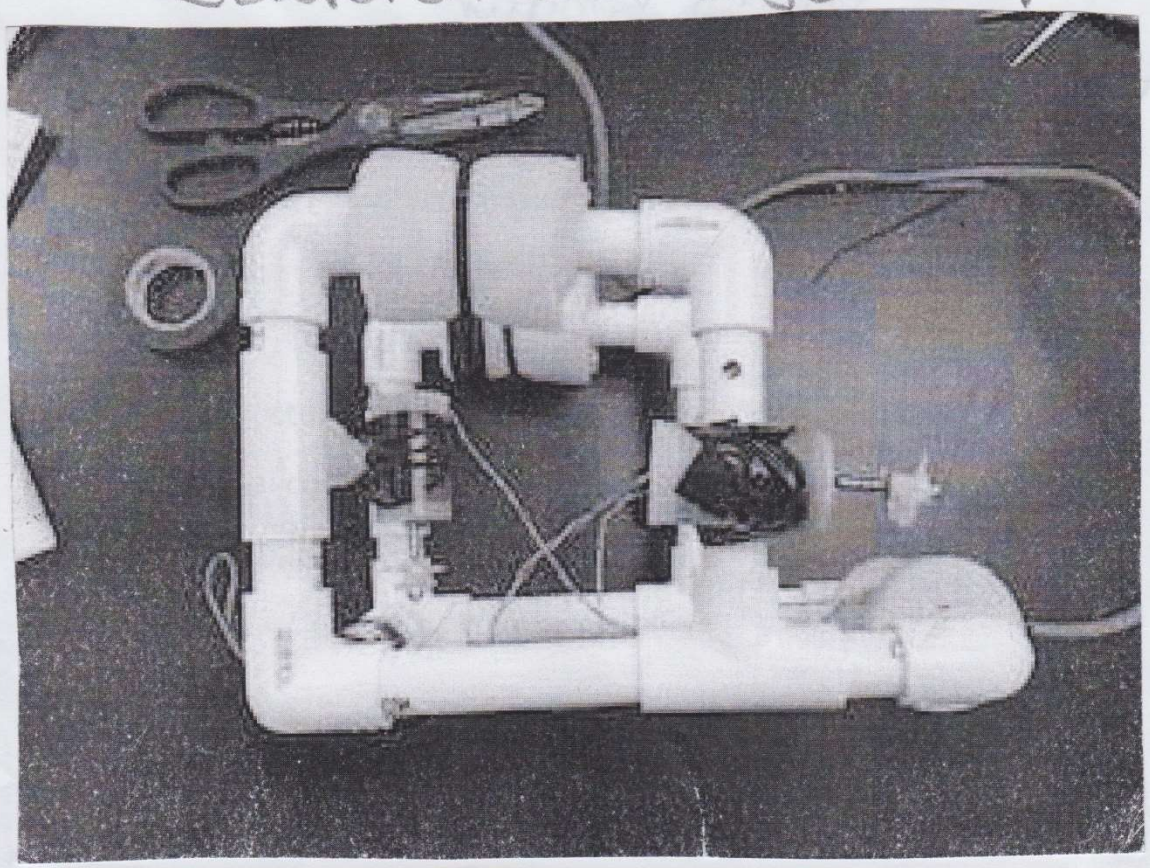
School or club name: West Mifflin Middle School

