

BRITISH COLUMBIA CANADA



DYNAMIC

GROWING



OCEAN TECHNOLOGY





BRITISH COLUMBIA

A Rising Leader in Ocean Technology

From establishing one of the world's first and largest undersea digital observatories to the developing deep water submersibles and remotely-operated vehicles, British Columbia has consistently been at the forefront of developments in ocean technology — and with dynamic shipyard expansion, we continue to move forward on new commercial applications for established and leading-edge technologies.



Linked to a Maritime Economy

British Columbia has a long history of experience in shipbuilding, ocean transportation and marine engineering. Our ocean technology industry has built on that history to lead in areas such as:

- Offshore energy
- Defence and security
- Marine transportation, shipbuilding and repair
- Environmental monitoring and ocean stewardship

BRITISH COLUMBIA'S THRIVING OCEAN TECHNOLOGY SECTOR

British Columbia's maritime history, dynamic shipbuilding industry and advanced technology are the basis for a strong cluster of new technology companies and researchers. Find out how these strengths can support your business, whether you are planning to locate to British Columbia or need the products and services we have available.

Established expertise

For over 35 years, British Columbia companies have been at the leading edge of research and commercial development of advanced ocean technologies. They have successfully developed, manufactured and exported products and systems to hundreds of government and private sector customers worldwide.

World-leading research network

Universities and research organizations in British Columbia work closely with private sector companies to share knowledge from the marine technology and science community and to commercialize data and components of its advanced research. The BC Innovation Council drives economic growth by matching innovators with industry challenges in our clean tech and natural resource industry, which includes oceans.

Highly educated workforce

British Columbia's advanced education system offers world-renowned programs in ocean sciences and technology. The highly educated workforce at British Columbia's ocean technology companies provide proven and innovative solutions to the challenges of working in the ocean environment.

Diverse marine sector

The diverse marine sector in British Columbia includes shipbuilding and design, marine transportation, aquaculture and fishing, tourism and recreation, government services and defence. Ocean technology companies target export markets worldwide with their wide range of knowledge, products, services and a network of business contacts and partners.

Strong government support

The Government of British Columbia offers strong support for buyers and investors in our economy. With competitive taxes, an open economy, international trade missions, trade and investment representatives and active support in the pursuit of international trade agreements, British Columbia supports the growth of our ocean technology companies.

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Industry Profile

A COASTAL PROVINCE WITH A GROWING TECHNOLOGY SECTOR

British Columbia is a province with an extensive coastline and a rich industrial history built around ocean and marine opportunities. The ocean technology cluster in British Columbia has grown beyond its roots in industry, government research institutes and academic expertise to successfully market its innovative products and services worldwide.

Nearly 1,000 companies are active in the ocean technology sector in British Columbia. Our technology companies sell throughout the international market, working with multi-national industry, research organizations and other governments. Companies range from specialized technology developers to project integrators. Their capabilities include sophisticated navigation and undersea rescue systems, sensors, remote operated vehicles and security technologies. They are complemented by companies with expertise in data management, integration and communications.

The health and vigour of the industry is supported by several public universities, regional universities, colleges and technical training institutes with specialty programs in the fields of ocean science and marine technology. In addition, several government research facilities and associations focus on the ocean and marine sector.

British Columbia ocean technology includes:

- **Ship design, building and repair** — advanced software, engineering, logistics and techniques to fabricate, repair and refurbish coastal and ocean-going ships
- **Acoustics systems and equipment** — equipment and systems that use sound underwater, such as sonars, echo sounders, data acquisition and processing systems
- **Marine security** — ocean technology products or services for the naval market, such as antisubmarine warfare, military underwater vehicles, stealth buoys and surveillance systems

BRITISH COLUMBIA IS A COASTAL PROVINCE WITH AN EXTENSIVE COASTLINE AND A RICH INDUSTRIAL HISTORY BUILT AROUND OCEAN AND MARINE OPPORTUNITIES.

