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Arctic Petroleum Development: Western Capabilities and Soviet Needs

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A Research Paper

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November 1986

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Arctic Petroleum Development: Western Capabilities and Soviet Needs [redacted] 25X1

A Research Paper

This paper was prepared by [redacted] 25X1
Office of Global Issues, and [redacted] Office of 25X1
Soviet Analysis. Comments and queries are welcome and may be directed to the Chief, Strategic Resources Division, OGI, [redacted] 25X1
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Arctic Petroleum Development: Western Capabilities and Soviet Needs

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Scope Note

The global market for petroleum equipment and services is an important arena of commercial competition for the United States. It is also likely to become the focus of growing East-West trade prospects. This paper examines the worldwide availability of equipment and technology to develop petroleum resources in the Arctic and looks at needs the Soviets would have for Western assistance if they move to develop their potentially sizable Arctic resources. 25X1

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Arctic Petroleum Development: Western Capabilities and Soviet Needs [redacted] 25X1

Summary

Information available as of 15 September 1986 was used in this report.

Exploitation of Arctic petroleum reserves will pose important policy choices for both the Soviet Union and the West as the next decade approaches. Moscow's choice of a development strategy will have a significant impact on its oil balance in the 1990s and on the allocation of investment funds in general. Decisions made by the United States and other major Western suppliers of advanced oil equipment and technology on trade policy with Moscow will influence the level of East-West trade in the next decade, the health of the Western oil equipment and services industry, and the pace at which the Soviets can exploit their sizable Arctic oil potential. [redacted] 25X1

The world's Arctic regions are largely unexplored but promise vast petroleum resources—perhaps as much as one-sixth of the world's estimated 2 trillion barrels of recoverable crude oil, [redacted] 25X1
[redacted] Developing these resources in a harsh environment forces operators to make costly modifications to some equipment or to design new equipment or facilities. North American companies have mastered the development of Arctic onshore petroleum resources by using drilling and production equipment modified for these conditions. Offshore drilling in the ice-infested waters of northern Alaska and Canada has been under way for over a decade using a variety of specially designed ice-resistant units, and the industry is confident that Arctic offshore production is technically feasible. Development has been slowed by a lack of large discoveries and more recently by the collapse of oil prices. [redacted] 25X1

The Arctic regions in the Soviet Union bear particular promise and importance. With prospects poor for further large discoveries in the Soviet territories now being exploited, the Soviets will need to find and develop a new oil region to avoid sharp declines in oil production during the 1990s. The Soviet Union has high hopes for the petroleum potential of its Arctic regions—in particular the Barents and Kara Seas. Although no commercial deposits have yet been confirmed, our own estimates suggest that the Barents could become a prolific oil province. [redacted] 25X1

We believe that Soviet reliance on domestic resources to develop its offshore Arctic oil potential would hold back oilfield projects by at least 5, and probably 10, years. The Soviet oilfield-equipment industry lacks the capability to manufacture equipment suitable for harsh offshore conditions, and an effort to establish such a capability would create further bottlenecks in onshore equipment availability—for which demand will

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grow sharply during the period 1986-90. If the Soviets discover a substantial oilfield in the offshore Arctic and elect to expedite development, their only viable option would be to rely on Western equipment, technology, and services that they can acquire either through outright purchases or joint operating agreements. Because of likely reluctance to share control of any major project in the energy sector and military sensitivity to foreign presence in these areas, Moscow would prefer to remain the sole developer and operator. If oil production slips rapidly, however, and falls below a level needed to satisfy domestic requirements—an unlikely prospect at least through 1995—and if Soviet offshore Arctic development is beset with problems, Moscow might be compelled to seek Western management and operational assistance to accelerate development and avoid further delays. 25X1

25X1 West European and Asian countries see the Soviet Union as a major growth market for their petroleum-equipment industries—especially for specialized equipment to develop the Soviet Arctic. Soviet officials have encouraged foreign suppliers by dangling the potential of large development projects such as Sakhalin Island and the Barents Sea. *Canadian* firms are well positioned to benefit from Soviet needs for Arctic petroleum equipment because of their operational experience in the North American Arctic. *Norway, Sweden,* and *Finland* are all trying to position themselves to sell Arctic equipment, particularly for offshore development, and the Soviets have responded by raising the possibility of collaborative development of the Barents Sea. Finland has pioneered the sale of Arctic offshore equipment to the Soviets and has built most of its offshore petroleum equipment industry on this business. A number of other countries with sophisticated petroleum equipment industries are vying for a piece of the Soviet Arctic petroleum equipment market, including *Japan,* the *United Kingdom, West Germany,* the *Netherlands, France,* and *Italy.* 25X1

The likelihood of large Soviet petroleum resources in the Arctic and the low level of Soviet technology applicable to the region at least theoretically creates a potential source of Western leverage in dealing with Moscow. Because the required technology is available from a variety of Western suppliers, however, we see little opportunity for the United States alone to exert much influence on Soviet Arctic development, or to use that development as a point of leverage in bilateral relations. Aside from

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advanced remotely operated vehicles and COCOM-controlled electronic sensing, measuring, and computer-related equipment, very little petroleum equipment used in Arctic onshore and offshore development has military uses. The Soviets remain cautious toward large-scale petroleum equipment deals with US firms because of the 1981-82 pipeline-equipment embargo and existing petroleum equipment controls. If equipment quality is critical to the project's success and US technology or equipment is clearly superior to other Western equipment, however, Moscow would probably opt to buy the US equipment. Before any large-scale deal or joint development project could be consummated, Moscow would probably demand delivery guarantees or stiff financial penalties for breach of contract. 25X1

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Contents

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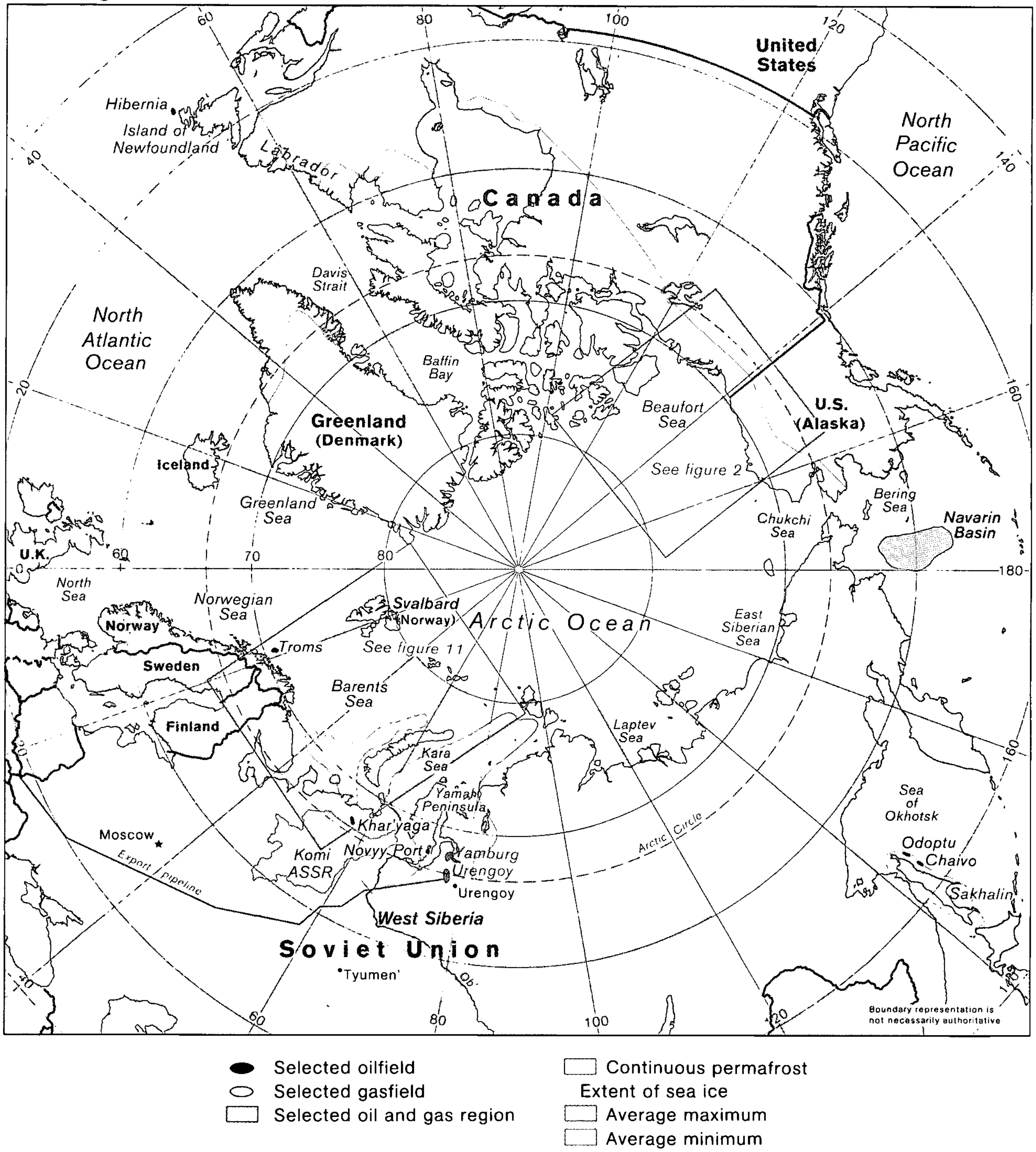
Figure 1
Arctic Region



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Arctic Petroleum Development: Western Capabilities and Soviet Needs 25X1

Introduction

The world's Arctic regions are largely unexplored but promise large petroleum resources—perhaps as much as one-sixth of the world's estimated 2 trillion barrels of recoverable crude oil. This area is one of the most inhospitable in which to explore for and extract petroleum resources. Cold temperatures, floating ice, harsh weather, and the remoteness of many Arctic regions create difficult operating conditions and require costly equipment to provide the reliability and stability needed to extract oil and gas over long periods. Although development costs are high, dwindling petroleum resources in more benign areas of North America and the Soviet Union—regions where Arctic petroleum resources are primarily concentrated—have created incentives to push northward. Because of recent industry advancements in engineering capabilities, Arctic development—at least in the West—appears limited only by the price of oil and the extent of petroleum resources discovered in the vast Arctic continental shelf.

The future of Soviet oil production may lie in Arctic oceans. Fifteen key oilfields currently account for nearly half of total Soviet oil production. Because output from most of these fields has peaked and is currently declining, the need to develop a new oil region—perhaps the Barents or Kara Seas—will be critical to keep oil production from falling sharply during the 1990s. Although gas production will remain onshore for the foreseeable future, the focus of gas development will be above the Arctic Circle in severe environments and continuous permafrost zones. Consequently, the USSR's need for more and better quality Arctic-grade equipment will grow.

