

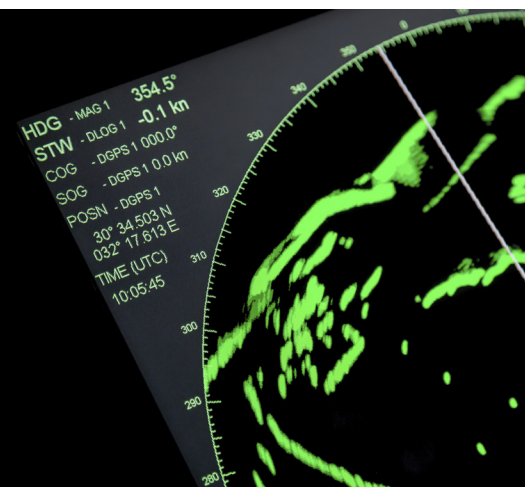


ASIA PACIFIC  
FOUNDATION  
OF CANADA

FONDATION  
ASIE PACIFIQUE  
DU CANADA



THE ASIA FACTOR  
LE FACTEUR ASIE



# THE ASIA FACTOR IN ATLANTIC CANADA'S OCEAN TECHNOLOGY SECTOR: OPPORTUNITIES AND CHALLENGES

*Institute for Ocean Research Enterprise*

2016

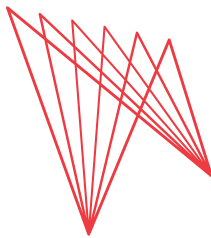
## ABOUT THE ASIA PACIFIC FOUNDATION OF CANADA

The Asia Pacific Foundation of Canada (APF Canada) is a not-for-profit organization focused on Canada's relations with Asia. Our mission is to be **Canada's catalyst for engagement with Asia and Asia's bridge to Canada.**

A leader in research and analysis on Canada-Asia relations for over 30 years, APF Canada partners with government, business leaders, academics, and opinion makers in Canada and across the Asia Pacific region to offer clear, specific, and actionable policy advice.

Established by an Act of Parliament in 1984, APF Canada's thematic priorities include: promoting trade, investment, and innovation; mobilizing energy assets; building skills and competencies; and understanding Asia now.

Visit APF Canada at [www.asiapacific.ca](http://www.asiapacific.ca)



ASIA PACIFIC  
FOUNDATION  
OF CANADA

FONDATION  
ASIE PACIFIQUE  
DU CANADA

## ACKNOWLEDGEMENT

This report was supported in part by the Atlantic Canada Opportunities Agency (ACOA) under the Atlantic Policy Research Initiative, which funds research projects and works to build public policy research capacity around key socio-economic issues in Atlantic Canada. The views expressed in this report do not necessarily reflect the views of ACOA or of the Government of Canada. APF Canada and the report author(s) are responsible for the accuracy, reliability, and interpretation of the information contained herein.

## THE ASIA FACTOR IN ATLANTIC CANADA

The Asia Factor in Atlantic Canada's objective is to assist the region in better responding to Asia's rising global economic importance by providing critical information on the opportunities and challenges for Atlantic Canadian business and trade with Asia.

The project represents the Atlantic side of The Asia Factor, a nationwide, multi-year project launched in 2014 by APF Canada that examines the interaction of each province and territory with Asia. The Asia Factor provides comprehensive resources, information and analysis on provincial level Canada-Asia relations.

For additional statistics and information on Atlantic Canada-Asia relations, visit [www.TheAsiaFactor.ca](http://www.TheAsiaFactor.ca)



THE ASIA FACTOR  
LE FACTEUR ASIE

## ABOUT THE SECTORAL REPORT SERIES

Atlantic Canada's traditional export markets have been the United States and Europe. Spurred by the economic effects of the 2008 financial crisis, and motivated by Asia's growth, this has started to change.

In order to help Atlantic Canada respond to Asia's rising economic importance, APF Canada contracted Canadian experts to write sector specific reports to analyze Atlantic Canada's trade with Asian markets.

Each report provides sector-specific overviews and critical information on the opportunities and challenges for Atlantic Canadian business and trade with specific Asian markets. Each report concludes with actionable, sector-specific opportunities to help increase business and trade with Asian markets.

The Institute for Ocean Research Enterprise<sup>1</sup> wrote this report on the ocean technology sector, which offers an assessment of this sector's trade and future prospects in China, India, Japan, Singapore and South Korea.

Recommended citation: Institute for Ocean Research Enterprise, "The Asia Factor in Atlantic Canada's Ocean Technology Sector: Opportunities and Challenges," Vancouver: Asia Pacific Foundation of Canada, 2016.

# TABLE OF CONTENTS

	<b>EXECUTIVE SUMMARY</b>	<b>5</b>
<b>1</b>	<b>INTRODUCTION AND SCOPE</b>	<b>6</b>
<b>2</b>	<b>ATLANTIC CANADA'S OCEAN TECHNOLOGY SECTOR</b>	<b>7</b>
<b>3</b>	<b>ASIAN MARKETS ANALYSIS: DRIVING DEMAND FOR OCEAN TECHNOLOGIES</b>	<b>15</b>
<b>4</b>	<b>MARKET OPPORTUNITIES AND ASSOCIATED CHALLENGES</b>	<b>22</b>
<b>5</b>	<b>SUMMARY OF KEY FINDING</b>	<b>25</b>
<b>6</b>	<b>OPPORTUNITIES TO ACCELERATE GROWTH</b>	<b>26</b>
	Appendices	28

## EXECUTIVE SUMMARY

The ocean technology sector in Atlantic Canada has evolved in parallel with activities in related industries, including defence and security, energy, marine transportation, ocean science and observation, and food and tourism. Canada's Atlantic region has enjoyed a long history of ocean-related economic activity. Over the last few decades, ocean technology clusters have organically formed in the region, composed of ocean technology firms, governments, and scientists who drive innovations in this sector. The region also has several ocean and marine-oriented university and college programs that draw new and veteran talent to both the industry and the region.

Asia has a growing demand for ocean technology products and services. Disputes in the South and East China Seas, increasing military expenditures by India, and regional tensions with North Korea account for some of the growing demand for defence and security subsector ocean technologies. Also contributing to demand is the booming Asian offshore energy industry, which is predicted to represent about 20% of total global industry expenditures between 2015 and 2019.<sup>2</sup>

Exporting relationships between Atlantic Canada and Asia are presently underdeveloped. Geographic distance, language, political and cultural differences, lack of awareness of how to access Asian markets effectively, and Canadian defence and security export regulations act as barriers to increasing Canadian engagement.

Notwithstanding these challenges, there are vast opportunities for Atlantic Canada's ocean technologies in Asia. This paper examines the key capabilities of Atlantic Canada's ocean technology sector to provide insight into where these capabilities align well with demand in Asia. This paper also highlights some key challenges that could hinder or encumber export activities to Asia. The report concludes by highlighting opportunities for accelerating Atlantic Canadian firms' presence in Asia Pacific markets.

# 1 INTRODUCTION AND SCOPE

The global ocean technology sector is part of a multi-trillion-dollar ocean economy filled with opportunity.<sup>3</sup> It is a dynamic sector composed of knowledge-based companies that invent, develop, or produce technologies or products for specific use in or on the ocean, together with companies that provide knowledge-intensive technology-based services unique to the ocean. Participants range from small start-ups around the world to established multinational enterprises. Collectively, they produce a vast range of technologies for an equally broad range of applications to meet the demands of government, business, and individual customers around the world.