- **Imaging oceans technology** — remote sensing equipment for ocean applications, such as software for visualization of large hydrographic data sets, geomatics, power propulsion, marine steering
- **Instrumentation and information systems** — sensors and systems that measure marine parameters, such as oceanographic instruments, drifting buoys, data collection systems, cabled seafloor observatories and their components
- **Communications** — products for marine navigation, communications and information management, such as seaway information, marine geomatics, marine information skyway, marine intelligent systems and wireless technologies
- **Platforms and vehicles** — equipment such as ocean vehicles, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), submersibles, ocean platforms and handling systems.
- **Ocean energy** — systems and technologies to use wind, wave, tidal and current potential to develop new sources of power
- **Services** — technical services specialized for the marine environment, such as marine survey, engineering, naval architecture, environmental services, vessel operations

NEW DIRECTIONS FOR FUTURE GROWTH

British Columbia companies have gained knowledge and experience with successful commercial relationships in world markets, including the U.S. military. While the domestic, U.S. and European markets remain key opportunities, a huge potential for customers in newer markets creates opportunities for expanding sales in the ocean sector.

Many of British Columbia's successful ocean technology companies are small to medium-sized enterprises. They compete globally by leading in their niche markets and innovating continuously to maintain their market position. While many started as spin-offs from research initiatives, their business strategies are often based on collaboration with international partners so that they can attain a significant presence and resilience in a worldwide marketplace. They have a dynamic outward focus that is grounded in British Columbia but targets the world.





STRONG GOVERNMENT SUPPORT

In 2011, Seaspan Marine Corporation of British Columbia was named as one of two successful proponents for the Canadian government's \$33-billion program to construct combat and non-combat vessels over the next 20 years. Canada has also provided substantial funding to operate a network of research facilities on British Columbia's coast, including the world-leading Ocean Networks Canada and the Institute of Ocean Sciences. British Columbia supports advanced research through its universities and marine training funding.

MARINE CLUSTERS IN BRITISH COLUMBIA

Ocean technology clusters in British Columbia are based primarily in the southern coastal areas around the cities of Vancouver and Victoria. Over 900 companies are headquartered in and around the two cities, including Seaspan Marine with its multi-billion dollar ship construction program for the Government of Canada. The clusters include associations, universities, research institutes and a large naval presence.



MULTI-BILLION DOLLAR PROGRAM REIGNITES BRITISH COLUMBIA SHIPBUILDING

British Columbia is the home of the multi-billion dollar non-combat fleet renewal program under Canada's National Shipbuilding Procurement Strategy (NSPS). The NSPS has awarded the long-term contract to **Seaspan Marine Corporation**, a corporate group with shipyards in North Vancouver and Victoria. A key feature of the project is a requirement to share contract work with British Columbia's shipbuilding industry. In 2016 alone, Seaspan executed \$184 million in new supplier contracts with 142 Canadian companies, with 87% of the value going to small and medium-sized businesses. Seaspan has committed to supporting private sector developments in modern construction and technology, with a focus on emerging technologies that improve productivity and competitiveness in marine research, new processes and new tools for the Canadian shipbuilding industry. Seaspan's work in the defence sector also includes frigate modernization, submarine maintenance and in-service support. Work is also underway for three new fisheries science vessels and an offshore oceanographic science vessel. Together with extensive private sector shipbuilding and maintenance work, British Columbia is looking forward to a lengthy period of growth and development for its marine industry.



Education and Research

Strong connections between British Columbia's research and academic institutions and our commercial sector build a strong and forward-looking culture.

Leading research institutions and centres include:

University of British Columbia, Department of Earth, Ocean and Atmospheric Sciences

One of the largest and most diverse departments of its kind in the world, it offers graduate education and research in oceanography, a rich interdisciplinary science made up of biology, chemistry, geology and physics. UBC institutes include:

