Carrollton City Schools GA

ROV: AKTAR

Bennett Stedwell

Laren Smith

Karl Sanchez

Meghan Smith

Abbey Greene

Patrick Dost

Quinn van Zanten

Jeremy Huff

Mentors: Matt and Lesley Greene, Ray and Marie Stedwell, Klaus and Jacqueline Dost, Kellie Smith, William Hicks and Gwen Benson

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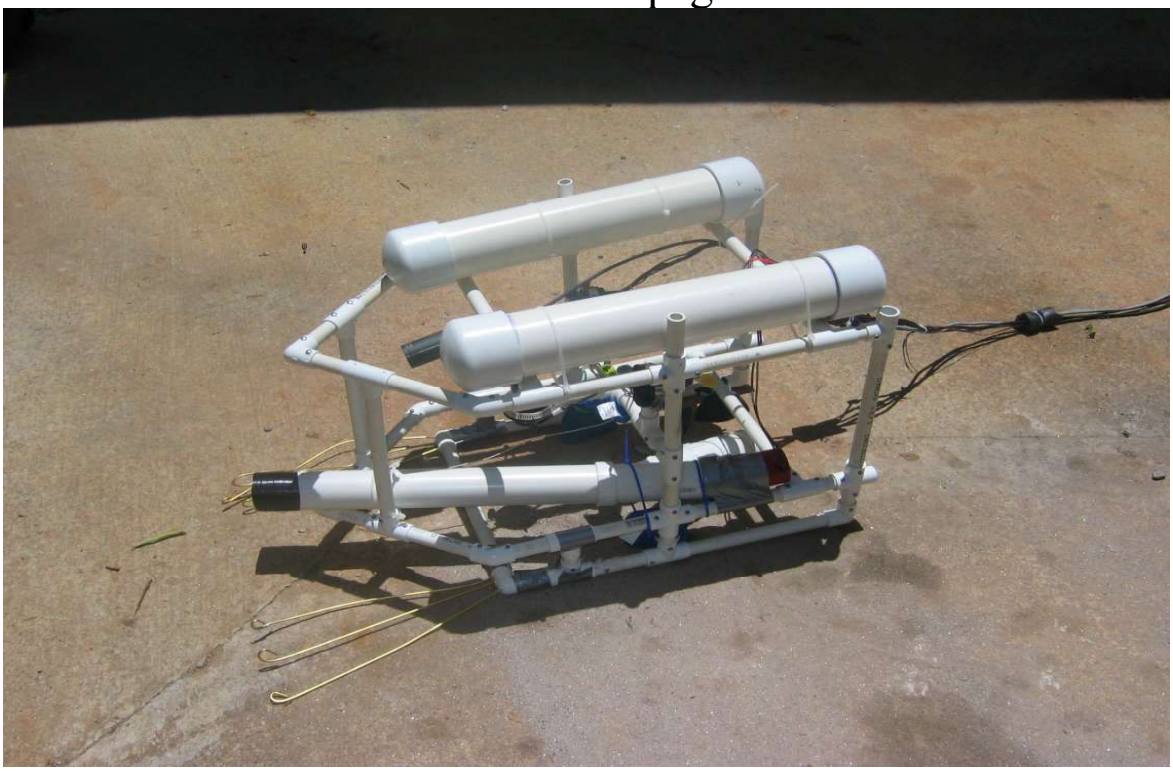


AKTAR

ROV Abstract

As the team from Carrollton City Schools in Carrollton Georgia, we had a couple of goals in mind when we entered the Marine Advanced Technology Education (MATE) Remote Operated Vehicle (ROV) competition. First was to learn and make use of new skills, and second was to bring honor to our school. We have realized that this has been an opportunity not only to identify what our skills are, but how we could make use of these skills to grow individually and as part of a newly formed team. This is our first year doing the ROV Competition, and our first year doing any large project of this sort. We have used this as a chance to grow, and to become more well-rounded people. Additionally, we have learned to work together as a team.

The ROV is mainly constructed of PVC piping and uses three bilge pumps for maneuvering and then another bilge pump to create a suction system that will collect rocks. Our suction system will bring the rocks into a collection basket so that it is easier for us to grab the rocks when the ROV gets to the surface.