The Arctic Challenge

Despite the Arctic's distinctive environment—dominated by rigorous cold and characterized by nearly continuous daylight in summer and nearly continuous darkness in winter—no single definition has evolved to mark its limits. Among the more common criteria are the area encompassed by the Arctic Circle, the area north of the tree line, and the area covered by sea ice and perennially frozen ground (permafrost). Geographically, five countries are most concerned by the problems posed by the Arctic zone—the United States, Canada, Greenland (Denmark), Norway, and the USSR. In addition, the subarctic, or the area bordering the Arctic where environmental conditions are slightly less extreme, is often affected by Arctic considerations (see figure 1). 25X1

Development of petroleum resources in the Arctic poses immense challenges to the petroleum industry worldwide. Logistic support is hampered by the geographic isolation of petroleum development projects and the lack of established infrastructure such as roads, ports, airstrips, and pipelines. Air temperatures can drop as low as −50° F, and high winds exceeding 80 miles per hour can drive the windchill factor to temperatures equivalent to −90° F. Permafrost complicates Arctic oil and gas drilling and production operations. Onshore and some offshore petroleum development projects involve drilling through continuous permafrost, which extends an average depth of about 500 meters in northern Siberia and in Canada. 25X1

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Permafrost is overlaid by an active ground layer, extending to the surface, that thaws in the summer and freezes in the winter. This creates the need for materials such as gravel for roads and drilling pads to permit year-round operations, special drilling muds and concretes to avoid alternate freezing and thawing problems, and insulation to prevent well casings from collapsing. Buildings must be constructed on specially designed refrigerated piles to prevent interior heat from thawing frozen ground. Oil pipelines must be insulated and/or elevated on complex supports to avoid environmental damage. Water supply, fuel, and sanitary piping must be placed in heated and insulated piping. 25X1

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Arctic Petroleum Development in the West

North American industry has mastered the development of Arctic onshore petroleum resources. Production on Alaska's North Slope at Prudhoe Bay began in 1977 and has reached 1.6 million b/d. More than 350 wells have been drilled and $12 billion spent, with another $12 billion planned for future development. The Trans-Alaska pipeline was finished in 1976 at an expense of an additional $8 billion. Offshore exploration in the Alaskan Arctic began in the mid-1970s with the use of drillships and artificial islands in the Beaufort Sea. Production of about 100,000 b/d from the Endicott field is scheduled to begin in 1987 from an artificial gravel island linked to shore by a gravel causeway—marking the start of commercial oil production in Arctic waters. Total Alaskan onshore and offshore undiscovered recoverable reserves are estimated to be 14 billion barrels, according to industry studies.

Canadian and US firms have spent more than $10 billion during the last 20 years drilling in the Canadian Arctic. Onshore drilling in the Mackenzie Delta region resulted in the discovery of major gas reservoirs as early as 1963, although the prohibitive cost of a Trans-Canada pipeline has prevented development of these fields. Offshore drilling in the Canadian Beaufort Sea began in 1976, and more than 50 locations have been explored using a variety of offshore drilling systems. The largest oil discovery in the region has been Gulf Canada's Amauligak field with recoverable oil reserves of nearly 1 billion barrels, but low oil prices have curtailed development. 25X1

Significant quantities of natural gas and some crude oil fields have been found in the Canadian Arctic island region, but transportation costs have prohibited development. Drilling offshore Newfoundland and Labrador in eastern Canada began in the late 1970s. The large Hibernia oilfield off Newfoundland is expected to be developed by the early 1990s with maximum production forecast at 150,000 b/d of crude. Although not in Arctic waters, the field lies in an area infested with massive icebergs that pose significant challenges to the design and operation of an offshore production system. 25X1

Exploration in the Svalbard region of Norway began as early as 1966, but intensive offshore exploration of the Norwegian Barents Sea was not carried out until 1975. This effort was suspended in the disputed zone of the Barents Sea [a] *because of the maritime border dispute with the USSR. Statoil, in a partnership with other Norwegian oil companies, has continued exploration farther south in the Troms Basin where significant quantities of natural gas have been discovered. Commercial development is unlikely in the next 10 years, however, because the finds are in water depths ranging from 250 to 400 meters.* 25X1 25X1

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Ice poses the greatest obstacle to Arctic offshore petroleum development; coping with the problem requires special equipment design and operational criteria. Arctic offshore petroleum structures must be able to withstand a variety of ice forces including the movement of sea ice and the impact of icebergs. Seabottom gouging by pressure ridge keels creates the need to bury offshore pipelines and seafloor wellheads deeply. In addition, the fine, silty sediments and subbottom permafrost commonly found on the ocean floor in Arctic regions pose major engineering problems in the design of foundations for drilling and production platforms.

Arctic Resources

Development of Arctic resources in the West has occurred primarily on Alaska's North Slope and in US and Canadian offshore areas of the Beaufort Sea (see figure 2 and inset, "Arctic Petroleum Development in the West"). US and Canadian companies have drilled in the Canadian Arctic islands region and in the subarctic regions off Newfoundland. Some seismic work has been conducted offshore eastern Greenland. In Western Europe, Norway has sporadically drilled off its northern Arctic coast. 25X1

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The Oil Potential of the Barents Sea

The Barents Sea has the potential to be a major oil bonanza for the USSR. We estimate that recoverable oil resources in the Soviet portion of the Barents Sea could amount to about 30 billion barrels—about the same as North Sea reserves. This is a conservative estimate; the aggregate oil potential of the Barents Sea could match or exceed that of West Siberia. Although geochemical indicators point to large potential reserves, we do not have information on the size of the reservoirs that may exist. [a]

The Barents Sea is a harsh area but presents no insurmountable environmental or technical obstacles to oil development. Because of the influence of the Gulf Stream, conditions in the southern part of the Barents Sea are similar to those in the North Sea, an area that has been in production for many years. Conditions in the north are similar to those in the Canadian Beaufort Sea, which is presently being explored by Western firms and will be developed when economic conditions permit.

The Soviet Union has primarily focused on developing gas resources in West Siberia, progressively moving farther north to the permafrost zone above the Arctic Circle. In recent years the Soviets have also emphasized exploration and development of Arctic onshore oil resources, but production from Arctic fields is less than 50,000 barrels per day (b/d). The Soviet offshore program is focusing on exploration of the Barents Sea, which we believe has outstanding potential although commercial quantities of oil have yet to be discovered (see inset, "The Oil Potential of the Barents Sea"). In addition, the Soviets have been trying to convince the Japanese to support development of the major gas reserves found in the subarctic fields offshore Sakhalin Island, but high development costs and Japan's numerous alternative sources of liquefied natural gas have stalled negotiations.

Arctic petroleum development in the West will be slowed considerably by the collapse of oil prices. Alaska's future hinges on the potential of finding large new fields, particularly in the Beaufort Sea, the Chukchi Sea, and the Navarin Basin in the Bering Sea, but development costs range from $20 to $35 per barrel. Development in the Canadian Beaufort Sea also depends in large part on whether reserves will support construction of a subsea pipeline to the Mackenzie Delta (see figure 2). Commercial development of the Canadian High Arctic will probably not occur until the next century because of high development costs. Future exploitation of the oil reserves off eastern Canada will also be slowed by low oil prices. 25X1

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Technology and Equipment Availability

US and Canadian firms responsible for the development of North America's Arctic onshore and offshore petroleum resources have pioneered the development of the specialized equipment and technology needed to operate in the Arctic environment. These firms, assisted by engineering, technical, and operational companies, have built up extensive experience operating in the Arctic environment. West European and Japanese companies also have a major stake in the Arctic petroleum equipment market, especially for offshore operations. The petroleum industry is an international business and firms from many countries work together to complete difficult projects (see appendix).[1] 25X1

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Onshore Equipment and Technology

Onshore equipment used in Arctic development to date is mostly North American in origin. US and Canadian firms, for example, have designed and produced all of the *drilling rigs* operating in North America. These rigs are modified to work in the Arctic by enclosing and heating the working areas in and around the rigs. Although building these metal

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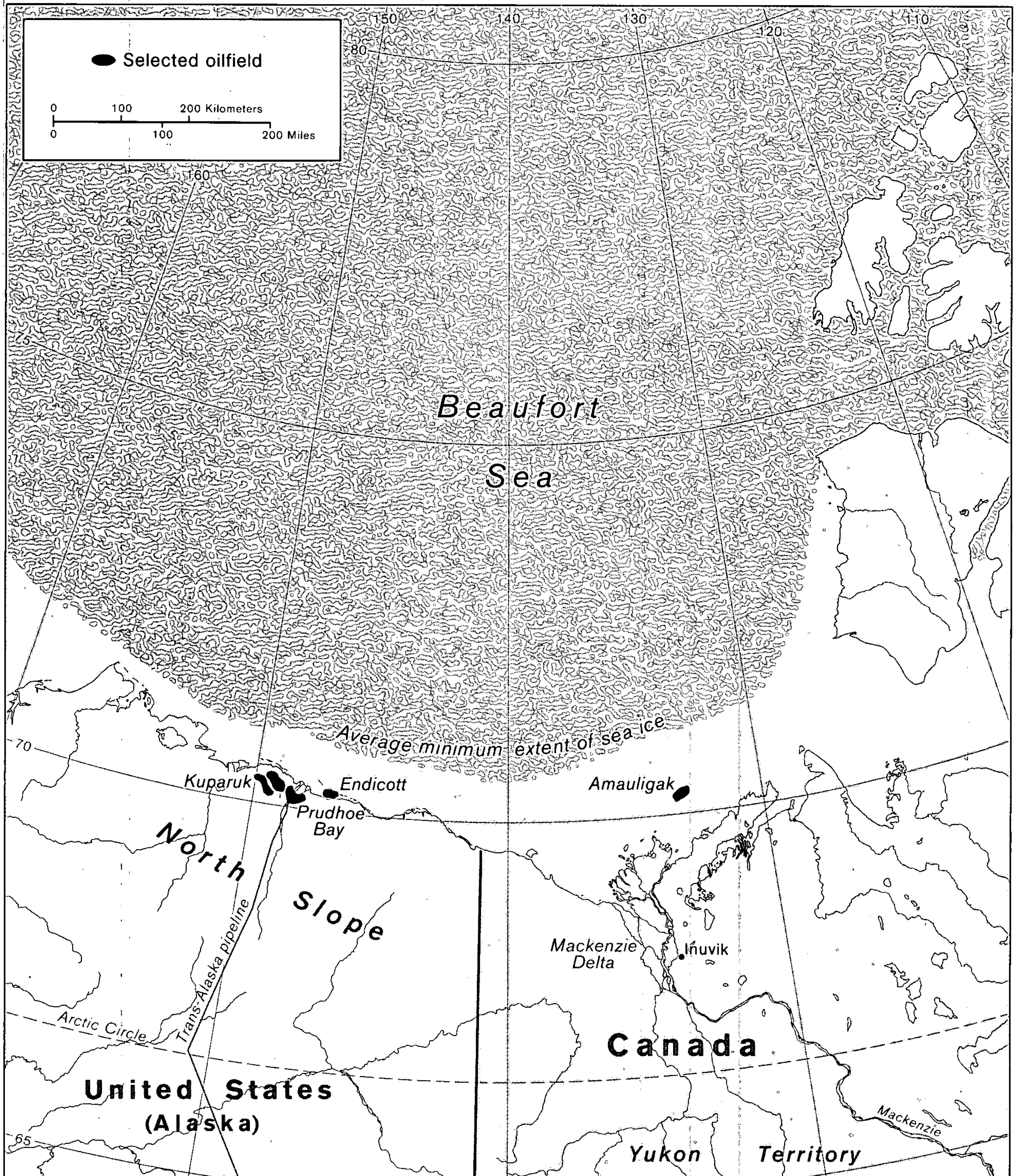
Figure 2
The North Slope and the Beaufort Sea Regions



