OCEANIC CONSULTING CORPORATION

Making Waves

Newsletter of Oceanic Consulting Corporation

Spring 2011

First-Year Ice Ridge Loads on Floating Structures

In the present global search for new hydrocarbon deposits, the Arctic is once again receiving a high degree of scrutiny as it is expected that as much as 25 percent of the world's undiscovered reserves may be present in northern regions. Worldwide demand for this energy has generated pressure to extract these resources, much of which lie beneath the sea bed. This presents a problem for many petroleum industry operators since exploration and production activities in such a harsh environment will require unique solutions to deal with the extremes of cold temperatures and large ice loads.

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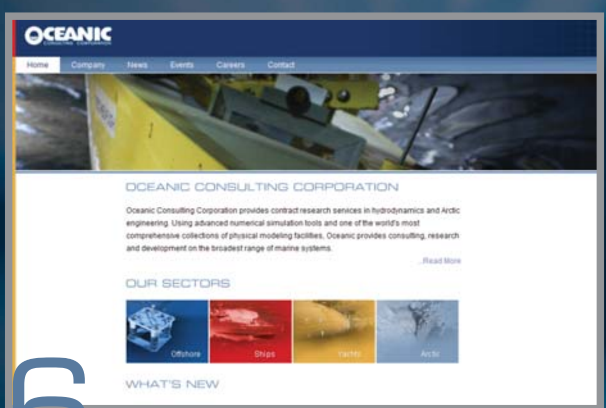

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It must be capable of successful operation in harsh environments: this is often identified as a design requirement for many of the vessels and offshore structures that find their way through the doors of Oceanic Consulting Corporation.

This statement usually refers to the ability of a craft or structure to operate in such extreme environmental conditions as hot or cold temperatures, high sea states, or ice-covered waters. Oceanic's naval architects and engineers, specialists in hydrodynamics and Arctic engineering, welcome the opportunity to assist our clients in developing designs that are capable of meeting challenging operational requirements and conditions.

As Oceanic navigates its way through a fragile economic recovery and assesses the industrial impact of the Deepwater Horizon incident in the Gulf of Mexico, the operational environment of the international marine industry can be labeled as "harsh", and we can see that many businesses are re-considering aspects of their operations as they look to the future. The marine industry has always been cyclical in nature but, despite this, it has demonstrated strong resilience through the years as industrial challenges have spawned innovative solutions. This history must inspire Oceanic's evolution as we strive to continuously exceed the needs of our clients. Ships and offshore structures form a significant portion of the global economy and the need to develop better platforms and vessels continues to grow. As the global marine industry navigates its way through the current economic challenges, Oceanic will follow a steady course with the continued aim of providing our clients with innovative and leading-edge services.

This issue of Making Waves highlights some of our recent innovations that currently are being employed to provide clients with expanded understanding of hydrodynamics and Arctic engineering. Oceanic continues to develop and expand our in-house numerical analysis capability by focusing on providing significant enhancements to the visualization of simulations. Graphically enhanced visualization of robust numerical simulations allows for effective communication of often complex results to a very broad audience. Strong communication of computer simulations is best achieved through realistic visualization capabilities that provide the viewer with the ability to rely on intuition to interpret results along with analysis of the "numbers". Along with continuing to further develop simulation capabilities, Oceanic has recently advanced our physical experimental methods. Specifically, we have developed the experimental approach and conducted a dual riser vortex induced vibration (VIV) experiment using our large VIV apparatus - we believe this may be a first of its kind at this size. In addition, we have advanced the understanding of performance of floating structures in first-year ice ridges along with our research partners in the CITEPH program.

As we continue to advance our capabilities, it is time to revise our internet presence and we will be launching our new website on May 2. We believe the new design and format will allow you to become more familiar with our range of capabilities and we are looking forward to hearing from you. Our website can be found at *www.oceaniccorp.com.*