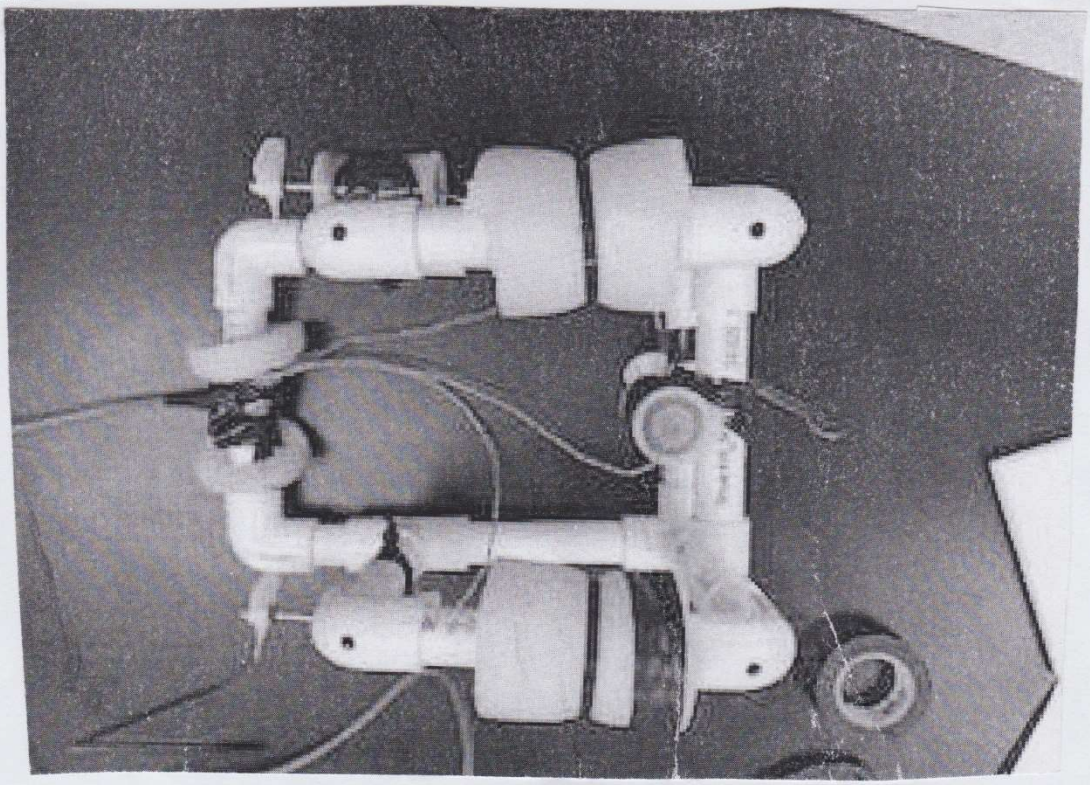
City, State: West Mifflin, Pennsylvania

Team name: Shark bait

ROV name: Shark

SeaPerch Challenge 2019





Team Information

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Goal #1

Goal #1: Finish the obstacle course in less than two minutes.

Steps we can take to reach this goal:
- practice controlling our model- this will make it easier to manouver through the rings
- practice going through the obstacle course- this will help us improve our time
- make our model smaller- by shrinking our model, it will make it faster improving our time

Progress update 1: On our first time going through the obstacle course, we got a time of five minutes and seven seconds. We also had an average pace of one and a half seconds per second for a straight distance of 17 feet. The size fit pretty well through the hoops.

What Next?: In class, we plan on making our model smaller to improve speed, and also to help it not to get stuck.

Progress update 2: The size of our model was shrunk and the time going through the obstacle course has improved. This time going through, we had a time of two minutes and fifteen seconds. This is an improvement of two minutes and fifty-two seconds. There was also an improvement in the maneuverability. If we continue practicing, we have a chance that we reach our goal.

What Next?: We'll cut down the PVC to help with speed, while still keeping the ability to maneuver our model. We need to keep practicing if we want to reach our goal.

Progress update 3: We have kept the same design, but shrunk our model and it is still easy to move around in the water. This time, when going through the course, we met our goal. We got a time of one minute and thirty-five seconds. We figured out a good driver and kept practicing and finally did it. Now we are just working towards getting our fastest time possible.

Final thoughts: Since we met our goal, we are just working on getting even better. We are going to continue practicing to get our best time we can.

Goal #2

Goal #2: Get the most amount points as possible on the challenge course

Steps we can take to reach this goal:

- have a big enough model to carry the canisters, but small enough to still move quickly - we dont want a slow model, but we also don't want a model that is quick, but cannot pick up canister or ROV pieces
- have a hook that is strong enough to pick up all canisters and ROV pieces - we want a strong hook so that there isn't a possibility that we drop any canisters or ROV sections
- Create a beacon activation device - this way we can keep the beacon on continuously and get four extra points

Progress update 1: On our first time going through the challenge course, we got one of the canisters on the platform, one didn't make it on the platform, and we got the big canister in its socket. We were also able to get both ROV sections on the staging station. We want to try and get all the canisters in the sockets.

What Next?: Next we want to try and create a beacon activation device to get that extra four points. We also want to get every canister in their sockets.

Progress update 2: Next time we practiced, we were able to get all the canisters in their sockets, both ROV sections on the staging station. We also successfully opened the vault. This was all finished in about ten minutes.

What Next?: Create a device to keep the beacon continuously, giving us more points. We are aiming to finish in the least amount of points.

Progress update 3: After we had created a beacon activation device, we were able to get it on the beacon, and light it up in one minute and thirty-six seconds. After that, we got all canisters in their sockets, both ROV pieces on the platform, and successfully opened the vault in under nine minutes.

Final Thoughts: We believe that we can continue improving our time so we can get time bonus points. We can continue practicing and working to achieve this.

First Model

When planning our first model, we had to take into account many different factors. First, we had to make sure we had the right amount of buoyancy. Second, we had to check to see how maneuverable it is, if it is not maneuverable, we will not be able to drive it. Third, we have to think about the size. If it is too big, it will be slow and may not fit through the hoops. If it is too small, it will be out of control and not drivable. We also have to see how it moves in the water.

Buoyancy: The ROV was too buoyant, and we had to test it multiple times before we fixed the problem and found a slightly positive buoyancy.

Maneuverability: The ROV was easy to control and had no problems while in the water. It moved smoothly the whole time. It is easy to go through the hoops.

Speed: Even though our model was easy to control, it was considerably slow. The speed of it was a lot slower than we would like.

Size: The size of our ROV was bigger than we wanted and the size will be brought down in future models.

