Oceanic Consulting Corporation was contracted to investigate alternate double-ended ferry propulsion system concepts for British Columbia Ferry Services Inc. (BC Ferries), Victoria, British Columbia, Canada. As part of an extensive infrastructure development plan, BC Ferries has contracted for the construction of three large double-ended ferries for service on the routes between mainland British Columbia and Vancouver Island. The new double-ended vessel will be developed based on the successful 140-meter C-Class ferry developed and built in the mid-1970s, of which five vessels are currently in service.

As part of a research and feasibility study, BC Ferries investigated the performance and efficiency of three propulsion concepts for the proposed new ferry’s conventional shaft and propeller with high lift rudder; podded propulsors in tractor mode; and contra-rotating propulsion utilizing a conventional shaft and propeller with a small pod unit downstream. The existing C-Class hull was used as the baseline.

The development of the podded propulsion in the tractor mode concept was further explored with the inclusion of three fairing shapes for the pods, comprised of a common housing and a spherical end cap, a conical end cap and a Nabla form end cap. A Nabla form was introduced to the study to assess if a bulbous bow effect could be generated that would result in a reduction in the resistance of the hull. As the vessel is double-ended, one pod will be continuously in the free stream at the bow of the vessel, and it was hypothesized that the pod geometry may be optimized to reduce the overall resistance of the hull.

A six-meter model of the double-ended ferry was fabricated and outfitted to accommodate the broad number of complex propulsion options to be studied. An extensive testing program of several hundred tests was developed and conducted in the National Research Council - Institute of Ocean Technology (NRC-IOT) 200-meter Tow Tank in February 2004.

The primary goals of the test program were to define the resistance characteristics of the C-Class hull form in bare and appended conditions with the various propulsion options; to develop the open water and appended propulsion characteristics of the various propulsion options; to investigate power sharing between the bow and stern propulsion plants for optimal efficiency; and to investigate the wake profiles of the vessel at several operating speeds.

The results provided BC Ferries with an in-depth understanding of the efficiency and performance of the benchmark design (the existing C-Class ferry) allowing for detailed comparisons of all potential designs offered by competing companies for the new vessel concept. The tests indicated that the conventional shafted system with a feathered bow propeller was the optimal configuration for the proposed application. This data was made available to the competing shipyards to facilitate development of their respective bids.
and they all have great stories of exploration and to the wharf has sailed in the open North Atlantic short periods while they visit the city. I love to visit and bluewater cruisers tie up their sailboats for of the harbor and a floating wharf where coastal things in this little piece of green space is a history promenade called Harborside Park. Among other of water has been a safe refuge for mariners.

The Southside Hills run from the south side of the St. John's Harbor opens to the North Atlantic underway in the adjacent facility that services It is also a great location to watch the activities getting underway and had hit a series of storms on their way past Newfoundland's South Coast discussing their route with the masters of some of the vessels tied up in the harbor when the skipper of a nearby supply boat that towered over the small sailboat told him that ‘the North Atlantic in winter would swallow him whole’. I suspect he was right because shortly afterwards, a sister ship of that OSV operating off Nova Scotia had three of her wheelhouse windows knocked out by a wave coming over the bow.

This issue of Making Waves focuses on a broad range of topics. Whatever the project, though, much of our work is to ensure the designs of our clients are not going to be ‘swallowed whole’ physically or financially.

On our front cover, we outline a project we carried out this past summer for BC Ferries, a company that operates the largest fleet of ferries in the world. Performance improvements, even small ones, for such a firm can mean millions on their bottom line.

We are truly delighted to outline a project we did for Textron Marine and Land Systems on page 3. Much of our work is focused on novel technologies and the HCAC project for Textron is no exception. Combining the benefits of a surface effect hull with a catamaran design, Textron has developed a design that has a comfortable cruising speed of 18-20 knots in one mode while having a top operating range of 50 knots in another.