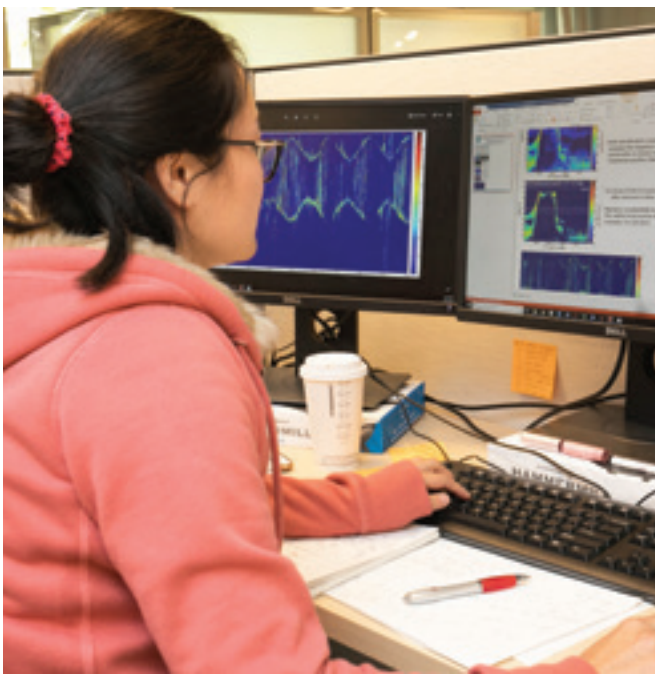
- Ocean Dynamics Laboratory
- Institute for the Oceans and Fisheries

University of Victoria, School of Earth and Ocean Sciences

A global centre of excellence in ocean, earth and atmospheric research, the school is active in world-class research covering the full geoscience spectrum from acoustical oceanography to climate modelling.

Other University of Victoria Information:

- Ocean Networks Canada, which includes an Innovation Centre to work with industry, over 100 researchers and experts in ocean data, real-time monitoring of all Canada's coasts and two large cabled observatories on the Pacific Coast:
 - NEPTUNE in the North East Pacific
 - VENUS in the Salish Sea
- Ocean Science and Technology
- Ocean Technology Test Bed
- Canada Research Chair in Deep Ocean Research
- Canada Research Chair in Ocean Carbon Dynamics



Fisheries and Oceans Canada

- Institute of Ocean Sciences
One of Canada's largest marine institutes, with more than 250 scientists and researchers, it has earned international recognition for its scientific work and expertise.
- Pacific Biological Station
The oldest fisheries research centre on the Pacific coast with scientists, technicians, support staff and ships' crews linked to a network of nine major science facilities across Canada.

Simon Fraser University

Earth2Ocean Group tackles global environmental problems through interdisciplinary collaborative science.

Bamfield Marine Sciences Centre

A world-class teaching and research facility on the west coast of Vancouver Island jointly operated by the Universities of British Columbia, Victoria, Simon Fraser, Alberta and Calgary. Facilities include research space, aquarium facilities, boats, diving equipment, library, lecture hall and accommodations.

University of Northern British Columbia, Atmospheric Science Faculty

Features a high-performance computing facility and lab for atmospheric and climate analysis.

British Columbia Institute of Technology, Marine Studies

A waterfront marine campus with state-of-the-art bridge and engine room simulators provides training for the maritime industry in navigation, marine engineering, seamanship, maritime security and nautical science.

Camosun College, Nautical Training

Transport Canada certified nautical training in nautical technology, ship management and for professional seafaring careers.

Vancouver Aquarium

- Coastal Ocean Research Institute
- Howe Sound Biodiversity
- Ocean Pollution Research Program
- Cetacean Research



SSI THE SYNCHRONIZED SHIPYARD

SSI develops Autodesk based solutions for the shipbuilding and offshore industry. SSI solutions take advantage of the native DWG platform and the global pools of experience provided by the world's most popular CAD platform. SSI combines this with industry specific standards, terminology and best practices. SSI's goal is to support and deliver increased productivity to the world's shipbuilding and offshore industries by bridging the gap between tradition and technology.

Leading British Columbia Ocean Technology Organizations

These are some of the leading ocean technology companies and organizations that market their products and services to the world from British Columbia.

Seaspan Marine

Provides shipbuilding and repair at three shipyards, marine transportation, ship docking and escort and related services

OceanWorks International Corp.

Specializes in the design and manufacturing of manned and unmanned underwater work systems and related equipment for the international marine industry.

AML Oceanographic

Designs and manufactures instrumentation and deployment systems for hydrographic surveying, environmental monitoring and other subsea applications. It has customers in more than 100 countries.

AXYS Technologies Inc.

Provides consulting services and turn-key environmental monitoring systems including directional wave buoys, metocean ODAS buoys, water quality buoys and port and vessel traffic management solutions.

ISE Ltd. (International Submarine Engineering)

Develops and manufactures undersea vehicles, control systems and robotics.

JASCO Applied Sciences

Collects, analyzes and assesses underwater acoustic data, and provides scientific consulting for all stages of environmental reviews and assessments of underwater noise.

