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Technical Report
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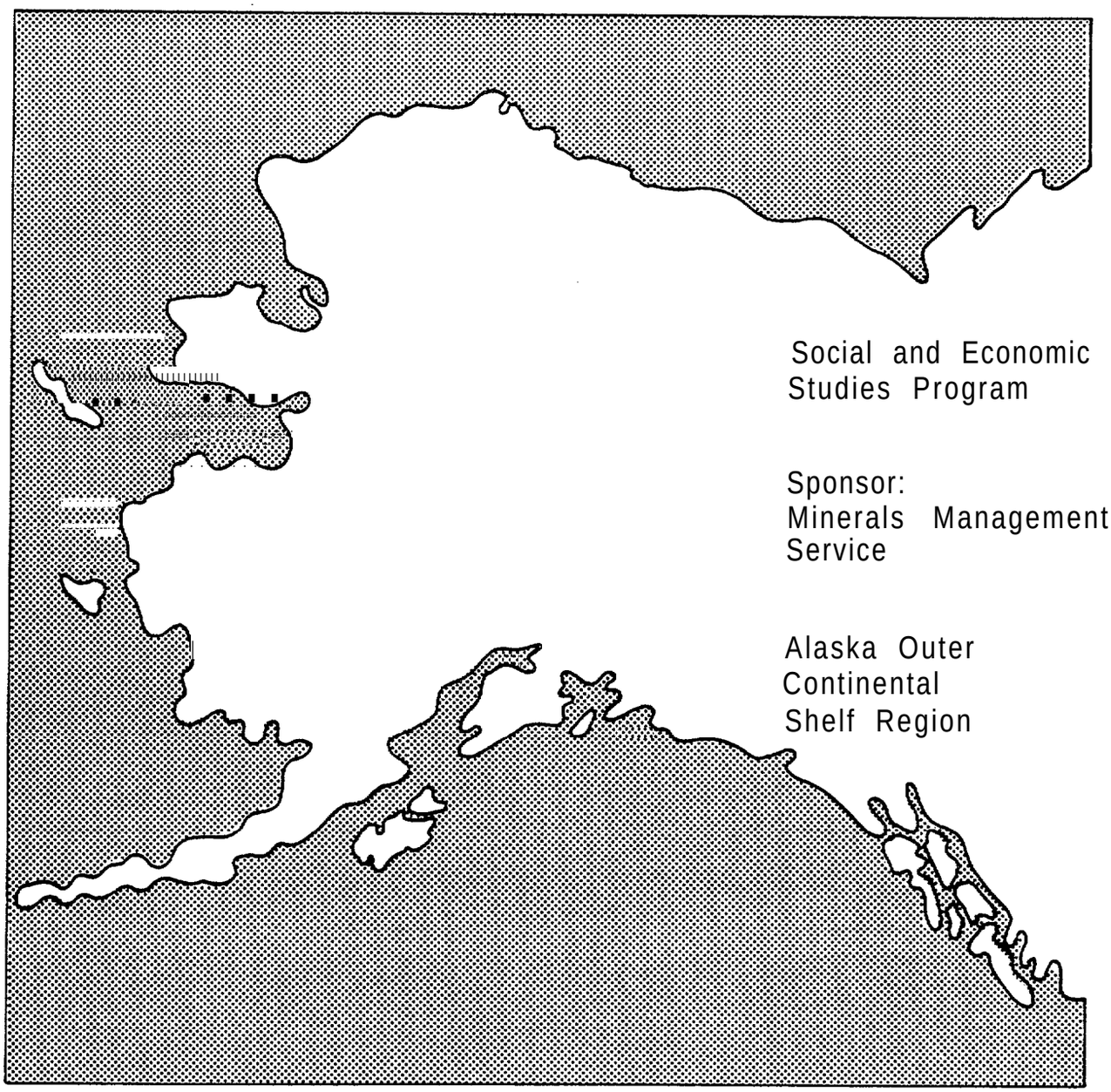

Social and Economic Studies Program

Sponsor:
Minerals Management Service

Alaska Outer Continental Shelf Region

Monitoring OCS Activity in the Bering Sea

Contract No. 14-12-0001-30171

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

FINAL TECHNICAL REPORT

MONITORING OCS ACTIVITY IN THE BERING SEA

prepared for
Minerals Management Service
Alaska Outer Continental Shelf Office

by

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ABSTRACT

The Minerals Management Service (MMS) commissioned this study to obtain an historical accounting of exploration activities and the effects of federal offshore leasing activity in the Bering Sea for the 1980 through 1984 study period. In the course of this research, over seventy firms who were active in Bering Sea exploration as either lease operators or service contractors were contacted. This report of the findings of the study includes a description of past, present, and future exploration activities and their effects on employment and the economy. Information presented in the report will assist the MMS to more reliably assess the potential effects of future oil industry activities in the Bering Sea on local communities and the State of Alaska.

Petroleum exploration activities in the Bering Sea Outer Continental Shelf (OCS) began with geophysical surveys in 1963. From 1976 to 1983, Continental Offshore Stratigraphic Test (COST) wells were drilled and regional geophysical and geological studies were conducted, Tracts were leased in the Norton and the St. George basins in 1983, and tracts were leased in the Navarin Basin in 1984. Eleven exploratory wells were drilled in the relatively intense exploration effort that began in 1984.

Pre-lease exploration activities included regional marine seismic surveys, high-resolution geophysical surveys, geological (geotechnical and geochemical) surveys, airborne geophysical surveys, and the installation and operation of navigation systems. Drilling phase activities included drilling vessel operations, marine and air support services and bases, lease operator supervision, and the serivces provided by numerous specialized contractors such as mud loggers and divers.

Marine support bases for the exploration activities included Captain's Bay near Unalaska and to some extent Nome. A new facility was built at Captain's Bay expressly for the purpose of supporting Bering Sea exploration. Fuel, water, food, and drilling supplies were staged from these bases. Air support bases at Cold Bay and Nome were used to support helicopters transporting crews to the drilling vessels.

Employment and expenditure data were obtained for all pre-lease and post-lease exploratory drilling phase activities. The expenditure estimates in this report do not include facilities construction expenditures, the capital cost of acquiring the vessels used in geophysical exploration, or the cost of acquiring leases. The employment estimates do not include facilities construction employment, the labor of governmental regulatory agencies, or secondary employment estimates.

During the 1980-1984 period, almost 4000 person years of employment were required for oil exploration in the Bering Sea. Approximately 510 person-years or 13 percent of all employment related to exploration activities in the Bering Sea OCS went to Alaska residents, and 255 person years or 6.5 percent went to local residents. Total wages and salaries paid during the 1980-1984 period approached $166 million, with Alaska residents accruing approximately 11 percent or $18 million.

Total expenditures during the period exceeded $500 million. About $126 million, or 25 percent of these expenditures were made in the State of Alaska. Local expenditures made in communities on or near the Bering Sea, approached $44 million or 9 percent of the total.

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1.0 INTRODUCTION"

1.1 PURPOSE AND SCOPE OF STUDY

The Bering Sea is a promising frontier area in the continuing search for additional domestic reserves of hydrocarbons. The potential reserves of the Bering Sea represent approximately 10 percent of the estimated undiscovered offshore oil resources of the U.S. (Dames & Moore, 1982). There are many promising geological formations in the Bering Sea. and this potential for hydrocarbon production is likely to stimulate a substantial increase in exploration activity in the next few years.

Bering Sea petroleum exploration was conducted at a relatively low level of activity for many years. Seismic surveys conducted in 1963 first indicated the petroleum resource potential in the area. In the following 12 years, other geophysical exploration activities reinforced the original positive indications. In 1976, the first Bering Sea Continental Offshore Stratigraphic Test (COST) well was drilled in the St. George Basin. Beginning in 1980 a series of four additional COST wells were drilled in the area. In 1983 the first Bering Sea lease sales occurred for the Norton and St. George basins. Since then, the magnitude of petroleum operations has increased with each lease sale. These operations will expand significantly if commercial quantities of oil are discovered. Since previous petroleum operations in this area have affected the human and natural environments, it is likely that the effects will increase as the scale of activity increases. However, an accurate assessment of these effects is often difficult since there is insufficient information available on the affected environment.

The U.S. Department of the Interior, Minerals Management Service (MMS) has regulatory and permitting responsibilities related to leasing. exploration. development. and production of offshore oil and gas resources. In addition, MMS, other federal agencies, and state agencies are charged with protecting the human and natural environments while allowing develop ment of the Outer Continental Shelf (OCS) resources. When the regulatory agencies are uncertain of the potential effects of petroleum exploration and development on the environment. they must assume a conservative posture to ensure that the stipulations and other regulations controlling the activities of the petroleum industry will, in fact, protect the environment. Often, as additional information becomes available and the degree to which petroleum-related activity affects the environment is better understood, the initial stipulations or regulations are modified to be more or less stringent while still ensuring that environmental goals are achieved.

In order to predict and evaluate the effects of OCS development upon the human environment within the State of Alaska, MMS conducts the Alaska OCS Social and Economic Studies Program (S ES P). The SESP is a multi-year research effort that includes several completed projects as well as continuing studies of the human environment in the Bering Sea. The general approach followed in SESP studies of the effects of petroleum activities is to conduct a three-step analysis. This initiates with a projection of major petroleum-related activities, progresses to forecasting the direct and indirect population and socioeconomic changes, and concludes with an analysis of the effects of these changes.

To date, most of the analyses and resultant stipulations for Bering Sea lease sales have been based upon work that was completed prior to the lease sales. These studies provided information on expected levels of employment and equipment deployment, as well as the likely timing and expenditures for OCS development.

To obtain more current information on the extent and effects of petroleum-related OCS activities in the Bering Sea, MMS contracted with Patrick Burden & Associates, in cooperation with Dames & Moore, to conduct a study of relevant OCS activities in this area. The purpose of this study is to obtain sufficient information to provide an accurate description of OCS development in the Bering Sea since 1980, including information regarding events. equipment, timing, employment, and expenditures. In addition, this study is designed to determine the effects of OCS activities, including the effectiveness of stipulations, and to integrate data collected by federal and state studies.

This report, which presents a summary of the findings of the Bering Sea survey. is divided into three major sections: Background information on Bering Sea exploration (Section 2.0); a description of the exploration process (Section 3.0); and a discussion of the effects of exploration activities on economic characteristics of the area (Section 4.0).

The remaining portions of this introduction present a brief overview of petroleum development in Alaska (Section 1.2) and a summary description of the research methods used in this study (Section 1.3).

1.2 PETROLEUM DEVELOPMENT IN ALASKA

The first commercial discovery of oil in Alaska occurred in 1902 near Katalla, a now abandoned community located approximately 80 miles south of Cordova on the Gulf of Alaska coast. Production continued until 1932 when " fire destroyed part of the production facility.

The modern era of petroleum development in Alaska began with the discovery of oil in the Swanson River area on the Kenai Peninsula in 1957, and the first offshore petroleum discovery in Alaska occurred in 1964 in the waters of nearby Cook Inlet. In that same year the State of Alaska began leasing land on the North Slope for oil exploration. The Prudhoe Bay oilfield was discovered in 1968, and planning for development of the field began that year. Production from the field was delayed until completion of the TransAlaska Pipeline System in 1977. Although a number of other fields have been discovered in the vicinity of Prudhoe Bay (such as Kuparuk, Milne Point, Seal Island, Endicott, West Saks Sands, and Point Thomson), only Kuparuk and Prudhoe Bay are currently producing. Milne Point is under development, and development of the remaining reservoirs is under consideration by the lease owners.

The first federal lease sale of the Alaska offshore area was held in April 1976 in the northern Gulf of Alaska. Since that time, there have been ten additional lease sales, three of which have been in the Bering Sea. Although exploration activities have occurred in leased areas on the Alaska OCS, they have not yet resulted in commercial discoveries.

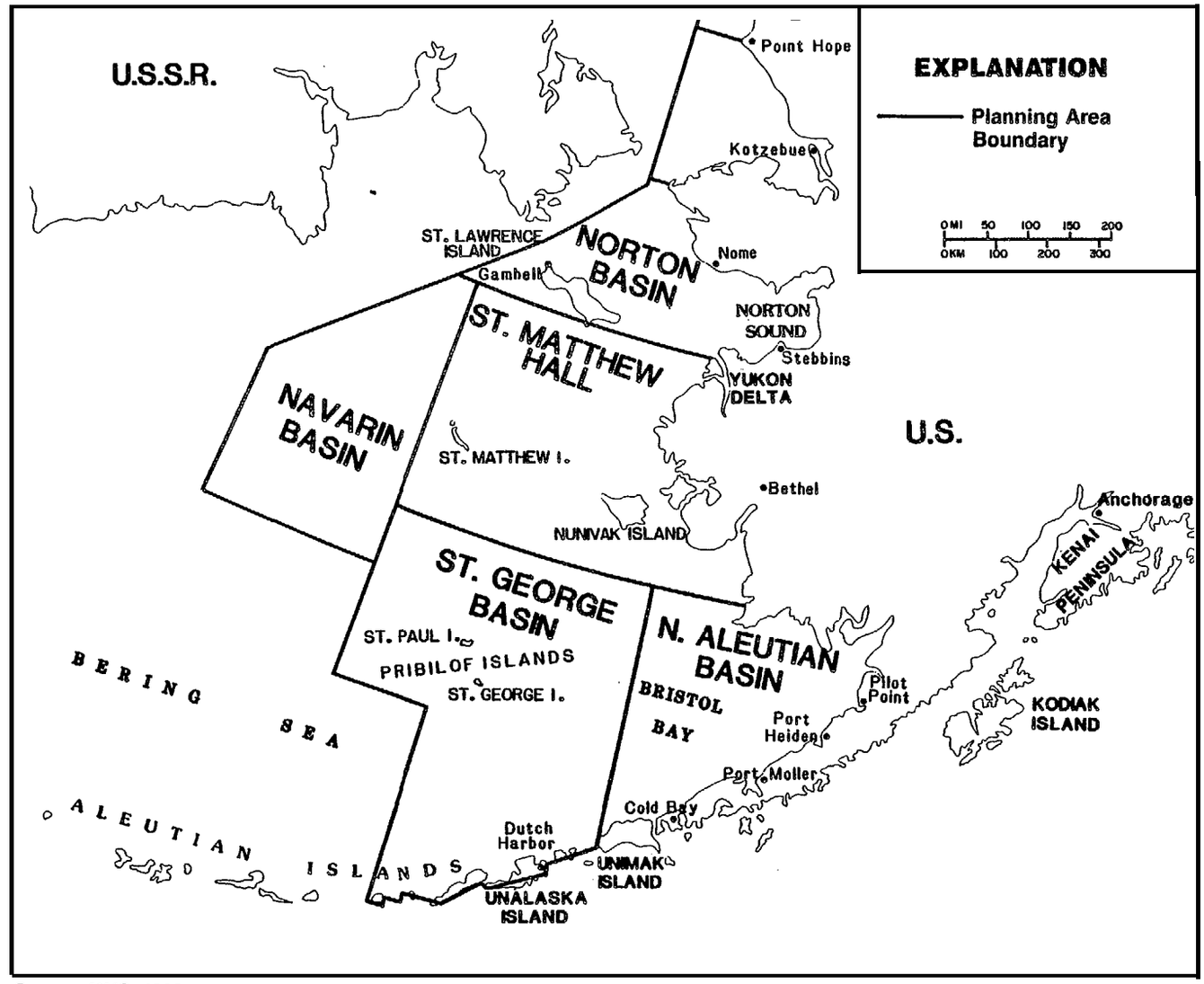
The Bering Sea OCS area extends from the Alaska Peninsula and its continuation as the Aleutian Chain, northward to the Bering Straits. As shown in Figure 1-1, this area contains five OCS planning areas: Norton Basin, St. George Basin, Navarin Basin, North Aleutian Basin, and St. Matthew Hall. Lease sales have been conducted for the first three planning areas. Exploration drilling has taken place on leases in Norton Basin and St. George Basin, and several firms plan to conduct drilling in the Navarin Basin in the summer of 1985. A lease offering for the North Aleutian Basin is scheduled for December 1985. St. Matthew Hall is not included on the present leasing schedule. (Additional information on exploration activities in the Bering Sea is presented in Section 2.1.)

1.3 RESEARCH METHODS

The study of Bering Sea OCS activities from 1980 through 1984 was conducted from October 1984 through February 1985. As described below, information was obtained from published documents and interviews with lease operators and support contractors. Field verification was not included but will be partially achieved through public and industry review of the draft of this document.

In the initial phase of the study, the project team assembled and reviewed available published documents for pertinent data. The primary sources were exploration plans and environmental reports; permit applications and similar public documents on file at public agencies; petroleum and construction industry trade publications (e.g., Oil and Gas Journal, Alaska

Figure 1-1
BERING SEA OCS PLANNING AREAS



Source: MMS, 1983

Report, Alaska Construction and Oil, and Offshore) that regularly report on the status of industry plans and projects; newspapers from several Alaskan communities; and available studies on relevant OCS related topics.

The extracted data were reviewed for timeliness and adequacy for the project, and data gaps were identified. The necessary additional information was obtained by further research of documents or file data, and through interviews with (1) industry personnel about oil exploration in the Bering Sea, and (2) staff members of public agencies responsible for management of OCS exploration.

Contacts were made with lease operator personnel and with staff members of firms providing services or equipment to the lease operators. Because of the different types of data requested in the scope of work for this study, different sets of questions were asked of lease operators, marine support contractors, air support contractors, shore bases, and other contractors, This arrangement assured full coverage and comparability in the quality of data collected from lease operators and contractors.

