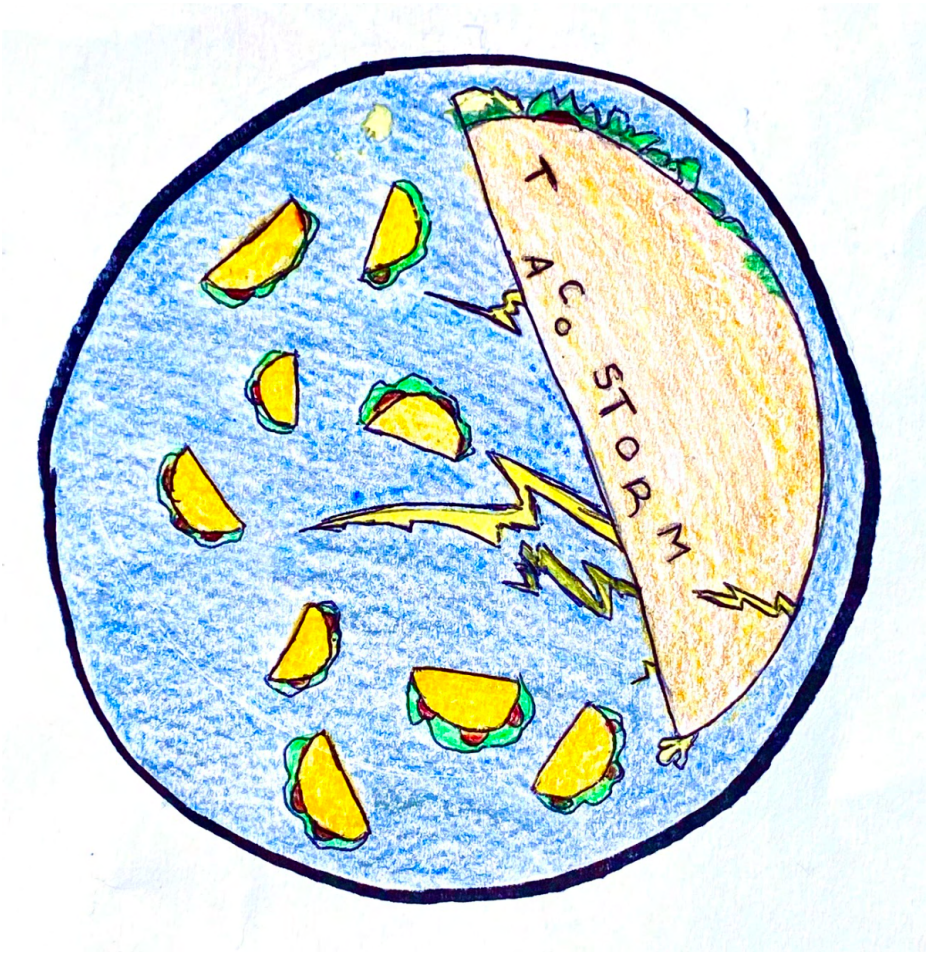
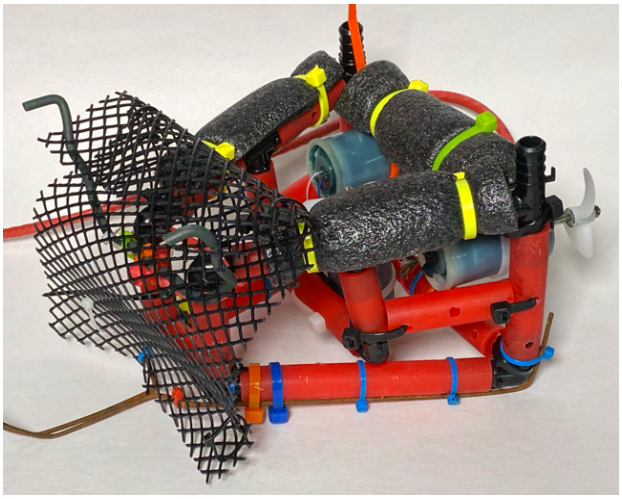
TACO STORM 1

