Arctic Leadership
With the industry's longest history of Arctic experience, technical innovation and unparalleled capabilities, ExxonMobil is best positioned to take on future challenges in the region.
A growing global economy requires energy from multiple potential sources. The Arctic provides the world’s largest remaining frontier of undiscovered conventional oil and gas resources. With energy demand projected to be about 30 percent higher in 2040 than it was in 2010, arctic resources will play an important role in helping to provide the supplies needed to meet growing demand.

ExxonMobil’s leadership in arctic and sub-arctic operations is based on 90 years of experience in this environment, a history of pioneering achievements in the Arctic and a sustained commitment to Arctic technology research and development. We are committed to operating in an environmentally responsible and sustainable way, working with indigenous people to develop resources in a manner compatible with their traditional way of life and the natural environment. ExxonMobil has a strong portfolio of assets and opportunities in a range of Arctic environments that will allow us to continue our legacy of delivering complex, integrated projects on time and on budget.

Challenges

The Arctic’s oil and gas resources have been largely unexplored to date, but have significant potential to help meet future global energy demand. Exploration and production in the Arctic, however, are subject to a broad range of challenges, including:

- Remote location
- Icebergs
- Mobile pack ice
- Permafrost
- Sensitive environments
- Changing ecology
- Prolonged darkness
- Severe storms
- Earthquakes
- Deep water
Norman Wells

1920
Discovery of the world’s most northerly oil field at the time

1932
First commercial oil field and refinery in arctic conditions

1985
First gravel production island
Norman Wells marked the start of the quest for arctic oil and gas

Norman Wells, located in the Canadian Northwest Territories 1,450 kilometers north of Edmonton, has been operated by ExxonMobil affiliate Imperial Oil Limited since continuous production began in 1932. When discovered in 1920 by Ted Link, an Imperial Oil geologist, Norman Wells was the world’s most northerly oil field. It later became the first commercial oil field and refinery in the Arctic.

Most of the Norman Wells reservoir is located under the Mackenzie River, which is covered with ice up to two meters thick for seven to eight months of the year. Seasonal flooding, ice jams and scouring by thick freshwater ice make for challenging exploration and production conditions. Some of the first applications of man-made ice islands for winter exploration drilling (1979) and the first application of gravel islands for production (1985) were employed here. Extended reach drilling (ERD) technology for horizontal wells to test reservoir quality underneath the river was also applied here in the late 1970s.

Some of the first applications of gravel islands for production were employed at Norman Wells.

Produced oil is transported through an 870-kilometer pipeline to Zama, in Alberta, Canada. The Norman Wells expansion project, completed in 1985, significantly enhanced recovery while also preserving the natural discontinuous permafrost and ensuring long-term pipeline integrity.
Alaska

1965
Granite Point field discovered

1966
First ExxonMobil ice-resistant platform installed (Granite Point)

1967
Granite Point production start-up

1968
Prudhoe Bay field discovered

1969
First oil tanker transit through the Canadian Northwest Passage

1972
Offshore Technology Conference Award for contribution to marine history by SS Manhattan voyage

1975
Construction of the Trans-Alaska Pipeline System started

1977
Prudhoe Bay production start-up

1990
Outstanding Achievement Award for civilian applications of NASA technology for heat pipe development
First ExxonMobil ice-resistant offshore platform

Granite Point field, located in Alaska’s Cook Inlet, began production less than two years after ExxonMobil discovered it in 1965. Development and drilling challenges included first-year ice (ice with less than one year’s growth) along with earthquakes, a high tidal range and strong currents. The Granite Point platform, installed in 1966, was the first ExxonMobil installation of an offshore, ice-resistant platform. While not presently operated by ExxonMobil, the platform is still producing after more than 40 years of successful operation.

Technologies for an Arctic mega-field

On March 13, 1968, ExxonMobil and Atlantic Richfield Company (ARCO) announced the discovery of the Prudhoe Bay field, the largest oil reservoir in North America. Prudhoe Bay had an estimated in-place resource of 25 billion oil-equivalent barrels. The field is located on Alaska’s North Slope, 400 kilometers north of the Arctic Circle.

