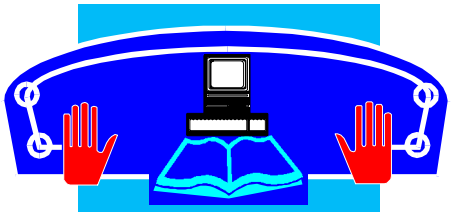


Summary Of The Resource Management Plan For The Lancaster Sound Region Hydrocarbon Development

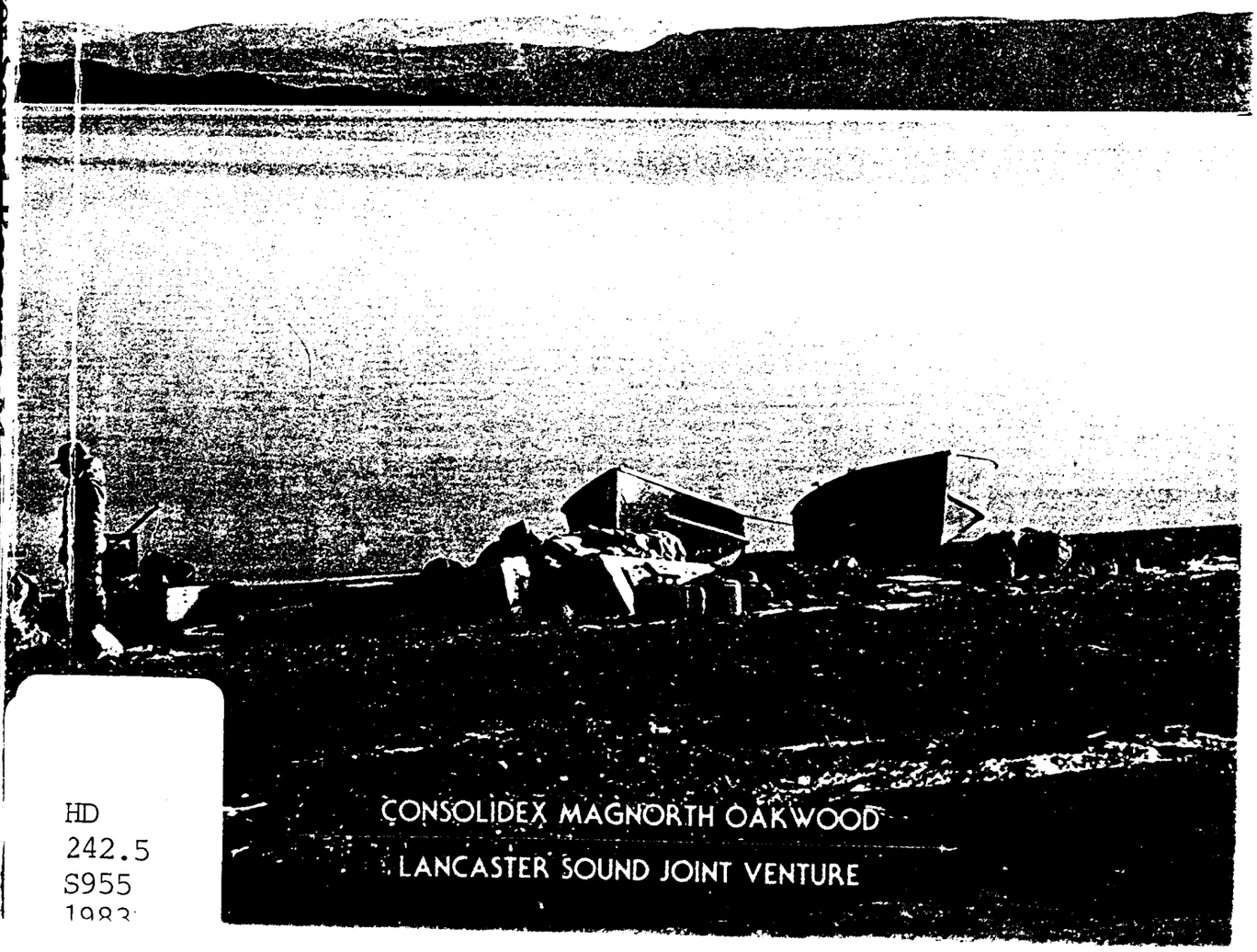
Type of Study: Plans/strategies

Date of Report: 1983

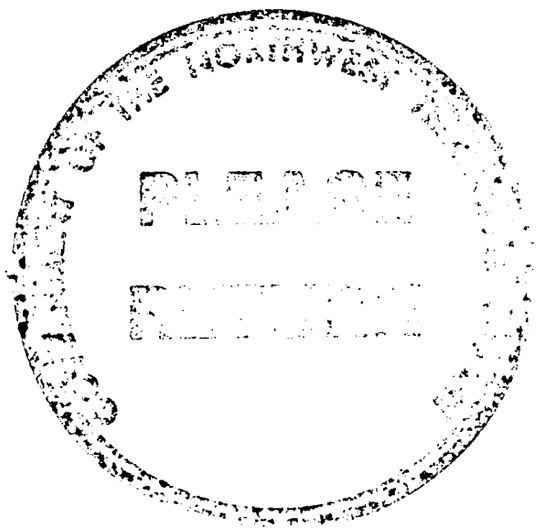
Author: Consolidex Magnorth Oakwood

Catalogue Number: 6-1-88

Summary of the Resource Management Plan for Lancaster Sound Region Hydrocarbon Development



SUMMARY OF THE RESOURCE MANAGEMENT PLAN FOR LANCASTER SOUND REGION HYDROCARBON DEVELOPMENT



SUMMARY OF THE RESOURCE MANAGEMENT PLAN FOR LANCASTER SOUND REGION HYDROCARBON DEVELOPMENT

INCLUDING CONCLUSIONS
AND APPENDICES DETAILING
THE RESOURCE MANAGEMENT PLAN SUPPORT
DOCUMENTS, MAJOR REFERENCES,
TABLE OF CONTENTS AND SUBJECT INDEX

Prepared by

CONSOLIDEX GAS AND OIL **LIMITED**
MAGNORTH PETROLEUM LTD.
OAKWOOD PETROLEUMS LTD.
THE **CONSOLIDEX MAGNORTH** OAKWOOD JOINT VENTURE

In consultation with
PALLISTER RESOURCE MANAGEMENT LTD.

DECEMBER 1983

THE RESOURCE MANAGEMENT PLAN

THIS IS A SUMMARY OF THE CMO RESOURCE MANAGEMENT PLAN FOR LANCASTER SOUND HYDROCARBON DEVELOPMENT (RMP). THE RMP PROVIDES INFORMATION CONCERNING THE CMO PROPOSAL TO DRILL AN EXPLORATION WELL, 'DUNDAS K-56'. THIS INFORMATION IS PRESENTED WITHIN THE CONTEXT OF A LONG-TERM PROJECTION OF ACTIVITIES AND THE POTENTIAL SOCIAL AND ENVIRONMENTAL EFFECTS WHICH COULD FOLLOW AN OIL DISCOVERY.

THE RESOURCE MANAGEMENT PLAN IS PRIMARILY ADDRESSED TO PERSONS AND AGENCIES INVOLVED, DIRECTLY AND INDIRECTLY, IN LANCASTER SOUND REGIONAL LAND-USE P LANNING.

ANALYSIS OF LAND-USE HAS NOW COME TO THE STAGE WHERE THE MINISTER OF THE DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT CAN REAFFIRM THAT PETROLEUM EXPLORATION IS AN ACCEPTABLE LAND-USE IN THE REGION.

OBTAINING THE AUTHORITY TO DRILL A WELL WITHIN THE TERMS OF AN EXPLORATION AGREEMENT IS A SECOND STAGE, TO BE NEGOTIATED WITH THE CANADA OIL AND GAS LANDS ADMINISTRATION (COGLA). THE SOCIAL AND TECHNICAL PROGRAMS AND PROCEDURES OUTLINED IN THE RMP WILL BE DETAILED IN DOCUMENTS TO BE SUBMITTED TO COGLA. THEY WILL BE SUBJECT TO APPRAISAL AND REVISION BY COGLA UNDER THE TERMS OF THE AGREEMENT.

THE RESOURCE MANAGEMENT PLAN AND RMP BACKGROUND AND SUPPORT DOCUMENTS ARE PUBLISHED UNDER SEPARATE COVER. THEY ARE AVAILABLE FROM CMO, OR, ARE AVAILABLE FOR INSPECTION AT ANY ONE OF THIRTY-TWO LIBRARIES LISTED IN THE 'APPENDICES' SECTION OF THIS DOCUMENT. A SUMMARY IN INUKTITUT IS AVAILABLE ON VIDEO-CASSETTE.

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THE CONSOLIDEX MAGNORTH OAKWOOD LANCASTER SOUND JOINT VENTURE

The Consolidex Magnorth Oakwood Lancaster Sound Joint Venture (CMO) is corn. prised of three companies, each based in Calgary, Alberta: Consolidex Gas and Oil Limited, with a 12½% interest; Magnorth Petroleum Ltd., with a 75% interest; and Oakwood Petroleums Ltd. with a 12½ % interest.

CONSOLIDEX GAS AND OIL LIMITED

Consolidex Gas and Oil Limited is a Canadian subsidiary of Internorth, a $4.2 billion energy corporation centred in Omaha, Nebraska. Other Internorth interests include the Northern Natural Gas 36,700 km pipeline system and a large retail natural gas service in the midwestem United States; the Northern Plains Natural Gas Company Northern Border Pipeline; interests in the Trailblazer/Overthrust pipeline, the proposed Alaskan pipeline systems, and other pipelines in Oklahoma and the Gulf of Mexico; the transportation, processing and marketing of propane, ethane, iso- and normal butanes, natural gas and helium through Northern Liquid Fuels Company; a world-scale olefin and polyolefin plant in Illinois, manufacturing and marketing plastic products; an on- and offshore exploration company, Nortex Gas and Oil, with more than 1.8 million acres under lease in the lower 48 states and in the Gulf of Mexico; and an international marketing agency for liquid hydrocarbons and petrochemicals. Consolidex Gas and Oil Limited holds interests in other exploration sites in the High Arctic, being operated by Panarctic Oils Ltd. Consolidex is the manager of operations with respect to the Magnorth permits in Lancaster Sound.

MAGNORTH PETROLEUM LTD.

Magnorth Petroleum Ltd. was formed in 1970 by twelve independent companies with exploratory permits in the Lancaster Sound region. These companies gifted their exploratory permits to Magnorth, and then subscribed to the common shares of the new company. Magnorth gross permit acreage in the High Arctic is 2,346,411 acres (about 950,000 hectares), with net holdings after deducting lands farmed-out and assigned to the joint venture partners of 1,738,535 acres. Most of these lands are in the Lancaster Sound - western Baffin Bay region. Other smaller Magnorth holdings and interests are in the Sverdrup Basin region, jointly held and/or operated with Phillips Petroleum Canada Ltd., Panarctic Oils Ltd., and Suncor Inc.

OAKWOOD PETROLEUMS LTD.

Oakwood Petroleums Ltd. is a $400 million Canadian public company with interests in oil and gas developments in Canada and internationally. In Canada, Oakwood land interests include properties in the southern Beaufort Sea, Lancaster Sound, the southwestern Northwest Territories, northeastern British Columbia, throughout Alberta and in southern Saskatchewan and Manitoba, and on the Labrador shelf. Oakwood has significant land interests, on- and offshore, in Australia, New Zealand and Spain; and is active in developments in the United States, with Oakwood holding controlling equity in American Oakwood Energy Ltd. and its wholly owned subsiary, Oakwood Resources Inc.

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- Resource Management Plan -

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Abstract

Marine geophysical surveys conducted in Lancaster Sound starting in 1970 resulted in the discovery of a significant geological feature, the Dundas structure. The companies holding petroleum exploration rights in the region, then Magnorth Petroleum and Norlands Petroleums, proposed drilling an exploratory well to test this structure. In 1974, the companies received Approval-in-Principle to drill a well from the Department of Indian Affairs and Northern Development (DIAND) on the condition that a comprehensive environmental program be carried out. The Approval-in-Principle expired in 1977 after DIAND had ruled that the studies conducted were not adequate.

DIAND referred the drilling proposal to an Environmental Assessment Panel. Norlands then conducted additional environmental studies and prepared an Environmental Impact Statement (EIS). Following a review of the EIS, the Panel concluded in 1979 that while the EIS did summarize the scientific knowledge of the area existing at the time, there were major gaps in the knowledge of the physical and biological environment. It also concluded that a meaningful assessment of the drilling proposal could not be made in isolation of broader issues affecting the uses of the area. The Panel recommended that drilling be deferred until government had studied the region's land uses and until the proponent had demonstrated that operations could proceed safely. DIAND accepted the Panel recommendations, deferring drilling authority until these two actions had been completed.

Government and industry conducted extensive studies from 1979 to 1983. In the past few months two major initiatives have been completed: government's Lancaster Sound Regional Study concluded and the joint venture of Consolidex Magnorth Oakwood (CMO) published its Resource Management Plan (RMP).

Now that this work is completed, CMO is requesting the Minister of DIAND to affirm that exploration drilling is to be

included in the range of land-uses of the Lancaster Sound region. We are also asking that the Minister authorize CMO to proceed with negotiations with the Canada Oil and Gas Lands Administration (COGLA) for an Exploration Agreement. Subsequently, CMO will seek authority to drill the Dundas K-56 well in 1985.

The Dundas geological structure lies within the very large, yet untested, Lancaster Sound Basin. The Dundas structure could contain some four billion barrels of recoverable oil. This represents nearly one-half of the estimated recoverable reserves of Prudhoe Bay and over twice the recoverable reserves of Hibernia.

The Resource Management Plan, summarized in this book, provides information about the CMO proposal to drill the Dundas well in the context of short-term and long-term activities. It states our management policies, operational procedures and describes in detail our research results and future plans. The information in the RMP is based on extensive research conducted by CMO, other companies and government. It has been critically reviewed by interested parties and discussed with Lancaster Sound residents.

During the course of this discussion and evaluation, no material inadequacies in CMO studies or plans in technical, environmental or socio-economic matters have been stated.

The concerns which resulted in the deferral of drilling have now been addressed by government and industry. These concerns, discussed at length in the Resource Management Plan, are:

- Safety Management
- Environmental Protection
- Social and Economic Impacts
- Regional Planning

With proper preparation, modem technology and well-trained personnel, drilling can be performed safely in Lancaster Sound. Safety cannot be compromised.

No significant environmental disruption will result from routine operations. In the unlikely event of an oil blowout, long-term significant damage to the biological resources is limited to possible impacts on subtidal benthos and to three bird species.

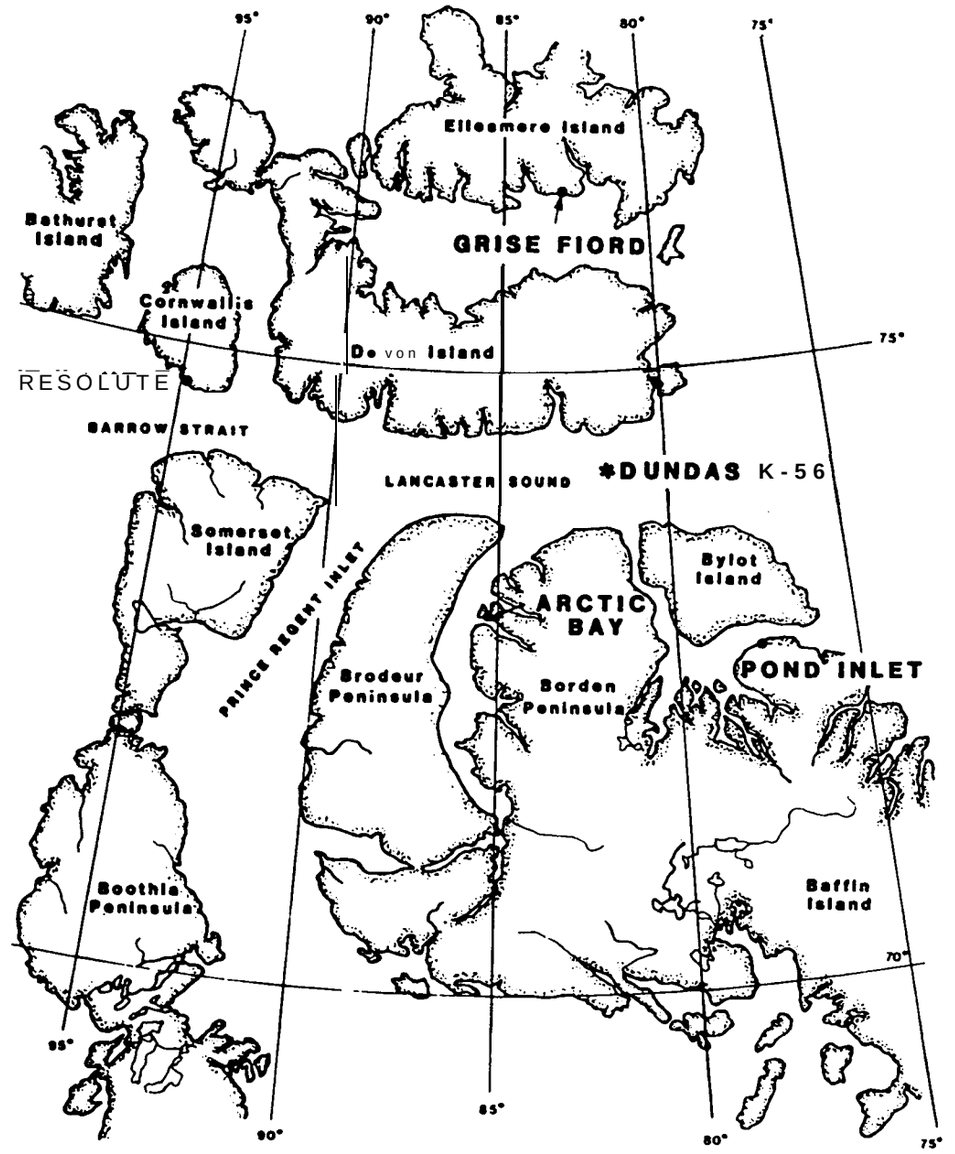
Precautions will minimize any adverse social-economic impacts from the project. Employment, training and business opportunities will be available to interested Lancaster Sound residents.

Hydrocarbon exploration will proceed gradually, with sufficient time to enable the local residents to be trained and to become involved with the project.

Few, if any, land-use conflicts would occur as a result of exploratory drilling. A knowledge of the oil and gas potential of Lancaster Sound is crucial to long-term land-use planning.

In the short-term, CMO plans to drill one test well in Lancaster Sound during the summer of 1985. A decision on additional wells will be made once results from the first well have been obtained. Should commercial quantities of oil be found, production could commence between the years 1994 and 2003, depending on the geological results.

With the completion of the Lancaster Sound Regional Study and major technical, environmental and socio-economic research programs, knowledge of Lancaster Sound has increased dramatically since 1979 when drilling was deferred. The geological information from the Dundas well will make an important contribution to regional land-use and local economic development planning, as well as to national energy planning. Sufficient information now exists that the Minister of DIAND can affirm that exploratory drilling is one of the acceptable land-uses of the region. Should oil be discovered in commercial quantities, significant economic benefits will be derived by all Canadians.



Linda Williamson

PROPOSED **DUNDAS** K-56 DRILLSITE

History

CMO is comprised of Consolidex Gas and Oil Limited, Magnorth Petroleum Ltd and Oakwood Petroleums Ltd, of Calgary, which hold petroleum exploration rights to about 950,000 hectares in the Lancaster Sound region. These rights were acquired in 1968 and 1969 as Exploration Permits. Extensive geological, geophysical and environmental surveys followed and a large geological structure beneath Lancaster Sound was mapped. An exploratory well was planned to determine whether the structure contains hydrocarbons. In 1974, the companies, then working under a farm-out agreement operated by Norlands Petroleums Limited, received Approval-in-Principle from the Department of Indian Affairs and Northern Development (DIAND) to drill a well on the condition that a comprehensive environmental program be carried out. DIAND later ruled that the requirements were not met and the Approval-in-Principle expired in 1977.