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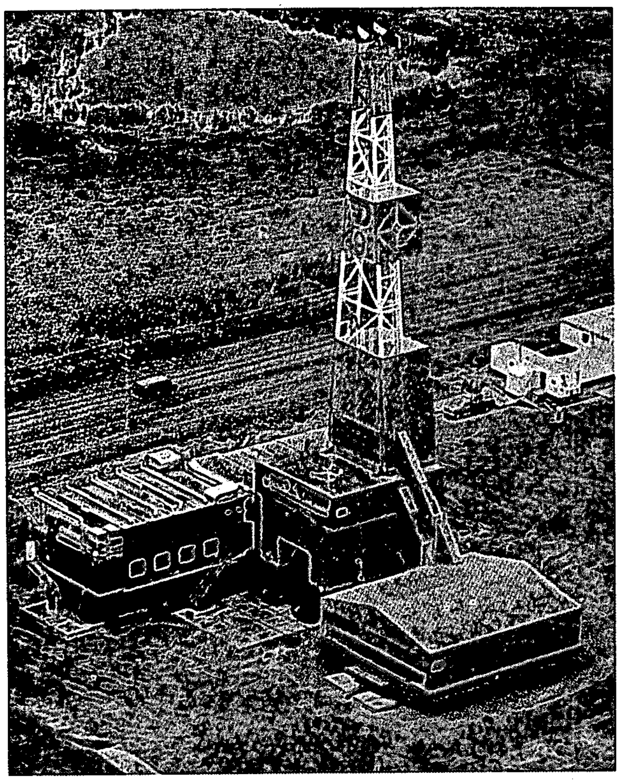

Figure 3. Canadian onshore state-of-the-art Arctic drilling rig. [redacted]

enclosures requires no special technology, considerable design work based on operator experience is required to reduce weight and install a heat conservation system, [redacted] Arctic rigs in North America are also modularly designed for easy transport by land or air. [redacted] a Canadian firm has just designed and manufactured a very large, mobile, wheel-mounted rig that can move from well to well at a drilling site on a pad in about 10 minutes and travel on gravel roads at about 5 miles per hour. Other Arctic rigs must be disassembled and moved to new drilling pads—a process that takes three to four days. Besides US and Canadian companies, a number of other foreign companies can manufacture Arctic drilling rigs. The most prominent of these are in Finland, Italy, Brazil, France, and Japan. [redacted]

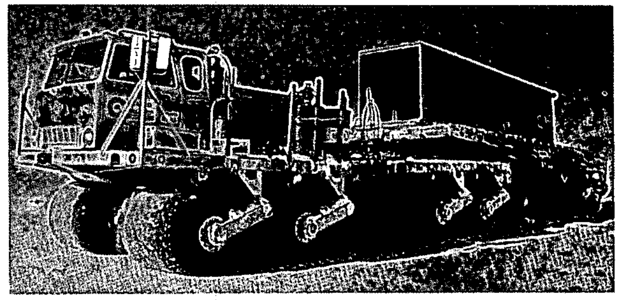

Figure 4. Rollogon vehicle for transporting cargo over permafrost and ice. [redacted] 25X1

US companies also dominate the field of specialized *downhole drilling* and *well completion equipment* and *techniques* used in Arctic development, although most of the equipment can be procured either from US foreign subsidiaries in Canada or in Western Europe. Offshore directional drilling techniques have proved valuable in overcoming problems posed by onshore permafrost. Directional wells drilled from a single gravel pad can tap up to one-quarter square mile of the surrounding reservoir. Electronic drilling gear greatly assists speed and accuracy. The wells are insulated near the surface with special casing to help prevent thawing, and special quick-drying cements are used to prevent the wells from collapsing. [redacted] 25X1

US and Canadian companies have overcome the severe *transportation* constraints imposed by the Arctic permafrost and the severe weather by developing two unique types of vehicles to transport heavy cargoes. The rollogon is a large flatbed truck equipped with special balloon tires for offtrack travel over ice and permafrost. The lampson crawler is a larger tractor consisting of a motorized platform on tracks and is used to transport oil and gas facility modules delivered by sea to the North Slope. During the winter, air transportation to remote drill sites is made possible by constructing ice runways using rollogons and employing heavy lift C-130 aircraft to transport drilling rigs and equipment. [redacted]

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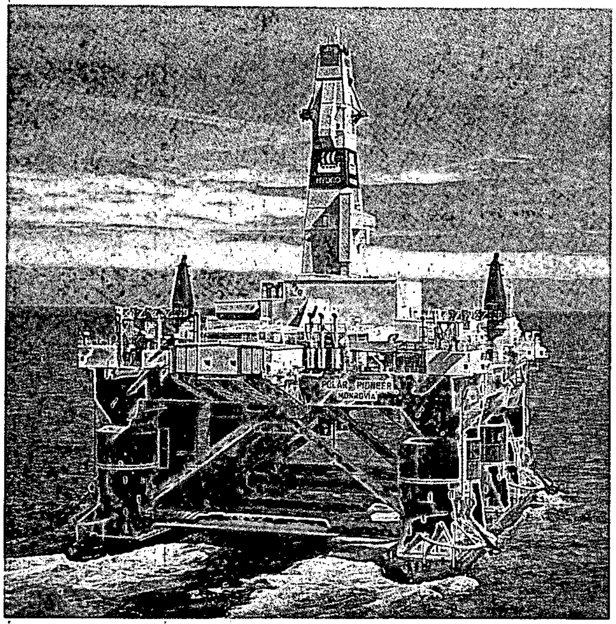

Figure 5. State-of-the-art semisubmersible for exploratory drilling in subarctic conditions.

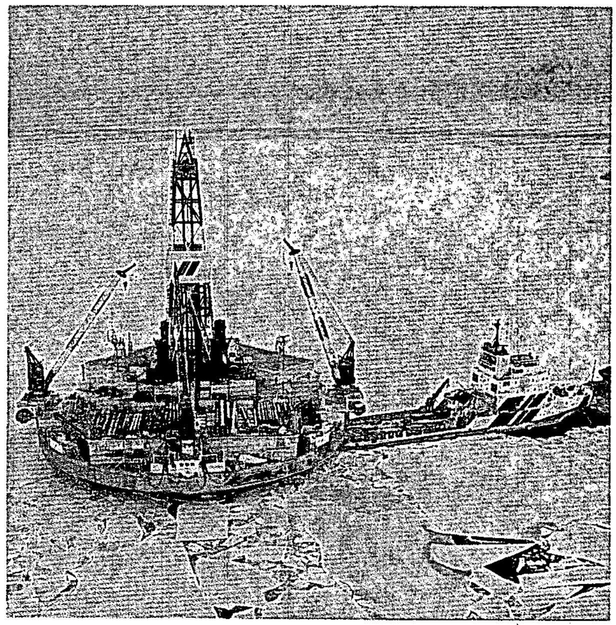

Figure 6. Gulf Canada's "Kulluk" mobile drilling platform for exploratory drilling in deep water (up to 90 meters) and severe ice conditions.

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Modular construction techniques drastically cut the time and cost of constructing petroleum facilities in the Arctic environment. Western engineers have solved problems such as construction on the permafrost and sewage treatment to enable personnel to live comfortably in an Arctic onshore environment. Canadian and Finnish companies are also experts in construction techniques in the Arctic. The Finnish firm Huure has built 22 complete village modules in Siberia for the Soviet gas export pipeline. Modular construction techniques are widely used in the offshore industry and are available from numerous West European companies.

Offshore Drilling Equipment and Technology

While US firms pioneered offshore oil development and are still preeminent in the field, the capabilities to design, construct, and operate state-of-the-art *offshore drilling vessels* are widespread among major shipbuilding countries. Arctic offshore drilling equipment includes modified conventional equipment and specially designed units to withstand severe ice forces. In partly or completely ice-free Arctic seas such as the Navarin Basin, eastern Canada, and the southern Barents Sea, the industry has employed a combination of *drillships, jack-ups,* and *semisubmersibles* reinforced against ice to drill primarily during ice-free periods of the year. In some ice-free areas, such as off northern Norway, operators have ordered state-of-the-art semisubmersibles that can operate year round. Practically all of the workplaces, including the top of the drill tower, are enclosed for protection. The rigs, which cost about $100 million to construct, are also equipped with deicing systems and heating coils to prevent ice buildup from sea spray. 25X1

In the multiyear ice zone of the Beaufort Sea, where the ice-free period lasts only three to four months, North American operators have built *floating units* 25X1 and *bottom-founded units* to drill in severe ice conditions. The only operating floating unit is Gulf Canada's conical semisubmersible unit, Kulluk, designed to drill to 7,000 meters in 24 to 185 meters of water. A number of mobile, bottom-founded units have been constructed for year-round operations. Global Marine has built a conical mobile concrete island drilling system that rests on the ocean floor. Gulf Canada has developed a similar mobile Arctic caisson—Molikpaq—which is towed to location, lowered onto

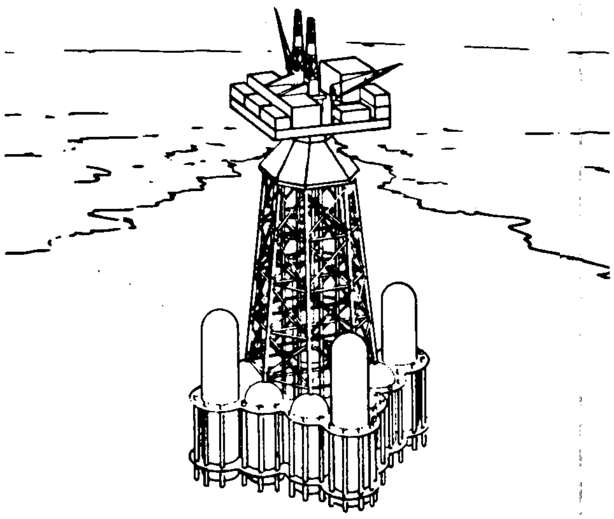

Figure 7. Arctic production platform designed for deep water and light-to-moderate ice conditions. [redacted]

the seabed, and filled with dredged material to withstand the pressure of pack ice. CANMAR has designed single steel drilling caissons that are converted tankers designed to rest on an underwater berm. The primary limitation of these mobile bottom-founded systems is their maximum water depth of no more than about 40 meters. [redacted]

Companies in Canada and the United States also have developed *artificial gravel islands* and *stacked caisson-restained islands* using concrete slabs and steel to permit year-round drilling in shallow waters. At least 20 islands have been established in the Beaufort Sea since the 1970s. [redacted] CANMAR developed a technique of injecting sand and gravel through the ice to build gravel causeways to transport drilling equipment to *artificial ice islands* to cut the high cost of gravel structures. The Canadian firm, Panarctic, developed a technique to drill offshore wells in the deep water of the High Canadian Arctic using artifically constructed *ice platforms* and to produce oil from them by installing subsea wells. [redacted]

Offshore Production and Transportation Technology

US companies are world leaders in the design of *offshore Arctic oil platforms.* Much of their work, nevertheless, has been done in collaboration with

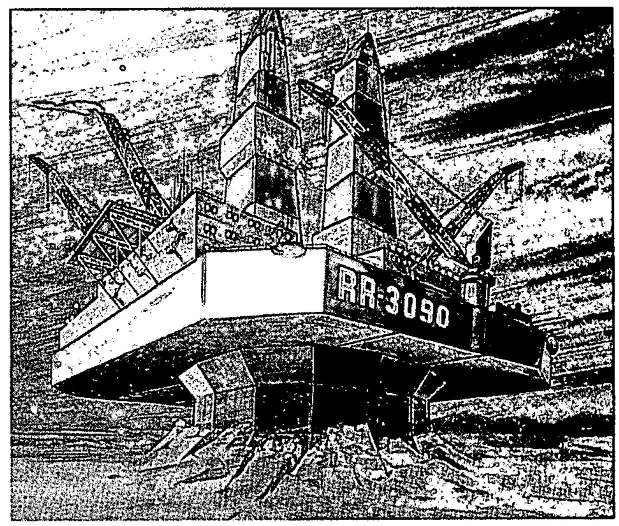

Figure 8. Arctic production system designed for severe ice conditions. [redacted] 25X1