Oil transport is one of the key challenges associated with commercializing a remote field such as Prudhoe Bay, with peak production of two million barrels per day. To explore the feasibility of a marine transportation system in the Arctic, ExxonMobil led the world’s first demonstration voyage of a commercial tanker, the SS Manhattan, through the Northwest Passage in the summer of 1969. In 1972, the Offshore Technology Conference recognized our contribution to marine history and technology as a result of this voyage.

Application of ExxonMobil’s enhanced oil recovery technologies and expertise have increased recoverable reserves at Prudhoe Bay by approximately 30 percent.

A pipeline system, made possible by integrating aerospace technology, was ultimately determined to be more effective for Prudhoe Bay oil transport. In 1975, construction began on the Trans-Alaska Pipeline System (TAPS). Challenges associated with the operation of a warm pipeline in thaw-unstable permafrost were solved by elevating the pipe above ground and using refrigerant-filled pipes to transfer heat from below ground to the air in winter. Where the TAPS route crossed unfrozen soil or thaw-stable permafrost, the pipeline was buried. In 1990, ExxonMobil’s heat pipe work was recognized by the United States Space Foundation with an Outstanding Achievement Award for civilian applications of NASA technology. Today, TAPS remains a first-of-its-kind design that has successfully operated within an arctic environment for more than 30 years.

ExxonMobil’s enhanced oil recovery technologies and expertise – including tailored well stimulation programs, full-field reservoir simulation and special core analysis – have significantly contributed to the Prudhoe Bay Unit’s success in increasing recoverable reserves at Prudhoe Bay by approximately 30 percent over initial estimates. ExxonMobil and its coventure partners continue to assess opportunities for additional recovery improvements at Prudhoe Bay.
Beaufort Sea

1973
First artificial exploration island; World’s largest outdoor ice-test basin

1978
First development of commercial ice island construction method; World’s largest ice-strength tests

1987
Start-up of first offshore Beaufort Sea production system

1989
World’s largest ice-spray exploration island
Setting industry standards for arctic design and leading the development of exploration platforms

In 1973, ExxonMobil built the world's largest ice-test basin in Calgary to study interactions between ice and offshore structures. Five years later, at Prudhoe Bay, we conducted the world's largest ice-strength characterization tests on level ice. Due in part to the knowledge gained from these studies, we have participated in drilling 44 shallow-water exploration wells in the Canadian and Alaskan Beaufort Sea since the early 1970s.

ExxonMobil pioneered the use of gravel islands for exploration drilling activities, installing the world's first gravel island in the Canadian Beaufort Sea in 1973 and completing the deepest-water gravel island in 1980. We have also developed industry standards for gravel island technology in the Arctic and held the first industry-wide seminar on the topic.

In addition to our work with gravel islands, we led an ice-island experiment in the Alaskan Beaufort Sea from 1978 to 1979. The results of that experiment led to the development of spray-ice construction methodologies and criteria for efficient and cost-effective implementation. In 1989, ExxonMobil built the world's largest ice-spray exploration island, Nipterk P-32, in an area of the Canadian Beaufort Sea outside the protection of the barrier islands, where significant daily ice movements are common.

The caisson retained island (CRI) structure, which requires less gravel than a traditional gravel island and is less expensive and faster to install, was developed by ExxonMobil and used in the Beaufort Sea in 1983. In order to further reduce construction costs, the concrete island drilling system (CIDS), a reusable gravity-based structure, was first used in 1984 at the Antares prospect in the Alaskan Beaufort Sea.

ExxonMobil used the heavily instrumented Molikpaq structure, a steel caisson filled with granular material, during Beaufort Sea exploration. In the winter of 1985-86, Molikpaq experienced the most severe ice conditions any man-made structure had ever sustained, including multi-year ice up to seven meters thick. The data collected on this structure significantly enhanced ExxonMobil's ice-load calculation methods and design criteria.

