1. ABSTRACT

This report explains how Team Leatherback built and improved our remotely operated vehicle (ROV) to compete in the 2021 SeaPerch Challenge. Our design goals were to improve velocity, maneuverability, and functionality. Between October of 2020 and April 2021, we designed and tested 6 distinct prototype ROVs. The report explains our use of the Engineering Design Process (EDP) to continually improve our prototypes to efficiently accomplish the challenge course tasks. The report discusses what makes our ROV design unique. We also discuss our future plans. We used the EDP to design the following innovations:

- **Servo Gripper**: Clamps down on sunken and floating trash to transport the items.
- **Servo Controller**: Allows two people to control the ROV using two controllers (servo controller, and motor controller). This helped us learn how to work as a team and while completing the challenge course tasks.
- **Visibility**: Bright colors on various parts allow us to track its orientation.
- **Syntactic Foam:** In the center of the ROV gives support to our up/down motor and our servo and adds buoyancy to the heart of our frame.
- **Corks on cable:** Keeps the cable from effecting the pitch of our ROV.
- **Bottom Fork (for servo):** Made out of plastic gutter and a threaded rod. It helps ease lifting of sunken trash.
- **Lightweight Frame:** Keeps the ROV from sinking to the bottom of the course.
- **Bulldozer Attachment:** Helps ram floating trash out of the ring.

2. TASK OVERVIEW

Challenge course: The challenge course consists of four tasks.

- **Task 1:** Requires picking up a "beacon" (PVC cross) and putting it in the box below for maximum points. We designed bottom forks (like a forklift) to pick the beacon up.
- **Task 2:** Requires turning the PVC pipe that opens up "the vault". Once the vault is open, we pick up a "mine" (weighted ball) and hang it on the pipe, weighing it down so we can turn the pipe and close the vault. To be able to control how we maneuvered the mine to hang it on the pipe, we added a servo on the top of the ROV to clamp down on the ball.
- **Task 3:** Requires removing floating trash and pushing/pulling it under or over the PVC ring to get the trash outside the box. We aren't required to have the ROV bring us the trash (unlike the original challenge course) therefore reducing transfer time. There are four bottles and a 6-pack soda plastic wrap we are supposed to get out of the box. The servo and the bottom fork help relocate the trash.
- **Task 4:** Involves picking up/pushing sunken trash, bringing it around a PVC pole, and dropping it in a square on the bottom of the pool. For maximum points we have to get all five pieces of sunken trash in the box to get maximum points. We are thankful we were taught about the servo and the bottom fork because they are ***very*** useful in this course, especially in this task.

Obstacle course: The obstacle course requires we go through five hoops as fast as possible while surfacing and backtracking afterwards. We won't have to do it in competition, but we still practiced for next year. We modified our ROV to reduce drag, increase speed, and make it more hydrodynamic. We made the front ROV parts curved so it would part the water (like a boat) making it more hydrodynamic.

3. DESIGN APPROACH

The design process we followed this past year has been **very** useful in the creation of our **final ROV** and the **ROVs** before it. This design process consists of 7 steps.

Step 1 (Ask Questions): What can we do to make our ROV efficient?
Step 2 (Research): Research the materials that are necessary.
Step 3 (Imagine): Imagine what we will do.
Step 4 (Plan): Gather materials and draw what we will build.
Step 5 (Create): Construct the ROV we planned for.
Step 6 (Test): See if what we constructed is effective.
Step 7 (Improve): Make the ROV better.

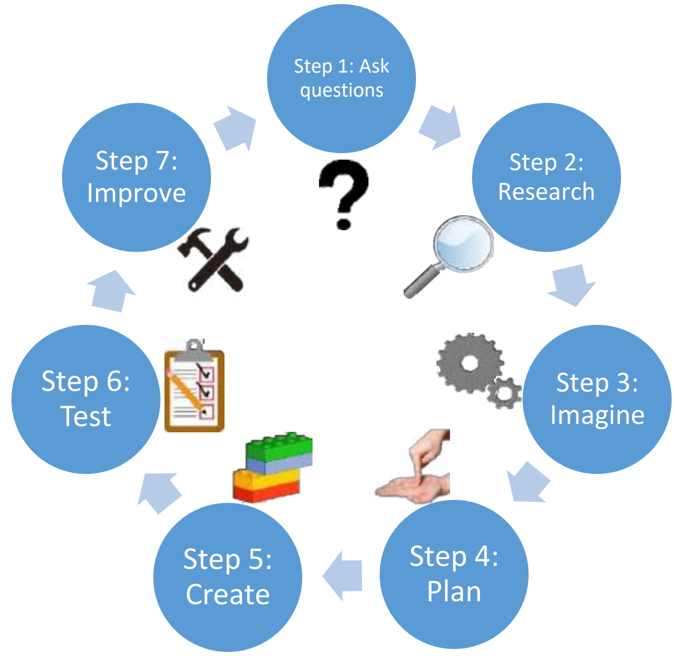

Figure 1 – EDP

ROV #1 - Our first **ROV**, we used the standard SeaPerch design. The standard design is very large, its shaped like a box, and it is heavy. These things make it very slow. The buoyancy we used was pool foam. When we tested it, we figured out while it may be very stable, it isn't fast.

Height:	18cm	**Width:**	16.5cm
Length:	30cm	**Weight:**	712g
Velocity:	1 FT/SEC		

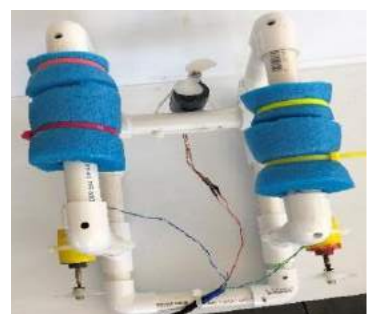

Figure 2 – ROV #1

ROV #2 - Our second **ROV** (or as we call them **ROV 2**), we made the ROV smaller and lighter to improve speed and decrease drag. We modeled it after the original ROV, but we made it 33% smaller in size. When we tested it, we found the buoyancy (the green foam on the right picture) wasn't working to the full extent we wanted it to because the buoyancy decreased over time while underwater.

Height:	12cm	**Width:**	10.5cm
Length:	21.5cm	**Weight:**	507g
Velocity:	0.89 FT/SEC		

Figure 3 – ROV #2

ROV #3 - For **ROV 3**, we further downsized the original design and changed the type of pipe. We used <u>PEX pipe</u> which is lighter than regular <u>PVC</u>. The ROV itself was around 79% smaller than **ROV 1** and around 53% smaller than **ROV 2**. PEX pipe is smaller, **<u>much</u>** lighter than regular PVC pipe, therefore, it makes it have less drag. We changed the buoyancy to plastic bottles instead of foam because the bottles provided a constant buoyancy. After testing, we found out **ROV 3** was faster than both **ROV** 1 and 2 because of the decrease in mass.

Height:	10cm	**Width:**	8.25cm
Length:	16cm	**Weight:**	230g
Velocity:	1.24 FT/SEC		

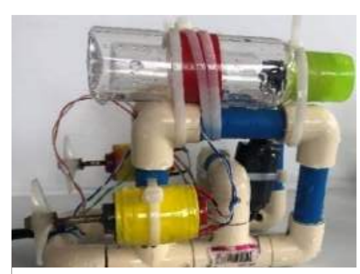

Figure 4 – ROV #3

ROV #4 - We used what we have learned & we used the **EDP** to create an ROV that is *fast*, *agile*, has good buoyancy, uses a *servo*, and is easy to see (*spray-paint & colored tape*). We used the tactics we have used in the past like having the front (and we also did it to the back) of the pipes *curved,* having the up & down motor facing down to prevent ripples on the water's surface, using the *syntactic foam* center piece to hold everything together, and having two halves of PEX pipe to hold on the forward and reverse motors. We also made the bottom fork out of *plastic gutter*, & we added carved *syntactic foam* to the front of the bottles to make it more hydrodynamic.