This paper first provides an overview of the ocean technology sector in Atlantic Canada, and of the demonstrated core competencies of the region. Next, this paper provides an overview of demand for Atlantic Canadian ocean technologies in Asian markets. It then examines Asian demand for technologies in (1) defence and security, (2) marine transportation, (3) energy, and (4) ocean observation and environmental monitoring, with a focus on current and emerging opportunities for Atlantic Canada's ocean technology sector in Asia. Finally, a summary of key findings is provided together with some ideas for accelerating growth the sector's presence in Asian markets.

## 2 ATLANTIC CANADA'S OCEAN TECHNOLOGY SECTOR

Atlantic Canada is home to a concentration of companies and institutions offering some of the most innovative ocean technologies in the world. Not surprisingly, the significant coastlines and marine territories of Canada's Atlantic Provinces have contributed to this region being a pioneer in marine transportation, ocean exploration, and monitoring, and an innovator in harvesting the ocean's resources.

### 2.1 INDUSTRY

Atlantic Canada's ocean technology industry hosts a vast array of knowledge-intensive enterprises that develop innovative ocean technology products and services for niche markets worldwide. Within the region, these firms support offshore oil and gas exploration and production, aquaculture, fishing, transportation, and the strategic and operational requirements of the Royal Canadian Navy's Atlantic Fleet. In addition, the sector has developed expertise in ocean science and observation technologies that provide the knowledge necessary for fact-based regulation of the ocean environments of Atlantic Canada and the world.

Quantifying the size of the sector in Atlantic Canada (or elsewhere in North America) is difficult, primarily because unique North American Industry Classification System (NAICS) codes have not been assigned to enable collection of granular data on ocean technology production. Efforts to establish the necessary codes are ongoing, and will require coordination between Canada, Mexico, and the USA. Until that time, all sector data will, by its nature, be imprecise, since the only reliable way to collect detailed information involves surveying all industry participants within the desired industry subsector and geographic region.

In the past decade, a small number of reports and studies have provided an order-of-magnitude estimate of the sector's size and illustrate the sector's growth trajectory:

- A 2006 study estimated ocean technology sector annual sales in Atlantic Canada at approximately \$330 million, of which 73.8% related to customers in North America, 10.8% related to customers in Europe, and 2.8% related to customers in Asia or the Middle East.<sup>4</sup>
- The same 2006 study found that companies in the Provinces of Newfoundland and Labrador and Nova Scotia comprise more than 80% of total Atlantic Canadian ocean technology firms.
- The Province of Newfoundland and Labrador has indicated that revenues of its ocean technology companies increased from \$117 million in 2001 to approximately \$230 million in 2005.<sup>5</sup> Current promotional materials from the Province of Newfoundland and Labrador indicate that companies specific to the development of ocean technology in the province currently employ more than 1,600 dedicated professionals and generate total estimated revenues of over half a billion dollars.<sup>6</sup>



- The Province of Nova Scotia has indicated that revenues of Nova Scotian ocean technology companies doubled from \$500M in 2009 to \$1B in 2011.<sup>7</sup> The award of the \$25B National Shipbuilding Procurement Strategy combat ship construction contract to Irving Shipbuilding in Halifax and its associated industrial benefits will undoubtedly continue to grow the ocean technology sector in Nova Scotia.

While small in comparison to resource-based industries (e.g., petrochemical, forestry, agricultural, fisheries, and other resource-based products), the ocean technology sector remains important to the Atlantic Canadian economy. The ocean technology sector is one of the largest advanced technology industries in the region. It stimulates high levels of R&D expenditures and innovation and attracts a highly skilled labour force. These factors reflect the sector's capacity for global presence and wealth generation.<sup>8</sup>

### *Regional Capability*

#### **Public Sector Research Institutions**

In addition to its industrial ocean technology strength, Atlantic Canada is home to world-class marine-oriented pure and applied science and research laboratories that support these same activities. These multidisciplinary institutions support research and development in various oceanographic fields, including geological, physical, chemical, and biological research disciplines. (See Appendix A: Summary of Public Sector Research Institutions in Atlantic Canada.)

#### **Universities and Colleges**

The region's universities and colleges complement Atlantic Canada's industrial ocean technology strength and wealth of research institutions, which offer diploma and degree programs in a wide variety of ocean science and marine disciplines, including pure and applied sciences (e.g., biological and chemical oceanography and marine engineering). They also provide specialized programs focused on ocean technology training, education, and research, and collaborate with industry and government researchers on regional, national, and international levels. (See Appendix B: Summary of Post-Secondary Institutions in Atlantic Canada offering Ocean Science and Marine Disciplines.)

With such a significant community of ocean-related expertise residing in Atlantic Canada, it is not surprising that many of the regional enterprises that have already established markets in Asia, have done so via connections to universities, colleges, and research institutes throughout the region. Consequently, at this time, the bulk of Atlantic Canadian ocean technology business in Asia remains with universities and research firms.

## **2.2 DEFENCE AND SECURITY**

Atlantic Canada is home to a dynamic aerospace, defence, and security industry that supports the regional presence of the Canadian Coast Guard (16 large vessels; 25 search and rescue and other small vessels), the Royal Canadian Navy's Atlantic Fleet (18 warships; additional auxiliary vessels), and Canada's largest military-industrial complex. The region has enjoyed a long history of activity in the marine industry, with early and notable presence in naval, marine transportation, and fishing industries. Atlantic



Canadian companies are world leaders in fields such as hull design, system electronics, sonar technologies, and computer-aided manufacturing. Particular industry key competency areas include the following:

- Sonar systems;
- Training and simulation products and services;
- Combat systems integration;
- Advanced surveillance and mapping systems;
- Integrated logistics support systems; and
- A variety of maintenance and fabrication capabilities in direct support of the Royal Canadian Navy fleet.

Ocean technology is dominated by centres of excellence at large multinational defence companies such as Lockheed Martin, L-3 Communications, General Dynamics, and Ultra Electronics Maritime Systems. Most of these centres are based in Halifax, Nova Scotia. In addition, many of the region's small and medium-sized enterprises provide subsystems, components and consulting services to the Royal Canadian Navy directly and also indirectly through large multinational companies.

### *Regional Capability*

Recently, Irving Shipbuilding Inc. (ISI) was selected as prime contractor for Canada's new arctic/offshore patrol ships and surface combatant vessels. This series of projects is valued at more than \$25B and is expected to revitalize and grow the shipbuilding and associated defence and security industry in Atlantic Canada over an estimated 30-year period. In preparation for these shipbuilding contracts, ISI and the Province of Nova Scotia have invested heavily in shipyard upgrades and workforce development to recruit, develop, and retain a highly skilled labour force. Other activities aim to strengthen Canada's marine industry as a whole through a series of government-mandated programs. Canada's National Shipbuilding Procurement Strategy is a long-term strategic sourcing arrangement in which selected suppliers must make commitments to regional and industry development with a focus on investment in people (i.e., workforce development), innovation, and commercialization. The overarching objective of these value proposition activities and government-mandated programs is the development of a robust industry that can compete at the regional, national, and global levels, and that includes prime contractors, suppliers, and offshoot marine technology clusters that will endure and thrive beyond the scope of the government contract.

## 2.3 MARINE TRANSPORTATION

Marine transportation has long been a major economic activity in Atlantic Canada. Offering North America's most easterly ports and access via road and rail throughout the continent, Atlantic Canada's ice-free deep-water ports have grown their capacity to support international trade, ferry and cruise ship traffic, and other ocean uses.

The Port of Saint John, New Brunswick, which is home to Canada's largest East Coast oil refinery, has infrastructure and expertise in oil and liquid natural gas terminals and operations, in addition to a full range of cargo-handling and passenger-handling facilities.

