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EAST COAST OFFSHORE OIL AND GAS DEVELOPMENT

Lynne C. Myers
Science and Technology Division

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ISSUE DEFINITION

The discovery of important accumulations of oil and natural gas in the east coast offshore region promises major economic and strategic benefits to Canada.

In particular, two important finds – the Venture natural gas field and the Hibernia oil field – spurred unprecedented oil and gas activity in Atlantic Canada in the 1980s in spite of a long-standing jurisdictional dispute between the federal government and Newfoundland. In March 1984, the Supreme Court of Canada ruled on the legal question of ownership, opening the door for exploration to proceed but without Newfoundland's agreement. After further negotiations, a federal-provincial agreement on the joint management of offshore oil and gas development, similar to that already in place with Nova Scotia, was signed in February 1985.

Exploration and development are bringing benefits to the region, for example, local employment, the building of oil and gas transmission systems, and the construction, supply and servicing of rigs and production platforms. However, they also bring a number of potential problems. One is the safety of offshore drilling activities, given the severe climatic conditions in which drill rigs operate. Another concerns the socio-economic impact of oil and gas development on the region in terms of demand for goods and services, infrastructure, and employment and training. The pace of development will be crucial in optimizing local business and employment opportunities and minimizing disruption of services.

Conflicts between the oil and gas industry and the historically all-important fishing industry will have to be resolved, as will the effects of development on marine resources.

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* The original version of this Current Issue Review was published in May 1983; the paper has been regularly updated since that time.

BACKGROUND AND ANALYSIS

A. Exploration

1. A Historical Perspective

The widely accepted theory of plate tectonics holds that the sedimentary basin off Canada's east coast was once part of Europe. Because this area apparently shares a close geological link with the North Sea, it is not unreasonable to find that it shares some of its hydrocarbon potential as well. To date, the United Kingdom's part of the North Sea alone has revealed some 22 billion barrels of recoverable oil. These favourable geological prospects prompted the start of oil and gas exploration off the east coast of Canada in 1966. Although early drilling results were not spectacular, there were numerous tantalizing "shows" of oil and gas. The prospect of success, coupled with developments in the North Sea oil fields, encouraged the exploration companies to return year after year to continue their modest drilling programs.

The first well was drilled on the Grand Banks of Newfoundland in 1966 and a show of natural gas was found. The Scotian Shelf area off Nova Scotia was first explored in 1967, the Gulf of St. Lawrence in 1970, the Labrador Shelf in 1971, the East Newfoundland Shelf in 1974 and the Bay of Fundy in 1975. Although many wells showed traces of oil and/or gas, the first major gas field – the Venture field off Sable Island – was not discovered until 1979. It is now estimated that Venture contains natural gas reserves in excess of 72 billion cubic metres (approximately 2.5 trillion cubic feet). On a national scale, in a country with established natural gas reserves of 4 trillion cubic metres, this discovery may not appear especially large; however, its location, in the one region of Canada dependent on imported oil for most of its energy needs, is of particular strategic significance.

The Venture discovery was followed within months by the announcement that a significant oil field had been found on the Grand Banks, namely the Hibernia field, which was originally estimated to hold recoverable reserves of 175 million cubic metres (1.1 billion barrels). With further delineation, this estimate has since been reduced to approximately 140 million cubic metres (884 million barrels). The discovery of Hibernia represents a find of national importance, given the fact that established Canadian reserves of conventional crude oil from the Western Canada Sedimentary Basin are in decline.

