When considering the operational expenses for a marine fleet, fuel charges are usually the second largest expenditure after labour costs. In these times of ever-increasing fuel prices (the price of oil has doubled since 2003), the emphasis on energy conservation is elevated as companies search for ways to reduce fuel charges.

As part of its business strategy, BC Ferries has implemented a Fuel Consumption Reduction Plan (FCRP) to address the impact of high fuel prices. BC Ferries operates thirty-four vessels of varying sizes and is the primary provider of ferry services in the Canadian province of British Columbia. In the last fiscal year, the fleet consumed over 118 million liters of diesel fuel. BC Ferries has scrutinized its entire fleet and is committed to reducing fuel consumption by 1% in fiscal 2006/2007, with a further 1% reduction in fiscal 2007/2008.

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LOYALTY IS PERHAPS THE MOST POWERFUL RELATIONSHIP THAT A COMPANY CAN DEVELOP WITH ITS CLIENTS. THROUGH A COMPANY’S DEMONSTRATION OF ITS COMMITMENT TO OBJECTIVITY, THE PRESENTATION OF USEFUL OPTIONS AND ALTERNATIVES, AND THE PROVISION OF FOCUSED GUIDANCE, CLIENTS WILL BE LEFT WITH A STRONG FOUNDATION ON WHICH LONG-TERM TRUST CAN BE ESTABLISHED. OCEANIC STRESSES TO DEVELOP SUCH A RELATIONSHIP WITH ALL OF ITS CLIENTS, REGARDLESS OF THE SIZE OF THE ORGANIZATION INVOLVED. OCEANIC’S BUSINESS IS UNIQUE IN THAT WE ARE COLLABORATORS WITH OUR CLIENTS AND NOT MERELY JUST PROVIDERS OF INFORMATION. THIS, WE HOPE, MAKES THE PROCESS OF DECISION MAKING NOT ONLY EASIER FOR OUR CLIENTS, BUT ALSO MORE SATISFYING.

THIS APPROACH TO BUSINESS IS PERHAPS WHY OCEANIC HAS EARNED THE LOYALTY OF CLIENTS SUCH AS BC FERRIES. BC FERRIES IS PRESENTLY UNDERTAKING ONE OF THE LARGEST FLEET EXPANSIONS IN ITS HISTORY AND IS PREPARING TO TAKE DELIVERY OF SEVEN NEW VESSELS OVER THE COURSE OF THE NEXT THREE YEARS. THIS INCLUDES THREE NEW SUPER C-CLASS DOUBLE-ENDERS NOW UNDER CONSTRUCTION, AN INTERMEDIATE SIZE FERRY TO BE CONSTRUCTED IN NORTH VANCOUVER STARTING THIS YEAR, A NEW VESSEL TO REPLACE THE QUEEN OF PRINCE RUPERT, THE IMMINENT ARRIVAL OF THE TWO-YEAR OLD MV SONIA TO REPLACE THE QUEEN OF THE NORTH, AND A NEW 35-CAR FERRY TO BE USED AS A RELIEF VESSEL FOR THE GULF ISLANDS ROUTE. OCEANIC HAS PROVIDED GUIDANCE TO BC FERRIES ON VARIOUS PROJECTS, STARTING WITH THE RESEARCH AND FEASIBILITY EVALUATION OF THE C-CLASS HULL FORM.

IN THIS ISSUE OF MAKING WAVES, WE LOOK AT FURTHER WORK THAT WE HAVE UNDERTAKEN FOR BC FERRIES. THE SPIRIT-CLASS VESSELS, WHICH ACCOUNT FOR APPROXIMATELY 20% OF THE FLEET’S FUEL CONSUMPTION, WERE RECENTLY EVALUATED TO DETERMINE POSSIBLE AVENUES FOR IMPROVING FUEL EFFICIENCY. THIS BULBOUS BOW OPTIMIZATION PROGRAM WAS SUCCESSFUL IN IDENTIFYING A BOW GEOMETRY WHICH COULD FURTHER REDUCE HULL RESISTANCE AND HENCE REDUCE FUEL CONSUMPTION.

ANOTHER CLIENT THAT HAS BENEFITED FROM OCEANIC’S EXPERTISE IS THE ELLIOTT BAY DESIGN GROUP. TWO RECENT PROJECTS UNDERTAKEN FOR ELLIOTT BAY ARE EVALUATION OF A NEW FERRY FOR LUMMI ISLAND AND ASSESSMENT OF DIRECTIONAL STABILITY OF A NEW DECK BARGE, BOTH OF WHICH ARE REPORTED IN THIS ISSUE. OCEANIC HOPES TO CONTINUE A LONG AND MUTUALLY BENEFICIAL RELATIONSHIP WITH ELLIOTT BAY FOLLOWING THE SUCCESSFUL COMPLETION OF THESE PROJECTS.