For Oceanic Consulting Corporation,
and with best regards,

Lee Hedd
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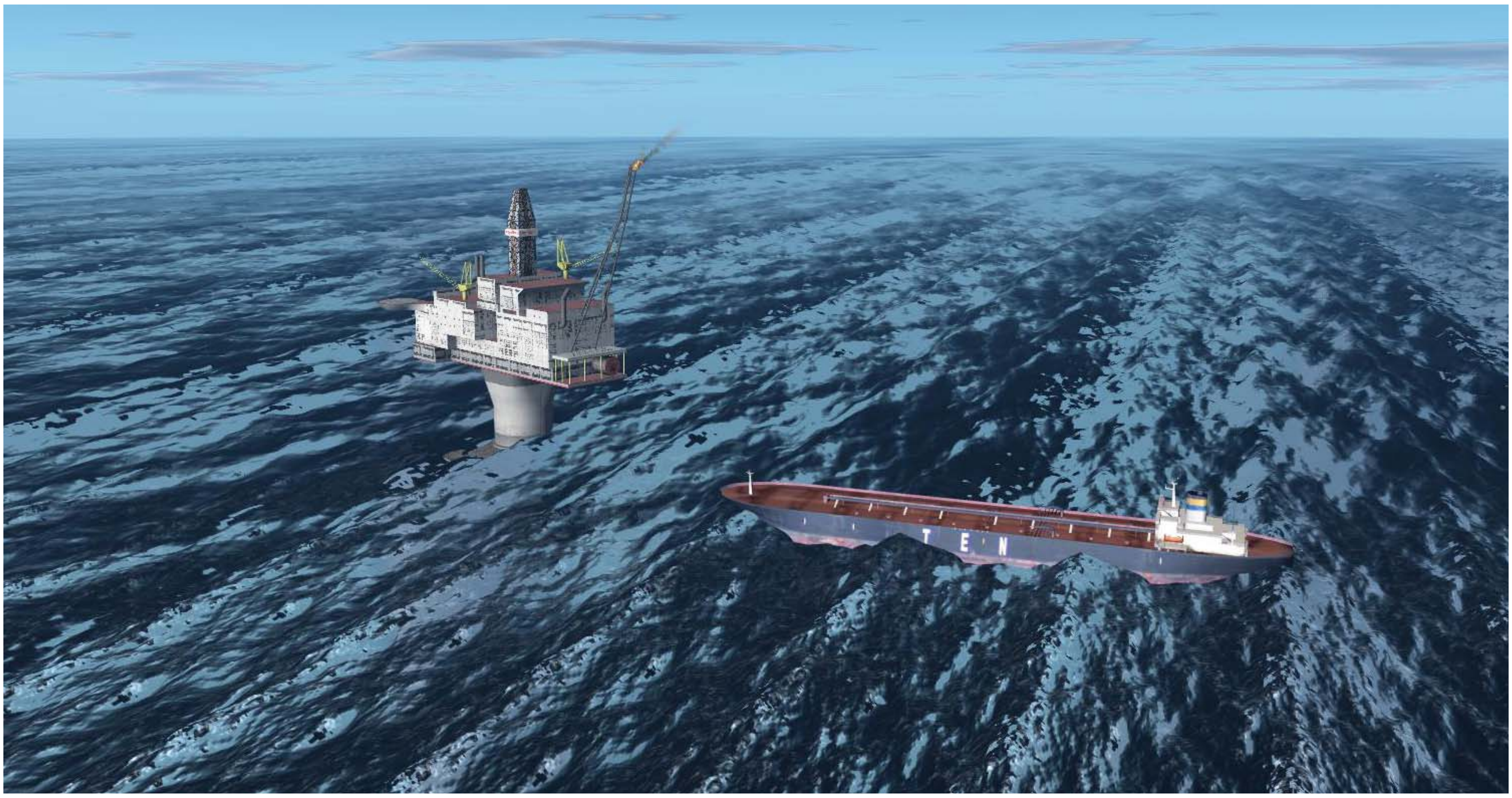
Accurate Numerical Simulations of Environmental Loads for the Safe Production and Transportation of Offshore Oil and Gas



Visualization of a GBS and shuttle tanker in offloading operations using Vega Prime.

Engineering research is about pictures and numbers. Whenever engineers try to solve a problem, the first thing they do is draw pictures. But pictures are only part of the story - engineers need numbers, too, to know which solution is the strongest, or the fastest, or the cheapest. Modern numerical simulations provide both of these options. Oceanic Consulting Corporation's computer programs provide the numbers, but more and more they provide the pictures, too.

Since its formation, Oceanic has been well known for its expertise in physical modeling. The company has carried out research with physical models for clients all over the world. Making measurements during the experiments satisfies the need for pictures and numbers, but it is also necessary to help clients understand why things happen.