We have been building the ROV since February and found that it was extremely fun as well as educational. We learned many things and learned to work as a team. This was our fist year and we will definitely do it again.

The Team

Laren Smith- (Captain) Laren is a rising tenth grader that enjoys tinkering with all things mechanical. He plays baritone in the Trojan marching band. His hobbies include playing with his dog, Sadie, his bearded dragon, Sydney, playing complicated video games, and building Legos. He has one sister, Meghan, a rising eighth grader and is on the team.

Karl Sanchez- Karl is a rising tenth grader. He is smart, and radiates authority and leadership. He plays the trumpet in the marching band. He passes the time by solving complex math problems and playing tennis. He has three brothers and one sister, Noah, Chris, Sammy, and Faith.

Quinn van Zanten-Quinn is a rising tenth grader who is aspiring to get his pilot's license and eventually wants to join the Air Force. He plays trombone in the high school band. His hobbies include debating, arguing, and being right. Quinn has one sibling, Asher.

Patrick Dost-Patrick is the final rising tenth grader on the team. He aspires to be a marine biologist and prides himself on his strong German upbringing. His hobbies include listening to loud rock music, Guitar Hero, and paintball. He is the tenor saxophone section leader in the marching band. Patrick has one brother, Tyler, a junior.

Bennett Stedwell- Bennett is a rising junior. Always the voice of motivation, Bennett kept the team on task the many times they goofed off. He has already achieved his SCUBA license and plans to become a marine archaeologist one day. He, like Quinn, plays the trombone in the band. He has one sister, Ryan, who is a junior in college.

Meghan Smith – Meghan is a rising eighth grader. She loves facing a new challenge. Meghan does very well in sports even while maintaining a high GPA. When she grows up she hopes to be a children's physical therapist. She will complete anything to the best of her ability. She has one brother, Laren.

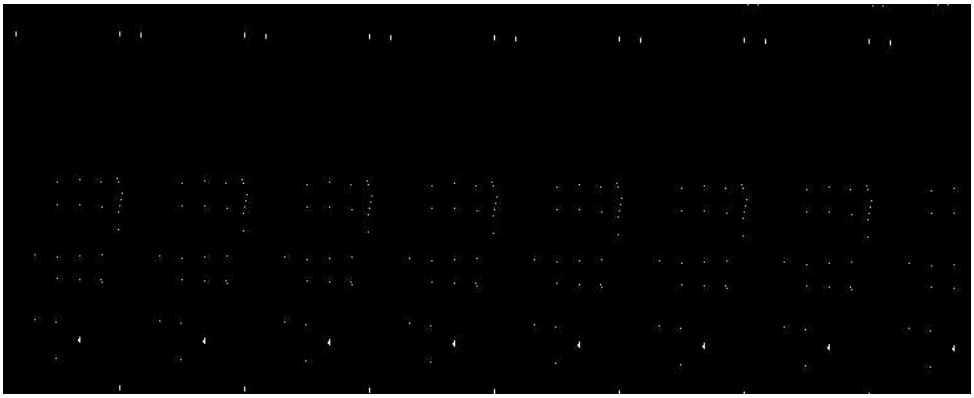
Abbey Greene – Abbey is a rising seventh grader who enjoys a wide variety of interest and hobbies. She plays Alto saxophone and guitar, runs cross country, and plays competitive soccer, while maintaining an all-A GPA. Abbey's dreams are to become a writer, doctor or engineer. She has one brother, his name is Noah

Jeremy Huff – (Coach) Jeremy is a fourth grade teacher at Carrollton Middle School. The '07 - '08 year was his first year teaching at CMS. He is married and has one son, Beau, a two year old. He became involved as our coach by the influence of Mrs. Gwen Benson.