OF COURSE, OCEANIC HAS BEEN HEAVILY INVOLVED IN NUMEROUS PROJECTS THAT HAVE ASSESSED VARIOUS DEVELOPMENTS RELATED TO THE LOCKHEED MARTIN MARINE SYSTEMS VARI-CRAFT. OUR LATEST INVOLVEMENT IN THE CURRENT EVOLUTION, THE E-CRAFT, HAS BEEN HIGHLIGHTED IN THIS ISSUE.

ALSO IN THIS ISSUE, OCEANIC RECENTLY UNDERTOOK A FORENSIC INVESTIGATION FOR JMS NAVAL ARCHITECTS AND SALVAGE ENGINEERS. USING OUR SEAKEEPING CODE MOTSIM, OCEANIC WAS ABLE TO ASSIST IN THE DETERMINATION OF THE PROBABLE CAUSE OF THE CAPSIZE AND SINKING OF THE SMALL PASSENGER VESSEL ETHAN ALLEN.

FINALLY, GIVEN OUR SIGNIFICANT EXPERIENCE IN ASSESSING SAILING YACHTS, OCEANIC HAS BEEN INVOLVED IN FURTHER EVALUATION OF A VINTAGE 12-METER YACHT, KIWI MAGIC. THIS WORK IS AIMED AT PROVIDING ADDITIONAL HYDRODYNAMIC IMPROVEMENTS AND EFFICIENCIES FOR THIS CLASSIC YACHT.

OCEANIC IS PLEASED TO BE OF ASSISTANCE TO ALL OF OUR CLIENTS AND IS APPRECIATIVE OF THE LOYALTY THAT IS DEMONSTRATED BY OUR REPEAT CUSTOMERS. WE THANK YOU FOR YOUR BUSINESS AND HOPE FOR CONTINUED SUCCESS IN THE FUTURE.

FOR OCEANIC CONSULTING CORPORATION
AND WITH BEST REGARDS,
Dan Walker, Ph.D, P.Eng
President
While conducting a sightseeing cruise on 2 October 2005, the 40-foot tour boat Ethan Allen capsized and sank on Lake George in the state of New York. Conditions on the water were good at the time but, unfortunately, twenty of the forty-seven passengers died in the accident.

As is usual in the case of marine accidents in the United States, the US National Transportation Safety Board (NTSB) undertook an accident investigation to determine the cause of the accident and to recommend safety improvements to prevent future accidents. The NTSB contracted JMS Naval Architects and Salvage Engineers (JMS) of Groton, Connecticut, to perform various tasks related to stability analysis. JMS subsequently contracted Oceanic Consulting Corporation to complete a dynamic analysis of the vessel. There had been conjecture that the Ethan Allen may have been hit by a wave that was generated by a passing vessel. Passenger testimony following the accident indicated that the master also attempted to turn the Ethan Allen into the wave. The purpose of the dynamic analysis was to determine whether or not such a passing wave could have contributed to the capsize.

To complete this analysis, Oceanic performed a number of numerical simulations using its seakeeping panel code MOTSIM. In essence, a roll sensitivity study was undertaken to assess the vessel’s response characteristics under varying conditions. Since the exact wave conditions experienced by the Ethan Allen were not known, it was deemed appropriate to undertake this study using regular wave analysis. Such a simplification would allow for easy examination of particular variables (e.g., wave characteristics, center of gravity position, heading, and vessel speed) in order to determine their influences on the dynamic response of the vessel.

For this vessel, motion response was shown to be insensitive to vessel speed over the range of concern. After identifying the headings that resulted in the most significant vessel response, further analysis assessed the impact of variations in the wave height as well as changes in the position of the transverse center of gravity (TCG). While the cases that were examined with the seakeeping code did not produce a capsize event, the resulting data was valuable in identifying factors that could have contributed to the capsize of the Ethan Allen. Essentially, the analysis completed by Oceanic helped to illustrate that the capsize probably was not caused by a single event but, rather, it may have been the result of a sequence of events.

An initial wave probably struck the vessel and caused passengers to lose their footing or to slide out of their seats. This would have compromised the vessel’s righting ability due to the resulting TCG shift. The fact that the vessel was turning into the wave also may have contributed to passenger TCG shifts. At such a point, the impact of a second wave on the Ethan Allen could have been sufficient to cause a capsize because of the change in the vessel’s loading condition and the subsequent loss of righting ability.