Planned Actions: One major thing we want to change with this model is the size of it. It is a lot bigger than we want, and shrinking it will help it improve. It will increase the speed if we cut down the size. The buoyancy will need to be changed as well, since the model will get smaller and will need less of the pool noodle. If we make the model too small, it will affect the maneuverability, but hopefully that won't happen. We also need to add a hook to our model.

Second Model

On our second model, the two major changes were the size and the design. The main reason for these changes were how slow our first model was.

Buoyancy: Due to our changes in the size and design, the buoyancy had to be changed as well. Since the size decreased, the buoyancy needed decreased.

Maneuverability: The ROV was still just as easy to maneuver as the first model.

Speed: The speed was a lot faster than the our previous model. Speed increase was a main thing we were aiming for.

Size: Size was another part of our ROV that was changed. three and a half inches were taken off of the side, and the backside was condensted.

Planned Actions: We plan on taking away some of the height to keep making it smaller. This, again, is going to affect the speed and size. We still need a place to put a hook as well.

Third Model

For our third model, it stayed very similar to our previous model. The only difference between this one and our second model, is the height.

Buoyancy: The buoyancy had to be altered, but nothing too drastic.

Maneuverability: This stayed as good as it was for our past two models.

Speed: The speed of our model was lightly effected by the changes in the height of our model.

Size: The change of its size was the height. The height was brought down three quarters of an inch.

Planned Actions: Our main problem after this was the fact that we had no hook, and that is what we are going to try and fix next. We decided we would try and put a piece of PVC in the front to attach the hook to.

Fourth Model

For our fourth model, our main concern was getting a hook. On all of our previous models, we didn't have a hook, and that was a problem since we couldn't practice the challenge course.

Buoyancy: The buoyancy was adjusted due the addition of an extra PVC pipe. We had to add more pool noodle from that added weight. Some pool noodle also needed to be added to the back since it was sinking there.

Maneuverability: It is still smooth in the water.

Speed: Even though we had the added weight from the PVC pipe piece and the hook, this model still moved at a good speed.

Size: The size of this model didn't change except for the added PVC pipe, and this did not change the length of and side.

Planned Actions: While driving in the water and practicing on the challenge course, the hook is hard to see, so we are going to add bright tape around the hook to make it easier to spot.

Final Model

Our final model, we believe, is a good one. We are able to drive it well, and we like the design of it. We have a good hook, and our beacon activation device works.

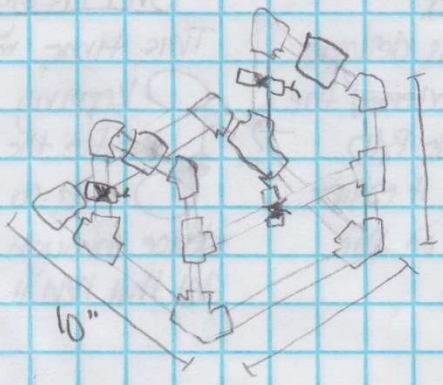
Buoyancy: The buoyancy only needed changed a little since the size was altered, but they buoyancy is good and we found a slightly positive buoyancy.

Maneuverability: The model moves smoothly through the water and can easily move through the hoops and do the challenge.

Speed: The speed is a lot faster than our first model, and we really like that. Speed is one of the main things we wanted to improve.

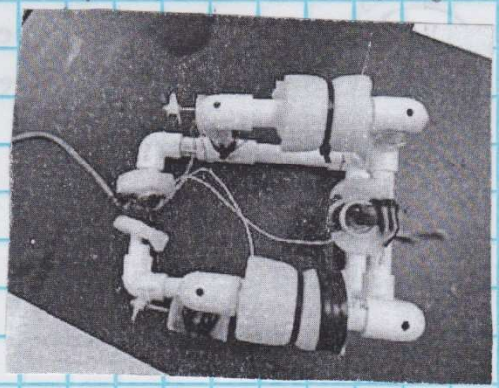
Size: The size of our model is average, not too big and not too small. It is quick, but is still maneuvrable through the water.

Sketch of final model

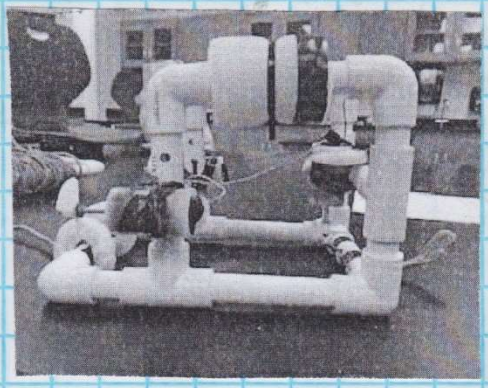


there were various trade-offs made in order to get a model that we liked.

