

Proposal for the Construction of a Towing Tank at the University of British Columbia

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### **Abstract**

This report explores the necessity for the construction of a towing tank at the University of British Columbia's Point Grey Campus. Through research conducted online through journal articles and industry documents on existing towing tanks, as well as in-person interviews with Subject Matter Experts in this field, this report argues that a towing tank at UBC is a necessity. To quantify the need for a towing tank at UBC, this report explores the potential revenue for the university, the benefits to the Naval Architecture and Marine Engineering (NAME) program already established at UBC, and the benefits for industry clients needing to complete necessary testing when designing new marine vessels. As a result of the research conducted and presented in this report, the need for a towing tank at UBC is necessary now more than ever to decrease lost research opportunities and lost revenue for the university, as well as increasing research and educational opportunities for students and faculty.

## **Proposal for the Construction of a Towing Tank**

Towing tanks are common place at educational institutions that perform research and education in the field of ship hydrodynamics. However, the University of British Columbia (UBC) does not currently have a towing tank, leaving faculty and students without a critical piece of equipment. In addition to lost research and testing capabilities, the university is missing out on revenue that could be generated by leasing the towing tank to companies that require this equipment to complete necessary testing when designing new ships and naval vessels. The towing tank facility could generate additional revenue from other industries, such as the film and television industry, as well as provide enhanced research capabilities for students in the newly created Naval Architecture and Marine Engineering program and undergraduate mechanical engineering programs at UBC.

### **Background**

The University of British Columbia (UBC) Point Grey campus, located in Vancouver, British Columbia was previously home to the British Columbia (BC) Ocean Engineering Centre (OEC) which housed two 67-metre-long towing tanks that were constructed in 1976 (Prato & McGreer, 2007). While the OEC towing tanks were smaller than those of larger institutions, they were cost-effective towing tanks compared to the towing tanks operated at larger institutions (Prato & McGreer, 2007). An example of the work performed by the BC OEC was the creation of the UBC Series, shown in Figure 1 below.

The BC OEC was in operation for 31 years before being closed in 2007, when the facility was deconstructed to make way for housing (Prato & McGreer, 2007). UBC has been without a towing tank for twelve years, which limits research opportunities for faculty and students,

especially for the newly created Naval Architecture and Marine Engineering (NAME) program, as well as restricting the availability of towing tanks for industry use.



*Figure 1. BC OEC Towing Tank. (SavetheTowTank, 2007)*

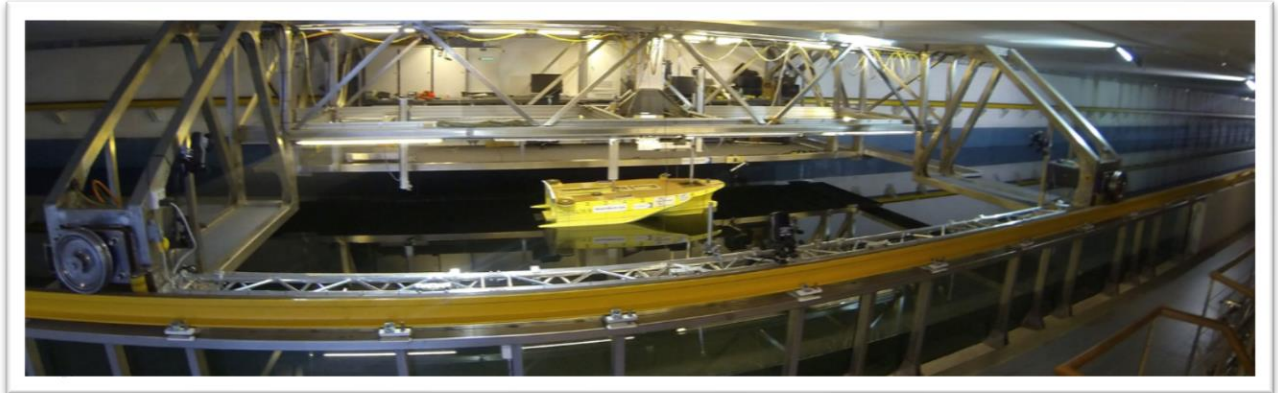
### **The Necessity of Towing Tanks in Research**