The results of Oceanic’s analysis were presented by the NTSB investigators during a public meeting on 25 July 2006. The NTSB determined that the probable cause of the capsize was the vessel’s “insufficient stability to resist the combined forces of a passing wave or waves, a sharp turn, and the resulting involuntary shift of passengers to the port side of the vessel.” Subsequently, recommendations were made by the NTSB concerning assessments and requirements for the stability of small passenger vessels.
An area of potential savings identified under the FCRP was to consider modifications to the bow bulbs on the Spirit-class vessels. While this class consists of only two vessels, with a length of 167 meters and an installed power of 15,600 kW, their fuel consumption is approximately 22 million liters per year or 20% of the annual BC Ferries fleet consumption. As these vessels are relatively new (1993/1994), improvements to their hull efficiency, through even a small reduction in hull resistance, could translate into a significant fuel savings over the life of the vessels. As stated by Bruce Paterson, BC Ferries' Fleet Technical Director, “The original model tests did not explore bulb geometry as the emphasis was on the deep design draft rather than a typical operating draft. We wanted to determine how much of a fuel saving could be achieved with an optimized bulbous bow.”

To this end, BC Ferries undertook a model test evaluation of the Spirit-class vessels to optimize the bow bulb geometry. Oceanic Consulting Corporation structured a test program to evaluate a range of bulb geometries and hull fairings. Examined options included a modification of the existing bulb, a cylindrical bulb, and a bulb with nabla sections. The 1:28 scale model was constructed with a removable bow section so that bow geometries could be interchanged as the test program progressed.

Resistance tests, including measurement of sinkage and trim, were completed for three different load conditions and investigated a speed range of 14 to 22 knots. Wave height measurements were taken at various distances from the vessel to establish the wave energy for the existing hull and to compare the effects of bow bulb modifications. Analysis of these results revealed that there was no clear trend between the calculated wave energy results and the predicted resistance results. As part of the test program, a flow visualization test was also completed to verify the flow angle over the existing bow thruster tunnels.

This test program showed that the existing bulb geometry was already reasonably efficient. However, the test results indicated that reduced resistance could be achieved through a slight modification to the existing bulb. This bulb protrudes above the water at the medium operating draft, but a modification to bring the top surface of the bulb below the water surface, in combination with an appropriate fairing to the hull, was found to be beneficial.

Over the target speed range of 18 to 19.5 knots for the medium operating draft, the model test results indicated that hull resistance could be reduced by 2.6% to 1.5%, respectively, by adopting this modification. Even with a reduction of only 1.5%, an annual fuel savings of approximately 330,000 liters could be expected for the two ferries. BC Ferries is currently evaluating the potential savings through a cost/benefit analysis that will also consider the costs associated with the hull modifications at the next scheduled dry-docking for each vessel.
Oceanic Consulting Corporation was engaged by Gunderson Marine of Portland, Oregon, to determine the towed directional stability and resistance of a new 400-foot deck barge which was designed by Elliott Bay Design Group (EBDG) of Seattle, Washington. The hull will be constructed by Gunderson Marine and will operate as a deck barge supporting the offshore oil industry in the Gulf of Mexico. The towed directional stability of these large barges is considered critical for safe and efficient operation.

Model tests were performed the 67-meter Towing Tank at the Ocean Engineering Centre in Vancouver, BC, using a 1:40 scale model. The model was constructed to a set of lines supplied by EBDG using a hybrid method of laminated wood for the bow and stern section and a ¾ inch plywood-on-frame method for the parallel mid-sections. The barge had a slightly raked bow with vertical headlog and a raked stern with skegs.

Calm water resistance tests showed that the resistance increase for the 0 degree skegs at 8 knots was approximately half that of the 5 degree skegs at the same speed (i.e., a 15% vs. 30% augment). Alternatively, the effect of the 5 degree skegs was to significantly increase the directional stability damping factor compared to that of the 0 degree skegs, going from a non-dimensional damping factor of 0.22 (which is just adequate) to a factor of 0.46 for the 5 degree skegs. This also resulted in very high damping for both the medium and light draft configurations that employed the 5 degree skegs.

Since the barge is not to be towed over long distances on a regular basis, it was decided by the Owner’s representative, the designer, and the shipyard that the directional stability will be a more significant factor and hence the 5 degree configuration has been adopted.