Top view of final model



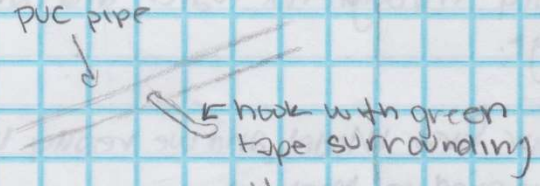
Side view of final model



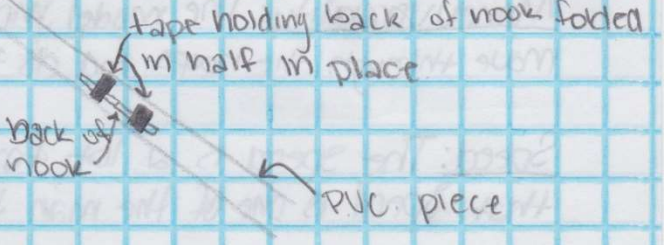
Hook

For our hook we decided on a simple design that came out of a piece of PVC curved which we bent in half and fed through two holes in the front of our ROV. When we first tested it in the water, it was strong and sturdy and carried everything easily. The problem was it was hard to see in the water. Our solution was adding bright green tape around it to make it more visible.

Front of PVC pipe

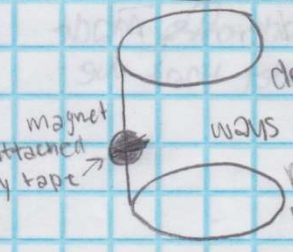


Back of PVC Pipe



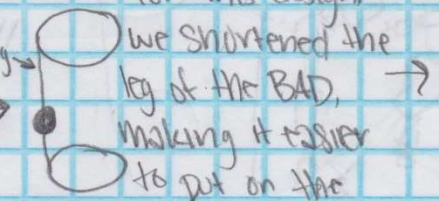
Beacon Activation Device (BAD)

1st design



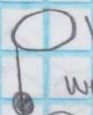
this was our first design. We tried different ways to attach the magnet, like wires, but our best solution was using tape for it. When it was in the water however, the tape unattached and the magnet slipped.

2nd design



for this design, we shortened the leg of the BAD, making it easier to put on the beacon.

3rd design

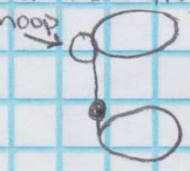


This time, instead of keeping the tape, we fed the wire we used to create our device through the magnet and that held it in place.

4th design

To try and make it easier to put the BAD over the beacon, we turned the top ring vertical, which ended up not working since it bent after we dropped it.

Final design

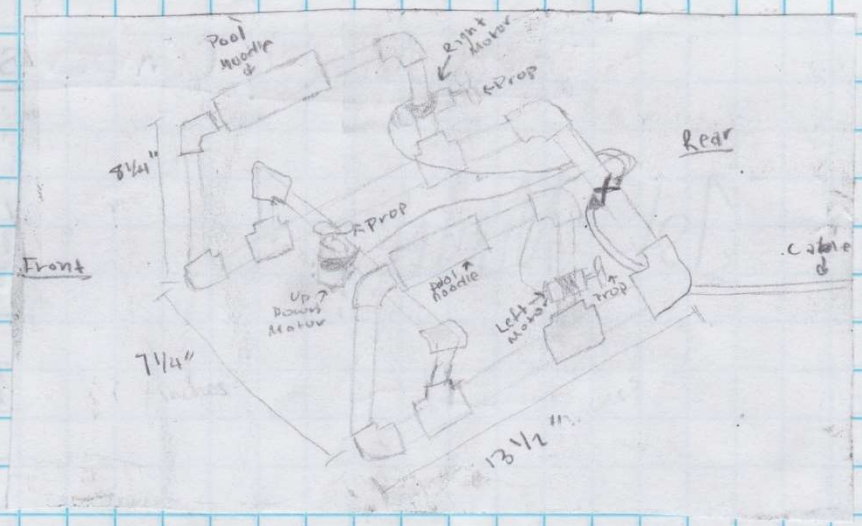


For our final design, we added an extra loop so we can carry the BAD and drop it easier onto the beacon.

Sketches

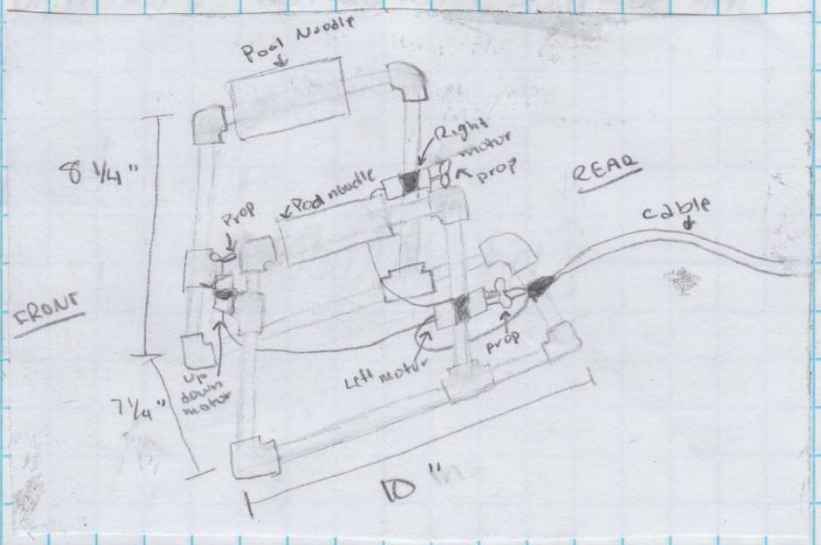
First Model

This is a sketch of our first model, with measurements and descriptions of each parts on it.