DIAND referred the proposal to the Federal Environmental Assessment Review Office. An Environmental Assessment Panel was established and it provided Norlands with Guidelines for the preparation of an Environmental Impact Statement (EIS). Norlands submitted an EIS and supporting documentation in 1978.

In 1979, after conducting public meetings and reviewing the proposal, the Environmental Assessment Panel submitted its findings and recommendations to the Minister of the Environment. The Panel stated that while "the EIS reasonably summarizes the existing scientific knowledge of the Lancaster Sound region", there were major gaps in the knowledge of the natural physical and biological environment. The Panel also concluded that there was insufficient information on the fate of oil and its biological effects, should a blowout occur. Other conclusions were reached regarding physical environmental conditions, the state of technology, potential environmental threats and countermeasures equipment. The Panel also concluded that a meaningful assessment of the drilling proposal could not be made in isolation of the broader issues affecting the uses of the region.

The Panel recommended that drilling be deferred until two actions were taken. The first was that government address the issue

of the best uses of Lancaster Sound. The second was that the proponent demonstrate "both a capability to deal safely and effectively with the physical hazards in Lancaster Sound and operational preparedness to mitigate the effects of a blowout ." The Panel also stated numerous specific conditions which should be met by the proponent prior to drilling. DIAND accepted the Panel's recommendations and deferred drilling authority pending completion of these actions.

During the past four years (1979-1983) government and industry have conducted the recommended work. The interdepartmental Lancaster Sound Regional Study Group led by DIAND began its work in 1979 to determine the "best plan" for Lancaster Sound. After a series of hearings and publications a *Green Paper* was released in July, 1982. Public review continued and a concluding workshop was held in June, 1983 in Pond Inlet. We provided a formal submission to the Regional Study in 1981 and participated in the public meetings.

Since 1979, numerous technical and environmental studies relevant to Lancaster Sound have been undertaken by government and industry. The Eastern Arctic Marine Environmental Studies (EAMES) program has added significantly to the knowledge of the Lancaster Sound region. Other related projects include those operated by the Canadian Offshore Oil Spill Research Association (COOSRA), the Arctic Marine Oil Spill Program (AMOP), the Arctic Pilot Project (APP), the Baffin Island Oil Spill Program (BIOS), and the Arctic Land Use Research Program (ALUR), to name a few. CMO has incorporated the results of these programs into its Resource Management Plan.

CMO was formed in 1982 after Norlands Petroleums was sold to Oakwood Petroleums Ltd. Norlands' parent company, Northern Natural Gas, retained an interest in the lands, which was assigned to its subsidiary, Consolidex Gas and Oil Limited.

We prepared a detailed *Response to the Green Paper* in October, 1982 which addressed the issues, concerns and options formulated by the Regional Study Group. The *Response* stated our position on land-use planning and provided a description of our future plans, to be outlined in detail in a Resource Management Plan. The RMP was completed in August, 1983, following lengthy public, government and industry discussion, consultation and review.

Approval for Drilling the Dundas K-56 Well

Now that the two actions recommended by the Environmental Assessment Panel have been completed, we are seeking the policy direction of the DIAND Minister to reinstate exploration drilling as a permissible land-use of Lancaster Sound, and to authorize CMO to proceed to negotiations with COGLA for an Exploration Agreement.

Under the 1982 *Canada Oil and Gas Act,* former Exploration Permits must be converted into an Exploration Agreement between the operator and COGLA. Once an Exploration Agreement has been concluded, the operator enters a three-stage COGLA approval process, leading to the issuance of an Authority-to-Drill-a -Well.

In order to complete the approval process, an operator must meet detailed and stringent technical requirements as stated in regulations administered by COGLA, such as the *Oil and Gas Production and Conservation Act* and the *Oil and Gas Drilling Regulations.* Environmental protection is safeguarded by legislation such as the *Arctic Waters Pollution Prevention Act.* Social benefits are also required through the *Canada Oil and Gas Act.* Although effective safety procedures will be in place, our operations would be interrupted if standards agreed to with government officials are found to be inadequate. In making that evaluation, inspectors should be aided in operations monitoring by regional representatives.

The southern shore of Lancaster Sound is made up of the north coasts of Baffin and Bylot Islands. The coastlines of the Brodeur Peninsula of Baffin Island consist of cliffs which rise to about 400 metres above sea level. The outcropping have been studied and found to be of Lower Paleozoic (deposited more than 400 million years ago) and Precambrian Age.

Petroleum Potential

The CMO acreage lies offshore in an area of thick sedimentary deposits known as the Lancaster Sound Basin. No exploration drilling has been conducted within this large Basin. One of the promising features of the Basin is the Dundas structure, which was formed as abasement uplift and has a faulted sedimentary sequence up to 4,000 metres thick. This sequence could contain hydrocarbons.

The Dundas structure is similar in size and shape to the Prudhoe Bay structure in Alaska. The Prudhoe Bay field, now in production, is estimated to contain 22 billion barrels of oil in place, of which 9 billion barrels are expected to be commercially recoverable. The potential reservoir in the Dundas structure, assuming it is only partially filled, is estimated to occupy an 80 square kilometre area. It could contain over 9 billion barrels of oil in place, of which some 4 billion barrels may be recoverable. Hibernia, in comparison, has recoverable reserves of 1.2 billion barrels, according to the Canadian Petroleum Association.

The proposed drill-site to test the Dundas structure, Dundas K-56, is located in 765 metres of water at 74 °05'38" N latitude and 81015'30" W longitude, approximately 65 kilometres southeast of Dundas Harbour (on Devon Island). The sea-bottom is flat at the well location. The well will pass through what is believed to be a shale, siltstone and sandstone sequence to the primary prospect which is about 1500 metres below sea bottom. Total depth of the well will be 2435 metres below the sea floor.

The Resource Management Plan

In proposing to drill an exploratory well in 1985 to test the Dundas structure we prepared the *Resource* Management *Plan for Lancaster Sound Region Hydrocarbon Development* (RMP) which states our management policies and describes our operational procedures. Along-term projection of the activities which would follow a major oil discovery in Lancaster Sound is included.

The seven key objectives of the RMP document are to:

1. Demonstrate our abilit y to accommodate the interests of local residents.
2. Document the technology and management systems which are available to conduct operations safely.
3. Outline the means through which the biological environment will be protected.
4. Indicate the extent to which field development could contribute to domestic energy supplies.
5. Outline the manner in which our plans are compatible and supportive of the goals of land-use planning in the region.
6. Detail the ways in which we will cooperate with the numerous agencies of the governments of Canada and the Northwest Territories to provide benefits to the people of Canada, consistent with governments' policies.
7. Describe our plans for the drilling of the first exploratory well, Dundas K-56, including our related project development and research activities.

These objectives were fulfilled through our acquiring, reviewing and interpreting the large volume of technical, social, economic, environmental and governmental policy information compiled by others over the past decade. In addition, we have undertaken field programs and research projects pertinent to the Lancaster Sound region. In the synthesis of this research and data we drew upon the collective experience of experts at the leading edge of responsible resource management in Canada.

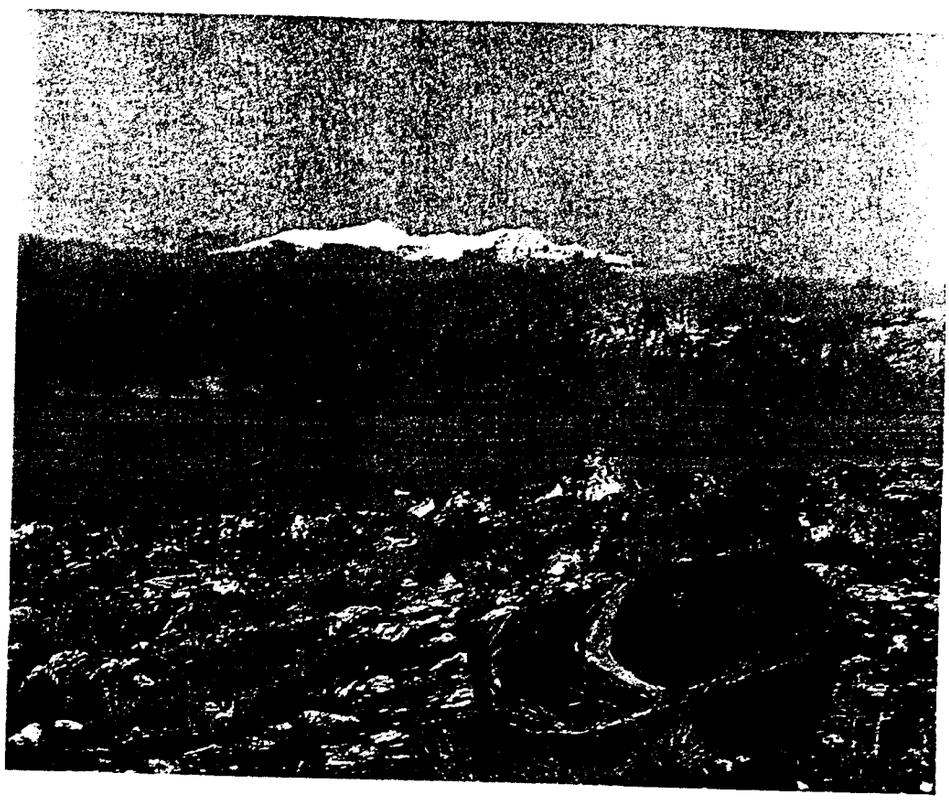
Management Policies

CMO management policies are concerned with such matters as safety, environmental protection, employment and training,

research, and local involvement in company activities. The policies recognize governments' policies and local and regional aspirations.

In brief, CMO policies and policy objectives are as follows:

- To discover, develop and produce hydrocarbon resources in a responsible and economical manner.
- To advance the technologies by which Canada can realize the benefits from oil and gas reservoirs beneath ice-frequented waters.
- To gather environmental base-line data.
- To review and interpret these data and those acquired by others in assessing the potential impact of the environment on drilling operations and of drilling operations on the environment.
- To conduct operations in a safe manner, with provisions for accident prevention and response capabilities.
- To use equipment suited to, and personnel trained for, arctic operations.
- To provide training programs and employment to local residents wishing to avail themselves of them.
- To purchase supplies and services from local and regional sources.
- To perform logistical operations with minimum disruption to local communities.
- To provide information regarding current and future plans to local communities and regional authorities.
- To participate and cooperate in regional planning and in sharing of infrastructure facilities.
- To purchase goods and services from Canadian sources in accordance with the guidelines of the Office of Regional and Industrial Benefits.
- To establish a procurement procedure in which local, regional and national suppliers of goods and services will be informed in advance of company requirements.
- To participate in joint studies and research with other companies and with associations in acquiring base-line environmental data, conducting technical feasibility studies and coordinating socio-economic programs.



Jeff Pallister

Detailed descriptions of the biological components and important processes in the Lancaster Sound region have been compiled through research programs such as EAMES and the Norlands Lancaster Sound studies (1975-1976), providing a basis for an understanding of the biological environment. Eastern Lancaster Sound and western Baffin Bay support a high diversity and large numbers of marine mammals, marine birds and lower life forms. The region ranks as a major staging and breeding area and migration corridor for sea- birds.

Project Development and Research

The information contained in the RMP is based on extensive research conducted by CMO, governments and other companies. A number of steps have recently been taken by governments in establishing northern planning mechanisms, while both government and industry have gathered a significant volume of additional social, technical and environmental data.

Land Use Planning

DIAND has developed northern resource and land-use policies, and has concluded a special planning study in the Lancaster Sound region. The Lancaster Sound Regional Study began in the fall of 1979, led by DIAND in cooperation with the Government of the Northwest Territories (GNWT) and the federal departments of Energy, Mines & Resources, Environment, Fisheries & Oceans, and Transport. Participants during the public review process consisted of local residents, public interest groups, industrial organizations and academics. The Study Group first assembled data and produced a data atlas and a series of technical background papers. The material was synthesized as a *Draft Green Paper*, released by the DIAND Minister in February, 1981. Public review of the issues followed in the northern communities and workshops were held in Resolute and Ottawa. A summary and interpretation of these meetings was published by the workshop chairman, Professor Peter Jacobs, in August, 1981. The Study Group's *Green Paper* identified specific regional concerns and issues and presented possible options for the future use of the region. Responses were invited from interested parties and public meetings were held in the north. A concluding workshop was held in Pond Inlet in June, 1983.

Concurrent with the Regional Study, DIAND prepared an important departmental draft paper, *Land-Use Planning in Northern Canada*, outlining government initiatives and principles in northern land-use planning. This draft paper was distributed among federal and territorial government departments and agencies, native organizations, and industrial concerns. With this document as a basis for discussion, agreement was reached between the involved governments and associations on planning principles for the Northwest Territories.

A *Northern Conservation Policy* is similarly nearing consensus among the involved parties. A Task Force on Northern Conservation was established in September, 1983, to make recommendations to the DIAND Minister, as well as to propose a strategy for implementation of a conservation policy.

In addition, DIAND has drafted a Northern *Oil and Gas Action Program* (NOGAP) and a *Northern Hydrocarbon Development Strategy,* which are currently under Cabinet review.

With these initiatives and policies in place and now proceeding to the implementation stage, a comprehensive and integrated approach to planning and monitoring northern development has successful y been inaugurated.

New Research Results

While government land-use and conservation planning studies were in progress, we obtained extensive information from new research results which supplemented the previous environmental work conducted by Norlands Petroleums. This information included industry, government and joint government/industry studies. More recently, we initiated a comprehensive data synthesis and assessment program for the RMP.

Of particular importance is the Eastern Arctic Marine Environmental Studies (EAMES) program. EAMES began in 1977 as a result of increased oil and gas exploration related activities in the Eastern Arctic offshore. One objective of the program was to take a 'regional' rather than 'site-specific' approach to environmental studies.

A number of petroleum operators have also contributed to the scientific knowledge and technologies for operating safely and effectively in the Arctic and in the ice-frequented waters off the East Coast. Government research programs have also improved the information base. Activities and projects applicable to Lancaster Sound operations include Eastern Arctic studies conducted under the 1982 *Beaufort Environmental Impact Assessment* program by Dome Petroleum, Esso Resources, and Gulf Canada Resources, and research conducted in support of the Arctic Pilot Project (APP). Other important government and industry research projects include those operated under Polar Gas, the Offshore Labrador Biological Studies (OLABS), the Arctic Land Use Research Program

(ALUR), the Arctic Petroleum Operators' Association (APOA), the Eastcoast Petroleum Operators' Association (EPOA), Canadian Offshore Oil Spill Research Association (COOSRA), the Baffin Island Oil Spill (BIOS) project and the Arctic Marine Oilspill Program (AMOP).

Recent CMO Research

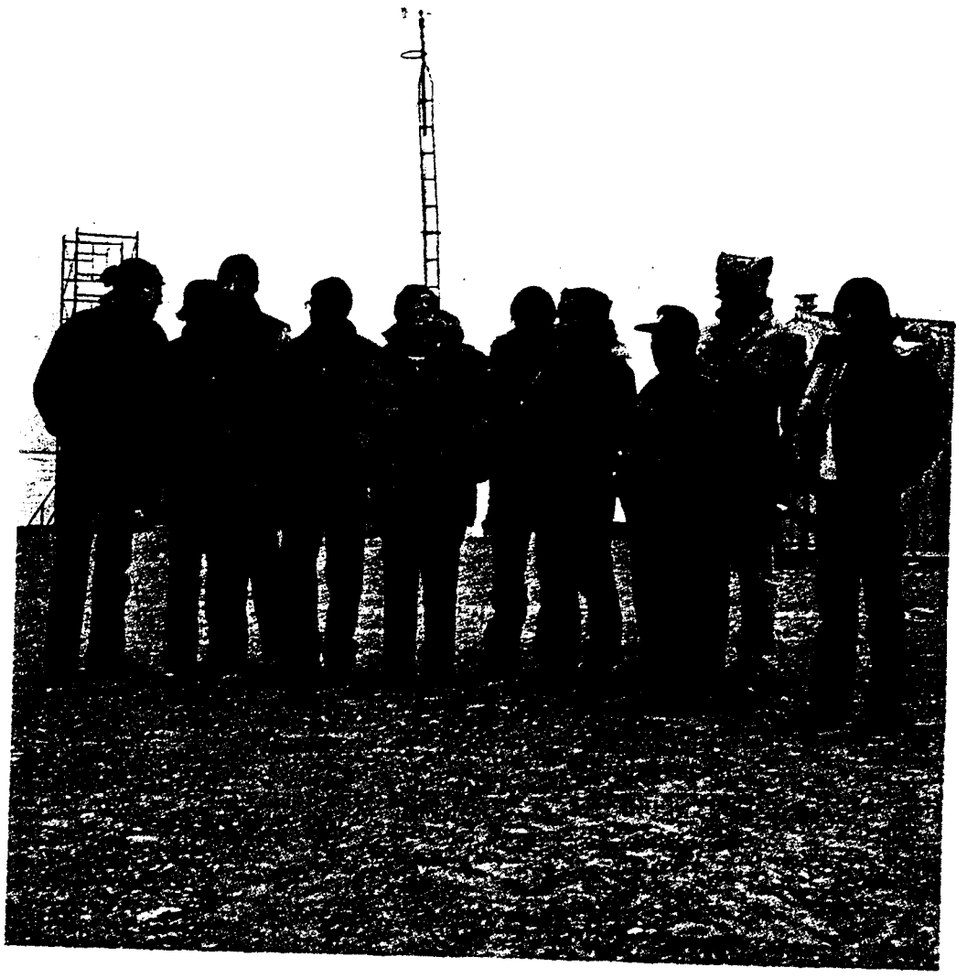
We conducted fifteen special studies in 1983 which integrated our previous work with that undertaken by government and by other companies. The services of eleven authoritative Canadian consultants and their associates were retained to ensure that the best available and most up-to-date information was contained in the RMP. The subjects addressed include federal, territorial and regional governments' policies, social and economic considerations, training and employment, oil spill countermeasures, sub-sea production systems, the biological environment, iceberg conditions, oil spill trajectory modelling, and technical operations. Report titles are listed in the Appendix of this *Summary*.

We have also consulted with other industry operators such as Petro-Canada, Canterra, Syncrude, and Dome, among others which have experience in the offshore, the Eastern Arctic and other relevant areas. We have worked particularly closely with Petro-Canada in the development of site-specific oil spill trajectory models, assessment of the impact of an oil blowout, and in acquiring technical, social and economic data.

The draft RMP and Support Documents were reviewed by government agencies, public interest groups, other industry operators, contractors and consultants. A seminar of consultants, CMO and other oil companies was held in June, 1983, as a peer review to critique these documents. An ongoing Research Program was also drafted during this seminar.

Ongoing CMO Studies

Additional work to be undertaken in preparation for drilling has been determined. Some studies are underway and others will be carried out following our receipt of an Exploration Agreement.



Jeff Pallister

CMO hosted a seminar in Pond Inlet in September, 1983, to discuss ways and means through which residents could become meaningfully involved in oil and gas exploration activities in the region. Pictured are Gamaliel Akeeagok, Larry Audlaluk, Imooshie Nutararjuk and Jaypotee Akeeagok who attended from Grise Fiord, together with CMO representatives and support personnel, photographed at the Borden Peninsula Radar Station on Lancaster Sound.

