As an introduction, could you give a broad overview of the current status of Canada’s offshore industry?

The Canadian offshore industry is in expanding into increasingly harsh environments including the Arctic region and deepwater locations off the North Atlantic coast of Canada. In responding to the new challenging ultra-deepwater and northern ice covered environment, the design requirements for floating systems, mooring lines and risers, subsea systems, underwater operations, and evacuation systems become considerably more demanding and border on the limits of technology. It is increasingly important to ensure a safe and cost effective means of expanding the offshore horizon. The call from the offshore industry to address these technical challenges is very strong.

The NSERC CREATE Training Program for Offshore Technology Research (OTR) offers graduate students the chance to study, research and intern in the offshore industry. Why was the Program created and what are its key objectives?

The OTR Program was created to address the current shortage of skilled professionals in the offshore industry. We discovered both in the literature and from industry collaborators that hiring professionals with the specific knowledge required for success was becoming increasingly important. The NSERC CREATE Training Program offered the means to provide necessary graduate research experience coupled with value added opportunities, including industrial internships and soft skills development. The initiative also enables students to address significant challenges in offshore design and operations identified by industry and academia.

The project’s key objective is to facilitate the transition of trainees from academia into the workforce whilst educating graduate students in OTR. The Program focuses on four OTR research areas, aiming to develop the students’ skills in their chosen sector.

Which specific areas of the offshore industry are you particularly focusing on and why?

The OTR Program focuses on four key areas of research in offshore technology: Floating Structures, Corrosion Material Engineering, Subsea Structures and Risers and Moorings. These four areas encompass the needs indentified by industry in oil and gas offshore exploration and development, as well as covering transportation in harsh environments.
What benefits are afforded by making offshore technology a research priority in Canada?

Canada is known as the ‘gateway to the north’. With engineering and technological advancements in offshore research, exploration and the development of natural resources and transportation in the Arctic region are becoming more feasible. In response to this, prioritising research in offshore technology directs research resources towards overcoming the challenges faced by vessels that operate in harsh environments. These challenges include climatic, management and safety issues. The OTR Program is conducting research in all these areas.

Could you highlight the training and education opportunities that are presented through the Program?

What sets our work apart from the regular graduate programmes is the focus on growth and development of each participant’s professional skills. We aim to develop capabilities such as team building, critical thinking, key industry problem solving, and writing and presentation skills to prepare them for the Canadian workforce. This is accomplished through unique opportunities, including four-month internships, student research seminars and specialised seminars and workshops presented by external industry and academia representatives. Prospective students can find information about the application process on the OTR website or by directly contacting the OTR office.

Do you have any near-future plans? Where are you hoping to focus your research efforts in the coming years?

We have received positive feedback from the current Program and are looking forward to extending it beyond the current six-year period to continue meeting the needs of industry on a long-term basis. Since the project’s inception, there have been significant announcements in the offshore exploration off the coast of Newfoundland. This indicates that the need for highly skilled professionals who are trained in offshore technology and enable them to interact with the OTR office.

Training new personnel in offshore technology

The NSERC CREATE Training Program for Offshore Technology Research at Memorial University, Newfoundland is providing graduate students with opportunities for research, training and exposure to industrial practice in order to prepare them for a future career in the offshore industry.

NEW OPPORTUNITIES ARE developing in the Canadian offshore industry. In recent years, several significant developments off the coast of Newfoundland – including Hibernia, Terra Nova, White Rose and Hebron – have led the oil and gas sectors further into deep sea and icy regions. With the rapid expansion of Canada’s offshore industry, there is a particular need for highly skilled professionals who are trained in offshore technology, research and practice.

THE OFFSHORE TECHNOLOGY RESEARCH PROGRAM

The NSERC CREATE Training Program for Offshore Technology Research (OTR) – led by Professor Wei Qiu, the Program’s Principal Investigator – was created in response to this developing need. Its purpose is to provide effective training for graduates and enable them to meet the demands of the current offshore industry market. Using an education and training platform coupled with practical experience, OTR aims to prepare graduates for work in key areas of offshore research and industry. The Program develops a number of adaptable skills including team building, critical thinking, key industry problem solving, writing and presentational skills, networking, mentoring and career development. Students are able to conduct research and undertake training in a range of fields, such as ocean and naval architecture, processing, electrical and civil engineering, and chemistry.