Between 1986 and 1987, ExxonMobil also drilled two exploration wells in the Alaskan Beaufort Sea using a single steel drilling caisson (SSDC) – an ice-strengthened, converted supertanker that rests on a mobile steel platform, allowing for year-round drilling. The combination of extensive, fundamental studies of ice mechanics; ice data collection; and our unique operational experience has provided us with unparalleled expertise in ice-load calculations that we have subsequently applied in other arctic environments.

First Beaufort Sea offshore production system

ExxonMobil is a coventurer in the Endicott oil field located in the Alaskan Beaufort Sea, about 13 kilometers east of Prudhoe Bay. Key arctic offshore technical challenges included a short open-water season and severe ice conditions in winter.

To address the issues of severe ice, heavy currents and ice scouring, two gravel production islands were built. These were the first applications of our gravel island technology for offshore production in the Arctic. The Endicott Production Island started up in October 1987 as the first offshore Beaufort Sea production system and continues to operate today.
Offshore Eastern Canada and Norwegian Barents Sea

1981-1985
Iceberg surveys in the Grand Banks

1984
Pond Inlet Joint Industry Project

1988
Northern-most offshore well at the time drilled with mobile offshore drilling unit (Barents Sea)

1988-1994
Ice Data Acquisition Program in the Barents Sea

1995
Grappling Island iceberg impact tests

2001
Iceberg impact field program
Pioneering iceberg hazard research

ExxonMobil’s arctic research program has included significant work to characterize the hazards associated with icebergs. In 1984, we led a large-scale iceberg strength test program in Pond Inlet, located on Baffin Island in far northeast Canada.

Between 1981 and 1985, ExxonMobil studied more than 700 icebergs in the Grand Banks, located offshore Newfoundland and Labrador, using both aerial photography and underwater profiling to determine iceberg drift velocity, size and mass distributions. Released to the research community, these data formed the core of an iceberg database developed by Canadian scientists from the Memorial University of Newfoundland, the Canadian Hydraulics Center and the Centre for Cold Ocean Resources Engineering in the late 1990s.

ExxonMobil coordinated the surveying of more than 330 icebergs from 1988 to 1994.

In 1988, ExxonMobil drilled the northernmost offshore well at the time in the iceberg-prone Norwegian Barents Sea with a mobile offshore drilling unit. To better understand and quantify iceberg hazards in this area, we established the Ice Data Acquisition Program (IDAP) in conjunction with the Norwegian Polar Institute and the Russian Arctic and Antarctic Research Institute. ExxonMobil coordinated the IDAP from 1988 to 1994, surveying more than 330 icebergs during those years.

ExxonMobil also participated in the 1995 Grappling Island iceberg impact test program to measure iceberg impact loads. Icebergs ranging from 200 to 1,000 tons were towed into a segmented ice-load panel attached to a nearly vertical cliff on Grappling Island.

In June 2001, offshore Newfoundland and Labrador, ExxonMobil participated in an iceberg impact field program in which the Canadian Coast Guard icebreaker vessel Terry Fox was equipped with novel ice-load panels to measure pressures on the hull during impact with icebergs.
Grand Banks

Hibernia start-up; First iceberg-resistant gravity-based structure (GBS)

Terra Nova production start-up; Installation of disconnectable FPSO

Hibernia OPA2 drill well, Canada’s longest extended reach well at 6.3 miles

Hibernia Southern Extension first oil; First subsea tie-back project to a GBS
Installation of the first iceberg-resistant platform

The Hibernia oil field, with between 1 billion and 1.3 billion barrels of recoverable resource, is operated by the Hibernia Management and Development Company Ltd. (HMDC). ExxonMobil Canada is the lead owner and plays a key role in executing this technologically complex, investment-intensive project. The field is located in the Grand Banks, 315 kilometers east-southeast of St. John’s, Newfoundland and Labrador. One of the world’s foggiest places, the sub-arctic Grand Banks is also renowned for its high waves, icebergs, sea ice and hurricanes.

To ensure the operational integrity in this environment, the HMDC built Hibernia, the first and only iceberg-resistant gravity-based structure in the world. Installed in 1997, it stands 224 meters tall and is designed to withstand the impact of a one million ton iceberg – equivalent to the weight of approximately three Empire State Buildings – with no significant damage. It is also designed to withstand contact with a six million ton iceberg, without harm to workers, the environment or operations.