Future project activities and research plans include:

. multi-disciplinary integration of the various oil spill related material
. refinement of iceberg downtime estimates
• amplification of the Contingency Plan
. establishment of a Resource Centre in the north Baffin region
• establishment of an environmental forecasting facility
. additional research on sea ice and iceberg characteristics, detection, monitoring and avoidance
• development of shoreline sensitivity maps
• implementation of environmental and social monitoring program
• determination of a liability and compensation policy
• participation with others in underwater acoustics studies
• further studies on sub-sea production systems and shore facilities

We intend to establish a Board of Consultants to assist in the development and implementation of future research and communications activities.

Several of the future environmental studies are expected to be conducted under the newly established Environmental Studies Revolving Funds (ESRF). Under the ESRF, research is financed through two funds, one for southern Canada and one for northern Canada. Funds are collected from petroleum companies through levies on their landholdings. Study costs are allocated to operators based on the relevance of work to a particular region. The ESRF levy formula is designed to distribute regional costs equitably among all oil and gas interest holders. As many of the programs are applicable to Lancaster Sound, a correspondingly high levy was assigned to CMO.

By late April, large amounts of new ice are no longer forming over the Sound, anda continuing easterly drift of remaining ice floes generally gives rise by late Mayor early June to open-water or low ice-concentration conditions. Icebergs enter the Sound through the southward-moving portion of the Baffin Bay circulation. Some 9070 of these icebergs have masses in excess of 20,000 tonnes.

The Major Concerns

The RMP was prepared as a comprehensive evaluation of the significant short and long-term effects from hydrocarbon exploration. These concerns, which resulted in the deferral of drilling in 1979, are:

- Safety Management
- Environmental Protection
- Social and Economic Impacts
- Regional Planning

Safety Management

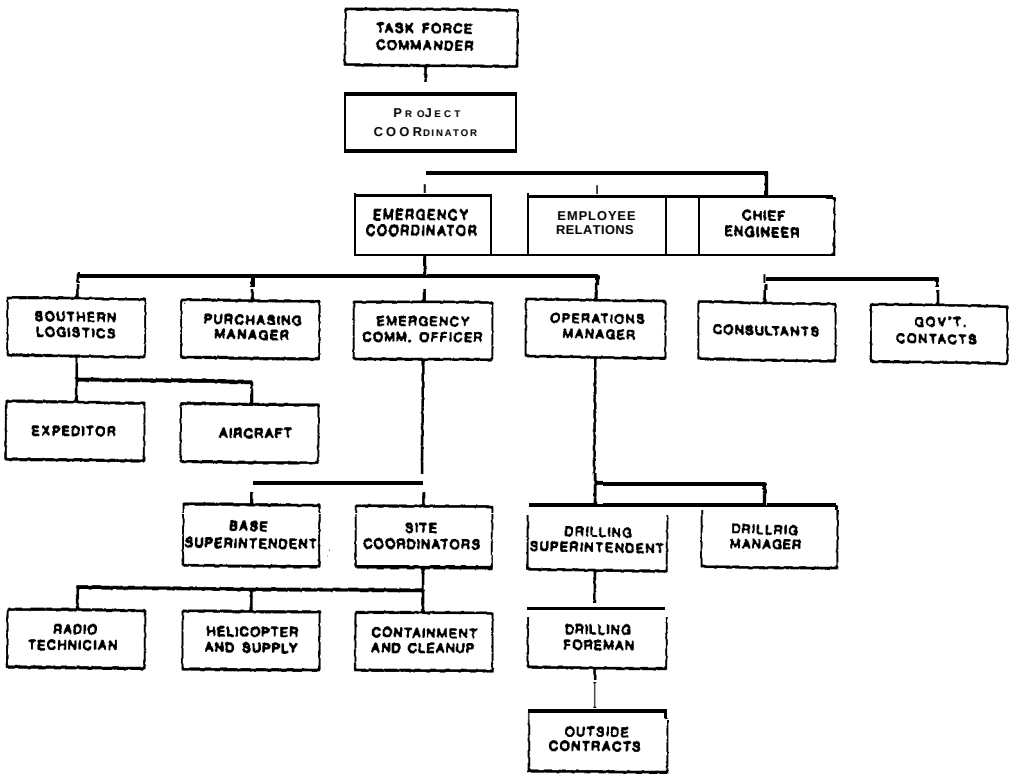
Safety of operations results from a combination of a knowledge of the operating environment, the effective use of state-of-the-art technologies and well-trained personnel. Through careful preparations, several hundred wells have been safely drilled in offshore Canadian waters. In planning for Lancaster Sound operations, we have carefully studied the operating conditions of this area and have established plans for systems which predict and prevent hazardous events. Our primary emphasis is on accident prevention and on the maintenance of safe operations.

An extensive number of laws, regulations, directives and guidelines are established, enforced and monitored by government to ensure safe operating practices. While the regulatory requirements are stringent, we will exceed these requirements wherever possible. Effective accident avoidance is, in itself, the solution to many other concerns.

The culture and livelihood of Lancaster Sound residents depends on the region's biological resources. In meeting our responsibility to safeguard these resources, while minimizing our own financial risks, every attempt will be made to ensure safe operations.

Safety cannot be compromised. We have designed a safety-oriented applied management program which meets government requirements, satisfies public concerns, and protects our investment. We have conducted studies of safety management, contingency planning, oil spill countermeasures and accident prevention procedures. Equipment and technical procedures to be employed have been identified.

TASK FORCE ORGANIZATION
DURING EMERGENCY OPERATIONS



In the event of an emergency, the Safety Team is mobilized into an Emergency Task Force, organized as depicted above, Each individual on the Task Force has specific, pre-determined responsibilities within this chain of command.

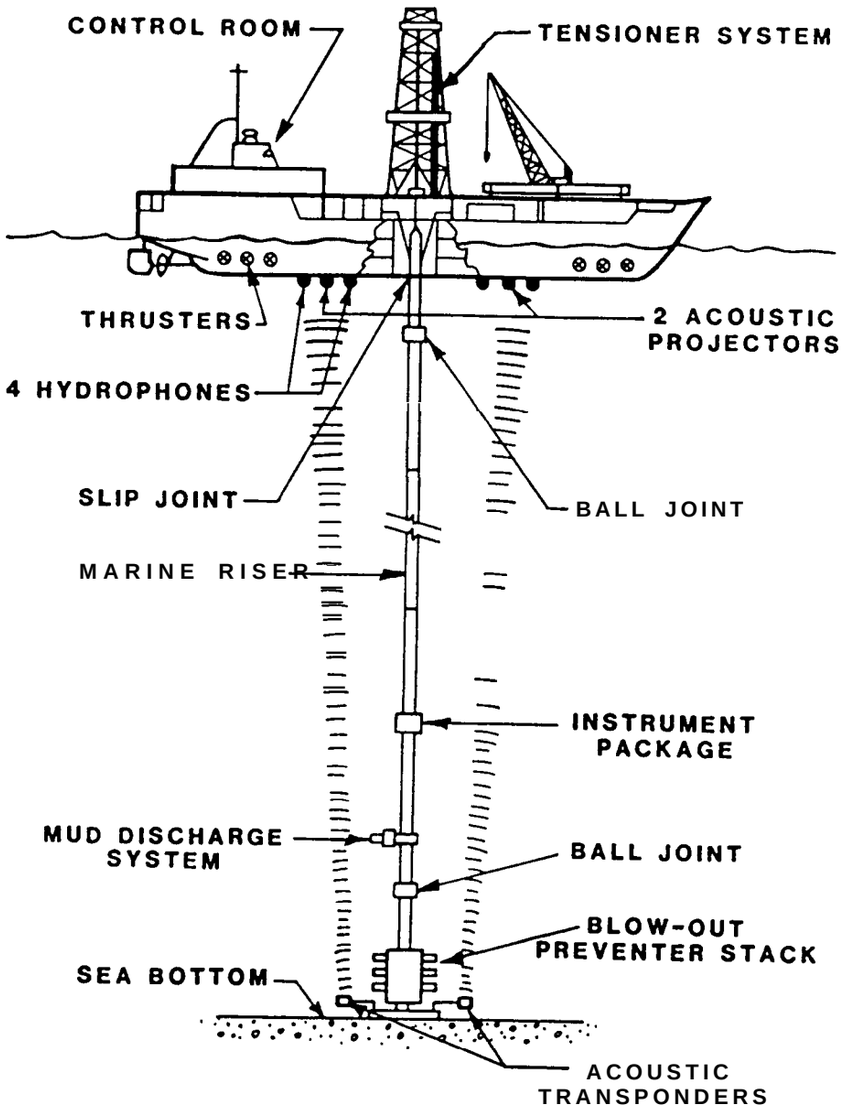
As the operator responsible for the drilling program, we will mobilize the required personnel to execute our management plan effectively. CMO anticipates that an agreement to perform the drilling will be made between the joint venture and a company experienced in the Canadian offshore. Many of the companies comprising the joint venture have this required background. As well, a competent drilling contractor having experience in northern waters will be engaged.

We have conferred with several operators active in the Canadian offshore in developing our operations plans. These firms include Petro-Canada, Dome Petroleum, Canterra Energy, and BP Exploration Canada.

A Dundas K-56 drilling application Update, incorporating provisions of the 1982 *Canada Oil and Gas Act*, will be submitted to COGLA subsequent to our negotiating the Exploration Agreement, at the time of our Notification of Intention to Undertake a Drilling Program. The Update will describe the applicable regulations, recent Lancaster Sound research, equipment advances, working environment, geology, environmental protection measures, operational constraints, proposed operations and environmental monitoring programs.

A Contingency Plan will also be submitted to COGLA at that time. The Plan, incorporating provisions for an Emergency Task Force, states the procedures to be followed in the event of injury, major fire, support craft loss, loss of well control, and for relief well operations, ice management (including iceberg detection and avoidance), and oil spill countermeasures. The Emergency Task Force is activated only in the event of such an emergency. The Task Force line of command starts with a Commander, and passes through a Project Coordinator, Emergency Communications Officer, On-Site Coordinator and Field Foreman. The Project Coordinator is advised and assisted by several staff functions including engineering, purchasing, logistics, employee relations, communications and environmental control.

A drillship, support vessels, helicopters and aircraft will be utilized for drilling operations. The drilling vessel will be similar to the *Pelerin* type. Built in 1976, the *Pelerin* is a modern ship, designed to withstand rough seas and to operate safely in water depths of up to 900m. The water depth at the Dundas K-56 site is 765m. The *Pelerin* has had substantial use in the ice-infested



DYNAMIC POSITIONING

waters offshore Labrador. The vessel has a dynamic positioning mooring system, using thrusters as opposed to bottom-founded anchors. Transmitters on the sea-floor broadcast position information to the ship and the ship's thrusters move the vessel in response. The ship is outfitted with a complete weather facsimile receiver, a complete offshore radio station and telex system, a complete weather forecasting system, and ice movement monitoring capabilities. These systems will be complemented with additional weather and communications facilities located at the base camp and in southern Canada. With the exception of fresh food provisions, the drillship is self-contained for the duration of a 3 to 4 month drilling program.

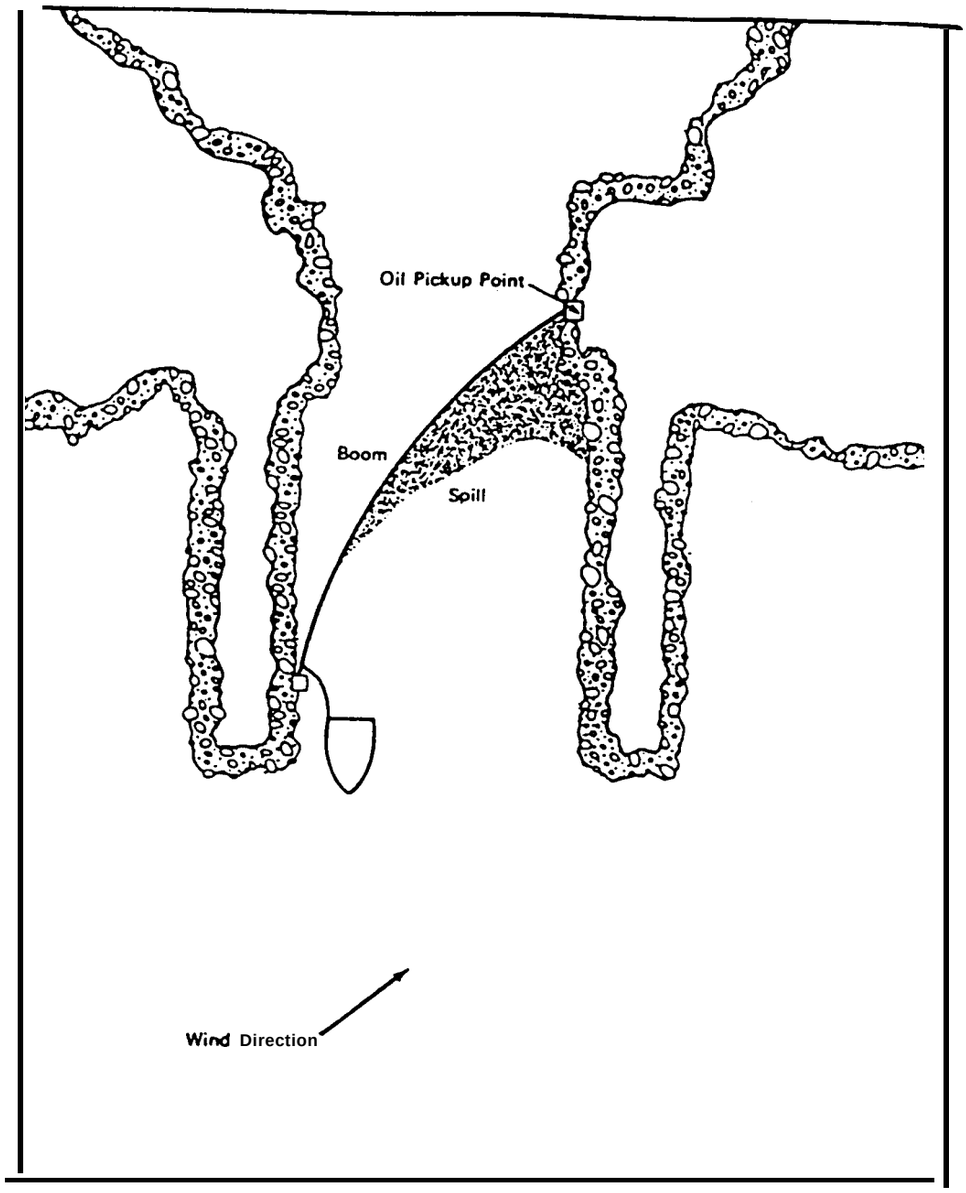
The base camp will be located near the Nanisivik mine site on Strathcona Sound. Located near existing air strips, it will provide fuel storage, helicopter and aircraft support services, emergency supplies and temporary shelter. The existing Nanisivik dock site consists of a main dock, mooring sites, an ore storage building, and a truck loading terminal. A road connects the dock site to Nanisivik and Arctic Bay.

The main risk of an accident in Lancaster Sound is that of collision between a vessel and an iceberg. Operational procedures will accommodate this potential hazard through an effective ice management system.

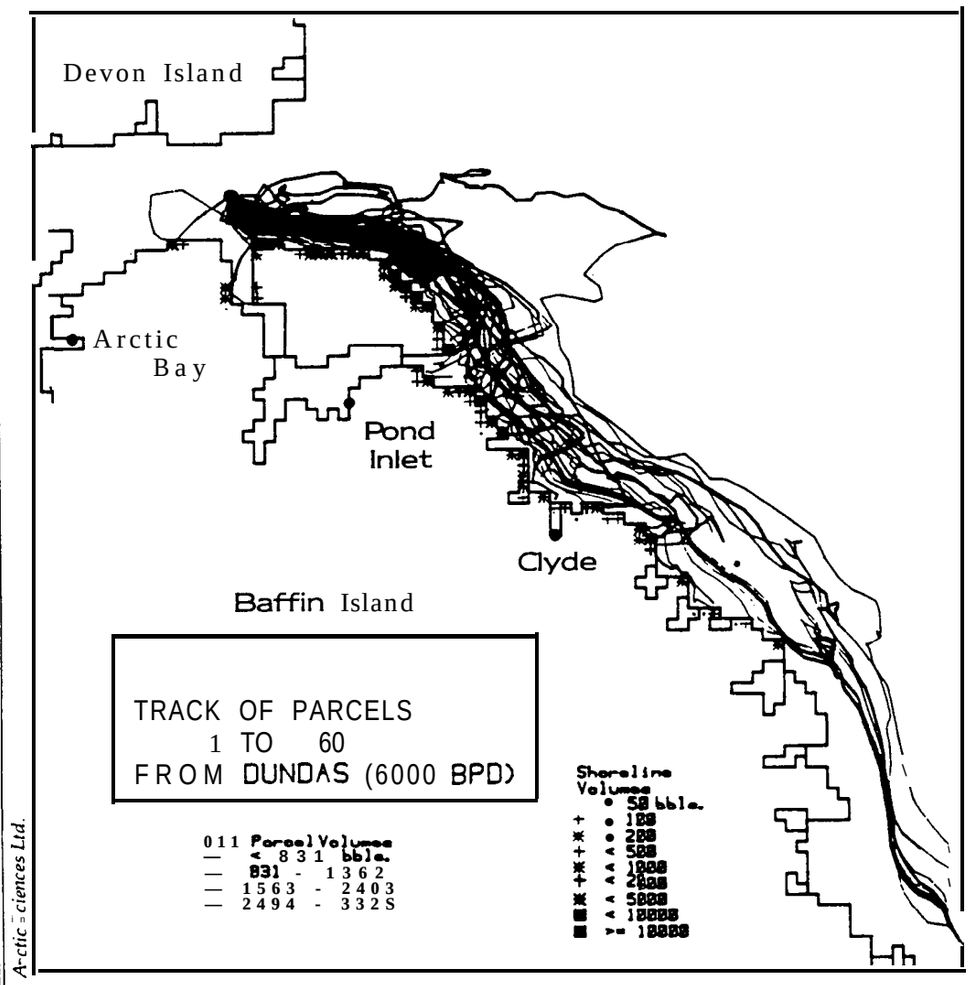
The ice management system consists of the detection and monitoring of ice movement, deflection and towing of ice masses, and if required, temporary suspension of operations and movement of the drilling site.

Additional work sponsored by CMO has been underway to refine the existing and successful iceberg and ice floe management system presently used off the East Coast and extend it to the Lancaster Sound region. The study is developing a model and procedures for the strategic detection, monitoring and avoidance of icebergs. The system will be tested and improved upon on-site during the season prior to drilling. With effective ice management techniques in place, the major risk of icebergs is an economic one. The results of this study will minimize the possible high costs resulting from extensive drilling vessel 'down-time' incurred while awaiting hazard-free conditions.

