

BRITISH COLUMBIA CANADA



DYNAMIC

GROWING



OCEAN TECHNOLOGY





BRITISH COLUMBIA

A Rising Leader in Ocean Technology

From one of the world's first and largest undersea digital observatories to the world's best 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 are continuing 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 in 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. B.C. companies have successfully developed, manufactured, and exported products and systems to hundreds of government and private sector customers in over 50 countries.

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.

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 Canada has committed almost \$12 billion in contracts to British Columbia's shipyards. The Government of British Columbia offers strong support for buyers and investors in our economy. With low taxes, an open economy, international trade missions and trade and investment representatives, and active pursuit of international trade agreements, British Columbia supports the growth of our ocean technology companies.

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Industry Profile

A MARITIME PROVINCE WITH A GROWING TECHNOLOGY SECTOR

British Columbia is a maritime province with an extensive coastline and a rich industrial history built around ocean and marine opportunities. The marine sector overall accounts for \$9 billion to \$11 billion of production, with 140,000 to 168,000 full-time employees. 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.

More than one hundred companies are active in the ocean technology sector in British Columbia. Our technology companies sell throughout the international market, working for multinational industry, research organizations, and other governments. Companies range from specialized technology developers to project integrators. 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 four large public universities and several 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 MARITIME 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.



“Canada’s NSPS program is the most interesting opportunity in the global shipbuilding industry today... Believe it or not, our costs are about on par with Korea... Where we are going to be able to compete is in specialty vessel construction — for example, research vessels and icebreakers for foreign governments or commercial use ... With the NSPS work under our belt, we’ll be more competitive internationally on specialty vessels and this will be attractive to other governments and operators.”

Brian J. Carter, President, Seaspan Shipyards

STRONG GOVERNMENT SUPPORT

The governments of Canada and British Columbia renewed their history of supporting the development of ocean technology in British Columbia. The national shipbuilding procurement strategy (NSPS) has committed over \$10 billion to invigorate the marine industry through the purchase of research and coast guard ships and support systems. 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 one hundred companies are headquartered in and around the two cities, including Seaspan Marine with a multi-billion dollar ship construction program for the Government of Canada. The clusters include associations, universities, research institutes, and a large naval presence. Sales in the technology sector of this industry amount to approximately \$785 million annually, with 5,230 fulltime equivalent employees.

SHIPBUILDING IN BRITISH COLUMBIA

Canada's defence shipbuilding program has ignited a new phase in a shipbuilding history in British Columbia that goes back to the nineteenth century. Skills and facilities built up for military and civilian shipping in the twentieth century created a well-developed

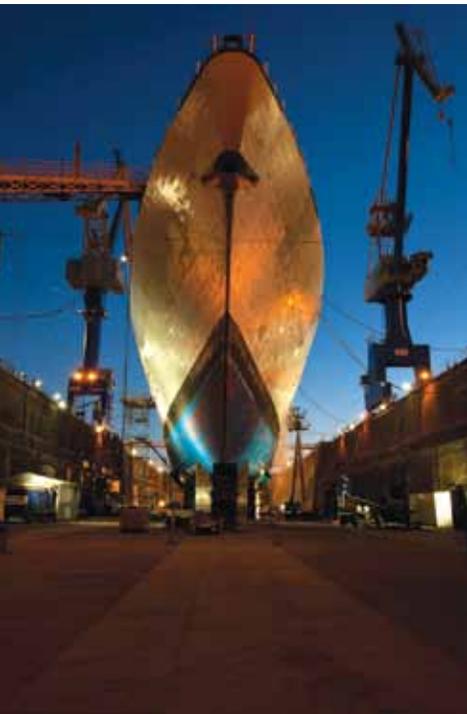
infrastructure. New defence contracts valued at almost \$12 billion have led to the modernization of the industry and the growth of a workforce trained in advanced shipbuilding technologies.

OCEAN ENERGY EXPERTISE

British Columbia's ocean energy companies have developed systems and technologies to use wind, wave, tidal, and current potential to provide renewable, reliable electricity in oceanside markets worldwide. Sector innovators include:

- Canoe Pass Tidal Energy Corp. and New Energy Corp., installing two 250-kilowatt turbines to harness tidal power
- Clean Current Power Systems Incorporated, designing and testing tidal energy technology with an underwater turbine generating energy from tidal currents
- Pacific Coastal Wave Energy Corporation, developing a wave power electricity facility to convert ocean swell movements to electric energy
- Syncwave Systems Inc., using a unique frequency-based wave energy conversion technology with higher efficiency than other wave energy capture devices

Marine Renewables Canada and the West Coast Wave Collaboration Project bring together researchers, engineers, entrepreneurs, and digital modelling experts to provide renewable energy solutions to world markets.