OTR is part of the Collaborative Research and Training Experience (CREATE) Program funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). As well as acquiring funding from Memorial University and NSERC, OTR has also received significant support from the Research and Development Corporation (RDC) and Petroleum Research Newfoundland & Labrador (PRNL). The Program, which is running for a six-year period, has a total budget of $3.24 million.

PROGRAM OUTLINE

OTR comprises of four key research areas. Students are provided with comprehensive research, training and experience in their chosen fields, and participate in seminars and workshops in the other areas to receive an overview of the field of offshore technology.

As well as standard and specialised research pursuits, students participate in the OTR Seminar Series. In the student research seminars, graduates are encouraged to share their research and learn about the work of their peers under faculty supervision. Such sessions help to develop professional skills such as oral presentation, and fielding and responding to research questions. There are also specialised seminars and workshops in which a series of guest speakers (both national and international) discuss topics of special interest in offshore technology research. These seminars provide students with an informed overview of many areas of offshore technology and enable them to interact with leaders in specific industry and research fields.

To date, special topics have included, marine
corrosion, innovations in floating offshore production systems, and the future of maritime and ocean technologies.

During the four-month internship, students are given the opportunity to experience working for an offshore industry or research company firsthand. The Program participates with national and international partners that encourage students to develop professional skills and increase their exposure to international offshore industry, with individuals travelling outside of Newfoundland provided with a travel subsidy. The internship is an integral part of OTR and contributes to its innovative nature, as Qiu underlines: “Internship opportunities with the national and international partners help the students develop professional skills and promote interaction between academic and non-academic research environments”.

RESEARCH AREAS
The Program focuses its research in four key areas – floating structures, mooring lines and risers, corrosion and subsea technology.

The floating structures area encompasses an array of research topics, including the dynamic positioning of floating structures in rough sea states, the interaction of surface ice with ship hulls and propellers, and the use of unmanned vehicles in harsh environments. Specific research targets include modelling of harsh environments, investigating the responses of offshore platforms in harsh environments, researching structural integrity as well as the development of advanced evacuation and rescue systems for operations in ice and other difficult environments. Safety and loss reduction in offshore conditions is an especially high priority, and has been reflected in many of the recent research ventures in offshore technology.

The mooring lines and risers theme focuses on the improvement of analysis tools which predict the dynamics of mooring lines and risers and also the forces and responses of risers that experience vortex-induced vibrations from currents. Its aim is to develop strategies which reduce the fatigue damage and alleviate other issues caused by these currents.

The North Atlantic is a particularly harsh environment, and the corrosion of ocean-borne structures and vessels is of great concern. The corrosion material engineering area is centred on developing innovative corrosion protection and monitoring technology for offshore infrastructures. The research into corrosion has been a collaborative effort between Memorial’s Faculty of Engineering and Applied Science and the Faculty of Science (chemistry). To date, teams have worked on the development and testing of new coatings for anti-fouling and preventing the corrosion of floating structures and transport vessels.

Finally, the subsea technology area examines subsea and pipeline infrastructures for the oil and gas industry, as well as underwater vehicles. The movement of ice and icebergs is a great concern for the oil industry, particularly in the area of exploration and development. Research into subsea systems includes the study of ice interaction with subsea structures and the sea bed, and also how ice affects the mechanical integrity of offshore pipelines. Research in this field has already advanced the design of subsea pipelines.

JUNSHI WANG
I joined the NSERC CREATE Program last year and my research topic is time-domain simulation of ship-wave interaction. An accurate simulation of ship-wave interaction can predict ship motions in water waves, which is of great importance for ship operations at sea and part of my research is the modelling of the free surface boundary condition. I benefit from the CREATE Program through the seminars which provide an opportunity to discuss my research with other students and professors. In addition to the research, the CREATE Program also provides me with the opportunity to develop professional skills. My internship has allowed me to work on different tasks related to seakeeping problems, which are also related to my research at school. I learn not only the expertise in naval architecture and ocean engineering, but also how to apply the knowledge to the engineering world. I feel fortunate to have joined the CREATE Program and I have enjoyed being both a researcher and engineer.