Point Hope Maritime

Full service shipyard that repairs and refits all types of commercial and private vessels

Xanatos Marine Ltd.

Delivers customized maritime domain awareness solutions to enhance safety, security and environmental stewardship.

Zodiac Hurricane Technologies Inc.

Manufactures military and professional rigid inflatable boats.

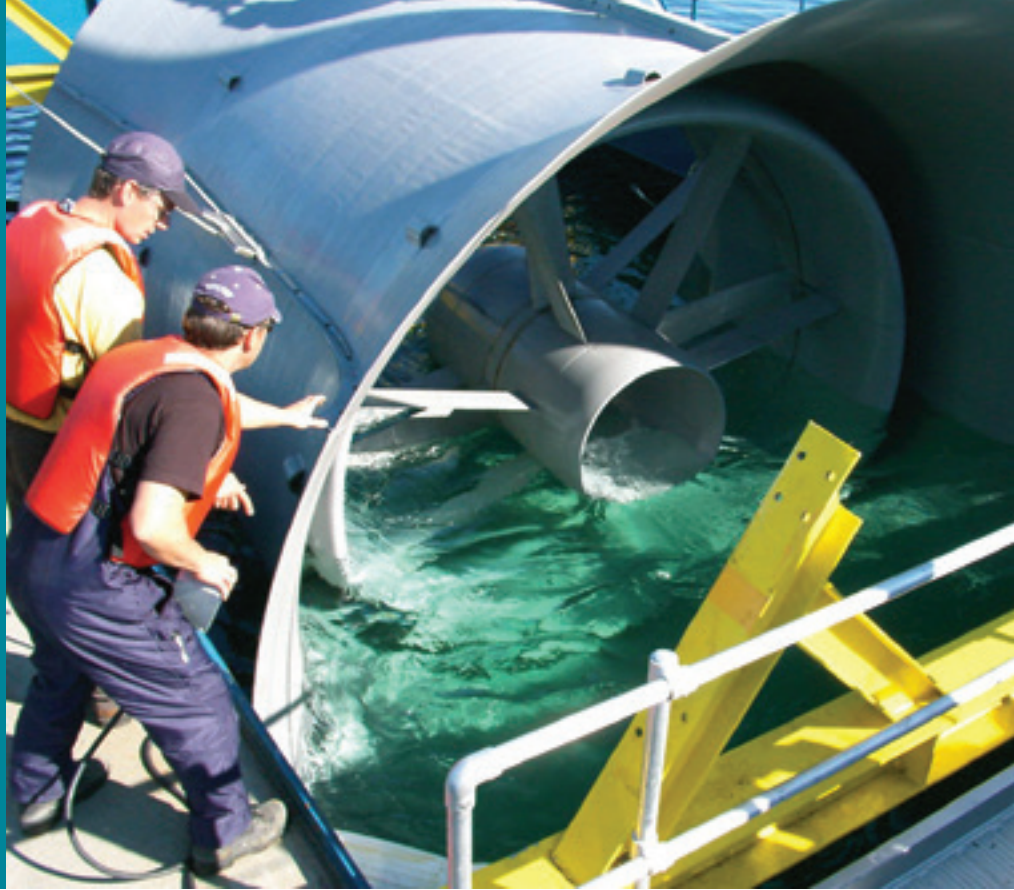
Additional Companies:

- A.G.O. Environmental Electronics Ltd.
- ACR Systems Inc.
- Advanced Subsea Services Ltd.
- ALS Canada Ltd.
- Aqua-Guard Spill Response Inc.
- ASL Environmental Sciences Inc.
- Canadian Scientific Submersible Facility
- Carmanah Technologies Inc.
- Cellula Robotics
- Diverlink International Technologies Inc.
- Electro Systems Inc.
- Foreshore Technologies Inc.
- GeoInfo Solutions Ltd.
- Imagenex Technology Corp.
- Interactive Oil Spill Training Center
- International Venturecraft Corp.
- Inuktun Services Ltd.
- Kongsberg Simrad Mesotech Ltd.
- McElhanney
- MDA Corporation
- Mustang Survival Corp.
- Ocean Networks Canada
- Orcatron Communications Ltd.
- Saab Technologies Ltd.
- Sea-Image Corporation
- Seabridge Marine
- TASC Systems Inc.
- Terra Remote Sensing Inc.
- TRAXX Automation Ltd.
- Underhill Geomatics Ltd.
- Versatech Products Inc.