The drilling vessel will be equipped with the most up-to-date drilling fluid handling systems, complemented by sophisticated

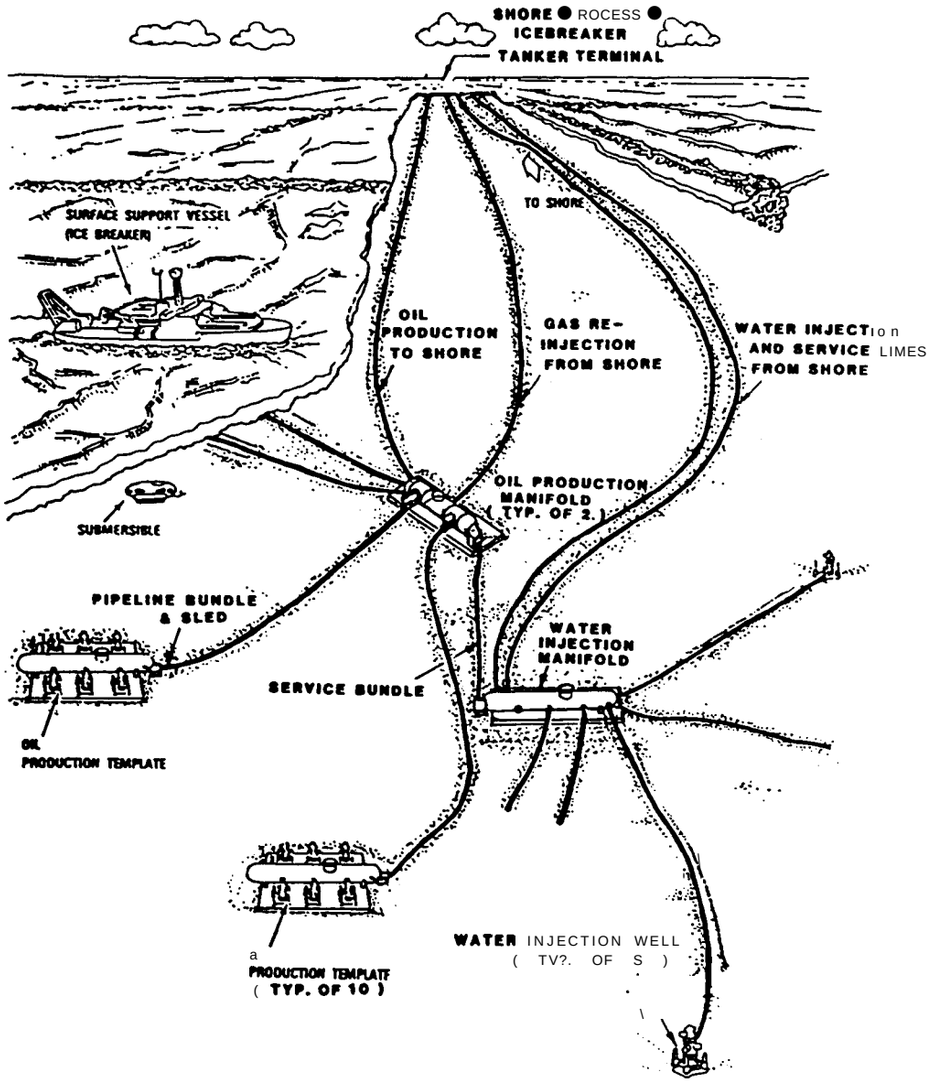


R search into oil spills includes the careful study and planning of untermeasures techniques. Oil from a spill reaching the shoreline would cleaned up in the manner best suited to the area. High energy shorelines m ıy be left to themselves, as this is the least damaging means of restora- n. Deltas and cobble beaches could be cleaned up with manual techni- es. The scenario depicted above is referred to as 'Exclusion Booming' xcluding" the interior harbour from the exterior), with the spill con- nment boom moored across a harbour entrance.



Minor fuel oil spills at the Nanisivik dock site on Strathcona Sound, *or at the drillship site, would result in small slicks which do not constitute a concern regarding their movement, fate, or effective clean-up. The possibility* of *a major spill requires more sophisticated planning. An important part* of *that planning is a knowledge* of *the probable movement* of *oil from a blowout. An oil spill trajectory model was developed to simulate the fate* of *oil reaching the surface from a hypothetical blowout at the Dundas site. The figure above is a computer generated map depicting one such scenario.*

DUNDAS SUB-SEA FIELD DEVELOPMENT CONCEPT



A sub-sea production system in Lancaster Sound would consist of drilling and production templates, production manifolds, water injection manifolds and satellite water injection wells installed on the ocean floor. The field is connected to shore via pipelines and electrical power and communications cables. The development of a suitable production system is a technological challenge which will require at least ten years to consummate, and will, naturally, be subject to oil being discovered in commercial quantities.

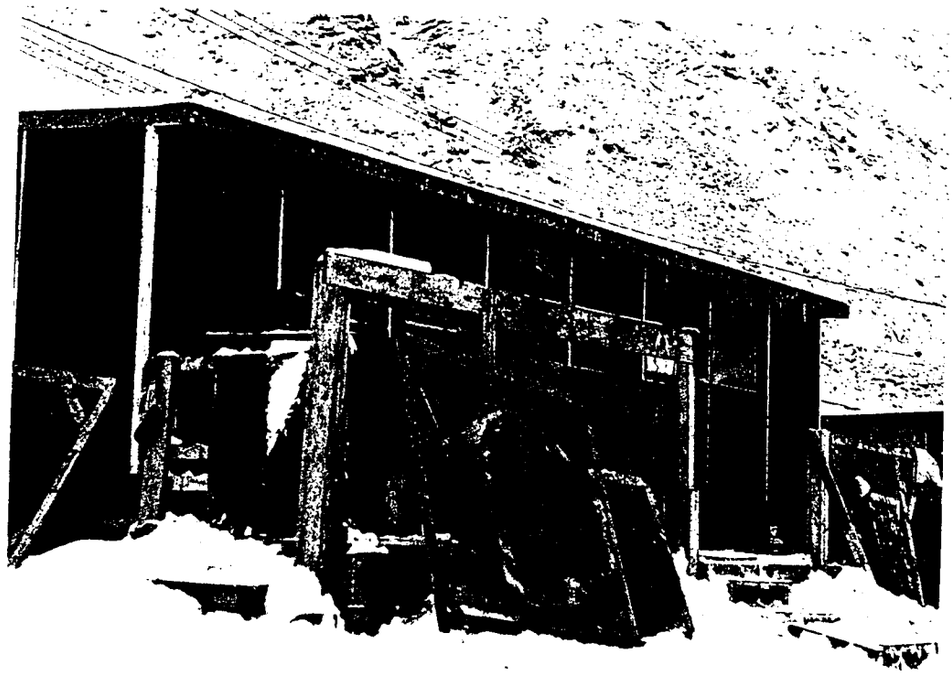
pressure-control equipment at the wellhead on the sea floor. The wellhead equipment restricts oil to within the drilling system and prevents a blowout from occuring. We have conducted detailed studies on drilling technology, including drilling fluid handling and wellhead disconnect procedures; countermeasures techniques; potential effects on the biological regime; and simulated oil trajectories from a hypothetical blowout at the Dundas K-56 site.

We have gathered information on oil spill countermeasures and cleanup techniques and equipment suitable for use in Lancaster Sound. Our research includes modelling the movement of spilled oil and the study of spilled oil characteristics; oil and ice interaction; equipment resources including booms, skimmers, dispersants, igniters and burners; equipment sources; equipment mobilization and countermeasures strategies; and spill monitoring. Environmental conditions influencing countermeasures response have been determined. An effective oil spill response will require the training of personnel and mobilization of equipment by both the operator and by government. The availability y of oil containment, cleanup and disposal technologies which are effective under arctic conditions, a knowledge of oil behaviour combined with our research into the dynamics of the physical environment provides the foundation for effective countermeasure procedures.

We are striving to supplement accepted safety procedures. To this end, we will establish a dedicated Safety Team. Members will receive advance training in emergency and safety procedures and will organize our Contingency Plan based on a knowledge of regional physical and biological characteristics. Light-to-medium duty oil spill equipment will be installed on-site and at the base camp. The Team will also be able to call on larger, remotely-located equipment. In the event of an emergency, the Safet y Team becomes the Emergency Task Force to coordinate company actions.

Drilling will be concluded at a date permitting sufficient time for a relief well to be drilled during the same open-water season. If adequate time is not available to complete Dundas K-56 to the required depth as a result of interruptions (to avoid icebergs for example), the drilling program will be suspended until the following year.

In addition to our own oil spill contingency actions, the federal government responds to oil spills. Adequate time is available in



Jeff Pallister

The seal is an important food and cash-crop in the area. Ringed seal is a year-round resident in eastern Lancaster Sound and western Baffin Bay. It is widespread in the region, its specific distribution and abundance largely determined by ice conditions. The winter population in the area is believed to exceed 500,000 animals.

advance of the 1985 drilling season for government preparation of a complementary countermeasures strategy.

Looking beyond the exploration phase, possible sub-sea production systems for use in Lancaster Sound have been evaluated. The two main environmental factors affecting the choice of production systems are the deep water and the ice cover. Our eventual development scenario depicts a sub-sea completion system producing via sub-sea pipelines to a shore processing facility, with oil delivered to market via an icebreaking oil tanker transportation system. Proceeding to a detailed design of production and transportation systems depends on oil being discovered by exploratory drilling. The installation of these systems would be subject to further study, and thorough technical, social and environmental review. Environmental impact assessments, formal hearings and a detailed appraisal of production and-transportation plans would be undertaken. Even with good geological results, oil production would not commence for at least ten years following the first exploratory well.

Environmental Protection

Environmental protection is a complex matter, and a great deal of study and analysis has been dedicated to this region in recent years. Research results relevant to Lancaster Sound drilling are listed in the Appendix of this *Summary*. We have reviewed the physical and ice environment of the Lancaster Sound region, including meteorology, water properties, surface and near-surface circulation patterns, sea-ice distribution and movement, and icebergs. Our research on the biological environment includes studies of plankton, fish, marine birds, and marine mammals. Analysis of the physical and biological environments also includes identification and descriptions of land and resource utilization by residents, the histories and economies of local settlements, resource harvesting, and ecologically unique or important areas.

The potential environmental impacts associated with exploratory drilling in eastern Lancaster Sound have been evaluated. The studies describe anticipated effects on land and resource utilization, direct impacts to wildlife from routine operations and the possible consequences of a major accident resulting in an oil spill. Effects are both direct and indirect, such as death, alteration of food chains, and disruption of wildlife harvesting. In each

The base camp will be located near the Nanisivik mine site on Strathcona Sound, pictured above. The presence of an existing airstrip, dock site, town site and communications network means that few additional facilities will be required.

case, the proportions of species which could be affected were estimated. Also, the species' ability to recover and the time required for recovery were estimated. A preliminary indentification of the potential environmental concerns from production and transportation systems has been made.

Normal operations entail the discharge of wastes and introduction of noise associated with drilling vessel, standby/supply ships and aircraft movements. Galley and sewage wastes, properly treated and disposed, will have no noticeable effects on marine life. The settlement of drilling mud and well-bore cuttings will temporarily disrupt the ocean-bottom habitat. Mud and cuttings will be diluted, thus having no damaging toxic effect. With the observance of aircraft routine restrictions, bird colonies will be protected from noise effects. It is unlikely that marine mammals will be affected by the noise or presence of the drilling vessel.

Operations of the base camp will not result in disruption of environmental processes. The facilities will be located near the Nanisivik mine site, an area of semi-vegetated rocky uplands, which supports habitats of poor quality. Existing facilities will be used wherever possible.

After drilling operations are completed, it is possible that wellhead equipment will remain on the sea-bottom. Being at a depth of 765 metres of water, it will not interfere with sea life or the passage of vessels and may itself support new habitats in the future.

Of all the possible consequences of exploratory drilling, a sub-sea blowout of oil would have the greatest impact on the biological environment. The anticipated environmental damage resulting from an uncontrolled oil blowout is described in RMP Support Documents. We have established the steps which will be taken to deal with an accident of this type. In order to assess the environmental damage from a hypothetical oil well blowout, spill trajectory models were generated to simulate the fate of discharged oil reaching the surface. These data were used in oil spill scenarios to provide information on how equipment could be mobilized in a countermeasure response.

In the following summary of findings, "significant" impacts mean that the numbers of individuals of a species or group killed cannot be recovered by normal reproduction within several generations. The assessment also assumes that no effort is made

to contain or clean up the oil. As countermeasures actions would be taken, actual environmental damage from a sub-sea oil blowout would be expected to be less than described.

Certain seabirds could be significantly affected by a blowout. Losses of at least 109i0 of local populations would expected for many species. Northern fulmars, thick-billed murres and black-legged kittiwakes would be incapable of recovering to their present numbers in the Lancaster Sound region. Eiders would be significantly affected. Impacts on other species, such as oldsquaws, gulls, dovekies, and black guillemots, would not be significant.

Some 370 to 12 % of eastern Arctic populations of narwhals could contact oil from a blowout. This would not cause widespread deaths, and less than 1% of the animals would be expected to suffer effects which might reduce their reproductive output.

No significant damage would be expected among white whale, walrus, harp seal, ringed seal, bearded seal, and polar bear populations. Although fouling of baleen might occur, little is known about the effect of oil on bowhead whales. Marine mammals and birds could suffer stress, which, while not fatal, could make the animal more vulnerable to other dangerous situations, reduce reproduction levels, or affect their food supply.

The economies of the communities in the region are heavily reliant on the harvesting of local marine resources. As few narwhal would be expected to contact oil, there would not likely be any reduction in the ability of Inuit hunters to reach their quotas. Similarly, few ringed and bearded seals would contact oil from a summer blowout. Others would be exposed if a blowout continued through the winter. Should seals or polar bears become oiled, the commercial value of their pelts would be reduced. No significant effect would be anticipated on white whales, walruses, harp seals or hooded seals — mammals taken irregularly by hunters.

It is possible that the numbers of birds and birds' eggs harvested would be reduced. These are not, however, an important component of the communities' economies or food supplies. Arctic char, an important food resource, is not expected to be greatly affected. The worst case would be that of some fish being tainted with oil.

While the possible effects of an uncontrolled sub-sea blowout are very serious, even in the worst instance, damage would not reach "catastrophic" proportions, or result in the destruction of all biological life, as has sometimes been perceived. The projection

indicates that among the full complement of vulnerable species, the major damage would be to subtidal benthos and three types of seabirds, which in the long-term may not be restored to existing numbers in the region.

In recognition of the potential impacts of a blowout, existing safety and countermeasures standards will be met, and exceeded where appropriate. Beyond our preparations to prevent a blowout from occurring, the priority in the event of an accident is to contain and cleanup any pollutants introduced into the environment before they can do the damage described. Equipment and techniques to manage arctic offshore drilling operations have advanced a great deal in recent years, and a countermeasures program based on these advances will be in place to reduce possible losses.

Our conclusion is that routine operations will result in an insignificant impact to the environment. Should a blowout resulting in an oil spill occur, significant impacts would be restricted to subtidal benthos and three, or possibly four, species of birds. As well, steps can be taken to control the effects of oil, potentially reducing these impacts.

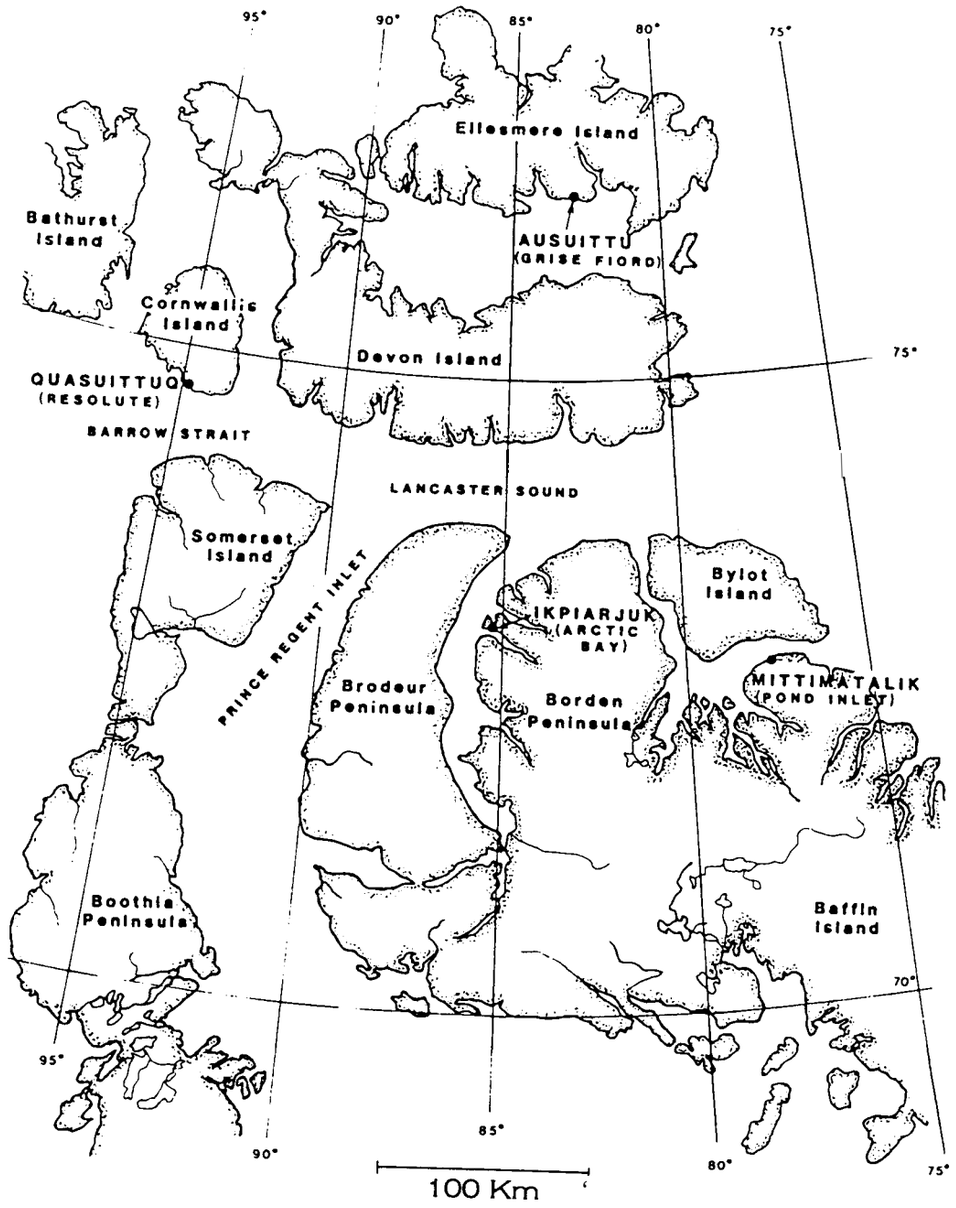
Social and Economic Impacts

For many centuries Inuit, and before them the Dorset and Thule people, have lived from the lands and waters of the eastern Arctic. Interaction with European explorers, whalers and fur traders resulted in income and material goods being obtained in trade for products from hunting. By the 1950's, the Government of Canada took an increased interest in native northerners and national social programs were instituted, including the relocation of Inuit in settlements.

Although Inuit continue to draw food and materials for clothing and shelter from the land, they are tending to spend less time hunting and are becoming more dependent upon southern goods and services. As a result, their livelihoods are increasingly linked to a monetary economy.

Abroad social and economic concern among the Inuit is whether local and territorial residents will receive benefits from development comparable to national and private interests, and whether these benefits outweigh the risks being taken.

Recognizing this concern, we have formulated policies and are proposing specific actions based on our perception of the attitudes



The communities near Lancaster Sound include Resolute, on Cornwallis Island to the west; Grise Fiord, to the north on Ellesmere Island; and Arctic Bay and Pond Inlet, on Baffin Island to the south-west and south-east, respectively, Statistics Canada 1981 estimates showed a regional population comprised largely of persons under 20 years of age, with persons between 20 and 54 making up about 4070 of a combined total population of about 1600.

and aspirations of our hosts. Since it is very important that these perceptions be as valid as possible, we have solicited advice on our social and economic plans from local residents. CMO representatives have visited Pond Inlet, Arctic Bay, Grise Fiord and Resolute several times in recent months to discuss the project with residents.