Built around the world's second-largest natural harbour, the Port of Halifax has been home to the Royal Canadian Navy's Atlantic Fleet for over 100 years and offers the deepest berths on the East Coast of North America. With two fully modern container terminals, on-dock direct-to-rail discharge, and facilities designed for bulk, break bulk, RORO, and project cargo, the Port of Halifax offers reliable and efficient service to the world's leading shipping lines.

Associated with these commercial ports and the many smaller ports and ferry terminals throughout Atlantic Canada, local companies and authorities have developed the full range of capabilities and services needed to support Canada's commercial fleet and shipment and trans-shipment of commodities and goods, as well as the country's Atlantic offshore energy industry.

### *Regional Capability*

The ports of Charlottetown, Corner Brook, Halifax, Saint John, Saint John's, and Sydney now host cruise ships through the summer months with Halifax alone receiving upward of 200,000<sup>9</sup> visits each year. The management of provisioning, power and fuel, security, and tourism activities for these vessels has become a significant business in the region and is a potentially exportable expertise.

CARIS, which was originally a spin-off from the Department of Survey Engineering at the University of New Brunswick, has become the global standard for software to produce marine charts—the maps used by mariners to navigate. CARIS is a leading developer of geospatial software designed for the hydrographic and marine communities, and its software products are used in all of the major government hydrographic offices around the globe.

Companies like Virtual Marine Technology (a spin-off from Memorial University of Newfoundland) and Bluedrop Performance Learning are establishing domestic and international markets for marine simulators and trainers both for navy and civilian use.

## 2.4 ENERGY

Atlantic Canada has significant offshore oil and gas reserves and production platforms that make this region an important source of energy for Canada and world markets. Energy exploration and production industries have contributed to the creation of Atlantic Canadian companies and the establishment of significant international branch operations with experience in all aspects of offshore oil and gas exploration and production. Some of these companies provide logistics and support services (such as chartering offshore support vessels and providing food and supplies) that are of regional importance, but that are not highly differentiated and would likely not be exportable. Other supplies and services are highly specialized and are globally well differentiated. These offer excellent potential for exports to Asian markets.

### *Regional Capability*

Atlantic Canadian industries have developed strengths in offshore structural design for harsh environments, offshore ice management, radar surface imaging, site-specific marine weather forecasting, offshore structure inspection, and tidal energy. Much of

this expertise is centred in Newfoundland and Labrador. The Newfoundland Offshore Industry Association, for example, has over 600 members and is the largest offshore oil and gas trade association in Canada. Companies in Nova Scotia, meanwhile, have been involved in coastal and offshore energy projects for decades. The province is also becoming a global leader in the tidal energy industry, with the Fundy Ocean Research Center for Energy (FORCE) being Canada's test centre for tidal energy technology.

## 2.5 OCEAN OBSERVATION AND ENVIRONMENTAL MONITORING

Ocean science and observation technology companies develop and produce goods and services that focus on ocean measurements including acoustic, optical, and chemical sensing of aquatic environments. Companies in Atlantic Canada are among the world leaders in these technologies, and the region also specializes in marine mapping and geophysical investigations, as well as ocean modelling and forecasting. Consulting companies in Atlantic Canada provide specialized expertise in coastal zone planning and environmental response.

Ocean technology firms in the region are already heavily dependent on exports, the majority of which have traditionally gone to the US and Western Europe. Latin America and Asia have been less well developed as export markets. At least 10 companies (Ultra Electronics, General Dynamics Canada, Kraken Sonar, Ocean Sonics, GeoSpectrum Technologies, JASCO, Omnitech, Turbulent Research, MetOcean Data Systems, and Xeos Technologies) currently manufacture underwater acoustic sensing products, and the region is well known internationally as a centre of excellence in this field. The origin of this expertise can often be traced directly or indirectly to the historical presence of the Royal Canadian Navy in the region and its traditional role as a world leader in anti-submarine warfare.

### *Regional Capability*

Atlantic Canada is home to a number of companies that use optics to visualize and measure the ocean (e.g., Sea-Bird Scientific/Satlantic, Welaptega Marine Limited, SubC Imaging), many of which have found viable markets in pure research as well as in the offshore oil and gas industry. The origin of much of this technology can be traced to the strong ocean research universities in the region, such as Dalhousie University (Halifax, Nova Scotia) and Memorial University (St. John's, Newfoundland and Labrador).

Rolls-Royce Canada-Naval Marine (formerly Brooke Ocean Technologies, a spin-off from Bedford Institute of Oceanography), for example, manufactures the SeaCycler under licence from Fisheries and Oceans Canada. The SeaCycler is a large automatic profiling system capable of long term monitoring of the ocean in remote locations. It has been successfully deployed both in Canada and in the US and could also be used by researchers in Asia.

Hawboldt Industries (Chester, Nova Scotia) designs and manufactures complex winches and handling systems used to deploy and recover remotely operated and fully autonomous marine research vehicles from large vessels. Hawboldt has recently been selected to supply such systems to the new science vessels being built at Seaspan's

Vancouver Shipyards for Fisheries and Oceans Canada. More interestingly, Hawboldt has translated that contract into a similar large contract to supply research winches for four new vessels being constructed for the Government of China.<sup>10</sup> In 2015, approximately 30% of Hawboldt Industries' business will come from this Chinese contract.

## 2.6 ANALYSIS OF ATLANTIC CANADA'S OCEAN TECHNOLOGY SECTOR

### *Strengths*

Strengths are positive attributes of the sector that give competitive advantage. Many of the identified strengths are inherent in the industry and are not unique to Asian exports.

1. Atlantic Canada is home to a significant cluster of globally competitive ocean technology firms with particular strengths in sensor design and manufacturing (acoustic, optical, and chemical), marine mapping, naval systems integration, and oil and gas services. While many companies in the sector are small and medium-sized enterprises (SMEs), they have unique product and service offerings that are proven in other export markets. This is a mature, well-established industry in Atlantic Canada with established supply chains for materials, parts, and components.
2. Atlantic Canadian ocean technology companies have local access to world-class ocean research institutes such as BIO (Bedford Institute of Oceanography), DRDC (Defence Research and Development Canada), and the NRC (National Research Council Canada) as well as universities such as Dalhousie, the University of New Brunswick, and the Memorial University of Newfoundland that provide well-educated staff, intellectual property, testing and prototyping facilities, and a "first customer" for new products.
3. Atlantic Canadian ocean technology companies can and do access government support programs both for product R&D and for export development through a variety of programs. These include Industrial Research Assistance Program (IRAP), Scientific Research and Experimental Development (SR&ED), Atlantic Canada Opportunities Agency (ACOA), Atlantic Innovation Fund (AIF) & Business Development Program (BDP), Economic Development Canada (EDC), the Canadian Trade Commissioner Service, Canadian Commercial Corporation (CCC), and provincial marketing supports. Since the ocean sector is identified as a key economic driver of the Atlantic Canadian economy, such support is well organized and readily available in this particular industry.
4. The region is home to a highly educated workforce. Atlantic Canada boasts a higher per capita number of students than any other region in Canada. Well-established post-secondary institutions offer a variety of diploma and degree offering ocean and marine related programs. Nova Scotia alone has one of the highest concentrations in the world of PhDs in ocean related disciplines.

