

Inspiration through Exploration: Proposal for Open the Oceans Puget Sound Dive

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I. The Proposal

A. Overview

Open The Oceans (OTO) is a young program full of unexplored possibilities. While ocean exploration has a long history, OTO is not just about exploring the depths, it is about giving inexperienced undergraduate researchers to gain a first-hand experience. Indeed, that is the mission of the OceanGate Foundation, and we hope to empower that mission by taking advantage of this second Open the Oceans Undergraduate Research Contest to inspire future teams to explore the underwater realm and to bring creativity into STEM researching.

Understanding the OTO Contest is still at its early age, and can really benefit from having a permanent procedure in terms of taking qualitative data. Our aim is to establish a novel method of data collection using the audio-recording capacity of our smart phones to record qualitative descriptions of what we see on the dive. Post-dive, our efforts will focus on standardizing this procedure so that future teams can make use of it should they so choose.

Thus far, Open The Oceans has sponsored a single undergraduate contest, from which the research team brought back sonar images of the shipwrecked *MT6*, as well as photographs of anemones on the sunken barge. While their findings are a strong start in two areas of exploration, there are so many more possibilities. If feasible, we will try to collect some data on water current and temperature to create a baseline should future teams choose to pursue related research. We believe that additional images of the ship and its fauna may help to illuminate changes in the environment over time and will be practical given the resources at hand. It is our hope that as research on the MT-6 proceeds, undergraduate researchers will be able to explore the shipwreck and the surrounding biology and oceanography of Elliott Bay and the Puget Sound in greater detail.

- a. **Further Exploration of the MT6:** Our team is proposing to collect additional visual data on the organisms living on the MT6 to contribute to an understanding of how the wreck has become a biological habitat. We will also compare our data taken in June to the previous team's data, which was taken in March to point out the significant changes in biology in the course of 3 months, if there's any. If time and equipment permit, we aim to collect additional 2D and 3D sonar images to add to the extant data. Our photos, sonar images and verbal descriptions of the MT-6 and sea-life will be added to the previous team's data to help catalogue any changes over time.
- b. **Inspirational Documentary-Style Video:** Additionally, we are proposing to generate interest in Open the Oceans by creating accessible, relatable media project that describes the qualitative experience of diving in the submersible. We will create a short video that will include personal accounts from each member of

our team, a simple but driving narrative centered on the sense of adventure and scientific opportunity. We believe that outreach will be important for bringing new ideas and talents to future explorations.

- c. **Qualitative Data Gathering:** We plan to engage our own human senses--specifically our sight and hearing--as highly sophisticated observation-gathering technologies. These observations will be used to enhance data gathered through sonar image capturing and smartphone photo and video tools. Alongside our own senses, we will use various settings of the smartphone camera including inverse exposure, night setting, backlight, close-up, and sports (movement setting) to capture the broad range of possible detail in both the shipwreck structure and surrounding biological life. After the dive, our qualitative observations can be transcribed and matched to photos using the timestamps automatically created by the smart phones. Observations will be used to enhance the eventual 3D model of the ship, to form the foundation of much of the documentary video, and to contribute to data on anemones and other sea life.

We will contribute to the long-term development of OTO by relating our experience within the submersible in an accessible way to a broad audience and expanding the possibilities for future student teams. The methodology of this data collection will be outlined below.

B. Design Considerations

Digital imaging technology is often considered superior to the human eye in capturing and conveying visual data, especially in a static and highly illuminated environment, where no barrier distorts the subject of the image from the location of the camera. However, within the conditions of the deep Puget Sound within the submersible, the human eye becomes an image capturing technology more valuable than most accessible cameras. According to Cambridge in Color, our eyes, unlike cameras that can only focus on and capture a limited range of a view, can perceive many dynamic fields of view at various distances in a very short time. Our minds then compose these images into a single and more complete view. Additionally, Robert Sanders, 2011, writes that the human eye is capable focusing sharply on images within a broad range, and unlike a camera, does not lose information of shadow detail in the process. This becomes especially exaggerated in lower light settings that contain visual obstructions, such as deep underwater inside of a submersible with a glass viewing window. For these reasons, relying more heavily on our eyes to capture the shipwreck scene will provide a more complete context than simple sonar or digital images.

The struggle with relying on our human senses in this way is to conveying the images we capture in a reliable and consistent manner. However, the visual and verbal artistic talents of members of our team provide a potential solution to this struggle. Visual images (of the shipwreck and the surrounding environment) that are perceived through our human eyes will be immediately converted into reliable sketches and verbal descriptions of the scene. Videos, photos and audio recordings taken on the iPhone are all automatically time stamped. In addition, audio files can be named in real time for easy identification after the fact. Following the dive, these multimedia files can be organized together based on their timestamps. In this way, our observations and verbal descriptions can be effectively linked with the photographs

and sonar. Written transcriptions can be provided for areas of interest and the images and audio files will be accessible to future teams, as well.