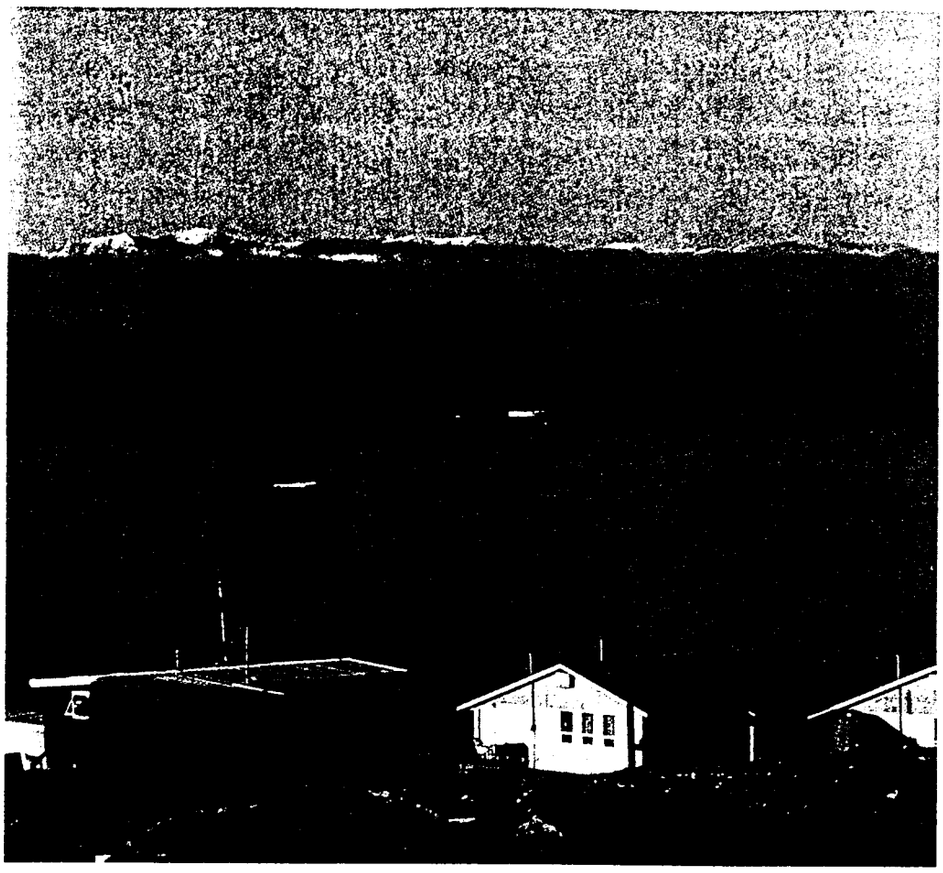
We have talked about ways of directing economic benefits from oil and gas exploration to the region. Our intentions and limitations have been described, in order that realistic, mutually-acceptable practices can be developed. The primary goal of our social and economic program is to encourage the local acquisition of new skills and facilities which have applications to long-term community needs.

A CMO Northern Seminar was held in Pond Inlet in September, 1983 to increase the rapport between CMO and the Lancaster Sound residents and to investigate the ways and means by which local residents could become meaningfully involved in our activities. Emphasis was placed on practical and tangible concerns of local people and attempts were made to solve certain of these concerns. The proposed drilling program was only one of four agenda items – the discussion concentrated on communications, the proposed 'Resource Centre', and community involvement in decision-making.

Canadian and northern benefits must be provided from petroleum projects. Although the nature and extent of these benefits can be shown in the long-term, some limitations exist in providing such benefits with a short-duration single exploratory well. For a single-well program we feel that efforts are best directed to related activities which result in local growth and benefit of enduring value. These activities may not be directly related to the project. As well, emphasis has been placed on reducing any possible adverse effects associated with a sudden lifestyle disruption in the local communities. In the long-term, should the petroleum potential prove to be commercial, significant long-term benefits are possible from Lancaster Sound hydrocarbon development.

Short Term

Few, if any, land-use conflicts will occur as a result of petroleum exploration activities interfering with wildlife harvesting by local residents. Land-based support activities will be restricted to relatively small harbour and land storage areas. Several facilities already exist at Nanisivik.



We appreciate and support the concerns of the Government of the Northwest Territories and local residents for orderly and beneficial northern development, and have established related CMO policies respecting the performance of *our activities in the Lancaster Sound region.*

Offshore exploration and development will not have much effect on the magnitude of alcohol and drug abuse, if basic precautions are taken. Drilling contractors generally maintain "dry" camps and are very strict in keeping alcohol and drugs out of operations and the neighboring communities.

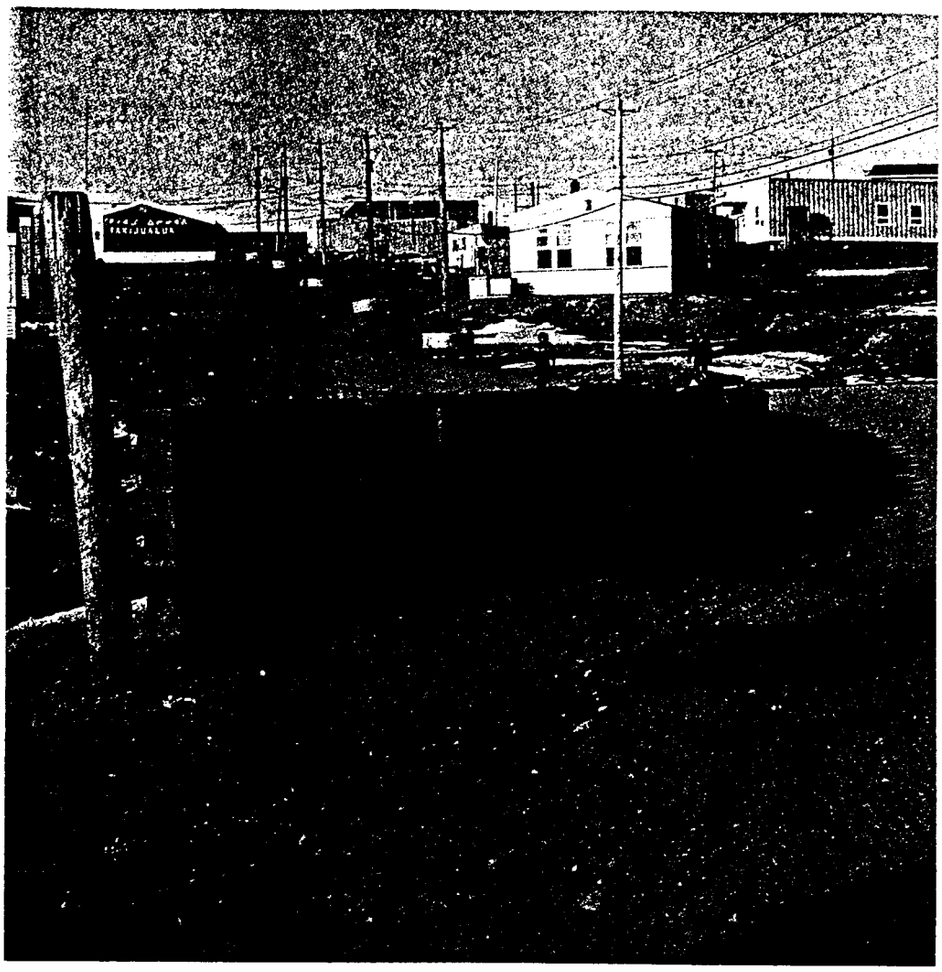
A possibility exists that employment of area residents could contribute to family breakdown. Every effort will be made to minimize this problem through counseling and adjustment of the work periods when an employee is away from home. It is more likely that family and community ties may be strengthened as a result of young people having a productive occupation to pursue.

Some people believe that the availability of wage employment for native people contributes to cultural weakening, as it tends to take them away from their traditional way of life. Others say that basic cultural ties can be improved through regular wage employment, since it provides funds to hunt and trap more effectively. We are aware of these possibilities and are consulting with local people to ensure that the exploration activities are carried out in a way which recognizes local cultural needs.

An increase in the population of local communities is not expected to result from exploratory drilling operations. Priority will be given in training and hiring to Lancaster Sound residents interested and capable of working on the project. Other employees brought in from southern Canada will be accommodated in camps and aboard ship, and returned home when their shift is completed.

In some areas experiencing rapid economic development, there have been instances where shortages of goods and services arose, causing some hardship for local residents. Local purchases for our operations will be carefully monitored to ensure that local residents have first priority for goods. As our purchases grow, local consumers could enjoy a wider range of choices and lower prices.

Although over 125 wells have been drilled in the Arctic Islands and inter-island waters, with north Baffin and other northern residents working on a number of the rigs, many local residents are naturally concerned about future regional social, economic and environmental effects. They tend to view resource exploration and development activities with a blend of anticipation and apprehension. The practical social and economic components of the RMP facilitate a mutally-effective offshore exploration program



Jeff Ramsay

The livelihood of the Pond Inlet people is largely resource-based, including hunting, fishing and trapping. The animal harvest has been estimated to provide each hunter with meat valued at $5,788 (1980) if bought at stores in Pond Inlet.

through the cooperation and involvement of local residents. Issues which we have examined include participation, local risk, conservation, environmental protection and northern benefits. Several actions are proposed to help residents achieve their social and economic goals, be aware of our activities, participate in opportunities, and resolve their concerns and apprehensions. These proposed actions are currently being refined through consultations with residents and government planners.

Long Term

As operations are limited to the summer season for many years to come, the exploration and development of Lancaster Sound oil and gas resources will proceed very slowly and on a smaller scale than other frontier areas. This will permit the involvement of northerners on a graduated and progressive basis, while providing important information for land-use and energy planning.

Should an oil field proceed into production in the years ahead, the location of offshore production equipment and transport routes would be of concern. We will work with local groups, government land-use planners and others to minimize any resulting disruptions.

Northern benefits consist of training, employment, local purchasing and support to community projects. The oil industry has demonstrated its ability to institute these programs. For a successful training program, suitable candidates are selected on the basis of motivation, interests, curiosity and learning history. Awareness of careers gradually develops from these factors and the increase in public esteem or respect resulting from training.

The discovery of oil would, in the long-term, result in significant added opportunities for local residents, including both professional and vocational employment opportunities. Development would provide an impetus for upgrading and initiating educational and training facilities.

We support the idea of promoting resident-controlled projects of use to the communities which will be economically viable after petroleum development activities wind down. Practical long-term business concepts exist, including resource-based businesses, commercial fish harvesting, wildlife ranching and commercial harvesting, public works and support services, and export-related businesses.

The people in this area have a way of life *based mainly on their traditional harvesting of local natural resources, which is now balanced with the use* of *modern technology and interaction with social and community institutions. Local residents have often expressed the desire to utilize the benefits* of *technologically advanced society, while maintaining as much traditional heritage as possible. Not unnaturally, many want the best of both worlds and are striving hard to achieve 'this objective.*

Fulfillment of long-term community needs entails a lengthy process of mutual education. As a tangible step towards this objective, we propose that a 'Resource Centre' be established in the region, most likely in Pond Inlet. Numerous functions have already been suggested for the Centre. As a library, the Centre could provide residents with ready access to reports, maps, photographs and other information and services. CMO personnel could, through the Centre, provide assistance and advice regarding community business development proposals related to oil exploration activities as well as talk about offshore exploration activities. The Centre's functions would not be limited only to CMO activities. Translations of resource documents could be made as required through the Centre. The Centre could provide training and participation in research activities, evaluate resource projects, identify research requirements at the local level, provide information exchange, perform contract research, sponsor students for further education and acquaint southerners with northern ways. At the present time, discussions between CMO and the community are continuing and no decision on the establishment of the Centre has yet been made.

Associated with hydrocarbon exploration development are numerous policy directions established by governments. Policies of particular importance are the National Energy Program, the provisions of the *Canada Oil and Gas Act* respecting Canada benefits, land use planning, environmental protection, and policies related to native land claims. The federal government has taken a progressive stance in furthering northern development. Based on the concept of "balanced development", government is striving to meld national and regional interests in northern development. This policy represents a formula promoting gradual development, while accommodating national energy policies, protection of the environment and the provision of benefits for northern residents.

Production from an oil field has direct financial benefits to CMO, governments, suppliers and their employees. Governments would receive funds through participation, royalties and taxes. Suppliers would benefit from providing materials and services. We will ensure that Canadians are given a full and fair opportunity to compete in providing goods and services.

Jeff Pallister

Practical long-term business opportunities addressing community needs exist. The selection, development and reappraisal process respecting individual proposals will require ongoing consultation, experiment, and dedication on the part of those involved. Possibilities include resource-based businesses, such as tourism and commercial wildlife harvesting; community-based businesses, such as language and cultural services; and industry-related businesses, such as environmental monitoring and heavy equipment maintenance.

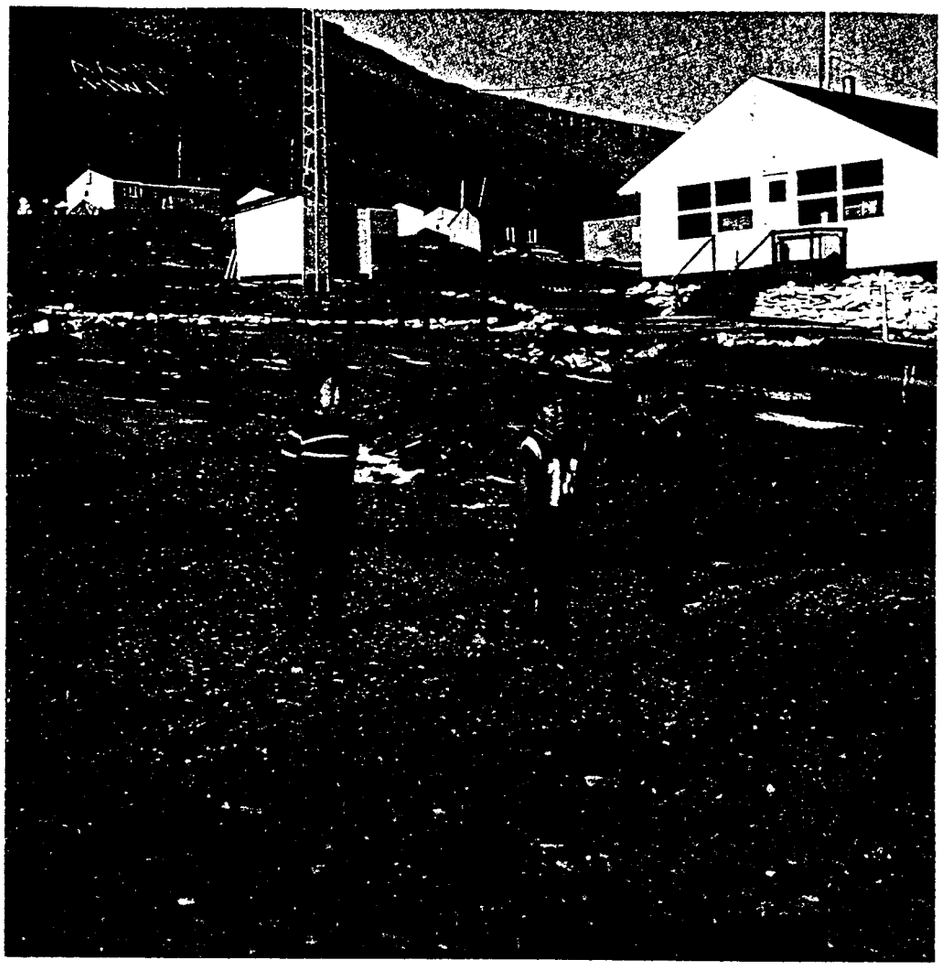
Government and industry have made large commitments to northern exploration over the next five years. With oil discoveries, a wide range of development and production-related benefits will flow to both northern and southern Canada. As stated by the Minister of the Environment, "Resource development projects north of 600 will have a considerable impact on the national economy — particularly on the degree of energy self-reliance Canada is able to achieve. Moreover, they offer the promise of a powerful stimulus for the nation's manufacturing, service and high-technology industries, and present the prospect of new jobs for southern Canadians. All Canadians therefore, will be affected by the course of the northern enterprise." (DOE, Discussion Paper, July, 1983)

Regional Planning

Land-use planning is defined by DIAND as a "systematic process of decision-making relating to the conservation, development, management and use of land. One purpose of planning is to "seek to resolve and minimize competing demands or land-use conflicts." In the Lancaster Sound region, planning is expected to evolve as a cooperative effort by the federal and territorial governments, the regional Inuit organizations and local residents.

As we are committed to enhancing both the productivity and conservation of northern lands, as well as the welfare of northern residents, we are prepared to assist government land-use planners in the performance of their tasks. With the conclusion of the Lancaster Sound Regional Study, and the consummation of related, northern land-use and conservation plans, a regional and territorial planning mechanism is being initiated. A knowledge of the oil and gas potential of Lancaster Sound is vital to effective local land-use planning, to strategies for regional economic development, and to national energy planning. With this knowledge and effective planning, the national interest and the interests of private sector investors can be realized in harmony with regional and local interests.

Regional planning also relates to such considerations as native land claims, territorial resource revenue-sharing, constitutional devolution and territorial partitioning. Although policy and legislation in these areas are outside the mandate of industry,



In Arctic Bay, barring major population shifts, the labour force, according to Statistics Canada 1981 estimates, will grow from 155 in 1981 to 230 in 1991, and 310 in 2001, a 100 % increase over 20 years.

CMO activities are complementary to these initiatives in terms of economic and social development.

Lancaster Sound residents have clearly stated their social and economic goals. While recognizing that there are differences of opinion among residents, we have learned that the people share certain aspirations for the future:

- to maintain balanced economic development
- to encourage traditional Inuit lifestyles
- to protect wildlife resources for future generations
- to participate in resource development decisions

Through the land-use planning process these aspirations will be integrated with the responsibility of developing northern resources for the benefit of all Canadians. Respecting the need for this dynamic balance, the Baffin Region Inuit Association prepared a set of tentative planning principles which address:

- Maintenance of biological productivity and environmental quality
- Interrelationships between biological, technical and social concerns
- Integrated environmental management
- Rights and responsibilities of northern residents
- Protection of specific areas
- Regional and long-term management
- Accident prevention and mitigation of environmental damage.

While we have endeavored to incorporate these objectives into our planning, the RMP is based on the premise that regional planning needs to proceed in tandem with industrial projects. The gradual pace of the CMO project does not interfere with the concurrent implementation of the broader northern policies being determined by DIAND, the GNWT and territorial residents. We appreciate that, while petroleum-related activities are an important component of regional planning, exploration drilling is only one of the "development" possibilities in the Lancaster Sound region which have been evaluated by government planners and local residents.

Our future communications plan consists essentially of listening to the concerns of Lancaster Sound residents, responding to those concerns and providing information. Through this consultation, we will draw upon the experience of *residents and incorporate their advice into our operations plan.*

Planning is an ongoing process. A 'best plan' will need to accommodate timely decisions which recognize changing situations. Careful study of development plans is required if regional planning and industrial projects proceed concurrently. Through the Resource Management Plan, we have provided information respecting our project to assist planners, and we will continue to do so in the future.

Jeff Pallister

A 'Resource Centre' is proposed to be established in the north Baffin region, to provide scientific information and to assist residents in their local economic development goals. A 'Regional Information Committee', comparable to the successful Beaufort Sea Community Advisory Committee in the western Arctic, is an alternative for implementation of communications programs with the Lancaster Sound communities. Such a Committee would logically function on a relatively small scale during the planning and execution of the first exploratory well.

Proposal to Drill in 1985

A key step required at this time in deciding how the resources of Lancaster Sound will be managed is to determine the nature and value of the potential petroleum resources. Information on the geology, not instant oil production, is our first priority.

We have assembled a team of management personnel and consultants who are prepared and able to proceed with this important geological evaluation. Proceeding to negotiations for an Exploration Agreement will enable us to maintain both our organization and momentum.

Following receipt of an Exploration Agreement, further research will be conducted and preparations will be made for drilling.

During a recent CMO seminar, leading scientists and industry personnel reviewed the draft RMP and Supporting Documents for accuracy and completeness. Participants identified additional site-specific information requirements and formulated a Project Development and Research Plan.

