

CANADA



Canadian Arctic Capabilities by Sector



Government of Canada
Trade Commissioner Service

Gouvernement du Canada
Service des délégués commerciaux

Canada



This guide has been prepared by the Government of Canada as a resource on Canadian arctic capabilities. All of the information in the listings of organizations have been provided by the organizations themselves. Global Affairs Canada assumes no responsibility for the accuracy, currency or reliability of the content.

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PREFACE

The intent of this new Canadian Arctic Capabilities Guide is to communicate information about the range of Arctic capabilities found in Canada—as well as exports of northern origin—in a comprehensive manner that encompasses most sectors. Our hope is that it will complement other publications, particularly directories of the many local and regional chambers of commerce and sector associations across Canada, and lead to greater exchanges of knowledge, expertise, products and services, and foster enhanced cross-fertilization between sectors.

The guide is organized by sector. Each sector comprises a broad overview of Canadian Arctic capabilities in that sector, and a listing containing brief profiles of companies and organizations with Arctic capabilities and who are interested in pursuing business opportunities internationally. Several companies and organizations are of northern origin. Users of the organizational listings should be mindful that each sector profiles only those companies that have identified the particular sector as its primary sector of focus. Notes have been inserted at the bottom of some sectors to cross-reference other companies listed in the guide with capabilities in that sector. In addition, a number of success stories are showcased throughout. The organizational listings and the success stories are not exhaustive, nor are they to be considered an endorsement. However, they do provide a representative exposé of the vast scope and quality of Canada's Arctic capabilities.

The development of this guide was led and coordinated by the Canadian International Arctic Centre (CIAC), in partnership with the Canadian Trade Commissioner Service (TCS) at Global Affairs Canada.



INTRODUCTION

The Arctic makes up 40 percent of Canada's landmass, and is an essential part of our collective heritage and future. Economic and business development in Canada's Arctic, and in its sub-Arctic regions, has been shaped by a number of historical drivers that have resulted in a wide range of Arctic expertise across sectors.

Canada's Arctic capabilities are reaching new heights as a result today's pursuit of enhanced scientific understanding, sustainable resource development and Arctic maritime readiness. Commercial opportunities are further advancing clean technology and renewable energy solutions, earth observation technologies and services, among many other areas of expertise.

Arctic know-how and competence is not only born out of or destined to the circumpolar Arctic. Each Canadian province has developed its own unique range of capabilities to address Arctic-like challenges locally. Although all provinces and territories have their particular strengths, a common thread spanning sectors across the country is a deep commitment to scientific research and education, technological innovation and sustainable economic development.

Canada's north is home to more than 100,000 people, many of whom are Indigenous and whose traditional livelihoods—including hunting, fishing, and arts and crafts—have long been the lifeline of the northern economy. Rooted in tradition, these economic activities will continue to be a mainstay. However, creativity, adaptability and resourcefulness are defining qualities of northern inhabitants, and have propelled not only cultural and creative industries—but all sectors—toward a more diverse economy that embraces innovation and technological advancement.



AXYS Technologies teamed up with the Water & Climate Impacts Research Centre at the University of Victoria to design and build a fully automated ice buoy and sub-surface sentinel system for continuous year-round, real-time monitoring of meteorological conditions, lake ice cover (initiation, winter growth, spring breakup), light penetration into the lake (through ice in winter), and lake water quality (chemistry, temperature, oxygen levels). The system is designed to run on solar power and sealed internal batteries, and can run autonomously for a number of years without frequent visits by researchers or technicians.

In 2014, ASL Environmental Sciences Inc. successfully completed a research study funded by the Canadian Space Agency that combined the technologies of RADARSAT-2 quad polarized satellite imagery and ASL's upward-looking sonar, the Ice Profiler, to provide a new, three-dimensional view of sea ice. Using Ice Profiler data sets, we showed that a number of satellite data products correlate very well with ice draft. This enabled the production of a first-time map representation of sea ice draft derived from satellite data that were validated against ice characterization from the Ice Profiler.



ICE AND OCEAN TECHNOLOGIES AND SERVICES



Bordering three oceans, Canada's coastline is the longest of any country in the world, measuring more than five times the circumference of the earth. Canada's waterways are inextricably linked to many sectors of vital economic importance to the country, including cultural industries, fisheries, maritime engineering, and oil and gas. This has facilitated a growing ocean technology sector that provides a range of niche products and services, such as instrumentation, environmental monitoring, underwater imaging and acoustics, and ice surveillance and management.

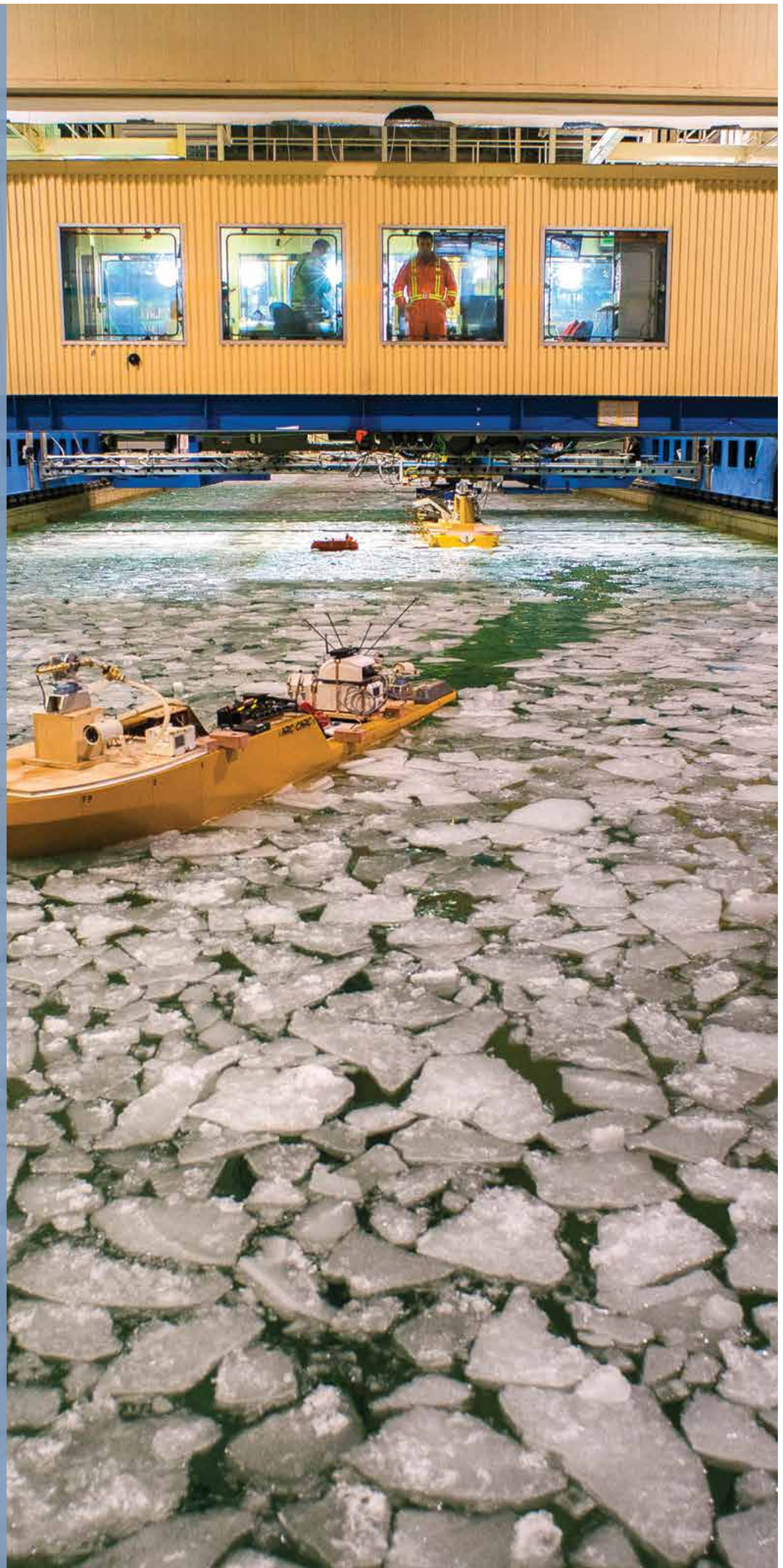
These capabilities have been adapted to a variety of cold climates and harsh conditions, from the rough Atlantic off the east coast, to the ice-ridden Beaufort Sea in the Arctic. The need to understand and safely navigate these diverse waters has driven the development of several clusters of expertise in ice and ocean technologies and services that are found across Canada—particularly in British Columbia, Newfoundland and Labrador, and Nova Scotia. Indeed, this is one of Atlantic Canada's largest advanced technology industries, with significant levels of research, development and innovation, a highly skilled labour force and a focus on exports. This has positioned both Atlantic Canada and the Pacific coast bases of operations for current and future Arctic-related activities.



"I wish to thank you and your team [PAL Aerospace] for the provision of integrated ice-management services in support of our 2012 3-D marine seismic operations off Northwest Greenland. This level of fully integrated ice management involving three multi-streamer seismic vessels and nine support vessels was an industry first. Much credit is due to your highly skilled ice specialists for the design and implementation of the first for-purpose Ice Management Plan and continued support. The project statistics are attestation to the effectiveness of the ice management in that there was zero ice-related equipment damage in the nine-vessel months equivalent of work in the region nicknamed 'iceberg alley'...."

- Drew St. Peter, Acquisition Project Manager, Polarcus DMCC

In 2014, Rutter Inc. was selected by ExxonMobil to deliver all of the ice detection and monitoring and oil spill detection and tracking radar systems for their Kara Sea Exploration drilling program. The sigma S6 Ice Navigator and the sigma S6 Oil Spill Detection radar systems were deployed across all of the support vessels as well as the drilling platform to ensure the safety and security of the personnel, equipment and the environment while operating at a remote location in the Russian Kara Sea. The systems delivered the critical information to ensure that the drilling program was performed safely.





ICE AND OCEAN TECHNOLOGIES AND SERVICES LISTING



aslenv.com

ASL Environmental Sciences Inc.

ASL Environmental Sciences Inc. is a physical oceanographic consulting and instrumentation company located in Victoria, B.C., with a staff of over 40 scientists, engineers and support personnel. ASL has over 38 years' experience in Arctic oceanographic and sea-ice measurements and modelling, including program design, field services, instrument lease, data processing and analysis and remote sensing. ASL's Ice Profiler is the globally leading technology for year-round high-resolution ice thickness measurements for offshore oil and gas companies and leading research organizations.



axystechnologies.com

AXYS Technologies Inc.

With over 40 years' experience in the design, manufacture and deployment of remote environmental monitoring systems worldwide, AXYS applies its extensive knowledge and experience to marine, freshwater and offshore wind resource assessment, and land-based monitoring systems that measure aquatic, oceanic and atmospheric parameters. AXYS offers technical field services in the operation and maintenance of all products, as well as data management and analytics services. AXYS systems and turnkey solutions are proven to be reliable and durable in harsh and remote marine environments such as the Arctic.



canatec.ca

Canatec Associates International Ltd.

Canatec helps offshore resource and marine operating companies in extreme ocean environments to work more safely and efficiently. We engage in conventional consulting on matters of sea ice and icebergs, in providing integrated ice support to offshore projects, in developing and maintaining tracking technologies for both ice and personnel, and in providing training for field ice observers and ice advisers. Primary work locations are Calgary, Alta., and St. John's, Nfld. Canatec is the world's largest private-sector firm focused on sea-ice and iceberg matters.



c-core.ca

C-CORE

Based in St. John's, Nfld., ISO 9001-registered C-CORE applies technical capability in remote sensing, ice engineering and geotechnical engineering, providing applied R&D solutions to mitigate operational risk in harsh environments and address security, sustainability and safety issues. With 100-plus highly qualified personnel and additional offices in Ottawa, Ont., and Halifax, N.S., C CORE leads the world in understanding and managing ice risk for Arctic design and is home to the national LOOKNorth centre for remote sensing innovation and the Centre for Arctic Resource Development.



CIDCO

CIDCO is a world-class, independent ocean mapping R&D centre. Based in Rimouski, Quebec, and Brest, France, CIDCO has eight employees, including two PhDs and four MScs. Several of our ongoing projects concern the Arctic directly, including the inspection of marine infrastructure using acoustic technologies, the collection of hydrographic data in extreme zones (HydroBall®), and the development of a prioritization model for the Arctic Ocean charting using hydrographic risk-based assessment.



PAL Aerospace

With 40 years of aviation, maritime patrol and aerospace experience, PAL Aerospace provides comprehensive services in the areas of maritime resource management, ice reconnaissance, ice management, sovereignty, environmental protection and enforcement for commercial and government organizations. Operating bases span Canada (St. John's and Goose Bay, Nfld.; Halifax, N.S.; and Comox, B.C.), and there are international bases in Curaçao and the United Arab Emirates. Ice management services are provided in Canadian and Greenland waters. PAL Aerospace provides a single point of contact for ocean and Arctic programs.



Rutter Inc.

Rutter Inc., headquartered in Newfoundland and Labrador, is a developer of advanced radar signal processing systems for marine safety, security and environmental monitoring. Rutter's products include the sigma S6 Ice Navigator™, Small Target Surveillance and Oil Spill Detection product lines, as well as the WaMoS® II wave and current monitoring radar systems. Our clients need to ensure the safety and security of their people, platforms and the environment while operating in areas of high risk such as the Arctic and marine offshore.



Seaformatics

Seaformatics is an ocean technology company based in St. John's, Nfld. Traditionally, specialized vessels are used to deploy and recover systems in the ocean that have exhausted their batteries—a very costly, time consuming and risky endeavour, particularly in remote Arctic environments. Our solution is to provide products that harvest power from ocean currents and communicate data wirelessly back to shore. Our customers will be able to lower their operational costs, spend less time in the field and reduce their risk while expanding their data-collection programs.



SL Ross Environmental Research Limited

SL Ross Environmental Research is a consulting firm specializing in oil and chemical spills and their control. The company has four full-time professionals, each having more than 20 years of experience in oil and chemical spill matters. Particular areas of expertise include Arctic oil spill control, training, risk communication, research and planning for in-situ burning and dispersant use, evaluation and design of countermeasures, equipment and techniques, and development and review of contingency plans, equipment needs and training programs.



subcimaging.com

SubC Imaging Inc.