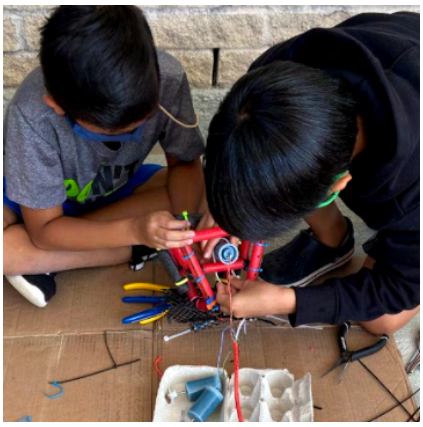




Abstract

Our intention was to make an ROV that could be easily maneuvered and could be very agile while being hydrodynamic. Before we assembled ROVs, we had to design prototypes. We had multiple diverse ROV designs. We had many challenges at the beginning but we were able to solve most of them. The engineering notebook contains information about what we wanted our ROV to do, our strategy, our designs that worked and failed, our steps to present our ROV, and the future for this team or what we plan to do in the future.

Our seaperch is unique, and different because we started out having built two designs and we combined to make one best ROV. We started out using toilet bowl wax to waterproof our motors but the wax consistency was too thick to work with. We needed the waterproofing material to be more doused, so we researched and found marine grease to be much easier to spread. Marine grease was made especially for submarines & motors, which was exactly what we needed for the ROV's motors. The buoyancy needs to be enhanced to make the ROV neutral to pick up heavy objects, and we don't want to be too positive or too negative. We made different prototypes of the flotation to test the buoyancy. We need to be able to go through the hoops in the challenge course and the obstacle course. We also need the most nimble time in the obstacle course with our ROV.



Task Overview

Our ROV Dorito had many tasks to complete, including going through hoops, picking up items, and pushing items around. We also want to have a neutral balanced ROV so our ROV is not constantly going up while driving, or constantly going down while driving. Then the net is employed to push objects on the surface of the water to the platforms and on elevated surfaces, we add a curve at the top so that objects could not fall out the net or float out It is also used to pull things under the water and pushing things over elevated surfaces, such as hoops or platforms.

But before we built multiple ROVs we had to build motors. We put electrical tape on the motor so it doesn't rust and so the boat grease doesn't clog the motors. After the electrical tape, we put on boat grease so water doesn't get in. We wanted our ROV to be small and make it buoyant and aerodynamic while also being easily controlled. We also put hooks that we made out of a metal hanger and flexible wire so we can pick up assorted objects and rings.

Design approach

Our ROV is small because originally we had thought a small ROV would be better so it could fit through the hoops of the obstacle course and so it could be faster in both the challenge course and the obstacle course. This also allows the water to go around the ROV without resistance. We needed a small ROV, but it needed to be strong and wide enough to support three motors, left (the color is blue), right (green), up and down (orange).

We did a complete rebuild of our ROV rather than using the stock ROV. We changed the PVC to the pipe we use now, PEX pipe which is smaller in size and less in weight which means that we can fit through obstacles and the motors have less weight to carry so we go faster. We also changed the flotation from the pool noodle to a piece of pipe insulation foam and after that the pipe insulator got deformed so we switched to a boogie board and it has worked so far.

We added a pex pipe to make a brace to support our motors. We made a brace on both the left and right side of our ROV. On the bottom we have two braces both with two holes in them to put zip ties through them to support our motor. There is a hook at the front of our ROV made of pex pipe and flexible wire. We used the flexible wire to get a longer reach on our hook, and pick up the objects in the water more easily.