Figure 5 – ROV #4

Height:	8.89cm	**Width:**	17.145cm
Length:	20.32cm	**Weight:**	156g
Velocity:	1.34 FT/SEC		

ROV #5 – This ROV is *very fast*, *light, agile*, and *hydrodynamic*. It is a 3D model with a *servo* and *bottom fork*. While it is fast and agile, it is actually very fragile because of its material. The frame had broken in certain places and we got over those challenges. We stabilized it and made the design better.

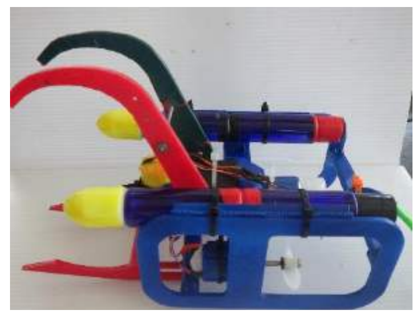

Figure 6 – ROV #5

Height:	10.16cm	**Width:**	13.97cm
Length:	17.78cm	**Weight:**	111g
Velocity:	2 FT/SEC		

Final Design/ROV #6 – We changed this **ROV** from **ROV #4** by making it flat therefore decreasing *drag* and increasing its *hydrodynamics*. It (like **ROV #4**) has a carved piece of *syntactic foam*, a *servo*, *corks on the cord*, & a *vertical up/down motor*. It has holes in the frame to let the water in. We also included our bulldozer servo attachment that connects to our gripper. This makes it easier to bump out the floating trash in task 3. This is the **ROV** used for the 2021 SeaPerch International Competition.

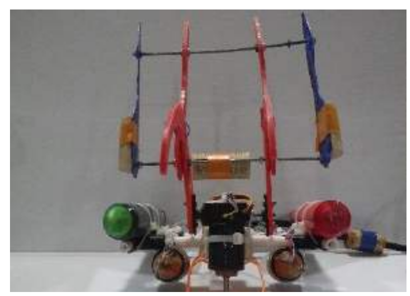

Figure 7 – ROV #6

Height:	.9525cm	**Width:**	17.78cm
Length:	15.24cm	**Weight:**	60g
Velocity:	2.43 FT/SEC		

Servo Controller – We have used this *Servo* since we built it shortly after we started working on our SeaPerch. We used *recycled* pieces from **ROV #1** to make the frame and put the batteries & the *circuit board* on a slab of cardboard and zip tied that onto the frame. It controls the servo that lays on the *syntactic foam* on our ROV. It has a 90º turn button & a 180º dial both of which control the servo movements. It also helps reduce the responsibility on the driver and builds trust and teamwork when the driver and line tender communicate.

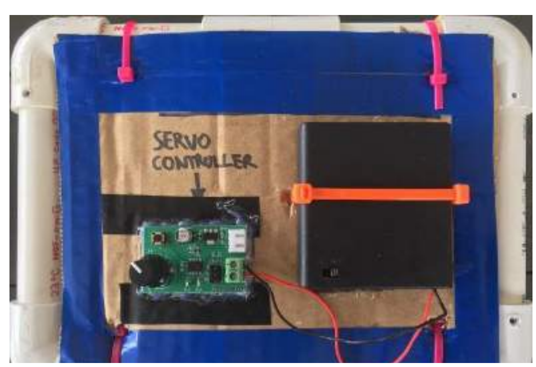

Figure 8 – ROV Servo Controller

4. EXPERIMENTAL RESULTS

While testing our ROVs, we discovered many things that impacted our design. Our replicated course reflected the specifications required for our final testing. The velocity we discovered testing ROV 1 & 2 were slow because of its big, bulky design. ROV #3 was about 15 seconds faster than the average of time in both ROV #1 & #2 because of its smaller pipes and design. We made the ROV #4 with even thinner pipes and a hydrodynamic frame design. These improvements in design resulted in a faster ROV, which resulted moving place to place faster than ROV #3. Our times decreased, helping us get the obstacles finished with time left to spare.

However, ROV#1, ROV #2, and ROV #3 were not easy to control, preventing us from finishing our courses as efficiently as possible, due to buoyancy and design. The buoyancy of ROV#1, ROV #2, and ROV #3 were all positive, making it difficult to submerge and retrieve trash.

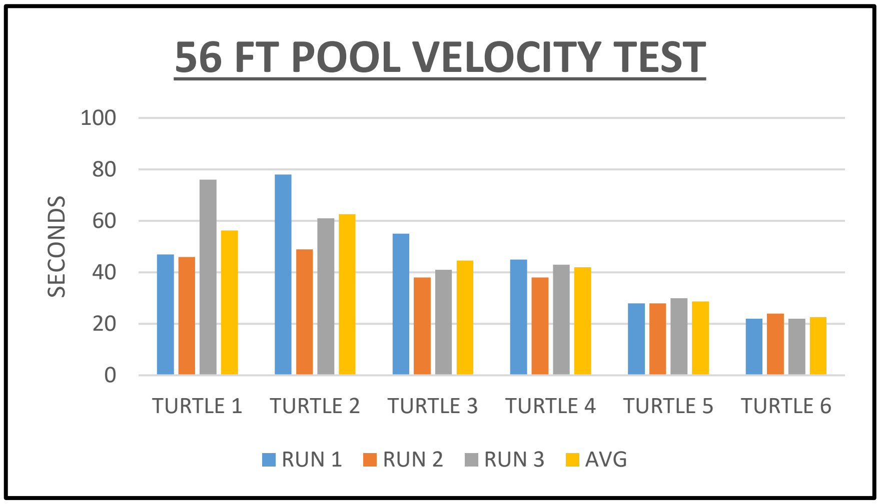

Figure 9 – ROV Velocity Test Results

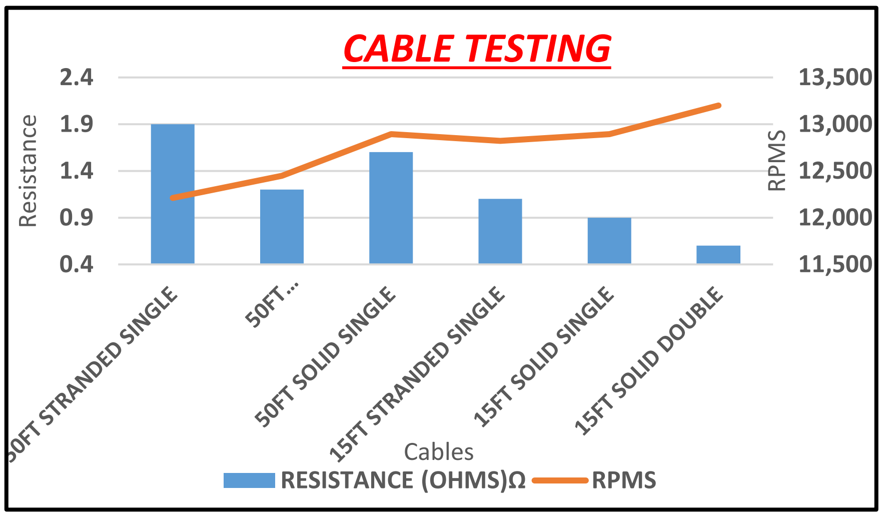

Figure 10 – ROV Cable Test Results

Velocity Test: We timed our ROVs from one end of the pool to the other and back (56 ft) to measure our average velocities in feet per second.