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. 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 getting underway for 10 additional coast guard vessels and three new fisheries science vessels. 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 institutions

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

Leading institutions include:

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

Graduate education and research in oceanography, established since 1949, include biological, chemical, geological, and physical oceanography and atmospheric science, with emphasis on interdisciplinary studies.

UBC institutes include:

- Ocean Dynamics Lab
- Fisheries Centre

University of Victoria, School of Earth and Ocean Sciences

Programs include Marine Biology, Meteorology, and Oceanography. Related institutes include:

- Ocean Networks Canada
- NEPTUNE and VENUS cabled observatories
- Institute for Coastal and Oceans Research
- Ocean Tech Lab and Ocean Tech Test Bed

- Canada Research Chair in Deep Ocean Research
- Canada Research Chair in Seagoing Physical Oceanography
- ONC Centre for Enterprise and Engagement

Simon Fraser University, Earth2Ocean Group

An international network of researchers collaborating on studies of aquatic ecology and conservation.

Bamfield Marine Sciences Centre

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

Institute of Ocean Sciences

One of Canada's largest marine institutes, with more than 250 scientists and researchers linked to a network of nine major science facilities across Canada.

Pacific Biological Station

The oldest 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.

**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 provides training for the maritime industry in navigation, marine engineering, seamanship, maritime security, and nautical science.

Camosun College

Training in nautical technology, careers, and ship management.



**THE OCEAN NETWORKS CANADA
CENTRE FOR ENTERPRISE AND
ENGAGEMENT (ONCCEE)**

is making British Columbia an international leader in ocean observing science and technology through the commercialization of its research and technology. ONCCEE is creating national and international partnerships with industry and academia in four focus areas: ocean sensor technologies; ocean observing system technologies; information and communication technologies; and public engagement. Ocean Networks Canada manages Canada's premier ocean observing networks, VENUS and NEPTUNE Canada. The observatories are cabled undersea systems that can provide power and high bandwidth communications to sensors in the ocean. The infrastructure supports near real-time observations from multiple instruments and locations.



**GERMANY'S ATLAS ELEKTRONIK GROUP
SAILS INTO VICTORIA**

Atlas Elektronik Canada Ltd., a subsidiary of Germany's Atlas Elektronik Group, chose Victoria for its British Columbia offices to support advanced electronic work under Canada's multi-billion dollar national shipbuilding procurement strategy. Work will take place in Victoria and at shipyards in North Vancouver, where federal non-combat vessels will be built by Seaspan Marine Corp. Work is expected to total up to \$40 million for the company and its local suppliers. Factors such as a cluster of companies with shipbuilding and high-tech marine expertise and a positive business climate influenced Atlas Elektronik's decision to open its new offices.



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

(www.seaspan.com)

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

OceanWorks International Corp.

(www.oceanworks.com)

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

Ocean Networks Canada

(www.oceannetworks.ca)

A national research facility operating world-leading ocean observatories with continuous real-time undersea data gathering through powered fibre-optic cables.

Canadian Scientific Submersible Facility

(www.ropos.com)

Manages a remotely operated deep-sea system capable of operating to depths of up to 5,000 metres.

AML Oceanographic

(www.amloceanographic.com)

Designs and manufactures ocean sensors, including conductivity, time-of-flight sound velocity, temperature, pressure, dissolved oxygen, and turbidity.

ASL Environmental Sciences Inc.

(www.aslenv.com)

Manufactures and operates oceanographic, acoustic, remote sensing, and ice research underwater acoustic instruments.

Axys Technologies Inc.

(www.axystechnologies.com)

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

International Submarine Engineering

(www.ise.bc.ca)

Develops and manufactures undersea vehicles, control systems, and robotics.

Xanatos Marine Ltd.

(www.xanatosmarine.com)

Develops a range of maritime solutions including Automatic Identification System (AIS) technology, for national security, ports, harbors, vessels and individuals.