SubC Imaging develops and manufactures state-of-the-art underwater imaging systems for harsh environments up to full ocean depth. Its product portfolio includes cameras, lights, lasers, batteries and topside media management systems. SubC has developed several technologies that decrease the risk and cost of conducting operations in the extreme conditions of an Arctic environment. Clients include companies conducting seabed surveys, the construction and inspection of subsea assets and ocean science organizations involved in marine research and exploration. SubC also specializes in fully integrated custom systems for client specific applications.



sulissubsea.com

SULIS Subsea Corporation

SULIS Subsea Corporation creates aquatic camera and robotics technology. Built to withstand the rigours of harsh environments, from the Arctic all the way down to the deepest of ocean trenches, SULIS is renowned for its innovation and attention to detail. Footage from their cameras is found anywhere from IMAX screens to satellite streams from ROV control rooms. Their camera and lighting products include 4K resolution and broadcast-quality controls to satisfy the standards of the world's top film directors, and unparalleled optical design to meet the exacting specifications of marine scientists.



ultra-ms.com

Ultra Electronics Maritime Systems Inc.

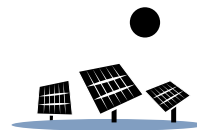
Ultra Electronics Maritime Systems is located in Dartmouth, N.S. A number of our sonobuoys have been deployed in the Arctic, including a geobuoy that we refurbished (and continue to refurbish) for Canada's Department of National Defence and the seismic buoy that was used for whale and mammal monitoring, as well as seismic studies. We deliver sophisticated and cost-effective solutions that are internationally known, which has reinforced our successful reputation among our clients.

Other companies with capabilities in this sector include: Enfotec Technical Services Inc. (p. 35), Kongsberg Digital Simulation Ltd. (p. 35).



In 2012, Keewaytinook Okimakanak (KO), a council representing six First Nation communities in Northern Ontario, approached Canadian Solar for a solution to reduce their dependency on diesel fuel and to increase their energy supply in a manner they can afford. The Deer Lake First Nation, with a population of about 1,200, was chosen for a pilot solar-diesel hybrid solution project. Canadian Solar proposed a phased-in solar capacity development plan. The first phase involved installing a 152KW DC solar rooftop system connected to the diesel generating station to establish a solar-hydro-diesel hybrid system. The installed PV system cuts the energy bill by \$112,000 for the community every year and the payback term is less than five years; displaces diesel fuel at least 31,000 litres per year; and, reduces emission 99 tons annually, equivalent to 20 cars' carbon emission every year.

Stratos provides ongoing strategic advice and leadership to the Mining Association of Canada (MAC) for its award-winning Towards Sustainable Mining (TSM) program, which promotes a higher standard of environmental and social performance for mining companies. In 2015, Stratos supported the Finnish Network



CLEAN ARCTIC TECHNOLOGIES AND SERVICES

Canada is a world leader in the development and deployment of clean technologies and services, in particular the generation of renewable energy. Through Canada's rich history of economic development, many lessons have been learned and experience gained by companies across all sectors. In recent years, from the commercialization of clean technologies to the provision of services ranging from stakeholder and Aboriginal engagement to environmental remediation, Canadian companies have been breaking new trails.

Canada has the world's fifth-largest capacity for renewable energy, and is the third-largest generator of hydropower in the world¹. This applies to many remote communities in the north, where renewable resources are plentiful. The Yukon Territory, for instance, invests heavily in hydropower, which constitutes over 90 percent of its electricity generation². While renewables have been growing in the north, efforts to diversify continue, particularly in Nunavut and NWT where reliance on diesel generation remains high and offers substantial scope for off-grid growth and investment.

Canada also has the seventh-largest installed wind energy capacity in the world. Indeed, wind along with solar are the fastest growing sources of electricity generation in Canada, with Canadian firms offering a variety of novel technologies, products and services. While adaptations are often required to enable these technologies to operate off-grid and withstand harsh climates, Canadian companies have implemented successful demonstration sites throughout the north. Biomass is also a sector of growth in Canada. With more biomass resources per capita than any other nation, Canada is making steady progress in the bioenergy industry.

¹ REN21, Renewables 2015 Global Status Report, 2015, p. 20.

² Canadian Electricity Association, Key Canadian Electricity Statistics, June 2014, p. 2.





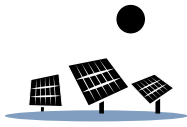
for Sustainable Mining as it initiated the TSM program in Finland, making it the first international jurisdiction to formally adopt TSM. Stratos provided in-depth training to a broad range of Finnish stakeholders on TSM, including environmental NGOs, mining companies, other land users, government officials and academia.

Each winter season, Inland recycles hundreds of millions of litres of glycol-impacted storm water produced from aircraft de-icing operations at airports throughout North America. This contaminated storm water typically contains millions of litres of glycol that is reclaimed through Inland's customized equipment and processed for reuse as feedstock in Inland's Type I aircraft de-icing fluid. Through the use of Inland's re-claimed glycol and the significant reduction in transportation required to ship Type I ADF from an off-site facility, the carbon footprint associated with de-icing is reduced.

The Canadian clean technology sector has a lot to offer for cold climate locales. Examples include: energy efficiency solutions, microgrid technologies, off-grid solar panels and wind turbines adapted to cold climates, biomass heat technologies and energy storage systems built for harsh environments.

Through collaborative efforts between industry, government and research institutes such as Polar Knowledge Canada and the Foresight ARCTIC program, Canada is at the forefront of collaborative R&D that provides solutions to a wide range of challenges in the Arctic, to ensure a more sustainable future for generations to come.





CLEAN ARCTIC TECHNOLOGIES AND SERVICES LISTING



aka-group.com

Aspin Kemp & Associates Inc.

Aspin Kemp & Associates (AKA) provides highly efficient and reliable power systems, primarily for marine installations and offshore and onshore island grid applications. Located in Prince Edward Island, the company specializes in increasing power plant and microgrid reliability, saving energy, reducing emissions, reducing maintenance costs and increasing safety. AKA offers vast experience working in harsh ocean environments and is well suited to bringing world-leading energy solutions and microgrid technology to remote communities in the Arctic.



atmacinta.com

Atmacinta Inc.

Atmacinta is a federally incorporated (2001) management and organizational consulting firm based in Montréal, Que. Atmacinta has extensive experience operating in rural, remote and cross-cultural contexts to advance community development. We possess an intimate understanding of working with Aboriginal and local communities, and can offer governments, not-for-profit and for-profit organizations a wide range of services, such as complex project management, business development and support, training implementation, telecommunications deployment and organizational development.



ati-eolien.com

Audace Technologies Inc.

Audace Technologies (ATI) has specialized in renewable energy for close to 20 years. Headquartered in Rimouski, Que., our company is growing quickly on the international stage, notably in Africa and South America. ATI has developed products that are perfectly tailored to extreme climates (deserts, the north, etc.) and has provided energy in isolated areas using tailored hybrid solutions. We have led projects to feed power to facilities such as telecom stations, measurement towers, radar installations and scientific stations.



canadiansolar.com

Canadian Solar Inc.

Canadian Solar (NASDAQ: CSIQ) operates as a global energy provider with subsidiaries in 20 countries worldwide. Besides being the second largest manufacturer of solar PV modules in the world, we are also a world leading developer of solar energy solutions, utility-scale solar farms, and microgrid projects. Our typical clients in northern Canada are remote Indigenous communities and remote mining sites. We provide microgrid and diesel hybrid turnkey solutions to help them build, operate, and maintain microgrid to reduce diesel consumption and improve energy efficiency.



GreenSunRising.com

Green Sun Rising Inc.

Green Sun Rising develops and implements turnkey solar systems, including in remote and Arctic locations. Our portfolio includes solar PV stand-alone off-grid—as well as microgrid—connected systems. We also design and implement solar thermal systems for heat energy. Green Sun Rising's customer base includes residential, commercial, municipal and utility clients. We have an excellent track record in the Arctic. Our in-house manufactured mounting system allows us extreme flexibility to meet tight timelines, and we are also able to offer custom solutions.

Inland Technologies Canada Inc.



Inland Technologies is a full-service airport environmental compliance and ground support specialist. We offer a complete range of services, including aircraft de-icing, spent aircraft de-icing fluid management and ground-handling services for large and small airports throughout North America and Europe. Inland is primarily a service provider, but it also designs, develops and manufactures the equipment used in the delivery of its programming and remains fully engaged in ongoing R&D initiatives to improve service offerings.

Invensun Environmental Corporation



Invensun, based in Calgary, Alta., is a premier designer and manufacturer of world-class solar panels used in diverse applications in all environments. Our flagship, the Sundragon Hazardous Grade Solar Panel, is specifically built to operate in classified hazardous locations and other locations such as the Arctic, where reliability and durability are essential. In addition to solar panels, Invensun also has the expertise to offer complete off-grid, grid-tie and energy storage systems.

NEXUS Coastal Resource Management Ltd.



NEXUS is an environmental resource management company that provides expert and technical services to support the development of natural resources and infrastructure. We have a firm grasp of the contemporary issues facing marine and environmental management decision making, and continue to advance our efforts and approaches in ensuring that the best possible project outcomes are achieved. NEXUS works in the social and political intersection of community, academia government and industry to promote sustainable economic development based on sound resource management.

North/South Consultants Inc.



North/South Consultants (est. 1981) is a Canadian-owned company specializing in the aquatic (freshwater, estuarine, marine) environment. Our company serves clients in the electrical, oil and gas, transportation, pulp and paper, agriculture and mining industries, as well as government, Inuit, First Nations and community organizations. North/South employs professional and technical personnel at the BSc, MSc and PhD levels, specializing in a broad array of aquatic disciplines (biology, ecology, taxonomy, toxicology, geographic information systems).

Sigma Energy Storage Inc.



Sigma Energy Storage offers a thermomechanical energy storage system suited to harsh environments thanks to its portability, longevity and temperature resistance. High-pressure compressed air energy storage, combined with a proprietary thermal recovery system, delivers unparalleled round-trip efficiency. Using Sigma's scalable system on a microgrid reduces diesel consumption (and associated costs and emissions). It enables the use of intermittent renewable energy sources, such as wind or solar, for sites looking to decarbonize their energy production.



Solvest Inc.

Established in 2012, Solvest Inc. is a solar project development and installation firm specializing in remote energy projects. Our team has experience building systems across Canada and the Arctic in the harshest of conditions. Whether you are looking to power your home or to reduce the carbon footprint of a large facility, Solvest will work with you to ensure that your solar system is a success.



stratos-sts.com

Stratos

Stratos, a specialized management consultancy, has worked extensively on sustainable resource development in Canada's north and internationally for over a decade. Our team is uniquely positioned to provide leadership and support to governments, industry, NGOs and Indigenous communities in the Arctic. Stratos has subject matter expertise in such areas as contaminated site management, stakeholder and Aboriginal engagement, sustainable resource development and socio-economic benefits. We are well respected for our ability to build effective relationships between diverse interests.



Unify Energy Inc.

Unify Energy Inc. is a Nova Scotia-based energy storage solutions company. We provide electricity storage solutions for intermittent generation sources (i.e. renewable energy), constrained electricity grid applications as well as remote end-user applications. Our technology is a combination of innovative regenerative air energy storage (RAES) technology plus Unify's Grid-level Advanced System Software. RAES is a low-cost, long-lifetime, high-efficiency and flexible energy storage technology.



Western Heritage Services Inc.

For over 25 years, Western Heritage has provided services in the area of heritage management, near-surface geophysics, geomatics and community engagement. We have provided imagery services in the High Arctic. Western Heritage grew out of a provincial research council. The senior staff have a combined total of more than 150 years of experience in impact assessment and compliance-based studies. Western Heritage is certified under ISO 9001:2015 for quality management and has an Enform certificate of recognition for safety.



TechnoCentre éolien

The TechnoCentre éolien is a centre of expertise supporting the development of wind energy through research activities, technology transfer and the provision of guidance and advice to businesses. Located in Gaspé, Que. with 26 full-time employees, TechnoCentre éolien's main areas of activity involve wind energy in cold climates and complex terrain, technology adaptation and integrating Quebec businesses into the supply chains of the wind energy industry.

Other companies with capabilities in this sector include: Stantec Consulting Limited (p. 27).



In 2015, the Canadian Armed Forces (CAF) procured the ARGO MIL-XT-AM vehicle for Arctic mobility. Facing a requirement to conduct operations in the Arctic under any climatic conditions, the CAF's 30-year-old over-snow vehicle fleet was in dire need of replacement; albeit in an extremely fiscally constrained environment. ARGO was selected to provide an extremely capable Arctic mobility vehicle as a cost-effective commercial-off-the-shelf solution.

ARKTOS Developments Ltd. has successfully supplied U.S. Coast Guard-Approved 52-person ARKTOS Evacuation Craft for three oil companies in the U.S. Arctic for offshore installations in the U.S. Beaufort Sea. These Craft have been in use in the Arctic since 2000, allowing the oil companies to operate year round by supplying additional safety for personnel. Although initially designed to be a "life-boat that can operate in ice", amphibious ARKTOS Craft can fulfil many logistical duties in the Arctic.



COLD CLIMATE MANUFACTURING

Representing more than 10 percent of Canada's GDP, manufacturing is a cornerstone of the Canadian economy. Canada consistently ranks among the world's top machinery-manufacturing countries. With more than 9,000 establishments and a labour force of some 170,000 workers, Canada's machinery and equipment industry recorded sales of manufactured goods of nearly \$50 billion in 2015, and exports accounted for over half of all sales. Traditionally, companies in Canada have served clients within the automotive and aerospace sectors, and Canadian manufacturers are also the country's leading investors in new technologies.

The already solid foothold of this industry has given Canada a competitive edge and an excellent foundation as companies increasingly find themselves operating in cold climates. Relevant products and equipment include heating systems, vehicles and amphibious craft, rough-weather protective clothing, sensors and camera equipment. While these products are diverse, a common trait is that they are purpose-built to handle extreme Arctic conditions.

With a penchant for identifying emerging opportunities in the north, and close ties to the research and innovation sectors, Canadian manufacturers are perfectly placed to develop machinery and equipment solutions that are designed for the Arctic of the future.





