PVC joints. The main issue we had with the joints was the huge increase in the weight of the vehicle because of the joints. We counteracted this weight gain by drilling holes throughout all of the pieces of PVC on the vehicle. The holes reduced weight and also allowed for water to flow through the vehicle, acting as part of the ballast system.

Problem II: Thunder Chickens

Out of the twelve members on the T.U.R.R.E.T. team, seven are on the Thunder Chickens, a FIRST robotics team. Their time commitment was extensive and overlapped with the schedule of the ROV team. The work fell to the remaining five members.

Solution II: Using Class Time

The team met this challenge by utilizing in-class time. Any decisions made by the five members at after-school meetings would be approved by the Thunder Chickens' members in class. It was mostly a matter of waiting until the Thunder Chickens' season was completed before we were able to resume full working mode with the participation of all twelve members.

Problem III: Controls

We originally wanted to use a joystick control system to move the robot. The joystick idea did not work because of a number of factors. Much time and effort was spent on experimentation, but the results were not acceptable. The team's main programmers were on the FIRST robotics team, Thunder Chickens, so they were not able to work on the controls as much as necessary. Also, the programming did not achieve a successful standard. There were too many bugs to work out.

Solution III:

After deliberating about it, the team decided to switch to the previous year's system of a control box and switches. This means that the motors were either full on or full off. This method was simpler to use because there is no programming involved. Only a few days after implementing this method of control, the vehicle was fully functional.
Problem IV: Funding

Money was a big issue this year. Every year, the class receives a grant from Michigan Tech University through participation in the High School Enterprise program. However, this year, most of the money went to the electrical plug-in go-kart team. Therefore, T.U.R.R.E.T. received only part of this year’s money which was combined with reserve money from last year.

Solution IV: Sponsorship

The team requested donations from corporations, the school district, and colleges. Team members created a brochure which helped with the efforts to gain sponsorships. In addition, the team did bottle drives throughout the school year. At the end of May, we held a Spaghetti Dinner fundraiser at the high school in order to raise the balance of funds necessary to attend the international competition in Hawaii.

We would like to thank the following companies and institutions for supporting us.

A special thanks to Geoffrey Clark, Scott Spry, and Michael Attan for their mentorship

We would also like to thank our families for their support and encouragement
Learning and Growth

Because of this project, we were all introduced to unfamiliar types of technology. Members of the team learned how to create 3-dimensional sketches using the Solid Works program. We learned how to use soldering equipment and band saws. Some members also learned how to put presentations together using traditional poster boards, PowerPoint, Microsoft Presentations, and word processors. Overall, every member of the team agrees that their participation in the project has positively impacted their lives.

Team Reflections

"The regional was a great experience. I enjoyed working with new people this year" – Sebastian Sznitka

“I think we were really successful this year. We worked well as a team, and during crunch time, we were amazingly productive and cohesive.” – Zach Elie

“It was a good time. I really liked getting to know everyone and becoming a team.” – Nick Zambelli

“It was just plain awesome. I don’t do much else outside of school so this helped to make me more of a team player. I loved the missions and I loved the objectives. I also really liked having fun with my teammates.” – Jonny Nguyen

“I liked how we didn’t just focus on the engineering aspects of the project; we had to analyze the business and team-working aspects also.” – Kara Marsh
“This competition gave me a glimpse into the world of engineering. I feel like I am now prepared to become a mechanical engineer.” – Breanna Meyer

“The regional competition introduced me to problems I didn’t even know existed.” – Jenna Ross

“I thought it was great how many girls were on the team. It really showed that women can be engineers too.” – Hayley Schuller

“I was excited to see all of our hard work come together. It was really fun to compete against people from around the country.” – Justin Wright

“This is such a unique and challenging program. Because of the MATE competition, I have become more of a well-rounded engineer.” – Kayla Wizinsky

“Being on this team was a good experience. Seeing all the robots in Chicago was exciting.” – Joe Wyrzykowski

“This program exposed me to another engineering process with which I was unfamiliar. I enjoyed the chance we had to work with the corporate world. This team really earned its cachet.” – Kate Sym
In the Future

We hope that next year’s team learns from some of our mistakes. We hope that they make a timeline and stick to it. The new team should take notes and record them on the chronology so that they know when they accomplished certain tasks and when they encountered certain obstacles. They should dedicate one member of the team to take pictures whenever there is a team meeting. The team should start fundraising in the beginning of the year to prepare for the competition expenses. Overall the whole team agrees that this experience was a beneficial and enriching one, and we all appreciate this opportunity.