More than 130 guests were in attendance at the Alaska Ship and Drydock facilities in Ketchikan, Alaska, on 24 August 2006 as U.S. Senator Lisa Murkowski sponsored the new E-Craft prototype ferry which will be known as the MV Sustina. The keel-laying ceremony, which is a time-honored shipbuilding tradition, marked the start of construction of the 195-foot ferry. The vessel will serve as a passenger/vehicle ferry for Knik Arm in Cook Inlet near Anchorage, Alaska and as an equipment and technology demonstrator for the U.S. Office of Naval Research.

Oceanic Consulting Corporation was pleased to be invited to the ceremony as projects directly linked to the development of this vessel have been ongoing at Oceanic for quite some time. Beginning with preliminary studies on operation of a SWATH vessel in ice-covered waters, this evolved into the evaluation of several hull iterations of the Lockheed Martin Marine Systems vessel, the VariCraft. The VariCraft is the basis design for the current E-Craft.

Oceanic has conducted three significant testing phases of the current version of the E-Craft including assessments of calm water resistance and powering, global structural loads, and performance in ice-covered waters. To investigate the calm water powering requirements, the model was tested with Oceanic’s SWATH/Catamaran towing dynamometer in both a fully captive test configuration and in a free-to-heave and trim arrangement. Resistance tests were conducted at a variety of loading conditions for various appendage configurations. The anticipated global structural loads for the vessel were assessed using seakeeping tests with irregular waves and predicted “design” regular waves. For the seakeeping tests, the model was configured to measure slamming pressures and structural loads on each demihull as well as on the movable center hull. This data was analyzed to provide estimates of extreme anticipated global loads for each specified sea condition.

The performance of the E-Craft in ice-covered waters was confirmed by a test program which focused on the specific ice conditions of Cook Inlet. Resistance and maneuvering tests in pack ice and in various degrees of ice coverage were conducted in the IOT 90-meter Ice/Tow Tank. The results were used to assess the effectiveness of the vessel’s novel ice-breaking geometry and to confirm the ability to navigate in the specific ice and current conditions of Cook Inlet, Alaska.
In recent years there has been a significant revitalization of the vintage America’s Cup class sailing yacht, the 12-meter yacht. Currently, the International Twelve Meter Association (ITMA) lists over 40 active member yachts and it sanctioned eight significant regattas during 2006. The first class regattas under the International Measurement System took place in 1907 and ITMA members plan to celebrate the centennial in 2007 with a series of regattas in the Mediterranean. Participants from around the world will gather in Valencia, site of the 32nd America’s Cup, in June 2007 for the first of six races that will finish up in St. Tropez in October 2007.

In preparation for the centennial events, Bill Koch, owner of *Kiwi Magic*, has been hard at work conducting a significant research and development program to explore performance gains that may be realized with this now vintage class of sailing yacht. *Kiwi Magic*, commonly referred to by her sail number KZ-7, represents a revolutionary era in sailboat racing. During the preparations for the 1987 America’s Cup, KZ-7 was designed by the impressive and innovative team of Laurie Davidson, Bruce Farr, and Ron Holland and represented the culmination of a development program that produced the first glass-fibre composite racing boats permitted under the International Rule. KZ-7 and her sister yachts KZ-3 and KZ-5 were given the dubious title of “Plastic Fantastic” as a result of their then novel hull construction.

As part of the current research and development program, *Kiwi Magic* is being tested with the same equipment and instrumentation presently used to test the current generation of 2007 America’s Cup yachts. The team is also exploring a wide variety of appendage options ranging from the existing appendage package to numerous alternate designs. Each appendage configuration is tested across various speeds, and heel and yaw angles to represent both upwind and downwind sailing conditions, thus providing a comprehensive matrix of data.

Oceanic Consulting Corporation has been working with Seattle-based firm Elliott Bay Design Group (EBDG) to bring a new ferry to Washington state. The new vessel will replace the 43-year-old vehicle/passenger ferry, *Whatcom Chief*, and will be operated by the Whatcom County Department of Public Works.

Oceanic fabricated the model at its facilities in St. John’s, NL, and conducted testing at the 62-meter Towing Tank at the Ocean Engineering Centre, in Vancouver, BC.

The test program for the ferry assessed the flow characteristics of the new design as well as the calm water resistance and performance in head and beam seas. Various configurations and loading conditions were evaluated to provide guidance to EBDG and the owner when they were considering the performance requirements and abilities of the new vessel. Particular attention was given to the performance of the vessel in the wave conditions found in the area of operation near Lummi Island, Whatcom County.
Oceanic Consulting Corporation is pleased to introduce Mr. John P. Manning as the newest addition to its Project Management Team.