Additional Companies:

- A.G.O. Environmental Electronics Ltd.
- ACR Systems Inc.
- Advanced Subsea Services Ltd.
- ALS Canada Ltd.
- Aqua-Guard Spill Response Inc.
- Carmanah Technologies Inc.
- Cellula Robotics
- DIVELINK Underwater Communications
- Electro Systems Inc.
- Foreshore Technologies Incorporated
- GeoInfo Solutions Ltd.
- Imagenex Technology Corp
- Interactive Oil Spill Training Center
- International Venturecraft Corp.
- Inuktun Services Ltd.
- JASCO Research Ltd
- Klein Systems Group Ltd.
- Kongsberg Simrad Mesotech Ltd.
- MDA Corporation
- Mustang Survival Corp.
- Orcatron Communications Ltd.
- Quester Tangent Corporation
- Sea Image Corporation
- Seabridge Marine
- Spectrum Signal Processing Inc.
- TASC Systems Inc.
- Terra Remote Sensing Inc.
- Terratech Mapping Services
- TRAXX Automation Ltd
- Underhill Geomatics Ltd.
- Versatech Products Inc.
- Zodiac Hurricane Technologies Inc.

OCEAN ENERGY TO POWER THE FUTURE

British Columbia's significant wave, tidal, ocean, and river current resources are sources of clean energy that will help meet the growing demand for electricity in Canadian and international markets. Coastal ocean energy capacity, including over 20,000 megawatts of raw wave energy and 4,000 megawatts of raw tidal energy, provides huge potential for energy applications in the North American market. More than 30 potential ocean energy sites have been identified and have received preliminary permitting. Several projects are actively demonstrating the power that companies can harvest from the ocean's wave, current, and tidal energy.



B.C. Companies in Marine Vessel Technology

PROPULSION & POWER GENERATION/STORAGE

- Analytic Systems (www.analyticssystem.com)
Power Conversion Systems
- Corvus Energy (www.corvus-energy.com)
Lithium-Ion batteries
- Pacific Rim Engineered Products (www.prepglobal.com/marine)
Gear Boxes

SYSTEM ENGINEERING & INTEGRATION

- Atlas Elektronik Canada (www.canada.new.atlas-elektronik.com)

TRAINING, SIMULATION SYSTEMS & SOFTWARE

- AutoShip Systems (www.autoship.com)
Cargo Management Software
- RaceRocks3D (www.racerocks3d.ca)
Training and Simulation Support
- Shipconstructor (www.ssi-corporate.com)
Autodesk solutions

NAVIGATION SYSTEMS & EQUIPMENT

- Current Corporation (www.currentcorp.com)
HD, NightVision Camera
- OSI Maritime Systems Ltd (www.osimaritime.com)
Integrated Bridge and Navigation System
- Russell Technologies (www.russelltechnologies.ca)
PC-based Radar Technology
- Think Sensor Research (www.thinksensor.com)
Inertial Instruments and Navigation Products
- Xanatos Marine (www.xanatosmarine.com)
Automated Identification System and Vessel Traffic System technologies

CONTROL SYSTEMS

- AutoNav Marine Systems (www.autonav.com)
Designs manual hydraulic and electrohydraulic steering systems
- ComNav Marine (www.comnavmarine.com)
- Dynamic Systems Analysis (www.dsa-ltd.ca)
- Jastram Engineering Ltd. (www.jastram.com)
Designs and manufactures digital and hydraulic steering systems
- Kobelt Manufacturing (www.kobelt.com)

NAVAL ARCHITECTURE

- Robert Allan Ltd (www.ral.ca)
Naval Architects & Marine Engineers
- STX Canada (www.stxmarine.net)
Naval Architects & Marine Engineers

DECK EQUIPMENT/CARGO HANDLING EQUIPMENT

- AdvanTec Marine (www.advantecglobal.com)
Doors, Windows, Hatches, Winches
- Shockwave Seats (www.shockwaveseats.com)
- Brockton Electronics (www.brockton-electronics.com)

OTHER

- Marelco (www.marelco.ca) Anti-fouling
- Seabridge Marine Services
(www.seabridgemarine.com) Contractor



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

International Submarine Engineering Ltd. is a world leader in the design and development of autonomous and remotely operated underwater vehicles and 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 fiber-optic cable in ice-covered waters. This development led to the design and construction of Theseus, a 10.7 meter long AUV that successfully laid 220 kilometers of fiber-cable from a site near the shore of Ellesmere Island in the Canadian Arctic to a scientific acoustic array in the Arctic Ocean about 200 kilometers from shore.

ASSOCIATIONS

ONC Centre for Enterprise & Engagement
(www.oceannetworks.ca)

Marine Renewables Canada
(www.marinerenewables.ca)

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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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