News of Hibernia set off a round of increased exploration activity in the east coast offshore region, particularly in the Jeanne d'Arc Basin where Hibernia is located. Whereas between 1966 and 1979, investment in the search for hydrocarbons off Canada's east coast totalled about $300 million, exploration companies spent $442 million in 1981 alone. Coincident with the Petroleum Incentive Program (PIP), put in place in 1982 and phased out beginning in March 1986, companies spent $4.5 billion on exploration within this region. Although only eight or nine wells were completed each year between 1978 and 1982, a total of 21 wells were completed in 1983 and another 23 wells in 1984 when rig activity was at its peak. Beginning in November 1986, the pace of activity slackened in response to world crude oil price fluctuations, so that by the 1989 season only two wells were completed. One resulted in a new discovery of natural gas and oil. Canada Oil and Gas Lands Administration reported that, as of 1989, the estimates of east coast offshore discovered resources(1) were 258.9 million cubic metres (1.6 billion barrels) of oil and condensate as well as 313.4 billion cubic metres (11 trillion cubic feet) of natural gas. Only one well was drilled in 1990. Activity rose slightly in 1991 with seven exploratory wells, five of them off Newfoundland. The first five production wells were also drilled off Nova Scotia in that year. No drilling activity off Newfoundland occurred in 1992 or 1993. Off Nova Scotia, three production wells were drilled in 1992 and seven in 1993. After a drought in drilling activity of about four years, several companies announced plans to drill exploratory wells in 1997. In 1999, three exploratory wells and four delineation wells were drilled offshore of Newfoundland and nine geophysical programs were carried out. The renewed interest in the east coast offshore has now expanded beyond the Jeanne d'Arc Basin to the Flemish Pass area. Activity continued at a high level into 2000-2001, with seven geophysical studies being carried out and two delineation wells and two exploratory wells being drilled. The sale of new leases was brisk, bringing the total outstanding commitment for exploration to $629 million for offshore Newfoundland. Exploration offshore of Nova Scotia also continues, with four exploration wells, two delineation wells and 12 geophysical programs being completed in fiscal year 2000-2001.

(1) "Resources" are volumes of hydrocarbons, expressed at 50% probability of occurrences, that are deemed to be technically recoverable but have not yet been delineated and have unknown economic viability. "Reserves," on the other hand, are volumes that have been proven by drilling, geophysical data, etc., and can be recovered using available technology under current economic conditions.

2. Environmental Impact

Although potential environmental problems are of concern anywhere oil and gas development occurs, the fishing grounds on the Grand Banks, the Scotian Shelf and the northern waters off Labrador are especially vulnerable. The Hibernia region is also an important fish spawning ground, and fish larvae are known to be very susceptible to even slight traces of pollution.

During the exploration phase, drilling fluids, drill cuttings and water associated with oil and gas deposits are released into the sea. Some of the additives contained in drilling fluids are toxic to marine organisms. Control must be exercised over the quantities and types of wastes released by exploration operations if damage to the fishery is to be minimized.

A second major environmental concern is the possibility of a well blowout. The potential for serious environmental impact is reinforced by the severe winter weather conditions and the presence in some areas of an impenetrable cover of pack ice. Such conditions could delay efforts to cap a well, thereby increasing the magnitude of environmental damage. In fact, two blowouts occurred in the area in 1984 – in two gas wells being drilled in the Venture field off Sable Island. The first well was brought under control 10 days after the initial incident in March 1984; the second well, which blew in September 1984, was only permanently capped and abandoned in July 1985. As predicted, weather conditions hampered attempts to assess and to rectify the situation. It was fortunate that low-sulphur gas, rather than crude oil, was flowing uncontrollably from the wells.

Environmental pollution of quite a different nature has presented a problem in the North Sea and could occur in the east coast region. Supply vessels and service boats have been known to dump large chunks of unwanted machinery overboard as they travel to and from rigs. This debris, lying on the bottom, can damage fish nets dragged along the sea floor. In one instance, it cost the oil companies $60 million to clean up a section of the North Sea fishing grounds that had been littered with such garbage.

These environmental concerns are not restricted to the exploration phase; they could be compounded during the development and production phases. Strictly enforced regulations and constant vigilance will be necessary if environmental damage is to be minimized.

3. Icebergs, Storms and Safety

Photographs taken with sophisticated sonar “cameras” show deep trenches and furrows crisscrossing the seabed off Canada’s east coast. Trenches up to 15 metres deep, 200 metres

across and three kilometres long bear mute testimony to the passage of massive icebergs (known as iceberg scouring). These icebergs, which can weigh up to 50 million tonnes and tower like skyscrapers above the water, are one of the most serious threats to offshore activities. The presence of icebergs and "bergy bits" (smaller chunks of ice which have broken away from the main iceberg), as well as fierce Atlantic storms featuring high winds, freezing spray, snow and low visibility, testify to the extreme conditions under which exploration and development are taking place.