The project team contacted over 100 firms and agencies to obtain the primary data for this report. A critical aspect of contacts with operating firms was the verification of exploration data. Verification was necessary since published data sources were sometimes in disagreement, and unforeseeable factors occasionally necessitated revising exploration plans after publication. In addition, the lease operators and support contractors represent an extensive source of information, whereas

information presented in general interest publications or even trade journals often did not meet the level of detail and specific data requirements of this study.

2.0 BACKGROUND ON BERING SEA EXPLORATION ACTIVITIES

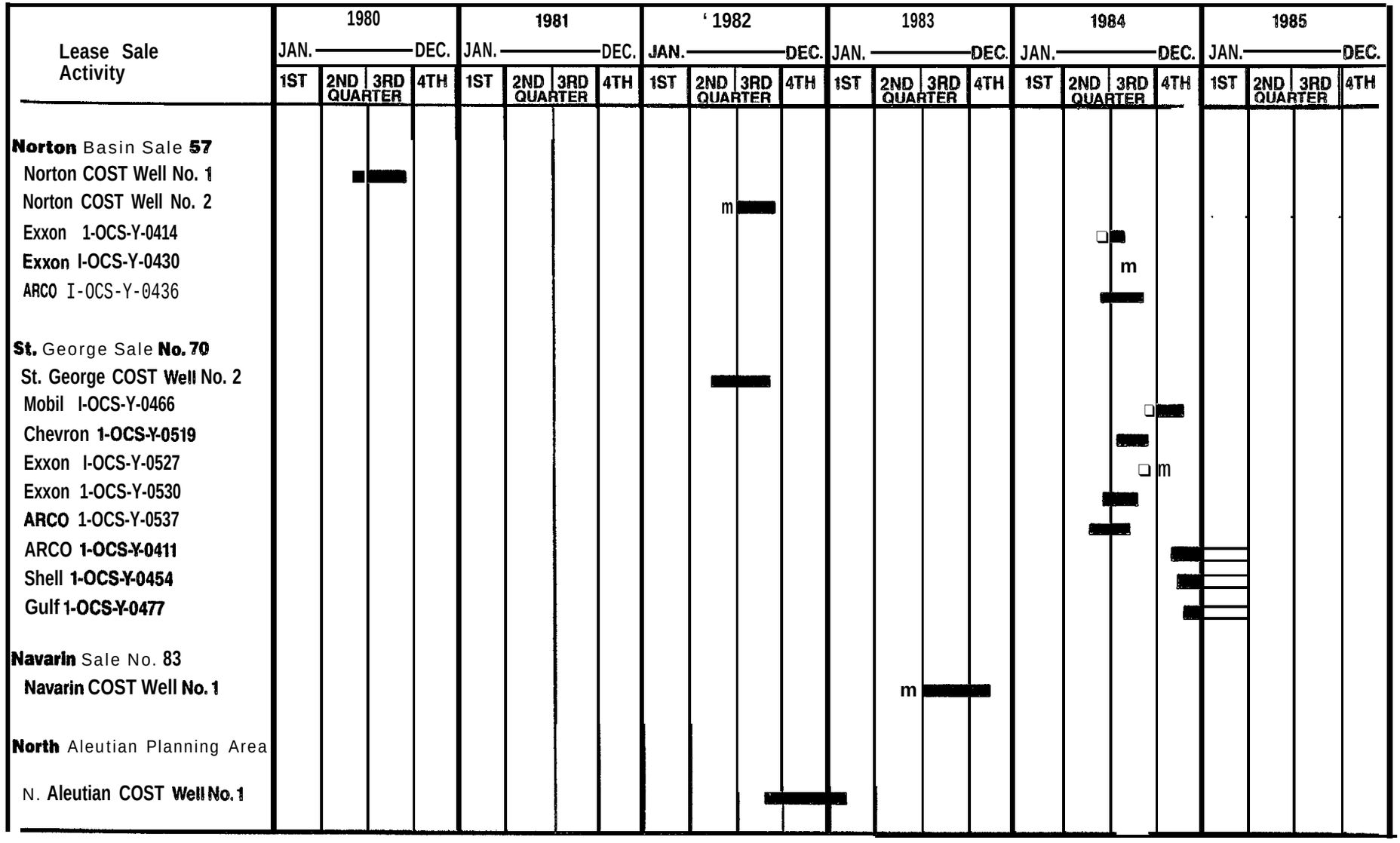
2.1 EXPLORATION ACTIVITIES BY BASIN

This section of the report briefly describes the exploration activities that have occurred in the Bering Sea from 1980 through 1984. During this time period, lease sales were held in three of the five Bering Sea OCS Planning Areas: Norton Basin Lease Sale 57, St. George Lease Sale 70, and Navarin Lease Sale 83. A fourth sale, to be held in the North Aleutian Planning Area, is scheduled for December 1985. As stated previously, no lease sales are currently planned for the St. Matthew Hall Planning Area. Figure 2-1 illustrates the sequence of exploratory drilling in the Bering Sea OCS from 1980 through 1984. Well names, numbers. and owners are listed in Table 2-1. As indicated in Figure 2-1, Wells Number 1-OCS-Y-0454. 1-OCS-Y-0477, and 1-ocs-Y-0411 were completed after December 31, 1984. Data regarding these wells is not presented in the report.

2.1,1 Norton Basin

The Norton Basin is generally located between St. Lawrence Island and the Seward Peninsula. Norton Basin Lease Sale 57, which was held on March 15, 1983. was the first lease offering in the Bering Sea OCS. A total of 418 blocks were offered, with 59 leased. Exxon was the highest bidder on 45 tracts and ARCO was highest bidder on 11. Other successful bidders included Chevron, Shell, and Sohio. The lease sale area is shown on Figure 2-2.

Figure 2-1
EXPLORATION IN THE BERING SEA OCS , 1980 - 1984



Prior to the sale, two Continental Offshore Stratigraphic Test wells (COST wells) were drilled in the Norton Basin Planning Area. The first well, which was located about 55 miles (88 kilometers) south-southwest of Nome, was drilled by ARCO on behalf of 20 other companies during the summer of 1980. The second COST well, drilled in the summer of 1982. was completed by ARCO on behalf of 19 other companies. This well was located about 50 miles (80 kilometers) east of the first COST well.

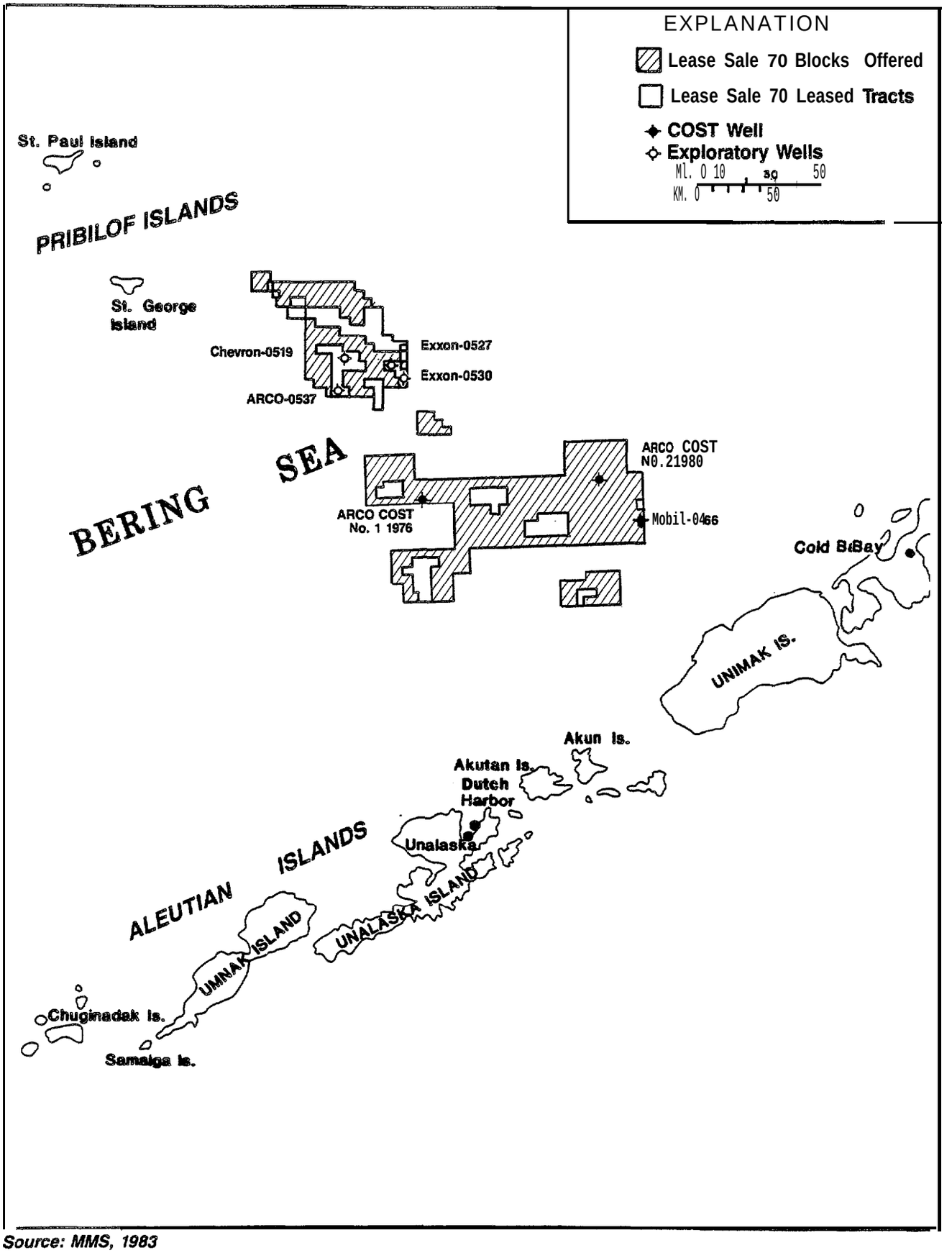
The first exploration wells in the Norton Basin were drilled by ARCO and Exxon in the summer of 1984. Exxon used the jack-up rig Rowan Middletown to drill Well Number 1-OCS-Y-0414" in June and July, and Well Number 1-OCS-y-0430 in July and August. Well Number 1-OCS-Y-0414 was plugged and abandoned as a dry hole, but no results have been released for Well Number 1-OCS-Y-0430. In June, July, and August of 1984, ARCO contracted for the jack-up rig Key Hawaii to drill Birch Well Number 1-OCS-Y-0436; data for this well have not been released.

2.1.2 St. George Basin

The St. George Basin is located east and southeast of the P ribilof Islands and west of Bristol Bay. The lease sale area is shown on Figure 2-3.

Governor Sheffield did not concur with the Department of Interior's determination as presented in the proposed Notice of Sale for St. George Lease Sale 70 that Lease Sale 70 would be consistent with the State of Alaska's Coastal Management Program. Consequently, two stipulations and

Figure 2-3
ST. GEORGE LEASE SALE 70



Source: MMS, 1983

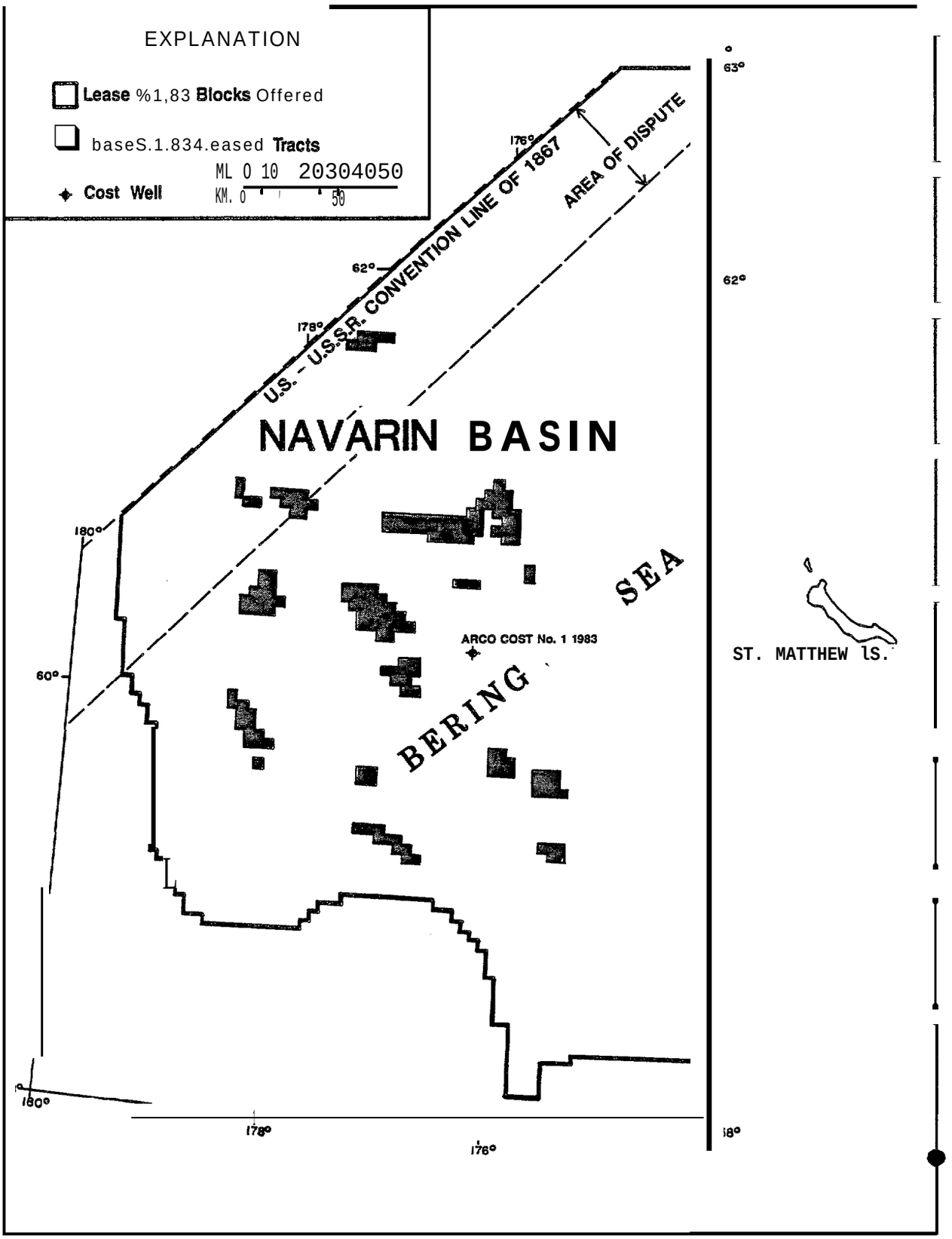
Lease operators drilled five exploration wells in the lease sale area between June and November 1984. Mobil, Chevron, and ARCO had each completed one exploration well by December 1. 1984. and Exxon had completed two wells. Additional wells were underway in the lease area but had not yet been completed as of December 31, 1984. Because these wells were not completed within the study time period, they are addressed as future plans (see Section 3.4.1).

2.1.3 Navarin Basin

The Navarin Basin is located west and northwest of St. Matthew Island. It consists of three distinct subbasins, one of which extends beyond the U.S. Continental Shelf and straddles the U.S.-Russia Convention Line of 1867. The actual location of this line is presently being negotiated by the U.S. State Department and the U.S.S.R.

Navarin Lease Sale 83 was held on April 17. 1984. The lease sale area. which is shown on Figure 2-4, consisted of over 5,000 blocks. with 163 leased. The total area of the leased blocks is 928,000 acres (375.562 hectares). Bids for 17 blocks covering 96.784 acres (39.169 hectares) were accepted by MMS in the area of the 1867 Convention Line. Leases for these bids cannot be issued until an agreement is reached between the U.S. and U.S.S.R. Future activities in this lease sale area are addressed in Section 3.4.1.

Figure 2-4
NAVARIN LEASE SALE 83



ource: Alaska Map Service, 1985

Prior to, the lease sale, one COST well was drilled in the Navarin Planning Area. This well was drilled by ARCO during May through November of 1983. on behalf of 17 other companies.