The Budget

Items	Source	Cost	Donations
Female QD 22-18GA	**Radio Shack**	**$1.99**	**$1.99**
Female QD 22-18GA	**Radio Shack**	**$1.99**	**$1.99**
Camera	**Donation**	**$400.00**	**$400.00**
Bilge Pump	**Donation**	**$75.00**	**$75.00**
Bilge Pump	**Walmart**	**$34.92**	**$34.92**
Bilge Pump	**Walmart**	**$34.92**	**$34.92**
Bilge Pump	**Walmart**	**$34.92**	**$34.92**
PVC40 PIPE	**Home Depot**	**$1.63**	**$1.63**
24" NAT tie	**Home Depot**	**$4.96**	**$4.96**
6 OTLT Surge	**Home Depot**	**$6.97**	**$6.97**
3/8DSCSHSCUT	**Home Depot**	**$16.47**	**$16.47**
3x15 BLK NET	**Home Depot**	**$12.98**	**$12.98**
11NA" TIE100	**Home Depot**	**$8.72**	**$8.72**
1oz SOLDER	**Home Depot**	**$4.94**	**$4.94**
SS CLAMP 10 PK	**Home Depot**	**$8.50**	**$8.50**
PIPE INSUL	**Home Depot**	**$2.48**	**$2.48**
36 in NAT TIE	**Home Depot**	**$5.97**	**$5.97**
SWITCH	**Auto Parts**	**$21.04**	**$21.04**
FUSE	**Auto Parts**	**$0.67**	**$0.67**
HOSE	**Auto Parts**	**$3.65**	**$3.65**
PROPELLER	**Rc Hobies**	**$6.00**	**$6.00**
PROPELLER	**Rc Hobies**	**$6.00**	**$6.00**
Total		**$961.78**	
Carrollton Emergency Room Physicians			**$500.00**
Dietech			**$500.00**
Lynn Kress			**$25.00**
Bryan Albright Company			**$100.00**
Price, Pyles, Dangle, Parmer and Rooks, PC			**$250.00**
Martin and Hightower Funeral Home			**$250.00**
Mike Horton			**$200.00**
Total Donations			**$2,786.78**

Electrical Schematic



Design Rationale

AKTAR has been under construction since February. It is an ROV that was constructed from PVC and whose framework was designed to be more hydrodynamic by tapering the bow into a 90° angle. It is powered by three electric bilge pumps at 2.271 kiloliters per hour. On the top of AKTAR are two ballast tanks. These are designed to make the ROV neutrally buoyant. This assists the ROV to be submerged and to ascend with great stability.

The three tasks we must accomplish are one, pick up and retrieve three crabs; two, knock off and retrieve three rocks and bring them to the surface; and three, take the temperature of the black smoker. First, to help us pick up crabs we use brass rods that do not corrode. This is so that we are not introducing rust into the environment, potentially harming marine life. Three straight strips of brass are on both corners in the front of the ROV. They are bent to avoid harming marine life.

The next task is to retrieve three rock samples. To do this we use a vacuum system composed of a bilge pump and some PVC pipe. The rocks are knocked off and are then pulled by

the suction created by the bilge pump. The rocks fall into a chamber. For safety reasons, we turn off the bilge pump before we remove the chamber.

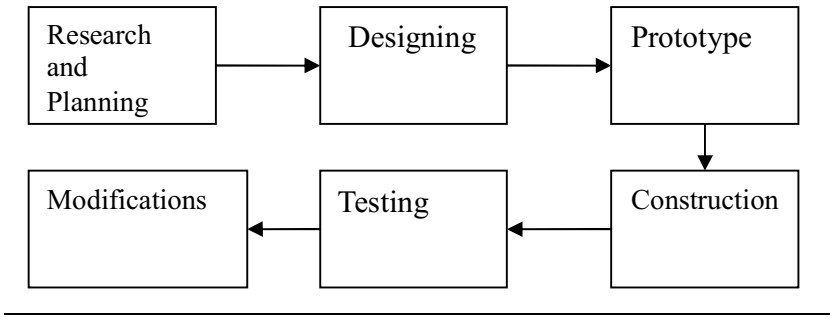
AKTAR uses a crystal temperature probe that is connected to a multi-meter. This allows us to get an accurate reading in a matter of seconds. This thermometer is a quick and efficient means of taking temperature.

ROV Measurements

Width: 410mm

Height: 480mm

Length: 850mm



Problems and Solutions

Our major challenge was how we were going to pick up the rocks. On our first design for the ROV, we designed a scoop system. This consisted of metal siding shaped as a dust pan. This did not work as well as planned during the regional competition. To solve this problem we came up with a system that will suction the rocks off the black smoker. It is made out of PVC piping, a bilge pump and a PVC cap. When we place the end of the PVC on a rock it sucks the rock up into a small PVC pipe with a cap at the end. This has turned out to work very well. This suction system was an efficient solution to our problem.