Further on, we outline some of the work that is being carried out by our research partners at MUN and NRC looking at the performance of inflatable Heurics. The work is looking not at the performance of the technology but the performance of the personnel who use the technology. As is too often the case in marine incidents, human factors play a significant role in whether or not an accident becomes a tragedy. With this work, we are aiming to include the human element in the prediction of system performance. This is perhaps the biggest, but most important, challenge of all.

Once again, I want to thank you for taking the time to read our newsletter.

For Oceanic Consulting Corporation
Best Regards,
Dan Walker, Ph.D., P.Eng.
President

Oceanic Consulting Corporation has recently completed a testing program of Textron Marine & Land’s HCAC (Hybrid Air Cushion Catamaran) concept vessel. Textron has been providing advanced craft ranging from air cushion marine craft to surface effect ships through to life boats for nearly 50 years.

The HCAC is a new and unique hybrid, combining the best traits of both the catamaran and the surface effect ship (SES). When operating as a catamaran (off the air cushion) on its diesel engines, it has an efficient cruise speed of 18-20 knots. As an SES (on the air cushion), it cruises efficiently at speeds ranging from 30 to 50+ knots. The HCAC has been designed to provide an exceptionally agile and stable platform at high speeds. Textron is currently developing the HCAC technology for application in the commercial marketplace.

Textron, in consultation with Oceanic, developed and supplied the test model, including the proprietary air lifting system and hull skirting arrangement as well as some of the specialized instrumentation. Oceanic assisted Textron in developing a test program to explore the two operational modes of the vessel, catamaran and SES. The HCAC was tested in Oceanic’s 200-meter Towing Tank at NRC-IOT in St. John’s, Newfoundland, over a nine-day period in fall 2004. The calm water performance of the vessel was evaluated across several displacement and trim configurations as well as a variety of air cushion settings. The test program also included investigation of the air drag of the vessel.

The results of this successful test program are very encouraging for the design and engineering staff of Textron Marine & Land and Oceanic who are looking forward to the next phase of the HCAC testing program.

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A unique instrumentation package has been designed for pod research as part of a joint venture at Oceanic. The partners are Oceanic Consulting Corporation, Memorial University of Newfoundland (MUN), NRC-IOT and Thordon Bearings Ltd.

Designed by Andrew Macneill, a Mechanical Design Engineer at Oceanic, the instrumentation allows a wide array of experiments to be conducted. The instrumentation has the following measurement capabilities: thrust and torque at the propeller hub location, thrust at the end of the propeller shaft, pressure in the gap between the pod end and rotating propeller face (at five different radii), drag force of the pod shell and a six-component global force balance. In addition, the instrumentation has been designed to allow quick changing of the outer pod shell shape and propellers. This feature drastically reduces the time between experiments and allows for the quick production and testing of custom-fabricated pod shells and propellers.

Currently Macneill is analyzing data from experiments carried out to evaluate the instrumentation’s performance as well the effect that gap distance has on propeller thrust measurement as part of his Masters of Mechanical Engineering thesis. This knowledge will allow future pod instrumentation designs to have increased reliability, ease of installation into models, and accurate measurement of the parameters of interest.

Other ongoing research utilizing this instrumentation includes pod shape optimization, investigation of propeller hub taper angle, and experiments of a pod in oblique flow.

Andrew Macneill
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A sailboat hull undergoes evaluation in the 200-meter research project that began in the mid-1990s. The stern showed up to 16% reduction in resistance and loaded ballast conditions were tested. An appended calm water resistance of the ATB. Ballast. The final phase of testing saw the model altered to achieve better flow in the tank would alter the flow. Several methods showed promising results and it was decided to proceed with their physical modeling. Temporary modifications were made to try and validate the CFD results. The results looked promising and it was decided that more permanent modifications would be pursued when the flume tank schedule permitted. During this phase of testing, more permanent changes to the flume tank will be implemented. These changes will allow for easier setups of the facility in order to modify flow.