Cable Test: We tested different cable lengths, strand types, and the # of wires (see Figure 10) to see which combination would produce the most RPMS. This test revealed which combination of cable types and lengths (15 or 50 FT length, solid single, stranded single, or solid double cables) would be best in competition. Figure 10 shows that as resistance in Ohms decreased, RPMs increased.

Maneuverability Test: Maneuverability was determined by how well prototype ROVs navigated through a typical Seaperch obstacle course.

Functionality Test: Functionality was determined on the challenge course by how well the ROV accomplished the four tasks.

5. REFLECTION & NEXT STEPS

Over the past 7 months, we used the engineering design process (EDP), detailed in our Engineering Notebook (Appendix C), to build and improve our series of 6 prototype ROVs. The EDP consists of 7 steps. Step #1 is to ask a question. We asked questions to generate ideas for improving our ROVs. Step #2 is to research. We researched materials and methods to increase our ROV's performance. Step #3 is to imagine. We imagined how the ROV might be redesigned using these materials and methods. Step #4 is to plan. We thought out our approach to the tasks that we imagined (coordinating with step 3). Step #5 which is to create/build. Over the past 7 months, we relocated motors, reconfigured frames, adjusted buoyancy, and upgraded our ROV to include a servo. Step #6 is to test. The Shanklin's house is where we practice on Wednesdays and Saturdays. They have a flat-bottomed pool where we test our ROVs. Finally, Step #7 is to improve (and, in a way, start the process all over again). After we ask questions, research, imagine, plan, build/create, and test our ROVs, we always think and start the whole process over. Before we start asking more questions about what would and wouldn't work, we always reflect over what we have done. Using the EDP has been essential in getting us where we are now.
After the competition, our team will come back next year and compete with a different ROV. We will move from the PVC class to 3D, or open class. We are also planning to make an Arduino board to control our ROV. This will require us to use coding skills. We are looking forward to building on what we have done over the past 7 months and accomplishing new things next year.

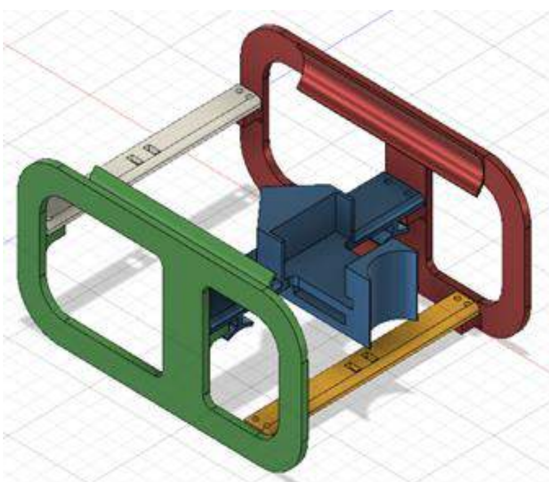

Figure 8 – CAD Drawing ROV#6

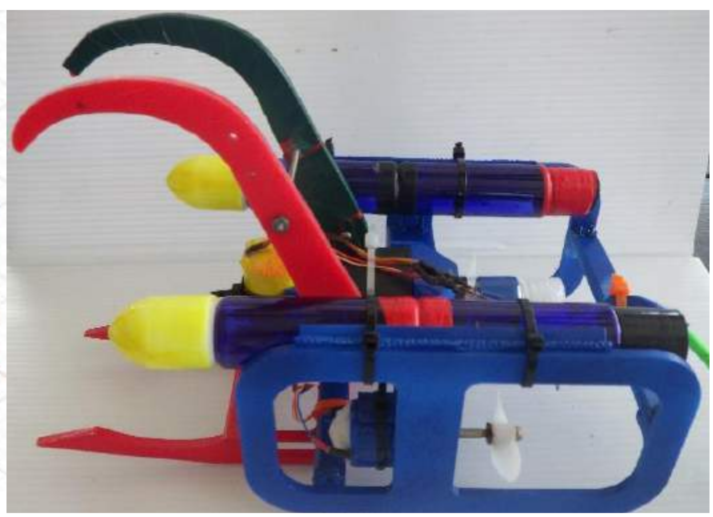

Figure 9 – 3D Printed ROV#6

6. ACKNOWLEDGEMENTS

We would like to thank our parents, coaches, and sponsors who have helped us achieve our success this season. Our sponsors are STEM 2 Hub, and TIAA Bank. Their donations gave us the funds to purchase our materials for our ROVs.
We thank our coaches, Mr. Hudson & Mr. Shanklin. They have coached us, challenged, and encouraged us since we joined the club.
Our parents have put in just as many hours of work as we have in the robotics club because they drive us to practice, they stay and help us in tasks that we can't do alone, they give us useful advice, and they have stuck with us throughout the competitions. We are so thankful for our parents, sponsors, and coach's support.

7. REFERENCES

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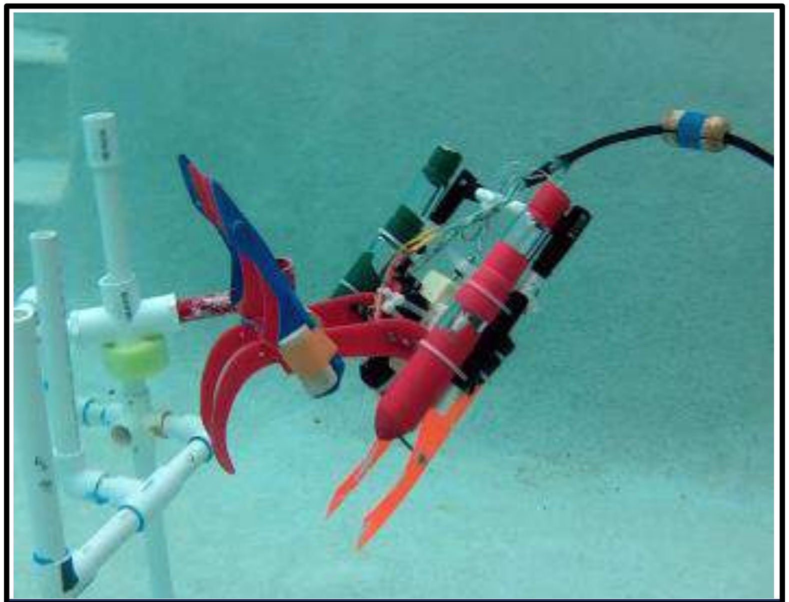
APPENDIX A: Budget

Component	Vendor	How was component used?	Cost (in USD)
Battery Case Holder (1)	Amazon	Power to Servo	$3.00
CAT 5 (Solid) 20 FT	Amazon	Motor Wire Improvement	$0.98
Servo (1)	ALIBABA	Drive Servo Gripper	$1.97
Servo Controller (1)	PFERISTORE	Operate Servo Gripper	$2.23
Batteries AA (4)	Amazon	Power Servo/Controller	$0.60
Expandable Sheathing (20 FT)	Amazon	Cable Wrapping	$1.80
Heat Shrink	Amazon	Waterproofing Terminals	$0.18
SLA Resin	Amazon	Waterproofing	$0.36
6x32 Screw 1" (1)	ACE Hardware	Gripper Fastener	$0.20
6X32 Nut (1)	ACE Hardware	Gripper Fastener	$0.09
¼ Inch PVC Pipe	Home Depot	ROV Frame	$0.72
Cutting Board	Dollar Tree	Gripper Arms	$0.50
½ Inch PVC Tee	Amazon	ROV Frame	$4.00
Vinyl Gutter Downspout	Home Depot	Gripper Bottom Forks	$0.72
Test Tubes (2)	Amazon	ROV Buoyancy	$0.93
½ Ounce Plastic Bottle (3)	Amazon	ROV Buoyancy	$1.74
4-40 Nuts (20)	Amazon	Gripper Construction	$0.64
4-40 Threaded Rod (2)	Amazon	Gripper Construction	$2.40
Cork (7)	Amazon	Cable Buoyancy	$1.12
Polyurethane Foam	Amazon	Cable Buoyancy	$0.85
TOTAL COST OF SEAPERCH COMPONENTS			$23.68

