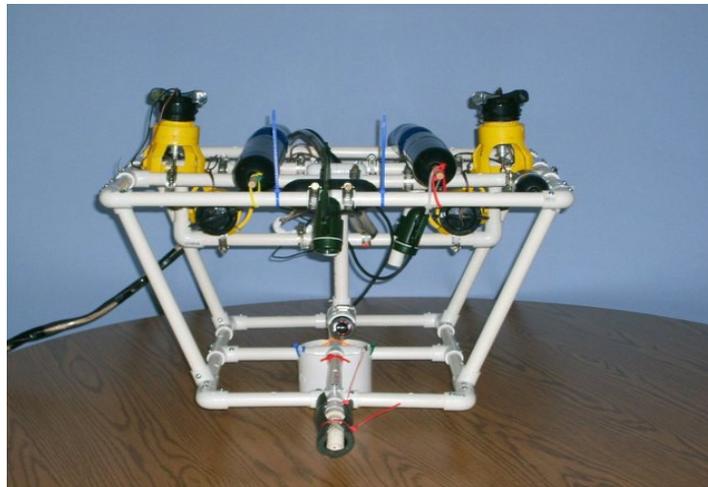


Mr. ROVoto

Immanuel Lutheran School

Alpena, Michigan USA

ROV Team



6th Graders

Kelli Adrian, Eric Bauer, Brett Boden, Ryan Cadarette, and Sarah Krueger

7th Graders

Ken Adair, Taylor Konczak, and Courtney VanWagoner

8th Graders

Amanda Dort, Brooke Godsey, Jake Kendziorski, and Justin Metzke

Mentors/Instructors

Mr. Arthur Hoch, Mr. Warren Kindt

Table of Contents

Table of Contents	1
Abstract	2
One Lesson Learned or Skill Gained	2
Design Rationale	3
Troubleshooting Techniques	4
Challenges We Faced	4
Future Improvements	5
U.S. Navy Submarine Rescue	5
Interview with Mr. Payne and Mr. Smith	6-7
Reflections	7-8
Electrical Schematic	9
Wiring Help	10
Pictures of Completed ROV	11
Budget Expense Sheet	12
Acknowledgements	13
References	14

Abstract

The Immanuel ROV team began meeting weekly in September 2008. We discussed ideas on the frame and construction of an underwater research robot. We began by brainstorming options for a possible frame design. We decided on a frame design once we learned the missions for the 2009 MATE ROV Competition. Buoyancy testing provided locations for float placement on the ROV. We drilled holes in the ROV frame to let water quickly flood the PVC pipes. When we were done designing and putting together the frame, we began thinking about tools that could complete each of the mission tasks. We made two simple tools that we connected to our ROV frame to complete the tasks. Our ROV, named Mr. ROVoto, was designed to be a cost-effective device for carrying out underwater mission tasks.

One Lesson Learned or Skill Gained

This year the Immanuel Lutheran ROV Team has learned many important skills that most of the students didn't know about before this opportunity opened up. We all learned about teamwork and how to work with one another. Most of us didn't hang out with each other at school, but this experience has brought us closer together. Winning the Super Team Award at the 2009 M.A.T.E. Great Lakes Regional Competition showed us that we can do this together, and that our actions affect other people around us. Even though some of us aren't as close as others, we always know that we can depend on one another to be there to help us when we need it.

Design Rationale

Our ROV is made of polyvinyl chloride (PVC) pipe that was formed into a trapezoid. We chose PVC piping because it is lightweight, easy to work with, inexpensive and it is readily available. The propeller guards are also made out of PVC piping and they are 10 centimeters in diameter. The team decided to have four different motors and three different cameras. We needed the various cameras because we decided to have different views for each of the missions we did. To make our ROV buoyant, we use plastic fishing net floats. We decided to attach the longer floats, which are 22.5 centimeters long, with wooden dowels that are 60 centimeters long. We have two of these wooden dowels on our ROV that each support two flotation devices. We decided to have the wooden dowels because it was the most efficient way to attach the floats without them moving around while we are in the water. We also have smaller floats along the frame of the ROV that are 12.5 centimeters in length. The top of our ROV is 54.5 centimeters long and the bottom is 50 centimeters long. The width of the top is 51 centimeters and the width of the bottom of our ROV is 39 centimeters. The height of the ROV is 33 centimeters without our mission tools mounted. With the docking mission tool attached, our ROV is 39.5 centimeters tall.