5. The cost of living is relatively low in Atlantic Canada, as is the cost of labour, particularly for engineering and management personnel. These workforce realities make the region well suited for SME growth and can provide a pricing advantage when exporting outside of Canada. A low Canadian dollar against the US dollar provides competitive advantage against key US competitors in Asian markets. Trade in ocean technology internationally is contracted in US dollars, and as a result, the reduced cost of labour from a declining Canadian dollar makes regionally based production more cost competitive.

### Weaknesses

A weakness is a feature that results in competitive disadvantage. Some of the identified weaknesses apply to all export markets; others are specific to Asian exports.

1. Asia is a long way from Atlantic Canada. This results in challenges in communicating across time zones, high transportation costs, and significant travel costs for business development and services. Asia itself covers a large geographic area, so that business travel between Asian customers can be expensive and time consuming for SMEs. This is in direct contrast to American and Western European markets where significant numbers of customers are physically clustered within an hour's flying time of each other, and where air travel costs are relatively low because of competitive pressures.
2. There is a general lack of awareness and understanding of Asian markets. While this is something of a circular problem, Atlantic Canadian ocean technology firms have a deep understanding of markets in the US and Western Europe, having exported to these regions for many years. They lack this understanding of Asian markets, and will invest the time to understand them only if it makes business sense for their smaller enterprises. Demographically, Atlantic Canada is much less multicultural than other parts of Canada, which means that there are fewer people living and working in the region who can provide this expertise. Hawboldt is an example of a company that has gone out of its way to hire Asians as part of its business development team in Atlantic Canada. They report that this has been a key asset in developing Asian business.
3. Language, culture, political and legal differences present practical challenges for SMEs interested in doing business in Asian markets. Atlantic Canadian ocean technology firms conduct nearly all of their business in Western economies similar to the domestic Canadian market. Many of these firms are not large enough to manage foreign business transactions of a very different form than what they are used to, or do not possess the cultural or legal expertise to navigate these complex transactions. Many local SMEs have "right size" capacity to meet their present workplace obligations, and the cost of the additional resources that would be required to manage these cultural and legal differences may outweigh the potential benefit to the company.

4. Defence and security products represent 30%–40% of overall sales by Atlantic Canadian ocean technology companies. This makes China, Asia's largest market for ocean technology products, very challenging (or unavailable) market because of Canadian export controls. Even if a product is intended for civilian use only, small parts of that product originating in the US (e.g., an integrated circuit or electronics module) may make it illegal to export the complete product beyond Canada to selected countries including China.
5. While the region is home to a highly educated population the ocean technology sector is still in need of more qualified personnel and better access to capital. There is a need for improved expertise in the areas of management, marketing and sales. Protection of intellectual property and business knowledge of government programs are generally weak. These all impede the sector's ability to advance from research to commercialization.

## 3 ASIAN MARKETS ANALYSIS: DRIVING DEMAND FOR OCEAN TECHNOLOGIES

### 3.1 INDUSTRY

Demand for Atlantic Canadian ocean technologies in Asian markets are largely driven by factors relating to Asia's vast coastlines and ocean resources, the rapid growth of its large national economies, and regional tensions and disputes that influence political and economic markets. Although demand follows the traditional categories of defence and security, energy, transportation, food, and tourism, four related factors appear prominent in Asia regarding these markets:

- Increasing demand arising from territorial disputes and tensions;
- Increasing demand for technologies for energy exploration and production;
- Increasing demand for technologies for ocean observation and environmental monitoring and remediation; and
- Increasing demand for marine transportation.

The maturity level of country-specific markets in Asia and the corresponding domestic capacities to satisfy ocean technology demand vary significantly. While technologies in certain countries, including Japan and South Korea, are highly developed and sometimes world-leading, other countries' technologies are still immature. A recent study estimates that China's ocean technology development may be as much as 10 years behind developed countries, especially in exploration and engineering.<sup>11</sup> This market diversity highlights the need to look at specific markets within Asia rather than looking at the region as a monolithic bloc.

Similarly, the needs and domestic capabilities of countries in Asia are not homogeneous, and the degree of regulation and market access varies widely. At present, many Atlantic Canadian ocean technology companies focus on Singapore as a centre for representation in Asian markets, as well as a centre for product maintenance and support. This is primarily due to Singapore's status as a free trade zone so that it functions primarily as a hub for re-export from North America and Europe to other Asian countries. Additionally, Singapore possesses a well-trained workforce and one of the most well-developed IT systems in the world,<sup>12</sup> competencies that expedite the flow of communication and trade agreements, making it a business friendly port. Finally, Singapore operates with a British legal system that facilitates contract enforcement.

#### *Demand for Technologies That Address Defence and Security*

The South China Sea is an area of significant tension among Asian countries regarding territorial sovereignty claims and maritime rights, including sovereignty over the Paracel Islands (claimed by China and Vietnam), Spratly Islands (claimed by China, the Philippines, and Vietnam), and other islands and shoals. In total, disputes in this region involve Brunei, Cambodia, China, Indonesia, Malaysia, the Philippines, Singapore, Taiwan, Vietnam, and the US. In addition to the importance of the South China Sea region to international marine transportation, the disputed territories contain significant fisheries and energy resources, including oil and gas reserves and production platforms.



Additional territorial disputes in the East China Sea include China, Japan, North Korea, and South Korea and, similarly, involve rich fishing grounds and energy deposits, in addition to strategic and marine transportation interests.

While most countries have indicated a desire for peaceful resolution of conflicts, North Korea is not among them. Tensions reached a peak in March 2010 when South Korea accused North Korea of sinking one of its warships, killing 46 navy personnel and injuring more than 50 others. A South Korean-led investigation attributed the cause of the incident to a North Korean torpedo, but North Korea denied involvement. North Korea is believed to have invested heavily in submarine development. This has resulted in a parallel increase in the demand for antisubmarine warfare technologies from neighbouring countries.

In addition, the Strait of Malacca and the adjacent Singapore Strait are some of the world's busiest and most strategic transit areas for marine transportation. In spite of increased naval presence by Singapore, Malaysia, and Indonesia, these areas and others remain vulnerable to marine piracy. As a result, bordering countries must continue spending to support and enhance detection and deterrence programs and technologies.

The competing security and economic interests of nations involved in these disputes and the need to combat organized crime have led to increased naval presence and demand for surface and subsurface manned and unmanned vehicles, together with sophisticated monitoring and detection systems. South Korea, Japan, Malaysia Taiwan, and Singapore, as close allies of Canada, have all looked to Atlantic Canadian suppliers for the supply of military ocean technology equipment. The market with the largest potential may be India, one of the world's largest weapons importer, which recently approved expenditures of US\$16B to construct advanced surface and subsurface combatants.<sup>13</sup> Companies associated with naval vessel supply chains may have opportunities to participate in these Indian projects, and Atlantic Canada's recent experience in preparing to revitalize its domestic warship building capacity may help in that regard.

Canadian controlled goods regulations and a practical need to comply with American arms trafficking regulations, however, tightly control the supply of military technologies and dual-use technologies.

### *Demand for Technologies That Address Marine Transportation*

Asian actors dominate the global marine transportation sector, including commercial shipbuilding, port and harbour construction, and the support services associated with the movement of goods by sea. All of the largest shipyards in the world are in Japan, South Korea, and China.<sup>14</sup> Nine out of ten of the world's largest container ports are in Asia,<sup>15</sup> and China continues to expand its ports at an unprecedented rate, adding 440 new deep-water berths by the end of 2015.

Canada's marine transportation industry is very small by any comparison with Asia. Atlantic Canada does, however, have specialized expertise, often in the form of consulting services, which can provide value in Asia. For example, Hammurabi Marine Consulting provides highly specialized expertise relating to marine regulation, navigation, and marine search and rescue.<sup>16</sup> This company continues to be very successful exporting its services to Taiwan, Singapore, Malaysia, and other countries in Asia.