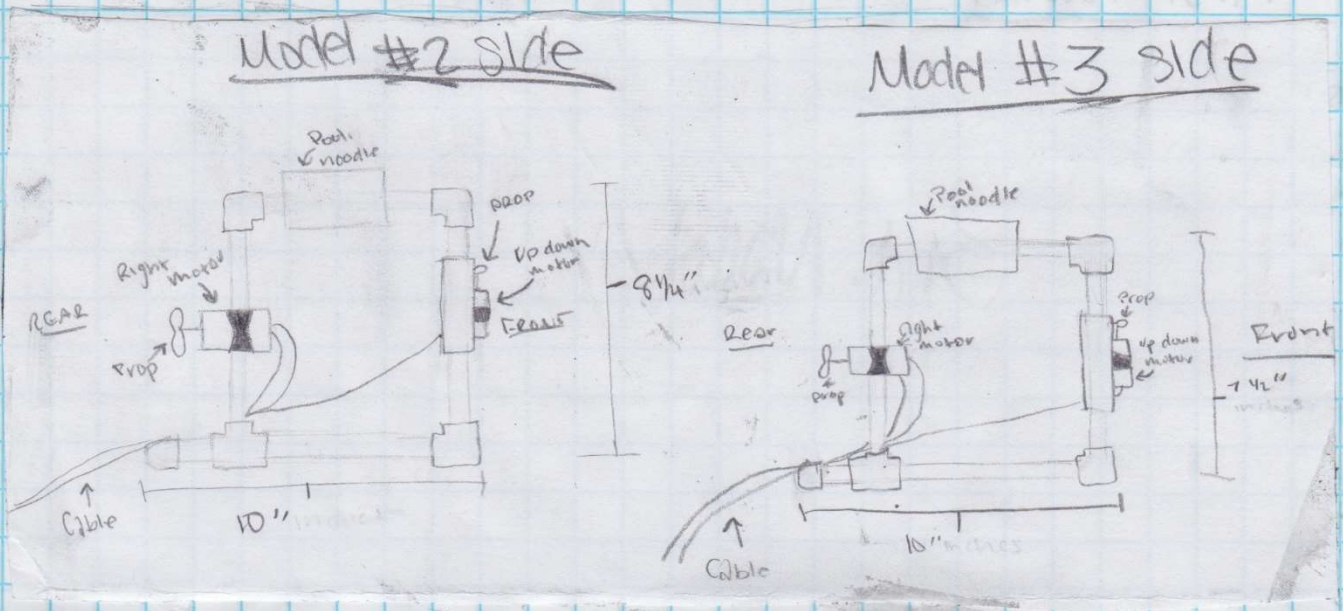
Second Model

This sketch of our second model shows the measurements and if you compare it to the first sketch, the length from the first to second is shortened.



Sketches

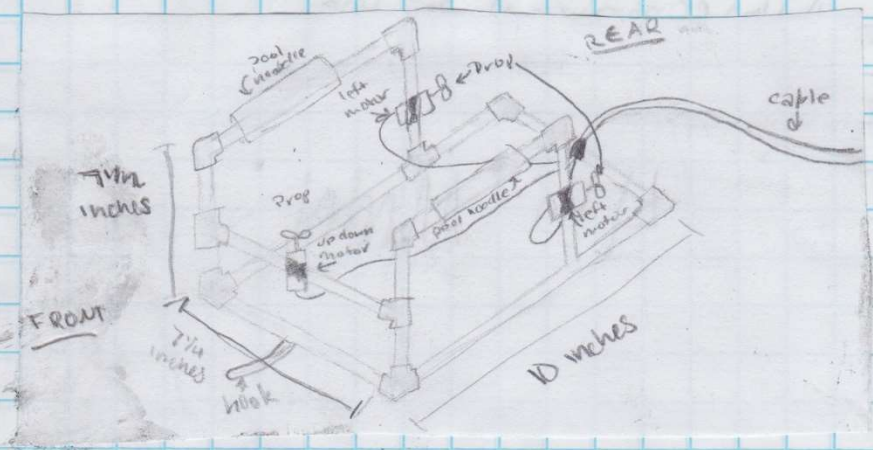
Third Model: Comparison



This sketch is a comparison of our third model to our second model. In this you can see the height difference in the two.