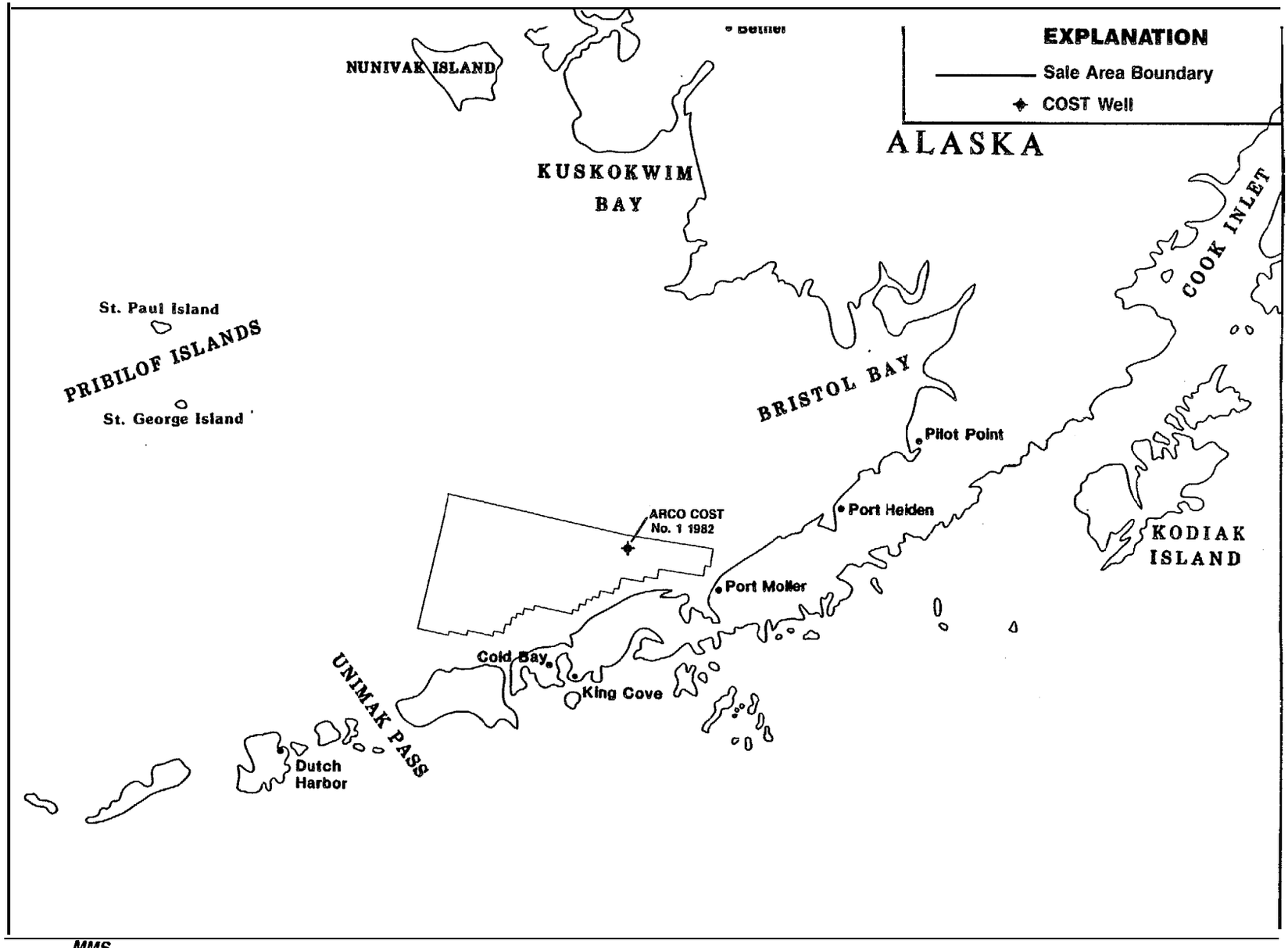
2.1.4 North Aleutian Basin

The North Aleutian Basin underlies part of the Alaska Peninsula and extends north into the Bering Sea. The area has been considered for leasing since at least 1975. In October 1983, a lease sale was proposed for an area termed North Aleutian Shelf Sale 75. However. This sale was postponed until December 1985 to allow completion of the Bristol Bay Cooperative Management Plan. This plan was completed in early 1984. As a result of anticipated environmental concerns addressed in the plan. MMS reduced the size of the sale area. Thus, the originally proposed 5.947 blocks covering 32.4 million acres (13.1 million hectares) was reduced on March 9, 1984. to 990 blocks covering 5.6 million acres (2.3 million hectares), The revised" sale area named North Aleutian Lease Sale 92 is depicted on Figure 2-5.

The Draft EIS for Lease Sale 92 has been completed, and public hearings were held during February 1985 in Dillingham. Naknek. Sand Point, and Anchorage.

One COST well has been drilled in the North Aleutian Planning Area. This well was drilled by ARCO in the fall and winter of 1982-1983. Since North Aleutian Lease Sale 92 has not taken place, no exploration activity has occurred in the lease area.

Figure 2-5
NORTH ALEUTIAN LEASE SALE 92



2.2 MANAGEMENT OF EXPLORATION ACTIVITIES

The following portions of the report describe the methods and regulations used by MMS and other agencies to manage exploration activities. Section 2.2.1 describes the permitting process and presents a specific example of how this process has functioned. and Section 2.2.2 addresses stipulations that are included in lease sales. Section 2.2.3 presents information on mitigation measures that have been developed as lease sale stipulations or other regulatory controls to minimize effects during exploration activities.

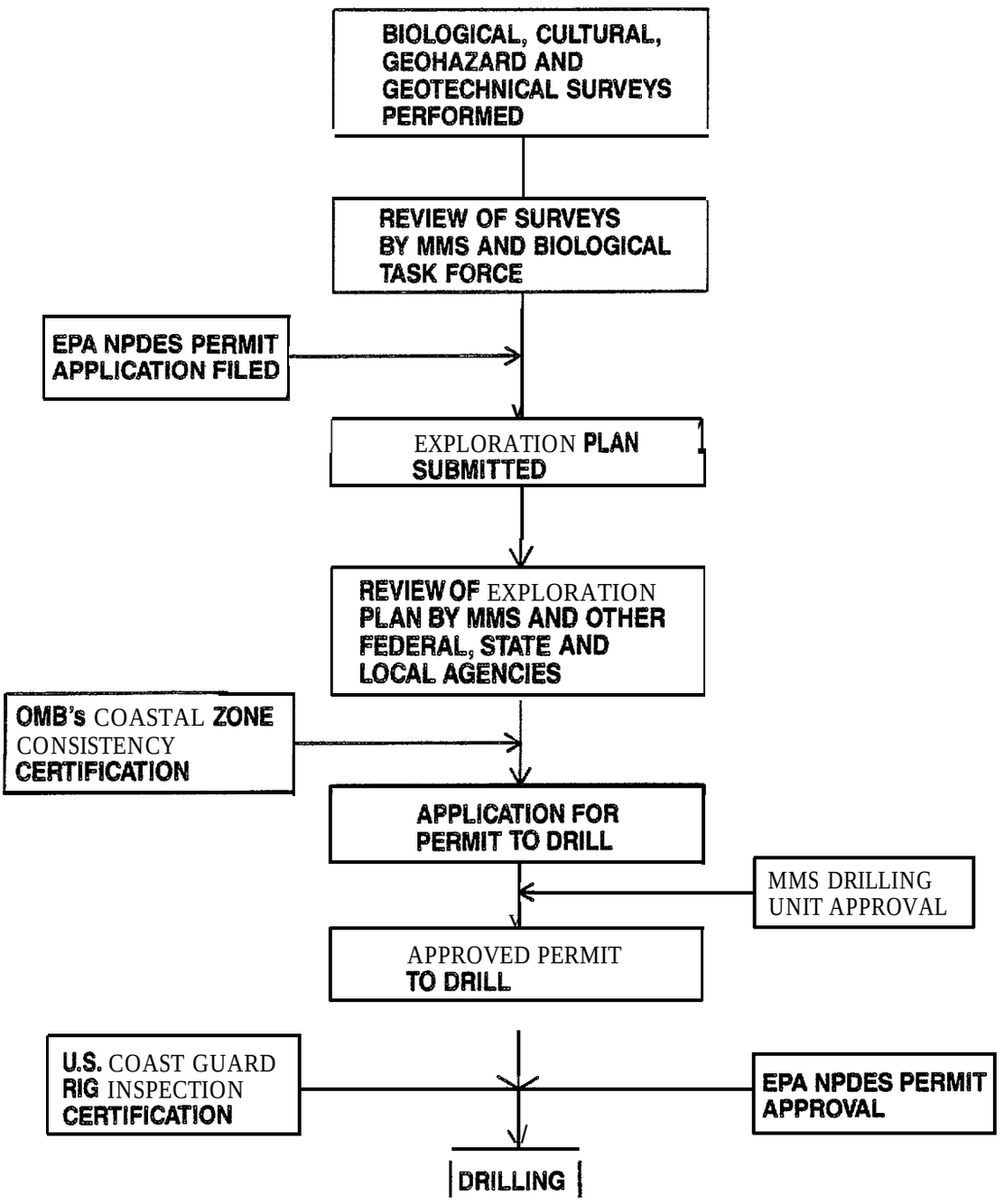
2.2.1 The Permitting Process for Exploration

2.2.1.1 Overview of the Permitting Process

Lease operators must satisfy the major permit requirements listed below before MMS can approve offshore drilling in a lease sale area. The sequence of permitting is illustrated in Figure 2-6. The application of these permit requirements for exploration activity in the Bering Sea is addressed in the remainder of this section. The major permit requirements are as follows:

1. Preliminary surveys must be performed as required by MMS in the lease sale stipulations. Surveys required for a specific lease sale may include any or all of the following: geohazards, cultural resources, biological resources, and geotechnical aspects.

Figure 2-6
SEQUENCE OF MAJOR PERMITS REQUIRED FOR EXPLORATION



This flow chart illustrates the **general sequence** of **MAJOR** permits. **and is not** intended to represent **all** aspects of the permitting **process.**

The preliminary survey requirements are prescribed in the lease sale stipulations. Cultural and biological survey requirements may be eliminated by the MMS Regional Supervisor if it is unlikely that areas of cultural or biological significance occur in the lease sale area. The Regional Supervisor determines what surveys will be required after reviewing comments from an appointed Biological Task Force and the State of Alaska Historical Preservation Officer. To date, geotechnical surveys in the Bering Sea have been required only for bottom-founded or fixed structures. Consequently, geotechnical surveys were required only for wells in Norton Sound where jack-up rigs were used. Geohazards surveys are required for all operations.

After survey results are submitted to MMS by lease operators. MMS reviews the data and may request revisions or additional information", if necessary. MMS formally approves surveys concurrently with issuance of an APD.

The most critical requirement for lease operators is approval of the Exploration Plan. Once the plan is submitted. MMS has 10 working days to determine whether or not the Exploration Plan is complete; that is. MMS must determine if the plan provides the information necessary for the regulatory review process. At the end of the 10-day period. MMS issues a Determination of Completeness. If the Exploration Plan is incomplete, the lease operator has as much time as necessary to complete and resubmit the plan. After the plan is determined to be complete. the lease operator must then submit copies of the Exploration Plan to MMS for distribution to federal, state. and local agencies. From this point, MMS has 30 calendar days to approve or disapprove the plan or require modification to the

plan. Within this 30-day time period, other reviewing agencies have 20 days to submit comments to MMS, and MMS must complete an environmental assessment of the plan. If MMS determines the Exploration Plan will not result in significant impacts, a Finding of No Significant Impact (FONSI) is issued. However. if MMS finds that significant effects may result from exploration activities, the agency must prepare an EIS. Issuance of the Final EIS may take up to 2 years from the time the decision is made to prepare the document assuming that the Draft EIS is not challenged in court.

As part of the application review process, the state's Coastal Zone Management Office, a branch of the Office of Management and Budget (OMB), evaluates the completed exploration plan with regard to consistency with the Coastal Zone Management Program. OMB has 45 days from the date it receives the plan from MMS to determine whether or not the plan meets Coastal Zone Consistency Certification requirements.

The Coast Guard initiates a review of the drilling rig proposed for use by the vessel operator in the Exploration Plan. When the vessel is approved, the Coast Guard issues a Certificate of Inspection. This certification is issued on an annual basis for each rig and the certification process usually does not affect the permit processing schedule. The MMS district office also approves each drilling unit. Most rigs are generally approved for use on a special lease although the MMS District Office occasionally approves a rig for an area or a proposed well site.

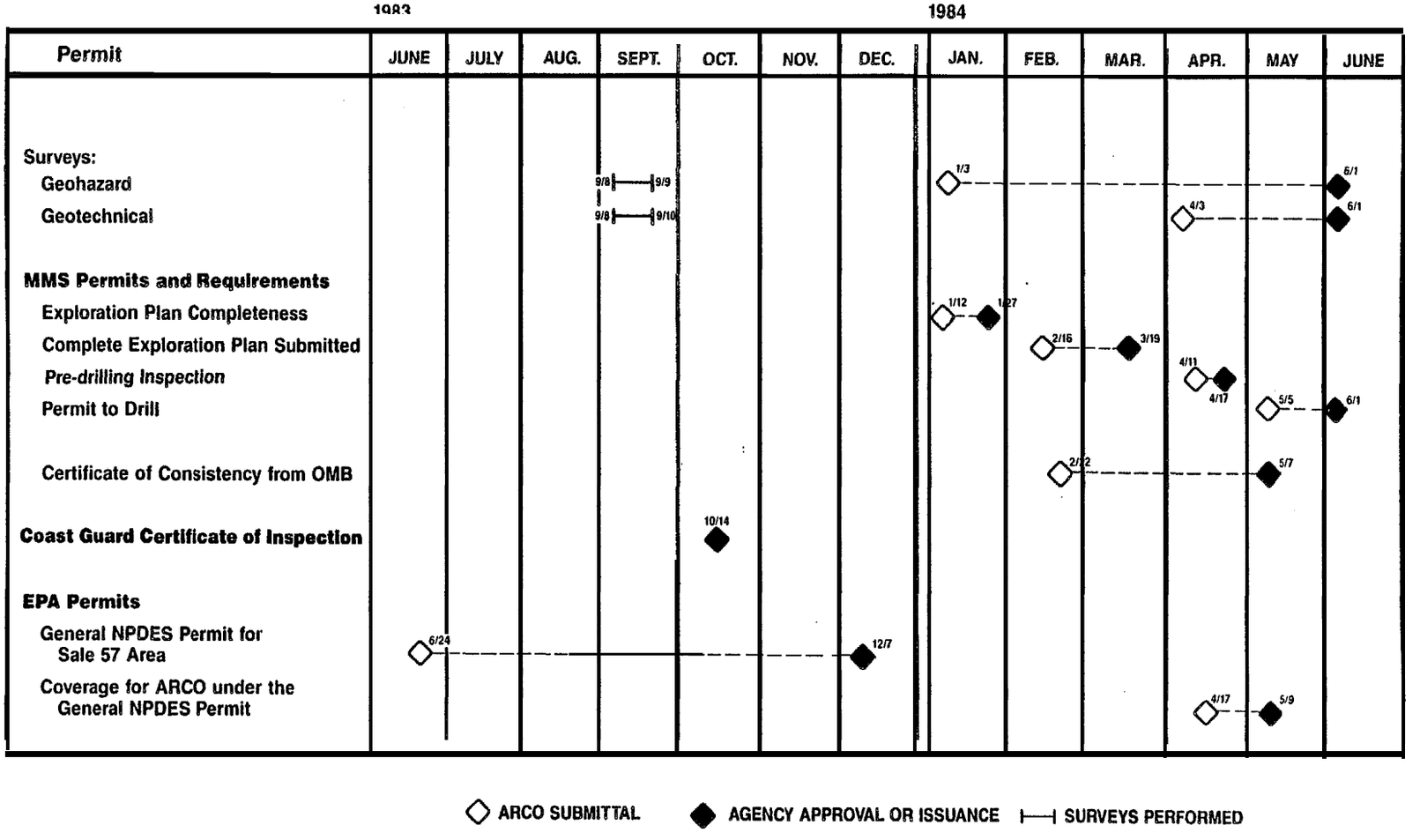
Each lease operator must obtain a NPDES permit from the EPA prior to initiation of exploration activities. Upon receipt of an NPDES application deemed to be complete by the agency, EPA will distribute appropriate information to agencies for review, with comments due back within 30 to 45 days. An individual NPDES permit can be issued for each well, a process that can take up to 6 months following receipt of an application deemed to be complete, or EPA can issue a general permit which covers an entire lease sale area. Within this general permit system, the lease operator need only apply for coverage of a specific well under an existing general NPDES permit.

EPA has issued general NPDES permits for Lease Sale Area 57, 70, and 83. A waived request seeking coverage under these permits must be submitted at least 60 days in advance of discharges. After approval of the Exploration Plan package by MMS, and after a Coastal Zone Consistency Certification is issued by OMB, a permit to drill can be filed and approved by the MMS District Supervisor. However, lease operators must still meet the requirements of the EPA and Coast Guard before any drilling can take place.

2.2.1.2 Permitting Process for ARCO's Birch Well

The following portion of the report describes the permitting process that was followed for ARCO's Birch Well Number 1-OCS-Y-0436 in Norton Basin Lease Sale 57. The procedures identified for this well are thought to be representative of the permitting process for all Bering Sea exploratory wells.

F gu e 2-7
MAJOR PERM TT NG PROCESS FOR ARCO'S B RCH WELL NO. OCS-Y-0436



This flow chart illustrates the general sequence of **MAJOR** permits and is not intended to represent all aspects of the permitting process.

In general, permitting for this well was accomplished within the time frame outlined above. With the exception of a delay in the Coastal Zone Consistency Certification Process, all other permits were issued on time and the entire process from receipt of the Exploration Plan by MMS to issuance of the APD. took 141 days, or about 4.5 months (see Figure 2-7).

No surveys of cultural or biological resources of the site were required by the MMS Regional Supervisor. A geohazards survey was conducted on September 8 and 9, 1983 and survey results were submitted to MMS on January 3. 1984. A geotechnical survey was performed on September 8, 9. and 10. 1983 and submitted to the MMS District Office on April 3, 1984. Approval of these surveys coincided with the issuance of an APD on June 1. 1984.

The Exploration Plan for Birch was initially submitted to MMS on Januarv 12, 1984. In the Determination of Completeness issued 10 working days later (January 27, 1984) MMS deemed the plan incomplete and requested further information on the Oil Spill Contingency Plan. ARCO resubmitted an Exploration Plan package that included the additional information. The plan was deemed complete on February lb, 1984 and the 30-calendar-day review period began. MMS issued a Finding of No Significant Impact (FONSI) and the Exploration Plan was approved on March 19, 1984. Although plan approval was issued 32 days after the plan was deemed complete, the 30th day was a Saturday, and the plan was approved on the first working day after that weekend.