The Hibernia platform is designed to withstand the impact of a one million ton iceberg.

An extensive iceberg-management program minimizes the risk of icebergs reaching the platform. The program uses boats, aircraft and a marine radar system to detect nearby icebergs and track their movement. If winds and ocean currents steer an iceberg toward the platform, one of the platform’s support vessels is deployed to tow or redirect it.

ExxonMobil’s enhanced oil recovery technology has been used to support the application of both water and gas injection at Hibernia, with the potential to recover as much as 60 percent of the hydrocarbon resource from complex and faulted reservoir formations.

First harsh environment project to use a floating production storage and offloading (FPSO) vessel in North America

ExxonMobil is the second-largest stakeholder in the Terra Nova field, located 35 kilometers southeast of Hibernia.

Terra Nova is the first harsh-environment development in North America to use an FPSO vessel along with subsea production and injection. Relying on the same iceberg-management technology that ExxonMobil helped develop during the Hibernia exploration phase, the Terra Nova FPSO is designed to handle the impact of small icebergs moving at average speeds, while being able to disconnect and move away from unmanageable ones. Subsea wells are protected from iceberg scouring by being placed in seafloor excavations.
1997
Unique sea ice data collection offshore Sakhalin

2002
World’s largest land-based drilling rig installed; Primorye tanker ice trials

2005
Sakhalin-1 production start-up; Orlan offshore platform installed

2006
World’s largest fixed-tower single point mooring (SPM) system installed

2010
Odoptu field production start-up

2012
World’s longest ERD well Z-44 completed
Record-setting development offshore Russia

Sakhalin-1, operated by Exxon Neftegas Limited (ENL) and consisting of the Chayvo, Odoptu and Arkutun-Dagi fields, has potential recoverable hydrocarbon resources of 2.3 billion barrels of oil and 485 billion cubic meters of gas. The fields are located beneath the shallow water of the Sea of Okhotsk. Exploration and production of these fields are challenged by the presence of thick ice six to seven months out of the year, and severe wave and earthquake activity year-round.

ExxonMobil delineated the Chayvo field reservoir using proprietary three-dimensional seismic and sequence stratigraphy technologies, both of which were developed by ExxonMobil.

Before operations began at Sakhalin-1, early ice studies were conducted in partnership with the Russian Arctic and Antarctic Research Institute. These studies provided the environmental data necessary to generate safe and cost-effective design and operating procedures to ensure operations had minimal impact on the environment.

ExxonMobil developed the Sakhalin fields using both land-based extended reach drilling (ERD) with the Yastreb rig and offshore ERD wells from the Orlan platform. Yastreb ERD wells are drilled eight to 12 kilometers from Sakhalin Island to reach the Chayvo and Odoptu offshore deposits. The Yastreb rig, completed in June 2002, is one of the world’s largest and most sophisticated land-based drilling rigs. Since 2007, ExxonMobil has drilled 19 of the world’s 30 longest ERD wells including the world’s longest Z-44 well drilled at Chayvo field with a total measured depth of 12,376 meters. Using ExxonMobil’s proprietary Fast Drill Process and Integrated Hole Quality technologies, these Sakhalin-1 wells were also the fastest-drilled ERD wells in the world.

Crude oil is transported across Sakhalin Island and the Tatar Strait to the DeKastri terminal in the Russian province of Khabarovsk Krai via a pipeline that crosses three fault lines. ExxonMobil conducted extensive studies of seafloor gouging by ice – including field surveys, laboratory studies and mathematical modeling – to determine the appropriate pipeline design and burial depth. This resulted in robust, proprietary design criteria for pipeline ice-scour protection. Fiber-optic lines were also installed on the pipeline to monitor integrity.

The DeKastri terminal boasts the world’s largest fixed-tower single-point mooring tanker-loading facility that can accommodate crude export year-round. The fully automated tower is located nearly six kilometers offshore.