OCEAN ENERGY TO POWER THE FUTURE

British Columbia's significant wave, tidal, ocean and river current resources help meet the growing demand for electricity in Canadian and international markets. Coastal ocean energy capacity, including over 50,000 megawatts of untapped tidal potential in B.C., provides huge potential for energy applications in the North American market.

- **Marine Renewables Canada** brings together industry, academia and government to provide ocean energy solutions to world markets.
- **The West Coast Wave Initiative** is modelling wave energy converter systems on Vancouver Island.



B.C. Companies in Marine Vessel Technology

PROPULSION & POWER GENERATION/STORAGE

- Analytic Systems
Power conversion systems
- Corvus Energy
Energy storage systems
- Pacific Rim Engineered Products
Industrial gear boxes

SYSTEM ENGINEERING & INTEGRATION

- Atlas Elektronik Canada
Command and control, sonar and unmanned vehicles

TRAINING, SIMULATION SYSTEMS & SOFTWARE

- AutoShip Systems
Cargo management software
- RaceRocks3D
Training and simulation support
- SSI Shipconstructor
Autodesk-based shipbuilding and offshore solutions

NAVIGATION SYSTEMS & EQUIPMENT

- Current Corporation
Day and night vision cameras for ships and coastal surveillance
- OSI Maritime Systems Ltd.
Naval integrated navigation and tactical solutions
- Russell Technologies Inc
PC-based hardware and software for local and remote control radar applications
- Think Sensor Research
High performance sensors for marine and aerospace applications
- Xanatos Marine
Customized maritime domain awareness solutions

CONTROL SYSTEMS

- AutoNav Marine Systems Inc.
Manual hydraulic and electrohydraulic steering systems
- ComNav Marine
Marine navigation systems
- Dynamic Systems Analysis
Dynamic analysis services and software tools for ocean engineering applications
- Jastram Engineering Ltd.
Digital and hydraulic steering systems
- Kobelt Manufacturing
Guiding and control systems

SHIPBUILDING AND NAVAL ARCHITECTURE

- Allied Shipbuilders
Shipbuilding, ship repair and engineering services
- Méridien Marine
Inspection and repair services at sea or along the dock
- Robert Allan Ltd.
Naval architects and marine engineers
- VARD Marine
Professional ship design, engineering and shipbuilding technology

DECK EQUIPMENT/CARGO HANDLING EQUIPMENT

- AdvanTec Marine
Doors, windows, hatches and winches
- Shockwave Seats
Shock mitigation technology
- Brockton Electronics
Cable assemblies and wire harnesses

OTHER

- BC Ferries
One of the largest ferry operators in the world
- EMCS Industries Ltd. (MARELCO™)
Marine fouling protection
- Seabridge Marine Services Ltd./
Seabridge Marine Contractors Ltd.
Barge/vessel builder, transporter

BRITISH COLUMBIA COMPANY LEADING THE WAY IN UNDERWATER VEHICLE AND ROBOTIC SYSTEMS DEVELOPMENT

ISE Ltd. (International Submarine Engineering Ltd.) is a world leader in the design and development of subsea, land and space robotic systems. The robotics sector of the company's business has expanded to encompass engineered solutions for the space, offshore and industrial markets. This technology is integrated with real-time control and vision software, developed by ISE's Controls Group. ISE provides the know-how and the capability to complete large systems integration projects and to bring concepts to market. Since 1992, it has worked to develop a large autonomous underwater vehicle (AUV) for laying fibre-optic cable in ice-covered waters. This development led to the design and construction of Theseus, a 10.7 metre long AUV that successfully laid several 220-kilometre cables in 600-metre depths under a 2.5-metre-thick ice pack in the Canadian Arctic.

ASSOCIATIONS

Association of British Columbia Marine Industries
Represents the interests of the industrial marine sector and its supply chain.

Marine Renewables Canada
Aligns industry, academia and government to provide ocean energy solutions to a world market.



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Every effort has been made to ensure the accuracy of this publication at the time of writing; however, the programs referred to, and data cited, are subject to change.

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