Future Improvements

Throughout the course of this project the Carrollton City School ROV team encountered many challenges and issues running the entire gamut of topics from engineering problems to unexpected scheduling and organizational changes. Though the path to this point in time has been an arduous one, the team, for the most part, has performed with great perseverance and intelligence in the face of daunting trials. Even so, looking back on the work that was accomplished, one can easily observe that there is room for improvement in future ROV competitions.

From an engineering standpoint, the ROV could have used several key enhancements that were not added on during the development process. More research and experimentation should have been conducted throughout the construction of the submersible. By doing so, a larger portion of the finished product's features could have been made more stable and reliable instead of having to be rushed during construction.

Changes in team communication would also greatly benefit us in future ROV competitions. The number of full group meetings needs to be increased to be more efficient in the designing and planning process. Also each group member needs to remain focused on the task at hand in order to be more productive. These changes would increase the Carrollton City School's achievements in future MATE ROV competitions.

Reflections and Lessons Learned

As we look back on all of the experiences gained throughout the course of this project, we realize how much we have grown not only as individuals, but as a team. We have gained skills and memories that will not only help us with future studies, but for the rest of our lives.

By rising to the challenges of constructing a functional ROV, each and every member of the Carrollton City Schools ROV Team was given the chance to gain knowledge of an extremely varied assortment of engineering skills from the electrical system and hydrodynamics to computer aided design and robotics.

Of course, the engineering experience was only a small fraction of what was taken home from the project. Each individual on the team grew closer as we slowly learned how to cooperate and function as a group. At the onset of the project we constantly argued and could hardly agree on anything. Thankfully though we matured and we became a stronger, more driven team as a result.

Acknowledgements

We would sincerely like to thank the following families who have given us their time and support during this project: the Smith family; the Dost family; the Greene family; the Stedwell family; the Kamishlian family; the Van Zanten and Cofer family.

We would also like to thank our instructors and mentors that helped us gain the knowledge and skills needed to accomplish this project: Jeremy Huff, Gwen Benson, William Hicks, Roger Daniels, Carl Malmquist, and Doug Green.

We would also like to thank the following businesses and individuals who made monetary contributions toward our project: Carrollton Emergency Physicians, Die-Tech

Industries, Price, Pyles, Dangle, Parmer and Rooks, Marin & Hightower Funeral Home, Mike Horton, and Albright Machine.

Hydrothermal Vents: Oases of the Deep

The oceans of our planet are truly enormous spaces. Of all the surfaces on Earth, they are the most abundant, encompassing more than seventy percent of the planet's surface area. What's more, over half of these oceans are at least three thousand meters deep. When all these factors are taken into account, it only takes simple mathematics for one to come to the conclusion that there is a completely alien world beneath the waves that has yet to be discovered. As a civilization, humanity has not even scratched the surface of the water, and every single day, new revelations about the sea are uncovered, some of which have already revolutionized the way we view life itself.

One such event occurred in 1977 when marine geologists studying ocean temperatures along the Galapagos Rift unwittingly stumbled upon a new ecosystem of life never before documented by science. There, in the deep, pitch-black ocean, locked away from the merest vestige of sunlight, crushed under the weight of the ocean above, and exposed to near freezing water temperatures, life not only existed but thrived.

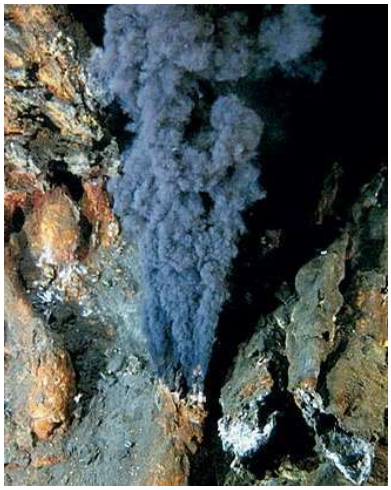
Two years later, in 1979, marine biologists in the manned deep sea submersible *Alvin* descended to those depths once again to formally research the seemingly impossible oasis of life at the bottom of the sea. What they found on that expedition and subsequent voyages was a completely new ecosystem that existed completely independent of the sun's energy, a feat that was considered impossible before the discovery.