Team Leatherback

Mayport Coastal Sciences Middle School Jacksonville, FL



MS-STOCK (PVC)

1 Years participating in SeaPerch

0 Times at the International SeaPerch Challenge

Our SeaPerch is unique because: (100 words MAX)

Superlight frame: Our 60g frame increases the thrust to mass ratio.
Uses syntactic foam: Provides buoyancy to the ROV.
Very colorful: The ROV is bright so we can see its current position.
Corks on cord: Prevents the cable from effecting pitch of the ROV.
Bottom fork (for servo): Made of gutter pieces and metal rod. In combination with the gripper, allowing us to transport trash securely.

SeaPerch Design Overview: (100 words MAX)

We used the SeaPerch design process to start building & improving our frame. We originally used regular PVC on our ROV and gradually used smaller PVC to reduce drag and increase its speed. To overcome the challenges of the course, we added a servo gripper. We use syntactic foam because it adds buoyancy, holds our ROV together, and it can be easily shaped to our liking. Overall, our ROV is awesome because our ROV can easily overcome all the challenges we throw at it!!!!!!!

Our biggest takeaway this season is: (100 words MAX)

We learned that teamwork is important to making decisions and then acting on those decisions. We also learned that good communication is critical. Communication allowed us to complete and test 6 prototype ROVs in 7 months. Finally, we learned that successfully making ROVs requires including everyone’s ideas, brainstorming which idea is best, conduct repeated, detailed testing, and practice, practice, practice!

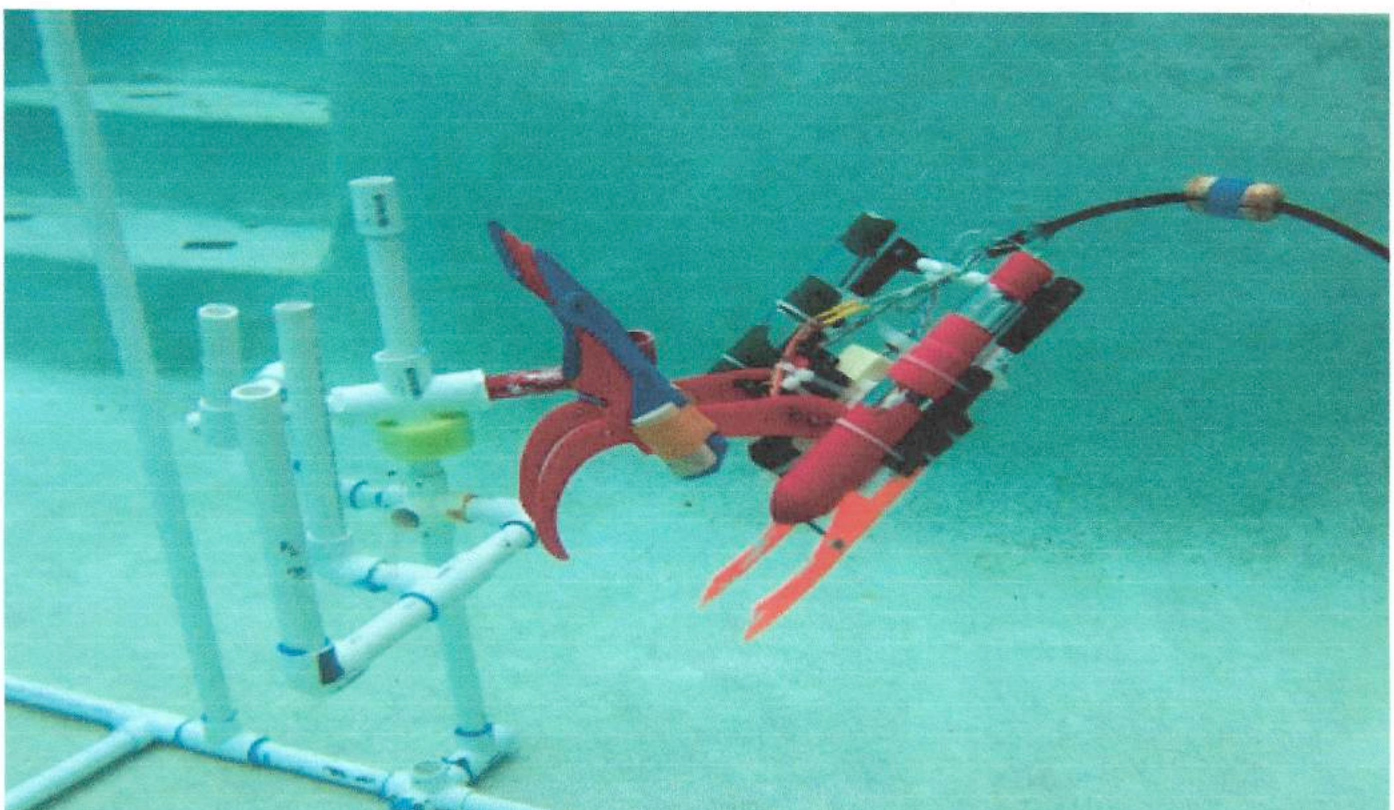
School or club name: Mayport Coastal Sciences Middle School

City, State: Jacksonville, Florida

Team name: Team Leatherbacks

ROV name: ROV #6

Seaperch 2020-2021
Engineering Notebook



TEAM INFORMATION PAGE

ADVISOR NAME:	Mr. William Hudson
ADVISOR CONTACT:	hudsonw@duvalschools.org, (716) 239-6640
TEAM NAME:	Leatherbacks
TEAM PARTICIPANTS:	Brendan, 6th Grade Gavin, 6th Grade Naurielis, 7th Grade
SCHOOL:	Mayport Coastal Sciences Middle School
SCHOOL DISTRICT:	Duval County, Florida