The new and exciting area of study around the maneuverability of icebreakers is receiving further attention through the recent evaluation of a novel bow design for Samsung Heavy Industries (SHI) at the NRC-IOT. The research project addressed some of the issues around the relatively poor-open water performance of traditional icebreaker bow. In order to break ice efficiently, icebreaker bows are designed to lift the ship up onto the ice and then use the weight of the ship to break the impeding ice. These shapes, however, have relatively low efficiency when there is no ice present. As a result, the final hull shape is a trade-off between the ability to move forward in ice and fuel consumption in open water. The new bow design was tested in a range of ice conditions in NRC-IOT’s 90-meter Ice Tank. With a usable ice sheet 76 meters in length, the Institute’s Ice Tank is the longest in the world, providing more data per test run than shorter facilities. In addition, two Cold Rooms support ice-related research, enabling the measurement of mechanical properties of real and model ice.

Efficient open water performance is as important as the ability to move forward in ice-covered water. The latest research project focused on designs for ice-encumbered ice conditions, such as those found in the Baltic Sea, where there are potential new markets for oil transportation in and out of Russia. Further collaborations will help determine the maneuver characteristics of ice-class vessels. Large ships are difficult to maneuver in ice because the sides of a ship do not break ice as easily as the bow. When a ship starts to turn, its sides come into contact with unbroken ice, considerably slowing the rate of turn of the vessel. So far, most research on hull shapes has focused on the ability to move forward in ice. Another proposal is also under consideration for ice-capable Liquefied Natural Gas (LNG) tankers. Worldwide demand for LNG is forecast to grow, and shipping it by sea is seen as the most cost-effective method. Since many potential routes involve passage through ice-covered waters, improving designs for icebreaking LNG ships is the next logical step after designs for oil tankers.

The expertise gained by NRC-IOT on these projects will contribute to future Canadian projects, such as building ships for Vekse’s Bay in Labrador, and tanker and Floating Production Storage and Offloading (FPSO) units being constructed for east coast of oil and gas production.

NRC-IOT's Ice Tank is the longest in the world, making it cost-effective for evaluating the performance of vessels in ice-covered water.
Liferaft Performance Under the Microscope.

A consortium of St. John's research organizations is studying the technology, human factors and training that determine the operational performance of inflatable liferafts. Lifeboats and/or liferafts are required for all vessels, but what can be expected of them when the people have to use them is largely unknown. The project is designed to provide reliable, objective knowledge about the performance of liferafts and the people who use them, in realistic environmental conditions.

Specifically, information is being gathered on how liferafts perform as weather deteriorates, the physical and cognitive demands upon the crew, and the required competencies for which training can be developed. The two-and-a-half-year project makes use of model-scale experiments, full-scale trials of lifeboat deployments and training trials. Recent projects have included the evaluation of inflatable liferafts in broken ice and waves using stereoscopic particle image velocimetry. The database is available at: http://iot-ito.nrc-cnrc.gc.ca/eer/home_e.html.

Bill Carroll
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Profile: Bill Carroll.

Bill Carroll is Oceanic's Vice President of Operations. The operations group is responsible for the physical side of Oceanic's marine performance evaluation work and is divided into three departments, Design, Fabrication and Testing, each with its own managers and staff.

The growth and success of Oceanic has necessitated its restructuring into departments. Establishing and overseeing these departments and their day-to-day performance are Bill's main responsibilities. When Bill graduated from Memorial University in 1986, he began marine performance evaluation work at the newly-opened Institute for Ocean Technology (IOT) in St. John's. Between 1986 and 1990, he worked for several engineering companies in various capacities at this new facility. In 1991, Bill left the marine performance evaluation field to work as a naval architect for the operator of a large fleet of vessels. In 1993 he joined a project team involved with Hibermia, Newfoundland's first offshore oil development project. When this project was completed, Bill returned to the performance evaluation field and since then has held senior positions within Oceanic. Bill's experience with largeorganizations has enabled Oceanic to respond to the requirements of multiple clients and, at the same time, to address the ever-increasing demands of its marine performance evaluation work.