As noted above, the OMB review process for issuance of the Certification of Consistency with the State Coastal Zone Management Plan normally takes 45 days from the date of receipt of a copy of the Exploration Plan from MMS. OMB received the Birch No. 1 document on February 22. 1984. On March 20, 1984 OMB stopped the 45-day process to request additional information on ARCO's Oil Spill Contingency Plan. ARCO prepared and submitted the requested materials to OMB on April 16, 1984. and the 45-day review process resumed. A Certification of Consistency was issued on Mav 7, 1984. This portion of the permitting process was delayed approximately 28 days.

ARCO proposed to use the drill rig Key Hawaii for the exploration well. This vessel had received a Coast Guard Certificate of Inspection on October 14, 1983 and MMS's Drilling Unit Approval inspection was performed on April 11, 1984, with the rig approved on April 17, 1984.

The Alaska Oil and Gas Association (AOGA) and several companies requested a general NPDES permit be prepared for Norton Basin Sale 57 in 1980. EPA issued this draft general NPDES permit on June 24, 1983. Public hearings were held on July 29 and August 2 in Nome, and public comments were accepted until August 15. The final general NPDES permit was issued on December 7, 1983. According to EPA personnel. the time taken to issue the permit was slightly longer than usual, primarily due to a lawsuit filed bv the people of the Village of Gambell against James G. Watt, Secretary of the Interior. The village sought a preliminary injunction to postpone Lease Sale 57 and a-permanent injunction requiring the Department of the Interior to protect their subsistence rights.

ARCO requested coverage under the EPA's NPDES general permit for Norton Basin on April 17, 1984. It was granted 22 days later on May 9. 1984, a relatively fast turnaround time. In addition to filing for the permit. ARCO was required to notify the EPA of any mud additives anticipated for use in their drilling fluids that were not already listed on the general permit. ARCO notified the EPA in four separate letters sent between April 13 and June 6 of the anticipated use of several such additives. On June 25, 1984, EPA approved the use of all chemicals identified in these letters.

After satisfying other permit requirements, ARCO submitted its Application for a Permit to Drill on May 5, 1984. Approval was granted on June 1, 1984, 141 days after submittal of the Exploration Plan.

2.2.2 Lease Sale Stipulations

The Notice of Sale for each oil and gas lease sale offered by the MMS includes stipulations that are intended to minimize potential environmental and cultural impacts due to OCS oil exploration and development. Stipulations for an individual lease sale are formulated by MMS in consultation with federal agencies such as the National Marine Fisheries Services and the U.S Fish and Wildlife Service, with the State Historical Preservation Officer, and with other local government agencies and private organizations. The stipulations used in Bering Sea lease sales are generally similar; commonly used lease sale stipulations are briefly addressed in Section 2.3.2.1. Section 2.3.2.2 provides more detailed

information on the stipulations included in Norton Basin Lease Sale 57, and their relevance to AR CO's Birch No. 1 well.

The stipulations in an oil and gas lease Notice of Sale are followed by a clarification of federal laws and other items pertaining to activities in the lease area ("Information to Lessees"). Other requirements are also included in the Notice of Sale, such as the requirement to submit an Oil Spill Contingency Plan, and suggestions regarding local input and local hiring are also listed.

2.2.2.1 Common Lease Sale Stipulations

In lease areas where the MMS Regional Supervisor has reason to believe that a site. structure, or object of historical or archaeological signif - icance, or a "cultural resource" may exist, the lease operator is required to conduct a remote sensing survey before any exploration activity can commence. This stipulation is included in all Notices of Sale regardless of the probable existence or non-existence of such resources.

The MMS Regional Supervisor determines whether or not there are biological resources or habitats present that require additional protection. If any such areas are identified, a biological survey may be required to further evaluate these areas.

A stipulation in each lease sale requires the lease operator to establish and conduct an environmental training -program for all personnel involved in exploration. In this program the lease operator must identify environ

mental, social, and cultural concerns unique to the lease sale area. This program must be attended at least once a year by all personnel involved in the conduct of operations.

Another commonly applied stipulation prohibits drilling below a designated depth in broken or pack ice conditions, unless the lease operator can demonstrate the ability to "detect, contain. clean-up and dispose of spilled oil in broken and pack ice condition s." Another stipulation used in all but Navarin Lease Sale 83 gives MMS the authority to determine if pipelines should be constructed, given a set of technical. environmental. and economic circumstances.

In some lease sale areas, endangered bowhead whales and gray whales are protected by a seasonal stipulation. This stipulation provides the MMS Regional Supervisor with the "authority to suspend oil and gas drilling operations" when these whales migrate close enough to the drilling operations to be adversely affected. For each lease sale area in which whales may be affected, the stipulation indicates the time period when the Regional Supervisor may require the suspension of exploration drilling. For example, in Norton Basin Lease Sale 57, a stipulation in the Notice of Sale listed April 15 through June 15, and November 1 through January 1 as the most likely periods of migration.

After the stipulations in the Notice of Sale for any lease sale area are made public, the MMS Regional Office may clarify and update information on these stipulations. For example, after consultation with the Bering Sea Biological Task Force. the need for and scope of biological surveys are

determined. Similarly, if it can be determined that no cultural resources exist on a specific lease tract or in the entire lease sale area, or if known cultural resources will not be disturbed by exploration activities, a cultural survey may not be required; The lessees are still required to report any cultural resources that are found during operation to the MMS Regional Supervisor, and the operators must take precautions against damage until the resource has been evaluated.

2.2.2.2 Stipulations for Lease Sale 57

Stipulations included in Norton Basin Lease Sale 57 are considered representative of stipulations that would be applied throughout the Bering Sea OCS. These stipulations are briefly addressed below, with the full text of the Lease Sale 57 stipulations presented in Appendix A.

Stipulation Number 1 of Lease Sale 57 requires that a cultural resources survey be conducted. However, the MMS Regional Supervisor stated in a letter dated September 28, 1983 that a cultural resources survey would not be necessary since MMS had determined that (1) cultural resources are probably not present in the lease sale area and, (2) if such resources are present, they would not be detectable. This MMS decision, which was made in consultation with the State Historic Preservation Officer, further stated that if any cultural resource is detected during geohazard surveys, additional actions may be required.

The second stipulation required all personnel involved in exploration activities to have environmental training relating specifically to environmental, social, and cultural conditions of Norton Sound. Lease operators were required to submit information regarding their training programs along with the Exploration Plan.

Stipulation Number 4 required the "suspension of exploratory drilling and downhole activities below predetermined threshold depth during broken ice and pack ice conditions" unless the lessee can demonstrate an ability to "clean up and dispose of spilled oil in broken and pack ice conditions". To date, no operator in Lease Sale 57 has applied for permission to drill during broken and pack ice conditions.

Stipulation Number 5 gave the MMS Regional Supervisor "authority to suspend oil and gas operations whenever bowhead whales are near enough to be affected by oilspills or other disturbances which would be likely to adversely affect the species", specifically if bowhead whales are sighted east of St. Lawrence Island. It further indicated that migration would most likely occur between April 15 through June 15, and from November 1 through January 1. Basically, this same seasonal stipulation was applied to drilling during gray whale migration east of St. Lawrence Island. MMS intends to have or require lessees to have a monitoring program in place to determine the status of bowhead and gray whale migration in the Lease Sale 57 area if operations are proposed during these periods when whales are expected to be present.

To date. all exploratory drilling in Lease Sale 57 has been conducted after June 15. Therefore, no suspension of operation was necessary in the spring of 1984. However, both Exxon and ARCO proposed to drill during the fall of 1984. To be consistent with the Alaska Coastal Management Program which has policies to ensure protection of migrating bowhead and gray whales, ARCO agreed to shut down Well Number I-OCS-Y-0436 (Birch No. 1) by August 15, 1984 and Exxon proposed to shut down Wells Number 1-OCS-Y-0414 and 1-OCS-Y-0430 (Teton No. 1 and Chugach No. 1) by September 10. 1984. or sooner if necessary to maintain relief well capability. These dates were selected to allow time for the drilling of a relief well during the ice-free season and before whales entered the area, in the event such wells were necessary.

Stipulations 6.7 and 8 address production activities such as pipeline location. offshore tankership loading and discharge of produced waters. . Since oil development has not reached the production phase, these stipulations have not gone into effect. .

Other lease area requirements and suggestions to lease operators in Lease Sale 57 are presented in the "Information to Lessee" section of the Notice of Sale (see Appendix B for the full text). These additional requirements were included at the request of Governor Sheffield in 1982 after the original Notice of Sale was found to be in conflict with the Alaska Coastal Management Program. Major aspects are listed below.

1. Marine vessels and aircraft are required "to maintain at least a l-mile distance from observed wildlife and known wildlife concentration areas ..."

2. Operators and contractors are advised to protect portions of the Iditarod Trail from Kaltag to Nome ". .. following along Norton Sound and crossing the ice between Shaktoolik and Bald Head and Ungalik and Bald Head... "

3. There should be minimal interference with subsistence harvests.

4. The Yukon Delta and St. Lawrence Island areas need specia I protection in the case of an oil spill.

5. The seasonal restrictions for the gray whale are to be identical to those for bowhead whales.

6. Lessees are encouraged to hire local residents and provide training programs to help mitigate local social and economic impacts.

7. Lessees are encouraged to work with local individuals and organizations to minimize adverse impacts.

2.2.3 Mitigation Measures

Offshore oil development in the Bering Sea could cause a variety of environmental, cultural. social, and economic effects in the Bering Sea region. Mitigation measures have been developed to reduce or eliminate anticipated effects. Many of these measures have been included as part of the lease sale stipulations, and others have been developed through local planning documents or public meetings.

Mitigation measures developed for Norton Basin Lease Sale 57 are described below. These mitigation measures were applicable to AR CO's Birch No. 1 well.

The stipulations and "Information to Lessee" listed in the Notice of Sale for Lease Sale 57 represent a set of mitigation measures. These stipulations. which are discussed in the preceding section, are intended to reduce effects to the local environmental, cultural, and socioeconomic systems.

The City of Nome Coastal Management Program, prepared by the City of Nome in 1983, addresses methods to minimize the impacts of exploration activities on Nome. It also includes measures designed to reduce the anticipated effects from siting an energy production facility in Nome.

The program outlines specific measures that must be taken by lease operators if a population increase of at least 5 percent of Nome's existing population occurs. In addition, the program more generally

addresses construction of new housing and utilities, subsistence protection, recreation facility needs, police protection, fire fighting capabilities, and adequate medical facilities. Mitigation measures are also addressed in the coastal management plans of areas adjacent to the Bering Sea. These areas include the Bering Straits Coastal Resource Service Area (CRSA) which has a plan currently under review, and the Yukon/Kuskokwim CRSA which had a Coastal Management Program adopted in October 1984.

In addition to the Coastal Management Programs, the Final EIS prepared by MMS for Lease Sale 57 also discusses mitigation measures. This document lists mitigation measures that were considered by MMS, the issue that has generated the mitigation measure, the intent of the measure, and response to the proposed measures from a variety of sources, including comments solicited by MMS during a series of public hearings held for the Draft EIS in Nome, Savoonga, Unalakleet, Kotlik, Emmonak, Bethel, and Anchorage.

The types of mitigation measures discussed in the Final EIS fall into the six general categories listed below.

1. Orientation or training for oil-service personnel.
2. Transportation of hydrocarbon products.
3. Protection of marine mammals during peak migration periods.
4. Areas of special concern.
5. Other information to lessees on bird and mammal protection.
6. Information to lessee on subsistence activities.

2.2.4 Accidents in the Bering Sea OCS

Environmental protection is one of the primary concerns in the exploration and development of a petroleum resource. For this reason, lease operators involved in oil-related activities are required to submit an Oil Spill Contingency Plan to MMS as part of the Exploration Plan. Further, stipulations listed in the Notice of Sale for lease sales in the Bering Sea require lease operators to design and implement an environmental training program for employees involved in drilling-related operations. A demonstration of oil spill cleanup capability and an oil spill training program are also required by the stipulations. However, accidents occasionally happen during exploration and development, in spite of the extensive effort designed to minimize their occurrence.

2.2.4.1 Hydrocarbon accidents

MMS defines a major (Class III) hydrocarbon accident as one in which over 200 barrels of hydrocarbons are spilled in a single incident within a 30-day period. From 1980 through 1984, no Class III accidents occurred in the Bering Sea Planning Area. A Class II hydrocarbon spill (between 6 and 200 barrels) occurred in Norton Sound on July 19, 1984, when a fuel tank was punctured while being transferred from a barge to the supply vessel Indian Seahorse. Approximately 100 barrels of diesel fuel spilled into Norton Sound creating a "sheen" 30 to 40 feet wide and about 4 miles long. There were also several reports of spillages of 1 gallon or less in the Planning Area.

2.2.4.2 Personal injury accidents

A major personal injury is defined by MMS as an injury that results in a loss of work time exceeding 72 hours. Several major personal injuries, including injuries that resulted in death, occurred during exploration in the Bering Sea OCS from 1980 through 1984. These injuries included a broken leg that occurred when an ARCO representative tripped as he disembarked from a helicopter onto the Key Hawaii in Norton Sound, and a hernia rupture suffered by an employee on the Rowan Middletown in Norton Sound.

Two diving-related deaths took place in 1980 and 1984. The first death occurred in the Norton Sound on the jack-up rig Dan Prince, and the second occurred in the St. George Planning Area on the Sedco 708. According to the attending physicians' reports, both deaths were the result of embolisms. A third death in January of 1985 was caused when a snatch block was dropped 85 feet and struck an employee on the Ocean Odyssey.

3.0 THE PETROLEUM EXPLORATION PROCESS

3.1 INTRODUCTION

Petroleum exploration is performed by a broadly-based industry that emphasizes a variety of special skills and technical disciplines. As Hutcheson and Hogg (1975) observed in the North Sea, major oil companies finance and control the exploration activities, but most of the work is contracted to specialist firms within the industry. For example, geophysical exploration and exploratory drilling are normally undertaken by specialist firms that own and operate the necessary vessels and equipment. Downhole engineering services such as well-logging, directional drilling, and flow-testing of oil or gas discoveries are performed by other service companies with the specialized equipment and expertise.

The network of firms involved in a Bering Sea petroleum exploration program is complex. Firms involved in providing services and supplies range from large international firms that own and operate semisubmersible drilling rigs that lease for $100,000 per day, to small, local janitorial supply firms that provide paper buckets for core samples.

To provide an understanding of the exploration industry and the manner in which it affects local communities and the State of Alaska, this section of the report addresses the exploration operation and the firms that are a part of this industry. Section 3.2 presents a brief summary of the exploration process. and Sections 3.3 and 3.4 provide information on pre-lease sale activities and drilling phase activities. Section 3.5 discusses the

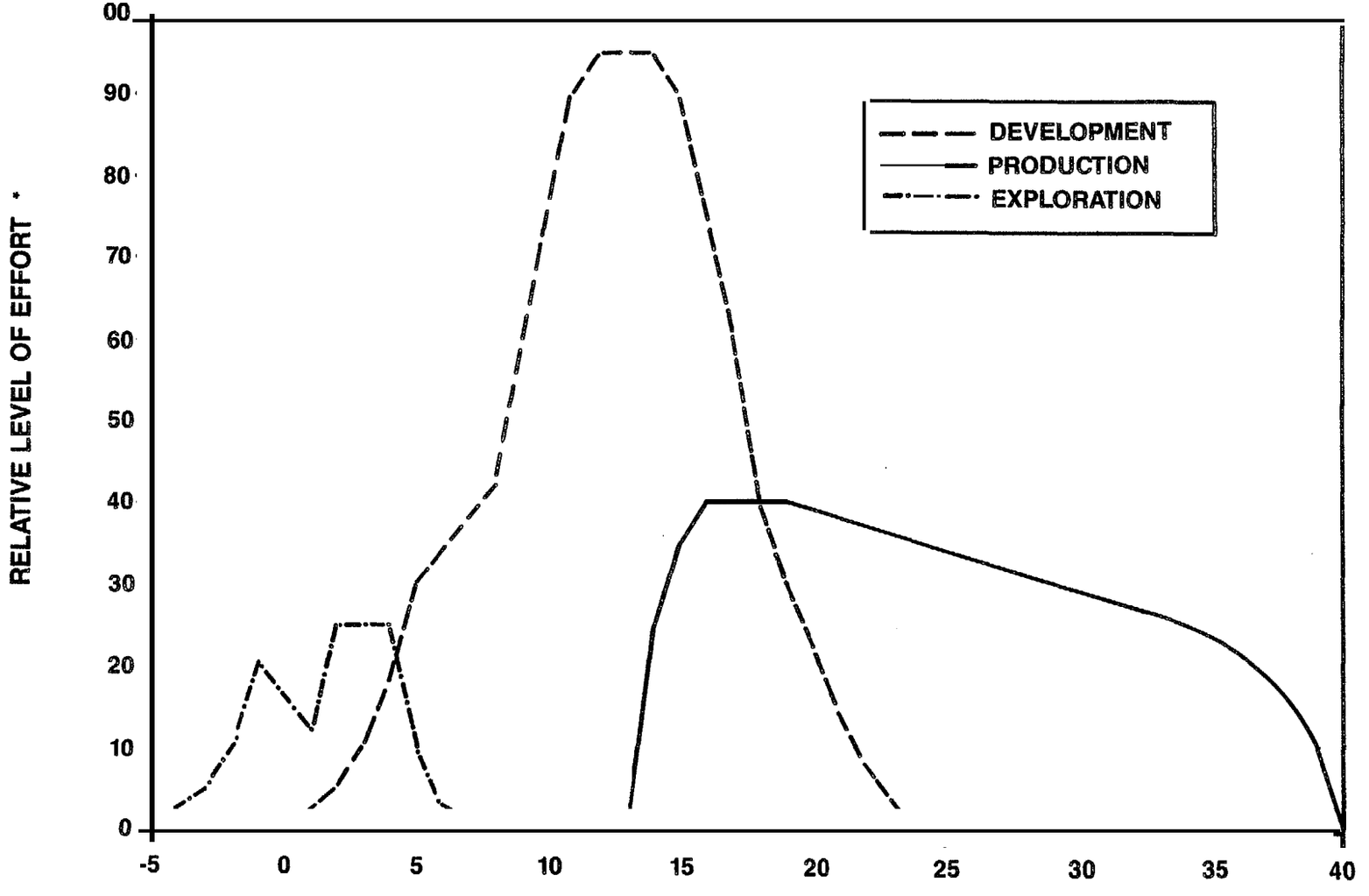
transportation system used for exploration, and Section 3.6 describes planned exploration and development activities in the Bering Sea OCS.