To power our ROV, we use an electrical system that controls our four motors and three cameras. We use three joysticks to control the motors: one for vertical motion, and two for horizontal moving. Our ROV can move the basic six directions: up, down, left, right, forward, and backward. This system is powered by a 12-volt portable, rechargeable battery that is attached to our ROV by an electrical, waterproof tether.

Troubleshooting Techniques

When we were faced with a challenge, our team had a few different ways of overcoming them. One of the ways that we seemed to use often, was trial and error. We would find the problem and then try different ways to try to fix it. Sometimes it took awhile, but when we all worked together to solve the problem, it was worth it. Another way we overcame challenges was asking the rest of the team for advice. Doing this gave us the opportunity to see the problem through a different set of eyes. It seemed like everyone had a different way of solving it and we would keep trying all of the ideas until we found the correct one that fixed the problem.

Challenges We Faced

One of the challenges that we faced was not getting enough pool time. Our team waited until we knew the mission tasks before we started building our ROV and that didn't give us much time to practice. We needed more pool time so that we had experience driving the ROV in the water, and once we got our ROV done, the Regional Competition was only a few weeks away. When we finally were ready to start practicing in the pool, we were more concerned about getting in the water than making sure our ROV was fully ready to go into the water.

Another challenge we faced was that the propellers kept falling off the ROV. This was because we didn't make sure they were secure. So, we spent most of our practice time trying to get the propellers from the water instead of using the ROV to practice the missions.

Future Improvements

Some improvements that we would like to make would be to change some of the tools that we used at the regional competition, because the tools that we had made to complete some of the missions did not work out as we had planned. When we started meeting in September of 2008, our mentors split us up into groups to work on tools. Each group had one tool to make.

It worked out well in the beginning, but once we started going to the ALpena Plaza Pool to practice, we did not really know what each of the other tools did. To solve this problem, we practiced with each tool individually to see what it was capable of, and also to see if it would help us in the upcoming competition. In the future, the team would want to work on all the mission tools together. Before the International Competition, we are going to redo some of the mission tools that we made, so that they are better designed to complete the assigned tasks.

U.S. Navy Submarine Rescue

In 1939, everyone in the U.S. Navy and almost everybody that knew anything about submarines agreed that if a submarine went down, the crew could not be rescued. Everyone agreed with them except for Swede Momsen. In May of 1939, Swede Momsen made a pear-shaped diving bell to save all 33 crew members of a sunken submarine. To this day, Momsen's feat remains the greatest underwater rescue that was ever carried out.

In 1989, the Navy established the Deep Submergence Unit (DSU). Today, the DSU is home to a fleet of advanced deep submergence vehicles, deep submergence rescue vehicles, remotely operated unmanned submergence vehicles, and support surface ships and crews.

Our Interview with Mr. Payne and Mr. Smith

On Wednesday, May 13, 2009, the Immanuel Lutheran ROV Team had the opportunity to interview two men who served with the U.S. Navy on two different nuclear submarines. The first was Mr. Thomas C. Payne II, an E4, who served on the U.S.S. John Adams. The second interview was with Mr. Roy Smith, an E5, who was stationed aboard the U.S.S. Fast Attack. He later taught at the Navy electronics school on Connecticut. Our interview took place over a phone, equipped with a speaker and microphone for conference calling.

During the interview we asked each of the men the same series of questions, and were surprised to see that most of their answers were the same. Mr. Payne served for 4 years as a torpedoman's mate and a missile launch technician. Mr. Smith served for 9 years as an electronics specialist, working on the periscope, electronics systems and radar.

Even though their responsibilities were very different, their responses to the general questions were the same. When asked how they were selected to serve on a submarine, both responded that they chose submarine as their place to serve. They thought it would be an exciting way to spend their Navy careers.

Both men agreed that the food was the best thing about serving on a submarine, and with regular meals of steak and lobster, we would have to agree. Mr. Smith and Mr. Payne each expressed that being isolated from family and the outside for extended periods of time was the worst thing about serving on a submarine.