Fourth Model

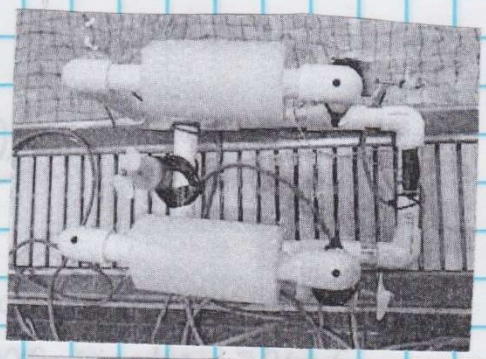
For our fourth model, we added a hook, and that was our main difference.

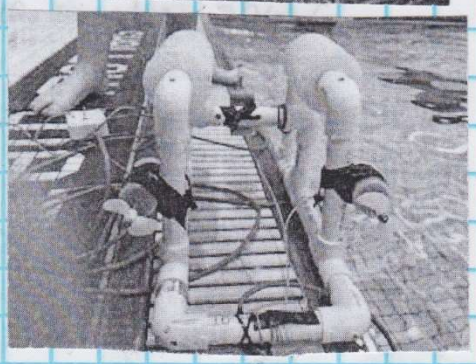


Pictures

First Model

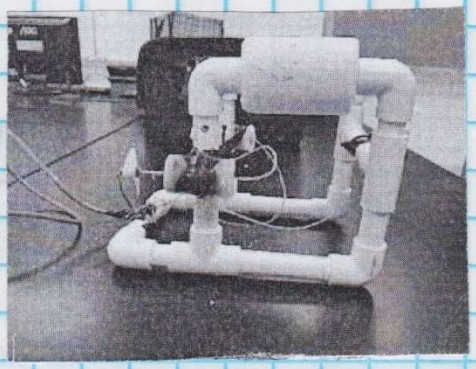
These are pictures of our first model. 2 top view and a view from behind.

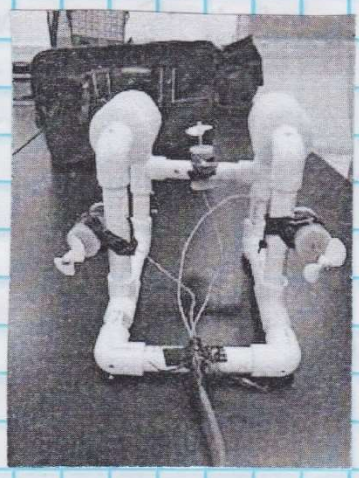




Second Model

The pictures are for our second model. The first picture is a side view of this model and the second picture is a view of the back.

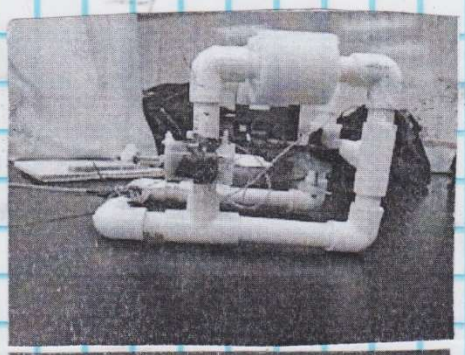


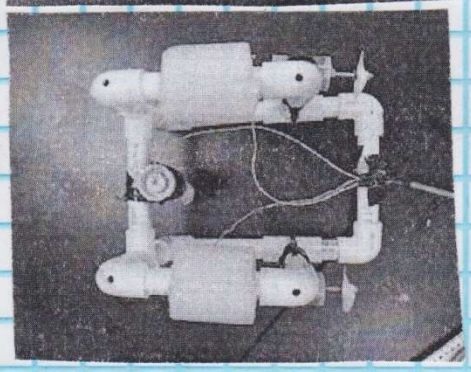


Pictures

Third Model

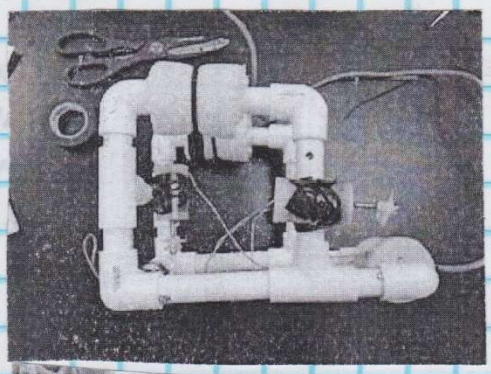
These pictures are of our third model and the top picture is a side picture and the bottom one is a picture of the top of our ROV.