3.2 SUMMARY OF THE EXPLORATION PROCESS

The exploration process represents the initial phase in the establishment of commercially successful hydrocarbon production. The end result of a successful exploration program is discovery of a commercial field. This discovery can lead to field development activities including engineering and construction of offshore platforms, pipelines. and other facilities. When this infrastructure is in place production of the oil and/or gas begins, and continues until volumes decline to a level that make it uneconomic to continue production from the field. Figure 3-1 illustrates the extent and duration of activities in a hypothetical oil field in remote OCS waters of Alaska. This illustration depicts the likely timing of events based on previous experience in Alaska. Although the exploration phase entails a significant effort, this work is dwarfed by the level of activity involved in the development and production phases.

Exploration entails two distinct activity periods, represented by the two peaks shown on Figure 3-1. The first peak occurs prior to the lease sale when geophysical and geological data are being acquired. data are being interpreted, and conceptual engineering, bid determination, and other similar pre-lease sale activities are in progress. This activity peaks about 1 year to 6 months before the lease sale. Following this peak. exploration activity decreases as companies prepare for the lease sale. After the sale, activity increases as successful bidders prepare exploration plans and obtain the necessary permits.

Figure 3-1
PHASES OF OFFSHORE ACTIVITY



SOJRCE: Patrick Burden & Associates

* NOTE: *This figure is intended to be representative of offshore activity and* The scale is relative and does not represent actual units.

The second peak in the exploration process occurs during exploratory drilling. Drilling normally continues for about 3 years, to delineate a commercial discovery, or until a lease operator determines that the likelihood of finding a commercial field in the lease area is very small. If exploration results in the delineation of a commercial field, development activities commence in earnest.

3.3 PRE-L EASE SALE ACTIVITIES

The primary activities during this phase of the exploration process are (1) the performance of preliminary geophysical and geological su rvevs over an entire region of development potential, and (2) the interp retation of data obtained in these surveys. The data obtained during this phase allows individual companies or operating groups to identify particular blocks of land they consider promising for exploration. COST wells are drilled before a lease sale occurs, and the information obtained and the effects of COST wells are similar to those of exploratory drilling. Thus. COST wells are discussed in Section 3.4, Drilling Phase Activities.

Seismic surveys as well as gravity and magnetic surveys are conducted as a part of pre-lease sale activities to evaluate areas likely to be further explored. Although most of these surveys are undertaken before the lease sale, additional surveys may be conducted after the sale to gather site-specific geological data to assist with exploration drilling and delineation decisions. High-resolution geophysical surveys are also conducted to determine the potential for shallow geologic hazards in the lease sale area. Most high-resolution geophysical surveys are conducted after the lease sale,

Descriptions of specific activities occurring during this phase of exploration as well as the equipment, labor, and support associated with them are addressed below.

3.3.1 Geophysical Surveys

Airborne, regional marine, and high-resolution marine geophysical surveys have been conducted in the Bering Sea OCS. These surveys will continue to be of importance in future exploration programs in the area. The activities, equipment, and personnel associated with these surveys are described below. Table 3-1 lists the types of surveys conducted. the firms involved, and the number of surveys conducted in the Bering Sea from 1980 through 1984.

3.3.1.1 Airborne geophysical surveys

Exploration in offshore frontier areas is usually initiated by fixed-wing aircraft performing reconnaissance-level gravity and magnetic surveys. These surveys are designed to aid in identifying sedimentary basins and determining their sedimentary thickness as well as to locate other large geologic features.

The surveys use a gravimeter to measure areal inequalities in the force of gravity that result from irregularities in the composition of the earth's crust. These irregularities result from the differing densities of rock types and from structural changes in rock formations. Similarly, magnetometers are used in magnetic surveys to measure abnormalities in the

TABLE 3-1

PRE-LEASE SALE ACTIVITIES
IN THE BERING SEA, 1980-1984

Activity/Company	Number of Operations by Year				
	1980	1981	1982	1983	1984
Regional Marine Surveys					
ARCO	0	0	1	1	0
C omap	0	0	0	0	1
Digicon	1	1	2	3	3
Energy Analysts	0	0	1	0	0
GECO	2	2	3	1	0
GS I	1	3	3	2	2
Mobil	0	0	1	0	0
Western Geophysical	4	5	6	2	5
Subtotal	8	11	17	9	11
High Resolution Surveys					
Harding Lawson	0	0	0	0	1
InterOcean	0	0	1	1	0
Marine Technical Svcs.	1	2	1	1	3
Nekton	1	0	0	1	1
Subtotal	2	2	2	3	5
Geological Surveys					
Geocubic	0	0	0	1	0
McClellan	2	2	2	1	0
TetraTech	1	0	0	0	0
Woodward-Clyde	0	0	0	1	0
Subtotal	3	2	2	3	0
Navigation Systems					
NCS, International	1	1	2	2	2
Offshore Navigation	1	1	1	2	2
Subtotal	2	2	3	4	4
Airborne Surveys					
Photogravity	0	0	1	1	0
Aeroservices	0	1	1	1	0
Subtotal	0	1	2	2	0
TOTAL OPERATIONS	15	18	26	21	20

Sources: Patrick Burden & Associates and Minerals Management Service

strength and direction of the earth's magnetic field. Data obtained from these surveys provide information on variations in the depth and nature of rock types.

Specialized firms generally conduct airborne geophysical surveys many years in advance of a potential lease sale. The results of the surveys are sold to interested firms on a non-exclusive basis. Purchasers of these data include major oil companies interested in acquiring lease tracts and marine geophysical firms interested in conducting detailed surveys in the region. In some cases an individual oil company or group of companies may contract with an aerial survey firm to obtain more data about a particular location within a larger region. The duration of each survey is dependent upon the size of the area to be surveyed, with field survey time ranging from several weeks to several months.

Airborne geophysical surveys are usually performed by specially equipped twin-engine aircraft with a crew of two. Food and lodging for the crew and aircraft fuel are the principal support requirements. Although firms conducting the surveys may occasionally lease hangar space for the aircraft, a tie-down location at a local airport is usually adequate.

Nome was the air support center for airborne surveys conducted in Norton Sound, and Cold Bay and the Pribilof Islands were both used as air support centers for surveys in the St. George Basin. The Navarin Basin surveys were conducted from St. Lawrence Island.

3.3.1.2 Regional Marine Geophysical Surveys

Regional marine geophysical surveys. which represent the second stage of exploration in offshore frontier areas, have been conducted in the Bering Sea since 1963. Firms in this industry own or lease specialized vessels that are used to conduct seismic, gravity, magnetic. and. occasionally, geological surveys in specific areas of interest within a region. Marine geophysical surveys are conducted on either a non-exclusive arrangement or on a contractual basis with one or more of the oil companies interested in obtaining data for a particular area. In addition, MMS frequently purchases non-exclusive information.

In seismic surveys, sound waves are directed toward the ocean floor from equipment towed behind the vessel. These sound waves are reflected from the different rock strata back to the vessel, with the time of sound wave travel dependent on the density of the formation. Data on sound wave reflections are recorded and analyzed to identify geologic features. Seismic data mapping is often conducted across a large area encompassing a COST well to permit correlation of seismic records with the rock formations identified from well sample analysis. This information aids in locating and identifying deviations from conventional patterns of sedimentation and stratiformation, deviations often associated with the presence of hydrocarbon reservoirs.

To ensure that data are collected in the correct locations, sophisticated navigation systems are used. These systems include combinations of compass heading and velocity sensors as well as satellite and radio

surveying systems. The radio systems include LORAN and ARGO, both of which measure the ship's position with respect to transmitter stations (see Section 3.3.3 for additional information). These transmitters are generally land-based. Because the Navarin planning area is located so far from shore, buoy mounts and transmitters were also used to triangulate positions.

Geophysical vessels operating in Alaskan waters are generally over 150 feet (46 meters) long and are equipped for cruises of up to 1 month in duration. A vessel may work in several lease sale areas during the season, starting in the southern Bering Sea in May or June moving northward as weather and ice conditions permit, and reversing the sequence in the fall. These vessels typically spend 3 to 4 months in Alaskan waters, although only a portion of this time may be in the Bering Sea. After completing their Alaskan assignments, many of the vessels return to ports in Seattle or California, with some continuing to the Gulf of Mexico or other temperate waters for geophysical surveys.

Marine geophysical surveys generally require a total crew size (including all shifts) of approximately 24 to 35, except for the largest vessels which c-an have crews as large as 45. Approximately half of the crew consists of survey technicians, and the remainder of the crew operates the ship. The crews generally rotate on a schedule of 2 months on and 1 month off, and are flown home on their off time as part of their employment contract. A typical technician crew during a survey would consist of 1 survey crew manager (and possibly an assistant), 2 navigation specialists, 4 or more seismic operators or observers, 2 mechanics, and 1 or more client representatives.

Most geophysical firms charter aircraft to transport their crews from Anchorage to Dutch Harbor or other transfer sites where the ships may be in port. This service is obtained on a competitive bid basis, with the average cost ranging from $12,000 to S15,000 for 1 crew change per month. This represents the charter cost for one roundtrip flight for half of the crew (approximately 15-18 persons). Vessels operating in Norton Sound have often made crew changes at Nome using helicopters or small craft, with charter flights used to transport crew members from Nome to Anchorage for flights home. In addition to these charters, the firms also purchase tickets from common carriers serving Anchorage to transport crew members to their homes, regardless of location.

Dutch Harbor is the principal marine support center for geophysical operations in the Bering Sea, although vessels occasionally anchor offshore of Nome to obtain supplies. Since the Port of Nome does not have adequate depth to accommodate these ships, supplies are transported from the port. to the survey ships on smaller vessels (lightening). Survey vessels try to minimize their port calls at Nome since the extra handling adds to the cost of operations. One operator indicated that lighterage fees added $7,000 or more to the cost of water obtained at Nome. The major lighterage firm in Nome (Arctic Lighterage) charges $0.11 per gallon of fuel or water lightered out to vessels with a minimum fee of S3.400. The survey ships generally call at Dutch Harbor or another support location every 28 to 32 days for crew change and to take on fuel, fresh water, supplies, and provisions.

Marine geophysical firms often employ agents at Dutch Harbor and other supply locations to aid in obtaining supplies and p revisions. Several firms indicated that they have expediters who travel in concert with the vessels to aid in facilitating crew changes and purchasing supplies. This coordination is often necessary since there are few ships' chandlers in Alaska, and apparently none of them meet the needs of the seismic industry. For example, many survey. firms indicated that. adequate sup p lies were not available at Dutch Harbor and that the available supplies were very expensive. Subsequently, most vessels come to Alaska in the spring with as many supplies as can be stored on board. If the vessel needs additional seismic survey supplies (such as magnetic tape, computer paper, or parts for related equipment) during its operation in Alaska, this material is air freighted from locations outside of Alaska. Other ship supplies (e.g., buoys. rope. and hand tools) are often air freighted from Seattle rather than purchased in Dutch Harbor or elsewhere in Alaska.

Most vessels are stocked with 3- to 4-months' supply of canned and dried foods before departing for Alaska and generally limit their Alaskan purchases to fresh and frozen foods. These provisions are generally purchased from either ships' chandlers or grocers in Dutch Harbor or Nome, or from supply companies-in Anchorage. Some firms even air freight food from Seattle. While one survey firm estimated that food purchased in Anchorage cost $12,000 per month with a crew of approximately 28 persons per vessel, a more common estimate was $10,000 per month, exclusive of air freight charges for transportation to Dutch Harbor. Potable water is also replenished when the vessels come into port, with water consumption ranging from 50,000 to 70,000 gallons per month.

The amount of fuel consumed by a survey vessel is a function of its size and propulsion equipment and ranges from approximately 50,000 to 100.000 gallons per month. Monthly fuel expenditures could range from $44.600 to S89.200 based upon a February 1985 price quotation of $0.892 per gallon for No. 2 diesel fuel. Prior to the fall of 1984, prices were estimated at $1.15 per gallon when, Chevron was the only fuel supplier in western Alaska and in previous years. Fuel is usually obtained at Dutch Harbor. although refueling is possible at Nome and Kotzebue.

Supply boats have been used in the Navarin Basin and the Chukchi Sea to replenish and refuel the geophysical vessels. In remote areas it is more cost-effective to charter a boat to transport these supplies than it is for the survey vessel to cease operations and spend 12 or more days traveling to Dutch Harbor and back to the survey area.

Geophysical firms often charter relatively large fishing vessels. such as crab boats or trawlers, as "chase" or "guide" boats to assist during surveys in areas of intensive fishing or in ice-infested waters. Guide boats are used principally in the St. George and North Aleutian planning areas where heavy concentrations of fixed fishing gear is present. such as crab pots or longlines. Crew members of the guide boats determine gear location before the geophysical vessel starts its cruise, or the guide boat may simply precede the geophysical vessel along the survey lines. Lease rates for guideboats range from about $1,900 to $2,300 per day; with fuel costs added, the average daily rate was estimated to be $2,500 per day. Guideboats are leased for varying periods of time during the summer

as survey vessels move to "new areas where fishing is in progress. Typically, a crew of 4 persons works aboard the guide boats.

3.3.1.3 High-resolution geophysical surveys

Potential lease block bidders must obtain information on ocean floor features to develop conceptual engineering plans for exploration and possible development. High-resolution surveys, in conjunction with data from regional geological surveys (described in Section 3.3.2), provide the necessary data.

High-resolution seismic surveys are conducted to define geologic conditions in the upper strata of the ocean floor before exploratory drilling begins. This technique aids in identifying fault lines that must be avoided by marine pipelines and other equipment, and locating shallow gas pockets which can cause severe damage to drilling rigs.

The operational time estimates discussed below reflect the average operating times reported for work conducted from 1980 through 1983. Industry's goal to drill in the St. George Basin in the summer of 1984 following the lease sale in April 1983 required permit-related surveys to be conducted during the winter of 1983-84. (Although these site clearance activities were conducted after the lease sale was held, they are discussed in the pre-lease sale section since they influenced the conduct of pre-lease surveys throughout the year.) Navigation systems were in place by early January 1984, and high-resolution studies commenced in that same

month. Operating in winter conditions required larger vessels than had been required in previous years, and costs were significantly higher since weather conditions resulted in substantial periods of time when operations could not be conducted. Employment and expenditures for geophysical activities in 1984 reflect the lengthened operating season.

The work involved in the performance of high-resolution surveys is similar to that of regional marine seismic surveys, although the operating season is generally about 1 month shorter for the former. During surveys requiring up to 2 months to complete, the crews are not rotated, but remain onboard the vessel for the duration of the survey. For surveys requiring 3 or more months, such as were conducted during 1984, the crews are rotated on a schedule of 60 days on and 30 days off.

Costs for fuel, food, and other supplies and services are lower than for seismic surveys due to smaller vessels and smaller crew sizes. High-resolution geophysical surveys typically involve 100-foot-long (31 meters) vessels that are specialized geophysical ships, or sometimes, fishing vessels chartered for the operation. During 1984, the average vessel size increased due to the need to operate in the winter storm season. Vessels used during the winter season ranged from 160 to 180 feet (49 to 55 meters) in length. Crew sizes on high-resolution survey vessels range from 17 to 20 persons. The ship's operating crew accounts for 7 to 8 of these positions, and the remainder is comprised of the seismic crew and (generally) 2 navigation specialists. None of the firms contacted indicated that they employed guide boats to survey fixed fishing gear.

3 .3.2 Regional Geological Surveys

In regional geological surveys, the ocean floor is sampled to obtain data on the strength and capability of the soil. These surveys may be conducted at the same time as the high-resolution surveys, sometimes using the same vessel. At sites where a bottom-founded drilling rig is to be installed, (e.g., a jack-up rig) core samples are taken to determine the foundation strength of the soil. In areas such as the Navarin and St. George basins, where the great depth of water requires the use of semisubmersibles and other types of floating rigs, samples of the upper layers of soil on the ocean floor are obtained by using specially designed sampling tools. Data from the analysis of these samples are used to assess the anchor-holding properties of the seabed. Geological studies also provide design information necessary for pipelines and other production facilities.

Geochemical investigations are often conducted with regional geological surveys. These investigations entail sampling seawater and the sea floor sediments. and subjecting these samples to geochemical analyses to determine the presence of hydrocarbons emanating from petroleum-bearing reservoirs. These analyses are useful in determining the presence of oil - seeps or gas plumes from the ocean floor and in locating these features.

Regional geological studies are conducted with vessels that are specially designed for conducting drilling operations. All of these vessels come from the Lower 48. The vessels average 160 feet (49 meters) in length. and the crew size is generally larger than geophysical survey crews due to the need to have a 6- to 7-member drilling crew on board the vessel.