A towing tank is a basin or pool whose purpose is to tow a model boat along its surface (Stadt Towing Tank, 2019). The model is towed by a towing carriage that has numerous sensors that measure the forces acting on the model by the water (Stadt Towing Tank, 2019). Towing tanks come in many different configurations, all with the purpose of analyzing the flow of fluid around the body, normally a scale model of a ship, that is towed along its surface (Stadt Towing Tank, 2019). See Figure 2 below. Towing tanks can usually produce waves that model real world operating conditions and are also used for research into tidal energy, a relatively new field that has the ability to produce an estimated 4,000MW of potential energy (Clean Energy BC, 2019).

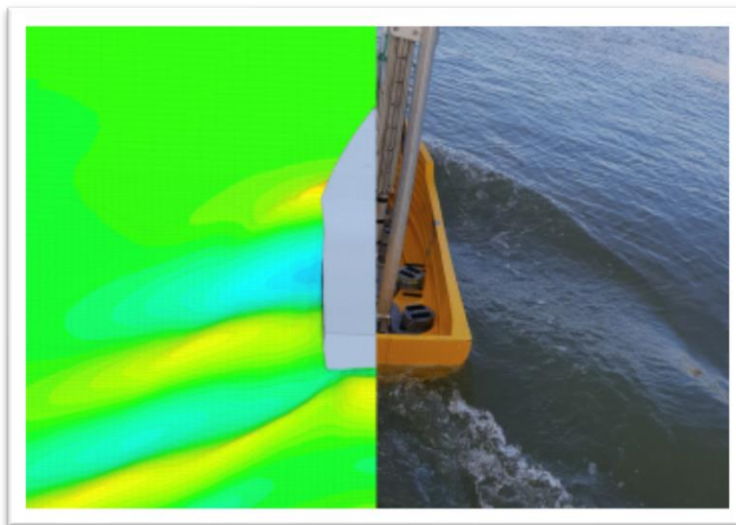
Commonly mistaken to replace a physical test, Computational Fluid Dynamics (CFD) is a computational tool that aims to simulate real world fluid body interaction. CFD, however, does

not always produce an accurate result, requiring physical tests in a towing tank. The use of towing tanks when designing new vessels is integral to the design and integrity of a marine vessel.

See Figure 3 below for a CFD versus towing tank comparison.



*Figure 2. Stadt Towing Tank (2019).*



*Figure 3. Comparison Between CFD Analysis and the True Wave Pattern. (UBC, 2019.)*

### **Current Availability of Towing Tanks**

In Canada, towing Tanks are common place throughout academia and government organizations, however, Canada is only home to one towing tank. This tank is located at

Memorial University (MUN) in St. John's Newfoundland (Memorial University, 2019). This towing tank is operated by the National Research Council of Canada (NRC) (National Research Council Canada, 2019). The NRC towing tank is a large towing tank that measures 200 metres in length and is capable of testing ship models up to 10 meters long (National Research Council Canada, 2019).

The United States is home to two towing tank facilities. One is located at the University of Michigan, and the other is in Maryland at the Naval Surface Warfare Centre (International Towing Tank Conference, 2019). Globally, towing tanks are commonly located at research universities. The International Towing Tank Conference (ITTC) is "a voluntary association of worldwide organizations that have the responsibility for the prediction of the hydrodynamic performance of ships and marine installations based on the results of physical and numerical experiments" (International Towing Tank Conference, 2019). The ITTC lists more than fifty towing tank facilities worldwide (International Towing Tank Conference, 2019).

