SeaHawks

Team Members: Travis Allen , Austin Ashby, and Devon Roach

Info

School: Springs Valley Jr./Sr. High School Address: 326 South Larry Bird Boulevard French Lick, Indiana 47432

Phone: 812-936-9984 Email: goldmanc@svalley.k12.in.us

Inspire. Prepare. Achieve. Succeed!

Meet The Team!

Travis Allen

This is Travis' first year in SeaPerch and he feeds cord for the Orbs Challenge. Travis wants to major in electrical engineering at ISU after graduating high school. This is Travis' first time at a National SeaPerch Challenge.

Austin Ashby

This is Austin's fifth year in SeaPerch and he feeds cord on the obstacle course. Austin wants to major in robotic engineering at IUPUI after graduating high school. This is Austin's third time at a National SeaPerch Challenge.

Devon Roach

This is also Devon's fifth year in SeaPerch and he is the driver of both courses. Devon wants to major in electronic/technology engineering at ISU after he graduates high school. This is Devon's third time at a National SeaPerch Challenge.

Objectives

- Design a simple, efficient, and original ROV
- Learn various engineering skills (Cad modeling and 3D printing)
- Be more efficient
- Be more strategic
- Improve our ROV by applying physics concepts (drag, resistance, center of mass, and buoyancy)
- Work together as a team

Modifications We Made

- Made the design longer and wider
- 3D printed pipes
- Added a larger holed netting to our ROV
- Added zip ties at the end of the mesh netting
- Taped motors to the frame
- Added zip ties on mesh netting to ROV
- Used new netting with larger holes
- Combined two CAT 5 cables into one tether

Why We Made these Modifications

- We made our design longer and wider to be able to efficiently catch the largest whiffle ball in the orbs course
- We 3D printed pipes for our ROV to increase its speed
- We added Larger holed netting to reduce drag within the ROV
- We added zip ties to the end of the mesh netting so no whiffle balls would escape our ROV
- We taped our motors to the frame to insure they would stay in place
- We zip tied the mesh netting to the frame to insure that the netting would stay in place
- We combined two CAT 5 cables into one tether to decrease the resistance within the wires and to increase the amount of watts that is traveling to the motors

Things We Learned

- How to make a CAD model
- How to 3D print
- How to be more innovative
- How to be more efficient
- To brainstorm
- How to be good role models
- How to have a good work ethic
- How to work as a team

Budget

On a $20 budget, here is a list of the different items that were purchased within the budget.

- 3 large rolls of electrical tape(57 cents a piece) = $1.71
- 1 large pool noodle = $1.29
- 1 package of J-B weld = $3.27
- 1 pack of Zip Ties = $3.90
- 1 roll of Garden Netting = $3.16
- 10 3D parts at 30 grams total (priced at 5 cents per gram) = $1.50
- 1 CAT 5 cord = $4.23

Total Cost = $19.06

21st Century Skills

What are 21st Century Skills you ask? The term 21st Century Skills refers to a broad set of cognitive, social, and emotional attributes that when paired with work habits provide the foundation for college and career readiness. These skills include adaptability, complex communication, self-management/self-development, and non-routine problem solving. Here are some examples of how SeaPerch can be connected to 21st Century Skills.

Adaptability

Adaptability is a huge part of SeaPerch. You have to adapt to the environment you are competing at, your ROV, and the changing of the challenge course every year. Each place you compete at is a completely different environment. The pool jets could be on while you're competing, the divers could be in the water creating waves, or the lighting could be different and could cause a glare. We as a team have to analyze what the problem is and adapt to it as much as we possibly can. Then there is adaptability with our ROV. For instance, before we changed how many watts were being put out to the motors of our ROV, it was a lot slower. The driver of our ROV had to adapt to the faster speed. We adapted by running through the different courses and perfecting them with the new speed. Finally we have the change of the challenge course every year. Every year there is always a new challenge course, in order to adapt to the new course we sat down and studied the design to see how it functioned. Then we finally ran the course a very large amount of times until we were fully adapted to the new course.

Self-Management/Self-Development

Self–Management/Self-Development is another important part of SeaPerch. We worked remotely by individually taking our teams ROV and doing specific things to it. We also worked as a virtual team by virtually sharing what we needed out of the person who had the ROV. We worked as a virtual team by using texts, phone calls, or emails. Self motivation is also another huge part of this specific 21st Century Skill. Our team has shown self motivation many times this year, and years before. We have individually, on our own leisure time; researched and experimented with different things that are SeaPerch related. Self Monitoring is very important to us as a team. We don't want to have to have our coach over our shoulders monitoring us and making sure we our getting things completed. We as a team can self monitor ourselves to make sure things are getting completed and in the fastest and most efficient way as possible

Complex Communication Skills

Communication is always key. Our group is very good at communicating while practicing, and competing. While practicing we communicate and develop objectives that we need to be completed by the end of practice.. While practicing in the water we use communication skills to talk through problems and other things. While competing we communicate about the courses and how they are set up, what route needs to be taken on the obstacle course, if the driver has surfaced on the obstacle course, if the driver is tangled, and if the driver had missed or lost a whiffle ball.

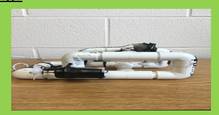
Non-Routine Problem Solving

Problem solving is one of our teams strong suits. We are always searching for problems at competitions and we are always finding a way to solve them. Due to our many years in SeaPerch we use our experience to help with our problem solving. For the obstacle course, we analyze how the rings are angled to determine the most efficient route to take. When problem solving we analyze the problem and then we brainstorm many ideas on how to solve the problem. Even when problem solving we have more than one solution to the problem. We do this just incase our first solution is ineffective.