It is difficult to imagine that meaningful engineering research can be done without a numerical model. Even a simplified or partial model can help clarify the relationships between parameters in a particular problem. Simulations tend to focus on three or four key variables, and simplify the others. However, researchers need to know that they are not failing to predict any important effects with these simplifications so model scale experiments are performed. Numerical methods and physical models go hand in hand. Without a physical understanding of the problem, one cannot create efficient and reliable modeling methods, but, without the numerical models, many possibilities would be left unexplored.

In July 2009, Oceanic Consulting Corporation signed a contract with the Atlantic Canada Opportunities Agency (ACOA) entitled, "Accurate Numerical Simulations of Environmental Loads for the Safe Production and Transportation of Offshore Oil and Gas". This contract will allow Oceanic to develop engineering software tailored to the needs of the offshore oil and gas industry, specializing in harsh environments which include ice-covered waters and extreme waves. The objective is to accurately predict the forces and resulting motions acting on complete offshore systems (such as drill ships, FPSOs, semi-submersibles, spars, support vessels, and shuttle tankers).

This agreement with ACOA will enable Oceanic to purchase commercial codes, modernize existing codes, and validate results against model- and full-scale data acquired by Oceanic and its partner, the National Research Council of Canada's Institute for Ocean Technology.

Through this initiative, Oceanic will work to address specific and immediate technical challenges for oil and gas exploration and production in harsh environments. The performance challenges for marine vessels in the global offshore petroleum industry are reflected in Atlantic Canada: the impact of wind, water, and ice on the motions and loads of moored or moving structures; safe passage for tankers and Liquefied Natural Gas (LNG) carriers between production sites and shore terminals; and safe berthing and maneuvering of vessels in harsh and/or confined waters.

Since the company's inception, Oceanic has used computer codes for client-sponsored research as part of its business. These codes include MOTSIM for calculating ship motions, Ship Maneuvering Laboratory (SML) for predicting ship maneuvering, and DECICE for predicting ice loads on a structure. These codes are unique and technically state of the art, but they are research-level codes and have not been optimized for efficient computation. They also require significant upgrades in some areas. The most important areas are interactive maneuvering, DP simulation, and the prediction of coupled motions and loads between a floating system and its moorings and risers.

By purchasing commercial codes, Oceanic has further expanded its numerical simulation capacity. Flow3D is a RANS CFD code developed for the accurate predictions of fluid-structure interaction in the time domain, with detailed representation of the free surface, including breaking waves. This code can run as a stand-alone code or can be coupled with other codes, such as MOTSIM, to give predictions of water motions inside a ship, such as in moon pools or water on deck.

Oceanic has also purchased FloSim, a potential flow code for predicting ship resistance and wave patterns, which will be used in combination with optimization routines to allow the automatic development of low resistance hull forms.

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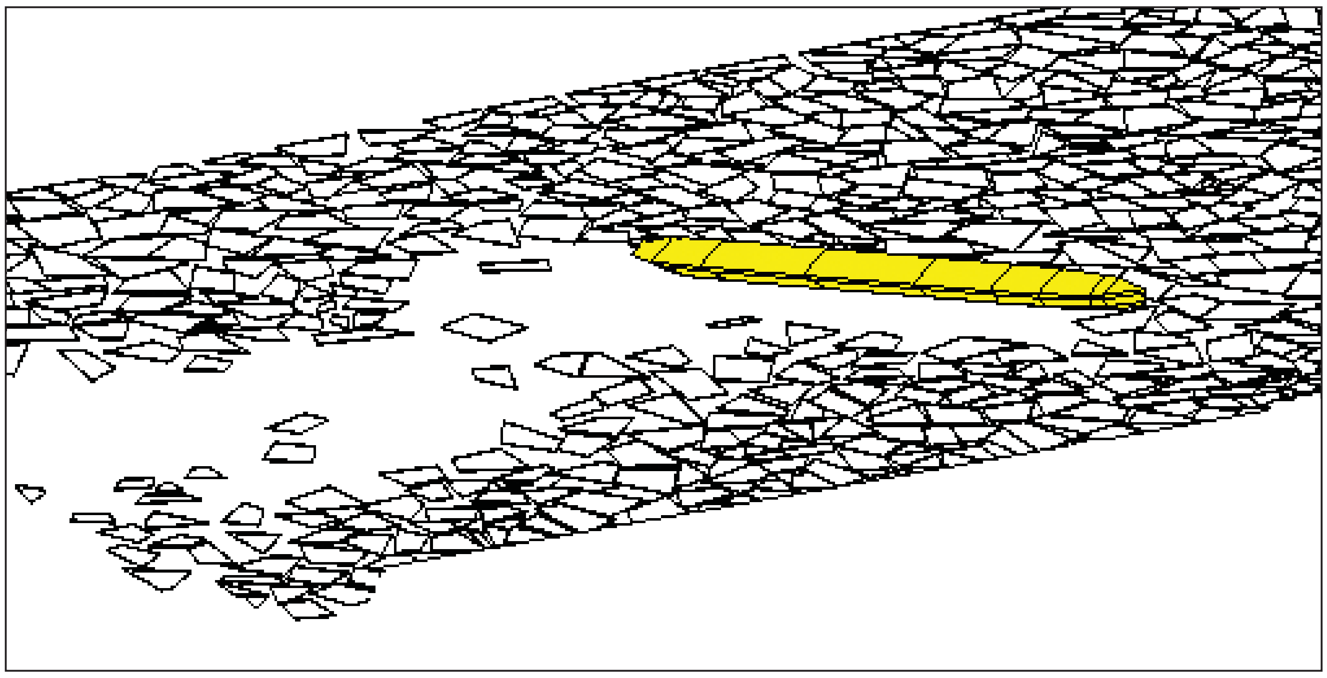
First-Year Ice Ridge Loads on Floating Structures