EER personnel also examined lifeboats in ice-covered waters in order to establish basic performance limits and the effects of additional power on the lifeboats' operations. On the model side of the research program, experiments have been carried out on the behaviour of a conventional lifeboat in broken ice and waves. Recently, a team evaluated three lifeboat designs for survivability in different weather conditions and at two different scales. Of particular interest were basic motion characteristics and the ability to execute rescue-related maneuvers.

All of this information is being added to the project database, which continues to be developed and upgraded by the NRC Canada Institute for Scientific and Technical Information. The information gathered will be used to formulate guidance for government and industry approval of safety equipment. The database is available at: http://iot-ito.nrc-cnrc.gc.ca/eer/home_e.html.

Introduction

Dr. Wei Qiu

Dr. Wei Qiu, the newest assistant professor in the Faculty of Engineering and Applied Science at Memorial University, says the exciting naval architecture and ocean engineering community is what attracted him to St. John's.

Dr. Wei Qiu and his family moved to St. John's in July 2004. “I am very excited about joining the naval architectural and ocean engineering community in St. John's,” said Dr. Qiu, who has been involved in collaborative research with the community since 1998. “My wife and I actually worked on a project at the Institute for Ocean Technology, National Research Council in the summer of 1998.”

Dr. Qiu’s research is in the area of marine hydrodynamics and its applications to ship and offshore structures including wave-body interaction, water shipping on deck, hydrodynamics of deepwater platforms, high-speed marine vessels, numerical marine hydrodynamics and wave energy conversion.

Dr. Ray Gasine, dean of the Memorial’s Faculty of Engineering and Applied Science, says Dr. Qiu is a great asset both to the university and the community. “We come to us with years of industry experience, a strong applied research background in hydrodynamics, and an excellent record of undergraduate teaching. We are very pleased to welcome Wei to the Faculty of Engineering and Applied Science, and to work with him to develop a vibrant research and development program at Memorial that is closely linked with industry.”

Dr. Qiu obtained a B.A.Sc. in Naval Architecture in 1990 and a M.A.Sc. in ship structural mechanics in 1993 from Dalhousie University, China. Dr. Qiu received his Ph.D. in Marine Hydrodynamics from Dalhousie University in 2001. Before joining Memorial University of Newfoundland, Dr. Qiu worked at Maritec Limited as a senior hydrodynamist and product manager for seakeeping software, and was a hydrodynamist at the Center for Marine Vessel Development and Research at Dalhousie University. Dr. Qiu is also involved in several professional associations, including the Royal Institution of Naval Architects and the Society of Naval Architects and Marine Engineers.

Wei Qiu
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Internal Reports:


90-meter Ice/Towing Tank — Facility Specifications:

- Length: 90m
- Width: 12m
- Depth: 3m
- Usable Ice Sheet Length: 76m
- Set-up Area: 15m
- Temperature Range: -30°C to +15°C
- Ice Growth: 2mm/hr at -20°C
- Ice Thickness Range: 5mm to 160mm
- Ice Strength Range: 10kPa to 150kPa Flexural
- Ice Formulation: NRC EG/AD/S Fine Grain Columnar Structure Ice (controllable density accurately models ice buoyancy)
- Carriage Speed Range: 0.0002m/sec to 4m/sec

Specification Sheets are Available for all Major Facilities, Including:

- Offshore Engineering Basin
- 200-meter Wave/Towing Tank
- 58-meter Wave/Towing Tank
- 90-meter Ice/Towing Tank
- Cavitation Tunnel
- 22-meter Flume Tank
- Centre for Marine Simulation

Specification sheets can be obtained from the Oceanic website or by contacting our office.