In the winter of 2002, ExxonMobil conducted a trial in the Tatar Strait, Aniva Bay and LaPerouse Strait with the Primorye tanker. The first experimental voyage of a large tanker in ice since the SS Manhattan, the trial showed that large marine tankers could safely operate throughout the winter and resulted in the development of safe operational criteria (referred to as “ice passports”) used by the tanker fleet currently transporting Sakhalin-1 oil.

ExxonMobil has developed novel production platform concepts for Sakhalin-1 and other sub-arctic areas, including suction-pile structures with minimal offshore facilities, to continue addressing the unique challenges of sub-arctic environments. ExxonMobil has also developed two arctic mobile drilling unit concepts and has demonstrated that these could be designed for year-round drilling in offshore Sakhalin ice conditions.
Unparalleled Capabilities
Arctic resources will play an important role in balancing the world’s future supply and demand needs.

With 90 years of operational experience in the Arctic and a sustained commitment to arctic research and development since the 1970s, the breadth and depth of our experience in the Arctic is second to none. Along with our industry-leading position in safety, national content development, complex project execution and technological innovation, ExxonMobil brings unparalleled capabilities to arctic exploration, development and production projects today.
Safety

ExxonMobil continues its industry-leading safety record and is recognized in the industry as the “gold-standard” for safety commitment and performance. These results are the product of our structured approach to safety management through our Operations Integrity Management System (OIMS), an eleven-point set of elements designed to identify and manage risks; in conjunction with the broad culture of safety that is driven by our leadership and resides throughout our organization.
National Content Development

ExxonMobil has a proven record of sustainable national content development that achieves economic growth and improves the quality of life in the countries in which we operate. Our distinguishing national content program includes three separately managed components: workforce development, supplier development and strategic community investment. Ultimately, raising the standard of living and the stability of the communities in which we live and do business promotes success for all project stakeholders.

During the initial phases of our Sakhalin-1 operations, more than 13,000 jobs were created. By the end of 2012, Russian nationals comprised 90 percent of the Exxon Neftegas Limited workforce. As of 2012, two out of three dollars invested in the project have been spent doing business with Russian companies or joint ventures with Russian participation, and our operations have had a significantly positive lasting effect on the local economy. Over the life of the project, community investment is expected to exceed $180 million.

Indigenous Peoples Engagement

ExxonMobil is committed to engaging with indigenous communities in a manner that is respectful of their cultures and customs. Through open consultation, we work to understand and incorporate indigenous perspectives into project planning, design, execution, and ongoing operations. Our approach is consistent with the principles of the ILO Convention 169 Concerning Indigenous and Tribal Peoples in Independent Countries, the U.N. Declaration on the Rights of Indigenous Peoples, the International Finance Corporation Performance Standards on Environmental and Social Sustainability, and the World Bank Operational Policy and Bank Procedure on Indigenous Peoples.

In Canada, since the beginning of the exploration program in the Beaufort Sea in 2007, an ExxonMobil affiliate (Imperial Oil) has been committed to providing employment opportunities to northern residents and businesses. As an example, Inuvialuit companies were awarded a contract for the 3D geophysical seismic acquisition program in 2008 and Inuvialuit businesses were hired to help design the field data collection program in 2009. From 2008 to 2011, Inuvialuit community members were key participants in the marine mammal observation program to protect marine mammals during project operations and to understand the distribution of marine mammals in the exploration license areas.
In 2011, the World Petroleum Congress recognized ExxonMobil with its Excellence Award in Technical Development.
Arctic Technology Innovation

Technology innovation continues to differentiate ExxonMobil from the rest of the industry in the Arctic and elsewhere. A few examples of our distinguishing technologies applicable to arctic exploration, development and production follow.

To help us prepare for future floating drilling operations in deeper water Arctic areas, ExxonMobil conducted unique trials above 81 degrees latitude in the Fram Strait using two world-class icebreakers to test methods for managing pack ice ahead of a stationary vessel. The trials confirmed the efficacy of ice breaking tactics and produced useful data to couple with our proprietary ICEMAN software to optimize ice management procedures.