Simulation of rubble field during ice-structure interaction.

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Much of the new hydrocarbon resources north of 60º are found in waters too deep for bottom-founded structures. Currently, floating systems are the only realistic option as practical techniques for subsea drilling technology have yet to be developed. The dynamic nature of ice itself places loads on the structure and may force it off its location; in extreme cases, these forces create a potential for structural damage. Therefore, the current challenge for industry is to provide drilling and production systems that will withstand sea surface ice.

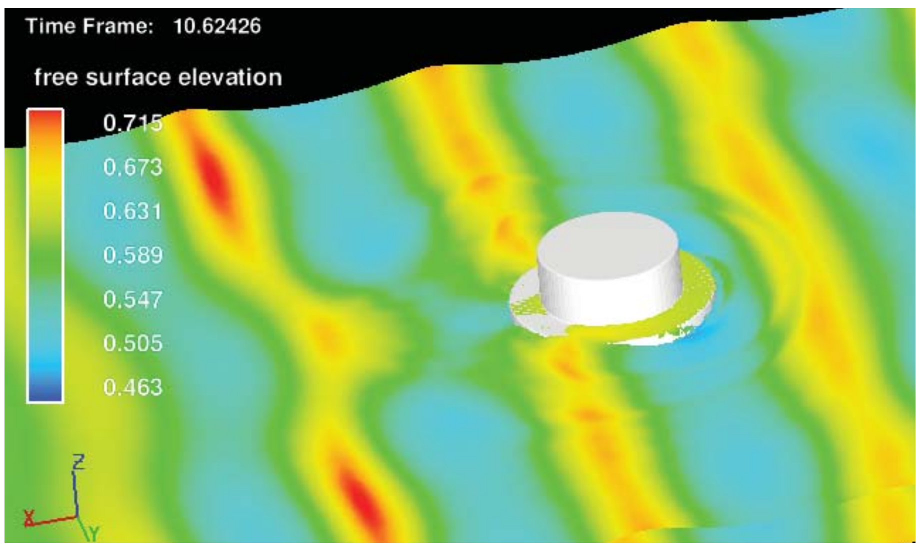
In order to obtain a better understanding of this challenge, a proposal was made by Oceanic Consulting Corporation, Océanide of Toulon, France, and the National Research Council of Canada's Institute for Ocean Technology to CITEPH in Paris, France, to examine some of these issues.

The objective of the project was to develop a design code for the maximum load on an offshore structure due to first-year ridges and rubble ice. The code will apply to such structures as cylinders and ship-like shapes which are held in place by moorings or dynamic positioning systems. Simple cylindrical structures mounted to the seabed will also be considered.

Initial discussions with the sponsors (Total E&P Recherche Development, Doris Engineering, Technip France, Entrepose Contracting, and Saipem) indicated that the primary interest was in predicting the maximum loads acting on ship-like structures, which would be representative of drill ships or Floating Production Storage and Offloading (FPSO) systems, and the secondary interest was in cylinders, which would be representative of spars or similar structures.