February is a particularly bad month for drilling, and there is some debate as to whether winter operations should be allowed at all. The winter of 1982-1983, for example, was exceptionally severe. The International Ice Patrol reported 120 iceberg sightings south of 48°N in February 1983. The average, since 1900, is 9 for this month. One method used to remove the threat that icebergs pose to drill rigs is to tow them away from the general area of the rig. This becomes impossible, however, when the presence of an iceberg near a rig coincides with high winds and rough seas. Such a combination of conditions is not unusual and, in fact, occurred in February 1983 when the West Venture rig drilling in the Hibernia field found itself with about 10 icebergs and many bergy bits in the vicinity. Regulations call for the rig to cease drilling, secure the drill hole, and move out of the area if icebergs come within a red alert zone. The West Venture attempted to do this but, because of rough seas, the 10 anchors keeping it in place over the drill site could not be pulled. None of the 84 people on board could be evacuated by helicopter or by service vessel, due to the weather conditions. Fortunately for all concerned, the storm passed. This episode is indicative of the hazards of operating in the offshore.

A new type of drill rig, which is dynamically positioned instead of anchored, was introduced in July 1983 in an effort to alleviate some of the difficulties experienced by the West Venture. The Sedco 710, a $150-million semi-submersible rig, was custom-built in Japan in a joint venture between Petro-Canada and Sedco Inc. of Dallas. Positioned over the drill hole by powerful computer-guided thrusters, it is more mobile than the anchored rigs and so can quickly move out of the way of icebergs.

Drilling rigs are equipped with radar systems designed to locate and monitor the movement of icebergs. When weather permits, overflights are carried out on a regular basis with sightings being made visually and with radar. A high sea state decreases the effectiveness of both types of detection; in bad weather, flights often have to be cancelled. A third method of iceberg

detection involves vessel ice patrols. These depend on line-of-sight detection and are therefore influenced by visibility and sea state.

A tragic accident early in the course of offshore exploration brought home the dangers faced when working in such a challenging environment. In February 1982, severe weather conditions combined with other factors to cause the worst disaster ever to strike the Canadian offshore oil and gas industry. On 15 February 1982, the drill rig Ocean Ranger sank 280 kilometres southeast of St. John's, Newfoundland, in 85 metres of water. All 84 crew members were lost in this tragic accident. The meteorological records show that waves as high as 26 metres (85 feet) and winds as high as 90 knots (104 mph) hammered the rig the day it went down.

A Royal Commission headed by Chief Justice T. A. Hickman of the Supreme Court of Newfoundland investigated the accident and issued its 400-page report in August 1984. It concluded that a chain of events that included a severe winter storm, design inadequacies and lack of knowledgeable human intervention caused the loss of the Ocean Ranger and its crew. The rig capsized and sank after seawater had entered the ballast control room through a porthole smashed during the violent storm; this caused the ballast control system to malfunction. The Commission concluded that, despite this occurrence, if the crew had simply shut off the electrical supply and shut the deadlights (steel shields designed to protect the portholes), the rig would have survived the storm. Instead, the crew, who did not properly understand the ballast system, reactivated it and thereby inadvertently let more water into the port portion – leading to the eventual capsizing of the rig and loss of the entire crew.

The Commission felt that the ballast control system was too complicated, the crew inadequately familiar with its operation, and the rig insufficiently equipped with lifeboats and survival gear. In addition, testimony before the Commission revealed inadequacies in the emergency evacuation training that crew members had received. A second 693-page report, issued in July 1985, contained 70 recommendations on methods to improve east coast offshore safety.

Even before the Royal Commission reports were issued, the federal and provincial regulations were changed to strengthen the safety systems on drill rigs. All rigs are now required to carry 200% lifeboat and survival suit capacity, and all employees must take a Marine Emergency Duties course.

According to the federal government, 85% of the recommendations had been totally or partially implemented by April 1986. The last of the recommendations were implemented with the passage of Bill C-58, *An Act to amend the Oil and Gas Production and Conservation Act*, which received Royal Assent on 23 June 1992. Despite these and other efforts to upgrade safety measures

on oil drilling rigs, the fact remains that the east coast offshore can present a very inhospitable environment for human activities.

4. Jurisdictional Disputes

The most contentious issue that faced the east coast offshore oil and gas industry in its early years was the question of who owns the offshore resources – the federal or provincial government. Although the question of jurisdiction varies from province to province, nowhere was it more contentious than in Newfoundland.

The legal aspects of this historic federal-provincial dispute are set out in some detail in the archived Current Issue Review 80-8E, *Offshore Mineral Resources: Legal Aspects*.