The Project Development and Research Plan consists of a description of programs which will be carried out prior to the commencement of exploratory drilling, concurrent with drilling, and during subsequent phases. It includes:

- Multi-disciplinary integration of oil spill related information
- Iceberg 'down-time' estimate improvement
- Ongoing refinement of the Contingency Plan
- Possible establishment of a northern 'Resource Centre'
- Founding a base camp environmental forecast facility
- Development of a sea ice and iceberg monitoring, detection & avoidance system
- Preparation of shoreline sensitivity maps
- Initiating environmental and social monitoring programs
- Establishment of a liability and compensation policy
- Participation in underwater acoustics studies
- Study of sub-sea production systems and shore facilities.

The specifications of environmental safeguards and technical operations are included in the RMP and its Background and Support Documents. While these satisfy the defined requirements,

additional data, not exclusively related to environmental hazards or safety of operations, will be gathered as the field program is organized and carried out. Sound economic reasons compel us to constantly improve upon working standards. We will continue to refine our plans and to consult with involved parties.

Among the numerous actions to be taken in preparation for drilling are the following:

- Weather, wave and ocean current monitoring and prediction systems will be installed.
- The base and communications systems will be made functional.
- Existing regional data on sea-ice and iceberg movement will be supplemented with a site-specific research programme.
- Our public information and communications program will be expanded.
- The specific extent of operator liability and compensation obligations will be determined through consultation with the responsible authorities.
- Training programs for interested northern residents will be organized.

Dundas Plan Schedule

The short-term plan is to drill an expendable stratigraphic test well, Dundas K-56, in 1985. A time schedule for the drilling of this well and operational and environmental-protection procedures is described in the following Dundas Plan schedule.

Recent Events

October 1982 — The CMO *Response* to the Lancaster Sound *Green Paper* was submitted to the *Green Paper* Study Group, the Minister of the Department of Indian Affairs and Northern Development, The Minister of Energy, Mines and Resources, and the Government of the Northwest Territories.

November 1982 — The *Response* was distributed to government departments and agencies, associations and the interested public.

December 1982 — Copies of the *Summary* of the *Response* in Inuktitut were provided to the Community Councils of Pond Inlet, Resolute, Grise Fiord, Arctic Bay, and Clyde, and native organizations.

January 1983 — Several leading consultants were engaged to prepare and analyze state-of-the-art research, for integration into a *Resource Management Plan* for hydrocarbon development in Lancaster Sound. Progress was communicated to the local communities.

An *Outline of the Contents of the CMO Resource Management Plan* was widely distributed to interested parties in English and Inuktitut.

February 1983 — Meetings were held with officials of DIAND, COGLA, the GNWT and native organizations to discuss the contents of the *Resource Management Plan* and the *Dundas Plan*.

March 1983 — A draft of the *Introduction* to the RMP was distributed to Lancaster Sound residents. Further discussion took place between CMO and community residents.

May 1983 — The RMP *Introduction* in English and Inuktitut was disseminated to interested parties.

June 1983 — The draft RMP was presented to the Green *Paper* Workshop in Pond Inlet and to other interested parties, supported by a detailed Background Paper to the CMO Workshop presentation in English and Inuktitut.

CMO conducted the RMP Consultants Seminar, bringing together leading social and scientific experts to evaluate and criticize the RMP.

August 1983 — The *Resource Management Plan* was submitted to DIAND, DIAND land-use planning agencies, the Government of the Northwest Territories, and provided to other interested parties.

September 1983 — The final report of the Lancaster Sound Regional Study, by Professor Peter Jacobs, was provided to the Minister of DIAND.

The CMO Northern Seminar was held in Pond Inlet.

Future Events Anticipated by CMO

December 1983

The Minister of DIAND announces his policy direction for the range of land uses in the Lancaster Sound region, and authorizes CMO to proceed to Exploration Agreement negotiations with COGLA.

January 1983

CMO submits a 5 year exploration plan to COGLA, beginning negotiations for an Exploration Agreement.

Resource Centre established in the north Baffin region, subject to further discussion with local residents.

CMO ongoing research and project development programs are mobilized, concurrent with community consultation as to progress, local concerns and involvement.

February 1984

CMO concludes an Exploration Agreement with COGLA and provides COGLA with Notification for Intention to Undertake a Drilling Program.

CMO employment and training programs for northern residents commence in preparation for the 1984 summer field program.

A drilling operator is established, likely through a contractual or farmout agreement with an experienced operator, to conduct drilling under CMO direction.

Negotiations commence to contract a suitable drillship, support vessels and aircraft.

April 1984

CMO submits an Application for Drilling Program Approval.

CMO establishes a dedicated Safety Team to research and establish safety and countermeasures procedures, equipment procurement and personnel training.

May 1984

CMO receives Drilling Program Approval and applies for Authority-to-Drill-a-Well.

Physical environment monitoring, communications and base camp facilities are established and tested during the 1984 summer season.

November 1984

A final detailed operational and contingency plan, inclusive of specific assurance of same-season relief well capability, is submitted.

December 1984

CMO receives an Authority-to-Drill-a-Well for Dundas K-56.

All contracts for drillships, support vessels, helicopters, fixed wing aircraft, standby rig and base camps are finalized.

April 1985

CMO occupies the base camp, re-testing facilities and systems. All equipment and personnel are mobilized in accordance with their relevant time schedules.

July 1985

The drilling vessel and support craft arrive on site and operations commence, ice conditions permitting.

August 1985

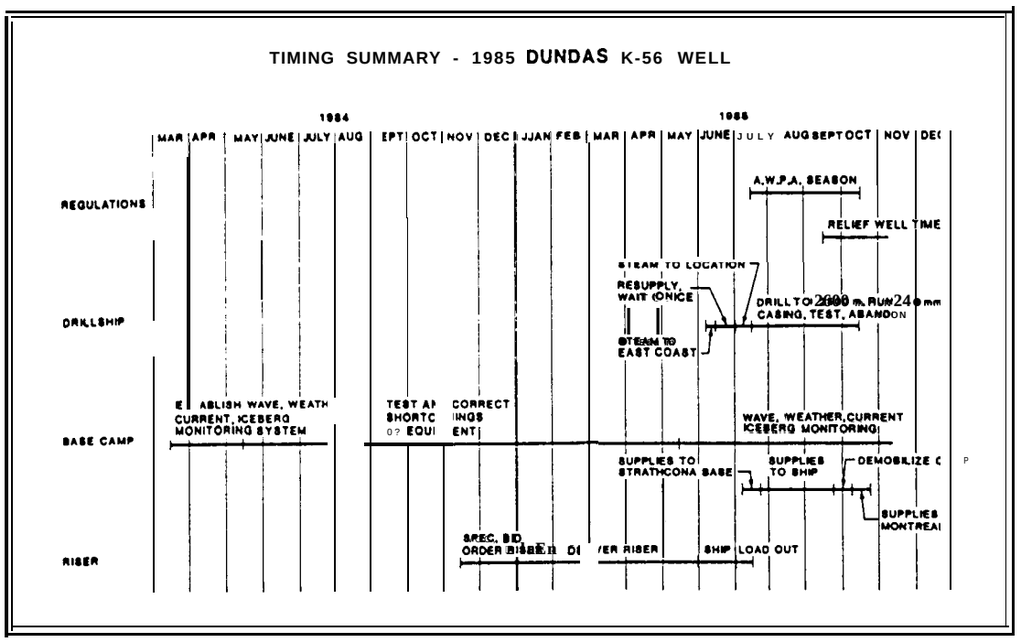
Drilling is complete to total depth at 2435 metres below the sea floor; the well is logged, cased, and testing commences.

September 1985

Testing is completed, the well is plugged, abandoned and the rig is released.

October 1985

The drillship and support vessels return to the south and the base camp is demobilized.



Field Development

Exploration and development activities beyond the first exploratory well have been projected. These activities are based on present geological assumptions and an understanding of the future Canadian oil market, as well as technological capabilities, and anticipated governments' review and approval processes. Some events **can** be controlled by ourselves; others are the result of natural factors such as reservoir characteristics. Without any drilling having yet taken place, the figures in the following tables are preliminary estimates only. The objective of this tabulation is to provide a broad timing scenario for possible Lancaster Sound field development.

Each of the following tables of assumptions establishes parameters, as fair, good and excellent cases. 'Geological results' refers to the presence, quality, and producibility y of an oil reservoir. This timing projection treats **1969,** the year the lands were acquired, as year 1.

Time Required for Each Phase

YEARS

	- Geological results -			
	Poor	***Fair***	***Good***	***Excellent***
Activity				
Pre-drilling phase	16	16	16	16
Exploration drilling	6	8	4	2
Delineation drilling	o	5	3	2
Development and Production Phase	o	29	27	26
Total	22	58	50	46

TIME INTERVALS

	- Geological results -			
Activity	*Poor*	*Fair*	*Good*	*Excellent*
Pre-Drilling	1969-1984	1969-1984	1969-1984	1969-1984
Exploration Drilling	1985-1990	1985-1992	1985-1988	1985-1986
Delineation Drilling	none	1993-1997	1989-1991	1987-1988
Development Drilling	none	1998-2010	1992-2002	1989-1998
Production Phase	none	2003-2026	1997-2018	1994-2014

The first Exploration Agreement will require only one well during the first five years (1984-1989).

Number of Wells

This table details the number of wells expected to be drilled during each phase of the Dundas program. The development phase indicated refers to the drilling of production wells and installation of production facilities.

NUMBER OF WELLS DRILLED

	- Geological results -			
Activity	*Poor*	*Fair*	*Good*	*Excellent*
Exploration phase	2	5	3	2
Delineation phase	o	6	4	3
Development phase	o	65	55	50
Total	2	76	62	55

WELLTYPE BREAKDOWN
(Good Geological Results):

Assumes year-round production with subsea completions and gathering, producing to **a** shore processing facility, on the basis of "good" geological results.

Exploration Wells Abandoned	3
Delineation Wells Completed to Production	4
Production Wells	9
Water Injection Wells	11
Gas Injection Wells	5
TOTAL WELLS	62

The results of the first exploratory well will indicate whether additional wells **are** justified. Encouraging results do not necessarily mean that oil is discovered. The chance of a discovery with a first exploratory well **is** statistically small. Through geological samples and drill **cores a well may,** however, indicate that the explorer is very 'close' to a reservoir. The first well can show where a second should be drilled in order to locate **an** oil-bearing reservoir. If an **oil discovery is** made, plans would almost certainly be forthcoming **to drill** delineation wells. Dundas K-56 is being drilled on the flank, rather than the top, of the structure. As a result, chances are increased that, while providing critical stratigraphic information and potential reservoir area, the well will be a dry hole.

Between three and six delineation wells will be required to determine the extent of the reservoir after exploratory drilling shows oil to be in place. This phase might be commenced in 1987 and finished in 1988, with all required information gained from three wells. If four or five exploration wells are needed to find oil, then this delineation phase might not begin until 1993, running though 1997, and requiring six wells.

Activity would be accelerated somewhat in the development and production phase, which includes the drilling of production wells, water and gas injection wells (wells used to pump water and natural gas drawn Up with the oil back into the ground, keeping reservoir pressure up and conserving the gas for possible production) and the installation of production and transportation-related equipment.

The development phase could begin as early as 1989, or as late as 1998, depending on the results of exploration and delineation drilling. In total, between 50 and 65 development wells would be drilled, over a nine to twelve year period.

Over the first five to eight years of this phase the first production wells would be supplying oil while additional production equipment is being installed and additional development wells are being drilled. Subject to economics, production could begin with as few as four production wells and two injection wells being drilled. The earliest anticipated date of production is 1994, assuming excellent geological results are achieved. Under good or fair geological results, production would be expected to commence between the years 1997 to 2003.

Each well drilled will be subject to individual review and approval by COGLA. Prior to the development and production phases commencing, a significant amount of additional research, analysis and review will be required.

Conclusions

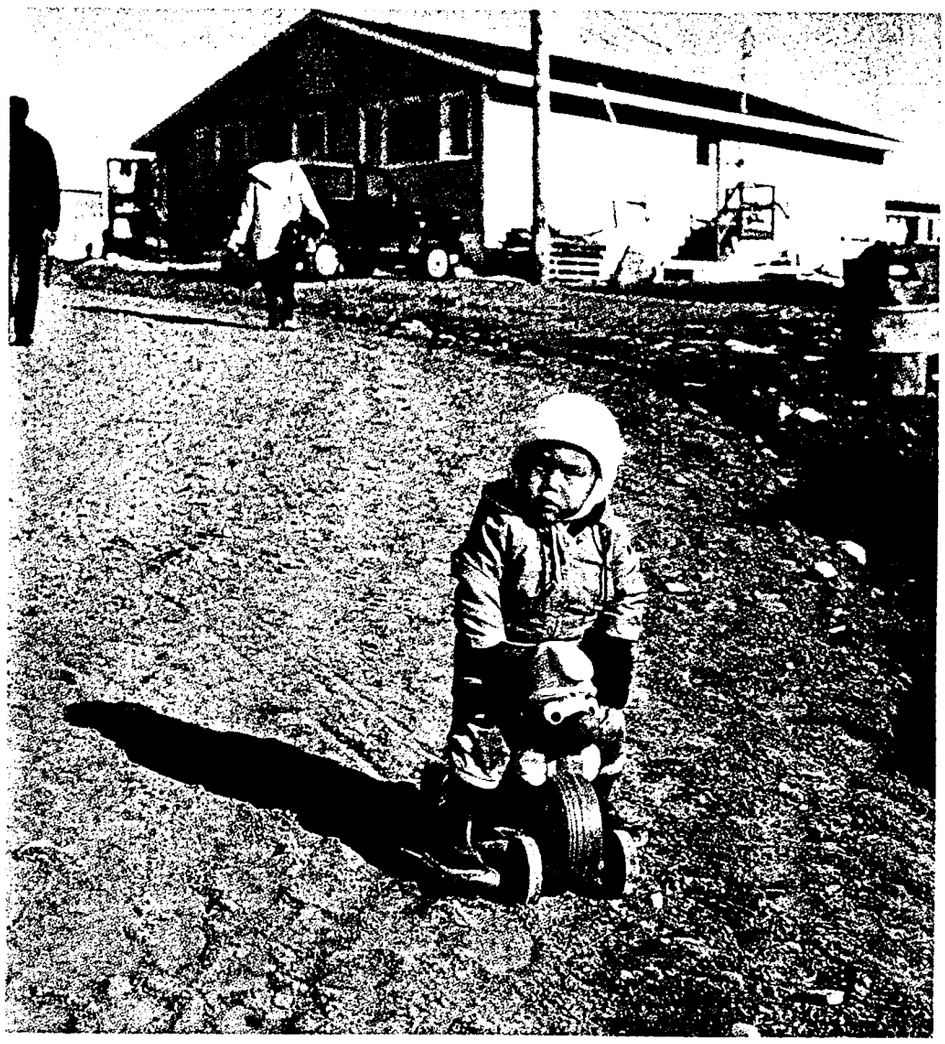
We have been engaged in northern petroleum exploration and research since the Magnorth shareholders obtained permits in 1968 and 1969. Our progress has been slow as the result of a lengthy series of reviews, hearings, studies and deferrals. During these proceedings we have refined our plans and responded to governments' and public evaluation and criticism. We acknowledge the value of the review process and recognize an ongoing program of biological, social and technical research as an integral part of field operations.

This *Summary* has been prepared for those who desire a general understanding of our proposal to drill an exploratory well in Lancaster Sound. We have attempted to present this information concisely, yet with sufficient detail to be useful. This book, and the RMP, are written in an informal and candid manner, largely in non-technical language. The material provided consists of factual information, interpretations of an immense data base, and statements of CMO policies.

The Resource Management Plan and Supporting Documents summarized in this book describe our preparedness to explore for hydrocarbons in Lancaster Sound responsibly and safely.

The key points and conclusions respecting Lancaster Sound hydrocarbon exploration and development are as follows:

- The actions recommended by the Environmental Assessment Panel in 1979 concerning the drilling proposal have now been completed. The Lancaster Sound Regional Study Group has recently concluded its work. Major programs of additional technical, environmental and socio-economic research have been undertaken. CMO has incorporated the significant body of new research results into its Resource Management Plan.
- Through a series of community visits and a Northern Seminar, we have discussed our plans with Lancaster Sound residents and have listened to their concerns.
- Our Resource Management Plan has been critically reviewed by northern residents, leading scientists, industry personnel and representatives from governments.
- On technical, environmental and socio-economic subjects, no material inadequacies in CMO studies or plans have been stated.



- Exploratory drilling can take place in the Lancaster Sound region in a safe and prudent manner.
- The sedimentary basin beneath Lancaster Sound is one of the few very large petroleum prospects in the Canadian offshore left untested. One structure within this basin, the Dundas structure, may contain some four billion barrels of recoverable oil. In comparison, the Hibernia oil field has estimated recoverable reserves of 1.2 billion barrels.
- We propose drilling one well during the summer of 1985 in Lancaster Sound to test this structure.
- Sufficient information exists for the Minister of DIAND to affirm that exploration drilling is an acceptable land-use of the region. No additional major studies are required to make this decision. Numerous and intensive studies by government and industry, particularly during the last five years, have been undertaken on land-use, environmental, technical and socio-economic subjects.
- Negotiation and receipt of an Exploration Agreement will enable CMO to maintain its organization and momentum to effectively conduct this important geological evaluation.
- CMOS decision whether to drill additional wells will depend on the geological results received from the first well.
- Geological information obtained from a test well will provide a good indication of the contribution which the Lancaster Sound Basin can make to future domestic energy supplies.
- The exploration of other Canada Lands has, to date, been disappointing. The remaining uncertainty of the economic viability of Beaufort Sea and Hibernia reservoirs place an increased importance on knowing the commercial oil potential of the Lancaster Sound region.
- Abetter knowledge of Lancaster Sound oil and gas resources will make an important contribution to effective local land-use and economic planning.
- In the unlikely event that a blowout resulting in an oil spill occurs, long-term significant damage to the biological resources is limited to impacts on subtidal benthos and to three bird species. Some short-term consequences would be anticipated in commercial wildlife harvesting due to fouling of pelts.

- Few, if any, land-use conflicts will occur between CMO operations associated with exploration drilling, and the activities of local residents. Most of our activities will take place offshore. Establishment of a small onshore base camp and use of existing facilities at Nanisivik will not result in any significant impacts. Possible social and cultural impacts can be mitigated through consultation and mutual education.
- Employment, training and business opportunities will be available to interested Lancaster Sound residents.
- Due partly to seasonal operating restrictions, the CMO exploration program will proceed sufficiently slowly to enable the training and progressive involvement of local residents.
- Should oil be discovered in commercial quantities, significant economic benefits will accrue to all Canadians.

Appendices

1. CMO Resource Management Plan Support Documents

¶ The following section details the CMO RMP Support Documents with brief citations, abstracts and outlines of contents.

1) *The Geological History and Evaluation of the Lancaster Sound, N. W. T. With Specific Reference to the Dundas Structure*
H.D. Daae, Consolidex Gas and Oil Limited, Calgary, 1983.

"The purpose of this report is to summarize the geological history and knowledge of the Lancaster Sound region and to delineate areas that are prospective for oil and gas exploration. The study area 460 kilometres long by 350 kilometres wide. The source of information is data obtained from 6S00 km of offshore marine seismic through the Lancaster Sound and geological field studies conducted by Magnorth Petroleums Ltd. and Norlands Petroleums Limited between 1970 and 1976. An effort has been made to incorporate and to combine into this report all literature on outcrop data as published by the Geological Survey of Canada, other governmental departments and industry together with well information released to the public. At the time of writing, no offshore wells have yet been drilled in Lancaster Sound."