Following a search-and-rescue (SAR) incident in the Arctic in 2011, Tulmar Safety Systems was commissioned by Canada's Department of National Defence to develop equipment to meet a specific need that could not be met by any product available at that time. Tulmar successfully developed an Arctic life raft for use on ice or in an ice and water environment. The life raft is deployable by airdrop, anchors to the ice and inflates manually with nitrogen gas. It has reinforced buoyancy chambers to resist abrasion, chafing and puncture, and has features that help survivors in low-temperature/high-wind environments.





COLD CLIMATE MANUFACTURING LISTING



advancedmatsystems.com



hermannelson.com



ARGOxtv.com

ARKTOS

Amphibious Solutions

arktoscraft.com

Advanced Mat Systems

Advanced Mat Systems (AMS®) specializes in designing and manufacturing a comprehensive range of customizable heated and non-heated anti-slip solutions for offshore/onshore applications and operations. With a strong focus on Arctic operations and as the world's only provider of our patented heated mat system (the Arctic Pad®), our solutions can be found across industry, ranging from mobile offshore drilling units, land-based facilities, maritime vessels and crane platforms to wind tower platforms. Whatever the application, these easily customizable, multi-purpose solutions have proven time and again to improve safety and operations.

Aerotech Herman Nelson International Inc.

Based in Winnipeg, Man., Aerotech Herman Nelson International manufactures commercial stand-alone heaters used in industrial sectors such as aviation, oil and gas, construction and the military. Our BT400 NEXD and BT400 NEXG engine-driven heaters are niche products in that their compact size can deliver an instant 400,000 BTUs of clean air heat to the most remote locations in the harshest of conditions.

ARGO XTV

Since 1967, ARGO has been the world leader in extreme environment off-road vehicles. The Argo is used extensively in the site operations of natural resource sectors such as mining and oil and gas exploration, as well as in military and SAR operations. The Argo is amphibious and over-snow terrain capable with a minimal environmental footprint. If your task takes you into the extreme environment of the Arctic, ARGO will get you there and back.

ARKTOS Developments Ltd.

ARKTOS Developments manufactures amphibious ARKTOS Craft currently being used by the oil industry for evacuation and seismic survey in the Arctic. A smaller craft is being developed for duties such as SAR, oil spill response, disaster response, surveillance and community support. A larger self-righting ARKTOS Evacuation Craft has also been designed and successfully model tested. ARKTOS Craft have unique capabilities that enable them to operate in mixed-ice water, shallow water and uncharted waters in all weather conditions.



campbellsci.ca

Campbell Scientific Canada Corporation

In 1988, Campbell Scientific Canada (CSC) secured the manufacturing rights for an ultrasonic snow-depth sensor from Environment Canada. There are now more than 6,000 of these sensors (Model SR50A) in use around the globe. CSC has recently introduced its second-generation CC5MPX digital camera, which has a -45 C operating capability. The camera has been received with great enthusiasm where remote, unattended monitoring is required. CSC, in partnership with Hydro-Québec, also manufactures the CS725, a non-contact snow water equivalent sensor.



climategear.ca

Climate Technical Gear Ltd.

Climate Technical Gear is a designer and manufacturer of commercial protective and safety garments. All of our products are designed and manufactured under one roof, which allows us to be uniquely responsive and adaptive. Our products range from commercial foul-weather gear used in northern fisheries to inflatable life jackets and ship abandonment suits. We also participate in R&D projects with local interests and government agencies in topics ranging from in-water survivability and thermal performance to flame-retardant protection.



fabersnowshoes.com

Faber and Co Inc.

A snowshoe manufacturer since 1870, Faber produces a selection of snowshoes from the traditional wooden snowshoes laced with rawhide to the best high-tech aluminium or hybrid snowshoes, as well as accessories like bindings, poles and bags for snowshoes. Our customers include both outdoor enthusiasts and companies across a range of sectors, such as utilities, mining and forestry, as well as military and security services.



frost-fighter.com

Frost Fighter Inc.

For over 50 years, Frost Fighter has provided the most reliable portable heaters, ranging from 200,000 to 1.5 million BTUs, for remote areas of the north. Frost Fighter heaters have been used for aircraft pre-heating and space heating structures, as well as in mining and general construction. All of our units are equipped with a proven burner that lights in extremely cold conditions, a fully insulated jacket for increased safety and a higher temperature rise, a GeniSys controller with easy troubleshooting access, and an environmental spill containment area around the tank.



maritimehydraulic.com

Maritime Hydraulic

Maritime Hydraulic is a manufacturer of highly specialized metal fabrication, hydraulic systems and motion compensation systems. We offer a solid team of dedicated specialists (80+ professionals) and strong manufacturing capabilities. Maritime Hydraulic manufactures equipment certified for -40 C, and is prepared for much colder environments. We typically manufacture unique equipment, designed specifically for complex situations and harsh environments. Our clients are global engineering, procurement and construction companies requiring technologically demanding solutions.



mustangsurvival.com

Mustang Survival

For 50 years Mustang Survival has been engineering high-performance marine gear for military, coast guard and rescue personnel. With a focus on applied research and field testing, we are committed to the protection of those who push themselves to extremes. We build fit-for-purpose and operationally relevant marine safety gear that saves lives and supports exploration on water. Mustang Survival is a dominant knowledge and product leader in extreme cold water and weather protection and survival technologies.

pami.ca

PAMI

PAMI is a technical services agency of the Saskatchewan and Manitoba governments. PAMI delivers applied research, development and testing, with diversified engineering expertise for direct application in the agriculture, transportation, energy, utility, military, forestry and mining fields. PAMI operates a vehicle test centre, with environmental chambers that enable testing for functionality, durability, performance and compliance. PAMI can carry out force and vibration simulations and controlled temperature testing between -50°C and 60°C. It also has capabilities in mobile test data acquisition and experience with bioenergy and alternative fuel studies.



sei-ind.com

SEI Industries Ltd.

For more than 30 years, SEI Industries' climate-specific fuel storage, spill containment and pumping systems have been field tested by operators working in extreme conditions and climates. Using proprietary materials, SEI's Arctic King fuel bladders and berms were the first to be certified to Canada's new national CAN/CSA-B837-14 standard. Arctic King tanks are purpose-engineered for above-ground storage of fuels in Arctic climates and provide a low cold crack temperature below -50°F or -46°C. Many mining, construction and exploration companies use the Arctic King.



stedfast.com

Stedfast Inc.

Stedfast Inc. is a worldwide leader in manufacturing value-added laminated and coated textiles, serving the material to specification needs of industrial, medical, protective clothing and military applications. Stedfast Barrier Textile Technologies provides coated fabric solutions for cold climates down to -40°C. Our team of chemists and engineers allows Stedfast to be a leader in engineering high-tech barrier textiles that are rugged and durable for all of the different applications to which they are dedicated.

TULMAR

tulmar.com

Tulmar Safety Systems Inc.

Tulmar is a specialist in the development, manufacture and servicing of textile products for rescue and life support. In an Arctic environment, our products are targeted to the aviation, defence and oil and gas sectors. Typical clients are military SAR or other groups using helicopters for transporting workers to oil/gas rigs across the Arctic. Our key differentiator is our ability to custom design products for harsh and extreme conditions.



www.weatherhaven.com

Weatherhaven Global Resources Ltd.

Weatherhaven is world leader in the design, manufacture, transportation and installation of rugged, portable fabric-covered buildings and ISO-container-based tactical shelters. Applications include workforce camps, workshops, laboratories and medical facilities. Weatherhaven's design commitment to maximizing transport efficiencies achieves unparalleled portability while maintaining a high-performance product for even the most inclement conditions.

Other companies with capabilities in this sector include: AirBoss Defense (p. 47), DEW Engineering and Development (p. 47).



Golder Associates was retained by the Government of Canada to assist with the stabilization of underground openings at the Giant Mine in Yellowknife. Remediation focused on backfilling to address risks to the public, worker safety and the environment. Golder developed detailed step-by-step work plans to manage complex underground mine geometry, regulatory commitments and the extreme cold, which involved unprecedented flexibility and innovation. Golder won the 2015 Canadian Consulting Engineering award for this project.

The Northstar pipeline was constructed to deliver crude oil from a human-made gravel island offshore in the Alaskan Beaufort Sea. As the world's first offshore Arctic project to transport oil from an offshore processing facility to shore through a trenched pipeline, INTECSEA overcame many challenges unique to the Arctic, including: environmental effects from seabed ice gouging, strudel scour and permafrost thaw settlement; mechanical design issues, including upheaval buckling; development of a hydrocarbon leak sensing system; and various permitting and ice-based pipeline installation challenges. INTECSEA used the latest developments in strain-based pipeline design and ensured a rapid and efficient ice-based pipeline installation during winter using conventional onshore construction practices.



NORTHERN INFRASTRUCTURE, ENGINEERING AND DESIGN

The Canadian infrastructure sector is an important knowledge-based industry and a key contributor to the Canadian economy, employing over 1.1 million Canadians while representing 8.6 percent of Canada's total GDP. Our Canadian infrastructure companies are globally recognized for their consulting engineering and architectural services, expertise in public-private partnerships (P3s), and supplying innovative, clean technologies and building products. In the decade ahead, the Canadian construction market is expected to become the fifth-largest in the world.

Few regions demand unique and purpose-built technical solutions like the Arctic. Engineering, construction, architecture and design of infrastructure in the north can be tremendously difficult. For example, foundation design, embankment and port engineering, winter road maintenance, structural engineering and wastewater management are but a few assignments that are complicated by challenges associated with operating in cold climates, such as icing caused by sea spray, snowdrifts, permafrost degradation, coastal erosion and avalanche risk.

In Canada's north, the infrastructure sector has had particular success with public-private partnerships. Canadian engineering and infrastructure companies operating in the north often specialize in providing environmental impact assessments, as well as advising and consulting regarding community planning, energy efficiency and permafrost changes. Many also have broad experience with operating in remote, isolated regions.





EVOQ was commissioned to design the new Canadian High Arctic Research Station (CHARS). With NFOE Architects and SNC-Lavalin, EVOQ designed a world-class station, demonstrating state-of-the-art design excellence that serves as a model polar installation. Supporting world-class, multidisciplinary science and technology research and a leader in green and sustainable technologies for the Arctic, CHARS is successfully attracting Canadian university researchers and international scientists to lease its leading-edge polar facilities.

Arctic Watch Wilderness Lodge is located 80 miles south of the Magnetic North Pole on Somerset Island. Sprung Structures provides sleeping and recreational facilities for hundreds of visitors throughout the summer who come to the Arctic for an ultimate wild life experience. Sprung Structures' 12 feet by 12 feet housing units are combined with 30-foot span structures to produce an exceptional facility for this remote Arctic location.





NORTHERN INFRASTRUCTURE, ENGINEERING AND DESIGN LISTING

ATCO

atco.com

ATCO

ATCO is a diversified global corporation with nearly 8,000 employees and assets of approximately \$19 billion. The company delivers service excellence and innovative business solutions in structures & logistics, electricity, pipelines & liquids, and retail energy to customers around the world. In the Arctic, ATCO provides rental and construction of modular buildings, site support, logistics and maintenance services, fuel handling and distribution, electricity generation and natural gas delivery. ATCO has a long history of commitment to the Arctic, partnering with Indigenous communities and providing dependable service on time and on budget.

bgcengineering.com

BGC Engineering Inc.

BGC Engineering is an international consulting firm that provides professional services in applied earth sciences. Our practice was established in 1990, based on a specialized appreciation of the impacts of geology on engineered structures, enabling us to address a broad spectrum of engineering and environmental issues related to development in challenging terrain. BGC is composed of over 300 professional engineers, geoscientists, technicians and support staff, who provide a full range of investigation, design and construction review services.

challengergeomatics.com

Challenger Geomatics Ltd.

Challenger is a proudly employee-owned Canadian geomatics company with offices in Calgary, Edmonton and Fort McMurray, Alta., and Whitehorse, Y.T. Incorporated in 1984, Challenger has grown to 140 staff who provide a full range of innovative, multidisciplinary survey, mapping, geomatics and engineering services to the oil and gas, mining, infrastructure, construction, government, utilities and land development sectors. Challenger has been servicing projects across Northern Canada and the Arctic since our inception, and has gained decades of experience with the unique requirements associated with surveying in the Arctic.

<http://evoqarchitecture.com/>

EVOQ

EVOQ, an architectural firm based in Montréal, Que., has a staff of 90 and has been active in the Canadian Arctic for 40 years. The firm works in partnership with Inuit-owned Panaq Design of Iqaluit, Nun. Services include community planning, programming, design charrettes, design and construction plans and specifications, construction supervision and administration. It is known for leading-edge expertise in Arctic design and construction, energy efficiency (LEED, PassivHaus) and architecture that is adapted to Indigenous cultures. Clients in Canada include the federal government, regional governments, local administrations and the private sector.

Flexiport Mobile Docking Structures Inc.



Flexiport offers docking solutions that are more flexible and environmentally friendly than conventional docking/port infrastructures. Our technology can serve many needs, including a new docking facility, offshore terminal or extension to an existing dock. Our docking solutions can accommodate various operational requirements and vessel types, and their mobility enables them to be relocated as required during a major project's lifecycle. Flexiport is based on a modular concept, which can be adapted to the specific sea, weather and ice conditions of any given Arctic location.

Golder Associates Ltd.



Golder Associates is a global, employee-owned engineering and environmental services firm with over 165 offices and 6,500 employees. Serving a broad range of clients and sectors, including manufacturing, oil and gas, mining, power and infrastructure, Golder offers a wide range of independent consulting, design and construction services that are well suited to the Arctic. Its work in the Arctic includes providing solutions to respond to permafrost changes and the impacts of climate change, as well as offshore and near-shore projects to study coastal and marine processes. Clients choose Golder for its technical excellence and proven performance.

Lateral Office



Lateral Office is a unique architecture firm that works at the intersection of architecture, urbanism and landscape. They are committed to the role of architecture in remote regions, where culture, ecology and logistics are central to making an architecture that is culturally and environmentally responsive. Lateral Office conducts urban research, master planning and strategic visioning for communities and organizations wishing to address urban, infrastructural or space planning questions. Lateral Office believes that architecture is a powerful tool for asserting culture and community.