More recently, there has been some dispute between Nova Scotia and Newfoundland as to the precise demarcation line between their respective offshore areas. A federal tribunal is currently working to resolve the issue. In addition, at the request of the New Brunswick government, the National Energy Board is holding public hearings on the rules governing short-term natural gas exports. The province feels that the current rules are favouring Nova Scotian exports to the United States over potential sale of the gas domestically – specifically to New Brunswick. The Government of New Brunswick claims that it does not have fair and equal access to increased production from offshore Nova Scotian gas, while Nova Scotia counters that there must be an open, international market for the gas in order to attract investment for future oil and gas development. NEB hearings are being held throughout the summer of 2002 and the Board is expected to make a ruling in the fall.

B. Development

1. The Impact of Oil and Gas Development

Oil and gas development, not exploration, will have the greatest impact on the economy and the social fabric of Atlantic Canada in the coming years. Exploration expenditure does affect the local economy to a great extent, but it is more likely to be seasonal and is much less "permanent" than the development and production stages. Nonetheless, many of the issues discussed in this section are applicable to the exploration phase as well.

To be very concise in quantifying the future impact of oil and gas development on the Atlantic region, one word will suffice – massive. As exploration increases and gives rise to

development and production, the local requirements for goods and services will soar. The long list will include:

- drill rigs, drilling fluids and drill pipes;
- food for the rig crews and for supply ships and their crews;
- engineering, geological and biological researchers and their ships as well as their equipment and provision needs;
- warehouse facilities and port facilities;
- housing and schools for the families of those working the rigs and supply vessels;
- people and equipment to supply essential meteorological information; and
- new sophisticated communications and data processing equipment.

This tremendous need for human resources, goods and services provides an opportunity for the Atlantic provinces to turn their economies around. But if too much expansion takes place too fast, can the society cope with the changes? Can local human resources fill the requirements of the new industry and can local companies grow fast enough to meet demand? If development comes quickly and demands cannot be filled locally, the oil and gas industry will look elsewhere and the region will lose out on these opportunities. There is also great interprovincial rivalry to capture as much of the offshore service industry as possible.

The Province of Newfoundland, for example, has a "Newfoundland first" policy whereby companies are required by law to give preference to local labour, goods and services, and local supply contractors where these are competitive in terms of price, quality and deliverability. In addition, under current Newfoundland regulations, future development plans must first be approved by the Minister of Energy and will then be thrown open to public scrutiny and debate. There is even provision for a waiting period if development appears to be moving faster than local capabilities can handle. Companies have been complying with the requirements, and the participation rate for local labour has been very high in some categories (varying from 55% for seismic operations to 71% for support staff). The province carried out a study entitled "The Economic Impact of Future Offshore Petroleum Exploration," identifying the areas in which the province could improve its share of the economic benefits and the means by which local participation could be maximized. Two areas identified for further development were the provision of infrastructure (port facilities and air bases) and indirect services such as catering and electronic instrument servicing. The potential for

economic development in Newfoundland related to Hibernia and other oil and gas development is tremendous. **The Canada–Newfoundland Offshore Petroleum Board reported that in the year 2001, spending related to work in the Newfoundland offshore totalled $1 billion, bringing the cumulative total since 1966 to $14.6 billion. At the end of 2001, more than 2,000 people were employed directly in petroleum-related activity, and 81% of them were residents of the province. The oil and gas industry contributed 11% to the provincial GDP.**

In Nova Scotia, the Canada–Nova Scotia Offshore Petroleum Board (CNSOPB) is responsible for ensuring that Nova Scotians and other Canadians have full and fair access to the employment opportunities offered by offshore oil and gas development. Under the regulations to the legislation that established the Board, any company applying for work authorization must file a Canada–Nova Scotia Benefits Plan before approval will be given. The efforts have proven successful, with thriving petroleum-related businesses being established. Many of these companies are members of the Offshore/Onshore Technologies Association of Nova Scotia (OTANS). The goals of benefits plans have been met, and even exceeded in some cases. For example, the Cohasset oil project (discussed in the following section) – the first commercial offshore oil project in Canada – reported that over its seven years of operation, 78% of the people employed were from Nova Scotia, 12.5% from other parts of Canada and only 9.5% were non-Canadian. The Sable Island natural gas project, also discussed in the following section, reports cumulative employment to December 2000 as 54% Nova Scotian, 11% other Canadian and 35% non-Canadian.

2. Development off Nova Scotia

The signing of the management and revenue-sharing agreement between Ottawa and Nova Scotia in March 1982 gave Mobil Oil of Canada the green light to proceed with its development plans for the Venture gas field. Under the direction of federal and provincial government officials, Mobil prepared a socio-economic impact statement (SEIS). The SEIS included a great deal of information such as: a project description (offshore structures, pipelines, the gas plant, etc.); the economic context of the project (regional population, labour force, employment impact); projected land requirements; housing implications; infrastructure and community service needs; and socio-cultural implications. For each of these subjects, the company described the existing situation, the anticipated impacts, and the possible mitigative measures to minimize the project's adverse effects or enhance its positive effects.