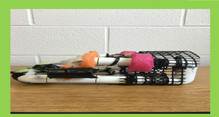
Design

Our team designed and developed our first design in four days. We tested the ROV and noticed that the dimensions of the ROV were simply not in sync with size of the biggest whiffle ball in the orbs challenge. We then decided to make a new design that was relatively the same but was both wider and longer. Our ROV had to be wide enough and long enough to fit the Biggest whiffle ball in our net. Our second design was very successful, but during testing it was just a little slow for us. After practicing for a while we noticed our design was fast, but it just wasn't fast enough for us. We decided to make our third and final design. We decided to get into CAD modeling and 3D printing. We didn't want to be to light or to heavy, so we only 3D printed certain pipes for our ROV. There are ten 1.25" PVC pipes that help connect elbows and T's together on our ROV. We decided to design a CAD model of those pipes and printed ten of them at the length of 1.25". A 1.25" PVC pipe measured in at approximately 6 grams per pipe. This means all ten pipes combined weighed in at a total of 60 grams. The 3D printed 1.25" pipes measured in at approximately 3 grams per pipe. This totals to 30 grams with all ten pipes combined. Since we cut the total mass of those ten pipes in half, we noticed we were quicker but stills stable. For the orbs challenge we decided to use the netting provided in the kit to help us catch and retrieve the whiffle balls. The netting was very useful and helped us catch and retrieve the whiffle balls very efficiently. After our local regional competition we changed the netting, the floats, and the wiring that led to the motors. We decided to change the netting because we had found some netting that had larger sized holes in it. The larger holes actually increases the flow of water that goes through it. This helps decrease some of the drag. We decided its time to cut down the drag of our ROV. We already had a pretty hydrodynamic design, and we have already reduced some drag with the netting, so what else can we do to reduce the drag of our ROV? We decided to shave the floats so they would be as hydrodynamic as possible. Doing this helped the water flow across the floats a lot smoother than before because the float is more spherical.

First Design



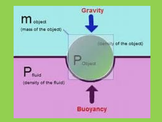
Final Design



The Science Behind It All

Buoyancy

Using Archimedes Principle, we know that buoyancy is an upward force exerted by a fluid that opposes the weight of an immersed object. To find the buoyant force of an object we will need to use the formula FB = ρ x V x g. To find the buoyant force you need to multiply the density of the liquid (ρ), the fluids displaced volume (V), and the gravitational acceleration (g). Knowing the buoyant force of your ROV is important to find out how much float you need on it.



http://physics.tutorvista.com/fluid-dynamics/buoyancy.html

Drag

In fluid dynamics, drag is a force acting opposite to the relative motion of any object moving in respect to a surrounding fluid. To decrease drag, we shaved the floats to where they would be more hydrodynamic. Making our floats more hydrodynamic reduces the drag of the ROV. Another thing we did to reduce drag was we replaced the netting that came in the kit with a much larger holed netting. The larger holes allows water to flow through it smoother and quicker.

Center of Mass

The center of mass is the point on an object where the mass of the object is equally distributed. Finding the center of mass for our ROV is very important. Finding the center of mass on your ROV determines where your up and down motor is located. To do this you need to take your ROV and balance it vertically and horizontally on a narrow object. This shows exactly where the center of mass is. In our design we decided not to put our up and down motor right on the center of mass. We decided to bring in a couple of centimeters toward the front of the ROV. Doing this gives our ROV wave like controls.

http://www.atmo.arizona.edu/students/courselinks/fall07/nats101s31/lecture_notes/sep27.html

Resistance

Ohm's law states that V=IR. Where V= voltage, I=current, and R=resistance. Ohms Power Law states that P=VI. Where P=power. Combining the two equations you get P=V^2/R. Therefore, power can be increased if resistance is decreased. To decrease the resistance we combined two CAT 5 cables together into one tether. Doing this decreased resistance and increased power.

Summary

SeaPerch is very much incorporated with 21st Century Skills. Adaptability, Self -Management/Self -Development, Complex Communication Skills, and Non-Routine Problem Solving are key attributes to being a successful team. The design of your ROV is very important. To have a successful design your design needs to be light, hydrodynamic, balanced, neutrally buoyant, and efficient for both of the courses that you compete in. Science is an important part of SeaPerch. Buoyancy, drag , center of mass, and resistance are some of the more important scientific subjects within SeaPerch. Finding the buoyancy of your ROV is important so you can determine how much float to put on it. Drag is another important factor of science within SeaPerch. Finding and reducing the drag is important because speed is very important in competing. Center of mass is important when trying to determine where your up and down motor should be located. Finally resistance is another important scientific factor in SeaPerch. Cutting down the resistance to increase the power running to the motors can increase your speed. Modifying your ROV in SeaPerch is very important. Modifying is very important because you really want your ROV to perform many challenging tasks as efficiently as possible. We made several modifications to our ROV to make sure it performed to its fullest potential. At the beginning of the season we make a list of objectives. By the end of the year we try to complete each individual objective. These objectives are very important for our team to further succeed and develop in life. When in the high school stock division you are given a budget of $20. We strategically planned out what items to purchase and their price. We bought a variety of items that we thought would benefit our ROV. Finally the learning experience is the most important thing for our team. We learned many new things this year. We learned how to do many new things that involve 3D printing and cutting down resistance through out our tether. Learning new things and gaining knowledge of new things is very important for our group's success through out life and through out our high school and future college careers.