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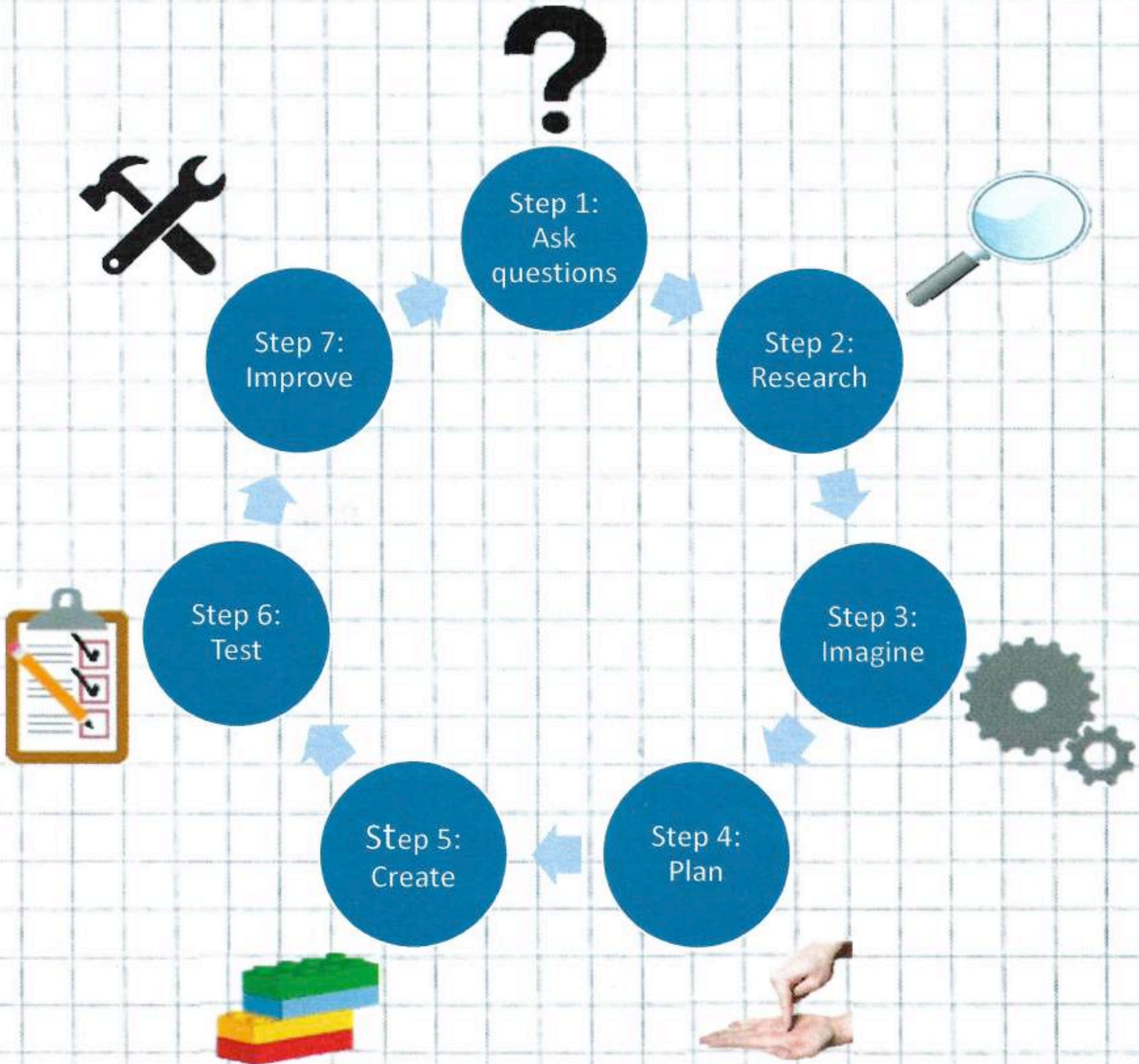
Engineering Design Process

3/20/21



Engineering Design Process (EDP)

We decided to use this EDP to help build our ROVS and it's accessories.

Team Goals

- [ ] To work together as a team and have fun!
- [ ] To build the best ROV possible.
- [ ] To make it to internationals and win.

Design Terms

3/20/21

Buoyancy - the overall tendency of an object to float in a fluid

Voltage - a unit of electro-motive force used in both the metric and imperial systems of measurement

Thrust - an actively generated, energy-requiring, propulsive force used specifically to cause or control vehicle movement

Mass - a measure of an object's intrinsic resistance to acceleration; regarded as a good measure of the amount of matter in an object

Pitch - 1. the forward/backward angle through which a vessel, such as a boat or plane, has tipped away from it's normal upright position

2. the theoretical distance a propeller would move forward through the air or water after exactly one full revolution, based on the blades' angle, if there was no slip.

Roll - the angle of sideways leaning to the right or left.

Trim - adjusting the bouyancy, pitch, and roll of a vechicle.

ROV #1

3/20/21

Our team asked what is the best way to build an ROV?

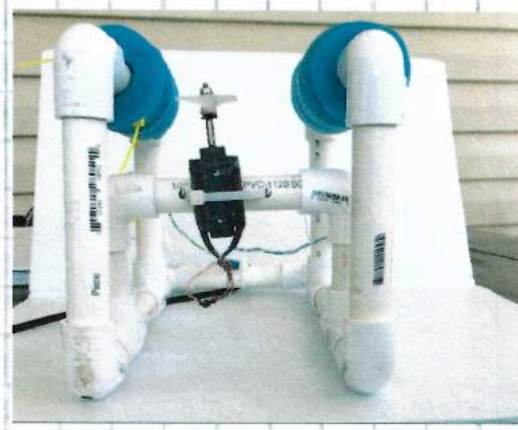
We researched ROV basics online.

We imagined SeaPerch designs but established to use the SeaPerch design.

We gathered the Seaperch Kit and materials.

As a team, we used the SeaPerch construction Manual to build our first ROV.

ROV #1 side view



ROV #1 front view

Dry weigt: 712g

Bouyancy: positive

control: easy, but slow

average run time: 56 sec/ 1ft per sec

Very easy to control, but very slow becouse of it's big size.

We decided as a team, to make ROV #2 smaller to decrease hydrodymanic drag and increase thrust to mass ratio.

ROV#2

3/20/21

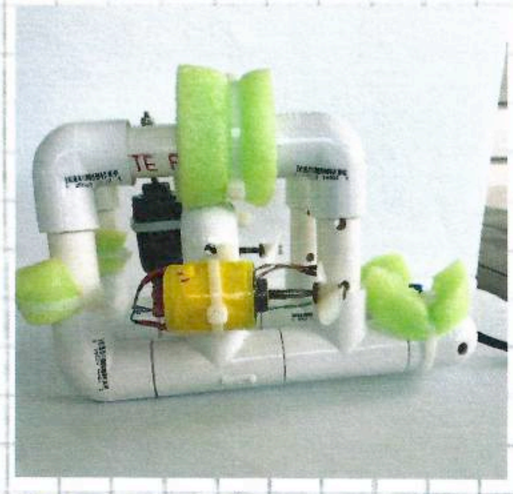
How can we make our ROV faster?

We researched how drag and hydrodynamics affect speed.

We imagined that by scaling down the size, our drag would decrease, by improving the hydrodymanics.

We planned to scale down the measurements of the height, width, and length of ROV#1.

We created a scaled down of ROV#1 using shorter tubes.



ROV#2 side view

ROV#2 front view

average run time: 63 sec/0.89ft per sec

Dry Weight: 507g

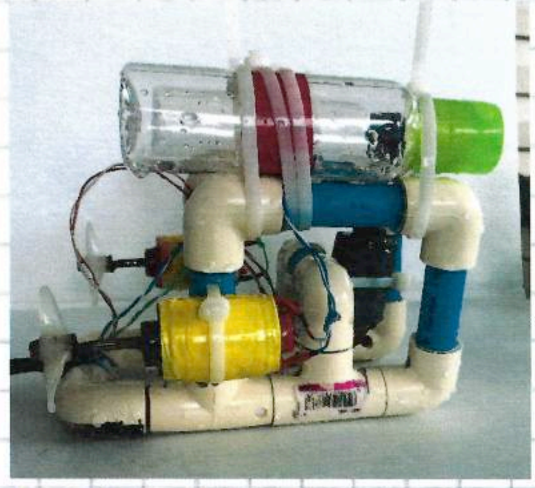
☐ maneuverability test: We drove ROV#2 through hoops to test how well it goes through objects.

☐ Velocity test: We drove ROV#2 to the end of the pool and back to test its speed.