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Canadian, Japanese, and West European engineering firms. Furthermore, many foreign firms have acquired licenses from US companies to build Arctic offshore production equipment and structures, [redacted] 25X1 [redacted] To date, more than 50 such 25X1 platform designs have been developed by this worldwide effort. Their designs vary according to the different thickness and force of the ice surrounding 25X1 the platforms. [redacted]

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Transportation of crude oil produced in Arctic regions poses major technical and economic hurdles. Three basic concepts have been proposed, including *subsea storage tanks, subsea pipelines,* and a combination of *tankers* and *icebreakers.* A more exotic 25X1 proposal involves massive *crude-carrying submarines.* 25X1 This type of system is only conceivable for fields in the high Arctic in very deep water. North American companies are currently focusing their efforts on developing transportation concepts using a subsea pipeline for Gulf's Amauligak field in the Canadian Beaufort Sea and a tanker system for Mobil's 25X1 Hibernia field off Newfoundland. [redacted]

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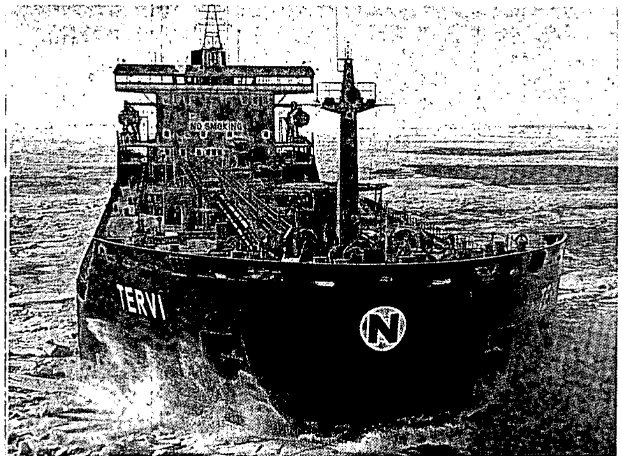

Figure 9. Finnish-built 46,000 DWT icebreaking tanker. [redacted]

Specialized Offshore Vessels and Equipment

Many specialized vessels and other equipment are required to develop oilfields in Arctic waters:

- In icy waters, *icebreakers* are required to maintain supply lines, break up heavy ice floes threatening a production structure, and open routes for tankers. *Ice-reinforced geophysical research vessels* and *supply ships* are important for exploration and production operations. The Finnish company Wartsila has built a diesel-powered *air cushion vehicle* to operate as a fast supply ship over ice-covered terrain.

- Other specialized vessels include *accommodation vessels* for living quarters, *derrick* and *lay barges* for heavy *lifting* and *pipelaying,* large *oceangoing dredgers* for constructing artificial islands, and *icebreaking tankers.*

- Subsea Arctic oil production in deeper waters will require *remotely operated vehicles* (ROVs) for installation, inspection, and repair activities. These vehicles use sophisticated gear, including robotics, and have wide military application, such as in mine neutralization. [redacted]

Much of this equipment is generally available in North America, Western Europe, and Japan. The Soviets already have purchased icebreakers and a number of research vessels from Finland. The Soviets are particularly interested in acquiring ROVs and related subsea technology, some of which is COCOM controlled. [redacted] 25X1

[redacted] 25X1

Operational and Technical Support

Most companies with operational experience of technical expertise in the Arctic are based in the United States, Canada, and the Scandinavian countries. *Drilling contractors* such as Nabors of Canada are essential to Arctic oilfield development, and firms such as Arctic Transportation, Ltd. operate a full range of logistic support craft needed in the Arctic. In addition, small, high-technology *consulting firms* provide operational support and advice to Arctic offshore operators. A number of Canadian firms such as the Bercha Group, for example, have become world leaders in understanding ice mechanics and analyzing ice risk to offshore structures. [redacted] 25X1

Access to sophisticated *research facilities* to test the effects of ice on vessels and offshore structures and to perform theoretical studies of ice mechanics is also an important requirement in Arctic work. The most sophisticated of these facilities contain ice model basins that simulate Arctic offshore ice conditions. Finland's Wartsila Arctic Research Center is recognized by industry as the world's leading ice laboratory. Japanese companies such as Mitsubishi and NKK have similar ice model basins. [redacted] 25X1

Arctic-Grade Steel

The severe temperatures of the Arctic environment require operators to buy *high-strength steel* for onshore and offshore structures and for tubular goods such as casing and line pipe. Most of the specialized tubular steel is produced in Japan and West Germany, although a number of companies in Finland, France, Sweden, and Italy also compete in this field. The Soviets have relied heavily on Japanese and West German companies for their line pipe and on Finland for structural steel for offshore equipment. [redacted] 25X1 25X1

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Development of Petroleum Resources in the Soviet Arctic

Current Trends and Plans for Soviet Oil Production

Although Western companies have pioneered the development of equipment and technology needed to exploit Arctic oil resources, a significant share of the Arctic oil potential lies within the Soviet Union. The importance of Arctic oil potential to the Soviet Union is underscored by the problems Moscow faces in fulfilling its ambitious oil production goals from more accessible regions. The Twelfth Five-Year Plan (1986-90) calls for production to rise to 12.7 million b/d in 1990. Despite intensive efforts to stabilize output—oil industry investment is doubling about every five years—we believe that oil production will fall to approximately 11.25 million b/d by 1990.

Prospects are poor for further large discoveries in the regions now being exploited, and the Soviets will need to find and develop a new oil region to avoid sharp declines in oil production during the 1990s. Oil development in West Siberia—which currently accounts for about 60 percent of national output—began more than 20 years ago, and West Siberia is now a mature oil-producing region. Production from regions outside West Siberia has been falling since 1975.

Petroleum Potential of the Arctic

The Soviets believe their Arctic regions—in particular the Barents and Kara Seas—have significant oil potential. Exploration of the Barents Sea began in 1978 with 6,000 km of seismic surveys. Exploration drilling began in early 1982 and has accelerated in recent years. Our analysis of Soviet technical literature and other information suggests a massive potential for recoverable oil in the Soviet portion of the Barents Sea (see inset on the Barents Sea).

The Kara Sea has also been described by Soviet geologists as having potential for major petroleum accumulations. Environmental conditions in the Kara Sea, however, are much more severe than those in the Barents Sea. Ice is thicker and more extensive, and the ice-free season is much shorter. Because of the formidable obstacles posed by the ice conditions, Moscow will probably develop any commercial deposits in the Barents Sea first as a means to learn the rudiments of operating in harsh environments. 25X1

The USSR has also discovered petroleum resources off Sakhalin Island in the Far East, although the discoveries are small when compared with the oil potential of the Barents and Kara Seas. Estimated recoverable reserves for two fields—Chaivo and Odoptu—are roughly 300 million barrels of oil, 96 million barrels of gas condensate, and about 160 billion cubic meters of natural gas. Although located well below the Arctic Circle, this region has ice-infested waters and severe cold periods and would require Arctic-capable offshore technology and equipment for development. 25X1

The future of Soviet gas development lies onshore north of the Arctic Circle. For example, the Yamburg gasfield, which is slated for development during 1986-90, will reportedly provide nearly all of the 25X1 growth in Soviet gas production during this period. Gas production from the Yamal Peninsula will probably begin during the early 1990s. The Soviet press has reported that experimental development of the Novyy Port oilfield—the southernmost of a series of oilfields that extend across the Yamal Peninsula above the Arctic Circle—has begun. Although most onshore oilfield development will remain below the Arctic Circle, much of the technology and equipment the Soviets would need for Arctic petroleum development 25X1 is suitable for the swampy and cold environment of the West Siberian oil-producing region. 25X1

Development Scenarios for Offshore Arctic Regions

Soviet offshore oil capabilities are much more limited than those of Western nations. In fact, indigenous Soviet offshore Arctic petroleum technology is virtually nonexistent. Most of the equipment and technology employed by the Soviets has been either purchased from the West or reproduced from technology supplied from Western firms. The Soviets rely heavily 25X1 on Western drilling equipment in current exploration efforts in the Barents Sea and Sea of Okhotsk (see "Sakhalin Island Development" inset). Soviet officials have indicated that exploration drilling is proceeding slowly, largely because of difficulty in assimilating the advanced technology. The Soviets have virtually no expertise in offshore Arctic drilling techniques that use artificial islands and ice platforms. 25X1

Sakhalin Island Development

In 1975, the USSR and Japan signed a general agreement to jointly develop Sakhalin Island's offshore petroleum resources. The agreement called for SODECO—a consortium of Japanese petroleum and trading companies—to finance and help develop the fields. The development of petroleum resources off Sakhalin Island was originally conceived to net more than $20 billion in hard currency earnings for the Soviet Union by the end of the project's life (about 20 years). Because of severe climate and icepack conditions—similar to those of the northern Arctic—development would require sophisticated petroleum equipment currently unavailable in the USSR. This project, however, is now in limbo because of falling energy prices and the failure, to date, to line up Japanese utilities to purchase the liquefied natural gas. Nonetheless, the Soviet approach to this project is instructive on how Moscow might develop its Arctic oil resources:

- *Moscow never considered using domestic equipment. From the outset, the Soviets looked for Western technology and equipment.*
- *Moscow sought to finance the project with credits from Western firms. In return, the Western firms were to receive Soviet oil and gas at preferential prices.*
- *The USSR also sought an offshore construction yard built as a complete turnkey facility.*
- *The Soviets wanted buyers of liquefied natural gas committed to definite purchases before development began.*

Moscow's actions in attempting to develop Sakhalin's petroleum potential indicate a desire to minimize risk, guarantee profitability, and acquire production capacity for state-of-the-art petroleum equipment. Such considerations may play an important role in Soviet ventures into other offshore Arctic development. [redacted]

The pace of Soviet development of offshore petroleum potential will be influenced by the degree of Western involvement. We have examined three development options to highlight issues facing both Moscow and the West: relying entirely on domestic oilfield equipment and technology; importing large volumes of Western equipment—including fixed production platforms—but excluding Western companies from operation and development activity; and joint operating agreements with Western firms, which would receive a share of profits from production revenues or payment in kind. [redacted] 25X1

"Go it Alone" Strategy. Soviet reliance on geophysical equipment currently available in the USSR—a mix of domestic and some Western hardware and software—would probably not delay the discovery of any large or giant oil deposit, but it would make finding small-size fields much more difficult. Soviet capability to conduct simultaneous computerized seismic, magnetic, gravimetric, and hydrocarbon seafloor sampling surveys with online mapping capability is low, and the Soviet Union lags behind the West in the computer technology essential in any advanced exploration system. [redacted] 25X1

Although Soviet capability to manufacture Arctic-grade offshore exploration vessels is limited, the USSR probably has enough vessels on hand to sustain a fairly extensive exploration program. Three of the four vessels currently used in exploration drilling were imported from Finland and equipped with fairly sophisticated equipment. Most of the hardware and software was provided by the French firm Sercel, a subsidiary of Companie Generale Geophysique. The Soviets' major problem to date has been inability to use this technology effectively. Although the Soviets have completed at least nine wells in the Barents, the Soviet press reports that drilling is proceeding too slowly and that high-ranking officials in charge of Arctic exploration were recently reprimanded and fined. [redacted] 25X1

If the Soviets find oilfields that warrant development, hard currency constraints might tempt Moscow to try to develop those fields using only domestic equipment and technology. Hard currency scarcity is forcing Soviet officials to reevaluate plans to import Western technology and equipment. Although Moscow continues to import oilfield equipment for which it has no suitable domestic substitute, [redacted] 25X1 25X1

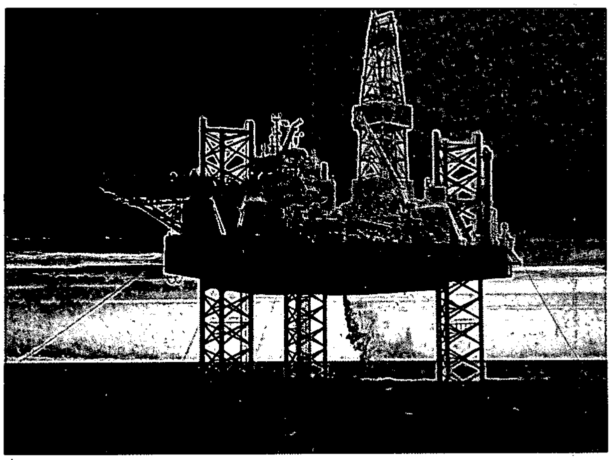

Figure 10. Finnish-built Soviet jack-up now operating in the Barents Sea.