The source of much of this intellectual property is the Canadian Coast Guard College in Sydney, Nova Scotia, where Jack Gallagher, Hammurabi's owner, taught for many years. Hammurabi continues to work with other companies in Atlantic Canada, including Martec/Lloyd's Register and Virtual Marine Technology, to satisfy its Asian clients' needs. Similar opportunities exist for other companies in Atlantic Canada that can provide government services and equipment to Asia markets in the fields of navigation and certification.

Small consulting firms like Hammurabi can often provide the lead-in for other firms in Atlantic Canada by identifying opportunities for additional business. It therefore becomes useful to support such consulting contracts to build more business opportunities for the region as a whole.

### *Demand for Technologies That Address Energy*

The Asian offshore energy industry is forecasted to represent about 18% of total global expenditures between 2015 and 2019, with Malaysia, Indonesia, and Brunei continuing to be the largest regional players.<sup>17</sup> Much of the offshore reserves in these countries are in shallow water close to shore with low production costs, making their development less sensitive to low oil prices than those in the North Sea, Gulf of Mexico, or Brazilian or Canadian waters.

Liquid natural gas makes up the larger segment of offshore developments in Asia, with China being the largest consumer of that commodity. Active land-based shale gas developments in China may suppress demand in these markets. China itself continues to develop offshore oil and gas reserves in the South China Sea; however, many of these developments are in regions that are politically claimed by other nations.

Atlantic Canadian firms have supplied equipment to companies servicing oil and gas exploration activities in Asia (e.g., seismic equipment from GeoSpectrum Technologies to service operators in Singapore, and environmental monitoring and forecasting services provided by Amec Foster Wheeler via its Singapore offices). Frequently, however, these sales are made to European or North American service providers who then deploy the equipment in Asian waters. China's ocean research institutes are often involved in field characterization of oil and gas reserves in China's coastal waters, and so some demand from those customers is driven by energy strategy in the region.

### *Demand for Technologies That Address Ocean Observation and Environmental Monitoring*

China's economic growth has elevated the importance of its ocean sector with two key drivers: the demand for energy and for defence and security. But as the economies of China and surrounding countries mature and their respective middle classes grow, so too grows public awareness of the environmental impact of rapid development and the concomitant effect of pollution on the lives and lifestyles of those citizens. This presents marine pollution mitigation and remediation as an emerging driver for ocean technology demand in Asia.

Overfishing, pollution from industrial run-off, destruction of habitat due to coastal land reclamation, and pollution from ships and oil and gas platforms have all been identified by the Chinese government as areas of domestic concern. Similarly, APEC (Asia-Pacific

Economic Cooperation) has indicated that the main threats to the sustainability of ocean and coastal resources in the region include pollution, invasive species, loss of marine biodiversity and habitats, unsustainable fishing and decline of marine resources, climate change, and ocean acidification.<sup>18</sup>

As an example of countries’ responses to these concerns, the Government of China is expected to continue allocating resources to ocean research and data collection, and to focus its efforts on three provinces: Shandong, Zhejiang, and Guangdong. The largest ocean research institutions in these provinces are expanding rapidly and, as a result, are purchasing significant quantities of oceanographic equipment from Western countries to accelerate their science activities. This build-up represents an excellent opportunity for Atlantic Canadian firms to gain new customers and to expand sales to existing customers in the region.

### 3.2 OCEAN RESEARCH ACTIVITIES AND ORGANIZATIONS IN SELECTED ASIAN COUNTRIES

Many Atlantic Canadian ocean technology companies provide equipment in support of ocean observation and ocean research. As a result, an active ocean research agenda in a particular country bodes well for exports from Atlantic Canada to that country.

The following is a summary of the key ocean technology trade activities and potential for trade in the six key Asian countries. Assessment of this potential, and the selection of these core competencies, was determined by historical knowledge of previous sales and through personal contacts and experience of senior staff at the Institute for Ocean Research Enterprise (IORE). In cases where there are no prospects in a given country for a particular core competency, the barriers are discussed elsewhere in the text of this report.

**Table 1: Summary of present and predicted trade activity between Atlantic Canada and six key Asian markets** (√: present or previous trades; x: no prospects for trades/significant barriers to trades; Δ: no present or previous trades, but potential for future trades—barriers have been/are being reduced, and demand is increasing)

Core Competencies	Taiwan	China	India	Singapore	Korea	Malaysia	Japan
Naval Sonar	√	x	Δ	Δ	√	Δ	x
Civilian Acoustics	√	√	√	√	√	√	x
Winches & LRS (launch and recovery systems)	√	√	x	x	Δ	Δ	√
Other Ocean Sensors	√	√	√	√	√	√	√
Training, Simulation & Consulting	√	√	√	√	√	√	x

Source: Data in this table reflect the opinion of a senior industry expert as well as validated data from the Ocean Technology Council of Nova Scotia (OTCNS, May 2015), and A Cluster Case Study from Newfoundland and Labrador: Opportunities and Lessons Learned (Hogan, September 2014).

### *Regional Capability: China*

The Chinese government continues to invest heavily in ocean research. Traditionally, this research has been mostly focused on the State Oceanic Administration (SOA) and its three Oceanographic Institutes in Qingdao in Shandong Province, Hanzhou in Zhejiang Province, and Xiamen in Fujian Province. SOA is roughly equivalent to the Science Branch of Fisheries and Oceans Canada or to the oceans branch of NOAA in the US. More recently, the Chinese government has funded the development of new ocean research and technology parks (cities) in each of these regions. The most ambitious of these is in Qingdao, where municipal, provincial, and national governments are combining to build the Blue Silicon Valley about 15 km from the existing city. A new campus of the Ocean University of China, part of the University of Shandong, is being built in this location, and it will eventually house 1,000 ocean researchers. Qingdao aspires to be a global centre of excellence in ocean science and technology on par with Woods Hole Oceanographic Institution, Scripps Research Institute, and the National Oceanography Centre in the UK. Significant amounts of oceanographic equipment will be purchased from foreign sources as this facility is made operational.

While the Chinese navy clearly has its own research institutes, these are not available markets for Canadian companies.

### *Regional Capability: Republic of Korea*

The key national ocean research organization in South Korea is the Korean Institute of Ocean Science and Technology (KIOST), formerly known as the Korean Ocean Research and Development Institute (KORDI). KIOST is based in Ansan and operates six research facilities throughout the country. Much of KIOST's focus has been on marine geology, with a particular focus on deep-sea mineral exploration. Recently, there has been a move to broaden the organization's research agenda and to open up research vessel access to Korean university researchers.<sup>19</sup> In addition, the Korean military research organization, the Agency for Defense Development (ADD) conducts naval research and has purchased equipment from Atlantic Canadian ocean technology firms. The Korea Maritime and Ocean University and Seoul National University are two of the top educational institutions for the training of ocean engineers and naval architects, reflecting Korea's position as the world's largest builder of ships.

### *Regional Capability: Japan*

Japan's key national agency responsible for ocean science and technology is JAMSTEC—the Japan Agency for Marine-Earth Science and Technology. JAMSTEC operates from six sites throughout Japan and employs more than 1,000 staff. JAMSTEC also operates a fleet of eight large research vessels, the latest of which was launched in June of 2015. JAMSTEC has a particular focus on marine geology and on fisheries biology, both areas of national interest to Japan.