When we asked the two men if any other submarines sank in the time they were serving on board their subs, and they said that there were some which sank. We asked if they were afraid, and they answered that they were concerned, but not afraid because they trusted the men that they were serving with. They knew that everyone would do their job to keep the crew safe.

When our interviews were over, there were two things which surprised us from the interviews. The first was that women are not allowed to serve on submarines. The second was that both men said that they could not tell how

deep their submarines could go, because it dealt with national security. We all felt that the interviews gave us a lot of good information about the people we would be rescuing from the sunken submarines.

Reflections

This is my second year of being on the Immanuel Lutheran ROV Team. Both last year and this year were great experiences. Last year, my team got 1st place in the Regional Competition, and that made us eligible to go to the competition in San Diego, California. It was such an awesome experience. When this year started, I was so excited and ready to begin. I am really happy for my team and all the effort they put into this ROV. Working with this year's team was awesome; we all worked very well together and had a great time doing it. I probably never would have joined ROV if it wasn't for a few of my friends telling me how much fun it is. Since I've been a part of the team, I've really enjoyed every bit of it, and I learned what it's like to work together. I am very proud to say that I am on the Immanuel Lutheran ROV Team.

Brooke Godsey

Even though this is my third year on the Immanuel Lutheran ROV Team, I still learned new things. I've learned many valuable lessons about teamwork, and I've learned how to do things that I didn't know how to do before I joined the team. I love feeling like I'm part of a family when I go into the classroom after school. I know that I can always count on all of my team members to pull through when we need it most, and I know that we will always be looking out for each other. I am very proud of all of my team members because they all did an awesome job on the ROV this year. Being able to go to the International ROV Competition last year was an awesome experience, and when we go this year, I hope it will be the same, or even better.

Amanda Dort

This is my second year on the Immanuel Lutheran ROV Team, and both years I've been on it have been great experiences. The first year, we won first place in the Regional Competition here in Alpena, Michigan, which enabled us to go the International Competition in San Diego, California. This class has opened up my career options and has influenced my thoughts on jobs in marine biology fields. It has been an amazing year over all, because of the people I've worked with and because I've learned more about what ROV really is. I hope this year will be just as good as last year, or even better than the last year.