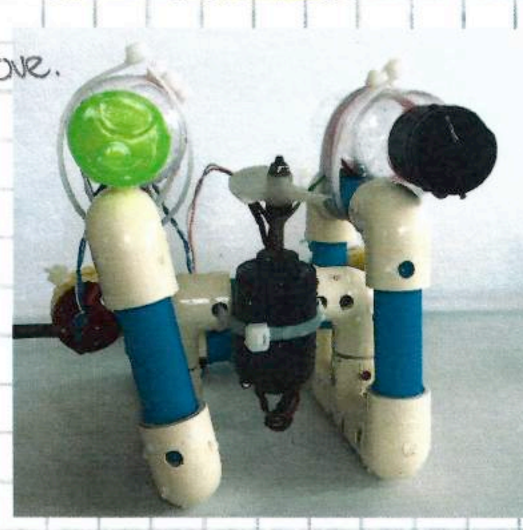
To make our next ROV better, we need to improve the drag, hydrodymanics, and weight.

ROV#3

3/20/21



ROV#3 side view



ROV #3 front view

what other material can we use to improve hydrodymanics?

We researched which materials can be used to improve hydrodymanics

We imagined that by changing the foam for bottles, our buoyancy would be affected less and by scaling down the size, our ROVs hydrodymanics would improve.

We planned to change the foam for bottles and to scale down the measurements of height, length, and width of ROV#2.

We created a scaled down version of ROV#2 using cpvc and used bottles instead of foam used in ROV#2.

Dry weight: 230g

average run time: 45 sec/1.24ft per sec

☐ maneuverability test: We drove ROV#3 through hoops to test how well it goes through objects.

☐ Velocity test: We drove ROV#3 to the end of the pool and back to test its speed.

To make our next ROV better, we need to improve the hydrodymanics by making the frame out of thinner material, we need to add a servo, so we can use the ROV for challenge courses, and add more visibles colors on the ROV for the water

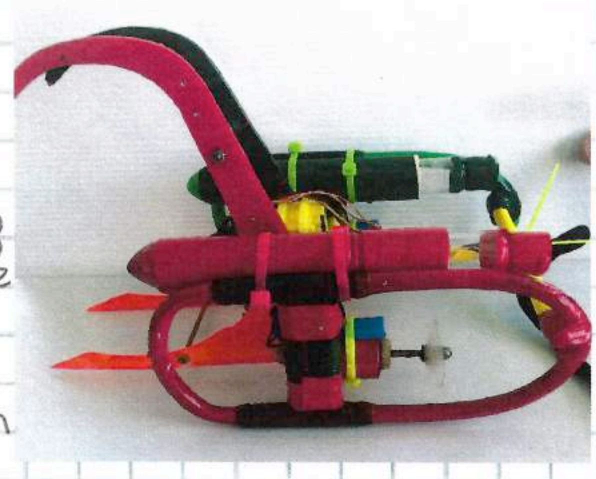
ROV #4

3/20/21

? How do we make a ROV thats easy to use in the challenge course?

We reaserched what kind of boyancy and pitch would be best to complete the challenge course effectively.

We imagined by sealing the ROV with epoxy, the boyancy and pitch will be effected less.



ROV #4 side view

We planned to spray paint vibrant colors on the ROV, seal the ROV with epoxy, add a bottom fork, and a servo to pick up floating and suken trash.

We created a ROV with different colors on each side to distinguish direction.
We sealed our ROV with epoxy. We added a servo and a bottom fork. (made of gutter)
We user thinner pipes ___ to decrease drag.

ROV #4 front view

average run time: 42 sec/1.33ft per sec

☐ functionality test: we drove ROV#4 through the challenge course. We noticed that the ROV picked up trash efficiently because of the servo and balanced boyancy

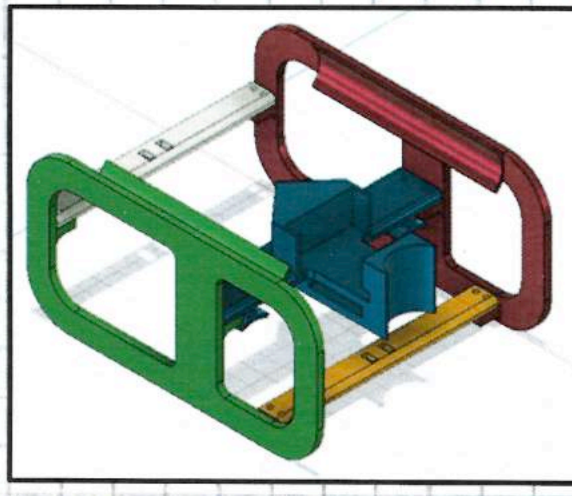
☐ Velocity test: We drove ROV#4 to the end of the pool and back to test its speed

To make our next ROV, we need to improve boyancy by trying to to make it more lightweight and stable using 3D printing.

ROV#5

3/20/21

? How do we improve the speed and stability of our ROV.



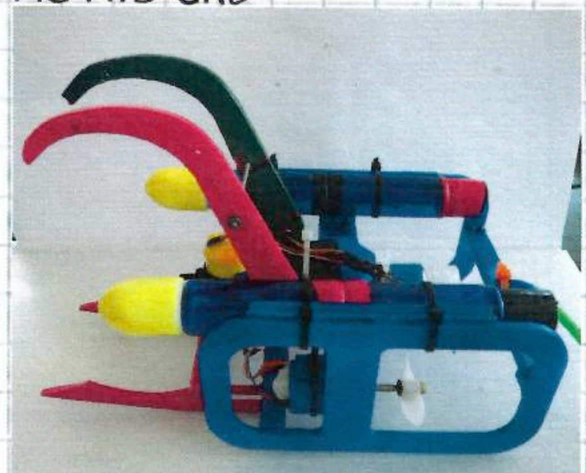
ROV#5 CAD

We researched which program to use to make a 3D printed frame and how to use the program.

We imagined that by using a 3D printed frame, the boyancy, pitch, and speed will improve.

We planned to make a 3D printed version of ROV#4 by using a computer aided design (CAD) program.

We created a 3D printed frame based on ROV#4 using CAD.



ROV#5 front view

Dry weight: 110g   average run time: 28sec / 2ft per second

☐ Velocity test: we drove ROV#5 to end of the pool and back to test its speed.

☐ Functionality test: we drove ROV#5 trough the challenge course. We noticed one of the motors fell off, so the ROV could not finish the challenge course.

☐ Stability and speed improved significally

To make improve our ROV, we are going to try to make our frame strong enough so it does not break easily by making it thicker.

ROV#6

4/24/21

How can we make our ROV less wide and more compact?

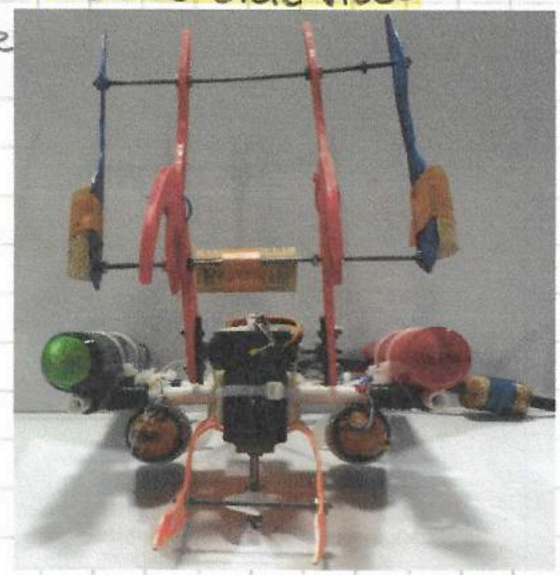
We researched how making our frame less wide and more compact would affect our ROV in terms of hydrodymanics, stability, and speed.