LFL Group



LFL Group is a group of general contractors offering construction services in the civil, mining, industrial, institutional, commercial and environmental sectors. The companies are Inuit/locally owned and serve all of northeastern Canada. We are specialists in remote, isolated regions, understanding their specific logistics, environments, techniques and cultures. Our typical clients are governments/institutions and municipalities but also mining and hydroelectric/energy companies. Our clients can rely on a solid organization and a team of experts who do not back down from any challenge.

Nuna Innovations Inc.



Nuna Innovations is a member of the Inuit-owned Nuna Group of Companies. It represents and introduces groundbreaking, innovative technologies to the mining, construction, defence, disaster relief, and oil and gas industries. Nuna Innovations provides cost-effective, safe and environmentally friendly alternative product and technology solutions for current industry applications. Our products are specialized for remote, cold weather, heavy-duty applications to reduce project timelines and allow companies to overcome conditions that would otherwise delay or prevent projects from moving forward.



Qikiqtaaluk Corporation

Qikiqtaaluk Corporation is the development arm of the Qikiqtani Inuit Association, which represents approximately 14,000 Inuit of the Qikiqtani region. Located in Iqaluit, Nun., Qikiqtaaluk Corporation and its group of companies is involved in most of the economic sectors of Nunavut. Our headquarters operation has approximately 60 full-time positions. We provide services in the transportation, fisheries, environmental remediation, real estate, and resource and energy sectors. Our clients have typically been governments, and we can solve the logistical and employee-relations challenges faced by new companies operating in Nunavut.



Sayle Group Inc.

Sayle Group provides quality health, safety and environmental products and services to the oil and gas, shipbuilding and construction industries worldwide. Our products and services help clients to achieve operational excellence in environmental permitting; occupational health and safety; emergency response; regulatory compliance; risk assessment; incident investigation; bridging documents; community, regulatory and stakeholder consultation; and monitoring and improvement. Our team is composed of leading experts who have global experience in delivering products and services to all tiers of the project supply chain.



SoilVision Systems Ltd.

SoilVision Systems provides finite element software and engineering numerical modelling consulting services related to Arctic applications. The software packages SVFLUX for groundwater flow, as well as SVHEAT for heat flow based on conduction or convection, are applicable in northern regions. The SVHEAT software is formulated to model the freeze/thaw phase change in soils. SoilVision Systems also provides consulting services related to numerical modelling in Arctic regions. Models can be related to the freezing/thawing of groundwater around mining structures, pipelines, or around thermosyphons to maintain permafrost zones.



Sprung Structures

Sprung Structures has achieved international recognition by providing (lease or purchase) over 12,000 shelter solutions (widths of 30 feet to 200 feet by any length) for thousands of different applications in 100 countries throughout the world. Our durable, precision-engineered structures are the solution of choice for a broad range of industries needing a fast, reliable and cost-effective building solution. This innovative building solution uses architectural membrane panels placed under high tension within a non-corroding aluminium substructure. Sprung provides an optional superior performing energy-efficient Johns Manville formaldehyde-free insulation package.



stantec.com

Stantec Consulting Limited

The Stantec community unites approximately 22,000 employees working in over 400 locations, including eight offices across Canada's north. Our services include feasibility studies, land/route reclamation, environmental impact assessments, regulatory permitting, community/stakeholder engagement, planning, engineering, architecture, procurement, construction management, site development and services, and project closure reclamation/ remediation. Our local strength, knowledge, and relationships coupled with a long-term commitment to the people and places we serve, gives us the ability to personally connect to projects and advance the quality of life in communities across the north.



worleyparsons.com

WorleyParsons Group

WorleyParsons Group is a global organization that delivers engineering, procurement and construction management services and offers a wide range of consulting and advisory services in the hydrocarbon, minerals, metals, chemicals and infrastructure sectors. Our knowledge and capability in the Arctic has evolved over more than 65 years of pioneering cold climate projects. We leverage our unparalleled concept-to-completion expertise to consistently deliver innovative, first-of-a-kind solutions that solve the unique problems of this unique area, including working with short construction seasons and tight delivery schedules.

***Other companies with capabilities in this sector include:
Advantech Wireless (p. 44), Cartwright Drilling Inc. (p. 38).***



NORTHERN TRANSPORTATION AND LOGISTICS SERVICES

In addition to the many settlements and geographical features with names of Indigenous origin, Canada's waterways and islands in the north are punctuated with the names of European maritime explorers spanning over 400 years, many of whom perished in their attempts to discover a commercial sea route to the established trading nations in Asia. Transportation in northern Canada has undergone considerable change since then thanks to decades of perseverance, experience and specialization. Today, and despite the invariable challenges of geography, seasonality, and climate change, there is a safe and increasingly efficient flow and movement of people and goods within Canada's north.

Arctic maritime operations are faced with many challenges, including unpredictable, rapidly changing weather, varying sea ice conditions, remoteness and an overall absence of shore-based infrastructure. In part because of this, maritime regulations in Canada's Arctic have received international recognition for their robust safety and environmental protection standards. This has contributed to shaping Canadian companies into leaders in delivering northern freight and passenger services, sealift services, dry bulk shipping, and shipping of petroleum and chemical products.

Over the years, air links have become a vital way to connect the north. Air passenger, cargo, all-weather helicopter SAR and medevac services, as well as remote and sea-ice/glacier operations, have become essential services for both onshore and offshore exploration and government and scientific research activities.

Naturally, the full suite of expertise and services supporting the northern transportation sector—including supply chain analysis and management, logistics solutions, cargo-handling and sealift support—has evolved in lockstep.

Canadian companies have demonstrated their resourcefulness and resilience in overcoming the range of transportation and logistics challenges the north presents. With expected growth in northern industrial activity and tourism, as well as the possibility of new northern trade routes in the coming decades, transportation and logistics companies in Canada are exceptionally well positioned to meet demand across the circumpolar Arctic.



NORTHERN TRANSPORTATION AND LOGISTICS SERVICES LISTING



bbex.com

BBE Expediting Ltd.

BBE Expediting Ltd. is a logistics company with four decades of experience in the Arctic. We operate from four facilities across Canada and three joint venture operations in northern Canada. BBE Expediting Ltd. provides the following services: cargo handling, warehousing, freight forwarding, field logistics personnel, sealift support, supply chain management, procurement and ship chandler services. BBE Expediting Ltd.'s southern consolidation centres combined with northern operations make us the strongest networked logistics provider in northern Canada and a one-stop shop for clients working in and out of the Canadian Arctic.



canadianhelicopters.com

Canadian Helicopters

Canadian Helicopters is the largest helicopter operator in Canada, with 24 locations and almost 100 helicopters. We have been providing transportation in Canada's Arctic for over 50 years. Our Arctic clients include onshore and offshore exploration companies and scientific research agencies. We also provide transportation for the 47 North Warning System radar stations spanning Canada's Arctic. Canadian Helicopters belongs to HNZ Group, an international provider of helicopter transportation services. HNZ Group has operations in Norway through its interest in Norsk Helikopterservice.



CHC

chc.ca

CHC Group Ltd. - www.chc.ca

CHC is a leader in enabling customers to go farther, do more and come home safely, including oil and gas companies, government SAR agencies and organizations requiring helicopter maintenance, repair and overhaul services through the Heli-One segment. CHC is headquartered in Vancouver, B.C., and operates the most technologically advanced helicopters in countries around the world.



cougar.ca

Cougar Helicopters Inc.

Cougar Helicopters Inc. has been providing world-class, all-weather helicopter SAR and medevac services since 1991. With headquarters located in St. John's, Nfld., the company is composed of 280 employees. As a leader in the SAR industry, Cougar's team of professionals provides 24/7/365 20-minute launch SAR capabilities responding to a wide range of emergencies on land or at sea in some of the world's harshest weather environments.



fednav.com

Fednav Limited

Based in Montréal, Que., Fednav Limited is Canada's largest ocean-going dry bulk ship-owning and chartering group, operating close to 100 vessels. In the Arctic, Fednav services five mine operations transporting concentrates from northern mines and, in three cases, returning with all resupplies. Enfotec, a subsidiary of Fednav Limited, offers support to vessels navigating in ice-covered regions with sea-ice assessments and marine accessibility studies.



desgagnes.com

Groupe Desgagnés

Desgagnés Transarctik Inc., à Groupe Desgagnés Inc. subsidiary based in Sainte-Catherine, Que., is the leading sealift operator with over 50 years of experience in remote northern regions, particularly in the Canadian Arctic (Nunavut and Nunavik regions). Pétro Nav Inc., a Groupe Desgagnés Inc. subsidiary based in Montréal, Que. since 1996, is a North American leader in ship chartering as well as petroleum and chemical product shipping. Pétro-Nav's clients include leading Canadian petroleum and chemical refining, production and distribution companies.



borekair.com

Kenn Borek Air Ltd.

With over 40 years of Arctic and Antarctic experience, Kenn Borek Air (KBA) offers a full range of specialized aviation services and is recognized worldwide as a highly diversified polar operations specialist. Polar services include passenger and freight transportation, airborne surveillance using custom designed and installed scientific instrumentation, medical evacuation, general camp support and resupply, bulk fuel, SAR activities, sea-ice/glacier operations, and other off-strip operations, including snow and tundra surface conditions. With a fleet of over 40 aircraft, KBA supports operations in geographic areas that other operators are unable to service.



logistec.com

Logistec

Logistec provides innovative logistics solutions and cargo-handling services. In the north, we help with the development of infrastructure, take the initiative in implementing natural resource export systems (e.g. for mineral concentrates), and manage the reception of the required supplies and equipment. We operate in some 30 ports and terminals throughout North America. Our experienced team handles all types of dry cargo, including bulk goods, break-bulk, project cargo and containers.



neas.ca

NEAS Group Inc.

NEAS Group is an Inuit-owned marine transportation company specializing in the transportation and delivery of general cargo and containers to the communities, mines, distant early warning (DEW) line sites, and remediation projects of Canada's Arctic. Our market stretches from the coast of Labrador, north as far as Grise Fiord and Eureka, and to the west as far as Kugluktuk in Canada's Western Arctic.



prologcanada.com

PROLOG Canada Inc.

PROLOG Canada Inc. is a transportation and logistics consulting firm that offers a range of economic development, project planning and logistics and supply chain analysis services, focused on the northern transportation sector. PROLOG has provided consulting services to government and industry since 1978, from offices in Whitehorse, Y.T., and Calgary, Alta. Assignments include a circumpolar focus on northern logistics that includes Nunavut, the Northwest Territories, Yukon, Alaska and Siberia.

Woodward Group of Companies



woodwards.nf.ca

We are a family-owned business headquartered in Happy Valley-Goose Bay, Nfld., providing petroleum product supply and delivery, as well as freight and passenger ferry services in the Arctic and sub-Arctic areas of eastern and northern Canada. We have been in the Arctic for decades and currently supply and deliver approximately half a billion litres a year north of 60. We own a fleet of five ice-classed tankers, as well as an ice-classed ferry and freight ship. We deliver to every marine-accessible community in Nunavut and to multiple mine sites, and we routinely conduct ship-to-ship transfers.

Other companies with capabilities in this sector include: ARKTOS Developments Ltd. (p. 18), Atlantic Towing Limited (p. 34), Kongsberg Digital Simulation Ltd. (p. 35), Stantec Consulting Limited (p. 27).



ARCTIC MARITIME

TriNav was commissioned by the Government of Nunavut to design and oversee the construction of a fisheries research vessel. TriNav Marine Design (TMD) designed the vessel, advised on technical specifications, and oversaw the ship's construction. The resulting RV Nuliajuk is a 64-foot custom-built, state-of-the-art research vessel. The vessel is currently being used by the Government of Nunavut to diversify and expand its fishing industry in a sustainable and responsible manner.

Enfotec, a subsidiary of Fednav Limited, developed the shipboard navigation system IceNav™ to enhance the safety and efficiency of ships operating in ice-infested waters. With IceNav, ship owners can provide their fleets with the clearest, most accurate and up-to-date ice information and satellite imagery available. IceNav was instrumental in the success of Fednav's icebreaker MV Nunavik, which became the first commercial vessel transporting Arctic cargo to completely transit the Northwest Passage unescorted, navigating from northern Quebec to China.



Canada has a long and proud naval and shipbuilding history. Today, a vibrant maritime industry continues to serve our expansive coastline and its network of marine communities dotted from sea to sea. Canada's Arctic coastline, stretching 162,000 kilometres, is more than twice the coastline of the European Union.

Canada's maritime expertise in the Arctic has deep roots in naval architecture, design and engineering, shipbuilding, vessel support and supply, as well as businesses supplying related equipment, technologies and services. As the industry has continued to progress toward high-value-added segments of the market, the sophistication of technologies and the quality of equipment and expertise has become increasingly imperative. For Canada, this is becoming more and more applicable to products and services in the north.

Canadian capabilities encompass everything from designing and building a wide range of modern ice-class vessels, to retrofitting and upgrading vessels for Arctic operations. A number of Canadian firms specialize in ice navigation services, ice management and information services as well as maritime ice simulation systems and training. With Arctic maritime activity expected to grow, companies in Canada are well positioned to meet increasing demand.





Davie Shipbuilding has retrofitted and extended the life of four of Canada's largest and most powerful Coast Guard icebreakers. In 2014, Davie completed a major refit and vessel life extension of the CCGS Louis St-Laurent, Canada's heaviest polar icebreaker, for the Canadian Coast Guard and installation of an underwater sonar to map the Arctic Ocean floor. Davie completed major upgrades to its propulsion, mechanical and electrical systems to ensure its safe navigability in Canada's high Arctic. The ship was also fitted with a hull-mounted sonar to support Canada's mapping of the Arctic Ocean floor.





ARCTIC MARITIME LISTING



allswater.com

Allswater Marine Consultants Limited

Allswater is a privately owned consulting engineering company specializing in marine and offshore applications. From offices in Nova Scotia and Newfoundland and Labrador, a staff of 20 provide services to governments, vessel owners, operators, shipbuilders and fabricators. For clients operating in Arctic waters, Allswater has prepared structural designs to upgrade vessels for Arctic operations, added ice skegs, performed condition and valuation surveys, and routinely prepared stability documentation, including on ice-accretion conditions.