There had been no guarantee as to when production could start, even though a significant step was taken in December 1984 with two agreements to sell Venture gas to utilities in the northeastern United States. Although the Venture discovery well showed great promise, disappointing results from delineation wells cast a different light on the project.

In July 1985, Venture partners Mobil Oil, Petro-Canada, Nova Scotia Resources and Texaco applied to the National Energy Board (NEB) to export 8.5 million cubic metres per day of natural gas to New England beginning in 1990. Nevertheless, the Venture sponsors never finalized this application, nor did they supply the NEB with detailed reservoir data that would have confirmed a commercially viable project.

The project remained stalled at this stage until June 1995. Further exploration and delineation had shown a projected three trillion cubic feet of recoverable gas reserves. The project's consortium then launched a pre-development assessment of the Sable Offshore Energy Project – an expansion of the former Venture project – and submitted a development application in the spring of 1996. The consortium (composed of: Mobil Oil [50%]; the operator, Shell Canada Limited [35%]; Imperial Oil Limited [9%]; and Nova Scotia Resources Limited [6%]) proposed to produce 400 million cubic feet a day of gas and 20,000 barrels a day of natural gas liquids. The first well in the project was drilled in the spring of 1998, and drilling will continue over the next 25 years as the field is fully developed. In early September 1999, laying of the subsea pipeline from the location of the first production platform to the landfall at County Harbour, Nova Scotia, was completed. Natural gas and natural gas liquids pipelines to Cape Breton are also in place. The Point Tupper Fractionation Plant and the Golboro Gas Plant are completed, and three offshore production platforms are installed on site. The Sable Island Offshore Project began production on 31 December 1999, on time and on budget. The natural gas produced from this area is serving markets in Nova Scotia, New Brunswick and the northeastern United States via the Maritime and Northeastern Pipeline, and its lateral lines.

A proposal to produce 30,000 barrels a day of light crude oil by mid-1992 from two small oilfields at Cohasset and Panuke, west of Sable Island, received regulatory approval on 12 September 1990. The $565-million COPAN project represented the first commercial oil production off the east coast of Canada, bringing with it 380 jobs a year during construction and another 260 during the expected six-year life of the project. The original project leader, Lasmo Nova Scotia Ltd., sold its 50% interest in the project to PanCanadian Petroleum Ltd. in 1996. A

Crown corporation, Nova Scotia Resources, holds the remaining 50% interest. In July 1992, the first 500,000 barrels of light oil were shipped by tanker to Mobile, Alabama.

After its takeover, PanCanadian continued exporting 500,000 barrels of oil twice a month to European and U.S. buyers, drawing from the 18,000 barrels of light oil a day it was pumping from nine wells. By late December 1999, the COPAN project reached the end of its economic life. Original estimates had projected that total production from the project would be about 35 million barrels. However, improvements in technology over the life of the project resulted in a total production of more than 44 million barrels of light, sweet crude. The wells were decommissioned throughout 2000, but parts of the infrastructure will be kept for use in further exploration work. In fact, discovery of a resource of one trillion cubic feet of natural gas in a deeper structure at the Panuke site (hence the project name Deep Panuke) is now being developed. **EnCana, the company formed by the April 2002 merger of PanCanadian and Alberta Energy Corporation, has filed regulatory applications for the project. Commercial production of 400 million cubic feet per day will begin by 2005 if the necessary approvals are received. Total anticipated investment in the project is $1.1 billion.**

3. Hibernia Development

a. Introduction

Development of the Hibernia field has presented certain unique problems. For one, Hibernia is in the Grand Banks, an environment much more hostile than the area off Sable Island. In addition, Hibernia is a deep-water development (76-78 metres), compared to Venture's 22 metres. This makes the choice of production and transportation systems more difficult and, it is estimated, three times as expensive for Hibernia. Sable Island involves the use of relatively simple off-the-shelf technology, while Hibernia has required development of new technologies. Even so, the Hibernia oil field began production in November 1997.

b. History

One of the first steps in bringing Hibernia into production was the naming of a Federal Environmental Assessment Review Office (FEARO) Panel in March 1985. The Panel held public hearings on the Environmental Impact Assessment in October and, in its report released in mid-January 1986, approved Hibernia development. However, at the same time, the Panel set out 50 detailed recommendations on how this should proceed.