ROV#6 Side view

We imagined that by making our frame less wide and more compact, the ROV would increase speed, hydrodymanics, and stability while driving in the pool.

We planned to decrease width, length, and height of ROV#6.

We created our previous ROV but with a decreased height, width, and length by shortening our tubes.



ROV#6 front view

Average run time: 23 sec/2.43ft per second

Bouyancy: positive

control: medium difficulty

Dry weight: 60g

To improve, we can try to increase the control of our ROV.

Servo Controller

3/20/21

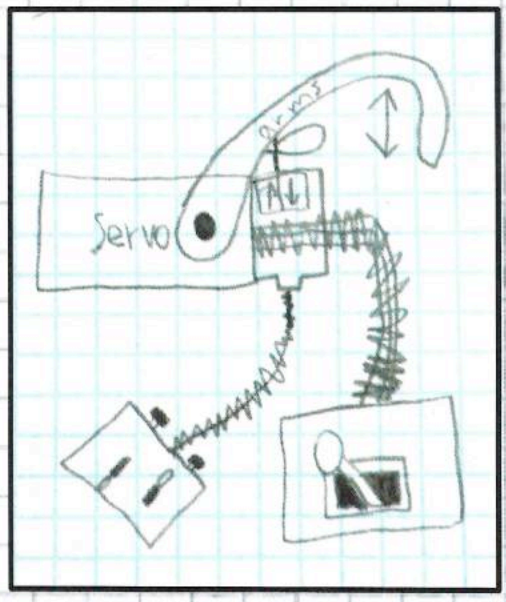
What is the best way to controll a servo?

We researched how to controll a servo and then researched how to build a servo controller. Lastly we researched how to use a servo controller.

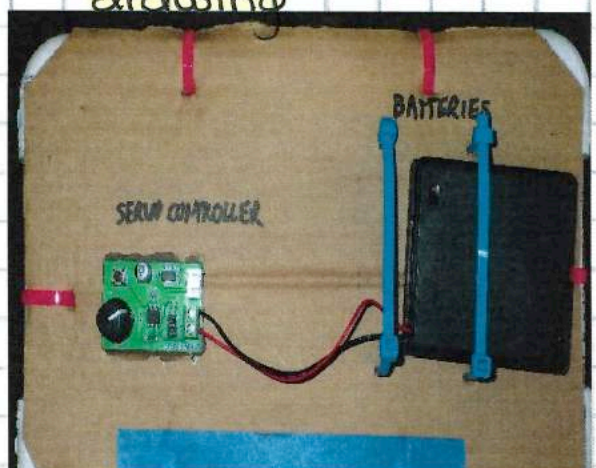
We imagined that a separate controller for the servo and driving the ROV will help with the cordinution of the challenge.

We planned to create a controller that has a Knob that can close and open the servor gripper at different degrees.

We created a custom motherboard with a Knob and a battery pack to supply power to the servo.



Servo controller drawing



Servo controller top view

☐ functionality test: We used the Servo controller in the Challenge course. The ROV was able to open and close the gripper properly to grab th trash efficiently.

We in future may try to improve the Knob and motherboard to add more functionalitity that could include a digital display that could tell the power of the controll.

Speed Graph

4/24/21

How would we get more RPM's out of our motors?

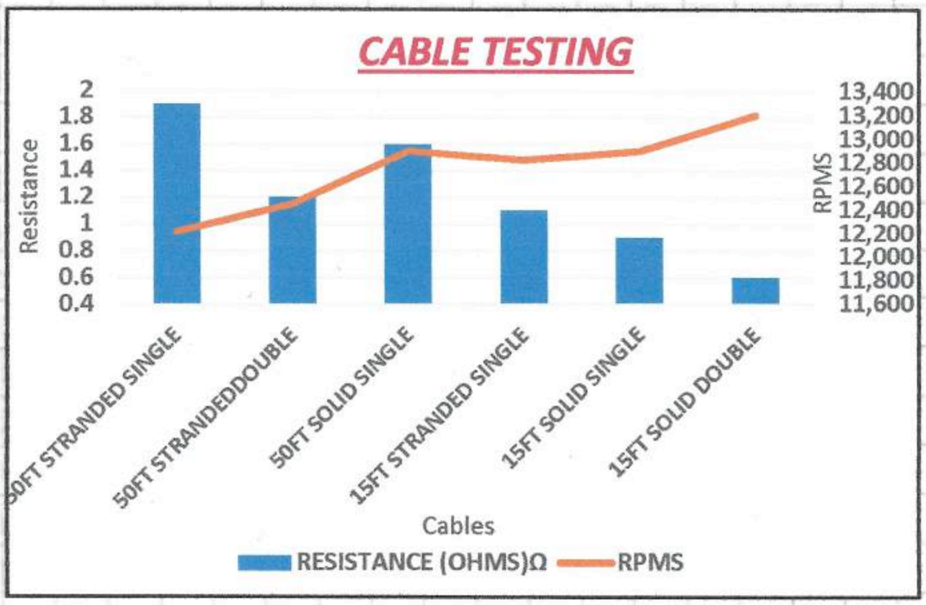
We researched how to increase current in our cable to increase RPM.

We imagined shortening our cable length would help increase our RPM.

We planned to decrease our cable length.

We created 6 cables to test, some were 15ft, 50ft, single stranded, double stranded, and solid stranded.

We tested RPM's and resistance on all 6 cables to see which cable was best for compitition.



Cable testing Graph

We found out the 15ft solid double cable is the best. We will contiune to research to improve our RPM.

Engineering Log

3/20/21

10/24 - We started to work on ROV#2 and learned how to solder.

10/28 - We finished ROV #2 and ROV#3. We then built the controller for our ROVs.

10/31 - We did ROV test runs for ROV#1 and ROV#2.

11/4 - We cut out the plastic sheathing on the wires and replaced it with black flexible sheathing. We soldered the wires to our motors.

11/7 - We took the pictures for ROV#1, ROV#2, and ROV#3. We did ROV test runs on ROV#3.

11/14 - We test runned ROV#3 and determined it's pitch. It's bouyancy was too positive, so we experimented with the position of the bottles to find out which pitch and bouyancy for ROV#3 was best to go through courses. We did practice runs with ROV#3 and worked on design process symbols.

ROV3	times
1	1.53min
2	1.23min
3	1.56min

11/18 - We waterproofed a servo and put CorrosionXD on it.

11/21 - We started working on ROV#4 and worked on the design process papers.

ROV#5= Mr. Shanklin's ROV

11/25 - We did timed runs for ROV#5 3 times (one timed run for each team member) and averaged it. We also discussed the design for ROV#4.

11/28 - We started to build ROV#4 and also finished it. We test runned 6 times (two timed runs for each team member) for ROV#4.

12/2 - We started to put together a back-up frame for the obstacle course.

12/5 - We put motors on ROV#4 and troubleshooted for the motors to stay still on ROV#4.

12/9 - We figured out how to attach motors to ROV#4.

12/12 - We worked on a new iteration of ROV#4 and added pipes cut into halves to it to keep the motors steady. We then brainstormed on how to install our servo on the new iteration.

12/19 - We started working on the technical design report. We then contiuned working on how to put a servo on ROV#4 (new iteration.

12/30 - We brainstormed motor and servo placement.

Engineering Log

3/20/21

1/2- We tested out Mr. Shanklin's 2 ROVs and started to work on the second iteration of ROV#4.