In addition, the Japan Maritime Self-Defense Force operates four research vessels, and the Antarctic support vessel Shirase. As well, Japan's large universities include Tokyo University of Marine Science and Technology and the Ocean Research Institute of the University of Tokyo.

There is a large indigenous Japanese oceanographic equipment manufacturing sector, so much of the equipment used by the Japanese Agency for Marine-Earth Science and Technology (JAMSTEC) is domestically designed and manufactured (e.g., Tsurumi-Seiki Co., Ltd (TSK), JFE Advantech, SGK Gikin, NiGK Ocean). There continue to be opportunities for Atlantic Canadian ocean instrumentation companies to sell specialized products in Japan on a case-by-case basis. For Canadian ocean technology products that incorporate regulated devices such as radios, certification barriers remain an issue in Japan.

### *Regional Capability: Singapore*

Singapore, being a city-state whose economy is entirely dependent on its strategic location on the Singapore Strait, has a number of research and education programs focused on ocean matters. These include the Singapore Maritime Institute, for the training of marine engineers and research in ship construction and operation, as well as the Tropical Marine Science Institute of the National University of Singapore, which focuses on ocean science. As well, the Maritime and Port Authority of Singapore has an in-house R&D organization focusing on clean energy and environment, port operations technology and maritime telecommunications technology. As mentioned previously, Singapore also serves as a trading hub for the import and servicing of ocean technology products for the entire region.

### *Regional Capability: India*

The National Institute of Oceanography (NIO) employs over 500 staff, 80% of whom are based at NIO's headquarters in Goa. NIO also operates regional research centres in Kochi, Mumbai, and Visakhapatnam. NIO's fleet includes three mid-sized research vessels.

The Indian Navy operates research facilities under the Naval Research Board, part of the Defence R&D Organization (DRDO). In January 2011, the National Institute for R&D in Defence Shipbuilding was opening in Kerala under the auspices of DRDO. Several dozen Indian universities offer programs in ocean-related topics; however, most large equipment purchases are made by NIO.

### *Regional Capability: Taiwan*

Taiwan's primary ocean research agency is the Taiwan Ocean Research Institute, one of the National Applied Research Laboratories of the Ministry of Science and Technology. This institute operates a network of coastal radar sites that provide real-time ocean current information. They also own and deploy ocean bottom seismometers for monitoring subocean earthquakes. In late 2015, their premier research vessel, RV Ocean Researcher 5, sank during a storm in the South China Sea with the loss of two lives. This vessel has not yet been replaced, but likely will. This may provide an equipment sale opportunity for Atlantic Canadian firms.

National Taiwan Ocean University provides professional and scientific training to about 8,500 students at their campus in Zhongzheng. Programs include transportation management, marine biology, marine engineering, and marine law. The university operates a mid-sized research vessel and conducts coastal research.

In addition, Taiwan Power Company, the state-owned electric utility, conducts coastal environmental monitoring around the sites of their various power plants and regularly purchases oceanographic equipment from a variety of foreign suppliers.

The Republic of China Navy operates a fleet of frigates and submarines, mostly purchased from the US under the Foreign Military Sales program or from France or the Netherlands. Taiwan is currently planning to build submarines at its own shipyards, but has struggled to find design partners because of pressure on third-party countries by the mainland Chinese government.

Generally, significant sales of Canadian defence products to Taiwan are politically complex because of concerns about negative reactions from the People's Republic of China.

## 4 MARKET OPPORTUNITIES AND ASSOCIATED CHALLENGES

The following section of this report provides a PEST analysis (Political and Legal, Economic, Socio-Demographic, and Technological) of the market for Atlantic Canadian ocean technology products and services in Asia. This analysis is informed by previous studies and reports, by economic statistics, and by a series of eleven interviews conducted with senior managers and owners of ocean technology companies in Atlantic Canada.<sup>20</sup>

### 4.1 ANALYSIS OF THE OCEAN TECHNOLOGY SECTOR IN ASIA

#### *Political and Legal*

- The focus of the Chinese government is on their ocean economy and ecology. The current Chinese Five-Year Plan outlines specific plans to build a “New China Marine Economy.” While the current Five-Year Plan also seeks to transition from a “made in China” economy to a “designed in China” economy, the design and development of domestic ocean technology products is not likely to be a high priority for the Chinese government since this is very much a low-volume specialty market. As a result, Chinese research institutions, particularly the large ones in Shandong, Zhejiang, and Guangdong provinces, will likely buy significant quantities of foreign-supplied ocean measurement equipment rather than designing their own in the short and medium term.
- China also publishes a Long Term Plan for the Development of Science and has identified technological independence as a key thrust in the move toward “designed in China” rather than just “made in China.” China has identified ocean technology as an area of focus, and so this underpins the move to develop China’s ocean resources for food and energy.
- Tensions in the South China Sea, between North and South Korea, and in transportation choke points like the Strait of Malacca will continue to drive increases in naval systems sales throughout Asia. Since Atlantic Canadian ocean technology firms supply world-leading naval system equipment including anti-submarine sonar, they are poised to gain more business in this region. While not able to export such equipment to China, proven export markets have been found in South Korea, Malaysia, India, and Singapore, among others. Atlantic Canadian firms do figure in these markets in their calculations of future sales forecasts.
- Singapore will continue to play a role as a trading and support hub for both oil and gas and marine transportation. Because of its Western-style legal system, strategic location, very well-trained workforce, and very progressive free-trade policies, Singapore continues to be a hub for ocean technology business. Atlantic Canadian firms currently supplying to the oil and gas sector can take advantage of existing commercial relationships they have already established with similar energy hub cities like Aberdeen, Scotland, and Stavanger, Norway, to extend into Asian markets via Singapore.



- A number of smaller Asian countries (e.g., Vietnam and Myanmar) have recently become somewhat more stable and open to Western business that will support growth of their own ocean economies. While still small markets, these countries were specifically mentioned as potentially of interest by several of the interviewed companies.
- Protecting intellectual property rights in China is still challenging. While improving, China's record on protection of IP remains poor, and the ability of small ocean technology companies to pursue IP infringement remedies in a Chinese court is extremely limited.
- India, while a large and growing ocean technology user, has never managed to rationalize the very slow, complex nature of its government procurement. Atlantic Canadian ocean technology firms remain interested in investing in Indian government procurements, but are wary of over-investing.
- More recently, in order to limit its foreign spending on defence technology, India has put in place quite stringent inward technology transfer requirements on all major capital purchases, to support knowledge transfer and capability development among regional participants. This could pose a challenge for both small and large Atlantic Canadian ocean technology firms bidding into the supply chains for Indian programs.
- Non-tariff barriers remain in Japan. For example, non-standard radio spectrum rules prevent ocean technology products that incorporate a radio transmitter from being imported to Japan without extensive and costly modification and testing.

### Economic

The recent opening of Chinese Central Bank offices in Canada will make trade with Chinese customers easier.<sup>21</sup> Traditionally, Atlantic Canadian firms have transacted business in China by way of irrevocable letter of credit drawn on the Bank of China in New York via a corresponding Canadian or US bank. Such transactions have traditionally been in US dollars. This has the disadvantage of incurring double bank transaction fees, and the buying Chinese customer will sometime incur up to a 100% domestic tax as a disincentive to spending US dollars internationally. The new Bank of China offices in Canada will allow Canadian companies to transact business more easily in Chinese currency, making their landed-in-China pricing more competitive.

Return on marketing investment, both time and direct costs, can be difficult to predict. Smaller companies entering Asian markets for the first time may have to spend years developing productive relationships before seeing any revenue. It is critical for these companies to be selective in their pursuits and to leverage their expenditures in every way possible through use of good distribution, through teaming with other companies, and by accessing government support where available. First mover advantage may not always be an advantage in Asian markets.