The experimental phase of the project investigated, at model scale, the maximum forces generated from the interaction of first-year ice ridges with simplified floating offshore structures. The experiments covered a range of first-year ridge dimensions that can be found in the Baltic, Sakhalin, and Arctic regions. The ridge properties considered were the maximum keel depth, the consolidation of the ice blocks, and the drift speed of the ridge relative to the structure. Barge-like floating production units and downward breaking cones were modeled. Another factor studied was the effect of mooring stiffness on the peak loads acting on the floating production unit. Local loads in the regions of high ice contact were also measured. In addition to the experiments, there was also a numerical component to the project. Ice loads were predicted using Oceanic's discrete element method DECICE. The overall objectives of the project are to establish the state-of-the-art for predicting the loads due to first-year ice ridges on moored offshore structures and to use that understanding to minimize the loads on the structure and its mooring system.

Accurate Numerical Simulations of Environmental Loads for the Safe Production and Transportation of Offshore Oil and Gas



Wave distortion around a GBS in shallow water.

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In the first twelve months of activity, Oceanic has expanded its complement of staff to include experts on numerical methods in ocean engineering and computer science. The initial focus was on ship maneuvering and pack ice loads on drill ships and spars. The ship maneuvering code SML was expanded to include simultaneous interactive control of multiple ships, and Dynamic Positioning (DP) capabilities have been implemented. As well, the user interface for the MOTSIM pre-processor has been modernized to make it more efficient, and DP capability is also being upgraded.

The two-dimensional version of the discrete element code DECICE, used for predicting ice loads on structures, has been expanded to include an actively controlled ship, which enables the simulation of ship maneuvering in pack ice of different thicknesses and concentrations. Initial validation studies of this upgrade were published at the Offshore Mechanics and Arctic Engineering (OMAE) Conference in Shanghai in June 2010. Some predictions of ice forces on a drill ship and two semi-submersibles calculated using the three-dimensional version of DECICE were presented at SNAME's Icetech conference in Anchorage, Alaska, in September 2010.

Other papers relating to wave run-up around a gravity-based structure and the resulting loads on the structure are being prepared for future presentations.

Oceanic sees tremendous potential for the growth of business in numerical simulation, and this development work has already resulted in several commercial contracts which would have been impossible to complete without this support from ACOA.

DYNAMIC POSITIONING SYSTEMS OPERATING IN ICE

Generic model of a drillship during a DP experiment in ice.

Drilling for oil and gas in ice covered waters is a very expensive operation. The working season is short, and operations will be disrupted by the presence of ice, especially at the shoulders of the season. Anything that will significantly increase the number of days available for drilling makes senior executives pay attention.

It is known that loads on a drill ship increase significantly as the drift angle of the ice gets further off the centerline of the vessel. It is also known that the loads decrease as the amount of ice management increases, but the trade-off is cost of ice management against cost of a stronger drilling platform. Costs can be reduced if a dynamic positioning system can be used to hold the drillship on location with its bow pointing into the direction of the drifting ice.

Dynamic Positioning (DP) systems have been proven capable of operating in harsh environments, where strong winds, fast currents, and high waves exist. But so far, it is not really known how effective they are in ice conditions. Environmental loads resulting from ice are quite different in nature than loads from other environments, such as wind, waves, or current. How a DP control system counteracts these loads is critical to its usefulness.

Dr. Jim Millan at the Institute for Ocean Technology (IOT) recently completed a successful demonstration of DP operation in ice covered waters, at model scale, using a completely free-running model. These arrangements removed all influences of umbilical cables or tow devices on vessel motions and showed that it was possible to keep the drill ship within an acceptable watch circle.

The DP system is based on non-proprietary control software that is backed by over 10 years of development and model testing experience. An important advantage of an open-source DP system like this is that it becomes possible to understand the influence of internal DP control parameters on the behaviour of a ship. Furthermore, the exact same code can be deployed in numerical simulations. Models can be equipped with up to six azimuthing thrusters, plus additional fixed thrusters, and rudders. The azimuthing thrusters are instrumented to measure thrust.

The debut of the DP system in ice was part of a workshop held at IOT, where 16 representatives from major oil companies, drilling companies, and research organizations met to review the performance requirements for DP in ice. Suggestions from the group were incorporated into the demonstration to assess their viability.