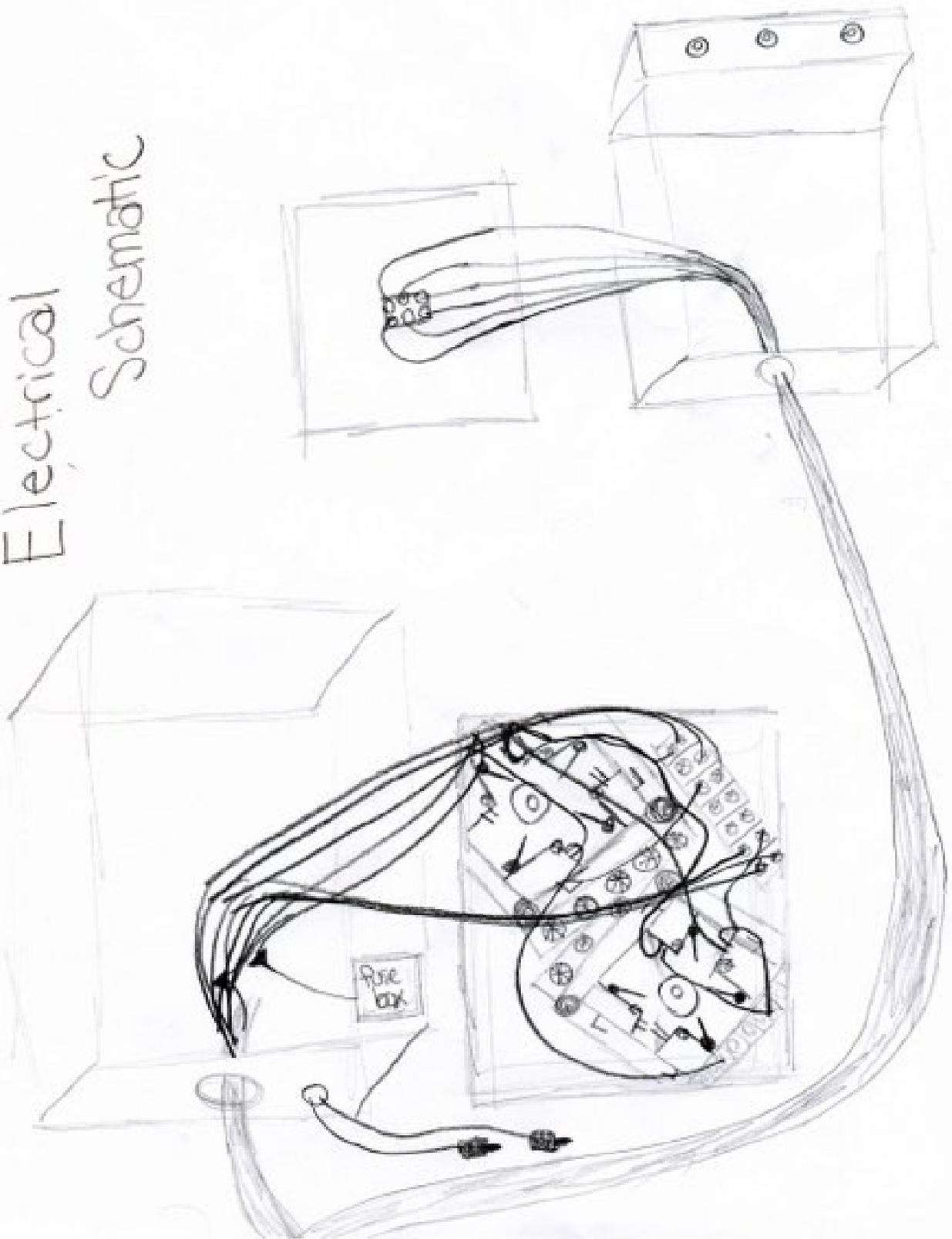
Courtney VanWagoner

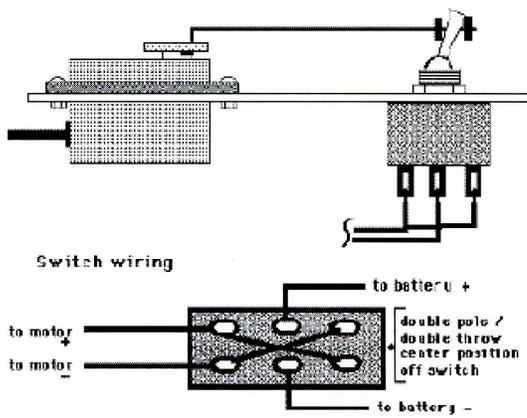
This is my first year on the Immanuel Lutheran ROV Team, and it has been a great experience. I hope to use these skills in some other field someday. I would like to thank our mentors, Mr. Hoch and Mr. Kindt, for guiding us throughout the year. One of the things I was able to do was build the ROV; I thought it was very fun. I'm excited to go to the International Competition in Buzzards Bay, Massachusetts. I hope that we do well in it, but even if we don't, I am still going to be happy for my team and be there for them. I think that joining the ROV Team was a very rewarding experience, and I hope to be on a team again next year.