2) *Description and Equipment Inventory of the Proposed Drilling Vessel* [from] *Submission in Support of An Application for Drilling Authority to Drill Norlands/Magnorth Dundas K-56, Lancaster Sound, N. W. T.*
Tri-Ocean Engineering, 1977 (Revised 1983).

"This report contains a detailed description of the proposed drilling vessel, the Pelerin, as to specifications and equipment. This drillship description is transcribed from the existing CMO Lancaster Sound drilling application, An Application for Drilling Authority to Drill *Norlands Magnorth Dundas K-56*. All specifications have been revised to metric units for this edition. The drilling unit proposed for use at tl Dundas K-56 site in Lancaster Sound is the drillship *Pelerin*. This vessel is a modem ship equipped with the latest equip ment and designed to operate in the rough areas of the world. The ship has operated in Canadian waters off the east coast, and has demonstrated its ability to drill in water depths greater than 900 metres."

3) *Northern Development; Federal Policy Directions*
Nordicity Group Ltd., Ottawa, 1983.

This study reviews current federal government policy direction regarding northern development, as a contribution to the preparation of the CMO Resource Management Plan for the proposed development of petroleum resources in Lancaster Sound. The Federal Government has taken a progressive stance in furthering the development of North. Based on the concept of "balanced development" it would like to meld national and regional interests in the development of the North. The stance is prodevelopment. At the moment the settlement of native land claims has the highest priority on the government's agenda because it is central to setting the framework for regional and local development and the involvement of natives in large natural resources projects. Because of the large number of government agencies involved in northern development, project sponsors need to make their plans known early-on to facilitate decision-making."

4) *Local and Regional Issues - Social and Economic Concerns*, CMO *Resource Management Plan*
Boreal Ecology Services, Yellowknife, 1983.

'Boreal Ecology Services was requested to prepare a report on how CMO can relate within northern development planning within the goals of the Government of the Northwest Territories.' The CMO Resource Management Plan for Lancaster Sound outlines in general terms the intentions of CMO. The report that follows will establish the grounds for northern concerns and make recommendations on how best these concerns might be addressed in the plans and proposals advanced by CMO."

5) *Socio-Economic Program for the Lancaster Sound Resource Management Plan*
Dick Hill, Arctech Services Ltd., Inuvik, 1983.

"Although the initial test drilling will involve a drillship for only three months and could have no contact with the Lancaster Sound communities, there are valid concerns over the possibility of large scale industrial developments should there be further exploration programs and the production of oil and gas from the region. The Lancaster Sound Resource Management Plan, including a practical socio-economic component, should facilitate effective exploration programs with the cooperation and involvement of local residents. Hopefully, most Lancaster Sound residents will endorse the initial drilling project when they have had a chance to review and question the Resource Management Plan. The challenge in the Lancaster Sound region - for industry, for government and for local residents - is to develop a mutual trust and turn a situation of 'animosity and uncertainty' to 'understanding and cooperation'. It appears appropriate for the Lancaster Sound test drilling to be ahead as proposed under the federal government's regular administrative procedures involving industry,

all levels of government and local residents. In thissocio-economic study for the Lancaster Sound Resource Management Plan several recommendations are made for discussion with Lancaster Sound community councils and other interested parties.'"

6) *Regional Socioeconomic Benefits, Planning and Policy, A Report to the Consolidex Magnorth Oakwood Lancaster Sound Joint Venture*
Herman Steltner, Pond Inlet Arctic Research Establishment, Pond Inlet, 1983.

"T'he events as observed from Pond Inlet since 1972 in relation to a proposed offshore exploration effort in Lancaster Sound have clearly demonstrated a general omni-directional frustration and consternation that has been caused by a *political* treatment of a technical *complex* and any systematic and preprequisite technical effort appears to have been biased by transient and popular notions. Systematic and methodic collection, analysis and synthesis of experience, knowledge and facts must replace the current peripatetic and transient process. Through such a change, the Public will benefit already by presentation of a clear and understandable concept. – This is the most pressing need at this time because any continuation of the existing review processes will add to the general confusion and lethargy that has been created, and further delays would erode the few remnants left of Government and Industry credibility."

7) *Oil Spill Countermeasures Applicable for Use in Lancaster Sound*
CanOcean Engineering Ltd., Calgary, 1983.

"The purpose of the study is to provide information on countermeasures (oil spill cleanup techniques and equipment) which are available and could be implemented in the unlikely event of an oil spill in Lancaster Sound either from a minor operational spill or a major well blowout spill during exploration drilling. This study does not deal with oil spill prevention methods. The study approach taken was first to review the most recent published reports on the area's environmental data to achieve an understanding of the local conditions and how these conditions would influence a countermeasure response. A countermeasure equipment review was also conducted to determine Arctic equipment developments, new equipment concepts and available equipment and equipment resource centres. The environmental and equipment data obtained were then applied to hypothetical minor and major oil spill scenarios with the intend of informing concerned parties of the available equipment resources and how they could be applied to a countermeasure response in Lancaster Sound."

8) *Petroleum Production From Lancaster Sound, A Study of the Application of Technology to Resource Development*
CanOcean Engineering Ltd., Calgary, 1983.

"The purpose of the study is to provide evidence of the industry's ability to work in deepwater within the arctic conditions of Lancaster Sound, and to provide preliminary information on a conceptual production field development scenario for Lancaster Sound. The report provides evidence of deepwater accomplishments through a historic overview of technology advancements to ever increasing water depths in the areas of platform design, drilling and subsea completion systems, pipelining technologies and field maintenance. The hypothetical development scenario discussed for Lancaster Sound, depicts asubsea completion system producing via subsea pipelines to a shore processing facility and delivers the oil to market using an icebreaker oil tanker transportation system. The development scenario is based on the current trends for deepwater production systems, remcte arctic processing and transportation systems, and on state-of-the-art technology for deepwater developments."

9) Environmental Issues and Impacts Associated with Exploratory Drilling in Lancaster Sound
LGL Limited, Toronto, Ontario, 1983

"This document presents an analysis of environmental impacts that may be associated with exploratory drilling in eastern Lancaster Sound. This report contains, in Chapter 2, an overview of the existing environment in Lancaster Sound. This chapter is not intended as a complete description of the existing environment, but rather it is a brief summary of the summaries presented by Fissel et al. (1981), Marko (1982) and LGL Ltd. (1982). Chapter 3 provides a description of the possible effects associated with exploratory drilling in Lancaster Sound. After an examination of the possible effects of routine drilling activities, there is a detailed discussion of the possible effects from an uncontrolled oil blowout on the biota of Lancaster Sound and an evaluation of the impact of those effects on the animal populations in the region. Effects of a blowout on resouce harvesting and a description of mitigative measures and residual impacts are also presented. The final chapter, Chapter 4, presents a brief summary of the types of environmental effects that might be associated with oil production systems in Lancaster Sound. "

10) *Iceberg Conditions at the Dundas Exploratory Drilling Site: Background and Evaluation*
Arctic Sciences Ltd., Sidney, B. C., 1983.

'The present understanding of iceberg behavior in these areas has been largely derived from data and appreciations attained during the extensive 1978 and 1979 EAMES field studies . . . The results of these programs demonstrated that the bergs in Lancaster Sound enter the region through a usually brief diversion or "intrusion" of the cyclonic Baffin Bay berg flow . . . Systematic and detailed estimates of the above water berg physical dimensions indicated that, in 1979, 90% . . . had masses in excess of 20,000 tonnes . . . the data indicate that the great majority of southward-moving bergs approached the Lancaster Sound area in a broad band cent red some 30 to 40 km east of Devon Island . Site Management Requirements Site Iceberg Conditions Sea Ice Conditions . A meaningful ice management program at the Dundas site must be designed to account for the unique aspects of the drilling area .

11) *Comprehensive Submission Updating Application for Authority to Drill Dundas* K-56 *in Lancaster Sound after Incorporating Applicable Provisions of the Canada Oil and Gas Act*
Tri Ocean Engineering, Calgary, 1983. [Draft 1

"This report incorporates the provisions of the Canada Oil and Gas Act (1982), which refers to the Canada Oil *and* Gas Drilling Regulations. The regulations state the requirements for?ures to be implemented to safely and efficiently conduct a drilling program. These regulations are interpreted as minimum requirements. More comprehensive procedures than those in the guidelines will be implemented, particularly with regard to details of well control, safety and environmental protection. "

12) *Lancaster Sound Exploration Program Dundas K-56 Contingency Plan*
Tri Ocean Engineering, Calgary, 1983. [Draft]

"This Contingency Plan outlines in detail the procedures to be followed in the event of a serious emergency. This manual will serve as a working document for supervisory personnel conducting the drilling and support operations. A safety team will be provided that will form the nucleus of the Emergency Task Force. This team will finalize the details of the Contingency Plan and will be familiar with emergency actions required in any circumstances including oil spill response."

13) Oil *Spill Related Research in the Public Domain at the Arctic Institute of North America- Citations and Abstracts-*
Arctic Science and Technology Information System, Arctic Institute of North America, Calgary, Alberta, at the request of The Consolidex Magnorth Oakwood Joint Venture, January, **1983.**

"These documents are a representative sampling of oil spill research reports available to the public at academic and government libraries. The purpose of this present compilation is to provide an overview of the nature of this research. The reports listed include studies of the biological effects and toxicity of oil in marine environments, the behaviour of spilled oil, and oil spill contingency planning, methods and technology."

14) *A General Bibliography of the Lancaster Sound - Baffin Bay Region.*
Comprised of Citations and Abstracts of Research Documents in the Public Domain at the Arctic Institute of North America. Prepared Through the Arctic Science and Technology Information System, Arctic Institute of North America, Calgary, Alberta, at the request of The Consolidex Magnorth Oakwood Joint Venture, January, **1983.**

"The purpose of this bibliography is to present full citations and abstracts for each of the entries in the title listing, together with a few addition (primarily socio-economic) studies. These documents are a representative sampling of Lancaster Sound - Baffin Bay related research reports. This listing does not seek to identify the full extent of that research and knowledge; norhasit been prepared by the Arctic Institute research staff as an ASTIS bibliography."

15) *Oil Well Blowout Simulations for the Dundas Droll Site Lancaster Sound N. W. T. - Comprised of - Summer Oil Well Blowout Simulations for the Dundas Drill Site, Lancaster Sound, N. W. T. [and] Winter Oil Well Blowout Simulations for the Dundas Drill Site Lancaster Sound, N. W. T.*
Arctic Sciences Ltd., Sidney, B. C., 1983.

"The following two research reports were undertaken to develop an oilspill trajectory model to simulate the fate of oil from a hypothetical blowout at the proposed Dundas K-56 drillsite in Lancaster Sound. "

Response to the *Lancaster Sound Regional* Study Green *Paper "The Lancaster Sound Region:* **1980 -2000" by** The Consolidex Magnorth Oakwood Joint Venture, October 1982

[Summary *of the* Response *to the Lancaster Sound Regional Study Green Paper in Inuktitut] by* The Consolidex Magnorth Oakwood Joint Venture, October 1982

An Outline of the Contents *of the Consolidex Magnorth Oakwood Joint Venture Resource Management Plan for the Lancaster Sound Region* [English and Inuktitut] by The Consolidex Magnorth Oakwood Joint Venture, January 1983

Introduction to the Draft Resource Management *Plan for Lancaster Sound Hydrocarbon Development* [English and Inuktitut] by The Consolidex Magnorth Oakwood Joint Venture, March 1983

- CMO LANCASTER SOUND JOINT VENTURE RMP SEMINAR -

Calgary, June 22 & 23, 1983

Seminar Attendees

(In alphabetical order & grouped according to consultants, CMO, other industry)

Consultants:

Dave Andrews - Tri Ocean Engineering Ltd, Calgary
Angus Bruneau - Bruneau Resources Management Ltd, St. John's
Paul Davies - Pallister Resource Management Ltd, Calgary
Rolph Davis - LGL Limited, Toronto
Bob Dryden - Resource Concepts, Calgary
Dick Hill - Arctech Services Limited, Inuvik
Ben Hubert - Boreal Ecology Services, Yellowknife
John Marko - Arctic Sciences Limited, Sidney
Allen Milne - A.R.Milne Environmental Management, Sidney
Ernie Pallister - Pallister Resource Management Ltd, Calgary
Jeff Pallister - Pallister Resource Management Ltd, Calgary
Herrnan Steltner - Arctic Research Establishment, Pond Inlet
Chris Truefitt - CanOcean Engineering Ltd, Calgary
Roger Voyer - Nordicity Group Limited, Ottawa
Don Verdonck - Tri Ocean Engineering Ltd, Calgary

CMO:

Nolan Blades - Vice President, Oakwood Petroleums Ltd, Calgary
Andy Blashyn - Vice President, Exploration, Oakwood Petroleums Ltd, Calgary
Don Daae - Manager of Exploration, Consolidex Gas and Oil Limited, Calgary
Cliff Fiesel - President, Magnorth Petroleum Ltd, Calgary
Richard Hobley - Manager of Engineering, Consolidex Gas and Oil Limited, Calgary
Barry McVicar - President, Consolidex Gas and Oil Limited, Calgary
Bill Morrison - Vice President, Nortex Gas and Oil Company, Houston
Don Snyder - Vice President, Consolidex Gas and Oil Limited, Calgary

Other Industry:

Alex Gordon - Syncrude Canada, Fort McMurray
Ned Klujcec - Petro-Canada, Calgary
Greg Lever - Petro-Canada, Calgary
Murray Morison - Dome Petroleum Limited, Calgary
Olaf Lauvli - H. Staubo and Co., Oslo, Norway
Barry Worbets - Canterra Energy Ltd, Calgary
Brian Wagner - Canterra Energy Ltd, Calgary

Dinner Speaker:

Lorne Matthews, Energy and Resource Development Secretariat, Government of N.W.T.

- EASTERN ARCTIC MARINE ENVIRONMENTAL STUDIES -

Baffin Bay - Lancaster Sound Sector
- EAMES North -

BIOLOGICAL REPORTS

BIRDS

Feeding *Ecology of Seabirds in Northwest Baffin Bay 1978*
M. Bradstreet, LGL Limited for Petro-Canada Exploration, 1979.

Distribution of Sea-Associated Birds in Eastern Lancaster Sound and *Baffin* Bay, May-July 1979
P.L. McLaren, LGL Limited for Petro-Canada Exploration, 1980.

Distribution of Sea-Associated Birds in Eastern Lancaster *Sound* and *Baffin Bay, May-July 1979: Maps*
P.L. McLaren, LGL Limited for Petro-Canada Exploration, 1980.

Distribution of Sea-Associated *Birds in Northwest Baffin Bay and Adjacent Waters, May-October,* 1978
P. McLaren & W. Renaud, LGL Limited for Petro-Canada, 1979.

Distribution of Sea-Associated Birds in Northwest Baffin Bay and Adjacent Waters, May-October, 1978: Appendix A, Distribution Maps, Volume 1 [Maps 1 through 152 /
LGL Limited for Petro-Canada, 1979.

Distribution of Sea-Associated Birds in Northwest Baffin Bay and *Adjacent Waters, May-October, 1978: Appendix A, Distribution Maps, Volume II [Maps 153* through *312]*
LGL Limited for Petro-Canada, 1979.

Late Winter Distribution of *Black Guillemots (Cepphus grylle) in Northern Baffin Bay and the Canadian High Arctic*
W. Renaud and M. Bradstreet, LGL Limited for Petro-Canada Exploration, 1980.

MAMMALS

Status of Ringed Seals (Phoca hispida) of the Baffin Bay Pack Ice
K.J. Finley, G.W. Miller, R.A. Davis, W.R. Koski, LGL Limited, May, 1982.

Marine Mammals Inhabiting the Baffin Bay Northwater *in Winter*
K. Finley & W. Renaud, LGL Limited for Petro-Canada Exploration, 1980.

Distribution and Migration *of* Marine *Mammals in Baffin Bay and Eastern Lancaster Sound May-July* 1979
W.R. Koski, LGL Limited for Petro-Canada Exploration, 1980.

Distribution of Marine *Mammals in the Canadian Central High Arctic July-September* **1979**
W. Koski, LGL Limited for Petro-Canada, 1980.

Distribution of Marine Mammals in Northwest Baffin Bay and Adjacent Waters, May-October 1978
W. Koski & R. Davis, LGL Limited for Petro-Canada, 1979.

Distribution of Marine Mammals in Northwest Baffin Bay and Adjacent Waters, May-October *1978 Appendix A, Distribution Maps*
W. Koski and R. Davis, LGL Limited for Petro-Canada, 1979.

Studies of the Late Summer *Distribution* and *Fall Migration* of Marine Mammals in *Northwest Baffin Bay and Eastern Lancaster Sound, 1979*
W. Koski and R. Davis, LGL Limited for Petro-Canada, 1980.

Polar Bear Studies in Eastern Lancaster Sound and Baffin Bay
R, Schweinsburg, J. Lee & P. Latour, N.W.T. Wildlife Service, 1980.

Summer Diet of the Bearded Seal (Erignathus barbatus) in the Canadian High Arctic
K.J. Finley, C.R. Evans, LGL Limited, 1982.

Summer Diet of the Narwhal (Monodon Monoceros) in Pond Inlet, Northern Baffin island
K.J. Finley & E.J. Gibb, LGL Limited for Petro-Canada, 1982.

OTHER BIOLOGICAL STUDIES

Wildlife Harvest Statistics from Clyde River, Grise Fiord and Pond Inlet, 1979
K. Finley & G. Miller, LGL Limited for Petro-Canada Exploration, 1980.

Studies of Plankton in Northwest Baffin Bay and *Adjacent Waters: July-October 1978*
A. Sekerak, et al, LGL Limited for Petro-Canada, 1979.

Benthic and Intertidal Studies in Lancaster Sound, Northwest Baffin Bay and Adjacent Waters: Final Report
D. Thomson, W. Cross, LGL Limited for Petro-Canada, 1980.

Benthic and Intertidal Studies in Lancaster Sound, Northwest Baffin Bay and Adjacent Waters: August-September 1978
D. Thomson, W. Cross, and G. Walder, LGL Limited for Petro-Canada, **1979.**

OCEANOGRAPHY AND ICE REPORTS

Data Report No. 1: Subsurface Current Measurements in Western Baffin Bay and Lancaster Sound 1978-79
D. Fissel and G. Wilton, Arctic Sciences Ltd., for Petro-Canada, 1981.

Data Report No. 2: Satellite-tracked Drifting Buoy Movements in Baffin Bay and Lancaster Sound, **1978-79**
D. Fissel, Arctic Sciences Ltd. for Petro-Canada, 1981.

Data Report No. 3: CTD Data from Western Baffin Bay and Lancaster Sound 1978-1979 Volume 1
D. Lemon, Arctic Sciences Ltd. for Petro-Canada, 1981.

Data Report No. 3: CTD Data from Western Baffin Bay and Lancaster Sound 1978-1979 Volume 2
D. Lemon, Arctic Sciences Ltd. for Petro-Canada, 1981.

Data Report No. 4: Current Profile Measurements in Western Baffin Bay and Lancaster Sound, Summers 1978 and 1979
D. Fissel & R. Birch, Arctic Sciences Ltd for Petro-Canada, 1981.

Data Report No. 5: Nearshore Studies of *the Physical Oceanography of Cape Warrender, Cape Fanshawe and Cape Hay, 1979*
R. Birch, Arctic Sciences Ltd. for Petro-Canada, 1981.

Data Report No. 6: Analysis of Water Level Record for Johnson Bay, N. W. T. August 22, 1978-May 12, 1979
R. Birch, Arctic Sciences Ltd. for Petro-Canada, 1981..

Data Report No. 7: Satellite-tracked iceberg Movements in *Baffin Bay and Lancaster Sound, Summers 1978 and 1979*
D. Fissel, Arctic Sciences Ltd. for Petro-Canada, 1981.