IOT and Oceanic see successful application of DP in ice as a major technological improvement for Arctic drilling, and are working together to develop significant collaborative research projects in this field.

STUDENTS MAKING WAVES AT OCEANIC

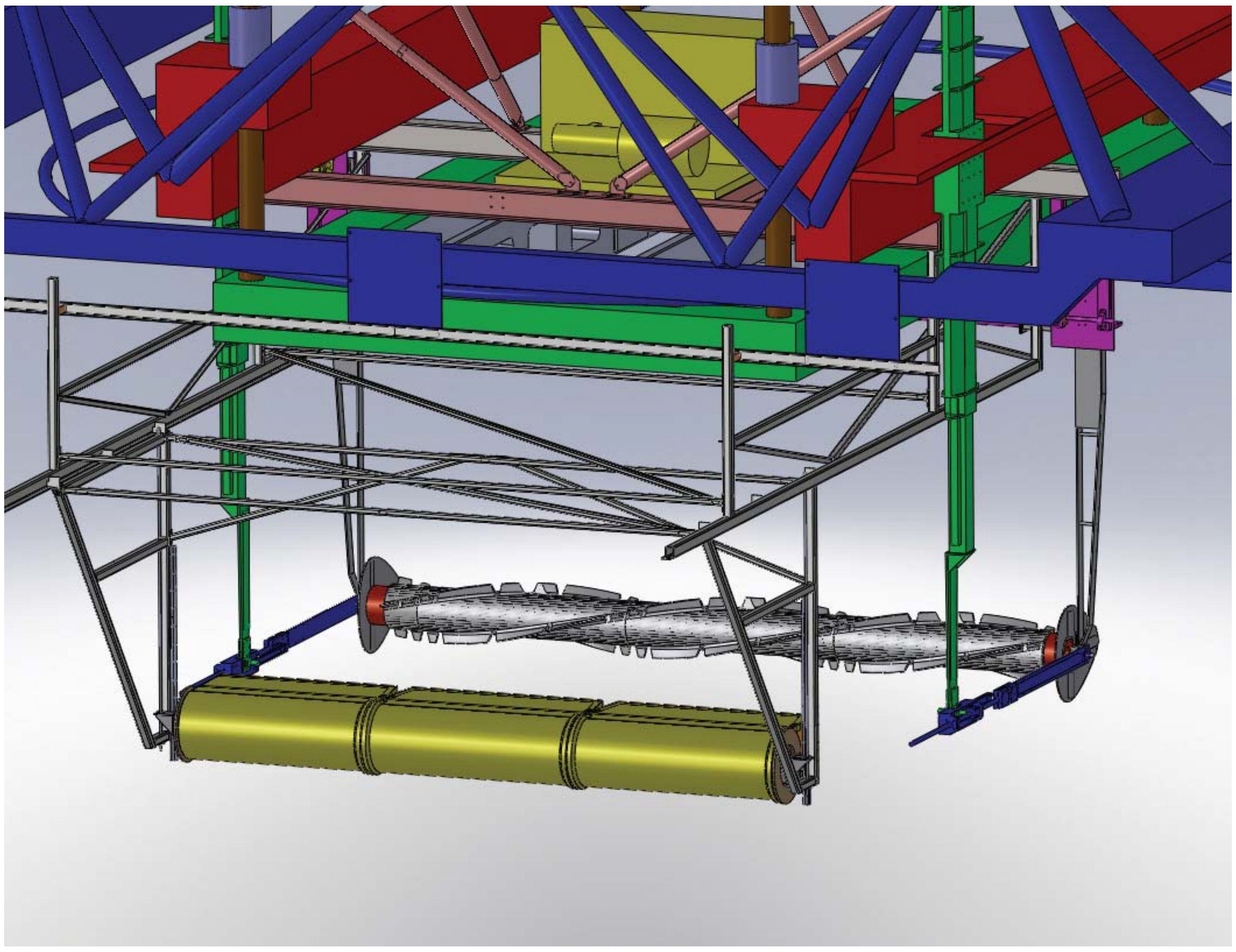
For more than a decade, Oceanic Consulting Corporation has been providing Memorial University of Newfoundland engineering students with work term placement opportunities. In 2008, Oceanic expanded this opportunity to include international students as well. While the company has been delighted with both the response and quality of its international applicants, New York's Webb Institute students have made a significant impression and the company has now developed a close relationship with the school. Graduates from both the Webb Institute and Memorial University are highly regarded in the maritime industry and eagerly recruited.