Some Soviet trade officials have indicated that planned purchases of oilfield technology and equipment may be scaled back in proportion to the loss of oil revenues.[2] We expect low oil prices and a probable decline in oil production during 1987-90 to reduce substantially hard currency revenues from oil sales for the remainder of this decade. Prospects for increased gas sales to fully offset lost oil revenues are not good.

The themes of several of General Secretary Gorbachev's speeches suggest that revitalization of domestic industry through investment in civilian machine building and intensified application of science and technology is the key to improving the supply and quality of standard oil and gas equipment. Nonetheless, the USSR probably would encounter serious delays and problems if it tries to develop offshore Arctic oil resources in such a manner. The Soviets have only recently begun to construct fixed offshore platforms to operate in water depths up to 200 meters in the Caspian Sea. Even in this case, equipment at the construction yards in the Baku area was provided by Swedish, French, and West German firms. Besides needing to first acquire the technology to make offshore Arctic platforms, Moscow would have to substantially expand the fabrication capability of the Vyborg shipyard. 25X1

The Soviets would have to overcome major obstacles before they could manufacture reliable offshore structures to produce and store petroleum:

- Their capability to make Arctic-grade steels would have to be substantially improved and expanded. These steels must possess high tensile strength and yet remain ductile enough to avoid becoming brittle in cold temperatures. Soviet attempts to make steel with these characteristics for large-diameter pipelines have at best been a mixed success. 25X1 The USSR is continuing to import large volumes of steel plate from the West—primarily Japan, Italy, and 25X1 France—to manufacture pipe.

- Soviet engineering and design for offshore structures will have to be improved significantly. 25X1 Their research and understanding of the dynamics of ice breakup and ability to develop designs to deflect ice buildup lag far behind the West.

- Soviet capabilities to build and equip offshore drilling rigs for platform, semisubmersible, and drillship applications are also inadequate. Improvements are 25X1 needed in dynamic positioning, anchoring, and seafloor wellhead reentry systems, including telescopic riser and seafloor connection systems, seafloor wellheads, and blowout preventer stacks with remote hydraulic controls—all required for reliability in semisubmersible rigs and drillships. The Soviets also need better mud-logging laboratories, geophysical well-logging equipment, and monitoring equipment that measure geologic conditions below the drill bit. 25X1

We believe Soviet reliance on domestic resources to develop the oil potential of the offshore Arctic would hold back oilfield development projects by at least five, and probably 10, years. In this case, any production probably would not begin until the turn of the

[2] Last year, Soviet hard currency exports fell by over 20 percent, in part reflecting the effect of a $3-4 billion drop in oil sales to the West. In 1986, the drop in hard currency earnings from oil sales to the West will be even steeper.

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century, and even then it could be severely impeded by a lack of sufficient quantity and quality of equipment. The Soviet oilfield equipment industry currently cannot even meet requirements for reliable onshore equipment to operate in temperate environments, much less meet needs for the harsh offshore conditions of the Barents Sea. Tasking these beleaguered industries and plants with the new and additional assignment of providing a wide assortment of offshore Arctic equipment would create further bottlenecks in onshore equipment availability. [redacted]

Developing an indigenous capability to manufacture offshore Arctic equipment would also require substantial additional investment, and investment resources for the 1986-90 period are already spread thin. We estimate that during 1987-90 the Soviets are planning to devote 30-35 billion rubles of the 200 billion rubles increment in the total investment to the oil sector. Investment resources probably will remain tight into the 1990s as Moscow tries to modernize its economy and the oil industry continues to consume increasing amounts of investment. [redacted]

Even with adequate funding, the introduction of new technology, or even minor modification of an existing product is a time-consuming process in the USSR. Changes in production schedules, improvements in metallurgy, and introduction of new methods of metalworking at existing Soviet and East European plants usually proceed at a glacial pace. Leadtimes probably could be reduced materially if some of the new production is assigned to the defense industries. Even with a concentrated effort, we do not believe the Soviets could produce all the new Arctic equipment they would need to develop large deepwater fields in the 1990s. [redacted]

"Mixed Bag" Strategy. With little, if any, applicable indigenous offshore technology, the success the Soviets have in developing their offshore Arctic petroleum resources will depend heavily on access to Western equipment, technology, and services. They can acquire this technology either through outright purchases or joint operating agreements. In our judgment, the most likely Soviet development strategy would involve huge equipment purchases from the West—including selective service arrangements. The Soviets would probably need to purchase everything from fixed production platforms to drill pipe, well casing, and production tubing. They also have very little experience on how to proceed with Arctic offshore development. [redacted] On the basis of the Soviets' past performance in the manufacture of oil and gas equipment, however, we doubt that even with precise designs and engineering specifications in hand they could manufacture and install all the equipment needed for a project. [redacted]

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Because wholesale reliance on Western equipment will require several billion dollars of hard currency and because of the low price for crude oil, we judge that Moscow will need to discover large and highly productive fields—on the order of 1 billion barrels of recoverable reserves and capable of daily production rates of approximately 200,000 b/d—before deepwater, Arctic offshore development would be warranted. We believe that the Soviets would probably forgo development of any small-to-moderate-size offshore fields unless they are shallow-water extensions of onshore fields. Smaller offshore projects would be less attractive to the Soviets than applying enhanced recovery techniques to existing onshore finds. [redacted]

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Heavy reliance on imports of Western equipment could allow offshore production to begin about five years from discovery. This would slip if, as frequently happens, the Soviets move slowly in awarding equipment contracts, partly to squeeze out the lowest possible price and best possible financing terms, at the same time educating themselves about the various sellers' products. [redacted]

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[1] The USSR has reportedly purchased a generalized "master plan" for operating in the offshore Arctic from a consortium of Norwegian firms (Boconor). [redacted]

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From the Soviet standpoint, a major disadvantage of this approach is continuing dependency on the West for equipment deliveries and spare parts. An effective multilateral embargo could bring the entire project to a standstill. During the gas-pipeline embargo in 1981-82, the Soviets had some options that permitted the project to move forward. An embargo of custom-made Arctic-grade fixed platforms and all the attendant production, storage, and transportation equipment would create greater delays and higher costs. For this reason, we believe Moscow is apt whenever possible to rely on non-US suppliers—whom they perceive as more reliable—or on US subsidiaries in countries that are not likely to impose economic sanctions.

Joint Development Strategy. Capital and hard currency shortages and the need to minimize risks arising from their own limited offshore experience could lead the Soviets to seek joint development agreements with Western firms. This would probably be the fastest way to develop a major discovery, and could also permit the development of small-to-moderate oilfields. Moscow probably recognizes that even with state-of-the-art Western equipment, operating expertise is essential. The USSR lacks the skilled management and labor to operate complex offshore equipment.

Although a joint development approach has the important advantages of sharing the considerable risks and capital outlays, Moscow would have to overcome major institutional obstacles before entering into joint oilfield projects with Western firms. A joint development agreement would require Soviet economic planners to relinquish some degree of control and would also highlight Soviet technological dependence on the West. Soviet military leaders, and especially the naval commanders, would also be reluctant to accept the presence of Western personnel permanently stationed in Arctic areas, particularly the Barents Sea.[4] The naval bases of the Kola Peninsula and the White Sea are home port to a quarter of the Soviets' major surface warships and almost two-thirds of its nuclear-powered submarines (see figure 11). Furthermore, the ports near Murmansk provide the Soviets their only year-round direct access to the Atlantic Ocean. The waters near the coast are used by Soviet ships and aircraft to test their weapon systems and maneuvers. Western observers on oil-related platforms would have the opportunity to collect valuable information on naval operations. If the military could not completely block the introduction of Western oil platforms and support crews from the Barents Sea, it would at least strongly oppose facilities near Soviet naval bases, local naval operating areas, or ocean transit lanes. 25X1

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Although we see increasing evidence that the Soviets may expand the scope of their economic arrangements with Western firms, joint oil and gas development projects probably will not—at least in the near term—materialize. Soviet officials have indicated that the consumer goods sector and some manufacturing industries are the most likely areas for any forthcoming joint ventures; extractive industries will reportedly be excluded. Nevertheless, the likelihood of joint operating petroleum projects hinges to a large degree on the level of USSR onshore oil production during the 1990s. If oil production begins to fall sharply and approach a level that is inadequate to cover domestic needs and if Soviet offshore Arctic development is beset with problems, then Moscow would perhaps see joint operating agreements as more palatable than reliance on imports of oil or throttling the domestic economy through forced reductions in oil allocations. 25X1

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Onshore Arctic Petroleum Equipment Capabilities and Needs

As the Soviets move farther north in West Siberia to develop onshore gasfields, they are encountering problems in drilling in continuous permafrost and in moving and setting up equipment. The press has reported that development drilling at the Yamburg gasfield is proceeding slowly and is behind schedule. After 1990, the Soviets plan to develop gasfields on the Yamal Peninsula where the environmental conditions will be even more severe. 25X1