Since joining Oceanic, Mr. Manning has conducted several evaluations including: resistance and flow visualization tests which examined alternative bow bulb geometry configurations for a ferry, ice tests for two types of ice protection structures for use in the Northeast Caspian Sea, and a resistance assessment of a tug-barge unit.

Prior to joining Oceanic, Mr. Manning was employed with JMS Naval Architects and Salvage Engineers and performed stability analysis for tank barges, tugs, pilot boats and passenger vessels. Mr. Manning is a self-described hands-on engineer who has also acted as project manager for the re-powering of a 180-foot vessel that included the installation of main engines, gears, generators, and other systems. Mr. Manning has worked in several sectors during his career including defence, with Technology, Management and Analysis Corporation of Alexandria, Virginia, and offshore, with Global Marine Drilling, and Transocean Offshore both of Houston, Texas, and with Andrew Palmer and Associates of Aberdeen, Scotland.

Mr. Manning is a Professional Engineer and holds a Bachelor’s degree in Engineering (Ocean & Naval Architectural) from Memorial University of Newfoundland. Much of his studies have focused on offshore structures, marine propulsion management, hydrodynamics, and vibrations. He is a member of the Association of Professional Engineers and Geoscientists of Newfoundland and Labrador and of the Society of Naval Architects and Marine Engineers.

Tanya Herlidan, a Naval Architecture student at Memorial University of Newfoundland’s Marine Institute, is the winner of the 2006 RINA Oceanic Student Naval Architect Award for her project, “The Design of a Great Lakes Icebreaker-Buoy Tender”.

Organized by The Royal Institution of Naval Architects (RINA) and sponsored by Oceanic Consulting Corporation, the award is made annually to a student who is studying Naval Architecture or a related subject and is adjudged to have given the best presentation of their final year project. The award and a cheque for C$700 were presented to Ms. Herlidan by Dr. Dan Walker, President of Oceanic Consulting Corporation, along with Dr. Brian Veitch of Memorial University of Newfoundland, on behalf of RINA.

Three finalists presented their projects at the Marine Institute on 23 May 2006. This is the third year in which an award has been presented to a student of the Naval Architecture programme at the Marine Institute.

“It is essential that Naval Architects are able to communicate their ideas beyond the drawing board” says RINA’s Chief Executive Trevor Blakeley, “and the RINA - Oceanic Student Naval Architect Award serves to promote and encourage this need.”

Lee Hedd, Senior Naval Architect with Oceanic, adds that “this opportunity is an important part of the education of Naval Architects as it emphasizes the importance of effective technical communication. The clear presentation of technical information and details can be difficult, particularly for young professionals with limited experience, but it is a crucial part of the development of a successful Naval Architect. The current group of students vying for the award clearly demonstrated that they have developed the necessary strong communication skills as they begin their careers.”

Projects were judged on both the written report and the presentation of the project. The judges considered technical content, originality, and structure. Presentations were additionally judged for style, explanation of technical content, and even audience appreciation.
200-meter Towing Tank:

- Length: 200m
- Width: 12m
- Still Water Depth: 7m
- Max. Tow Carriage Speed: 10m/sec
- Max. Wave Height (Regular Waves): 1.0m
- Max. Sig. Wave Height (Irregular Waves): 0.50m
- Range of Wavelengths at 7m Depth: 0.50m-40m
- Max. Wind Speed (1m from Fans): 11m/sec
- Max. Wind Speed (5m from Fans): 5m/sec

Instrumentation and Equipment:

- 12 - 530mm Diameter Wind Fans
- Hydraulically Operated Dual-Flap Wave Maker
- Parabolic End Beach (absorbs waves)
- Strain Gauge Load Cells
- Precision Dynamometers (measure forces and moments in 6 degrees of freedom)
- Capacitance Waves Probes
- Accelerometer Arrays & Motionpak (measures accelerations and rotational rates)
- Propeller Dynamometers (thrust and torque measurements)
- Propulsion Control System (including dynamic positioning system with azimuthing thrusters)
- 5-hole Pilot Tube 3-D Wake Survey Apparatus
- Laser Doppler Velocimeter (for non-intrusive flow measurement)
- Above Water and Underwater Video
- 64 Channel Data Acquisition

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
- MOTSIM

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

Meet us at:

Oct. 25-27
St. John's, NL

Oct. 26-30
Fort Lauderdale, FL

Nov. 29-Dec. 1
New Orleans, LA