ExxonMobil has maintained a leading position in enhanced oil recovery through our extensive research and development commitment over the past 50 years, our operational capabilities and our worldwide field experience. At Prudhoe Bay in Alaska, these technologies have helped increase reserves by 30 percent over 1980 estimates, and have the potential to help recover up to 60 percent of the resource at Hibernia. We also operate the world’s largest thermal bitumen recovery project at Cold Lake, Alberta, Canada.

In continuing to improve our ability to design structures to resist iceberg loading, ExxonMobil used new technology to perform complete 3D shape surveys of about 30 icebergs (both above and below the waterline) offshore Newfoundland and Labrador. This unique data set allows us to understand how icebergs interact with various structure geometries and to better predict the potential magnitude of ice impact loading.

ExxonMobil’s Arctic design capabilities are grounded in pioneering ice-mechanics studies, our leadership position in characterizing ice conditions, and are validated by physical testing. Recent application of this technology includes the development of ice-design criteria for the Orlan and upcoming Arkutun-Dagi platforms at Sakhalin-1. ExxonMobil’s ice-load simulation capabilities have also been recently expanded to include determination of loads from multi-year ice for vertical and sloped structures designed for more severe arctic locations.
ExxonMobil has an industry-leading strain-based assessment framework for pipeline design in demanding environments. Environmental conditions – including areas subjected to seismic activity, ice gouging and/or discontinuous permafrost – are readily addressed using our proven approach. Recent applications of this technology include multiple pipelines in the Sakhalin-1 development, pipelines associated with the Papua New Guinea liquefied natural gas project and early design work for Alaska gas development.

Faster drilling rates and reduced downtime are the result of sustaining our breakthrough fast drill borehole management (FDBM) process technology. Using FDBM, the Sakhalin-1 wells are not only the world’s longest wells, but are also some of the world’s fastest-drilled extended-reach wells.

ExxonMobil’s pioneering work in fundamental ice mechanics and ice-load calculations, such as Ralston’s method, form the basis of several design standards. ExxonMobil also pioneered the development of gravel- and ice-island technologies, and is the only company with experience in the design and construction of a variety of offshore structures used in arctic environments. In combination with our ongoing research and development program, where we work to develop novel solutions for extending our reach into deeper arctic waters and harsher ice environments, these demonstrated capabilities provide ExxonMobil unparalleled capacity to address the current and future challenges of arctic environments with our partners.
Project Execution

ExxonMobil consistently delivers complex, integrated projects on time and on budget. The factors that differentiate us include our focus on extensive, detailed front-end planning and our assessment of all options to determine the most robust concept. We identify potential risks early and take steps to mitigate or eliminate them. Our global functional organization also ensures that lessons learned and best practices are systematically captured and shared around the world.
Our focus on mitigating impacts to local communities and the environment is supplemented by our long-term commitment to research and development.

ExxonMobil is committed to operating in an environmentally responsible manner everywhere we do business. The Arctic’s fragile environment and sensitive ecology present unique challenges. The company’s efforts are always guided by an in-depth scientific understanding of the environments in which we operate, and the potential impact of our operations on the environment and society. All design and operational plans are based on the goal of eliminating unacceptable environmental and social impacts, with today’s experience used as a basis for improving future performance.

In 1989, the Exxon Valdez supertanker ran aground in Alaska’s Prince William Sound. It was a tragic accident that the company deeply regrets. ExxonMobil and the U.S. Coast Guard began a massive cleanup effort and, by 1992, the Coast Guard declared the cleanup complete.

In the aftermath of the accident, ExxonMobil refocused its commitment to safeguarding the environment, its employees and operating communities worldwide. We developed an even more rigorous management system and built it into the culture of our company. Today, the implementation of OIMS enables us to effectively manage the risks associated with our operations.

There are several examples of how we plan and modify our operations to reduce impacts on people and the environment. One way is through early engagement with indigenous people and local communities.
In addition to reducing impacts to indigenous people and local communities, ExxonMobil focuses on the protection of animal and marine life.
At our Point Thomson project on the North Slope of Alaska, we have established a positive working relationship with Kaktovik and other nearby villages that rely on traditional subsistence activities. We frequently hold community meetings to inform residents about the project while also soliciting their feedback. As a result of this two-way exchange, the project has adopted several specific design measures to ensure that our operations do not conflict with traditional subsistence activities.