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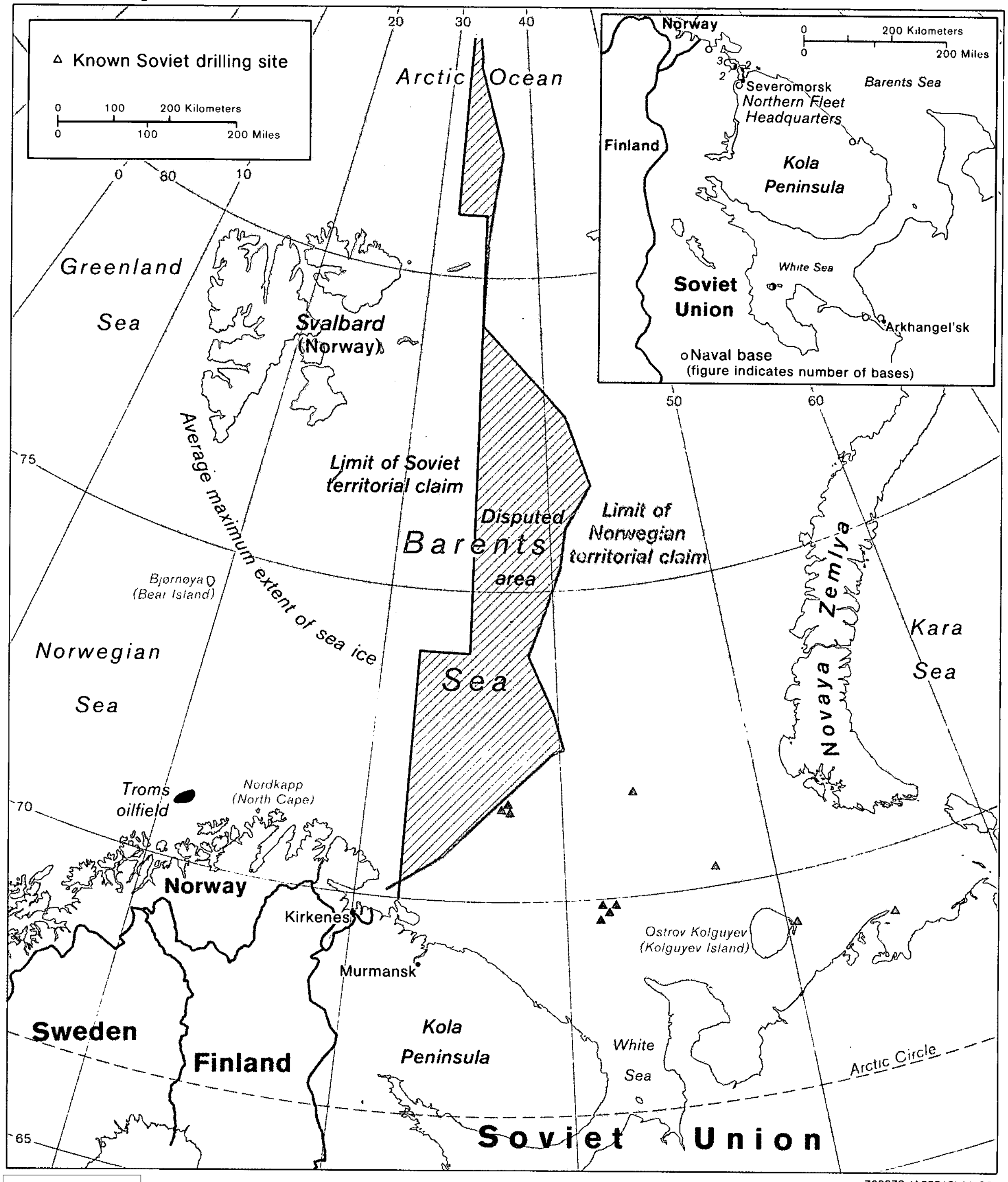
Figure 11
Petroleum Exploration in the Barents Sea



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In onshore Arctic oil development, the Soviets are moving steadily northward in both Tyumen' and in the Komi ASSR, and they plan to bring the Khar'yaga and Novyy Port fields—located above the Arctic circle in the continuous permafrost zone—on line during 1986-90. Although most Middle-Ob' oilfields are not in a continuous permafrost region, the operators are often confronted with similar problems because thawing of the upper layer of the sporadic permafrost during the May-September period turns much of the area into swamp. [redacted]

[redacted] Delegations of Soviet drilling experts have recently traveled to the US North Slope and to Canada on two occasions to inspect Arctic drilling operations. The Soviets are reportedly particularly impressed with the shirt-sleeve environment of the rig floor even in severe weather conditions and with the ability to move drill rigs efficiently by air. [redacted] Soviet rigs are not designed for Arctic conditions. They are unusually heavy and cumbersome, and the Soviets have admitted that only one-half of the Soviet rig inventory is drilling at any given time while the other half is being disassembled, en route, or being reassembled at a new site. The Soviets have also reportedly admitted Siberian operations cannot cope with a temperature below −35°F because the diesel fuel on the rig begins to congeal. In addition, [redacted] the collapse of casing in permafrost is a problem that has almost shut down some Soviet Arctic fields. Besides wanting to learn North American drilling techniques, the Soviets are interested in purchasing US cementing and mud technology and chemicals used in well fracturing and well testing. [redacted]

[redacted] transportation and logistics are major onshore bottlenecks. Large areas in which the Soviets are working are covered with water during the summer, and the Soviets have shown particular interest in purchasing all-terrain and heavy-lift vehicles such as the rollogon, which would permit year-round transport of producing rigs and heavy equipment. The Soviets also want to acquire the technology to construct foundations for structures in permafrost areas and modularization techniques for petroleum facilities including utility modules. The Soviet press has reported that Moscow has contracted to purchase six gas-cooling plants from the French firm Sofregaz. One of the plants is currently under construction at the north end of the Urengoy gasfield. Soviet technicians who will operate the facility were trained in France. [redacted] 25X1

Although Western Arctic equipment is not essential for Soviet gas development, it would improve efficiency greatly. Access to Western modularized Arctic drilling rigs that can be disassembled, airlifted, and erected at a new location in 18 days—as compared with often several months for Soviet rigs—would speed Siberian exploration drilling considerably. The Soviets could also use Western modularized gas and gas condensate treatment facilities. The press has indicated that modularized units used for constructing the gas treatment plants at Urengoy need to be enlarged substantially for use at Yamburg, especially because the Soviets plan to develop Yamburg at a faster rate. [redacted]

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We believe that hard currency constraints will lead the Soviets to make selective purchases of some items—drilling rigs, insulated casing, rollogons, and modularized gas plant components—with the intent of copying part or all of the embodied technology. Domestically produced equipment—whether based on Soviet or Western design—although not as good as the Western equipment, could be produced to supplement these imports. [redacted]

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Western Business Opportunities With the Soviets

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[redacted] West European and Asian countries view the USSR as a potential growth market for their petroleum equipment industries—especially for specialized equipment to develop the Soviet onshore and offshore Arctic (see figure 12). This hope is based primarily on a belief that during the 1990s the Soviets will have to begin intensive

Figure 12
Relative Strength of Key Countries Engaged in Arctic Petroleum Equipment Manufacturing, Operations, and Technology, 1986

Legend: ● State of the art ◍ Acceptable ● Developing capability ○ Potential capability

Engineering and Equipment Categories	United States	Canada	Finland	France	Japan	Norway	United Kingdom	West Germany
Arctic onshore								
Drilling rigs	State of the art	State of the art	Developing capability	Potential capability	Potential capability	Potential capability	Potential capability	Potential capability
Specialized transport	State of the art	State of the art	Potential capability	Potential capability	Potential capability	Potential capability	Potential capability	Potential capability
Drilling/production	State of the art	State of the art	Potential capability	Potential capability	Potential capability	Potential capability	Potential capability	Potential capability
Construction	State of the art	State of the art	State of the art	Acceptable	Potential capability	Potential capability	Potential capability	Potential capability
Arctic offshore								
Drilling rigs								
Design	State of the art	State of the art	State of the art	State of the art	Acceptable	State of the art	Acceptable	State of the art
Construction	Acceptable	Acceptable	State of the art	Acceptable	State of the art	Acceptable	Acceptable	Potential capability
Production platforms								
Design	State of the art	State of the art	Developing capability	State of the art	Acceptable	State of the art	Acceptable	Developing capability
Construction	Developing capability	Developing capability	Developing capability	Potential capability	State of the art	Potential capability	Potential capability	Potential capability
Specialized vessels	Acceptable	State of the art	State of the art	Potential capability	State of the art	State of the art	Potential capability	State of the art
Operations	State of the art	State of the art	Developing capability	Acceptable	Potential capability	Acceptable	Potential capability	Potential capability
Technical support	State of the art	State of the art	Acceptable	Potential capability	Acceptable	State of the art	Potential capability	Potential capability
Arctic research facilities	Acceptable	State of the art	State of the art	Potential capability	State of the art	State of the art	Potential capability	State of the art
Arctic-grade steel	Acceptable	Acceptable	State of the art	Acceptable	State of the art	Potential capability	Acceptable	State of the art

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development of their Arctic resources to slow declines in oil production. Soviet officials at high levels have encouraged foreign suppliers by dangling the potential of large development projects such as Sakhalin Island and the Barents Sea. In a meeting between Gorbachev and the American industrialist Armand Hammer, Gorbachev indicated interest in acquiring offshore petroleum equipment and technology for hostile environment operations, according to the US Embassy. [redacted] 25X1

Many foreign firms have already taken advantage of the marketing opportunity resulting from the imposition of US export controls on petroleum equipment to the USSR by filling the void left by departing US companies. These companies are eager to maintain and increase their share of the Soviet market, especially because the current oil industry depression has intensified international sales competition. Cutbacks in high cost development projects such as in the North American Arctic and the North Sea have also created incentives for many domestic suppliers of Arctic equipment and technology to look toward the Soviet Union—the only major customer in the world outside of North America requiring Arctic petroleum equipment. [redacted] 25X1

Canadian firms are in an excellent position to benefit from Soviet requirements for Arctic petroleum equipment because of their Arctic operational experience and capability to offer either onshore or offshore equipment and technology. In particular, the Soviets have sought out Canadian state-of-the-art Arctic onshore drilling equipment and technology, Canadian all-terrain vehicles and Canadian ice expertise, [redacted] Moscow's interest in Canadian petroleum equipment is reinforced by the Soviet perception that they are buying US petroleum technology and expertise without having to deal with US Government export restrictions. According to the US Embassy in Moscow, the Canadians have not hesitated to play on this point with the Soviets. Canadian companies have promoted sales of Arctic equipment to the Soviet Union by attending trade fairs in Moscow and inviting Soviet delegations to inspect Canadian Arctic equipment and development projects including offshore drill sites in the Beaufort Sea. [redacted]

In our judgment, Canadian manufacturers such as Dreco can meet all but extremely large orders for drilling equipment. In the onshore Arctic transportation field, Foremost has made numerous sales of all-terrain vehicles and is currently engaged in a joint venture with the Soviet Union to manufacture rollogon-type vehicle, according to press reports. Offshore equipment and technology sales will probably be limited to engineering consulting and operational support because Canadian yards cannot compete with those in the Far East or in Finland. [redacted]

Japan is the only country with facilities to fabricate Arctic offshore drilling units capable of operating in severe ice conditions. Japanese companies won these orders because of state-of-the-art production facilities, high-quality Arctic-grade steel, and competitive pricing. Because orders for the North American Arctic offshore market are not expected until oil prices rebound, Japanese companies are hoping to develop ice-resistant offshore drilling and production platforms for the eastern Soviet Union, including use in Sakhalin Island development. In our judgment, Japanese interest in the Sakhalin project is probably driven by the potential of large equipment orders rather than a nearby source of natural gas—which is available from many other countries in Asia. Japanese companies also are expecting large Soviet orders for such Arctic-grade tubular goods as line pipe and casing.