ATLANTIC TOWING
atlantictowing.com

Atlantic Towing Limited

Atlantic Towing services the offshore oil and gas sector by providing vessel support and supply, along with ice management, through our offshore vessels located across eastern Canada. Furthermore, many other industries are serviced by our harbour and terminal towage, coastal tug and barge and salvage operations. In the Arctic, each summer we provide sealift services to resupply northern communities when passage is permitted. Our ice-strengthened vessels and experienced crews have demonstrated our strong capabilities in providing these services time and again.



fleetech.com

BMT Fleet Technology

BMT provides leading-edge naval architecture, marine engineering and program management services, structural and mechanical system damage assessment, materials and welding engineering and integrity assessment. The company is committed to retaining and applying practical knowledge and subject matter expertise in developing responsive solutions to customers' needs, and will deliver a long-term, enduring base of capability and capacity for major engineering projects. BMT provides design, engineering, logistics and management services to the Arctic Offshore Patrol Ship Project Management Office.



davie.ca

Chantier Davie Canada Inc.

As Canada's largest and highest-capacity shipyard, Davie has been responsible for building the majority of the Canadian Coast Guard's icebreakers and is a pioneer in combined Arctic-maritime technologies, including liquefied natural gas (LNG) and dynamic positioning integration on high ice-class vessels. Davie is the Canadian Coast Guard's centre of excellence for its icebreaker refits and upgrade programs. Currently, Davie is building three ice-class subsea construction vessels and two ice-class dual-fuel LNG ferries. Davie is also building Canada's next naval supply ship, a Resolve-class auxiliary oil replenishment ship.



Enfotec Technical Services Inc.

Enfotec is a subsidiary of Fednav Limited, Canada's largest ocean-going, dry-bulk ship-owning and chartering group. In addition to supporting Fednav's Arctic and winter operations, Enfotec provides a wide range of ice-related information services to the marine and resource industry as well as government agencies worldwide. Enfotec is the developer and distributor of IceNav™, a shipboard navigation system designed specifically for vessels operating in ice-infested waters. The division also provides sea-ice assessments and marine accessibility studies for current and projected shipping operations.



Innovation Maritime

Innovation Maritime is a research centre affiliated with the Québec Maritime Institute and has been active since 2001. The centre offers R&D and technical assistance services, and disseminates information to companies and organizations linked to the marine sector. Its projects focus mainly on six major research areas: marine transport and transport logistics; navigation; marine engineering; marine safety and security; environmental technologies; and professional diving. The centre has completed more than 300 projects for the marine industry.



Kongsberg Digital Simulation Ltd.

Kongsberg Digital Simulation Ltd., located in St. John's, Nfld., is built on 40 years of simulation leadership and unrivalled maritime experience. Kongsberg simulators help train for complicated scenarios in order to improve safety, technical proficiency and R&D in the merchant, navy, coast guard and offshore markets. All products are certified to the highest standards from DNV-GL and include crane simulators, dynamic positioning simulators, engine room simulators, liquid cargo handling, offshore vessel simulators and ship bridge navigation simulators.



Martech Polar Consulting Ltd.

Martech Polar Consulting is a privately owned company providing global ice pilotage/navigation services in accordance with International Maritime Organization Guidelines for Ships Operating in Polar Waters and Canadian Arctic Waters Pollution Prevention Regulations. We can provide onboard polar shipping and ice navigation advice and polar research and expedition logistics support and consulting for polar shipping and transportation.



Portsmouth Atlantic

Portsmouth Atlantic is an advanced engineering company based in Atlantic Canada that is focused on the defence and marine industry. Portsmouth Atlantic is a dedicated centre of excellence for marine technologies for the Portsmouth Group of companies. The company has eight decades of experience in the global defence domain, providing quality turnkey solutions, from concept through engineering design, manufacturing, implementation and support. Whether the requirement is Canadian or international, Portsmouth Atlantic provides operator solutions for clean air, clean water, storage, shipping, and weapons handling/integration.



TriNav Group of Companies

The TriNav Group of Companies is composed of nine firms offering services ranging from fisheries and business consulting, crewing recruitment and management, vessel and seafood brokerage, naval architecture and marine design, to publishing and property management. In particular, TriNav Fisheries Consultants has experience providing fisheries advisory services in Nunavut. Northern Crewing offers crews for marine activities in the Arctic. TriNav Marine Brokerage is the largest broker of vessels, licences and quotas on the east coast of North America, with a number of international clients.



Vard Marine Inc.

Vard Marine is headquartered in Vancouver, B.C., with offices in Ottawa, Ont., and Houston, Tex. With a total staff of approximately 100, mainly degreed professionals, we design specialized vessels for Arctic operations, from the Canadian polar icebreaker to ice-capable supply and research vessels. We provide consulting services to Arctic-related projects in areas including risk assessments, feasibility studies and operational analyses. Clients come from the private and public sectors, and our high level of repeat business is based on providing effective solutions to client requirements.



Virtual Marine Technology

Virtual Marine Technology (VMT) specializes in maritime simulation systems. VMT's customers consist of oil and gas companies, defence contractors and first response organizations such as coast guards. As these organizations push operations farther north, ice management and navigation in ice-covered waters becomes more important. Working with partners, VMT has developed ice simulation systems for military vessels and small vessels working in the Arctic. The systems are now being trialled by industry and have been deployed in educational programs.

Other companies with capabilities in this sector include: Advantech Wireless (p. 44), ARKTOS Developments Ltd. (p. 18), Rutter Inc. (p. 9), Stantec Consulting Limited (p. 27).



NORTHERN MINING EQUIPMENT AND SERVICES

The remote Isua iron ore mine is located in central west Greenland at the edge of the Greenland ice sheet. At Isua, Cartwright Drilling overcame multiple challenges of drilling through: permafrost, which necessitated heating salted water before pumping it down the hole; a very slow moving, 150-metre thick glacier; and moraine underneath the glacier, containing many round rocks and boulders.

Mining has deep historic roots in Canada's north. Its early beginnings can be traced back to the Klondike Gold Rush in the Yukon in the late 1800s. Canada's vast northern expanse is home to an abundance of mineral and metal deposits, leading to the development of a thriving mining industry across northern Canada and fostering cutting-edge innovation among Canadian mining equipment and service suppliers.

A testament to the strength of Canada's mining industry is the fact that Canada consistently attracts on average 15 percent of worldwide exploration spending, produces some 60 minerals and metals, and boasts nearly 200 producing mines, many in the country's northern expanses. The Toronto Stock Exchange (TSX) and TSX-Venture Exchanges together accounted for 62 percent of the equity capital raised globally for mining in 2014, totalling \$8.9 billion.³

With mineral exploration and development becoming an increasingly important driver of the northern economy, Canadian companies continue to pioneer the advancement of mining operations in remote and harsh climate regions. Such operations require advanced logistics and geo-mapping tools, sophisticated drilling technology and equipment, as well as extensive experience in dealing with the challenges that accompany constant sub-zero temperatures, permafrost and thick layers of ice. In addition, Canadian companies are at the forefront of successfully integrating community relations, Indigenous engagement and environmental management practices into their business culture.

As exploration activity increases in harsh and remote regions, mining in the Arctic is an increasingly complex endeavour. Moreover, the effects of climate change present new challenges that demand fresh, innovative solutions. World-class proficiency in all of these aspects is the hallmark of the Canadian mining industry.

³TMX, Leading the World in Mining Financing, <http://www.tmx.com/newsroom/news-feed?id=289>, March 3, 2015



NORTHERN MINING EQUIPMENT AND SERVICES LISTING



aatechnical.ca

A&A Technical Services

A&A Technical Services supplies and installs geomembrane lining systems, geotextiles and geogrids, among other items. Specializing in cold weather “Arctic” installations, A&A pioneered the use and successful installation of high-density polyethylene geomembranes in extreme temperatures (down to and beyond -40°C), meeting or exceeding all critical quality control and scheduling requirements. Other cold-weather liner installations include those involving bituminous geomembranes, geosynthetic clay liners and geotextiles.



ageophysics.com

Abitibi Geophysics

Abitibi Geophysics provides the highest quality geophysical data acquisition, processing and interpretation services to help its clients find precious and base metals, diamonds, uranium and other mineral resources. Located in the Abitibi region of Quebec, we have built an international reputation over 32 years in the northern regions of Canada with safe acquisition and delivery of top-quality products, at a competitive price, on time. We deliver new innovations through the development of proprietary techniques to meet today’s mining industry challenges to better serve our clients.



candig.com

CanDig Mini Excavators Inc.

CanDig Inc., based in Kamloops, B.C., manufactures trenchers for mining exploration, which remove 10 feet of rocky, icy ground so geologists can identify drill sites. With short Arctic seasons, CanDig excavators save time compared with digging by hand. Unlike mini-tracked excavators, which are difficult and expensive to transport by helicopter and damage ground between trench sites, CanDigs move from one trench site to the next, on steep ground, without any damage to the environment. Land use permitting is easier and less expensive.



cartwrightdrilling.ca

Cartwright Drilling Inc.

Cartwright Drilling Inc. is a diamond core drilling company for mineral exploration, with headquarters in Goose Bay, Nfld., and branches in Thunder Bay, Ont., St. John’s, Nfld., and Nuuk, Greenland. We specialize in heli-portable surface core drilling in remote areas and in areas with permafrost. We also do geotechnical and environmental drilling. Our typical clients are mineral exploration companies and geological and environmental consultants. We were established in 1995 and own nearly 30 drill rigs.

Discovery Drill Manufacturer Ltd.



discoverydrills.com

Discovery Drill Manufacturer (DDM) produces hydraulic diamond drills for mineral exploration and shale gas and is located in Beresford, N.B. Our clients, drilling contractors, are located throughout North America, South America, Africa, Europe and Russia. We offer turnkey drilling solutions that are high-performance, highly efficient and versatile, while providing for employee safety and being sensitive to the environment. With five models to date (EF-20F, EF-50, EF-50F, EF-75, EF-75F), DDM is currently manufacturing the EF-100, which will have a depth capacity of over 11,000 feet.

***Other companies with capabilities in this sector include:
Advantech Wireless (p. 44), Atlantic Towing Limited (p. 34),
BGC Engineering Inc. (p. 24), Stantec Consulting Limited (p. 27).***



HARSH ENVIRONMENT OIL AND GAS EQUIPMENT AND SERVICES

To support the development of the Alaskan North Slope exploratory and production facilities, Ausenco provided the detailed design for offshore human-made island (gravel and artificial ice) engineering, permafrost foundations and ice encroachment protection services to various clients.

These islands were designed to withstand severe ice and wave conditions for safe operation of their facilities. Ausenco also designed and supervised the ice road for pipeline installation and offshore construction for three islands.

Canada is the world's fifth-largest producer of oil and natural gas. Northern Canada is home to approximately 35 percent of Canada's remaining conventional light crude as well as 38 percent of its remaining marketable resources of natural conventional gas. Despite these vast endowments of resources, as well as a long history of northern exploration dating back to 1920, it is off the Atlantic coast and in the northern reaches of Canada's energy-rich provinces that have seen high levels of oil and gas exploration and development.

Faced with similar challenges of harsh climates in highly regulated environments, it is in these regions where oil and gas equipment and service suppliers have developed into world leaders in innovative oil and gas technologies and services for application in Arctic and sub-Arctic conditions. Key strengths developed across the Arctic include onshore engineering and construction, remote location operations, ice-road design, offshore human-made ice-island design, ice-based pipeline installation, subsea engineering and construction, and oil and chemical spill detection and response. In addition, Canadian companies have proven their ability to successfully adapt to various export markets across northern latitudes, collaborating with wide-ranging stakeholders, including local communities, governments and scientists, as well as other local industries such as fisheries.

Approximately 84 percent of oil and gas in the Arctic is expected to be found offshore, which presents significant challenges, including stormy seas, ice shelves, icebergs, vicious winds, months of darkness and isolated locations. Located in a region where drifting ice is a common phenomenon, Newfoundland and Labrador's harsh environment oil and gas cluster has a deep pool of experience and expertise from which to draw to address these challenges.

With Canadian research institutions working closely with industry to address operational challenges and technology gaps, Canadian oil and gas equipment and service suppliers have emerged as world leaders in harsh environment oil and gas innovation. Not only does Canada have an extensive research infrastructure addressing oil and gas exploration, production and transportation in Arctic areas, the ability to conduct tests close to infrastructure offshore Newfoundland and Labrador is unique.



HARSH ENVIRONMENT OIL AND GAS EQUIPMENT AND SERVICES LISTING

Ausenco

ausenco.com



cpe.ab.ca

KVAERNER

kvaerner.com

NorQuest

Ausenco Engineering

Ausenco's international reputation for site-specific Arctic, northern development and cold region designs is based upon decades of successful project delivery and industry innovation. Our expertise covers concept studies through to detailed design in remote locations and harsh weather environments. Our pioneering work on ice technology has made Ausenco the leading designer of ice roads and ice islands. We also apply our integrated engineering services to gravity base and pile-supported structures, artificial islands, through-the-ice pipelay, winterization, permafrost foundations and loading terminals.

Canadian Petroleum Engineering Inc.

Canadian Petroleum Engineering is a multidisciplinary consultancy, based in Calgary, Alta., which specializes in oil and gas drilling and related operations in the Arctic. The company has been operating in this field for over 20 years, both onshore and offshore. Prior to the formation of Canadian Petroleum Engineering, the majority of its principals were engaged in Arctic offshore drilling for Canadian Marine Drilling (CANMAR), the pioneer in drilling in ice-covered Arctic waters in Canada and the United States.

Kvaerner Canada Limited

Kvaerner is a leading provider of engineering, procurement and construction services for onshore and offshore projects in the oil and gas industry. We are proudly recognized by our clients for delivering some of the world's most amazing and demanding projects in the Arctic, with a strong focus on health, safety, security, environment and quality. Kvaerner has 100-plus employees in Canada and 2,800-plus employees worldwide, with offices in Norway, Russia, the United States, the United Kingdom, China and Finland.