Data Report No. 8: Ice Velocities in *Lancaster Sound - Northwest Baffin Bay as Determined* from *LandSat and NOAA Satellite Imagery 1978-79*
M. Wilson & J. Marko, Arctic Sciences Ltd. for Petro-Canada, 1981.

Movement of Oil Slicks in Northwestern Baffin Bay SLIKTRAK Simulations
S. Narayanan, J. Marko & D. Fissel, Arctic Sciences Ltd for Petro-Canada, 1979.

Kill Distribution, Age, and Reproductive Status of *Ringed Seal (Phoca hispida) Taken by Inuit Hunters in the Canadian High Arctic G.* W. Miller, K.J. Finley, LGL Limited for Petro-Canada, 1982.

Diet *of Ringed Seal (Phoca hispida) in the Canadian High* Arctic K.J. Finley, LGL Limited for Petro-Canada, 1982.

Summer Diet of the Bearded Seal (Erignathus barbatus) in the Canadian High Arctic K.J. Finley, LGL Limited for Petro-Canada, 1982.

Summer Diet of *the Narwhal (Monodon monoceros) in Pond inlet, Northern Baffin Island* K.J. Finley, E.J. Gibb, LGL Limited for Petro-Canada, *1982.*

- NORLANDS LANCASTER SOUND STUDY REPORTS -

ENVIRONMENTAL IMPACT ASSESSMENT

The Environmental Impact Statement for Exploratory Drilling in the Lancaster Sound Region, Executive Summary
Norlands Petroleums Limited, June 1978.

The Environmental Impact Statement for Exploratory Drilling in the Lancaster Sound Region
Norlands Petroleums Limited, June 1978.

Th Environmental Impact Statement for Exploratory Drilling in the Lancaster Sound Region, Summary in Inuktitut
Norlands petroleums Limited, June 1978.

Lancaster Sound Exploratory Well Proposal: Approval-in-Principle Submission
Norlands Petroleums Limited, 1974.

The Northwest Passage, An Environmental Study Related to Offshore Operations with Emphasis in Lancaster Sound
The Foundation of Canada Engineering for Norlands Petroleums Limited, January, 1974.

Lancaster Sound Proposed Deep Water Drilling System
Prepared for Norlands Petroleums Limited by Westbume Engineering, January, 1974.

Preliminary Environmental Impact Assessment of the Proposed Lancaster Sound Offshore Drilling Operations
Prepared for Norlands Petroleums by F.F. Slaney and Company Limited, February, 1974.

BIOLOGICAL REPORTS

Marine Mammals Recorded during Aerial Surveys of Birds in Eastern Lancaster Sound, 1976
Prepared for Norlands Petroleums Limited by S.R. Johnson, W.E. Renaud, R.A. Davis, and W.J. Richardson, LGL Limited, 1976.

Aerial Surveys of Birds in Eastern Lancaster Sound, 1976 Volume 1
Prepared for Norlands Petroleums Limited by S.R. Johnson, W.E. Renaud, R.A. Davis, et al, LGL Limited, 1976.

Aerial Surveys of Birds in Eastern Lancaster *Sound, 1976 Volume 2*
Prepared for Norlands Petroleums Limited by S.R. Johnson, W.E. Renaud, R.A. Davis, et al, LGL Limited, 1976.

Aerial Surveys of Marine *Mammals of Lancaster Sound*
Renewable Resources Consulting Services Ltd., 1976

Survey of Marine Mammals of *Lancaster Sound, October 1975*
P.R. Stepney & L. Wooley, Renewable Resource Consulting Services, for Norlands Petroleums, 1976.

Summer Feeding Ecology of Seabirds in Eastern Lancaster Sound
M.S. Bradstreet, LGL Limited, for Norlands Petroleums, 1976.

Biological Oceanographic Studies in Lancaster Sound, 1976
A.D. Sekerak, R.A. Buchanan, W.B. Griffiths and M. Fey, LGL Limited for Norlands Petroleums, 1976.

A Status Report on Polar Bear Studies in Lancaster Sound, December *1977*
R.E. Schweinsburg, I. Stirling, S. Oosenbrug, and H. Kiliaan, Northwest Territories Fish and Wildlife Service Report to Nodands Petroleums, 1977.

OIL SPILL STUDIES

An Oilspill Motion *Model for* Eastern *Lancaster Sound*
Fenco Consultants Ltd., *1978.*

Analyses *of Heavy Metal and Chlorinated Hydrocarbon Contamination of Five Sea Birds from* Lan*caster Sound*
Renewable Resources Consulting Services Ltd., 1977.

Lancaster Sound Oil Spill Contingency Plan
Westburne Engineering for Norlands Petroleums Limited, 1974.

OTHER STUDIES

A Review of *Ocean Currents and Surface Winds of Lancaster Sound*
P.H.R. Stepney, Renewable Resources Consulting Services Ltd., for Norlands Petroleums, 1977.

Submission in Support of an Application for Drilling Authority to Drill Norlands/Magnorth Dundas K-56, Lancaster Sound, N. W. T.
Tri Ocean Engineering, 1977.

An Addendum to the Submission in Support of an Application for Drilling *Authority to Drill Norlands/Magnorth Dundas K-56, Lancaster Sound, N. W. T.*
Tri Ocean Engineering, 1978.

Lancaster Sound Cost of Compliance - A Case *Study*
C.L. Fiesel, H.D. Daae, and J.B. Osborne (assisted by R.F. Blanchard), Magnorth Petroleum Ltd., Nodands Petroleums Limited, and BP Canada Inc., 1980.

Wave and Current Measuring Program in Lancaster Sound Summer 1976
Oceanographic Services Inc., 1977.

Submission *to the Government Green Paper Committee on Lancaster Sound*
Norlands Petroleums Limited and Magnorth Petroleum Ltd., 1981.

Economic Evaluation of the Dundas Structure Lancaster Sound: Executive Summary
EPI Resources Ltd, 1981.

Economic Evaluation of *the Dundas* Structure *Lancaster Sound*
EPI Resources Ltd, 1981.

[Estimate of the Cost of *Drilling* a *Single* Well *in* 2500 *feet of Water in Lancaster Sound (July 1981)]*
EPI Resources Ltd., 1981

Geological History of *the Northwest Passage*
H.D. Daae and A.T. C. Rutgers, Norlands Petroleums Limited, 1974.

SELECTED ARCTIC PILOT PROJECT ENVIRONMENTAL STUDIES

¶ Relating to the CMO Lancaster Sound Proposal

a) Reports filed with National Energy Board (NEB)

(Note: for *the most* comprehensive *analysis of information the reader should refer to NEB Transcripts and Prepared Evidence for panels 3B* (Safety), *6A (Noise), 6B (Northern interest) and 6C (Marine Special Interest). This information is available from the NEB, Ottawa).*

NEB Exhibit #

75 — *Study of Bridging a Ship Track in Landfast Ice*
ARCTEC Canada Ltd., April 1979

76 — *Study of the Influence of Shipping on Break-up and Freeze-up in Lancaster Sound*
ARCTEC Canada Ltd., December 1979

83 — *Environmental Statement: Shipping Component*
Arctic Pilot Project

84 — *Environmental Statement: Supplementary information*
Arctic Pilot Project, November, 1979

104 — *Towards an Environmental Management Strategy for the Arctic Pilot Project*
ESSA (Environmental and Social Systems Analysts Ltd.), March 1980

120, 121, 122 — *Observations of Marine Mammal and Seabird Interaction with Icebreaking Activities in the High Arctic* (three reports concerning two field season operations) Hatfield Consultants Ltd., Dec. 1979; Sept. 1980; Dec. 1980

125 — *Remote Sensing Overflight. Data Acquisition and Reduction Program*
Intera Environmental Consultants Ltd., November 1977- May 1978

126 — *Late Winter Distribution of Black Guillemots, (Ceppus grylle) in Northern Baffin Bay and the Canadian High Arctic*
LGL Limited, January 1980

127 — *Marine Mammals Inhabiting the Baffin Bay Northwater*
LGL Limited, January 1980

167-169 — *Integrated Route Analysis (Volumes 1, 2, 3)*
Arctic Pilot Project

172 — *Transport Canada Termpol Assessment of the Arctic Pilot Project (Northern Component)*
August, 1981

175 — *The Question* of *Sound from icebreaker Operations; Proceedings of* a *Workshop* February 23, 24, 1981
Arctic Pilot Project sponsored workshop; edited by Western Ecological Services (B. C.) Ltd.

176 — *Report* of *the Environmental Assessment Panel - Arctic Pilot Project* (Northern Component)
EARP, Report # **14,** October 1980

199 *Ice Crack* Morphology *in Barrow Strait*
Acres Consulting Services Ltd., July 1981

200 *Distribution of Wintering Marine Mammals in Southern Baffin* Bay *and Nor. them Davis Strait*
LGL Limited. March 1981

397 *Proposed Organization of a Research and Development Program for the Arctic Pilot Project*
Pallister Resource Management Ltd., Feb. 10, 1982

531 *Preliminary Oil and Hazardous Chemical* Spill Prevention *and Contingency Plan*
Petro-Canada, 1982

548 *Radiated* Noise Tests for *an Arctic LNG Carrier*
Report of the Netherlands Ship Model Basin, February, 1982

570 *Ice Effect Trials in Arctic Waters on CCGS Louis St.* Laurent
Department of Transport (27 pages)

673 *Sources of Underwater Ship Sounds*
Arctic Pilot Project

685 *Ship Track Crossing*
Arctic Pilot Project, 1982

714 *Observations of the Bowhead Whale (Balaena mysticetus)* in Central West Greenland in March - May 1982
E.W. Born and M.P. Heide-Jorgensen, Denmark

b) Reports prepared but not filed with NEB (either as a result of NEB Hearings adjournment or studies not completed as of August 1982)

Ice Feature Mapping in Resolute Passage
Intertech Ltd., 1982

Distribution and Migration of *Bowhead* Whales (historic) *in the Eastern North American Arctic*
R. Reeves, Department of Fisheries and Oceans

History of *Bowhead Whaling in the Eastern Arctic*
G. Ross and A. MacIver, 1982

Underwater Vocalizations of Wintering Pinnipeds in *the* High *Arctic*
I. Stirling et al, Canadian Wildlife Service, April 1982

Sea Ice Atlas of Northern *Baffin Bay*
H. Ito, Swiss Federal Institute of Technology, (Zurich), 1983)

Distribution of Wintering Marine Mammals in Southern Baffin Bay and Nor-*thern Davis Strait (1982 field program)*
LGL Limited, 1982 report

Aerial Observations of Marine Mammals at the Barrow *Strait - Lancaster Sound Ice Edge (1982 field* program)
T. Smith, Department of Fisheries and Oceans

Observations and Underwater Acoustics Associated with Ship Traffic in Admiralty Inlet (1982 field program)
LGL Limited

Ringed Seals in the Baffin Bay Region: Habitat Use, Population Dynamics and Harvest Levels
LGL Limited, August 1982

CANADIAN OFFSHORE OIL SPILL RESEARCH ASSOCIATION STUDY REPORTS

Fireproof Boom Development, Phase III - Prototype Construction and Testing
McAllister Engineering Ltd., n.d.

Burning of Crude Oil *Under Wind Herding Conditions*
Energetex Engineering, 1981

Fireproof Boom Development - Ohmsett Trials
Oil Spill Research Section, Beaufort Sea Production Development Department, Dome Petroleum Limited. n.d.

Oil and Gas Under Sea Ice (Final Report), Volume 1
Oil Spill Research Section, Beaufort Sea Production Department, Dome Petroleum Limited, n.d.

Oil *and Gas Under Sea Ice (Appendices), Volume 2*
Oil Spill Research Section, Beaufort Sea Production Development Department, Dome Petroleum Limited, n.d.

The Development and Testing of *a Helicopter Portable Burner*
Oil Spill Research Section, Dome Petroleum Limited, n.d.

Saacke Burner Operating Manual
Oil Spill Research Section, Beaufort Sea Production Development Department, Dome Petroleum Limited, 1981.

Return to Balaena Bay: Long Term Effects of a Large Scale Crude Oil Spill Under Arctic Sea Ice 1975 *to 1981*
D.F. Dickins Engineering, together with Arctic Laboratories Ltd., & J. Hellebust, University of Toronto, for Gulf Canada Resources, n.d.

Subsea Containment Study: Phase 1, Preliminary Feasibility
Centre for Cold Ocean Resources Engineering (C-CORE), 1981.

Subsea Containment Study: Phase 2, *Turbulent Burning*
Energetex Engineering, 1981.

Subsea Containment Study: Phase 3, *Environmental Loads*
CanOcean Resources Ltd., 1981.

Subsea Containment Study: Phase 4, Preliminary System Design
CanOcean Resources Ltd.. 1982.

Experiments with Scale Models of Oil Collectors for Sub-sea Well Blowouts
Jerome H. Milgram, Christopher J. von Alt, James J. Burgess, Massachusetts Institute of Technology, Cambridge, Massachusetts, n.d.

Proceedings of a Brainstorming Workshop on Recovery of Oil in an Ice Environment
S.L. Ross Environmental Research Ltd., 1982

Fate and Behaviour of Water-in-Oil Emulsions in Ice
Oil Spill Research Group, Frontier Division, Dome Petroleum Limited, 1983

EASTCOAST PETROLEUM OPERATORS' ASSOCIATION RESEARCH PROJECT REPORTS

North *Atlantic Sea Ice Survey*
K.G. Nolte and M.E. Trethart, Amoco Canada Petroleum Company Ltd., n.d. [1971]

iceberg Dynamics Project Report Volume 1: Experimental Equipment and Procedures
A.A. Bruneau and R.T. Dempster, [Amoco Canada], 1972.

Iceberg Dynamics Project Report Volume 2: Observations, Data and Analysis.
A.A. Bruneau and R.T. Dempster, [Amoco Canada], **1972.**

Iceberg Dynamics Project Report Volume 2: Iceberg Towing Procedures
A.A. Bruneau and R.T. Dempster, [Amoco Canada], 1972.

iceberg Impact Effects on Drillship
Fenco and German & Milne for Eastcan Exploration on behalf of EPOA, 1971.

Eastern **Canada** *Oil Sensitivity Study*
A.R. Lock, Dalhousie University for Mobil Oil Canada on behalf of EPOA, 1975.

EPOA Marine Oil Pollution Baseline Study
E.L. Walker, M.E. Trethart, D.L. Andrews, [EPOA Marine Oil Pollution Baseline Study Committee], n.d. [1972]

Design of a Hydrocarbon Baseline Study of the Scotian Shelf
Beak Consultants for the Marine Applications Council, 1974.

Radio Communications Used for Off-Shore Oil Explorations in a Canadian Maritime Region
L.E. Petrie and U.I. Campbell, Petrie Telecommunications Ltd., 1974.

Case Studies for Shoreline Classification of Atlantic Canada
J. Pinsent and H. Scarth, Memorial University of Newfoundland, 1977.

12. CMO Information Centres

¶ The CMO *Resource Management Plan* documentation, including the RMP, Support Documents, CMO Reference Works, and Background reports, are available for public examination at libraries from coast to coast and in the northern territories in Canada, together with federal government departmental libraries in Ottawa, Ontario, and libraries in Alaska, and Colorado. The following listing is arranged by province and territory, followed by American libraries, and Canadian government libraries.

Copies of all documents have also been placed with the Hamlet Councils of the Communities of Resolute, Grise Fiord, Arctic Bay, Pond Inlet, and Clyde, Northwest Territories.

BRITISH COLUMBIA

Library
Institute of Ocean Sciences
9860 West Saanich Road
SIDNEY, B.C.
V8L 4B2

ALBERTA

Arctic Institute of North America
Library Tower
University of Calgary
2s00 University Drive N.W.
CALGARY, Alberta
T2N 1N4

Boreal Institute for Northern Studies
University of Alberta
EDMONTON, Alberta
T6G 2E9

SASKATCHEWAN

Institute for Northern Studies
Department of Geology
University of Saskatchewan
SASKATOON, Saskatchewan
S7N OWO

MANITOBA

Library
Freshwater Institute
501 University Cresent
WINNIPEG, Manitoba
R3T 2N6

ONTAR1O

Dana Porter Arts Library
University of Waterloo
WATERLOO, Ontario
N2L 3G1

Scott Library
York University
47oO Keele Street
DOWNSVIEW, Ontario
M3J 2R2

Institute of Environmental Studies
University of Toronto
TORONTO, Ontario
M5S 1A4

QUEBEC

Library
Centre for Northern Studies & Research
McGill University
1020 Pine, Avenue West,
MONTREAL, Quebec
H3A 1A2

CINEP
Centre d'Ingénierie Nordique
École Polytechnique
Université de Montréal
Case Postale 6079, Succursale A
MONTRÉAL, Québec
H3C 3A7

NOVA SCOTIA

Environment Canada Library
Queen Square, Fifth Floor
45 Alderney Drive
DARTMOUTH, Nova Scotia
B2Y 2N6

Library
Bedford Institute of Oceanography
Ocean & Aquatic Sciences, Atlantic
P.O. Box 1006
DARTMOUTH, Nova Scotia
B2Y 4A2

Killam Library
Dalhousie University
HALIFAX, Nova Scotia
B2H 4L3

NEWFOUNDLAND

Ocean Engineering Information Centre
Memorial University of Newfoundland
ST. JOHNS, Newfoundland
A1B 3X5

NORTHWEST TERRITORIES

Government In-Service Library
Government of the Northwest Territories
YELLOWKNIFE, N.W.T.
XIZ 2L9

YUKON TERRITORY

Librarian
Yukon Archives
Box 2703
WHITEHORSE, Yukon
YIA 2C6

THE UNITED STATES

Arctic Environmental Information
and Data Centre
University of Alaska
707 A Street
ANCHORAGE, Alaska
USA 99501

Elmer E. Rasmuson Library
University of Alaska, Fairbanks
310 Tanana Drive
FAIRBANKS, Alaska
U.S.A. 99701

World Data Centre-A for Glaciology
Cooperative Institute for Research in
Environmental Sciences
Campus Box **449**
University of Colorado
BOULDER, Colorado
U.S.A. 80309

Library of Parliament House of Commons
OTTAWA, Ontario
K1A 0A9

National Library of Canada
395 Wellington Street
OTTAWA, Ontario
K1A 0N4

Canada Institute for Scientific and
Technical Information Library
National Research Council
OTTAWA, Ontario
KIA 0S2

Library
Energy, Mines and Resources Canada
OTTAWA, Ontario
KIA 0E4

Library
Fisheries and Oceans Canada
240 Sparks Street
OTTAWA, Ontario
K1A 0E6

Library
Industry, Trade and Commerce Canada
235 Queen Street
OTTAWA, Ontario
K1A OHS

Library
National Energy Board
Trebla Building
473 Albert Street
OTTAWA, Ontario
K1A 0E5

Library
Transport Canada
Transport Canada Building
Place de Vine
33o Sparks Street
OTTAWA, Ontario
KIA 0N5

Library
Employment & Immigration Canada
OTTAWA, Ontario
KIA 0J9

Library
Regional Economic Expansion Canada
OTTAWA, Ontario
K1A 0M4

Library
Canada Oil and Gas Lands Administration
580 Booth Street
OTTAWA, Ontario
K1A 0E4

Library
Department of Indian Affairs and
Northern Development
Les Terrasses de la Chaudiere
OTTAWA, Ontario
K1A oH4

Library
Environment Canada
OTTAWA, Ontario
KIA OHS

3. **Resource Management *Plan Table* of Contents**

¶ Following are the verbatim Table of Contents and list of Tables and Figures from the RMP (August 1983). Page numbers refer to that document.

TABLES AND FIGURES

4. *Subject Index to the Resource Management Plan*

¶ Following is the verbatim 'Subject Index' from the RMP (August 1983). Page numbers refer to that document.