On 24 June 1986, the Canada–Newfoundland Offshore Petroleum Board approved the Development and Benefits Plans for Hibernia. Negotiations on fiscal matters and on tax and royalty levels began between Mobil and its partners, and the governments of Canada and Newfoundland. The company sought a federal loan guarantee of $1 billion.

On 18 July 1988, the federal government announced the details of an agreement reached with the four-company consortium to develop the Hibernia field. The deal involved a combination of a $1.04-billion federal capital grant, a $1.66-billion federal loan guarantee, $300 million in federal interest assistance, $175 million in temporary financing, $95 million from the Canada–Newfoundland Offshore Fund, and $11 million from the Newfoundland government along with tax exemptions and tax reductions. The project was estimated to cost $5.2 billion with an additional $3.3 billion required for production-related spending. The target date of 31 March 1989 for finalizing the details of the agreement was repeatedly postponed, and agreement was not achieved until 14 September 1990. Production of 125,000 barrels a day was originally slated to start in 1992 and last for 18 years. In fact, Hibernia oil destined for the U.S. market finally began flowing in November 1997.

The federal and Newfoundland governments negotiated with the consortium to ensure that two of the five newly designed rig modules were built in Newfoundland. Newfoundland would like to promote itself as an offshore-rig building centre. The province eventually agreed that one rig module (instead of two) and some ancillary work would be completed in the province. Much of the work on the four other modules, worth up to $300 million, was supposed to be set aside for Canadian companies. Newfoundland expected to receive 10,000 person-years of work over the six-year construction period. Federal Minister of Fisheries John Crosbie announced in September 1991 that $3 million in training funds would go to prepare Newfoundlanders for jobs on the Hibernia project.

Before federal legislation authorizing $2.7 billion in grants and loan guarantees was passed on 6 November 1990, interim financing of $95 million from the Canada–Newfoundland Offshore Development Fund was obtained to meet the September 1990 target for issuing construction tenders.

In November 1991, the federal government negotiated an agreement with the consortium that provided for 25% of its loan guarantee to be picked up by private lenders if certain economic criteria were met once production began.

Subsequent to project go-ahead, one of the four members of the consortium, Gulf Canada Resources Ltd., put up for sale half of its 25% interest in the project. Then, in February 1992, it withdrew from the project altogether. The consortium was then made up of Mobil Oil, Petro-Canada, and Chevron Canada. Mobil was contributing $1.1 billion, Petro-Canada $1 billion, Chevron $879 million, and the federal government's contribution was $1 billion. Gulf's promised $1 billion had, of course, been withdrawn. So far, the consortium had spent $450 million.

Newfoundland and Canada had agreed to indemnify the partners for 75% of their costs for proceeding with the project beyond 15 May 1992 if a replacement for Gulf could not be found and the project had to be shelved. On 15 January 1993, the federal government announced that a new agreement had been reached. Murphy Oil of El Dorado, Arkansas, would take 6.5%, Mobil Oil and Chevron would increase their interest by 5%, and the Government of Canada would acquire an 8.5% interest which would be held by the Canada Hibernia Holding Corporation (a newly formed subsidiary of the Canada Development Investment Corporation). The government was also offering the three partners interest-free loans of up to a total of $132 million. The project was now said to be viable at then-current oil prices of between $20 and $30 a barrel.

In April 1994, Petro-Canada announced a cost overrun of $1 billion and a delay of six months in the construction schedule as a result of the project's engineering design complexities. NODECO (Newfoundland Offshore Development Constructors) was replaced by Norwegian Contractors, a consortium that had been overseeing NODECO since the fall of 1993.

In October, the management company moved the electrical part of the offshore contract from Marystown, Newfoundland, to the Saint John Shipyard in New Brunswick. This resulted in 300-400 job losses for Marystown. M. I. L. Davie Inc., a competitor, disputed this decision, claiming it violated the Hibernia Benefits Plan. The Government of Canada announced in December that no legal remedy was available in the case of such a violation. It requested a review of the implementation of this benefits plan.

By the end of June 1997, $5.4 billion had been spent on the project, of which $4.0 billion was spent in Canada. About $2.6 billion of the amount spent in Canada was spent in Newfoundland.