NorQuest Systems Division

NorQuest Systems is located in Lethbridge, Alta. The owner of the company has more than 34 years of consulting experience in multiple Arctic/northern jurisdictions. NorQuest provides marine consulting services involving physical, chemical and biological oceanography, ice climatology, Arctic biogeochemistry and ocean engineering to oil and gas companies, government agencies and other clients with Arctic and/or cold-ocean issues that need to be addressed. It is also the managing partner of the Northern BioGeoScience Innovation Alliance.

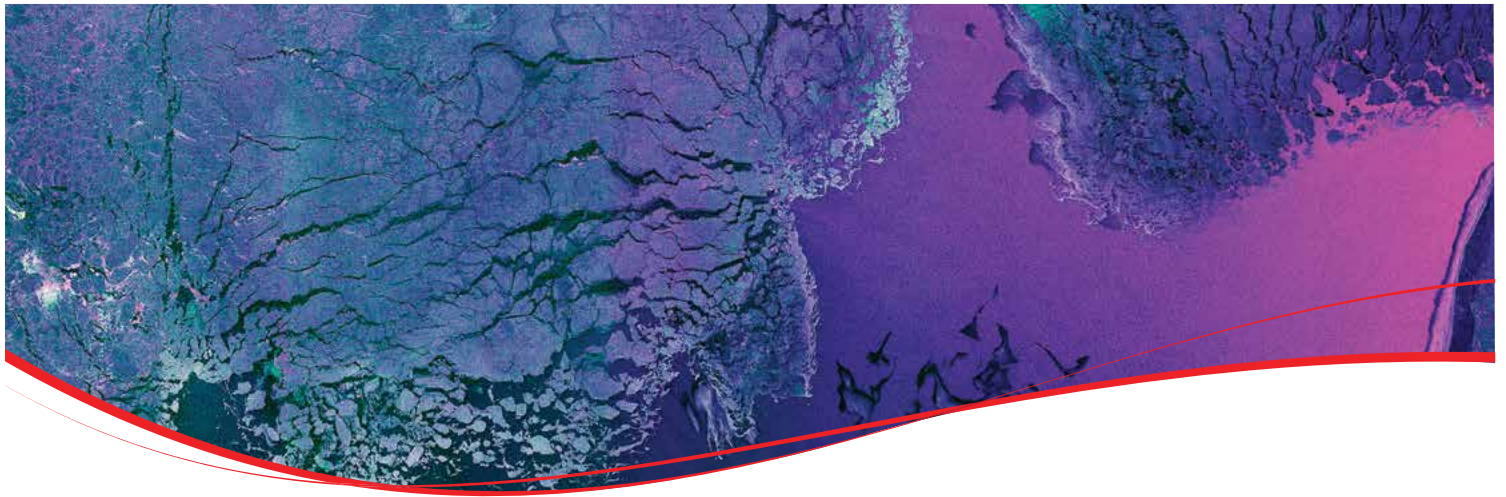
subsea 7

subsea7.com

Subsea 7 Canada

Subsea 7 is a leader in seabed-to-surface engineering, construction and services to the offshore energy industry. We provide integrated services and have a proven track record in delivering complex projects in deep water and in challenging, harsh environments. We differentiate ourselves by delivering high-quality services that are built on our core values of safety, integrity, innovation, performance and collaboration. This is demonstrated by our core strengths in engineering and project management and supported by our commitment to invest in people, technology and assets.

Other companies with capabilities in this sector include: ARKTOS Developments Ltd. (p. 18), Atlantic Towing Limited (p. 34), BGC Engineering Inc. (p. 24), Kongsberg Digital Simulation Ltd. (p. 35), Rutter Inc. (p. 9), Stantec Consulting Limited (p. 27).



HARSH CLIMATE INFORMATION AND COMMUNICATIONS TECHNOLOGY AND ARCTIC EARTH OBSERVATION

Canada is the second-largest country in the world. Close to half of its territory lies in the rugged and harsh north, and few roads connect the north and the south. In the sparsely populated and vast northern expanse, there is a clear need for reliable, efficient and advanced means of communication. Canadian companies, often in public-private partnerships, have been instrumental in improving broadband speed, and wireless coverage in remote communities.

Information and communications technology (ICT) in the north is a critically important factor in human development and scientific research, as well as in creating economic opportunities. However, achieving desired coverage comes with unique challenges due to geography, the harsh environment and differing regional needs. Canadian companies and communities alike have typically relied on satellite technology, which has created a wealth of expertise within the satellite and earth observation technologies sector. Such technologies have many applications—navigation, environmental monitoring, ice observation, aviation, telemedicine and ship tracking, to mention a few. Thanks to tremendous amounts of available data, Canadian companies can export valuable information gathered in the Arctic at the flick of a switch.

Canada's investments in RADARSAT satellites have provided a unique vantage point for observing Canada's land mass and coastlines, for which the Arctic is a region of considerable interest with respect to ice movement, environmental monitoring, geological mapping and resource exploration. Canada's next generation RADARSAT Constellation mission, which will be composed of three satellites and is scheduled for launch in 2018, will increase the daily revisit time over the Arctic, providing additional data that will aid in monitoring climate change, land-use evolution, coastal change, urban subsidence and even human impacts on local environments.



HARSH CLIMATE INFORMATION AND COMMUNICATIONS TECHNOLOGY AND ARCTIC EARTH OBSERVATION LISTING



AdvantechWireless.com

Advantech Wireless

Established in 1988, Advantech Wireless designs, manufactures and deploys satellite and terrestrial wireless communications networking equipment for broadband connectivity. Our revolutionary technologies include VSAT hubs and terminals with A-SAT-II optimization, world-leading second-generation satcom GaN SSPAs/BUCs, frequency converters, fixed and deployable antennas, terrestrial microwave radios, routers and ruggedized products. We provide highly reliable satcom equipment designed for Arctic operation. With corporate offices in Canada, the United States, the United Kingdom, India, Russia, Brazil and Venezuela, Advantech Wireless's reach extends around the globe.



exactearth.com

exactEarth

exactEarth is the world's leading supplier of satellite automatic identification system (S-AIS) data services with unprecedented ship-tracking capabilities in the Arctic region. With our own constellation of satellites, including dedicated polar assets, exactEarth is the only S-AIS provider that effectively tracks all vessel activity in this remote region. exactEarth sells its data to maritime authorities across the globe, which use the data for a number of operational activities in the north, ranging from oil spill recovery and SAR response to environmental protection.



mdacorporation.com

MDA

MDA is a global communications and information company providing operational solutions to commercial and government organizations primarily in two principal markets: communications, and surveillance and intelligence. Founded in 1969, MDA has over 4,800 people at 13 locations across Canada, the United States and elsewhere. MDA provides reliable communications and information using space-based technology. Typical clients include defence and commercial customers. MDA owns and operates the RADARSAT-2 satellite, which allows customizable geospatial information solutions.



A division of WADE Antenna, Inc.

tacoantenna.com

TACO Antenna

TACO Antenna has been designing products for both military and commercial applications in the very high and ultra-high frequencies for over 70 years. Our D8076 Arctic Aviation Antenna is a rugged, high-performance antenna developed specifically for harsh winter environments with special coatings to reduce ice build up. This prototype was shipped to the Federal Aviation Administration Alaskan region for field testing over the 2014 winter season at a remote mountain site. Our D7061-L shipboard antenna is rugged enough to perform without fail on vessels charting even the most northern routes.

UrtheCast



UrtheCast is an earth observation company based in Vancouver, B.C., that owns and operates two satellites through its Spanish subsidiary, Deimos-Imaging. Both satellites are capable of acquiring images of the Arctic, with typical revisit times of between 24 and 48 hours. Deimos-2 is a high-resolution, multispectral optical satellite that delivers 0.75-m pan-sharpened multispectral data. Deimos-1 is a tri-band optical sensor with a 20-m ground sampling distance and a 650-km swath. It acquires 5 million km² of data every day.



DEW Engineering has designed and manufactured thousands of medium support vehicle system trucks, ISO container shelters and special equipment vehicle kits, and field space and water heaters. Our latest innovation is the D900 Multifuel Military Utility Snowmobile. These products all use commonly available diesel fuels, which simplify logistics operations in remote locations. These products were designed to operate reliably in the harshest Arctic winter conditions.

ING Robotic Aviation is a pioneer in collecting unique high-resolution airborne data in remote harsh conditions with industrial drones. Imaging polar bears forms one great example of our Arctic work both in the visible and multi-spectral spectrums. We flew these missions off of Hudson's Bay for Environment Canada and Polar Bear International. While flying in subzero temperatures and in winds over 50 kph, we collected unprecedented images of many polar bears in their natural habitat — all without impacting the wildlife.

In September 2014, Seamatica Aerospace (SMA) performed a UAV mission above the 72nd parallel, in Pond Inlet, Nunavut. Despite the limitations imposed by the client-selected, consumer-grade UAV, the mission was successful, overcoming challenges related to temperature, flight speed and heading. The team successfully launched and recovered from a moving vessel at 25 kph, completed multiple successful land-based missions and overcame issues (on site) with preselected payloads.



ARCTIC AEROSPACE AND DEFENCE

Canada's aerospace and defence industry is research-intensive, innovative and fast growing. Its aerospace sector is highly integrated into global value chains and exports 80 percent of its production. Canada is a proven market leader in aircraft and engine production, aircraft technology development, and flight simulation. Similarly, its defence sector is also highly integrated into global value chains and exports account for 60 percent of its sales. Central Canada accounts for the majority of aerospace and defence manufacturing, while western Canada is a significant player in maintenance, repair and overhaul, and Atlantic Canada is growing quickly in this sector.

Canada's climate and geography naturally makes dealing with Arctic-like conditions a prerequisite for the aerospace and defence industry. For instance, Canadian companies lead the way in designing, testing and manufacturing innovative mobility, sustainment and protective equipment for cold climates. Manitoba is home to cold weather R&D/testing sites for the world's largest engine manufacturers, with facilities in Winnipeg and Churchill in northern Manitoba. In the northern territories, Iqaluit, Nunavut has garnered a reputation as a reliable cold-weather testing site among airplane manufacturers. This may be just the beginning of growing aerospace activity in Iqaluit once its improved international airport project is completed, expected in 2017.



ARCTIC AEROSPACE AND DEFENCE LISTING



airbossdefense.com

AirBoss Defense

AirBoss Defense, a world leader in personal protective equipment, is an innovative, integrated company that capitalizes on its long-standing expertise and advanced technologies to develop, design and manufacture ergonomic equipment that meets the highest quality standards. Our line of innovative protective equipment includes the extreme cold weather mukluk (ECWM). The ECWM achieves the optimal balance between weight, warmth, insulation, comfort and durability. Lightweight, breathable and anti-microbial, this boot is recognized as one of the best in the world in extreme cold weather.



analyticsystems.com

Analytic Systems Ware Ltd.

Analytic Systems has a long history of meeting the needs of the Canadian Military with DC-AC Inverters, DC-DC Voltage Converters, AC-DC Power Supplies and AC or DC source Battery Chargers that can operate in the chill of the Arctic. Our facilities and personnel are Canadian Controlled Goods Directorate certified. We are experienced in designing for and meeting MIL461F (EMC), MIL 810G (Environmental) and many other military standards. In-house testing capabilities include conducted and radiated emissions, electrostatic discharge, vibration and temperature.



cascadeaerospace.com

Cascade Aerospace Inc.

Cascade Aerospace specializes in the fleet management, in-service support and modification of Lockheed Martin C-130, Boeing 737 and 757, and Bombardier Q400, CRJ200 and CL-215 aircraft. Cascade serves domestic and international customers. As one of the world's only two Lockheed Martin-authorized C-130J heavy maintenance centres, as well as a Lockheed Martin-authorized C-130 service centre, Cascade has managed Canada's fleet of C-130 Hercules for over a decade. Many of these aircraft are used in a fixed-wing SAR role, including in Canada's north.



dewengineering.com

DEW Engineering and Development ULC

DEW Engineering is a Canadian company located in Ottawa, Ont., and Miramichi, N.B. Our 200 employees design, engineer, test and manufacture mission-focused mobility, sustainment and protective equipment for the military, institutional and police markets. Through nearly 40 years of engineering and manufacturing equipment designed to operate in the Arctic region, DEW has developed valuable expertise in the techniques, materials, finishes and ergonomics necessary for our products to operate successfully in extreme environments. DEW is registered to ISO 9001:2008 (Quality) and 14001:2004 (Environmental).



fellfab.com

GENERAL DYNAMICS Mission Systems–Canada

gd-ms.ca



ingrobotic.com



seamatica.ca

FELLFAB Limited

Headquartered in Hamilton, Ont., FELLFAB® manufactures innovative textile products to many critical and demanding markets. The FELLFAB® Arctic portfolio includes military-grade Arctic tentage as well as a host of down/synthetic-filled sleeping bags and clothing. The company's XPD Arctic sleeping bag is rated to -40°C. FELLFAB® capabilities extend into Arctic-ready tactical gear (backpacks/vests) and specialty equipment covers. With an in-house design department, FELLFAB® can work with Arctic exploration organizations to develop project-specific products to withstand extreme Arctic climates.

General Dynamics Mission Systems - Canada

General Dynamics Mission Systems - Canada is a defence-focused and public safety systems integrator and product supplier, with particular expertise in land and joint communications, command-and-control systems, air and naval acoustics, mission management systems and data transport technologies, including satellite communications networks and private LTE networks. Solutions are developed ITAR (International Traffic in Arms Regulations)-free in Canada for extreme conditions where operations are critical.

ING Robotic Aviation Inc.

ING Robotic Aviation has been leading the unmanned aviation sector since 2001, having flown the equivalent of 81 times around the planet. ING is unique in its ability to deliver solutions that span aviation, data collection and data analytics. We provide unprecedented aerial data solutions especially in harsh conditions by delivering fixed wing and rotorcraft products as bundled solutions; drone-as-a-service turnkey aerial data solutions; training in safe operations, pilot-type certification, payload operations; data analytics; and customer-driven R&D solutions.

Seamatica Aerospace

Seamatica Aerospace (SMA) is an Atlantic Canadian company operating out of St. John's, Newfoundland. The SMA team has over 45 years combined experience with unmanned aerial vehicles (UAVs) and specializes in UAV flight operations, pilot training and engineering services. SMA also develops unique technologies to enhance and improve existing UAV systems, such as the GuardianEye beyond visual line of sight system. SMA's operations range from moderate climate zones to high Arctic regions, and the SMA team is experienced in both land-based and shipboard missions.