1/6- We finished the second iteration of ROV#4 and put epoxy on it.

1/9- we tested out the second iteration of ROV#4 with a servo on. We tinkered with the placement of the servo and bottles. We then made our own bottom fork with gutter.

1/13- We test runned the second iteration of ROV#4. We then adjusted the bottom fork and servo.

1/16- We added a new bottom fork (Mr. S made) to the second iteration of ROV#4. We did test runs with the bottom fork on and tried bouncy, symmetry, and pitch.

1/20- We moved the tail on our second iteration of ROV#4 down to decrease backwards pitch and also put corks on the motor cable to even out our pitch.

1/23- We test runned our second iteration of ROV#4 and spray painted it

1/30- We took pictures of our ROV and we worked on our fact sheet.

2/3- We finished our fact sheet and started to work on our design report

2/6- We worked on our notebook. We then added a narrower bottom fork and did test runs.

2/10-3/6- during these weeks, our team work on making a 3D designed frame to possibly use next year. our team has also work on Notebook and it is almost finished. Lastly, our team has done several test runs to test maneuvurbility, speed, and funcunality.

Engineering Log

4/24/21

4/3- Won jacksoville regionals. Brainstormed how to make our ROV better. We did motor cable testing and found out short, solid, double wire increases rpm to our ROV by 800rpm.

4/7- Worked on new Rov frame. Built competition motors. The Surface area of our left and right motors is 25% less than the Seaperch motor.

4/10- We test runned one of Mr. Shanklin's ROV and finished working on ROV#6. We moved the bulldozer mechanisim on the claws of ROV#6, took a photo of it, and weighed Mr. Shanklin's ROV (it weighed 59g, dryweight)

4/14- We test runned ROV#6 from the start of the pool to the end three times and timed it to average all the three times. We also did an extra test run with the challenge course.

4/17- We recorded tasks 1 and 2 on the challenge course. We also messed with the buoyancy of ROV#6 and practiced the challenge course.

4/21- We worked on our notebook and technical design report. We also graphed numbers for resistance and rpm's for all our 6 cables we are using and used before.

4/24- We worked on our notebook and technical design report.

4/28- We worked on editting our Technical Design Report.

MATERIALS

% USED: 50%
TOTAL COST: $3.00

% USED: 2% (20FT)
TOTAL COST: $0.98

 # USED: 1
TOTAL COST: $1.97

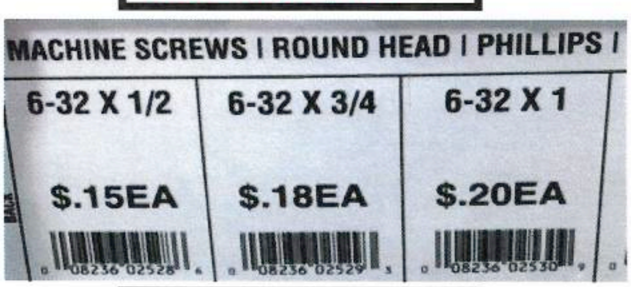
 # USED: 1
TOTAL COST: $2.23

% USED: 4%
TOTAL COST: $0.60

% USED: 20% (20FT)
TOTAL COST: $1.80

% USED: 3%
TOTAL COST: $0.18

% USED: 5%
TOTAL COST: $0.36



 # USED: 1
TOTAL COST: $0.20

 # USED: 1
TOTAL COST: $0.09

MATERIALS

% USED: 15%
TOTAL COST: $0.27

Cooking Concepts Dual-Sided Cutting Boards, 8x11 in.

% USED: 50%
TOTAL COST: $0.50

One Stop Outdoor 20-Pack - Irrigation Fittings Tee for 1/2" Drip Tubing - Barbed Connectors (Fits Most Brands, Rain Bird 16mm .520 ID and Compatible Drip or Sprinkler Systems) (Tee 20-Pack)

Price: $9.99

 # USED: 4
TOTAL COST: $2.00

$10

% USED: 7%
TOTAL COST: $0.72

DEPEPE 30pcs 50ml Clear Flat Plastic Test Tubes with Screw Caps

Return eligible through Jan 31, 2021

$13.99

Buy it again | View your item

 # USED: 2
TOTAL COST: $0.93

0.5oz Mini Clear Plastic Empty Bottle with Flip Cap Small Travel Bottles Storage Containers Jars for Cosmetic Sample Lotion Shower Gel Emulsion Toiletries - BPA-free - Set of 24

Brand: SYBL

55 ratings

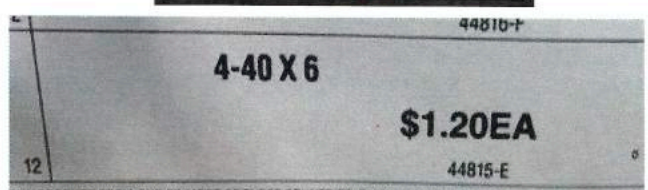
Price: $13.99

& FREE Returns

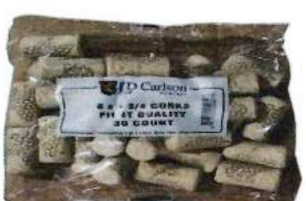
 # USED: 3
TOTAL COST: $1.74

ASME B18.6.3 Zinc Plated Steel Machine Screw Hex Nut, #4-40 Thread Size, 3/32" Width Across Flats, 1/4" Thick (Pack of 100)

 # USED: 20
TOTAL COST: $0.86



% USED: 2.5
TOTAL COST: $3.00



8x1 3/4 First Quality Straight Wine Corks 44 X 22mm 30/Bag

Price: $4.90

 # USED: 7
TOTAL COST: $1.12

Sculpture Block - Polyurethane Foam Carving Block - 6 x 6 x 1 inches

% USED: 16
TOTAL COST: $1.13

MATERIALS

Component	Vendor	How was component used?	Cost (in USD)
Battery Case Holder (1)	AMAZON	Power to Servo	$3.00
CAT 5 (Solid) 20 FT	AMAZON	Motor Wire Improvement	$0.98
Servo (1)	ALIBABA	Drive Servo Gripper	$1.97
Servo Controller (1)	PFERISTORE	Operate Servo Gripper	$2.23
Batteries AA (4)	AMAZON	Power Servo/Controller	$0.60
Expandable Sheathing (20FT)	AMAZON	Cable Wrapping	$1.80
Heat Shrink	AMAZON	Waterproofing Terminals	$0.18
SLA Resin	AMAZON	Waterproofing	$0.36
6x32 Screw 1" (1)	ACE HARDWARE	Gripper Fastener	$0.20
6X32 Nut (1)	ACE HARDWARE	Gripper Fastener	$0.09
¼ Inch PVC Pipe	Home Depot	ROV Frame	$0.27
Cutting Board	Dollar Tree	Gripper Arms	$0.50
½ Inch PVC Tee	AMAZON	ROV Frame	$2.00
Vinyl Gutter Downspout	Home Depot	Gripper Bottom Forks	$0.72
Test Tubes (2)	AMAZON	ROV Buoyancy	$0.93
½ Ounce Plastic Bottle (3)	AMAZON	ROV Buoyancy	$1.74
4-40 Nuts (20)	AMAZON	Gripper Construction and Fork Guard	$0.86
4-40 Threaded Rod (2)	AMAZON	Gripper Construction	$3.00
Cork (7)	AMAZON	Cable Buoyancy	$1.12
Polyurethane Foam	AMAZON	Buoyancy	$1.13
TOTAL COST OF SEAPERCH COMPONENTS			$23.68

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