In addition to reducing impacts to indigenous people and local communities, ExxonMobil focuses on the protection of animal and marine life. For example, our scientists have been involved with research on western gray whales off Sakhalin Island since 1997, leading to an improved understanding of this small (150 individuals) but important population. During these studies, every known gray whale in the area was monitored, photographed and cataloged. These studies have increased scientific knowledge of the health of individual animals, and monitoring their population has demonstrated not only that our actions have minimized impact on the whales and their habitat, but also that their population is increasing at a rate of about four percent per year.

ExxonMobil responsibly manages risk as we continue to move further into the Arctic frontier.

Understanding that high-quality, credible baseline data is essential to developing safe and environmentally sound exploration drilling programs, ExxonMobil conducted environmental baseline studies in the Canadian Beaufort Sea from 2008 to 2011. These multi-disciplinary, multi-year, collaborative field programs were designed and implemented with significant Inuvialuit participation to characterize the baseline conditions of the project area. These studies included multiple vessel-based and aerial programs and drew heavily on academic and government expertise and traditional knowledge provided by the Inuvialuit.

We are also participating in environmental habitat studies offshore Greenland that include whale migration, fisheries resource assessment, migratory bird habitats and understanding the impact of resource development on indigenous communities.

Our focus on mitigating impacts to local communities and the environment is supplemented by our long-term commitment to research and development. For example, we have the industry’s only dedicated, in-house oil spill response research program and have led several joint industry projects enhancing oil spill response in ice. Most recently, ExxonMobil, along with eight other companies, formed the International Oil and Gas Producers’ Arctic Oil Spill Response Joint Industry Program. This is a three-year, $20 million initiative that will expand industry knowledge of, and capabilities for arctic oil spill prevention and response.

Through this proactive research, planning and engagement approach, ExxonMobil is demonstrating its ability and commitment to minimizing operational impacts to local communities, wildlife and the environment and to responsibly managing risk as we continue to move further into the Arctic frontier.
Future Opportunities
Russian Arctic

ExxonMobil has multiple areas of exploration interest in the Russian Arctic. A Strategic Cooperation Agreement was first signed by Rosneft and ExxonMobil in August 2011 with an expansion of this agreement announced in February 2013. The original agreement included exploration for hydrocarbon resources in the Kara Sea and covers more than 125,000 square kilometers across three blocks, equivalent in size to the total leased acreage in the entire U.S. Gulf of Mexico. The expanded agreement includes an additional 600,000 square kilometers across seven new blocks in the Chukchi Sea, Laptev Sea and Kara Sea, considered among the world’s most promising and least explored offshore areas.

Exploration activities commenced in 2012 with the acquisition of a large 3D seismic survey and a regional 2D seismic survey. Drilling of the first exploration well is expected to begin in 2014.

In June 2012, ExxonMobil signed an agreement to jointly develop tight oil resources in Western Siberia, and in February 2013, the companies agreed to study a potential liquefied natural gas project in the Russian Far East. ExxonMobil is working with Rosneft to establish the best areas for unconventional oil, and technical work is underway with a goal of initiating pilot development drilling in late 2013. ExxonMobil is also collaborating with Rosneft on an Arctic Research Center. The technologies and processes developed with Rosneft will enhance our capability to operate in arctic conditions.
ExxonMobil has a portfolio of significant Arctic opportunities, with ongoing studies spanning the range of exploration, project feasibility assessment and planning, and technology development.

**Canadian Beaufort Sea**

ExxonMobil and Imperial Oil increased our acreage position in the Beaufort Sea by winning exploration rights to license EL 446, which includes a hydrocarbon prospect known as Ajurak. The companies have also concluded a joint-venture agreement with BP Exploration to share exploration and potential development work on the Pokak prospect in licenses EL 446 and 449, significantly increasing all three companies’ acreage positions. Imperial will be the operator of the licenses.