***Other companies with capabilities in this sector include:
Kongsberg Digital Simulation Ltd. (p. 35), Rutter Inc. (p. 9),
Tulmar Safety Systems Inc. (p. 20).***



NORTHERN CULTURAL, CREATIVE AND SPECIALTY FOOD INDUSTRIES

Canada's Indigenous peoples have deep cultural traditions. Each region has traditional subsistence economies, which are based on hunting, trapping, fishing, and traditional arts and crafts. In an unforgiving and unrelenting climate, Inuit art grew out of the skills needed to survive. Developed over the course of millennia, Inuit artwork and culture have become world famous for exquisite carvings of stone and bone, fibre arts, jewellery, ceramics and paintings.

In the north, Inuit art holds an especially prominent standing. It is estimated that there are 3,000 artists in Nunavut—and with a population of approximately 37,000 this means that the territory has more artists per capita than any region in the world. Traditional cultural artwork, as well as the growing array of contemporary creative activities, form an important part of the local economy in many communities and benefit from international exporting.

A variety of unique animal species and vegetation found in the remote north formed the subsistence basis for Indigenous peoples for thousands of years. Many northern specialty foods continue to be sought-after sources of food to this day. Northern Canadian fish and seafood products are harvested from some of the cleanest, most pristine waters in the world. For example, Arctic char—which is native to the Arctic—is known as a highly prized delicacy due to its fresh taste. Fish and seafood, long an economic driver in other circumpolar regions, is expected to have a promising future in several sub-regions of northern Canada.

Icy Waters Arctic Charr



icywaters.com

Icy Waters Arctic Charr (IWAC) is a vertically integrated arctic char aquaculture facility located in Whitehorse, Y.T. IWAC provides Yukon Gold ova to fish farms around the world and is considered to be the largest producer of commercially available arctic char ova. IWAC is known for its consistently high rate of survivability and the availability of ova twice per year. IWAC has a hatchery for egg and fingerling production, a tank farm for growing fingerlings to market size, and a Canadian Food Inspection Agency-approved processing plant equipped with modern fish-processing machinery.

Kopula | Northern Perspectives



kopula.ca

Kopula | Northern Perspectives is an emerging design collective based in Montréal, QC. Kopula | Northern Perspectives' members and collaborators aim to create a participatory platform within the international northern design community, favourable to project development and collaborative events between professional designers and students, highlighting and linking northern design initiatives. The project seeks to explore, following the principles of sustainability and adaptability, the role of design in a northern context.

Nunavut Arts and Crafts Association



nacaarts.org

The Nunavut Arts and Crafts Association (NACA)'s vision is to support Inuit art and craft producers in Nunavut in their efforts to further their endeavours. A stronger arts community works toward a common goal of making art a vibrant, industrious, prosperous and self-sustaining sector of the economy. NACA supports and promotes the development and growth of the Inuit arts and crafts sector through communications, advocacy and marketing domestically and globally. We represent about 3,000 artists who call the territory of Nunavut home.



ARCTIC RESEARCH AND EDUCATION

"They [Arctic Response] delivered some of the highest-quality field training I have experienced. I have spent the last 23 years teaching and attending various safety training sessions, managing corporate safety programs, and evaluating trainers from the Amazon to Alaska. This is a top-notch outfit with quality trainers who not only know their subject matter, but have the real world experience to keep the training relevant and interesting. Their Predator Defence course was the best wildlife safety course I have ever taken, combining theory, animal behaviour traits, statistics, and practical scenarios with hands-on practice with shotguns, bear spray, and various deterrents. The team of trainers were flexible with content to tailor to our specific needs... This is a solid team of professionals." - Dan Hodgkinson, Science Systems and Applications, Field Operations Manager, NASA Carbon Cycle and Ecosystems Office, Goddard Space Flight Center.



Canada's brand is based on consistent high quality and a reputation for excellence across the entire education sector. With less than 0.5 percent of the world's population, Canada produces 4.1 percent of the world's research papers and 4.7 percent of the world's most frequently cited papers⁴. And in a recent survey of over 5,000 leading international scientists, Canada's scientific research enterprise was ranked as the fourth-highest in the world⁵.

Research on the Arctic is no exception to this track record; Canada is highly specialized in Arctic research. It ranks as the second most productive country in Arctic science, maintaining a constant share of about 15 percent of world papers in the field⁶. Canada's leading strength in Arctic research is in the subfield of environmental sciences, consistent with Environment Canada's top world ranking this field⁷.

Due to climate change, the Arctic is changing rapidly and is a unifying focus of activity for many Canadian researchers. In-depth knowledge about the Arctic is needed more than ever, and Canada's Arctic research community is well placed to conduct such research, particularly northern colleges and those with access to research facilities in Canada's north. Ecosystems, biodiversity, ocean observation, resource development, green technology, Indigenous knowledge and northern communities are related areas of Canadian scientific excellence.

Canadian researchers—governments, universities, colleges and other institutes—are providing leadership in Arctic science while working cooperatively with scientists internationally. For example, the Canadian Network of Northern

⁴ The Expert Panel on the State of Science and Technology in Canada, *The State of Science and Technology in Canada*, 2012 (prepared for the Government of Canada), Council of Canadian Academies, 2012, p. 37.

⁵ *Ibid.*, p. 63.

⁶ Côté, Grégoire and Picard-Aitken, Michelle, *Arctic Research in Canada: A Bibliometric Analysis* (submitted to Indian and Northern Affairs Canada) Science-Metrix, 2009, p. 3.

⁷ *Ibid.*, p. 11.



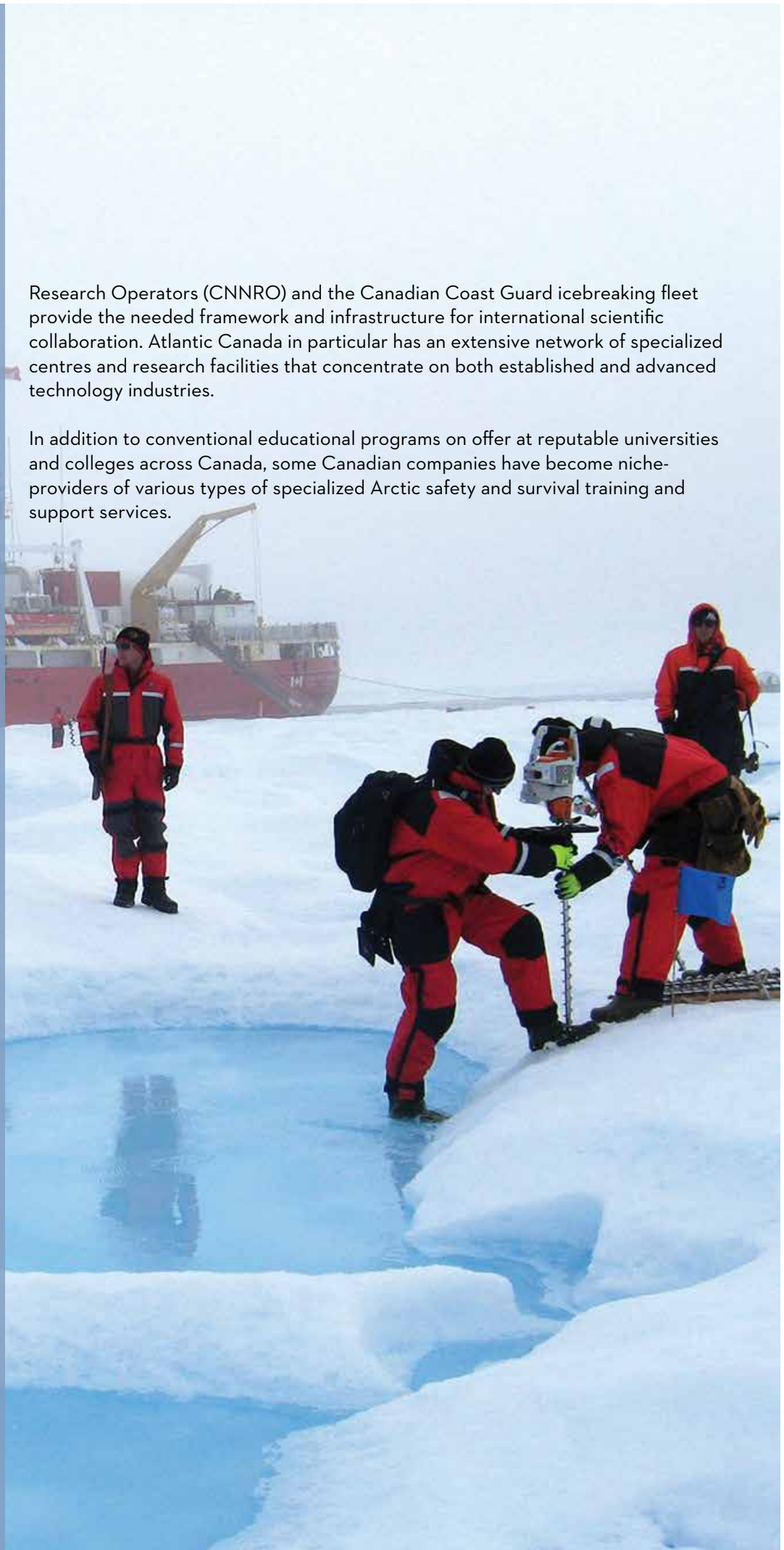
In August 2012, Ocean Networks Canada (ONC) was granted permission to install a demonstration cabled seafloor observatory in Cambridge Bay, Nunavut. This scaled-down version of ONC's larger world-leading observatories is the first location in Canada's Arctic that delivers year-round, continuous undersea monitoring of the northern environment. Data streaming from the instruments support cutting-edge research as well as educational and community outreach. Extensive scientific interest has tripled the number of sensors to 24, which includes real-time ice thickness and meteorological instruments. This community observatory is now being leveraged as a key component in assessing ice conditions for safe shipping throughout the Canadian Arctic archipelago.

In 2012, the University of Manitoba led the formation of the Arctic Science Partnership (ASP) with Aarhus University in Denmark and the Greenland Institute of Natural Resources to integrate Arctic field campaigns and academic programs across institutions with the aim to address international, global-scale climate change research initiatives. ASP completely integrates over 350 investigators across partner institutions. The success of ASP has led to its recent expansion and inclusion of the University of Tromsø as a collaborative partner and other institutions have expressed interest.



Research Operators (CNNRO) and the Canadian Coast Guard icebreaking fleet provide the needed framework and infrastructure for international scientific collaboration. Atlantic Canada in particular has an extensive network of specialized centres and research facilities that concentrate on both established and advanced technology industries.

In addition to conventional educational programs on offer at reputable universities and colleges across Canada, some Canadian companies have become niche-providers of various types of specialized Arctic safety and survival training and support services.



In 2012 researchers from the University of Victoria's Ocean Technology Lab (OTL) used their autonomous underwater vehicle (AUV) to assist the Parks Canada team in its search for the lost ships of the Sir John Franklin expedition. Using OTL's specially designed Bluefin-12 AUV, the Parks Canada team was able to dramatically increase the size of the search area off Nunavut's King William Island.

Partnering with Yukon Research Centre (YRC), Northwestel (NWTel) was able to reduce their off-grid site dependence on diesel using solar panels. With almost half of NWTel's 87 remote off-grid diesel-powered microwave stations only accessible by helicopter, the YRC devised a solution using solar panels to offset diesel and repair and maintenance costs. This solar/diesel hybrid has had such significant savings that NWTel has a 4.5 year payback on capital investment from the reduction in diesel use. NWTel has since placed solar panels at 10 more of its remote microwave stations.





nwtresearch.com

Aurora Research Institute

Aurora Research Institute (ARI) is the research division of Aurora College. ARI delivers on its mandate by licensing and coordinating research, promoting communication between researchers and the people of the communities in which they work, promoting public awareness, and supporting or conducting research that contributes to the social, cultural and economic prosperity of the people of the Northwest Territories. ARI provides its services through three research offices and centres in the N.W.T., in Inuvik, Fort Smith and Yellowknife.



cnro.ca

Canadian Network of Northern Research Operators

The Canadian Network of Northern Research Operators (CNNRO) is a network of research support facilities enabling research in the Canadian Arctic and sub-Arctic regions. Our members provide the know-how and infrastructure that make research possible throughout northern Canada. The CNNRO is inherently an organization with great diversity of membership but with a common purpose to create a cooperative network that will advance the objectives members share in common. CNNRO is currently composed of 41 members, with 31 regular members having permanent research infrastructure in the Arctic.



cen.ulaval.ca

Centre d'Études Nordiques

Centre d'Études Nordiques (CEN) is an interuniversity centre of excellence for northern research. Its mission is to contribute to the sustainable development of northern regions by way of an improved understanding and prediction of environmental change. Our research focuses on northern ecosystems and geosystems, and is used to formulate adaptation strategies relevant to the north. In partnership with collaborators, CEN plays a pivotal role in environmental stewardship and the development of the circumpolar North through its research on cold environments. CEN operates an extensive network of over 110 environmental monitoring stations and eight research stations in the Canadian Arctic and Subarctic.



umanitoba.ca/ceos

Centre for Earth Observation Science, University of Manitoba

The mandate of the Centre for Earth Observation Science (CEOS) is to research, preserve and communicate knowledge of earth system processes using the technologies of earth observation science. Its research is multidisciplinary and collaborative, seeking to understand the complex interrelationships between elements of earth systems and how these systems will likely respond to climate change. The Arctic marine system is a unifying focus of activity. CEOS consists of 12 faculty, including a Tier 1 Canada Research Chair in Arctic System Science and a Canada Excellence Research Chair in Arctic Geomicrobiology and Climate Change.



umanitoba.ca/faculties/environment/departments/ceos/research/CMO.html

The Churchill Marine Observatory, University of Manitoba

The Churchill Marine Observatory (CMO) is a globally unique, highly innovative, multidisciplinary research facility located in Churchill, Man., adjacent to Canada's only Arctic deep-water port. The CMO will directly address technological, scientific and economic issues pertaining to Arctic marine transportation and oil and gas exploration and development throughout the Arctic. CMO consists of an Oil in Sea Ice Mesocosm (OSIM), an environmental observing system, and a logistics base. OSIM includes two saltwater sub-pools designed to simultaneously accommodate contaminated and control experiments on various scenarios of oil spills in sea ice.