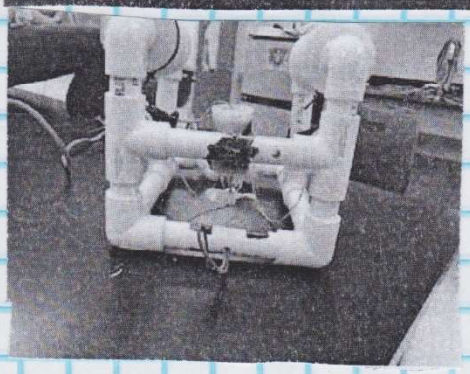




Fourth Model

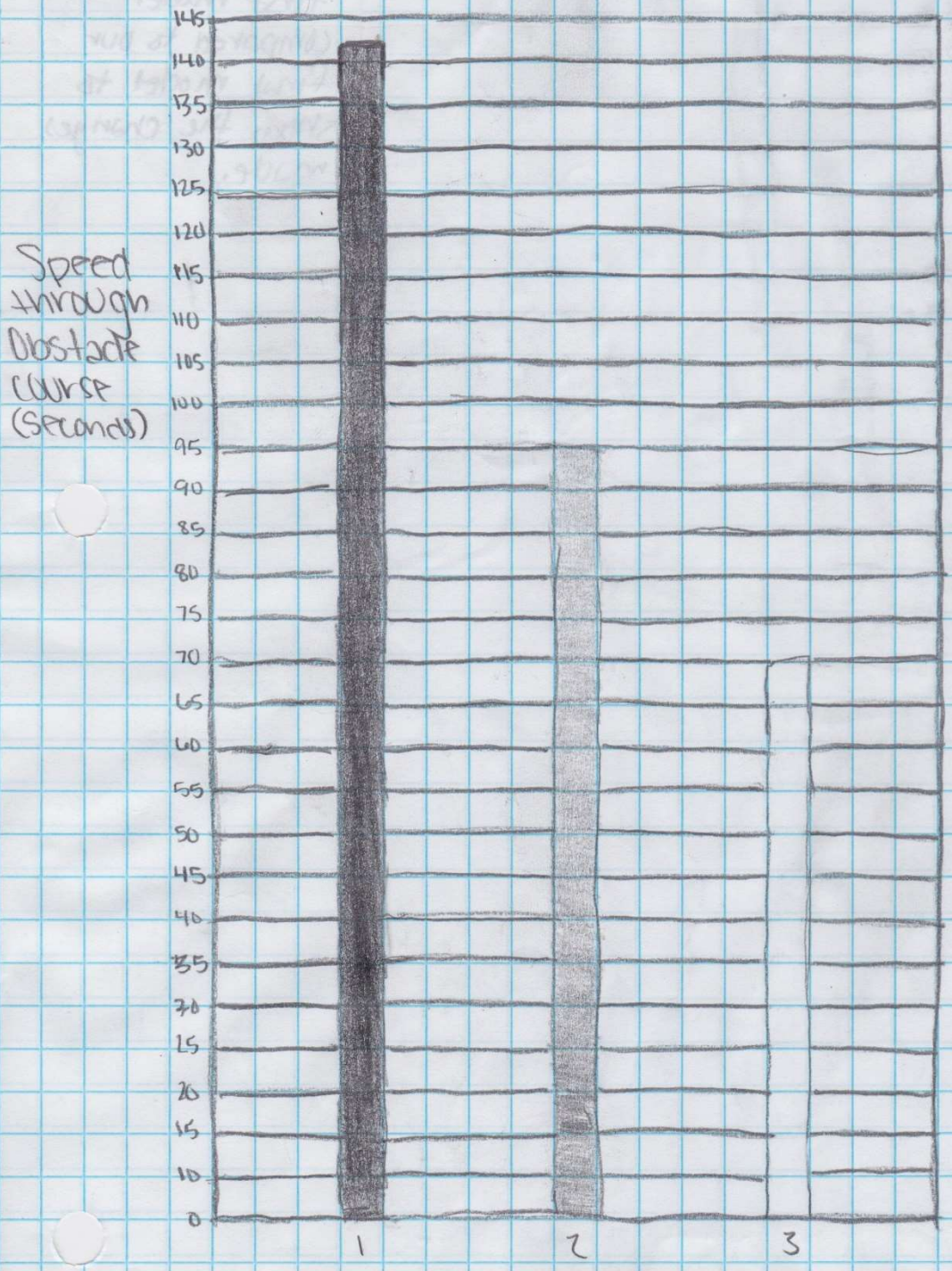
In the pictures to the right of our fourth model, there is a view of the side, and a view of the front. As you can see throughout the pictures, there are major, and some not so noticable changes in each of them.