### *Socio-Demographic*

The growth of a sizeable and educated middle class, in India and China, in particular, has come with a parallel increase in awareness and attention to ecological issues within those countries. This presents opportunities for technologies and services relating to marine environmental monitoring and remediation.

Cultural norms relating to innovation versus replication of technology limit the effectiveness of regulations and restrictions relating to intellectual property, which can temper interest in partnerships in Asia.

### *Technological*

Markets and suppliers in Asia have shown more interest in commercial products than in niche products related to ocean research that have limited scalability and opportunities for commercialization. This provides some comfort to Atlantic Canadian ocean technology firms, as it seems likely that Asian customers will continue to buy rather than make their ocean instruments.

## 5 SUMMARY OF KEY FINDINGS

1. Asia is currently a very small market for Atlantic Canadian ocean technology firms, representing no more than 4% or 5% of overall sales for the sector.
2. Because of distances, cultural differences, and business structures, business development costs can be high and provide uncertain returns. Atlantic Canadian ocean technology firms need to develop careful market penetration strategies that highly leverage their business development expenditures and focus their efforts on truly viable market opportunities.
3. Because of the over-weighting of defence and security products in the Atlantic Canadian ocean technology industry, coupled with the over-weighting of China (a mostly inaccessible market for defence firms) as a market in Asia, there may be a mismatch for this sector, and the opportunity could be overstated.
4. India remains a promising, but as yet mostly unfulfilled, market for Atlantic Canadian ocean technology firms. Complex procurement processes and a trend toward inward technology transfer are challenges.
5. Continuing naval tensions in the region, combined with robust economies, provides opportunities for naval system exports to South Korea, Japan, Malaysia, and Singapore.
6. The increased focus on the ocean economy and on ocean ecology by the Chinese government represents a significant civilian product export opportunity for Atlantic Canadian ocean technology firms. Appropriate in-country representation is critical in accessing this market. Adding Chinese-speaking business development professionals to the staff of Atlantic Canadian firms will help to develop this market. In this regard, it may be valuable to discuss possibilities of expanding shore-based technologies of Atlantic companies already in China, such as Phase Separation Solutions, to include marine-based remediation and/or protection.

## 6 OPPORTUNITIES TO ACCELERATE GROWTH

Atlantic Canadian ocean technology firms can benefit from support from efforts from federal and provincial governments, and from steps taken by industry itself. Below are a number of initiatives that, if implemented, could help grow this sector's presence within Asian markets.

- Companies would benefit from clear market intelligence that objectively assesses the costs and benefits of Asian business opportunities. While the Trade Commissioner Service generally provides excellent advice, trade commissioners do not always have specialized knowledge of niche markets like ocean technology. In such cases, private-sector experts, in cooperation with ocean technology trade associations, could help perform in-depth market analysis.
- Technology demonstrations are a standard part of sales in Asian markets. Canadian naval systems companies have sometimes been disadvantaged in Asian sales by not having sufficient support from the Canadian Department of National Defence for on-ship demonstrations of installed equipment. Such support is readily available to European competitors from their various navies. Facilitating visits by customers from allied Asian countries to Canadian warships to see Canadian technology installed and working could help relieve this disadvantage. This could be done during foreign port calls by Canadian ships or by facilitating visits to Canadian naval bases.
- Governments can help open doors of government buyers and influencers in Asia. This is particularly true in centrally controlled economies like China, where a visiting business delegation led by a government representative will often get a better reception than a pure business delegation.
- Ocean technology companies would benefit from financial and organizational assistance to facilitate business development travel to Asia, including to significant sector trade shows and conferences, such as Oceanology Asia. Such support could also extend to funding and providing organizational assistance for incoming qualified Asian customer visits to Atlantic Canada.
- Smaller firms would benefit from formal and informal training and mentoring in Asian business development. Larger or more experienced firms could act as the mentors facilitated through networking events or workshops.
- The sector would benefit from better vetting Canadian companies that engage in sales missions. This could include a requirement for substantially Atlantic Canadian content and agency. Indicating to Asian buyers that the companies in a delegation have passed some sort of Canadian government evaluation could prove valuable for fostering trust and relationships on which sales depend.

- Businesses interested and capable of expanding into Asian markets could benefit from hiring in-house business development and customer support staff who speak the language(s) and know local Asian business customs of matching target markets.
- Businesses could benefit from considering a more formal means of “cross-marketing” their non-competing products so that they can share some of the high costs of early stage business development in Asia.

## APPENDIX A: SUMMARY OF PUBLIC SECTOR RESEARCH INSTITUTIONS IN ATLANTIC CANADA

### **Bedford Institute of Oceanography** (*Dartmouth, NS*)

BIO is Canada's largest centre for ocean research and was the first major national centre devoted to oceanography. The institute supports more than 600 researchers that perform targeted research on a broad range of ocean issues such as sovereignty, safety and security, environmental protection, resource sustainability, and integrated management of coastal zones and large ocean areas. Government of Canada departments and agencies present at the Bedford Institute of Oceanography include the following:

- *Canadian Coast Guard*—owner and operator of the Government of Canada's civilian fleet, with responsibility to ensure safe and accessible waterways for Canadians, and sustainable use and development of Canada's oceans and waterways;
- *Environment Canada*—Canada's leader in environmental adaptation, pollution impact reduction, biological diversity conservation, and sustainable development support;
- *Fisheries and Oceans Canada*—a national and international leader in marine safety and the management of ocean and freshwater resources;
- *National Defence*—responsible for Canada's maritime defence and security, with surface and sub-surface capabilities throughout the Canadian and international waters of the Atlantic Ocean; and
- *Natural Resources Canada/Geological Survey of Canada-Atlantic*—Canada's premier agency for geoscientific information and research.

### **Defence Research and Development Canada-Atlantic** (*Dartmouth, NS*)

DRDC's scientific capabilities include world-leading expertise in underwater acoustics, antisubmarine warfare, mine and torpedo defence, shipboard command and control, and air and naval platform technology, in addition to expertise in dual-use ocean science and observation technologies.

### **National Research Council-Institute for Ocean Technology** (*St. John's, NL*)

NRC-IOT is an internationally recognized leader in ocean engineering that conducts research to improve the prediction of offshore system performance in marine and ice environments. Its wealth of specialized facilities includes the world's longest ice tank.

### **National Research Council-MBL** (*Halifax, NS*)

NRC-MBL is a leader in the study of harmful algal blooms and algal biofuels.

### **St. Andrews Biological Station** (*St. Andrews, NB*)

Canada's oldest permanent marine research facility and home to the Canadian Fisheries Research Network.

With more than 450 PhDs in ocean-related fields in Nova Scotia alone, Atlantic Canada has one of the highest concentrations of ocean technology researchers in the world.

## APPENDIX B: SUMMARY OF POST-SECONDARY INSTITUTIONS IN ATLANTIC CANADA OFFERING OCEAN SCIENCE AND MARINE DISCIPLINES

### **Fisheries and Marine Institute of Memorial University of Newfoundland**

*(St. John's, NL)*

The Marine Institute is Canada's leading centre of fisheries and marine training, and is made up of an elite group of public educational institutions including the Offshore Safety and Survival Centre, Centre for Marine Simulation, and Centre for Applied Ocean Technology.