churchillscience.ca

Churchill Northern Studies Centre

Churchill Northern Studies Centre is a non-profit, independent research and education facility offering logistical support to researchers and learners in the Western Hudson Bay region. Our LEED Silver-certified, 84-bed facility is located 23 km east of Churchill, Man. We are an active research facility, hosting researchers and conducting in-house research and contract research on behalf of others. Our main product is logistical support such as accommodations, meals, lab space, classroom space, vehicle usage and technical services. We also host credit and non-credit courses.



falck.ca

Falck Safety Services Canada

Falck Safety Services Canada delivers high-fidelity safety and survival training in Nova Scotia and Newfoundland and Labrador. Our team believes that training and education is the most critical contributor to lifesaving preparation, and we use the latest technologies and scientifically supported techniques to deliver on this belief. Our training is reinforced by a local full-time research and development division focused on industry operations and survival. We offer aviation, safety and survival training to the oil and gas, marine, military and industrial sectors.



mi.mun.ca

The Fisheries and Marine Institute, Memorial University

The Fisheries and Marine Institute is a world-class centre of advanced fisheries and marine technology, education, training and research. Employing over 420 people, the institute is an ISO 9001-accredited, degree-granting institution, offering bachelor's and master's degrees, diplomas, certificates and industry training for the fisheries and marine sectors. The main campus is located in St. John's, Nfld. The institute's highly qualified team provides accredited fisheries and marine training and research for clients throughout the Canadian Arctic.



mun.ca

Memorial University

Located in Newfoundland and Labrador, with facilities across the province and several locations in Canada and the U.K., Memorial University has the broadest range of Arctic and cold-ocean expertise of any university in Canada. Cold oceans and Arctic science, technology and society have long been key areas of focus for Memorial University researchers, training programs and public partnerships. Specific areas of expertise include fisheries and aquaculture, oil and gas, naval and maritime engineering and technology, ocean technology, aerospace and defence, and Aboriginal and northern culture and society.



nri.nu.ca

Nunavut Research Institute

Nunavut Research Institute is a subgroup of Nunavut Arctic College. It is located in Iqaluit and is made up of a research institute and a teaching facility for the Environmental Technology Program. The research institute provides the following services: logistical support to researchers, licensing for research, assistance in research policy and design, and research project administration. The institute licenses more than 100 projects in Nunavut each year. Most researchers take advantage of the facilities and support provided by the institute in Iqaluit, Arviat and Igloodik.

Ocean Networks Canada, University of Victoria



oceannetworks.ca

Ocean Networks Canada (ONC) operates world-leading cabled ocean observatories that supply continuous power and Internet connectivity to a broad suite of subsea instruments off the west coast of Canada and in the Arctic. These data are freely accessible to scientists around the world through ONC's data management system, Oceans 2.0—recognized internationally as a World Data System. ONC works directly with researchers, industry and communities to monitor the ocean. ONC serves sectors such as ocean technologies and Arctic research and informs infrastructure, oil and gas, marine safety, and aerospace and defence.

Schools on Board



schoolsonboard.ca

Schools on Board is an outreach program of ArcticNet, based at the University of Manitoba. It was developed to bridge Arctic research with science education in high schools; to increase awareness of issues related to climate change; and to educate youth about the challenges and career opportunities of Arctic research. Schools are given the unique opportunity to send students and teachers to the Arctic, on board the CCGS Amundsen to participate in an educational experience completely integrated into the research activities of the science teams.

Sirius Wilderness Medicine Inc.



siriusmed.com

For over 25 years, Sirius Wilderness Medicine has been a leader in wilderness first aid training, risk management and remote medical support services. Sirius training programs conform to international wilderness medical guidelines and are recognized across Canada and abroad. Our clients include government and non-government organizations, industry, communities and individuals. Over the years, we have developed an expertise working within remote northern communities and in the Arctic. Our medical personnel provide complete support to research teams, exploration sites and remote camps and facilities.

Students on Ice



studentsonice.com

Students on Ice (SOI) is an award-winning organization offering educational expeditions to the Arctic and Antarctic. Our mandate is to educate youth about the importance of the polar regions, support their continued growth, and inspire and catalyze initiatives that contribute to global sustainability. Guided by a team of leading scientists, elders, artists and educators, more than 2,500 students from 52 countries have benefited from SOI's life-changing journeys. The result is globally and environmentally minded youth with a connection to the natural world that fuels their goals and ambitions.

University of Alberta



uab.ca/north

The University of Alberta has significant historic and ongoing links to the Arctic and boreal regions. The north is relevant to all 18 faculties and involves more than 250 faculty and student researchers, whose work addresses issues such as climate change, resource development and conservation, Indigenous knowledge and self-determination, and public health. The university will be the home of the Canadian Ice Core Archive. UAlberta North is an office established to bring energy, effective coordination, relationship building, and profile to the university's work in the north.



**University
of Victoria**

uvic.ca

University of Victoria

The University of Victoria (UVic), located in western Canada, is consistently ranked in the top tier of Canada's research-intensive universities. UVic has significant research capacity in the areas of Aboriginal language revitalization, Indigenous law, law of the sea and of Arctic regions, Arctic and circumpolar politics, the study of climate change, green technologies and ocean observing technology (see Ocean Networks Canada's profile). UVic has strong partnerships with industry, research organizations, Arctic communities and government—locally, nationally and internationally.



yukoncollege.yk.ca/research

Yukon College - Yukon Research Centre

The Yukon Research Centre (YRC) ranked fourth in Canada for College research intensity and has been recognized nationally for its research partnerships. We are solving northern problems with northern expertise in the areas of climate change, cold climate innovation, environmental remediation, and biodiversity monitoring. We have strong partnerships with First Nations, industry, government and communities throughout the territory. Our in-house experts and connections across the circumpolar North allow us to build an effective team that can answer your research questions and meet your innovation needs.

***Other organizations with capabilities in this sector include:
Kongsberg Digital Simulation Ltd. (p. 35), Rutter Inc. (p. 9).***



GOVERNMENT OF CANADA IN THE ARCTIC

The intent of this guide is to feature the Arctic capabilities of Canadian companies and research institutes. However, it would be remiss not to mention a number of government entities that make key contributions to help ensure that Canada remains a world leader in the Arctic. While much of the Government of Canada's Arctic policy expertise resides within various departments, this section will highlight a few key federal entities that deliver northern economic development and Arctic knowledge and research programs and services. They work hand-in-hand with territorial and provincial governments, Indigenous land claims organizations, co-management boards, communities and other key stakeholders. Each of them plays a key role in laying the foundation for Canada's Arctic capabilities:

The Canada Centre for Mapping and Earth Observation

is responsible for the Inuvik Satellite Station Facility, hosting several national and international installations receiving earth observation data and communicating with satellites for a variety of applications including sea ice monitoring, climate change and supporting a sustainable Arctic. Developed by Natural Resources Canada (NRCan) with the goal of becoming a world-class earth observation destination, the Inuvik Satellite Station Facility will provide economic diversification in the Arctic.

The Canadian Coast Guard (CCG)

is responsible for services and programs that contribute to the safety, security and accessibility of Canada's waterways. The Coast Guard has a long and proud history of providing services to the north, for example, through icebreaking and northern resupply. The CCG helps the government meet the public's expectation of clean, safe, secure, healthy and productive Arctic waters and coastlines.

The Canadian Ice Service (CIS)

is the leading source of information about ice in Canada's navigable waters. CIS works to promote safe and efficient maritime operations and to help protect Canada's environment by issuing timely and accurate ice information as well as through the provision of field services and ice and remote sensing science research. CIS has been providing environmental monitoring of sea ice in Canada for over 50 years, and more recently has expanded into oil spill detection in Canada's navigable waters.

The Canadian Northern Economic Development Agency (CanNor)

works to help develop a diversified, sustainable and dynamic economy across Canada's three territories. CanNor works with industry, northern governments, communities and other partners to ensure credible regulatory activities that foster job creation and sustainable resource development in the north.

The National Research Council of Canada (NRC)

is the Government of Canada's premier research and technology organization. Working with clients and partners, NRC provides innovation support, strategic research, and scientific and technical services. NRC's Arctic Program is developing technologies to ensure sustainable, low-impact development of the north while increasing the quality of life of northerners.

Polar Knowledge Canada (POLAR)

is a Government of Canada agency whose mandate is to advance knowledge of the Canadian Arctic and mobilize science and technology in order to improve economic opportunities, environmental stewardship and the quality of life of Canadians in the north. POLAR consists of a pan-northern science and technology program; a knowledge management function to support polar research and the world-class Canadian High Arctic Research Station (CHARS), CHARS will provide a year-round presence and complement the network of research facilities across Canada's North and once complete, will be Polar Knowledge Canada's (POLAR) headquarters in Cambridge Bay, Nunavut. POLAR is Canada's adhering body to the International Arctic Science Committee (IASC) and the Scientific Committee on Antarctic Research (SCAR). POLAR is a key contact point for the international polar research community to explore opportunities to pursue research in Canada's Arctic.

The Northern Contaminants Program (NCP),

led by Indigenous and Northern Affairs Canada (INAC), engages northerners and scientists in research and monitoring related to long-range contaminants in the Canadian Arctic. The data generated by the NCP are used to assess ecosystem and human health, and the findings of these assessments are used to address the safety and security of traditional/country foods that are important to the health and traditional lifestyles of northerners and northern communities. The findings also inform policy, resulting in action to eliminate contaminants from long-range sources.

The Polar Continental Shelf Program (PCSP),

created in 1958, provides safe, efficient and cost-effective logistics services to scientists from universities, government and NGOs. PCSP's logistics coordination and planning, and their partnerships—including with Polar Knowledge Canada—ensure that over 1,000 scientists, students, field technicians and volunteers each year have access to aircraft, fuel and field equipment at the lowest cost. PCSP's communications network also provides field researchers and students with the highest margin of safety possible when learning and working in the Arctic.

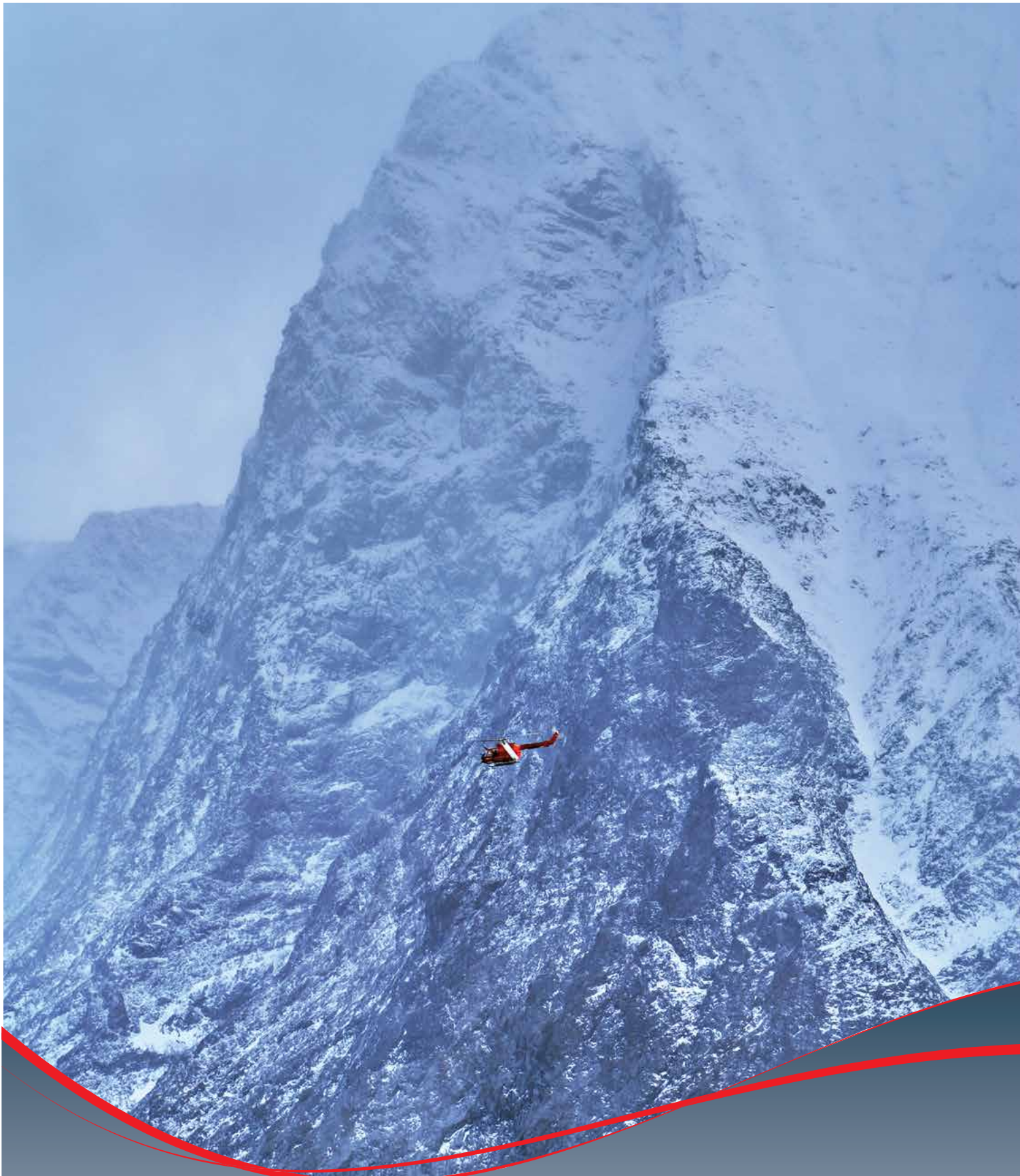
There are many additional governmental entities at the federal, territorial and provincial levels that have long and proven track records in the Arctic and are instrumental to Canada's leadership position across a wide range of Arctic capabilities.

The Canadian Foundation for Innovation (CFI), the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Networks of Centres of Excellence (NCE) are key facilitators of Arctic science collaboration and innovation funding.



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The Canadian International Arctic Center

For more information on Canadian Arctic
Capabilities, or to connect with organizations
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