Industry work terms are an integral component of both Memorial University and Webb Institute programs. They aim to provide an opportunity for students to see the operations of an organization, and to get a broad view of how various engineering principles are put into practice on a daily basis. Work terms provide exposure to a high level of professional engineering skills and represent a practical implementation of university topics.

Webb Institute graduate, WIll Markuske.

Oceanic's international work term students find this experience especially rewarding. Webb Institute Class of 2010 alumni Will Markuske said of his Winter 2008 work term, "My experience at Oceanic rates as one of the best things I've done in my life…no doubt. The hands-on experience, incredible facilities, and social atmosphere in St. John's far exceeded my expectations - it was a work-term like no other." Mr. Markuske recently joined Oceanic as a Testing Engineer and is enrolled as a graduate student in Memorial's Ocean and Naval Architectural Engineering program. He will complete his Master's degree in May 2012.

A New VIV Development for Oceanic



Rendering of the High Reynolds Number VIV test apparatus.

Oceanic has recently completed the commissioning of new added features to its high Reynolds Number VIV test apparatus. The apparatus, originally designed and built to offer full scale VIV research capability for the Deepstar JIP with a single 12" diameter riser specimen, now offers tandem riser capability. With variable riser spacing from 3" to 20" pipe diameters (in the horizontal and vertical planes), Oceanic now can investigate the interactions and flow characteristics between two instrumented risers. Successful commissioning was concluded with a commercial research program studying the interaction effects of several different full scale strakes and fairings ranging in size from 12" to 20" (pipe diameter) with Re greater than or equal to 1,500,000.

Additionally, with the advent of newer fairing technology and advancements in strake design, full scale specimens to fit 23" diameter risers have been experimented with over the last few research campaigns. Oceanic is excited to continue its VIV research and development with its commercial and academic clients, involving oil majors, equipment vendors, and JIPs (including Deepstar and the Norwegian Deepwater Programme).

Oceanic Studies the Influence of Belly Strakes on Spar VIM

FloaTEC LLC of Houston, a world leader in the design of truss spars, wished to determine what influence belly strakes would have on the Vortex Induced Motion (VIM) of a truss spar.

Spar model with belly strakes.

VIM occurs when the strong Gulf of Mexico loop current passes by the spar and sets up vortex shedding. The shed vortices interact with the hull and at resonance can lead to high translational motions which in turn lead to fatigue of risers and moorings. Belly strakes are the section of VIM suppression strakes that have been removed to allow the spar to be transported on its side and launched. There would be considerable cost savings if the belly strakes were not required but there must not be a substantial increase in the VIM. A model experiment was conducted in the Flume Tank at the Marine Institute, St. John's, NL, Canada. A big advantage of using the 4 m deep Flume Tank was that the test duration could be suitably long to give reliable statistical data. Typically, a VIM experiment had 70 cycles. Three different variations of belly strakes were tested: full strakes in way of the belly, partial strakes over the belly, and no belly strakes at all. The testing covered a range of reduced velocities from 3 to 12 and five heading angles. The heading angle was seen to be very important and was related to the relative positions of the mooring chain groups. The results concluded that the belly strake configuration made a significant contribution to the suppression of VIM, but it was noted that the partial and the full strakes had about the same effect.

Coming May 2, 2011

Oceanic's website re-launch

Oceanic Consulting Corporation is delighted to announce the re-launch of its company website.

The most visible update can be seen in the site's layout, with a new, cleaner, easier-to-navigate design template implemented across all of Oceanic's pages.

We are delighted with the brand new website, and feel it offers visitors to the site improved ways to discover not only our services, but our experts, past projects and more besides.

www.oceaniccorp.com

On the Ground in Houston: Mr. Tony C. Randell, P.Eng.

Mr. Tony C. Randell, P.Eng.

Mr. Tony Randell graduated from Memorial University of Newfoundland in 1984 with a bachelor's degree in engineering (electrical). Since then he has worked for Marystown Shipyard Ltd. and, in 1985, joined the National Research Council of Canada's (NRC) Institute for Ocean Technology (IOT), most recently as Leader of the Design and Fabrication Group.

Mr. Randell presently resides in Houston, Texas, where he has worked as a Senior Consultant for Oceanic Consulting Corporation since 2008.

