**The Need for the Engineer – Ocean Engineering**

**Written by: Mary**

**Team number :11123A**

**Goulburn, NSW, Australia**

In November 2021 I was introduced to Mercedes McLean as part of the Curious Minds Program. Mercedes comes from Canada and is currently a PhD student at the University of Queensland in the School of Earth and Environmental Science, Applied Marine Biogeography Lab. Mercedes is completing her PhD to gain knowledge and scientific data to increase our understanding of migratory marine species and how the changes to the ocean environment can affect and influence the migration patterns of marine species. From speaking to Mercedes, I started to wonder how this data is being collected, what equipment is needed to do this accurately as well as, how is the equipment going to last in such as diverse, harsh environment for long periods of time. This is how I learnt about the career, ocean engineering.

Ocean engineers have invented, designed, tested, and modified thousands of devices and instruments that have changed the way scientific research has been gathered in the ocean and costal environment. Ocean engineering is a combination of mechanical, electrical, civil, acoustical, and chemical engineering techniques and skills. As an ocean engineer you work with oceanographic disciplines (marine biology, marine geology, oceanography and geophysics) to develop devices and instruments that can be used in scientific research using the design process.

1. **Define the problem**

When an ocean engineer defines a problem, it is often in collaboration with other science disciplines. Mercedes McLean researched the migration patterns of Killer Whales she worked with an ocean engineer to design a tracking system that could be used to gather accurate information.

This is like our team process. At the beginning of each season, we sit down as a team and watch the 2 minute video describing the game.

1. **Do background research**

When an ocean engineer is presented with a problem it is important that they research the environment in which they will be working with. When designing a tracking system for Killer Whales it is important that the environment is understood. The design needs to consider the pressure, depth, temperature, and isolation. It is also important to research the current technology so that device and instrument development takes place.

This is like our team process. When we are starting to look at each season we research and remind ourselves the variety of base format such as, H shape, U Shape and Square. This helps us to brainstorm as much variety as possible and will help us to select the best solution.

1. **Specify requirements**

To assess specific requirements an ocean engineer will collaborate with the people involved to ensure that the specific needs are met. This would include having a device that can withstand 30 times normal atmospheric pressure and temperature range of -5oC – 30oC. Remote data uploads and long-life batteries.

This is like our team design process as we go though the game manual at the beginning of each season and identify the specific requirements needed for this season. This includes start size expansion rules and number of motors.

1. **Brainstorm solutions**

It is important that a good length of time is given to brainstorming and that a team of people participate in this. Ocean engineers often will gather a team that includes mechanical and electrical engineers as well as research scientists. By diversifying the team that brainstorm many different types of knowledge and skills are represented.

When our team brainstorms, we have every member participate. We draw ideas, list sections of the designs and will work on the brainstorm for 1-2 weeks.

1. **Choose the best solution**

When choosing the best solution an ocean engineer needs to evaluate each design against the specific requires, budget and time frame and available skill levels of people.

This is the same as our team process. We need to look at when the first scrimmage will be held and ensure that we have a working robot ready to go.

1. **Develop a prototype**

A protype is a version of the solution. It allows for testing and developing the final solution. When a monitoring device is put into the field for a long time it is important that the design process includes a prototype so that when the device is developed and put in the field it is reliable.

Our team process doesn’t really work with a protype because we use the VEX material. We test and modify our one robot and don’t work on a variety of robots.

1. **Test and redesign solution**

This section of the design process can involve multiple redesigns. When a prototype is tested a problem is found, changes are made and then the prototype is retested. Ocean engineers have a very harsh environment to work in. The low temperatures and high pressures can result in the device being affected by salt water which is very corrosive to metal which is used in many location trackers. The data collected also needs to be remotely uploaded because catching a Killer Whale to gather the data would not be an easy thing to do.

We spend the most time in this step of the process. We evaluate the after each scrimmage and tournament ass well as a week before each scrimmage.

1. **Communicate the results**

It is important that the process used to develop the solution to the problem is documented. This allows reflection and evaluations to take place. It allows other to learn from the knowledge gained as well as supporting the manufacturing stage.

Our team tries to document as much as possible in the engineering book. We have looked over other teams engineering books as part of our research stage to learn how to do certain designs.

By comparing the design process that is used by an ocean engineer it has highlighted the skills and knowledge that the VEX program has helped us develop. Having an understanding allows for better communication between the scientists conducting the research and the engineers involved. The skills learnt also include teamwork, time management, meeting specific criteria that is required and the need to research.

Reference List

<https://dosits.org/galleries/career-gallery/ocean-engineer/>

<https://www.marinecareers.net/ocean-engineering>

<https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-process-steps>