We plan to use the iPhone 5s during our dive and for the creation of the post dive video. The device is certainly up to the task as the makers of Tangerine--a recent Sundance Film Festival favorite shot entirely on the handheld 5s--can testify. Casey Newton writes, in her review of the creation of the film that "it was surprisingly easy" to use the iPhone for excellent imaging for the entire film.

C. Acknowledging the Limitations of the Submersible

It is still early in the life of Open The Oceans as a project, and Antipodes has only taken a single two-dive expedition to the MT6. During these dives, according to the first dive team, it was discovered that the sonar imaging device only captured one image of the shipwreck before it stopped rotating. Some images were still captured, but they were limited to two-dimensions rather than the hoped-for three dimensions. Because of this, our group plans to rely more heavily on alternate methods of recording data of the characteristics of the wrecked ship. We also recognize that the submersible is not equipped to capture water or other physical samples from the Puget Sound. For this reason, all data regarding living systems including plant life and fish life, and anemones will be made through our visual observations. We hope that data on sea life will be useful to future teams. We also note that there is no Internet connection and our phones have limited storage. For this reason we will begin the dive with minimal data and applications taking up storage space on our phones.

II. The Problem Our Project Addresses

Our methods address the problem of capturing and conveying reliable visual data of the shipwreck in the Puget Sound. The approach outlined above addresses the limited light and limited sonar capability at the wreck because we will broaden the methods of capturing visual data in order to form more complete understandings of the wreck. Additionally, we will use our data to relate our experience in the submersible to a broader audience. We will collect new data surrounding the wreck by using iPhones, our human eyes, sonar data, and recorded verbal descriptions. We hope to utilize data from our own dives, as well as the digital and sonar images taken previously by the first dive team in order to create a context for the environment surrounding the wreck.

III. How Our Team Will Accomplish this Plan

- A. Skills of Our Team Members: We are fortunate to have a talented team that brings an array of skills to the table. All five team members are passionate learners and hard workers. Our team is composed of science students and future scientists. We have, in our group, four future doctors and a future theoretical chemist. We have studied in physics, biology, mathematics, and chemistry together for several years and know each other's strengths, weaknesses, and communication preferences. Several of our members are strong in mathematics and data analysis. Several of our members also possess excellent spatial awareness and problem solving abilities that will be invaluable during our dives and in the analysis that follows. While many research teams have a project lead, given our team's strong skillset, the comparable levels of experience represented, and the

ambitious nature of our project, we have chosen an egalitarian structure in which each team member will take the lead on those aspects of the project that most fit their strengths and interests.

B. The Role of Each Member:

1. Elizabeth Forsyth is the project's *Lead Writer* as well as the *Video Creative Director*. She is also responsible for primary communications regarding planning and logistics. She is also our team coordinator. Elizabeth is responsible for the final video project, though we will all be collaborating during its creation.
2. Andrew Loys will act as both *Technology Lead* and *Social Media Liaison*. He will be responsible for managing the blog that we have created to present our data and experience to the public. He will also coordinate our facebook, twitter, and youtube posting. He will research iPhone applications, such as orasis for correcting color distortion of underwater photos, that will be used during the dive and also problem solve any technology mishaps.
3. Hao Mai will be the *Data Synthesis Lead*. She will be concerned with the synthesis of the figure data and present them in a scientific but comprehensible way using charts, graphs and timelines. She will be leading the process of standardizing the step by step video recording procedure.
4. Clare Obradovich will be the primary *Artist* for the documentary video, and will also be the *Qualitative Data Lead* for the dives. She will coordinate the recordings of the verbal descriptions during the dive and sketch images during the dive. She is also responsible for ensuring each team member is physically prepared for the dive.
5. Clare Zipf-Sigler will be the *Data Lead for Digital Imaging and Living Organisms*. She will be the primary photographer of the external environment during the dive. Her role also includes analyzing data on location of the anemones on the barge and any other surrounding plant and sea life that indicate the ship as a habitat for organisms.

III. How Will We Share What We Learn

- A. We propose to add our data and video creation the previous team's blog, as we believe this will create a sense of continuity and collective effort. Our video will also be shared on any social media networks associated with Open the Oceans, including their Facebook page. We believe that the experience of travelling to the deep Puget Sound is one that many people have never considered. We live surrounded by these waters yet very seldom consider the world that exists beneath them. Therefore, this opportunity is one that a large community of scientists, students, and researches will be interested in.
- B. Our long term goal is to create a short documentary-style video following our experience in the submersible and our findings surrounding the wreck. We believe it is important for this video to include a brief historical exposition, candid observations and experiences of

the student researchers on the dive, footage of the wreck, and a discussion of the special skills and talents that future researchers could bring to bear on the project (programming skills that could be applied towards processing video exterior-facing video and photographs, 3D printing expertise). We hope that the narrative will pull the viewer along and capture their attention, but the segments describing the experience of the dive will ultimately convey the mission of Open The Oceans: to create *Inspiration Through Exploration*®.

References

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