Shipyards in Korea and Italy were awarded contracts to build four of the five supermodules – used to house crew and drilling equipment – that sit atop the drilling platform. The fifth was built in Newfoundland by a Canadian-Norwegian consortium. (This $350-million contract is worth more than the other four put together.) Pouring of the concrete for the base of the drilling

platform began in April 1993. Design changes and slow construction delayed the schedule for towing the concrete and steel base to a deep-water site. The original cost estimate of the gravity base of $1.2 billion also rose by 30%. In the end, the modules in place on the assembly pier were mated to the rig's concrete base in early 1997.

On 23 May 1997, the completed gravity-based structure began its nine-day tow 500 kilometres to its final offshore location, where it sat 224 metres high on the ocean floor in 80 metres of water. Once it was installed on site in June 1997, more than 400,000 tonnes of iron ore ballast were added to the gravity base over a 30-day period. Installation of the offshore loading system, which transfers crude oil to the tankers, took place at the same time. Drilling of the first production well began on 28 July 1997 and the second well was started on 1 August. Production, which will involve about 1,000 jobs, began on 17 November 1997.

The Hibernia project reached another milestone in March 1998, when the Bull Arm construction site was handed over to the provincial government for the sum of $1.00. All parties had agreed that this handover would take place once Hibernia production reached three million barrels of oil loaded on to tankers. The three-million-barrel mark was reached in February. The site has already been leased to a company that is building topside modules for the floating production vessel to be used in the Terra Nova project discussed below.

c. Recent Developments

By the end of the year 2001, a total of 29 wells had been drilled in the Hibernia reservoir – 16 production wells, 7 water injection wells and 6 gas injection wells. In 2001, a total of 54.3 million barrels of oil were produced at an average rate of 148,767 barrels per day.

The Avalon Ben Nevis Reservoir that is located about 1,300 metres above the Hibernia Reservoir, the site of all production to date, was the site of additional activity. This reservoir is a more geologically complex one; as a result, further development work is still required to identify its full extent and potential. Additional drilling is continuing and the Hibernia Management and Development Company will file a revised development plan by the end of 2002.

4. Other Development on the Grand Banks

In December 1995, a consortium led by Petro-Canada announced it would be proceeding with the next major Newfoundland development, the Terra Nova field, which is estimated to contain 300-400 million barrels of oil. The project's expected cost is $4.5 billion, with

production averaging approximately 115,000 barrels per day over a period of 15-20 years, starting in 2001. Located 350 kilometres southeast of St. John's, Terra Nova is the second-largest oil reservoir on the Grand Banks after the Hibernia field.

The development at Terra Nova will make use of a Floating Production, Storage and Offloading (FPSO) facility, rather than the type of fixed gravity-based structure (GBS) that is being used for Hibernia production. The choice of the floating system was determined by three factors: more extreme weather conditions, more numerous icebergs, and deeper water at the Terra Nova location. Hull fabrication for the FPSO started in August 1998, at the Daewoo shipyards in South Korea. The vessel, which would form the "shell" of the completed FPSO, left Korea in December 1999 and arrived in Bull Arm, Newfoundland, in February 2000. At Bull Arm, the topside modules were installed and all final equipment hook-up and commissioning took place. This process was delayed for a number of technical and labour-related reasons but was finally completed in the summer of 2001. In early August 2001, the completed FPSO set sail from Bull Arm bound for the Terra Nova field. **Offshore hook-up and commissioning was concluded by the end of 2001 and the first oil was produced in January 2002. Just nine days after start-up, Terra Nova reached its approved production rate of 125,000 barrels per day.**

The level of activity in the Newfoundland offshore led a number of oil companies to construct a transshipment terminal at Whiffen Head, on the isthmus connecting the Avalon Peninsula to the rest of Newfoundland. The facility, which began with three tanks each with a capacity of 500,000 barrels of oil, receives oil by tanker from Hibernia. The oil is stored temporarily and is then taken away by second-leg tankers to market.