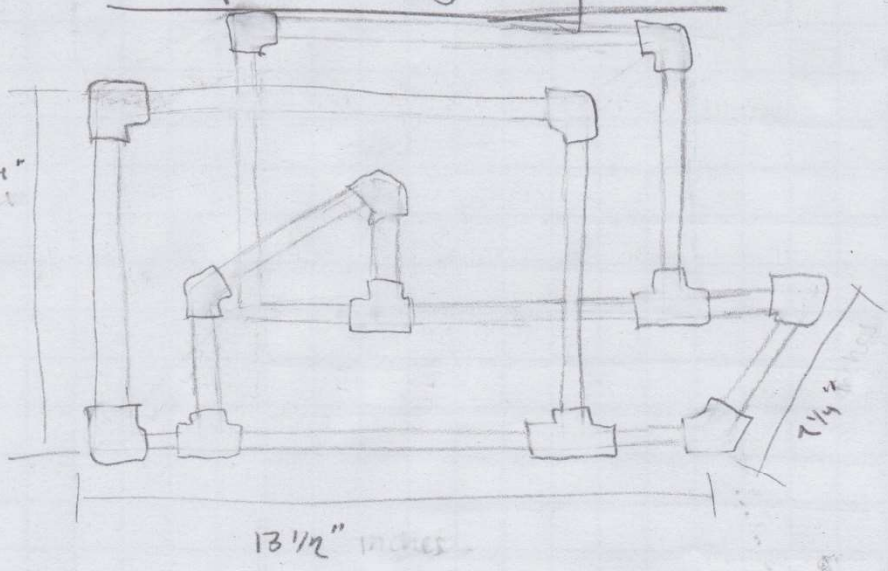
Data Tables and Graphs

This bar graph is data for how quickly we went through the obstacle course in seconds for each pool practice. Our times slowly increased as we continued practicing.

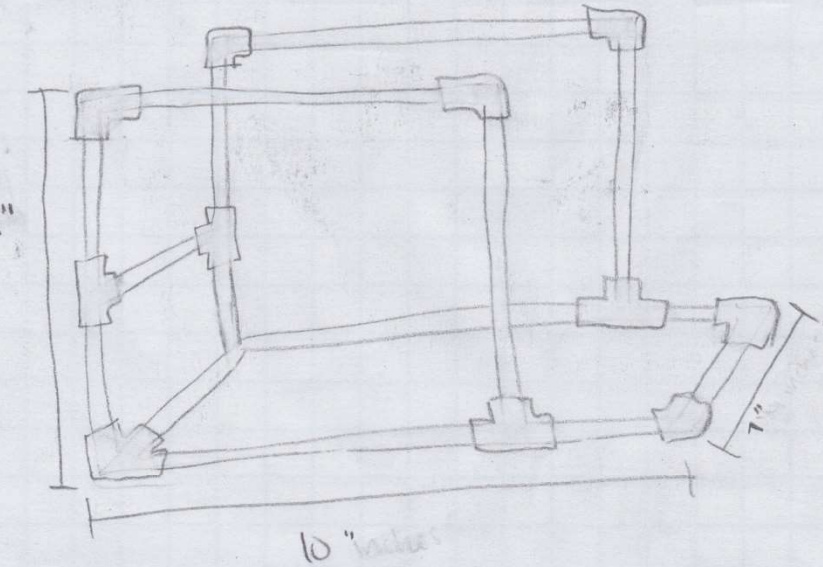


Comparison

Shape & Beginning Model



Shape & End Model



This sketch is a comparison of our first model compared to our final model to show the changes made.

Problems We Faced

- One issue we had was too much, or not enough buoyancy
- another problem was that our speed wasn't where we wanted it to be
- Our motors were falling off of our ROV while in the water.
- While going through the challenge course, we would drop the ROV sections and they would fall flat.
- One of the wires on our control box detached from where it was soldered.

How We Overcame These Problems

- For the buoyancy, we continued testing it and seeing if we needed more or less pool noodle. After a while of testing we got the right buoyancy

- for the speed of our ROV, we continued to shrink our models, and got the speed that we wanted.

- On our first model, our motors kept falling off of the ROV so we taped the motors as well as tightening the Zipties which solved the issue.

- To grab the ROV sections that fell flat, we tried different ways to get them angled so we could pick them up. We tried getting underneath the flat part to pick them up but that didn't work. This did not work because our hook is slightly angled upwards. Next we tried pushing the sections on top of the pipe connecting the course. We were able to push it on the pipe and get it angled enough to pick it up.

- When ever the wired disconnected, we had to take off the lid and resolder the wire back in place.

Final Times

For the school competition, we had a time on the obstacle course of one minute and twenty-three seconds, and the challenge course time was eight minutes and forty-five seconds.

Our Hopes

For the regional competition, we hope we can get even better times than the school competition. We hope that we will be able to move onto the National Competition.

Final Conclusion

In conclusion, we are very happy with our model. We like the buoyancy, maneuverability, speed, size, hook, and beacon activation device. All of these are key points in a successful and working ROV. We keep on improving with our times and the amount of points we are getting on the challenge course. This course is a great way to show and represent ways Sea Perch can be used in the real world. Similarly to what this course was designed after the rescue mission in Thailand where the kids were stuck in a cave- it show how it can help rescue or help people who are in danger. It can also help to recover things that are valuable or lost in a large body of water.

Engineering Terms Glossary

Soldering - to join metal objects with solder.

buoyancy - the ability to float in air or water

trade-offs - getting rid of one thing to have acess to another

data table - a table organizing information

graph - a way of representing data by distinct dots, lines, or bars.

Project Budget

Piece	Unit Price	Total
4 Extra Elbows	0.50¢	$2.00
4 zip ties	0.10¢	0.40¢
Wire	$2.00	$2.00
		$4.40

Refrence Page

hyperphysics.phy-astr.gsv.edu - page about buoyncy

www.ntffiod.com/search - page on soldering

academia.edu - page on hydrodynamics

www.bmtdesigntechnology.com.au - page on submarine design

Seaperch.org - official sea perch page