### **Memorial University (St. John's, NL)**

Newfoundland and Labrador's university hosts a number of ocean-related R&D centres, including the Ocean Engineering Research Centre, Canadian Centre for Fisheries Innovation. C-CORE (Centre for Cold Ocean Resources Engineering)—a multidisciplinary R&D organization created in collaboration between Memorial University and the oil and gas industry maintains a world-leading capability in remote sensing, ice engineering, and geotechnical engineering. About 40% of total research at Memorial is ocean-related.

### **Dalhousie University (Halifax, NS)**

Atlantic Canada's largest university is one of the world's top marine science universities and a world leader in oceanographic study and research. It is home to more than 100 researchers engaged in interdisciplinary ocean research, including 13 Canada Research Chairs and the country's only Canada Excellence Research Chair dedicated to ocean science and technology, as well as the following ocean technology-based networks:

- *The Marine Environmental Observation, Prediction and Response Network (MEOPAR)*  
This network is a \$25M funded network of universities and partners working to better understand, predict, and respond to the impact of marine hazards on human activities and ecosystems.
- *The Ocean Tracking Network (OTN)*  
The Ocean Tracking Network is a \$160M funded international network building a global platform of state of the art acoustic receivers and oceanographic monitoring equipment to comprehensively examine the local-to-global movements of marine species.

### **University of New Brunswick (Fredericton, NB)**

The University of New Brunswick is the leading university in Canada in ocean surveying and ocean mapping. In addition, the University of New Brunswick has world-class expertise and facilities supporting fluid dynamics research and fish biology.

### **Nova Scotia Community College (Halifax, NS)**

In addition to its mariner training and other ocean-related programs, the Nova Scotia Community College has a new Applied Oceans Research Lab in ocean technology and an advanced diploma program in Oceans Technology. NSCC also has world-leading ocean mapping capability, including airborne LIDAR at its Centre of Geographic Sciences.



**The Canadian Coast Guard College** (*Sydney, NS*)

The Canadian Coast Guard College offers a four-year Bachelor of Technology in Nautical Sciences for all officers in the Canadian Coast Guard. In addition, it conducts specialized training and research in search and rescue, marine communications, and marine traffic management. In the past, the Coast Guard College has provided training to foreign coast guards from many countries, including countries in Asia (including Taiwan) and a number of Caribbean countries.

## APPENDIX C: INTERVIEW PROTOCOL

1. Are you currently exporting products to Asia and if so to which countries? If yes, then:
  - a. What attracts you to these markets?
  - b. Is this a significant part of your overall business?
  - c. Is it growing?
  - d. How do you sell in Asia—directly or through representatives and agents?
  - e. What are the challenges in selling in Asia?
  - f. Do you plan to invest further in developing Asian markets, and if so what sorts of things will you do to grow these markets?
2. If you do not currently export products to Asia, why not? Would you consider exporting to Asian markets in future?
3. What are the specific barriers to Asian export your company faces?
4. Are there things that you feel Canadian government agencies at all levels could do to facilitate more Asian exports from Atlantic Canada?

## APPENDIX D: COMPANIES AND INDIVIDUALS PARTICIPATING IN INTERVIEWS

**Peter Giles** | General Dynamics Canada

**Paul Yeatman** | GeoSpectrum Technologies

**Andrew Hoggarth** | CARIS

**Ken Walker** | Ultra Electronics

**Derek Inglis** | Xeos Technologies

**Richard Vallee** | VEMCO

**Desiree Stockermans** | Ocean Sonics

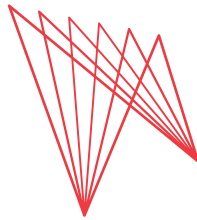
**Paul Phillips** | Hawboldt Industries

**Tony Patterson** | Virtual Marine Technology

**Jack Gallagher** | Hammurabi Marine Consulting

## APPENDIX E: NOTES

1. Institute for Ocean Research Enterprise, 1355 Oxford Street, 3 Floor, Halifax, Nova Scotia, B3H4J1.
2. Douglas-Westwood Consultants. "World subsea vessel operations market forecast." <http://www.naturalgasintel.com/articles/100145-subsea-techology-backlog-highest-in-four-years-says-fmc>.
3. In 2014, the global maritime-related market was worth GBP2T (C\$3.7T) according to a study published March 3, 2014, by the Institute of Marine Engineering, Science & Technology (IMarEST).
4. ACZISC Secretariat and Canmac Economics Ltd. February 2006. The ocean technology sector in Atlantic Canada – Volume 1: profile and impact.
5. Based on an industry profile study commissioned by the Newfoundland and Labrador Department of Innovation and published in "Oceans of Opportunity: Newfoundland and Labrador's Ocean Technology Sector Strategy," Newfoundland and Labrador Department of Innovation, Trade and Rural Development (2006).
6. See <http://www.nloceantech.ca/industry.html>.
7. Province of Nova Scotia. 2011. Defined by the sea: Nova Scotia's oceans technology sector present and future.
8. ACZISC Secretariat and Canmac Economics Ltd. 2006. The ocean technology sector in Atlantic Canada – Volume 1: profile and impact. Page 5.
9. See <http://theasiafactor.ca/ns#tourism-outer>.
10. See <http://www.cbc.ca/news/canada/nova-scotia/hawboldt-industries-in-huge-growth-mode-with-chinese-business-1.3119471>.
11. See [http://news.xinhuanet.com/english/2015-05/21/c\\_134259452.htm](http://news.xinhuanet.com/english/2015-05/21/c_134259452.htm).
12. See <http://www.prweb.com/releases/singapore/business-news/prweb10270104.htm>.
13. Deutsche Well. Naval build-up reflects India's "ambition to project power." <http://www.dw.com/en/naval-buildup-reflects-indias-ambition-to-project-power/a-18275292>.
14. See [https://en.wikipedia.org/wiki/List\\_of\\_the\\_largest\\_shipbuilding\\_companies](https://en.wikipedia.org/wiki/List_of_the_largest_shipbuilding_companies).
15. World Shipping Council statistics. (See <http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports>.)
16. See <http://www.hammurabi.ca>.
17. See <http://www.infield.com/market-forecast-reports/offshore-asia-market-report>.
18. Asia-Pacific Economic Cooperation (APEC) Ocean and Fisheries Working Group. August 2014. APEC marine sustainable development report. Page iv.
19. See <http://www.nature.com/news/south-korean-survey-ships-open-up-to-science-1.16663>.
20. Interviews were conducted by phone on May 25–26, 2015 (see Appendix C: Interview Protocol and Appendix D: Companies and Individuals Participating in Interviews, for a summary of interview questions and participants). As agreed during the interviews, individual comments or sales information are not attributed to any particular company or individual. The purpose of the interviews was not to generate statistically significant sample data but instead to identify opportunities and issues in the Asian market as seen by private sector companies in Atlantic Canada's ocean technology sector.
21. See <http://www.newswire.ca/en/story/1546365/a-decision-that-strengthens-economic-ties-between-china-and-quebec-industrial-and-commercial-bank-of-china-canada-opens-its-first-branch-in-greater-mo>.



ASIA PACIFIC  
FOUNDATION  
OF CANADA

FONDATION  
ASIE PACIFIQUE  
DU CANADA



THE ASIA FACTOR  

---

LE FACTEUR ASIE

**Asia Pacific Foundation of Canada  
Head Office**

900-675 West Hastings St.  
Vancouver, BC  
Canada V6B 1N2  
Tel: 604-684-5986  
Fax: 604-681-1370

**Asia Pacific Foundation of Canada  
Toronto Office**

205-375 University Ave.  
Toronto, ON  
Canada M5G 2J5  
Tel: 416-597-8040  
Fax: 416-597-1162