Jake Kendziorski

Electrical Schematic

NOT TO SCALE

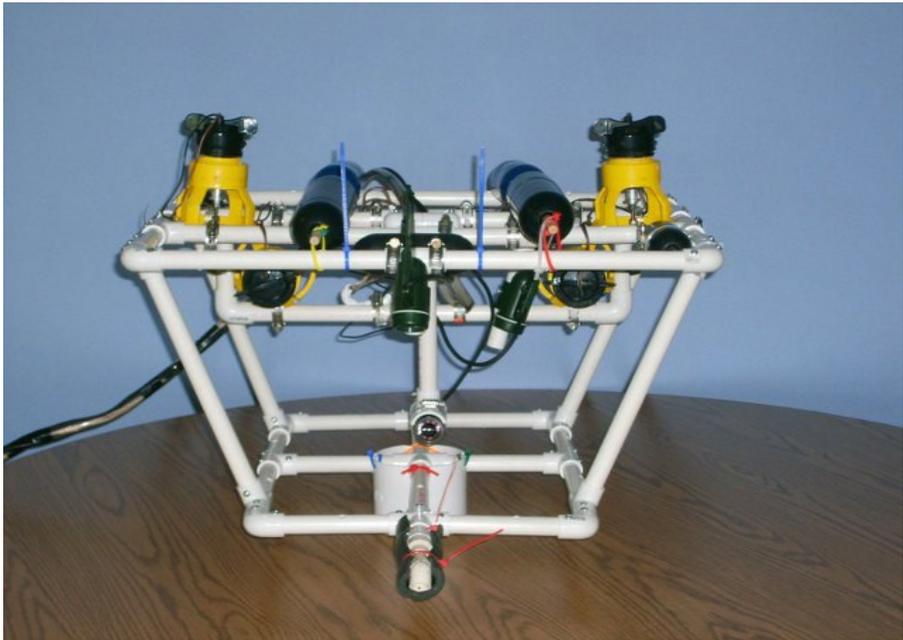




Completed ROV



Left Side View



Front View

Budget/Expense Sheet
From September 2008 to May 2009

Immanuel Lutheran School ROV Team

Funds: \$1800.00

Date	Expense/Donation/Salvage	Description	Cost	Quantity	Total
05/18/09	Expense	Phono Jacks	\$3.99	1	\$4.23
03/18/09	Expense	Three-Way Switch	\$12.98	1	\$13.77
03/10/09	Expense	Electrical Tape	\$0.79	5	\$3.95
03/10/09	Expense	Card Reel	\$9.49	1	\$9.49
03/19/09	Expense	Control Boxes	\$4.99	2	\$20.00
03/27/09	Expense	Propellers	\$13.77	4	\$23.28
10/14/08	Donation	Wire		1	\$13.77
10/07/08	Donation	PVC piping/Tether Wire/Plastic Tubing	\$194.34		\$194.34
02/17/09	Expense	Fishing Camera (B&W)	\$119.97	2	\$239.94
01/27/09	Expense	PVC piping	\$7.01	9	\$7.01
04/07/09	Expense	PVC piping/ Nuts, Bolts, & Screws	\$4.34	11	\$4.34
	Salvage	Joysticks for Control Box		2	
	Salvage	PVC joints		1	
	Salvage	Camera (color)			
	Salvage	Pipe Insulator			
	Salvage	Fishing Net Floats		8	
02/01/09	Expense	Blige Pump motot cartridges	\$38.68	4	\$154.72
03/01/09	Expense	Pool Rental @50% for 2 hrs	\$50.00	6	\$300.00
		Total			\$780.73

Acknowledgements

The Immanuel ROV Team would like to thank the following organizations and people for their support: The M.A.T.E. Center for Sponsoring the International and Regional Competitions, N.O.A.A Thunder Bay National Marine Sanctuary for their Co-sponsorship of the Great Lakes Regional Competition, the Alpena County Plaza Pool for donated pool time, to our mentors, Mr. Hoch and Mr. Kindt, and to Mrs. Tippman for help and guidance in setting up our poster.

We would also like to thank the following businesses and people for their financial and material donations:

Air Force Association
Immanuel Lutheran Church (stock sales)
Mayor Carol Shafto
Alpena Furniture
Alpena Alcona Area Credit Union
David & Tammy Veasy
Tom Mullaney
Pepsi Company
Jewell Disposal Service, Inc.
Bannan Funeral Home
Sports Unlimited
Sevan Inc.
ABC ACE Hardware

References

Construction Help:

Bohm, Harry, and Jansen, Vickie, *Build Your Own Underwater Robot and Other Wet Projects*. Vancouver: Westcoast Words, 1997.

WireHelp. <<http://rctankcombat.com/articles/speed-control/Toggle.gif>>. (accessed 26 May 2009)

Underwater Research:

<<http://usgovinfo.about.com/library/weekly/aa081700a.htm>> (accessed 10 April 2009)

Interviews:

Payne, Thomas. Interview by author, 13 May 2009.

Smith, Roy. Interview by author, 13 May 2009.