Eventually, it was learned that the entire ecosystem was centered around special hydrothermal vents located on the seafloors mid ocean ridges at an average depth of about 2100 meters. The vents, caused by plate tectonics, spewed superheated, mineral rich water into the surrounding ocean. Though the liquids were expelled at temperatures in excess of four hundred degrees Celsius, the extreme pressure and low temperature of the surrounding seawater kept them from evaporating. This factor, along with the high mineral content, gave the vent water its characteristic black, billowy form, thus garnering the structures the name "black smokers."

The black smokers, as it was discovered, provided an energy source for certain types of extremophile archeabacteria, which were able to convert the heat and sulfur emanating from the vents into energy for their own needs through a process called chemosynthesis. The archaea, in turn, provided the basic food source for an entire menagerie of strange deep sea organisms, thereby making them the key producers for an entire underwater ecosystem of animals. Tubeworms, clams, eyeless shrimp, white crabs, sea anemones, pale sea snail, and many other life forms were all observed at the vents. In fact, the sheer biodiversity of such isolated ecological communities truly astounded the scientific world. All were unique to their particular habitats, yet all of them depended on such a seemingly impossible source of nutrients. By all previous logic, nothing at all should have existed at those depths, yet there they existed and flourished in the darkness.

During the following years, more hydrothermal vents were discovered the world over, and even stranger creatures were found and catalogued living off of the same archeabacteria. Even today, the deep ocean hydrothermal vents give scientists valuable insight to the true tenacity of life and shed light on the possibility of extraterrestrial life as well. As a whole, the

black smoker's present humanity with a unique opportunity to learn and discover that even in the most adverse of conditions, life can not only exist, but grow and endure.



Hydrothermal Vents

ROV Discovers Bismarck

Located at the bottom of the North Atlantic Ocean, nearly five kilometers beneath the waves, sealed away in the dark crushing depths are the remnants of the German battleship, the *Bismarck*. Originally sunk on May 27, 1941 during an engagement with the British in WWII, the battleship was condemned to silence at the bottom of the sea.

For over forty years, the *Bismarck*, like many ships of the era, corroded quietly on the seafloor. Salvation for the vessel finally came on June 8, 1989 when Robert D. Ballard, an explorer and marine archeologists, utilized an ROV, the *Argo* to explore and identify the downed battleship. With the help of powerful sidescan SONAR, specialized underwater cameras, and powerful lights, the vehicle was able to venture into the deep ocean and shed light on the structure. By doing so, a once lost piece of history was rediscovered and restored to its proper place, thanks to the use of ROVs.

Bismarck

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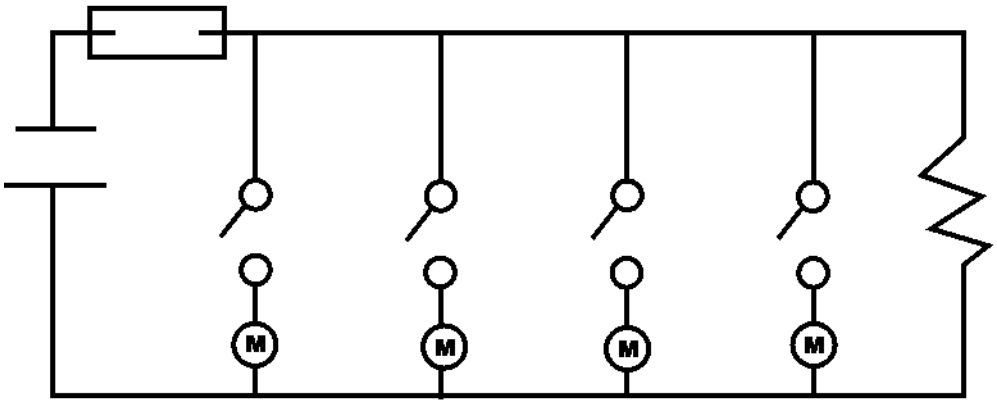
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