### **Stakeholder Requirements**

Unfortunately, the questionnaire that was sent out in order to complete research regarding the necessity of towing tanks at UBC did not receive any interest. The lack of interest is most likely due in part to a limited number of possible survey participants. I did, however, meet with the co-chair of UBC's Naval Architecture and Marine Engineering program, Dr. Chris McKesson, with whom I was able to discuss my proposal in detail.

Dr. McKesson's background includes 27 years as a Naval Architect in industry, before undertaking graduate studies and joining UBC as a professor in 2014 (McKesson, 2009). His experience positions him well as a subject matter expert for this report. Dr. McKesson was happy to hear of my proposal as he sees the need for a towing tank facility that would be available to

both academia and industry, suggesting other possible uses such as used in the movie industry. Dr. McKesson told me that a towing tank is absolutely relevant in the world of computational techniques such as Computational Fluid Dynamics or CFD, as mentioned above, stating that “there is so much that CFD doesn’t do right.” He also stated that he “did all of his tow tank testing in Norway” when he worked in industry as a naval architect and spent millions of dollars in industry funds on this testing. He also stated that a routine towing tank contract costs about “300,000 dollars to 500,000 dollars”. He estimated that hundreds of thousands of dollars a week in revenue potential works out to approximately 10 million a year in revenue for academic or industrial institutions who have towing tanks available for use.

As Dr. McKesson stated, industrial clients would spend hundreds of thousands of dollars purchasing time at towing tanks to perform the testing required when designing new vessels. It is clear that a towing tank facility at UBC could potentially bring in millions of dollars in revenue annually from industry. This revenue could greatly offset the operating cost of a towing tank, as well as develop a huge revenue stream for UBC that would create many more opportunities for students and faculty to conduct research and further UBC’s academic and research reputation.

### **Alternate Uses for Towing Tanks**

As Dr. McKesson suggested, towing tanks have been used in the movie industry in films such as Titanic and Life of Pi (Baja Studios, 2012). Several tanks are used in the film industry world-wide including the Louisiana Wave Studio in Shreveport, Louisiana, USA, and the Mediterranean Film Studios in Malta, an island nation in the Mediterranean (Louisiana Wave Studio, 2018; The Producer’s Creative Workshop, 2019). Other large tanks have been built for movies, such as the one at the Baja Film Studios, which was constructed in 1996 for the film, Titanic (Baja Studios, 2012). These tanks are much larger than any tank that would be required



for UBC's needs, however, constructing a tank at UBC with this possible use in mind, would open up the possibility of additional revenue generating stream with the film industry in Vancouver.

### **Benefits of Towing Tank for NAME Program at UBC**

Although not part of the NAME program at UBC, I was involved with the research of a vessel through UBC's Undergraduate Mechanical engineering program. The availability of a towing tank at UBC would have been useful for my research for several reasons. In order to complete testing on this vessel, I was required to travel to the marina where the vessel was located and complete testing in un-controlled environments which lead to inaccurate testing and research. It would have been beneficial to have a towing tank facility on campus to conduct the necessary research for this project, to decrease traveling costs for myself, as well as for the university who reimbursed my costs as part of the project. Not only would a towing tank facility at UBC have been beneficial for my research, but it would be beneficial for future students conducting similar research.

With the newly created NAME program at UBC, a towing tank on campus will increase the opportunity for students to conduct real life research on vessels, as well as gaining experience in the field of marine engineering with faculty who are experienced in this field of study. Without the proper equipment and available towing tanks, students in this program are not receiving the full benefits of conducting real life research on vessels in an appropriate environment, thus providing a disservice to students who are interested in research of marine vessels.

### **Conclusion**

The need for a towing tank facility at the university of British Columbia is tri-fold: to generate revenue, to continue to perform leading academic research projects and to benefit the educational needs of students in the NAME program at UBC. UBC could additionally generate income through the use of the towing tank in the film industry, which continues to expand, especially in Vancouver. This report strongly suggests that UBC should consider the construction of a towing tank at their Point Grey campus, should their future goals include generating more revenue for research and to benefit future studies of their naval architecture and marine engineering students.

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