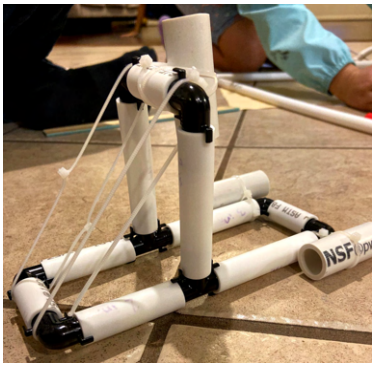
The net at the front of our ROV is curved to the top allowing our ROV to pull floating objects underwater and push floating objects above the surface of the water. We particularly needed to use that to push those floating objects over or under a hoop in the water. We tried both methods (pulling the objects underwater and pushing it above the hoop) .Our coaches told us that most other teams pushed the bottle/floating object over the top of the hoop. Our way of taking it underwater we think is more efficient.

We came up with the idea of Dorito from the stock ROV. But the stock ROV was too big, bulky and heavy. So we thought of the idea of the Dorito, a similar and smaller version of the stock ROV. But when we first made it the Dorito was unstable so it kept going to the surface of the water like a dolphin. To fix that we added weights to one side and more floatation to one side.

That's when we decided to change the frame from PVC to pex pipe to make it lighter and an even smaller version of our ROV. By then our team had decided to change out the flotation from the stock ROV's pool noodle to the pipe insulation foam . We decided to do that because the pool noodle like we said before had a lot of holes in it so it kept getting more negative than positive. So then we had to change it out a lot and that got very inconvenient. So we used the pipe insulation foam. But then the floatation kept deforming when heavy objects were put on top of it. And that also turned out to be inconvenient too because there are a lot of heavy things that can be put on top of our ROV floatation including our zipties.

So we decided to switch to pipe insulation. And so far that has worked out pretty well so far. But since our ROV is so small, floatation is one of the hardest parts of our design. This was especially hard because if there is just a little bit more on one side it will tip, if there is just a little more on the front then it will tip backwards. So we figured out that we had to cut our two flotations as close to exactly the same as we could. We tried this and experimented with this until we had decided that we had cut it as close to exactly the same size that we could. So this year and last year we experimented with a lot of components of our ROV to make our ROV faster, stabler and just a better ROV.





Experimental Results

When we were in the beginning of SeaPerch, our ROV had very thick PVC pipes. When we used that, Dorito was not stable. Because of this, we needed to change the PVC to a thinner PVC material. We made a good decision; Dorito had to have a smaller PVC frame. This was one experiment we've had. Another test we've observed was the size of Dorito at the time. Once, it was large, but we realized Dorito was not able to fit through the obstacle course hoops.

Another development we made was how we renewed the waterproofing of the motors. The first wax we used was Toilet Wax. Toilet Wax only lasted for a little while, but then it stopped being able to waterproof the motors, and the motor began to rust. We knew that we couldn't use Toilet Wax again, so we tried a different approach. And this year, we used Marine Grease. We think that Marine Grease is better because Toilet Wax is too solid against the motor, and it starts to melt which means that water can slide in easily. This puts us at a point where we needed to change the wax to an enhanced wax: the Marine Grease. Right now, the Marine Grease is doing much better than Toilet Wax.

The last major augmentation was our floatation. The flotation was always a difficulty, we could never get the floatation in the exact neutral buoyancy, so our ROV would either sink or float. The floating a bit was good because we needed it to be slightly positive to lift heavy objects. The first item we used was pool floatation, but the problem with using that was that we had to change the pool floatation several times. In doing that, it took too much time. Instead of taking up our time, we started to use a pipe insulator. Pipe insulator was perfect, it didn't deform, and it wasn't bulky and hard to mount.

We can make our ROV more stable by tweaking our motors to a better position to make it a little more stable. We also need our ROV to be faster, and smoother, to make our ROV faster we might make it smaller and more hydrodynamic. The more hydrodynamic the ROV the faster. A sharp Item is hydrodynamic, and there is less water resistance, while a blunt object has more water resistance. Our motors are put on the outside because it gives us increased maneuverability. One of the ROVs we made has the up and down motor with the propeller facing down. The propeller facing down has an advantage. If the propeller is facing up, the propeller is vulnerable to be broken if you accidentally ram into the hoop.