3.3.3 Marine Navigation Systems

Navigation systems typically involve a number of radio transmitters placed at known coordinates to provide signals for special equipment that is capable of plotting the position of a vessel. These systems can be existing LORAN stations operated by the U.S. Coast Guard, or systems installed by contractors. In the Navarin Basin, where LORAN signals are weak and the distance from land precludes placement of adequate numbers of temporary onshore stations, large buoys with radio transmitters have been installed and maintained during the survey period to provide navigational information. The cost for contracting the installation and maintenance of such buoy systems is reportedly $120,000 per month. This fee can be shared among two or more survey firms. with the individual costs a function of the number of firms using the system. Some survey firms employ navigation technicians onboard the survey vessels, while others subcontract such navigation services to independent firms. This service includes several technicians and equipment onboard to fix, plot, and record the position of the vessel at all times. The cost of this service ranges from S50,000 to $80,000 per month. The $50,000 per month fee would typically use LORAN signals for position reckoning while the S80.000 estimate would include placement and maintenance of temporary transmitters at a number of shore locations.

3.3.4 Lease Sale Evaluation

During the time that geophysical and geological surveys are in progress. the interested petroleum firms conduct preliminary assessments of lease blocks to determine whether or not they will bid on any blocks, and if so. the amount they will bid. This process varies among companies, but generally a small team is assigned to each lease sale area or major prospect (i. e., a geologic feature that could contain petroleum). This team assesses the potential for a commercial discovery based on the available geophysical information. Additional evaluations are conducted as the results of surveys become available.

Assessing the potential of a prospect requires reliable geophysical and geological information. and most companies sponsor non-exclusive surveys in addition to purchasing proprietary data. However, the interpretation of these data is an inexact science, and professionals will differ significantly in their interpretations of the same data.

Starting as much as 1 year prior to a lease sale, engineers and other specialists will begin to develop conceptual plans and designs for development of potential commercial discoveries in a basin with completion of the engineering and planning scheduled for approximately 6 months before the lease sale. Prior to that time, petroleum engineers, economists and financial experts within the firm would have started preparation of computer models as an aid in the determination of bid prices. These programs are designed to assess production potential and feasibility and

calculate production cost estimates. The results of these engineering and economic evaluations would be completed 3 to 4 months prior to the lease sale. This process results in estimates of (1) the potential for a lease area to have a certain amount of petroleum product, and (2) the revenues from that field. Potential revenues are compared with the costs of exploration and development to establish the bid price on a particular block in the lease sale area.

3.4 DRILLING PHASE ACTIVITIES

The geophysical activities described in the above section serve to identify promising prospects. Once promising areas are identified and after the lease operator obtains all necessary permits (see Section 2.2.1). exploratory drilling will be initiated to further define the extent and location of potential resources.

Information on drilling activities is presented below, including descriptions of site surveys, drilling vessels, supply and other marine support vessels, air support, and shorebases and work camps.

3.4.1 Site Surveys

Prior to drilling a lease operator is required to undertake several studies to investigate the potential well site. These site surveys (often called lease block clearing surveys) include a high-resolution geophysical (geohazards) survey and a geotechnical survey, and may include surveys of biological and cultural resources. The geophysical and geotechnical

surveys are conducted in part to determine the most appropriate well locations within a tract. This work is accomplished prior to the issuance of a drilling permit. These surveys determine the presence of natural hazards such as gas seeps and unstable bottom conditions that would make drilling dangerous. Wells are located to avoid these hazards. The studies are accomplished by contractors using bottom samplers, cameras, and seismic equipment, and occasionally shallow coring devices. Operation of the surveys is similar to that discussed in Section 3.3.1.2.

Site specific marine biological surveys are designed to provide biological data at proposed well sites. Underwater video and photographic documentation, plankton tows, infaunal sampling, and trawling are used to determine the relative abundance and types of organisms. If unique habitats or species are present at the proposed site, the drilling program, and possibly the well location would require modification. Cultural and archeological surveys are not required in areas where the probability for these resources is low. However, if review of the television transects and side scan sonar surveys conducted as part of the biological and geophysical surveys indicate anomalies, review by qualified specialists would be required.

3.4.2 Drilling Vessels

3.4.2.1 Types of vessels

Two types of drilling vessels, jack-up rigs and semisubmersibles, were used to drill the COST and exploratory wells in the four Bering Sea

planning areas. In the shallow Norton Basin, jack-up rigs were used, These vessels are essentially barges with legs that can be raised during towing. Large ocean-going tow boats are used to transport the rigs to and from the drilling sites, since they are not self-powered. Jack-up rigs consist of a drill rig, storage tanks for fuel and water, storage for tubulars, a helipad, storage for mud and cement, and crew accommodations.

Once the vessel has been towed to the drilling site, the legs are lowered, and the hull is jacked up out of the water. Jack-up rigs are limited to drilling in water depths of up to approximately 300 feet (31 meters) due to strength and stability constraints on leg construction. Since the water depths in the Norton Basin typically do not exceed 60 feet (18 meters), this type of rig is adequate for drilling in the area.

In the remaining three Bering Sea lease sale areas (St. George, Navarin, and North Aleutian), the water depths typically exceed the limits of jack-up rigs. In these areas, exploratory wells have been drilled using a semisubmersible drilling vessel. This type of vessel has the same basic equipment on board as the jack-up rig; however, the vessel is mounted on hollow caissons (hulls). Once the semisubmersible arrives at the drilling site, it takes on seawater ballast in its caissons for stability. The vessel is held in place by anchors which extend from lines on all four corners of the vessel. Anchoring requires the use of workboats or special anchor handling boats. Semisubmersibles can be used to drill in water depths of 1500 feet (457 meters) or deeper, which is adequate for all potential target sites in the Bering Sea.

Precise location of the drill rig above the desired hole location is very important for exploration and COST wells. The lease operator contracts with a firm specializing in offshore rig-locating surveys to accomplish this critical task. Radio beacons located at shore stations and satellite navigation devices are used to determine the exact location of the rig. For drill sites far offshore, radio beacons placed on floating buoys may be used to locate the rig.

3.4.2.2 Summary of drilling

Once the vessel is in place. "spudding in'" is initiated; that is, the drill hole is started. This usually consists of setting a length of large - diameter "conductor" pipe in the upper soil layers and cementing it in place. Blowout preventers are used while drilling, after the conductor is cemented in place.

The time involved in drilling, logging, and testing an exploratory well is directly related to the depth of the well. A 10,000 - to 15, 000-foot (3048- to 4572-meter) exploratory well offshore ordinarily takes 2 to 3 months to drill and test. Shallower wells, such as those drilled in Norton Sound take less time. Exploratory wells are drilled with extreme care and caution and qualified personnel continuously check and analyze drill cuttings and mud characteristics for oil or gas content and relays this information to the driller. The information obtained from analyses or drill cuttings and drilling mud can help in the evaluation of downhole conditions which aids against blowout at a time when field pressures are unknown.

Because exploratory wells are drilled to investigate for hydrocarbons, not produce them, the expendable wells are plugged after completion, and the rig is moved on to the next drill site. Thus, plugging an exploratory well does not necessarily mean that the field will be abandoned.

If oil and gas are discovered, operators drill additional exploratory wells to confirm the find and to delineate the volume and extent of the reservoir. Delineation and exploration of the reservoir may take 3 or more years. Field delineation is the closing phase of exploration.

3.4.2.3 Data on drilling

Data regarding drilling vessels and drilling operations are presented in Table 3-2. Certain data regarding supplies (cement, drilling mud, casing and tubing, water, and fuel) were not available for all wells. These data were estimated by comparisons with other wells where appropriate. Data on the results of drilling were available for only a few of the exploratory wells. The remaining wells are "tight holes," which means that the lease operator is not yet prepared to release the results of the exploration because they might affect competitive bidding on forthcoming lease sales.

The crew complement on the drilling vessels is also listed on Table 3-2. including size of the crew which is onboard the vessel during the drilling operations. Since drilling vessels crews typically work 12-hour shifts, half the indicated number is on duty at any given time. The number of people employed by the drilling contractor is larger than the number shown

on the table, because home leave rotation is typically 4 weeks on and 4 weeks off. The typical crew sizes reported in Table 3-2 are on a per rotation basis; the number of persons present on the vessel.

The drilling, maintenance. and service crews. and in some cases the catering crew and medical technicians, are employed by the drilling contractor. In addition, there are oceanographers and meteorologists. well loggers, mud loggers and mud engineers, cement engineers. and supervisory employees of the lease operator aboard the vessel at all times. Government employees from the MMS are aboard the vessels and. occasionally, representatives from other agencies.

TABLE 3-2

DRILL VESSEL DATA

	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	N.ALEUTIAN COST # 1	NAVARIN COST # 1	NORTON.0436 BIRCH#1	NORTON.0414 TETON#1	NORTON.0430 CHUGACH#1
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON	EXXON
SPUD DATE	6-14-80	5-19-82	6-7-82	9-6-82	5-26-83	6-25-84	6-19-84	1-25-84
COMPLETED	9-28-80	9-2-82	9-15-82	1-14-83	10-24-83	8-19-84	7-23-84	8-17-84
DRILLING DAYS	104	103	98	128	148	54	34	22
DRILLER	DANTEX	SEDCO	KEYDRIL	SEDCO	SEDCO	KEYDRIL	ROWAN	ROWAN
RESULT	ABANDONED	ABANDONED	ABANDONED	ABANDONED	ABANDONED	DRY HOLE	DRY HOLE	CONFIDENTIAL
WATER DEPTH	90'	375'	45'	285'	420'	65'	52'	35'
WELL DEPTH	14,683'	14,626'	14,888'	17,155'	14,500'	10,950'	3636'	4951'
LOCATION	54 Mi.SSW NOME 63-47N/166-05W	115 Mi.N DUTCH 55-38N/165-27N	68 Mi.SE NOME 63-42N/164-11W	75 Mi.NE COLD BAY 56-16N/161-59W	60-11N/176-15W	30 Mi.S NOME 64-04/165-37	60 Mi.SSE NOME	80 Mi.SSE NOME
RIG NAME	DAN PRINCE	SEDCO 708	KEY SINGAPORE	SEDCO 708	SEDCO 708	KEY HAWAII	ROW. MIDDLETON	ROW. MIDDLETON
RIG TYPE	JACKUP	SEMISUBMERS	JACKUP	SEMISUBMERS.	SEMISUBMERS.	JACKUP	JACKUP	JACKUP
COST	NOT AVAILABLE	$80 MM	$40 MM	$80 MM	$80 MM	$50 MM	NOT AVAILABLE	NOT AVAILABLE
PLACE CONSTRUCTED	NOT AVAILABLE	OAKLAND CA	SINGAPORE	OAKLAND CA	OAKLAND CA	TAMANO JAPAN	VICKSBURG MS	VICKSBURG MS
YEAR CONSTRUCTED	1976	1977	1982	1977	1977	1983	1980	1980
RATED WATER DEPTH	300'	1500'	300'	1500'	1500'	300'	350'	350'
RATED DRILL DEPTH	25,000'	25,000'	25,000'	25,000'	25,000'	25,000'	30,000'	30,000'
POWER	NOT AVAILABLE	6000 BHP	4500 BHP	6000 BHP	6000 BHP	4500 BHP	6000 HP	5000 HP
QUARTERS CAPACITY	NOT AVAILABLE	100	120	120	120	120	120	120
CASING (FEET):								
30 INCH OD	294'	150'	300'	150'	150'	400'	NOT AVAILABLE	NOT AVAILABLE
20 INCH OD	1207'	1000'	1200'	1000'	1000'	1000'	" "	" "
13-3/8 INCH OD	4667'	4500'	4500'	4500'	4500'	5000'	" "	" "
9-5/8 INCH OD	12,170'	12,000'	13000'	12,730'	12,00'	11,000'	" "	" "
7 INCH OD	0'	14,500'	2000'	0'	13,000'	0'	" "	" "
WATER CONSUMPTION-GAL:								
DOMESTIC	NOT AVAILABLE	800,000		2611200	NOT AVAILABLE	378000	71400	46200
DRILLING	728000	2101200	686000	800,000	800,000	NOT AVAILABLE	1300000	841170
CEMENT CONSUMPTION-TON	550	720	600	720	'720	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
MUD CONSUMPTION-TON	536	1600	NOT AVAILABLE	1600	1600	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
RIG FUEL CONSUM-GAL	156000	461440	147000	573440	663040	81000	92820	400400
DAILY LEASE RATE-$M:								
DAILY LEASE DRILLING	$34 M	$99 M	$50 M	$99 M	$101 M	$32 M	NOT AVAILABLE	NOT AVAILABLE
MOBILIZATION	$528 M	$12116 M	$3500 M	$307 M	$632 M	$1200 M	" "	" "
DEMOBILIZATION	$1,528 M	NOT AVAILABLE	NOT AVAILABLE	$307 M	$17956 M	$500 M	" "	" "
STAND-BY	$2040 M	114M/DAY(B)	$60 M/DAY (B)	$24174	$44450		" "	" "
TYPICAL CREW/ROTATION:								
DRILLING	11	22	11	22	22	14	14	14
MAINTENANCE	8	7	8	7	7	8	6	6
SERVICE	9	15	9	15	15	10	12	12
CEMENT	1	1	1	1	1	1	1	1
MUD CONTROL	3	3	3	3	3	3	3	3
ENVRON. MONITORING	1	1	1	1	1	1	1	1
SUPERVISORY	4	4	4	4	4	4	4	4
MEDICAL	1	1	1	1	1	1	1	1
DIVING		2		2	2	0		
CATERING	8	10	8	10	10	8		
OTHER SUPPORT								
OTHER								
TOTAL CREW:	46	66	46	66	66	50	42	42

e==ESTIMATED BASED ON DATA FROM OTHER RIGS,
B==INCLUDES BOTH DRILLING AND SUPPLY VESSELS.
M==THOUSAND

- SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

TABLE 3-2 CONTINUED

ORILL VESSEL DATA

	ST. GEO.0537 RAT#1	ST. GEO.0466 BERTHA#1	ST.GEO.0519 INTREPID#1	ST. GEO.0530 TUSTEMENA#1	ST. GEO.0527 TUSTEMENA#2	ST. GEO.0511 SEGULA#1	ST.GEO.0454 FERN # 1	ST.GEO.0 CAMELOT
LEASE OPER.	ARCO	MOBIL	CHEVRON	EXXON	EXXON	ARCO	SHELL	
SPUD DATE	8-4-84	9-29-84	7-20-84	6-29-8!	9-13-84	11-06-84	11-20-84	11-27
COMPLETED	10-31-84	11-08-84	9-23-84	9-4-84	11-19-84	1-3-85	1-23-85	1
DRILLING DAYS	57	33	63	65	66	57	65	NOT AVAILA
DRILLER	SEDCO	SEDCO	SEDCO	WESTERN OCEAN	WESTERN OCEAN	SEDCO	ODECO	WESTERN OC
RESULT	CONFIDENTIAL	CONFIDENTIAL	CONFIDENTIAL	CONFIDENTIAL	CONFIDENTIAL	CONFIDENTIAL	CONFIDENTIAL	CONFIDENT
WATER DEPTH	465'	354'	450'	420'	421'	410'	420'	4
WELL DEPTH	12,456'	8090'	11,085'	9,303'	12,433	14,500'e	13,000'	9,1
LOCATION	160 Mi.NNW D.H.	95 Mi. W OF C.B. 55-26N/165-00W	180 Mi.NNW D.H.	160 Mi.NNW D.H.	90 Mi.NNW D.H.	151 Mi.N DUTCH 55-26N/165-00W	120 Mi.N DUTCH	90 Mi.N 55-10N/166-
RIG NAME	SEDCO 708	SEDCO 712	SEDCO 712	DOO SUNG	000 SUNG	SEDCO 708	OCEAN ODESSEY	000 S
RIG TYPE	SEMISUBMERS.	SEMISUBMERS.	SEMISUBMERS.	SEMISUBMERS.	SEMISUBMERS.	SEMISUBMERS.	SEMISUBMERS.	SEMISUBME
COST	$80 MM	$100+MM	$100+MM	CONFIDENTIAL	CONFIDENTIAL	CONFIDENTIAL	$ 100+ MM	CONFIDENT
PLACE CONSTRUCTED	OAKLAND CA	SEOUL KOREA	SEOUL KOREA	PUSAN KOREA	PUSAN KOREA	OAKLAND CA	OPPAMA JAPAN	PUSAN KO
YEAR CONSTRUCTED	1977	1982	1982	1984	1984	1977	1983	1
RATED WATER DEPTH	1500'	1500'	1500'	NOT AVAILABLE	NOT AVAILABLE	1500'	1500'	NOT AVAILA
RATED DRILL DEPTH	25.000'	25,000'	25,000'	" "	" "	25,000'	30,000'	" "
POWER	6000 BHP	6000 BHP	6000 BHP	" "	" "	6000 BHP	NOT AVAILABLE	" —
QUARTERS CAPACITY	120	120	120	120	120	120	120	
CASING (FEET):								
30 INCH OD	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILA
20 INCH OD	" "	" "	" "	" "	" "	" "	" "	" "
13-3/8 INCH OD	" "	" "	" "	" "	" "	" "	" "	" "
9-5/8 INCH OD	" "	" "	" "	" "	" "	" "	" "	" "
7 INCH OD	" "	" "	" "	" "	" "	" "	" "	" "
WATER CONSUMPTION-GAL:								
DOMESTIC				(WATER MAKERS)	(WATER MAKERS)		(WATER MAKERS)	(WATER MAKE
DRILLING	1162800	1302840	2487240	195000	198000	1162800	600,000	600,
CEMENT CONSUMPTION-TON	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILA
MUD CONSUMPTION-TON	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILA
RIG FUEL CONSUM-GAL	255360	131670	251370	300300	304920	255360	300,000	276
DAILY LEASE RATE-SM:								
DAILY LEASE DRILLING	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILA
Mobilization	" "	" "	" "	" "	" "	" "	" "	" "
DEMOBILIZATION	" "	" "	" "	" "	" "	" "	" "	" "
STAND-BY	" "	" "	" "	" "	" "	" "	" "	" "
TYPICAL CREW/ROTATION:								
DRILLING	22	22	22	22	22	22	28/28 22	
MAINTENANCE	7	7	7	7	7	7	7	
SERVICE	15	15	15	15	15	15	15	
CEMENT	1	1	1	1	1	1	1	
MUD CONTROL	3	3	3	3	3	3	3	
ENVRON. MONITORING	1	1	1	1	1	1	2	
SUPERVISORY	4	4	4	4	4	4	4	
MEDICAL	1	1	1	1	1	1	1	
DIVING	2	2	2			2	2	
CATERING	10	10	10	10	10	10	10	
OTHER SUPPORT								
OTHER								
TOTAL CREW:	66	66	66	64	64	66	67	

e== ESTIMATED BASED ON DATA FROM OTHER RIGS,
B==INCLUDES BOTH DRILLING AND SUPPLY VESSELS,
M==THOUSAND

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

While casing strings are being run, casing specialists are on board, and coring specialists, well testing specialists. well loggers, fishing tool operators. and communications installers are aboard the rig on an as-needed basis. Divers are used on most of the semisubmersible rigs to check subsea blow-out prevention stages or do underwater repairs of various types. While diving. a crew of 6 or more is aboard the vessel.