[redacted] Japanese joint-venture involvement in large Soviet energy projects is a good possibility because Japan has sufficient steel production and fabrication capacity as well as licensed access to most Western technology. [redacted] 25X1 25X1 25X1

The Scandanavian countries of *Norway, Sweden,* and *Finland* are all still trying to position themselves to sell Arctic equipment to Moscow, particularly for offshore development. The Soviets have responded by raising the possibility of collaborative development of the Barents Sea. Finland has pioneered the sale of Arctic offshore equipment to the Soviets and has developed its offshore petroleum equipment industry around this business. The Soviets have used this exchange to acquire state-of-the-art Western offshore equipment via the Finnish firms. Sales are made as part of a bilateral trade agreement in which the Soviets sell oil and gas to the Finns in exchange for industrial equipment, including offshore drilling rigs and specialized Arctic-class vessels. [redacted] 25X1 25X1 25X1

[redacted] *Finnish* companies are currently preparing to compete in the development of offshore production platforms for Arctic waters by signing technology-sharing agreements with US and UK companies. [redacted] The Finns reportedly are pessimistic about trade relations with the Soviets in energy and see Soviet demand for large orders of offshore equipment drying up unless a large structure is found in the Barents Sea. The Finns, however, are still interested in selling onshore equipment and services to the Soviets, and [redacted] Rauma Repola is seriously interested in manufacturing Arctic drilling rigs under a US license. In addition, the Soviets have approached the Arctic Research Division of the Technical Research Center of Finland requesting assistance in developing the Yamburg gasfield, [redacted] The Soviets are particularly interested in 25X1 25X1 25X1 25X1 25X1 25X1 25X1 25X1 25X1 a turnkey project that includes construction of a port, pumping stations, pipelines, and camp facilities on permafrost. [redacted]

Norwegian companies have been actively courting Soviet officials about participation in the development of the Soviet offshore—particularly the Barents Sea—and have been given the green light by the Norwegian Government to seek engineering and construction contracts, according to the US Embassy in Oslo. So far, the only concrete business acquired by Norwegian firms is Boconor's master plan for development of the Barents Sea. The Norwegians believe that they have the advantage of local experience and could provide nearby access and maintenance facilities to a Barents Sea development project. A Norwegian company, Barents Base Kirkenes, is touting the development of Kirkenes, Norway, as a major supply base for the Barents Sea. The same company has also played a key role in establishing Kirkenes Engineering—a group of nine Norwegian, one Finnish, and one Swedish engineering firm—to offer engineering services to the Soviets for the Barents Sea. [redacted]

Sweden has a long Arctic tradition in shipbuilding and navigation, and 12 Swedish companies have formed the Swedish Arctic Offshore Group to help market their expertise. According to press reporting, government-level discussions have been held with the USSR on cooperative development of the Barents Sea. The Swedish semisubmersible rig builder Gotaverken Arendal has developed state-of-the-art floating production systems that could have application for the ice-free areas of the Barents Sea. [redacted]

Besides Canada, Japan, and the Scandinavian countries, many other countries with sophisticated petroleum equipment industries are vying for a piece of the Soviet onshore and offshore Arctic petroleum equipment market:

- The *United Kingdom* is making a major effort to sell oil and gas equipment to the Soviet Union and, according to press reporting, made a trade agreement in April to share energy technologies, including harsh environment technology and equipment for ice-resistant offshore structures. According to reports from the US Embassy in London, offshore technology was highlighted, although the British came away with the impression that the Soviets intend to play down offshore oil exploration and concentrate on activities onshore. 25X1

- *French* engineering companies, including C. G. Doris, Technip, and ETPM, have been working on conceptual designs for Arctic offshore drilling and production systems. Technip hopes it is in position to win a major engineering contract to develop the Sakhalin Island LNG facility if the project is approved, according to industry press reporting.

- Emerging industrial nations such as *Brazil* and *South Korea* also could be in a position to supply the Soviets offshore equipment. Brazil has state-of-the-art offshore technology for early production systems—potentially useful for development of the Barents Sea, and South Korea will probably soon give the Japanese stiff competition in the manufacture of ice-resistant platforms. [redacted] 25X1

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Outlook and Implications

The Soviet Union now confronts choices on Arctic petroleum development that will affect its petroleum production levels in the 1990s. The need for a new oil-producing region is likely to lead to a greater effort in the Arctic. If Moscow elects to expedite offshore Arctic development, its only viable option would be to rely heavily on Western equipment and technology. Because of the need to expand production of onshore oilfield equipment during 1986-90 and the scarcity of investment resources, we do not believe that the USSR can establish a significant manufacturing capability for offshore Arctic equipment before 1995. Moscow would probably prefer to remain the sole operator and developer of its Arctic resources, but, if oil production declines rapidly, Moscow may turn to the West for operational expertise and management to minimize delays. [redacted] 25X1

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The likelihood of large Soviet petroleum resources in the Arctic and the low level of Soviet technology applicable to the region create a potential source of Western leverage in dealing with Moscow. Because Arctic technology is diffused among a variety of Western supplies, however, we see little opportunity for the United States alone to exert much influence on Soviet Arctic development, or to use that development as a point of leverage in bilateral relations. The large potential market the Soviets represent will make it difficult for the United States to persuade its Western allies to adopt joint policies that might jeopardize their access. [redacted]

Moscow appears to be developing a selective approach to US Arctic equipment and services companies. The pattern of Soviet dealings with US companies has been to seek out operational advice—particularly for drilling in permafrost conditions—and engineering assistance in developing preliminary engineering designs for offshore Arctic structures.[5] The Soviets have visited US Arctic onshore operations at least twice in the last two years. [redacted]

The Soviets have also shown interest in purchasing selected US equipment for Arctic development such as Arctic drilling rigs, rollogons for all-terrain travel, and transport aircraft capable of delivering rigs in the Soviet Arctic. [redacted]

Besides selected Arctic equipment purchases, the Soviets have indicated interest in purchasing US manufacturing capability for Arctic equipment. [redacted] The Soviets have also expressed interest in buying facilities to manufacture subsea systems and other petroleum drilling and production equipment such as drilling rig modular and downhole gear, [redacted] These plants probably would be built on a turnkey basis, although the Soviets have recently floated the idea of joint ventures with foreign firms, according to [redacted] press reporting. [redacted]

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Aside from advanced remotely operated vehicles (ROVs) and COCOM-controlled electronic sensing, measuring, and computer-related equipment—mostly used in the exploration phase—very little petroleum equipment used in Arctic onshore and offshore development has military uses.[7] Moreover, the current depression in the international petroleum equipment industry and the traditional reluctance of most COCOM countries to agree to controls on sales of industrial equipment and technology to the Soviet Union make it unlikely that existing controls on petroleum equipment can be expanded. [redacted]

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Although US companies are world leaders in offshore Arctic development—especially in fields such as conceptual engineering for ice-infested waters and project management in harsh environment areas—adequate Arctic equipment and services are available in other countries to preclude major dependence on US suppliers. The Soviets remain cautious toward large-scale petroleum equipment deals with US firms because of the recent 1981-82 pipeline-equipment embargo and existing petroleum equipment controls. If equipment quality is critical and US equipment is clearly superior to other Western equipment, however, Moscow would probably opt to buy the US equipment. Before any large-scale deal or joint development project could be consummated, Moscow would probably demand delivery guarantees or stiff financial penalties for breach of contract. [redacted]

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[6] A major stumblingblock to these plants are COCOM controls on computer-related technology, including closed-loop manufacturing systems that the Soviets deem crucial for improving reliability of their equipment and industrial productivity. [redacted]

[7] ROVs have alternative naval application in mine neutralization and object search and retrieval. ROVs that can dive below 1,000 meters and have sophisticated robotic equipment are covered under COCOM controls. [redacted]

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The primary effect of nonparticipation by US companies in the development of the Soviet offshore Arctic probably would be to stretch out the time required to put fields on stream. However, as foreign firms gain even more experience working offshore in harsh environments, this differential will diminish substantially. Soviet offshore experience in harsh environment areas will also increase, further reducing the advantage of US firms. [redacted] 25X1

Appendix

Foreign Availability of Arctic Petroleum Equipment, Technology, and Services [a]

Company	Country	Comments
Onshore drilling rigs—fabrication		
Exploration/development rigs		
Dreco Energy Services, Ltd.	Canada	25,000-ft capable. Major competitor to US manufacturers.
Nabors Drilling, Ltd.	Canada	25,000-ft capable. Manufacturing relationship with Dreco.
Cardwell	Canada	Mobile workover rig specialist.
Foundex Exploration	Canada	Builds very light Arctic helicopter transportable rigs.
Rauma Repola	Finland	Joint-venture discussions with Dreco-Canada.
Industrial Export-Import	Romania	
Potential fabricators		
CFEM	France	
Joseph Paris	France	
Nuovo Pignone	Italy	
Mitsui	Japan	
Mitsubishi	Japan	
Villares	Brazil	
Wirth	West Germany	
Drilling contractors		
Forex	France	Subsidiary of Schlumberger. Major drilling contractor.
Forasol	France	
Santa Fe International	Kuwait	US-based international drilling contractor.
Norcem Drilling	Norway	Extensive experience offshore Norway.
Offshore drilling rigs—fabrication (includes drill ships, jack-ups, semisubmersibles, and Arctic mobile caissons)		
North Atlantic Contractors	Canada	Partnership of Norwegian Contractors, the Lundigran Group, and Dillingham Construction, Ltd. to design and build concrete platforms offshore eastern Canada.
Newfoundland Offshore Development Group	Canada	Partnership of C.G. Paris of France and four local Canadian companies.
Versatile Pacific Shipbuilding, Ltd.	Canada	Formerly Burrand Yarrow Corporation.
Versatile Davie, Inc.	Canada	Shipyard that specializes in harsh environment offshore rigs.
Rauma Repola	Finland	Builds semisubmersibles, jack-ups, and drill ships for USSR.
Hitachi Zosen	Japan	Built "Polar Pioneer" semisubmersibles for Norsk Hydro for $90 million.
Nippon Kokan (NKK)	Japan	Built Concrete Island Drilling System (CIDS) for Global Marine–US.
Ishikawajima-Harima Heavy Industries Co. (IHI)	Japan	Built Molikpaq drilling unit for Beaudril–Gulf Canada.

[a] Data as of September 1986.

Foreign Availability of Arctic Petroleum Equipment, Technology, and Services [a] (continued)

Company	Country	Comments
Mitsui	Japan	Built graving dock to construct Arctic drilling/production units.
Mitsubishi	Japan	Built "Marosso 56" harsh environment semisubmersible.
Sumitomo	Japan	Planning to build graving docks for Arctic drilling production systems.
Kawasaki Heavy Industries	Japan	Built ice-strengthened semisubmersible "Zapata Arctic."
BOS Pacific S.A.	Mexico	Joint venture between Bouygues-France and Kaiser-US. . . . No units fabricated.
Daewoo	South Korea	Semisubmersible experience.
Hyundai	South Korea	Building "Aker H-42" semisubmersible.
Samsung	South Korea	New competitor in semisubmersible business.
Gotaverken Arendal (GVA)	Sweden	Semisubmersible experience.
Blohm and Voss	West Germany	Owns license for Fednav-designed semisubmersible "P.099."
Offshore drilling rigs—design (includes drill ships, jack-ups, semisubmersibles, and Arctic mobile caissons. Arctic production system designers noted)		
Canmar	Canada	Subsidiary of Dome Petroleum. Designed "SSDC" Arctic mobile drilling vessel.
Swan Wooster	Canada	Developing Navarin Basin production concepts.
Earl & Wright-Lavalin	Canada	Designed Gulf Canada's conical drilling unit.
Fednav, Ltd.	Canada	Designed semisubmersible "P.099."
C. G. Doris	France	Joint venture with Fluor. Developing Jack Down Arctic Monopod (J-DAM).
Bouygues Offshore	France	Developing "Zee Star" Arctic mobile drilling rig.
ETPM	France	
Elomatic Oy	Finland	Consulting services for Arctic drilling and production systems.
Rauma Repola	Finland	Developing in-house semisubmersible design.
Nippon Kokan KK (NKK)	Japan	Ice engineering specialists.
Mitsui	Japan	Designing SPM for Arctic waters.
Tecnomare	Italy	Joint venture with Brown & Root. Developing technical feasibility of steel platform for Barents Sea.
IHC	Netherlands	Drillship design capability.
Gusto Engineering	Netherlands	Designed drillships and jack-ups fabricated by Rauma Repola for USSR. Designed Bow Valley's "Grizzly" harsh environment jack-up.
Marine Structure Consultants, Ltd.	Netherlands	Joint venture with Sumitomo for design for "DSS-40" Arctic-class semisubmersible.
Hydronomic	Netherlands	Design and construction of artificial Arctic islands.
ACZ Marine Contractor	Netherlands	Designed steep slope island for Arctic production.
Polar Frontier Drilling A/S	Norway	Joint venture between W. Wilhelmsen and Sonat. Designed semisubmersible for Norsk Hydro.
Ross and Marotec	Norway	Designed "Marosso 56" semisubmersible.
Aker Engineering	Norway	Developed "D-6" subarctic semisubmersible.
Norwegian Contractors	Norway	Designed concrete monopod platform.