From his work at NRC-IOT, Mr. Randell has gained extensive experience in tank model testing. As Group Leader for Design and Fabrication at IOT, Mr. Randell oversaw the continued development of IOT's infrastructure and capability in the design and construction of physical models, mechanical equipment and associated instrumentation used in research at IOT over nearly a 25-year span.

Mr. Randell has contributed his expertise to a vast range of projects that cover a large spectrum of applications. These include offshore projects such as the Ekofisk platform, the Hibernia GBS, and the Terra Nova FPSO. Mr. Randell has also contributed his expertise to projects ranging from measurements of bergy-bit impacts with full-scale ship hulls as well as ice ridge impacts with offshore structures that included the design of a unique instrumented model seafloor to measure global ice loads.

As a former competitive sailor in local club racing, Mr. Randell was pleased to have been involved in developing the technology used at IOT for racing yacht model testing. Subsequently, this technology was used for a number of successful America's Cup research programs performed by Oceanic. CAD/CAM and complex surface modeling are areas of specialist expertise for Mr. Randell.

He has published numerous technical papers in this area, including one on the development of a parametric CAD design program, PARAPROP, used to automate the process of developing high quality surface models of propellers for the purpose of CNC manufacturing. Another relevant publication discussed the development of a technique to use a 3D scanning laser to extract "as built" design data from model propellers.

He also has extensive training and experience in QA/QC and project management. He was a member of the IOT Standards Committee that was tasked with developing, documenting, and reviewing the IOT standard procedures and practices for experimental work.

Mr. Randell has served on several NRC-wide groups and committees. He served on a sub-committee of the NRC's National Committee for Occupational Safety and Health (NCOSH) to develop workshop and laboratory safety policies and procedures. He also was a member of the NRC Cross Imitative Group on Advanced Composites.

Mr. Randell is a member of the Association of Professional Engineers and Geoscientists of Newfoundland and Labrador (PEG-NL) and the Society of Naval Architects and Marine Engineers (SNAME).

A Visit from Canada's Prime Minister

Prime Minister Stephen Harper visiting with Oceanic staff at its IOT-based offices in St. John's.

On 11 February 2011, Prime Minister Stephen Harper visited the National Research Council's Institute for Ocean Technology where he highlighted Canadian achievements and groundbreaking research which is helping to create jobs and economic opportunity in the region and beyond. Accompanied by Defence Minister Peter MacKay and Senator Fabian Manning, the Prime Minister spent time touring the facility and viewing demonstrations in the Institute's offshore engineering basin, 200-meter towing tank, and 90-meter ice/towing tank. During his visit the Prime Minister also took time out to speak with several members of Oceanic's consulting, testing, and fabrication staff.

Oceanic Consulting Corporation is one of more than 50 provincial ocean technology companies that bring tangible benefits to Newfoundland and Labrador's economy.

Centre for Marine Simulation

Bridge Length	5 m
Bridge Width	7 m
Window Angle	15°
Visual Theater Diameter	20 m (approximate)
Visual Theater Height	12 m (approximate)
Visual Theater Field of View	360° Horizontal
	27° Vertical

Instrumentation and Equipment:

- Full-size Modular Ship Bridge
- Full-motion Platform Base Actuated in Six Degrees-of-Freedom
- Visual Screen with 360° Horizontal Field of View
- 10 High-resolution Projectors
- Advanced Computer-generated Imaging System
- Four-channel Sound System
- Electronic Chart System
- Simulated DGPS Positioning System
- Data Bridge 2000 Integrated Navigation System
- Array of Working Vessel Controls

Applications:

- Training in Advanced Navigation, Piloting and Bridge Resource Management
- Simulation of Ship Hulls and Offshore Structures
- Training in Ship Handling, Single Point Mooring and Station Keeping

Tests Performed:

- Seakeeping
- Maneuvering
- Motion Studies in Wind, Tide, Current, and Precipitation
- Ship Model/Bottom Interaction

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 • MOTSIM
• Centre for Marine Simulation • Ice Engineering • VIV Test Apparatus

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

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Meet us at:

Offshore Technology Conference	Atlantic Canada Petroleum Show	SNAME Annual Meeting & Expo 2011	The International WorkBoat Show
May 2 - 5 Houston, TX	June 22 - 23 St. John's, NL	Nov 16 - 18 Houston, TX	Nov 30 - Dec 3 New Orleans, LA