The first tanker unloaded at Whiffen Head in October 1998. By March 2000, 72 tankers had been received from the Hibernia field and the terminal had transferred in and out approximately 45 million barrels of oil. Newfoundland Transhipment Limited, owners of the terminal, announced in January 1999 that two additional 500,000-barrel storage tanks would be added, to accommodate additional oil coming from the Terra Nova field. **This Phase II construction has been completed and a sixth tank came into operation in May 2002**. **Further expansion is anticipated in the future as other offshore reservoirs are developed.**

As Terra Nova approached the production phase, a development application was filed, in January 2001, for yet another Newfoundland offshore oil field – White Rose. A consortium, led by Husky Oil, has plans for a $1.5-billion offshore oil mega-project to tap the White Rose field, located east of Hibernia and northeast of Terra Nova. The field has an estimated discovered resource base of 283 million barrels of crude oil, along with 76.7 billion cubic metres of natural gas and 15.3 million cubic metres of natural gas liquids. Delineation drilling started in

August 1999 and is continuing. **Public hearings on the application, environmental assessments, and all other regulatory matters were dealt with throughout 2001. Approval for the project to proceed was given by the federal and provincial governments in December 2001, and in March 2002 the project owners announced they would be proceeding with development**. Production could start as early as the end of 2003. The White Rose development will use the same FPSO technology as is being used at Terra Nova, rather than the more costly gravity-based structure in use at Hibernia.

Not all proposed projects in the Newfoundland offshore have gone ahead. In February 2002, the project owners announced that they would be discontinuing their joint evaluation of the Hebron–Ben Nevis–West Ben Nevis oil field, after two years of evaluation. As reasons for their decision, they cited unfavourable economics related to market conditions and the technical challenges of extracting the heavier oil found in this field.

CHRONOLOGY

7 June 1966 -	The first well was drilled in Canada's east coast offshore, on the Grand Banks.
Nov. 1978 - June 1979 -	Drilling at the Venture D-23 well off Sable Island resulted in a major gas discovery. The Venture field was estimated to contain 72 billion cubic metres (2.5 trillion cubic feet) of gas.
May-November 1979 -	A major oil discovery was made at the Hibernia P-15 well on the Grand Banks.
12 February 1982 -	The Government of Newfoundland submitted the question of ownership of offshore resources to the Supreme Court of Newfoundland.
15 February 1982 -	The drill rig Ocean Ranger, working in the Hibernia field, sank with a loss of all 84 crewmen.
2 March 1982 -	The "Canada–Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing" was signed.
March 1982 -	The *Canada Oil and Gas Act* was proclaimed, establishing the Canadian Oil and Gas Lands Administration (COGLA) to administer development on Canada Lands. The east coast offshore was included in the definition of Canada Lands, angering Newfoundland, which also claimed ownership of offshore resources.

29 June 1982 - The *Petroleum Incentives Program Act* received Royal Assent. This program provided exploration incentives to companies meeting certain Canadian ownership requirements and exploring on Canada Lands.

17 February 1983 - The Supreme Court of Newfoundland handed down its ruling, stating that the ownership of offshore resources rests with the federal government.

8 March 1984 - The Supreme Court of Canada ruled that the federal government has jurisdiction over the mineral and other natural resources of the Hibernia field off the coast of Newfoundland.

30 June 1984 - Legislation authorizing the "Canada–Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing" received Royal Assent.

11 February 1985 - Canada and Newfoundland signed the Atlantic Accord, a long-term agreement on the joint management of offshore oil and gas development.

30 October 1985 - A new offshore tax credit regime of $150-250 million a year was announced.

17 June 1986 - *The Canada–Newfoundland Atlantic Accord Implementation (Newfoundland) Act* received Royal Assent.

24 June 1986 - The Canada–Newfoundland Offshore Petroleum Board announced approval of Hibernia Development and Benefits Plans.

1 October 1986 - The Government of Canada eliminated the Petroleum and Gas Revenue Tax.

25 March 1987 - *The Canada–Newfoundland Atlantic Accord Implementation Act* received Royal Assent.

29 May 1987 - *The Canada–Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act* received Royal Assent.

21 July 1988 - *The Canada–Nova Scotia Offshore Petroleum Resources Accord Implementation Act* received Royal Assent.

February 1992 - Gulf Canada Resources Inc. withdrew from the Hibernia project.

23 June 1992 - The *Oil and Gas Production and Conservation Act* received Royal Assent.

15 January 1993 - The Government of Canada announced an agreement to proceed with Hibernia under a new partnership arrangement.

17 November 1997 - First production of oil from Hibernia took place.

24 September 2000 - Hibernia production passes 100-million-barrel mark.

4 August 2001 - Terra Nova Floating Production, Storage and Offloading (FPSO) platform set sail for the offshore field.

January 2002 - Production commenced at Terra Nova.

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Web site for Canada–Newfoundland Offshore Petroleum Board – http://www.cnopb.nfnet.com.

Web site for Hibernia – http://www.hibernia.ca.