The 3 ring test	
Name	Time
Talan & Jason	1:39
Kaleb & Talan	1:32
Tristan & Talan	6:30
Mateo & Tristan	4:03
Jason & Talan	34(secs)

Picking objects			
Driver Tether	Run1 (secs)	Run 2 (secs)	Run 3 (secs)
Jason Kaleb	20	29	27
Kaleb Jason	41	53	31
Kaleb Tristan	33	32	47
Jason Tristan	24	28	19
Mateo Talan	32	25	33
Talan Kaleb	18	20	26
Objects + 1 Ring			
Ellie	1.09	1.09	.34
Sophie	1.12	1.01	.40
Isabella	1.51	1.20	1.03
Skylar	1.18	1.03	.50

Reflection & Next Steps

This season was great. We learned a lot of things about how to solder and work together as one. We had some challenges along the way like having trouble with our motors because our right motor was slow so we had to make new motors to replace. Another challenge we faced was, the water reflected light which made it hard to see and the water jet made it hard for us to learn to navigate the ROV. We learn a lot of life skills in seaperch we could do a lot of things because we learned how to use many tools. So if we had any job that included teamwork we could communicate because we could work with other people.

Trying to adjust to the reflection was hard to adjust to because you have to think hard to drive. When light refracts the object isn't in the same place as it seems to be, and that doesn't help our driver drive. To overcome this effect on our ROV we have to practice a lot.

Compatibility was an issue because not everyone will understand each other. Sometimes the Navigator will say something that the Driver might not understand. Here Is why compatibility is an issue, because if someone doesn't listen to someone's suggestions they might get into a massive issue.

While we were making our ROV there have been challenges throughout the experience and part of this experience is trying to be able to fix the driving. When we were driving forward it wouldn't go forward it would just turn while going up at the same time. It took us a long time to fix this problem, but in the end we learned balancing your ROV is not easy. We learned that any changes we made to the floatation, and position of the motors can change the balance of the ROV.

Acknowledgements

- We would like to thank Mr. and Mrs. Milam for letting us use their pool. Without the Milams, we wouldn’t be able to practice and therefore be really bad at driving our ROV.

- We would also like to thank our coaches, Mr. and Mrs. Cao, for teaching us about SeaPerch, like soldering, water proofing, and much more! Without the Cao’s we wouldn’t be able to have an ROV in the first place and we wouldn’t know how to solder or drive.

- We would like to give the biggest thanks to Senior Chief Johnson, he is an awesome person, and he sponsored the regional competition. Because of him, we are able to experience SeaPerch this year.

- We would like to thank our parents for supporting us and always taking the time to take us to practice.

- We would like to thank the Bui’s for letting us meet over at their house for the first year of our SeaPerch journey.

- We would like to thank Shadow Creek Ranch HOA for letting us use the community pool for our first year.

- We would like to thank RoboNation for giving us the opportunity to experience SeaPerch.

References

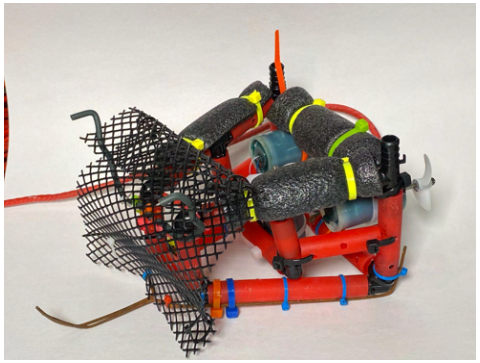
1.	https://www.youtube.com/watch?v=2PW9Sls8_10&ab_channel=RoboNation This video was a demonstration and showed us how to do obstacles 1 and 2
2.	https://www.youtube.com/watch?v=lgc8cTJucFM&ab_channel=RoboNation This video showed us how to do obstacles 3 and 4
3.	https://www.youtube.com/watch?v=zRsKwNg2OTM&ab_channel=JohnWhite This video helped us by showing us tips and tricks on making ROVs
4.	https://www.youtube.com/watch?v=D_FTeWZyorA&ab_channel=LkldTV This video explained the goal of SeaPerch and what our ROV is meant to do
5.	https://www.youtube.com/watch?v=bys5lBNwg6A&ab_channel=UtahRov This video explained to us how to waterproof the motors
6.	https://seaperch.org/competition/ This is the official SeaPerch website
7.	https://robonationforum.vbulletin.net/forum/robonation-programs/seaperch This is the forum for SeaPerch
8.	https://shop.robonation.org/collections/seaperch Robonation supplies