3.4.3 supply Vessels (Workboats)

Supply vessels or workboats are used to supply almost all of the materials needed for supporting the drilling vessels. These supplies include diesel fuel, drill water, tubulars for drilling, mud and chemicals. and cement for setting casing. Some staple groceries are also shipped by supply vessels.

During the study period, supply vessels operated between a shorebase in Captain's Bay (near Dutch harbor in Unalaska) and the drill rigs. For the Navarin COST well and all wells in the Norton Basin area, supply vessels were used to transfer supplies from barges which were used as intermediate supply bases. The supply vessels were also used to resupply the barge with fuel and drill water purchased in Nome. These barge operations are further described in Section 3.4.4.

The supply vessels are ocean-going towboats that are specially designed for offshore petroleum support. In addition to heavy-duty towing capacity, these vessels are fitted with large water and fuel tanks and large, flat decks for tubulars and other heavy equipment used on drilling

vessels. Table 3-3 lists the vessels and vessel capacities for work boats used in Bering Sea exploration activities during the study period.

The supply vessels are typically about 200 feet (61 meters) long with a 40 foot (12 meter) beam. They are generally powered by 5000-7500 horsepower (3725-5588 kilowatt) engines and use a twin screw configuration for maximum control of direction during towing. Bow thrusters, which further enhance direction control. are also fitted to the vessels. In addition to the supply function, these vessels are used to tow the jack-up rigs and to assist in positioning the drilling vessels.

During the study period, drilling operations were not conducted when ice was present since the drilling vessels were not rated for ice. However, most of the supply vessels used are rated ice class l-C, which allows them to operate under light ice conditions.

3.4.4 Other Marine Support Vessels

In addition to the supply vessels described above, drilling operations at the Navarin COST well and the Norton Basin COST and exploration wells used the services provided by supply barges. These barges were used to resupply the drilling vessels with tubulars, cement, and drilling mud. This was necessary because of the shallow draft of the Nome harbor. and the distance between the drilling sites and the Captain's Bay shorebase.

TABLE 3-3

WORK BOAT DATA

	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	.ALEUTIAN COST # 1	NAVARIN COST # 1	NORTON.0436 BIRCH#1	NORTON.0414 TETON#1	NORTON.0430 CHUGACH#1
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON	EXXON
SPUD DATE	6-14-80	5-19-82	6-7-82	9-6-82	5-26-83	6-25-84	6-19-84	7-25-84
COMPLETED	9-28-80	9-2-82	9-15-82	1-14-83	10-24-83	8-19-84	7-23-84	8-17-84
DRILLER	DANTEX	SEDCO	KEYDRIL	SEDCO	SEDCO	KEYDRIL	ROWAN	ROWAN
RIG NAME	DAN PRINCE	SEDCO 708	KEY SINGAPORE	SEDCO 708	SEDCO 708	KEY HAWAII	MIDDLETON	ROWAN MIDDLETO
SHORE BASE	CROWLEY-DUTCH	CROWLEY-DUTCH	CROWLEY-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH
WORK BOAT OPER.	BIEHL	BIEHL	OCEAN MARINE	BIEHL	BIEHL	BIEHL	SEAHORSE	SEAHORSE
VESSEL #1:								
VESSEL NAME	BIEHL TRAVELER	BIEHL TRAVELER	OCEAN RAY	BIEHL TRAVELER	BIEHL TRAVELER	BIEHL TRAVELER	INDIAN SEAHORSE	INDIAN SEAHORSE
PURCHASE COST			$7.0 MM					
PLACE CONSTRUCTED	U.S.A	U.S.A	NEW ORLEANS	U.S.A	U.S.A	U.S.A	NEW ORLEANS	NEW ORLEANS
YEAR CONSTRUCTED	1976	1976	1978	1976	19-6	1976	1976	1976
HORSEPOWER	500 HP	7500 HP	7500 HP	500 HP	500 HP	7500 HP	5600 HP	5600 HP
VESSEL LENGTH	2.6'	206'	220'	2 6'	2 6'	206'	206 X 40'	206 X 40'
WATER CONSUMPTION			1 TON/DAY					
FUEL CONSUMPTION:								
TOWING	25 TONS/DAY	25 TONS/DAY		25 TONS/DAY	25 TONS/DAY	25 TONS/DAY		
CRUISING	13 TONS/DAY	13 TONS/DAY	4000 GPD	13 TONS/DAY	13 TONS/DAY	13 TONS/DAY	2400 GPD	2400 GPD
CREW SIZE	10	10	12	10	10	10	10	10
TOT CARGO CAPACITY	1200 TONS	1200 TONS	1400 TONS	1200 TONS	1200 TONS	1200 TONS	1173 TONS	1173 TONS
FUEL CAPACITY	400 TONS	400 TONS	200,000 GAL	400 TONS	400 TONS	400 TONS	500 TONS	500 TONS
WATER CAPACITY	450 TONS	450 TONS	180,000 GAL	450 TONS	450 TONS	450 TONS	350 TONS	350 TONS
QUARTERS CAPACITY			28				19	19
VESSEL #2:								
VESSEL NAME	VIGILANT	BIEHL TRADER	OCEAN DOLPHIN	BIEHL TRADER	BIEHL TRADER	BIEHL TRADER	NONE	NONE
PURCHASE COST			$7.0 MM					
PLACE CONSTRUCTED	U.S.A	U.S.A	NEW ORLEANS	U.S.A	U.S.A	U.S.A		
YEAR CONSTRUCTED	1976	1976	1976	1976	1976	1976		
HORSEPOWER	7500 HP	7500 HP	7500 HP	7500 H-	500 HP	7 00 HP		
VESSEL LENGTH	206'	206'	220'	2.6'	2.6'	2 6'		
WATER CONSUMPTION			1 TON/DAY					
FUEL CONSUMPTION:								
TOWING	25 TONS/DAY	25 TONS/DAY		25 TONS/DAY	25 TONS/DAY	25 TONS/DAY		
CRUISING	13 TONS/DAY	13 TONS/DAY	4000 GPD	13 TONS/DAY	13 TONS/DAY	13 TONS/DAY		
CREW SIZE	10	10	12	10	10	10		
TOT CARGO CAPACITY	1200 TONS	1200 TONS	1400 TONS	1200 TONS	200 TONS	1200 TONS		
FUEL CAPACITY	400 TONS	400 TONS	200,000 GAL	400 TONS	400 TONS	400 TONS		
WATER CAPACITY	450 TONS	450 TONS	180,000 GAL	450 TONS	450 TONS	450 TONS		
QUARTERS CAPACITY			28					
TYPICAL SHIFT ROT.	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED
TYPICAL LEAVE ROT.	50% ON/OFF	50% ON/OFF	40 ON/20 OFF	0% ON/OFF	50% ON/OFF	50% ON/OFF	30 ON/30 OFF	. ON/30 OFF
DAILY LEASE RATE			$7600/DAY			$13,000/DY		

M==THOUSAND

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

TABLE 3-3 CONTINUED

WORK BOAT OATA

	ST.GEO.0537 RAT#1	ST.GEO.0466 BERTHA#1	ST.GEO.0519 INTREPID # 1	ST.GEO.0530 TUSTEMENA # 1	ST.GEO.0527 TUSTEMENA #2	ST.GEO.0411 SEGULA#1	ST.GEO.0454 FERN # 1	ST.G CAME
LEASE OPER.	ARCO	MOBIL	CHEVRON	EXXON	EXXON	ARCO	SHELL	
SPUD DATE	8-4-84	9-29-84	7-20-84	6-29-84	9-13-84	11-06-84	11-20-84	1
COMPLETED	10-31-84	11-01-84	9-23-84	9-4-84	11-19-84		1-23-85	
DRILLER	SEDCO	SEDCO	SEDCO	WESTERN OCEAN	WESTERN OCEAN	SEDCO	ODECO	WESTER
RIG NAME	SEDCO 708	SEDCO 712	SEDCO 712	BIG DIPPER	BIG DIPPER	SEDCO 708	OCEAN ODESSEY	D
SHORE BASE	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OSI-DUTCH	OS
WORK BOAT OPER.	ZAPATA	OCEAN MARINE	OCEAN MARINE	SEAHORSE	SEAHORSE	BIEHL	OCEAN M ARINE	S
VESSEL #1:								
VESSEL NAME	CONSTITUTION-SV	OCEAN TARPON	OCEAN TARPON	ATLNTC SEAHORSE	ATLNTC SEAHORSE	BIEHL TRAVELER	OCEAN FIN	ATLNTC
PURCHASE COST	$5-6 MM	$6.2 MM	$6.2 MM	CONF.	CONF.		$7.0 MM	
PLACE CONSTRUCTED	SAN DIEGO	NEW ORLEANS	NEW ORLEANS	TEXAS	TEXAS	U.S.A	NEW ORLEANS	
YEAR CONSTRUCTED	1977	1977	1977	1974	1974	1976	1978	
HORSEPOWER	6000 IHP	7500 HP	7500 HP	5750	5750	7500 HP	7500 HP	
VESSEL LENGTH	206'	220'	220'	210 X 40	210 X 40	206'	220'	2
WATER CONSUMPTION	360 GPD	1 TONIDAY	1 TON/DAY				1 TON/DAY	
FUEL CONSUMPTION:								
TOWING	6000GPD					25 TONS/DAY		
CRUISING	2700 GPD	4000 GPD	4000 GPD	2400 GPD	2400 GPD	13 TONS/DAY	4000 GPD	2
CREW SIZE	12	12	12	10	10	10	12	
TOT CARGO CAPACITY	840.2	1400 TONS	1400 TONS	1106 TONS	1106 TONS	1200 TONS	1400 TONS	11
FUEL CAPACITY	127.000 GAL	200,000 GAL	200,000 GAL	534 TONS	534 TONS	400 TONS	200.000 GAL	5
WATER CAPACITY	204.000 GAL	180,000 GAL	180,000 GAL	1100 TONS	1100 TONS	450 TONS	180.000 GAL	11
QUARTERS CAPACITY	24	28	28	19	19		28	
VESSEL #2:								
VESSEL NAME	LIBERTY SVC	OCEAN RAY	OCEAN RAY	PACIF SEAHORSE	PACIF SEAHORSE	BIEHL TRADER	OCEAN MARLIN	PACIF S
PURCHASE COST	$5-6 MM	$6.2 MM	$6.2 MM	CONF.	CONF.		$7.0 MM	
PLACE CONSTRUCTED	SAN DIEGO	NEW ORLEANS	NEW ORLEANS	TEXAS	TEXAS	U.S.A	NEW ORLEANS	
YEAR CONSTRUCTED	1978	1976	1976	1974	1974	1976	1976	
HORSEPOWER	6000 IHP	7500 HP	7500 HP	5750	5750	7500 HP	7500 HP	
VESSEL LENGTH	206'	220'	220'	210 x 40	210 x 40	206'	220'	2
WATER CONSUMPTION	360 GPD	1 TON/DAY	1 TON/DAY				1 TON/DAY	
FUEL CONSUMPTION:								
TOWING	6000GPD	1400 TONS				25 TONS/DAY		
CRUISING	2700 GPD	4000 GPD	4000 GPD	2400 GPD	2400 GPD	13 TONS/DAY	4000 GPD	2
CREW SIZE	12	12	12	10	10	10	12	
TOT CARGO CAPACITY	840.2	1400 TONS	1400 TONS		1106 TONS	1200 TONS	1400 TONS	11
FUEL CAPACITY	127.000 GAL	200,000 GAL	200,000 GAL	534 TONS	534 TONS	400 TONS	200.000 GAL	5
WATER CAPACITY	204.000 GAL	180,000 GAL	180,000 GAL	1100 TONS	1100 TONS	450 TONS	180.000 GAL	11
QUARTERS CAPACITY	24	28	28	19	19		28	
TYPICAL SHIFT ROT.	12 HR ON/12 OFF	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS NEEDED	AS
TYPICAL LEAVE ROT.	60 DY ON/60 OFF	40 ON/20 OFF	40 ON/20 OFF	30 ON/30 OFF	30 ON/30 OFF	50% ON/OFF	40 ON/20 OFF	30 ON
DAILY LEASE RATE	$13,300/DY	$7600/DAY	$7600/DAY				$7600/DAY	

M==THOUSAND

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

When the barges were first brought to the drill sites from the Lower 48, each barge carried a full load of supplies - mud, cement, tubulars, and fuel. Supply vessels and smaller barges and tugs replenished the drill rig and supply barge with fuel, water, and food supplies transported from Nome. Two local lighterage barge services operate regularly, transporting fuel and other supplies to the City of Nome and the surrounding villages. These existing lighterage services were also used to move fuel, water, and other supplies from the shallow draft (15 feet or 5 meter depth) Nome harbor out to the deeper water in which the Biehl supply vessels could anchor. The Seahorse supply vessel used to support the Exxon wells had sufficiently shallow d-raft to dock at Nome. Small tank barges with draft shallow enough to dock at Nome were also used. The supply barges and small tank barges are described in Table 3-4. The lighter barges normally operating out of Nome are not included in Table 3-4 since they are not dedicated to the exploration process.

3.4.5 Air Support Activities

3.4.5.1 Aircraft Operations

Air support was used to transport supplies and personnel to the drilling vessels. These supplies and personnel were transported from Cold Bav for the operations in the North Aleutian and St. George areas. For Norton Basin and Navarin Basin wells, Nome was the air support base. Both Cold Bay and Nome are served by commercial airline carriers and jet aircraft. In addition, fixed-wing charter aircraft are often used during mobilization, demobilization, and drilling. Table 3-5 presents information on air support of drilling during the study period, including the types of

TABLE 3-4

BARGE DATA

	NORTON COST # 1	NORTON COST # 2	NAVARIN COST # 1	NORTON .0436 BIRCH#1	NORTON.0414 TETON#1	NORTON.0430 CHUGACH#1	NORTON.0414 TETON#1	NORT CH
LEASE OPERATOR	ARCO	ARCO	ARCO	ARCO	EXXON	EXXON	EXXON -	
BARGE OPERATOR	CROWLEY MARINE LEASING		MARINE	LOGIS. MARINE	LOGIS. MARINE	LOGIS. MARINE	LOGIS. MARINE	LOGIS. MARINE
BARGE TYPE	SOPPLY BARGE	SUPPLY BARGE	SUPPLY BARGE	SOPPLY BARGE	SUPPLY BARGE	SOPPLY BARGE	TANK BARGE	TAN
BARGE NAME	CORDOVA	SUPER SERVANT 3	MLC 331	MLC 330	MLC 331	MLC 330	MLC 165	
PURCHASE COST	UNK		$ 3.5 MM	$ 3.5 MM	$ 3.5 MM	$ 3.5 MM		
PLACE CONSTRUCTED	USA		SEATTLE	SEATTLE	SEATTLE	SEATTLE	RICHMOND CA	RICH
YEAR CONSTRUCTED	1969		1982	1982	1982	1982	1943	
VESSEL LENGTH	400'X76	331'	330X78'	330X78'	330X78'	330X78'	165 X 35'	16
CREW SIZE	7		12	12	12	12	NONE	
TOT CARGO CAPACITY	9100 ST	10,000 T	10,000 T	10,000 T	10,000 T	10,000 T	7500 BBLS	75
FUEL CAPACITY	6,370 ST						7500	BBLS 75
WATER CAPACITY								
QUARTERS CAPACITY	10		16	16	16	16	NONE	
TYPICAL SHIFT ROT.	AS NEEDED	12 HOUR	12 HOUR	12 HOUR	12 HOUR	12 HOUR	N/A	
TYPICAL LEAVE ROT.	50% ON/50%OFF	NONE	NONE	NONE	NONE	NONE	N/A	
DAILY LEASE RATE		$ 34.5M/day	CONF	CONF	CONF	CONF	CONF	

M==THOUSAND

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE.