BRUCE QUINTON
As an NSERC CREATE-supported PhD candidate I have been able to carry out award-winning graduate research and attend conferences/industry functions that provide the opportunity to showcase my research and network with industry professionals. At Memorial University of Newfoundland, I study how ice-strengthened ships react to accidental impacts with ice. The term ‘accidental’ implies that the impacts are well beyond the design strength of the ship. In particular, I study the differences in how a ship reacts to ice that slides along its hull versus ice that remains in one place on the hull during the impact. This research involves development of a novel experimental apparatus and use of high performance computing for structural simulation. This research has been awarded the Vice Admiral E L Cochrane Award from the Society of Naval Architects and Marine Engineers (SNAME). The experience garnered through contributions from the CREATE Program have reshaped my views of engineering and industry-driven research.
and contributed towards the risk reduction of subsea environmental disasters.

ACHIEVEMENTS TO DATE

OTR has been running for three years. It is currently training 21 Master’s, 15 PhD, two postdocs and 12 undergraduate cooperative students.

The Program has already shown signs of great success. To date, eight of the 12 graduates are now employed in the offshore technology sector, two have attained postdoctoral positions and two are pursuing PhDs. 12 internships have been completed and a further six are scheduled or in process. Another measure of success is the impact that the academic work undertaken by the students has had on the field of offshore research. Within the first three years there have been over 70 conference papers, 55 refereed journal papers and also a US Patent application.

Qiu is understandably enthusiastic for the project. “ OTR creates a win-win-win situation, providing benefits to the university, the companies and the students”. The Program’s collaborators look forward to the further impact that their project will have on the offshore industry, the assistance and experience it will provide for students and the positive attention it will direct towards Memorial University.

DOUG SMITH

I recently completed a Master’s degree at Memorial University of Newfoundland as part of the NSERC CREATE Program. My research was focused on the interaction of two floating bodies at close proximity and involved physical modelling of two floating bodies at model scale. The NSERC CREATE Program included an internship component that allowed me to work with the model testing group at Oceanic Consulting Corporation. This was very helpful in learning techniques and methods that were being used in model test environments for state-of-the-art industrial projects. NSERC CREATE also provided funding for me to attend the Society of Naval Architects and Marine Engineers (SNAME) Annual Meeting. This was a great professional development activity where I represented CREATE at the SNAME Student Recruitment Fair. It was a great programme to participate in and has helped build my professional career. I have since moved on to pursue my PhD in arctic offshore research.

JINGHAN FENG

I am a Master’s student in the NSERC CREATE Program at Memorial. From my point of view, this programme is a natural choice for students who want to pursue graduate studies. One of its attractions is that it offers internship opportunities in Canada and the US for graduate students. For example, I had an opportunity to do my internship in American Bureau of Shipping (ABS), Houston. ABS is one of the top three classification societies worldwide. I worked in the Rules Administration Department and successfully completed the notations comparison project with tasks such as researching information on classification rules of ABS and other organisations, analysing and comparing classification notations, and updating the existing database. As an engineering student, I have learned about real-world technology and services and have broadened my knowledge base of the industry, which has helped me to understand the nature of classification organisation. In addition, I extended my network in my field by building relationships with new colleagues at ABS, who are specialists in the field of offshore technology research. I believe this internship will prove to have been an unforgettable experience.

INTelligeNCE

NSERC CREATE TRAINING PROGRAM FOR OFFSHORE TECHNOLOGY RESEARCH

OBJECTIVES

To establish an innovative and collaborative training programme that addresses significant scientific challenges in offshore design and operations, and to train highly qualified personnel for the growing offshore industry. The Program aims to build on research strengths associated with Canada’s research priority on natural resource and energy as well as the province’s priority on ocean research, and to facilitate the transition of new researchers from trainees to productive employees in the Canadian workforce.

KEY COLLABORATORS AND PARTNERS

ConocoPhillips • BMT Fleet Technology • Husky Energy • American Bureau of Shipping (ABS) • Lloyd’s Register (LR) • INTECSEA • Oceanic Consulting Corporation • National Research Council of Canada • Australian Maritime College • Norwegian University of Science and Technology • Dalhousie University

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WEI QIU is a professor in the Ocean and Naval Architectural Engineering (ONNAE) discipline and Director of Ocean Engineering Research Centre (OERC). He is experienced in marine and offshore hydrodynamics, specialising in solving fluid-structure interaction problems using experimental and numerical methods. Qiu serves as Principal Investigator and Program Director of OTR. He also leads the research in the area of floating structures.