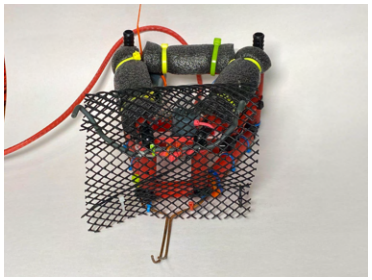
Appendix A: Budget

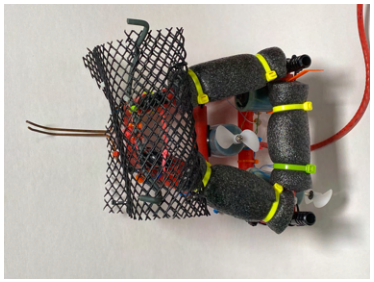
Component	Vendor	How was component used	Cost (USD)
Pex pipe tee (2)	Home Depot	Frame connector	2.51
Pex pipe 5ft	Home Depot	Frame material	1.86
Pex elbow (8)	Home Depot	Frame connecter	6.83
Wire connector	Amazon	Connecting wires	1
Flexible wire		Shape the net	1
Hanger		Hook	0.20
Marine grease		Motor waterproofing	1
Pipe insulation	Home Depot	Buoyancy	0.25
Wire winder	walmart	Organize cable	1
		Total Cost $:	**15.65**

Taco Storm

Shadow Creek Robotic Club, Pearland, TX, USA







Middle School Class Competition

#Years participating in SeaPerch: 2 years

#Times at the International SeaPerch Challenge: NONE

Our SeaPerch is unique because:

Our ROV was small and agile unlike other bulky big ROVs. Our other goal was to make it easily controlled. We also wanted it to be able to go through hoops and pick up items while still being very fast and easy to control. We also tried making it so no one did 1 thing alone. Everybody was involved in multiple tasks.

SeaPerch Design Overview:

We built the stock ROV and decided it was too big and bulky. We then wanted to make our ROV small and easy to control. We found the smallest light weight material to make the smallest ROV we can make. Then we needed to modify our ROV to pick up heavy items and rings. We removed all of the non necessary items and tried reducing the zipties and other items.

Our biggest takeaway this season is:

Our biggest take away is soldering because we have never seen it done before. It was amazing that our coach taught us how to solder the wires onto the motors. Another big takeaway was teamwork. It was difficult to work with 9 members and it was hard to get all 9 members input. But as the SeaPerch season progressed, we became better at working together.

TEAM MEMBERS PROFILE

	SKYLAR Salutations! I am Sky. I'm 10, the youngest of the group and my favorite part is how we get to work as a team and work together to create a different ROV than other teams.
	ELLIE Hi I am Ellie. I am 10 and my favorite part of seaperch was the testing and modifying of the ROV. This was my favorite part because we got to perfect Bob our ROV and then drive it to test it.
	ISABELLA Hi, I'm Isabella. I am 11 years old. My favorite part of seaperch is when we got to design and build our ROV. My favorite position of seaperch is being a tether.
	SOPHIE Hi, I am Sophie McClain. I am 11 years old. My favorite part of SeaPerch is when we get to work as a team