Foreign Availability of Arctic Petroleum Equipment, Technology, and Services [a] (continued)

Company	Country	Comments
Veritec-Technip	Norway-France	Joint venture.
Blohm & Voss A. G.	West Germany	Designed Arctic production platform.
Sols Group—AEG-Telefunken	West Germany	Designing subsea early production system for Arctic fields.
Demenix, Thyssen, Bilfinger & Berger	West Germany	Designed concrete gravity monocone production platforms.
Production platforms—fabrication		
Rauma Repola	Finland	Joint venture with Brown & Root for fabrication of steel platforms.
Valmet	Finland	Joint venture with Foster Wheller–UK for fabrication of steel platforms. Built test cone platform to be used in Bay of Bothnia.
Dillingham Corp.	Canada	Joint venture with Lundrigans, Ltd. and Norwegian Contractors to build offshore Nova Scotia platform.
Mitsui	Japan	
IHI	Japan	
Hitachi Zosen	Japan	
Nippon Kokan (NKK)	Japan	Designed with US company Arctic Mobile Drilling Platform (AMDP).
Gotaverken Arendal (GVA)	Sweden	Early production system specialist.
Hyundai	South Korea	
Dae Woo	South Korea	Joint venture with Fluor-US.
Samsung	South Korea	
Norwegian Contractors	Norway	Concrete platform specialists.
Aker Verdal	Norway	Member of Aker Group. Steel construction specialists.
Moss Rosenberg Verft	Norway	Member of Kvaerner Group. Top-side specialists.
Specialized onshore transportation equipment—fabrication		
Fiat	Italy	Bulldozers/pipelayers.
Komatsu	Japan	Major suppliers to USSR of bulldozers and pipelayers.
Foremost	Canada	Builds wheeled and tracked all-terrain vehicles (ATVs).
		Joint venture with USSR to develop ATVs.
Bombardier, Ltd.	Canada	Builds wheeled and tracked all-terrain vehicles.
Dreco	Canada	Rig-moving systems wheeled units.
Specialized Arctic equipment—fabrication		
Svenka Skumslacknings	Sweden	Develops water canons for ice berm construction.
Can-Ocean Resources (Nova Corp.)	Canada	Develops Arctic subsea production concepts and equipment. Subsidiary in the United Kingdom.
Teknos Moalet	Finland	Develops ice-resistant hull coatings.
Huurre Group	Finland	Built 22 complete village modules for USSR export gas pipeline project.
S. A. Tervo	Finland	Associated with Huurre Group in pipeline project.
Norsemen Shelters, Ltd.	Canada	Builds complete rig and pipeline shelters.
Sofregaz	France	Building natural gas cooling stations in the USSR Urengoi field.

Foreign Availability of Arctic Petroleum Equipment, Technology, and Services [a] (continued)

Company	Country	Comments
Specialized Arctic offshore vessels—fabrication		
Summa Corp.	Canada	Built minisubmarines designed to test Arctic transportation systems.
Versitile Pacific Shipbuilding, Ltd.	Canada	Icebreakers, supply ships.
Saint John Shipbuilding, Ltd.	Canada	Icebreakers, supply ships. Built Gulf Canada's supply ship—Kigoriak.
Rauma Repola	Finland	Research vessels, supply ships, tankers.
Hollming	Finland	Research/service vessels for Arctic.
Wartsila	Finland	World leader in icebreaker construction and offshore support vessels including cranes, dredgers, and pipelayers. Building 34,000-dwt oil rig transport vessel for Soviets. Also builds air cushion vehicle (ACVs) for use in Arctic. Joint venture with Arctic Transportation, Ltd.
Valmet	Finland	Supply ships, research vessels, pipelayers, icebreakers.
O&K Tagebau and Scheffstechnik	West Germany	Building one of the world's largest self-propelled suction dredgers.
Nippon Kokan (NKK)	Japan	Built icebreaking supply vessel Ikaluk for Beaudril–Gulf Canada.
Mitsui	Japan	Built Arctic Archimedean screw tractor for offshore operations.
Hitachi Zosen	Japan	Building submersible base for Canmar for operation with SSDC.
Liaaen	Norway	Built seismic supply vessel—"GECO Echo."
ISE	Canada	Built umbilical-free ROV "Arcs" for operations under the ice. Building world's biggest commercial nuclear submarine "SAGA N" with Comex of France for Arctic subsea oil and gas operations. Scheduled reactor startup date in 1988.
Ulstein Group	Norway	Group has 40 percent of world's market of offshore vessels under construction. Specializes in vessels designed for specific geographical areas. Numerous licensing agreements.
Far East Levingston Shipbuilding (FELS)	Singapore	Building icebreakers tugs for USSR for Arctic regions.
Oil companies and service companies with Arctic expertise		
Esso Resources, Canada	Canada	
Peter Bowden Drilling	Canada	Joint venture with Western Ocean to drill in Hudson's Bay using Dutch-owned ice-class drillship "Neddrill 2."
Bow Valley	Canada	
Canmar (Dome Petroleum)	Canada	Contract drilling, engineering, and offshore service.
Fenco	Canada	Ice island drilling, engineering, and offshore service.
Beaudril (Gulf Canada Resources)	Canada	Arctic offshore drilling subsidiary.
Foundex Exploration	Canada	Arctic exploration drilling specialists.
Beau Tuk Marine	Canada	Arctic oil and gas construction turnkey projects.
Pan Arctic Oil	Canada	54 percent owned by Petro Canada. Produced first commerical oil from Canadian Arctic islands in early fall, 1985.
Arctic Transportation, Ltd.	Canada	Joint venture between Fednav, Ltd. and Crowley Maritime Corp. Icebreakers, survey vessels, supply ships, barges for Arctic waters.
Neste Oy	Finland	Investigating providing seismic oil exploration services to USSR for operations in Arctic waters.
GECO (Schlumberger)	Norway	One of world's largest exploration companies. Recently purchased by Schlumberger.

Foreign Availability of Arctic Petroleum Equipment, Technology, and Services [a] (continued)

Company	Country	Comments
Saga Petroleum	Norway	Discussions with Soviets concerning exploration and development for the Barents Sea.
Norsk Hydro	Norway	Operating off northern Norway using "Polar Pioneer" semisubmersible.
Statoil	Norway	State-owned company; largest in Norway.
Smedrig Drilling	Norway	Owns and operates winterized rigs.
Kirkenes Engineering	Norway	A consortium of Norwegian, Finnish, and Swedish engineering firms. Established to offer engineering services for the Barents Sea and Kola Peninsula.
Pomor Oil	Norway	Subsidiary of Pomor Nordic. Signed cooperation agreement with GECO to negotiate with Soviet authorities on seismic studies in the USSR.
Boconor	Norway	Consortium of six companies. Concluded a cooperation agreement with USSR regarding design of platforms suited to the Barents Sea wave forces, wind, ice, and temperatures.
Barents Base Kirkenes A/S	Norway	Oil and gas service support to the development of the Barents Sea.
Bugsier—Rederei and Bergungs	West Germany	Arctic towing services.
British Petroleum	United Kingdom	Exploration with Statoil on Slavbard Island, Norway.
Engineering and technical support for ice-infested waters		
Arctec Canada, Ltd.	Canada	Ice environment and remote sensing specialists.
Peter Hatfield, Ltd.	Canada	Naval architects and marine consultants.
Arctic Sciences, Ltd.	Canada	Ice environment specialist.
Western Geosystems	Canada	Oil production engineering from Arctic.
Geotech	Canada	Ice environment research.
Tri Ocean Engineering, Ltd.	Canada	Onshore and offshore engineering.
Weir-Jones Engineering Consulting, Ltd.	Canada	Ice force sensor specialist.
Arctic Laboratories	Canada	
K. R. Croasdale	Canada	Arctic and cold ocean research technology.
Bercha Group	Canada	Risk analysis specialists for Arctic Seas.
Husebeye Olsen Assoc.	Norway	Ice island design.
Det Norske Veritas	Norway	Developing Arctic construction standards.
Thyseen Nordseewerke–Emden	West Germany	Developing new icebreaker systems.
SOLS Group AEG Telefunken Deminex Thyseen-Nordsewerke	West Germany	Develops subsea oil loading system for early production of Arctic fields.
Arctic Consulting Group	Denmark	Specialists in Greenland Arctic development.
Arctic Offshore Engineering Group	Finland	Specializes in behavior of structures in Arctic environment.
Stal Refrigeration	Sweden	Ice island design specialists.
Skipskonsulent A/A	Norway	Designs Arctic-Antarctic expedition ships and tankers for Arctic services.

Foreign Availability of Arctic Petroleum Equipment, Technology, and Services [a] (continued)

Company	Country	Comments
Arctic research facilities		
Nagasaki Technical Institute	Japan	Mitsubishi's frozen sea experimental facility. Studies influence of frozen seas on offshore structures.
Tsu Research Laboratories	Japan	NKK's ice model basin.
Centre for Frontier Engineering Research at University of Alberta	Canada	
National Research Council at St. Johns, Newfoundland	Canada	Onshore and offshore Arctic construction testing. State-of-the-art ice basin.
Alfred-Wegener Institute for Polar Research—Bremerhaven	West Germany	Handles West German Antarctic research vessel RV Polarstern.
Hamburg Ship Model Basin	West Germany	Tested Gulf's Kulluk Arctic drilling rig.
Wartsila Arctic Research Center	Finland	World's leading ice laboratory.
Technical Research Centre of Finland	Finland	Ice-going vessel research activity.
Continental Shelf Institute—Trondheim	Norway	Barents Sea geophysical work: geoscience hydrography.
Norwegian Hydrotechnical Laboratory	Norway	Tests influence of freezing sea spray on offshore platforms.
Nutec Norwegian Underwater Technical Center	Norway	Underwater technology research.
CMI, Christian Mechesen Institute	Norway	Meteorology and oceanography instrument technology.
Arctic and Antarctic Scientific Research Institute—Leningrad	USSR	Icebreaker expertise.
Det Norske Veritas	Norway	Verification services for offshore.
Marintek	Norway	Tests ship models and offshore structures. Studying waves force on conical structures and concrete platforms under Arctic conditions.
Moscow Institute of Civil Engineering—Moscow	USSR	Arctic port construction research.
Siberian Branch of the Academy of Science—Novosibirsk	USSR	Research into effects of sea ice on structures.
Manufacturers of specialized steel and oil country tubular goods (OCTG) for Arctic conditions		
Nippon Kokan (NKK)	Japan	Specialists in structural steel for Arctic regions.
Nippon Steel	Japan	Produces seamless casing and rubing for cold regions.
Kawasaki	Japan	Produces seamless casing and rubing for cold regions.
Kobe Steel	Japan	Low-temperature steel for Arctic offshore drilling rigs.
Tubemuse	Belgium	Arctic-grade OCTG servoces.
Mannesmannrohren-Werke AB	West Germany	Line pipe/downhole tubulars.
Thyseen Aktien Gesellschaft	West Germany	Line pipe/downhole tubulars.
Stahlwerke Peine Salzgitter	West Germany	Line pipe/downhole tubulars.
Rautaruukki Oy	Finland	Provides steel used in 65 percent of all icebreakers in the world.
Neles OY (Rauma-Repola)	Finland	Supplies steel to offshore and shipbuikding industries.
Rauma-Repola	Finland	Arctic and high-quality-grade steel using vacuum process.
Ramnas (Ljusne)	Sweden	Anchor chain specialists.
Nuova Italsider	Italy	Arctic gas pipeline steel production.
Angoma Steel	Canada	Produces seamless OCTG.

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