Besides arctic conditions and a short open-water season, the licenses have water depths ranging from 60 to 1,200 meters, making for a broad range of challenging exploration conditions. Active exploration continues, including the acquisition of extensive three-dimensional seismic data in 2008 and 2009 using solid streamers, our preferred method to record sound waves in an environmentally sensitive manner.

**Hebron**

The Hebron field, which consists of the Hebron, Ben Nevis and West Ben Nevis reservoirs, is located offshore Newfoundland and Labrador in the Jeanne d’Arc Basin, about 350 kilometers from St. John’s in 90 to 100 meters of water. In addition to the complexities faced by development of the nearby Hibernia field, the Hebron field also faces challenges associated with the recovery of heavy oil.

**Mackenzie Gas project**

The Mackenzie Gas project includes the potential development of three onshore anchor fields containing approximately 170 billion cubic meters of natural gas in the Mackenzie Delta region of northern Canada. In addition to individual field development, the project includes a gathering pipeline system, a gas processing plant, a natural gas liquids pipeline to Norman Wells, and a natural gas pipeline to northwestern Alberta.

ExxonMobil has conducted extensive studies on high-pressure, strain-based design pipelines, applicable to both the Mackenzie and Alaska Gas projects, which provide a solid basis for the safe and effective design of large export pipelines in permafrost areas, addressing both frost heave and thaw settlement.
Alaska gas development

As the largest holder of discovered gas resources on the North Slope of Alaska, ExxonMobil is working to develop these resources to compete on a global scale with other world-class resources. The company is currently advancing an ExxonMobil-operated project at Point Thomson, a remote field located 60 miles east of Prudhoe Bay, to develop its estimated eight trillion cubic feet of natural gas (about 25 percent of the North Slope’s gas resources) and its associated gas liquids. Over the next few years, ExxonMobil will continue to work toward delivering this reliable and secure source of clean energy to global markets.

Norway and Greenland

ExxonMobil has been an active explorer in Norway since 1965 and currently holds exploration licenses in the Outer Voring and Møre Basins. Exploration has been conducted on a regional scale along the Atlantic Margin and Barents Sea in preparation for future license rounds in both Norway and Greenland. ExxonMobil has previously participated in the drilling of more than 20 Barents Sea wells.

Since 2007, ExxonMobil has been actively exploring in Greenland. Esso Exploration Greenland Limited (EEGL), an ExxonMobil affiliate, was awarded two licenses offshore West Greenland, near Disko Bay and has been evaluating new opportunities in Greenland.

Key Arctic-related challenges for any future project in these areas include the development of cost-effective solutions for the protection of offshore pipelines, seabed facilities, gravity-based structures and floating production systems in an extreme iceberg environment, where migrating whales and birds spend critical periods of time feeding, breeding and molting.

Hibernia Southern Extension

The Hibernia project is well below the Arctic Circle, but is subject to arctic ice and very high-energy weather and sea conditions. The Hibernia Southern Extension is a subsea development that will consist of four production wells drilled from the existing Hibernia gravity-based structure (GBS). Five subsea water-injection wells with tiebacks to the GBS will be drilled from an excavated drill center on the seafloor seven kilometers southeast of the GBS. Drill center excavation will take place in 2012, with subsea installation and water-injection well drilling to begin in 2013.

Sakhalin-1 future phases

As with Sakhalin-1’s Chayvo and Odoptu fields, development of the Arkutun-Dagi field will be carried out in phases; the first of which is planned to commence in the northernmost portion of the field in 2014.

The first phase of the Arkutun-Dagi development will employ an ice-resistant fixed platform, which is expected to become the largest offshore oil and gas production platform in Russia. The platform substructure is a concrete gravity base and was installed in 2012. The topsides will be installed onto the substructure in 2013. This platform, named Berkut, will become the first ExxonMobil-operated platform with friction pendulum bearing isolators to protect topsides facilities during a seismic event.

Future project plans also call for the expanded development of Chayvo natural gas resources that are not associated with current oil production. These development plans will require the drilling of additional gas wells and the expansion of existing onshore and offshore facilities.
ExxonMobil brings 90 years of experience and unparalleled capabilities to exploration, development and production projects in the Arctic.