TABLE 3-5

AIR SUPPORT DATA

	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	N.ALEUTIAN COST # 1	NAVARIN COST # 1	NAVARIN COST # 1	NORTON. 0436 BIRCH#1	NORTON.0414 TETON#1	NORTON.043 CHUGACH#
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON	EXXO
RIG SERVICED	DAN PRINCE	SEDCO 708	KEY SINGAPORE	SEDCO 708	SEDCO 708	SEDCO 708	KEY HAWAII	ROWAN MIDDLETO	ROWAN MIDDLETO
START SERVICE	6-14-80	5-19-82	6-7-82	9-6-82	5-26-83	5-26-81	6-25-84	6-19-84	7-25-8
COMPLETED	9-28-80	9-2-82	9-15-82	1-14-83	10-24-83	10-24-83	8-19-84	7-23-84	8-17-8
AIR CONTRACTOR	E.R.A.	E.R.A.	E.R.A.	E.R.A.	E.R.A.	BOEING/COLUMBIA	AIR LOG	E.R.A.	E.R.A
AIRCRAFT TYPE #1	BELL 212	BELL 412	BELL 212	BELL 412	BELL 412	BOEING 234 ER	BELL 212	BELL 212	BELL 21
AIRCRAFT TYPE #2	BELL 212	BELL 412	BELL 212	BELL 412		BOEING 234 ER	NONE	BELL 212	BELL 21
FLYING CREW/AC	2	2	2	2	2	4.5	2	2	
MAINT. CREW/AC	1	1	1	1	1	5	2	1	
PASSENGER CAPAC.	13	11	13	11	3	17	13	13	1
CARGO CAPACITY	2600	2200	2600	2200	N.A.	3400	2600	2600	260
AIR SUPPORT BASE	NOME	COLD BAY	NOME	COLD BAY	NOME	NOME	NOME	NOME	NOM
DISTANCE TO RIG	54 Mi.	110 Mi.	68 Mi.	80 Mi.	460 Mi.	460 Mi.	33 Mi.	96 MI.	96 MI
FLYING TIME (R-T)	1.2 HOUR	2 HOUR	1.3 HOUR	1.5 HOUR	3.5 HOUR O.W.	8-10 HOUR	0.5 HOUR	1 HOUR	1 HOU
AVG. TRIPS/WEEK	14	7	11		MEDEVAC ONLY	3 TO 4	7	10	1
DAILY LEASE RATE	$2000/DAY + $450/HR	$2000/DAY + $450/HR	$2000/DAY: $450/OR	$2000/DAY + $450/HR	$2000/DAY + $450/HR	$7 MIL. TOTAL	$2660/DAY	$2000/DAY + $450/HR	$2000/DAY + $450/H
FLIGHT CREW:									
TYP. SHIFT--HRS	14 ON/10 OFF	14 ON/10 OFF	14 ON/10 OFF	14 ON/10 OFF	14 ON/10 OFF	VARIES	14 ON/10 OFF	14 ON/10 OFF	14 ON/10 OF
TYP. ROTATION-WK	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	20 DY/10 DY	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OF
MAINT.CREW:									
TYP. SHIFT--HRS	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF	8 ON/16 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OF
TYP. ROTATION-WK	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2001/10 DY	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OF

	ST. GEO.0537 RAT#1	ST. GEO.0466 BERTHA#1	ST. GEO.0519 INTREPID#1	ST. GEO.0530 TUSTEMENA#1	ST. GEO.0527 TUSTEMENA#2	ST. GEO1O511 SEGULA#1	ST.GEO.0454 FERN # 1	ST.GEO.0477 CAMELOT # 1
LEASE OPER.	ARCO	MOBIL	CHEVRON	EXXON	EXXON	ARCO	SHELL	GULF
RIG SERVICED	SEDCO 708	SEDCO 712	SEDCO 712	BIG DIPPER	BIG DIPPER	SEDCO 708	OCEAN ODESSEY	SEDCO
START SERVICE	8-1-84	9-29-84	7-20-84	6-29-84	9-13-84	11-06-84	11-20-84	11-27-84
COMPLETED	10-31-84	11-01-84	9-23-84	9-4-84	11-19-84	1-3-85	1-23-85	1-85
AIR CONTRACTOR	E.R.A.	E.R.A.	E.R.A.	AIR LOG	AIR LOG	ERA	ERA	ERA
AIRCRAFT TYPE #1	SIKORSKY S-61N	BELL 212	AS 33C PUMA	(2)BELL 214ST	(2)BELL 214ST	NOT AVAILABLE	BELL 214ST	
AIRCRAFT TYPE #2	SIKORSKY S-61N	BELL 212	BELL 214 ST	(1)SIKORS.S76	(1) SIKORS.S76	" "	BELL 214ST	
FLYING CREW/AC			2	2	2	" "	2	
MAINT. CREW/AC		i	2	1	1	" "	i	
PASSENGER CAPAC.				14/6	14/6	" "	14	
CARGO CAPACITY	0	0	0	2800#/1200#	2800#/1200#	" "	2800	0
AIR SUPPORT BASE	COLD BAY	COLD BAY	COLD BAY	COLD BAY	COLD BAY	COLD BAY	COLD BAY	COLD BAY
DISTANCE TO RIG	184 MI.	100 MI		175 Mi.	175 Mi.	NOT AVAILABLE	140 Mi	
FLYING TIME (R-T)			2.9 HOUR	2 HOUR	2 HOUR	" "	1 HR	
AVG. TRIPS/WEEK	14	3	10	7	7	" "	4	
DAILY LEASE RATE	$9,000/DY	$2000 /DAY + $450/HR	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	" "	4500/DY/AC	
FLIGHT CREW:								
TYP. SHIFT--HRS	14ON/10 OFF	14 ON/10 OFF	14 ON/10 OFF	14 ON/10 OFF	14 ON/10 OFF	14ON/10 OF?	14 ON/10 OFF	14 ON/10 OFF
TYP. ROTATION-WK	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF
MAINT.CREW:								
TYP. SHIFT--HRS	10 ON/14 OFF	100 N/14 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF	10 ON/14 OFF
TYP. ROTATION-WK	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF	2 ON/2 OFF

SOURCE:PATRICK BURDEN& ASSOCIATES AND DAMES & MOORE

of equipment used, the number of trips and distances from the air support base to the rigs, and data on the maintenance and flight crews.

Helicopters were used for crew changes and to move light materials and fresh groceries out to the drill vessel in all four planning areas. As indicated in Table 3-2, the drilling vessels typically require crews of at least 50, with most of the crew rotating out every 3-4 weeks. The crew is divided into 4 sections so part of the crew changes weekly. In addition, speciality contractors (such as casing, coring, and diving contractors), lease operator personnel. and government observers flew to the rigs on occasion. These personnel movements generated the majority of the need for air support. An average of 1 helicopter trip per day was required to support the drilling activity, with the reported number of trips ranging from 2 or 3 per week to 2 per day. The barge was frequently used by the helicopters during the "drilling of the Navarin Basin COST well.

Helicopters from Cold Bay and Nome landed at helipads on the drilling vessels. In addition, while the Navarin Basin COST No. 1 well was being drilled, a barge anchored in the lee of St. Matthew Island was used as an alternate landing point in case landing was not possible at the rig due to weather conditions.

3.4.5.2 Equipment

The helicopters used must be capable of flying to the drilling rig and returning without refueling. This capacity is required because of the possibility that the helicopter may not be able to land at the rig. For

the Norton Basin, St. George Basin, and North Aleutian wells this posed no problem, since the wells were located within the range of conventional helicopters. For drilling in the Navarin Basin, the distance from the air base to the rigs necessitated the use of long-range equipment.

The Navarin Basin COST well air support was accomplished using Boeing 234 ER (Extended Range) twin-rotor helicopters. These helicopters are a civilian version of the military Chinook helicopter. To allow sufficient fuel for a roundtrip of over 900 miles (1450 kilometers), these helicopters were fitted with auxiliary fuel tanks located in the forward section of the passenger compartment. An extensive maintenance facility was maintained at Nome to support this operation. which was the first commercial use of the Boeing 234 ER. In addition to the Boeing aircraft, a Bell helicopter along with its flying crew and maintenance crew was stationed at the SEDCO rig for emergency medical evacuation.

3.4.5.3 sup port Facilities

Cold Bay's airport is the only facility in the Alaska Peninsula capable of handling jet aircraft and it has been used extensively during OCS exploration activities. A shorebase located in Cold Bay acts as temporary storage for light materials flown by helicopter from the airport in Cold Bay to the drilling vessel. The shorebase also serves as temporary quarters for personnel on their way to or from these same vessels. This air support center was opened in 1980 expressly for the support of COST and exploratory wells drilled in the St. George Basin (with the exception of St. George COST No. 1 well) and the North Aleutian COST well.

There are quarters for up to 60 people with a kitchen and septic system on site. There are also two 60- by 80-foot hangars owned by Air Logistics and Evergreen, that are used to store helicopters. Other facilities include a flight service station. and some storage and maintenance structures leased by oil companies.

Employment at the Cold Bay shorebase totals 15 with a breakdown as follows: 2 cooks, 1 service station manager, 4 oil company emplovees (Exxon), and 8 pilots and mechanics.

Some facilities associated with the air support for the Navarin and Norton Basin lease sales were also developed in Nome, but unlike Cold Bay these facilities were not built expressly for OCS support. Basically, existing facilities in Nome were expanded to include 2 new helipads and hangars. Existing apartments were used to house personnel stopping in Nome on their way to or from drilling vessels.

Air support facilities are also being developed on the island of St. Paul. For"details of this new development see Section 3.6.1.2 on Planned Support.

3.4.6 Shorebases

During offshore exploratory drilling, shorebases were established to provide marshaling areas for goods enroute to drilling vessels. Mud. cement, tubulars, wellhead equipment, fuel, drill water, and food were

staged at shorebases. These shorebases also provide temporary housing for workers in transit to or from the marine support vessels, and for expediters marshaling drilling mud, tubulars, cement, and chemicals.

Shorebases associated with exploration are often operated only for the duration of exploration drilling. Wherever possible, these camps are located where transportation and utility systems are in place. Permanent locations for shore bases are established only after exploration data indicate that major oil resources are present.

During exploration in the Bering Sea, two shore bases were established by private companies near Dutch Harbor in Captain's Bay. Both were developed to support exploratory and COST wells drilled in the Norton Basin. North Aleutian Basin, St. George Basin and Navarin Basin. Further information on these camps is presented in Sections 3 .4.6.1 through 3.4.6.3.

Nome was also used as a shore base for wells drilled in Norton Basin. Supplies such as water, fuel, and groceries were lightered by local small vessels to larger supply vessels outside of the Nome port, then carried by the supply ships to the rigs. However, only a few small storage areas were used. The Sitnasuak Native Corporation provided drayage for fuel and water, and other services such as grocery shopping, and vehicle and apartment rentals.

Crowley Maritime Corporation and Offshore Systems, Inc. (0S1) each established shorebases to support COST and exploration wells drilled in the Bering Sea. The bases are located in Captain's Bay on Unalaska Island and

they served as "loading and unloading areas for crew and SUPPLY boats associated with offshore petroleum exploration. In early 1985, only the 0S1 facility was carrying on OCS-related operations.

3.4.6.1 Shorebase facilities

The first shorebase in Captain's Bay was developed by Crowley Maritime in 1976 for the first St. *George* Basin COST well. The 30-acre (12-hectare) camp provides marine support with a T-shaped wooden pier extending 350 "feet (107 meters) offshore with a 410-foot (125-meter) dock face. The dock was constructed by the military in 1940 and upgraded in 1975 and 1982. The pier is currently 40 feet (12 meters) wide.

Two covered storage areas are available at the Crowley facility. One, a roofed warehouse with a concrete floor, is 80 feet (24 meters) by 225 feet (69 meters) with a 16-foot (5-meter) ceiling. The other roofed warehouse is 80 feet (24 meters) by 112 feet (34 meters) with a 16-foot (5-meter) ceiling. In addition to covered storage, there are about 19 acres (8 hectares) of open storage area, including a l-acre (0.4-hectare) fenced storage area.

Crowley constructed and maintains the road system within the camp. Security is currently provided by contract with McNeill Securities. Housing in the Crowley Maritime camp consists of a 45- by 90-foot (14- by 27-meter) bunkhouse with sleeping quarters and a washroom and recreation area sufficient to accommodate 34. A mess hall and kitchen are located next to the bunkhouse with a dining area seating capacity of 48. In

addition, a duplex apartment, about 24 feet by 69 feet (7 by 21 meters) is also available. Each unit has a bathroom and kitchen.

Power is supplied by a 150-kw portable diesel generator. Diesel fuel is stored in four 10,000-barrel (1590-cubic meter) tanks, and a fuel distribution system carries diesel to the dock. A septic tank and drain field system has been installed and is currently functional. Fresh and potable water is available from the public water supply system. The minimum loading rate is 500 gallons per minute per vessel.

Crowley Maritime plans to expand its dock facilities, housing, and storage areas to accommodate additional traffic resulting from exploration, development, and production of oil.

0S1. leases 40"acres (16 hectares) of a native allotment in Captain's Bay at Port Lekanoff. The 0S1 lease includes an option on the remaining 80 acres (32 hectares) in the allotment. The dock, which was constructed with an upland staging area by 0S1 in the winter of 1982-1983, is 50 feet by 150 feet (15 by 45 meters) with two mooring dolphins. In addition, there is a 30- by 60-foot (9- by 18-meter) crane pad for a 150-foot (46-meter) mobile crane.

At present, there are 6 mobile homes at the camp, with a maximum capacity of 22 people. One other unit is available with 5 single rooms and a kitchen. The only covered storage area at the camp is a 12,000-square foot (115-square meter) covered warehouse.

Electricity is supplied by two 150-kw diesel generators. Fuel, purchased by 0S1 from the Chevron fuel facility in Dutch Harbor, is stored in a single 10.000-barrel (1590-cubic meter) tank. A septic tank system and drain field provide onsite sewage disposal. The City of Unalaska provides fire, medical, airport, and planning services to 0S1.

0S1 has plans to expand housing, storage, and other utilities if oil development and production occurs in the Bering Sea, or if exploration activities continue at the current pace.

3 .4.6.2 Shore base Operations

Both the Crowley Maritime and 0S1 shorebases serve as loading, unloading, and storage areas for crew and supply boats associated with offshore petroleum exploration. This marine support was provided for COST and exploration wells in all four planning areas. Materials such as mud, water, cement, tubulars, and fuel were handled at each base. Incoming supplies were brought by barge to the Crowley or 0S1 dock. temporarily stored onshore, then loaded on supply boats for transport to the drilling vessels as needed.

Crowley Maritime provided shorebase support for the Norton sound and St. George Basin COST wells. Its dock facility was used to load, unload, and store materials arriving from Anchorage and outside of Alaska. Crowley 's boat docking fees were based on the weight of the cargo, the length of the boat, any covered or uncovered storage space used, and water and fuel purchased.

The period of peak activity for the Crowley shorebase was in the summer and fall of 1982 while the second COST wells were being drilled in the St. George Basin and Norton Sound. Assuming that 2 work boats per well docked 3 times per week, the peak activity at Crowley 's base was about 12 to 15 boat dockings per week. Crowley operations took place 2 to 3 years ago and detailed information on wage and employment were not available.

0S1 began its shorebase operation in the Bering Sea in 1982. Since then, they have provided support for the North Aleutian COST well, Navarin COST well, and all exploration wells drilled in 1984. Its work camp and dock facilities are the loading and unloading point for materials brought to the Bering Sea by barge. These materials are stored until needed by a drilling vessel.

0S1 bases its total docking charge per boat on the length of the boat, the weight of the cargo, any covered or uncovered storage area needed and water and fuel purchased.

Approximately 16 full-time people were hired in 1983 to maintain and operate the camp. In 1984, that number rose to 72 to accommodate the expanded activity in the Norton Sound and St. George Basin.

At the peak of drilling activities in the fall of 1984, 0S1 employed two 14 person crews on “back-to-back” 12 hour shifts. The crews were composed of:

6 riggers;

1 loader;

2 forklift operators;

2 crane operators;

1 walking boss; and

2 truck drivers.

In addition to the 0S1 crew, contractors worked out of the OSI base. These included (at peak) 3 to 4 expeditors for various lease operators, plus employees of the cement, mud, testing, and diving contractors. These non-OSI employees were generally housed in the 0S1 bunkhouse. Local residents comprised 94 percent of the 0S1 workforce and lived in their homes in the City of Unalaska. No leave rotation was necessary for these local residents.

In 1983, $275,000 was expended for local wages, with total 1983 expenditures estimated at $750,000. In 1984, local wage expenditures rose to $512,830. Part of the 1984 expenditures were for completion of a pipe storage yard.

0S1 paid $14.000 in local property taxes in 1983, and $15,000 in 1984. In addition, a new personal property tax of about $20,000 will be paid in 1984 (Tony Hearn, 0S1 personal communication 5/85).

0S1 representatives estimate that about two boats per lease operator were serviced every other day at the shorebase in Dutch Harbor. During the peak of drilling activity in the Bering Sea during the summer of 1984. about 40 support vessels docked at the 0S1 facility each week.

3.4.7 Other Contractors

More than 25 different types of contractors and subcontractors were used during the drilling phase of the COST and exploratory wells in the Bering Sea. Table 3-6 presents the names of the contractors used on each of the wells. The services provided by many of these contractors have been described above. In this subsection the services provided by most remaining contractors are briefly described.

Contractors are used for many specialized aspects of the drilling operation. During drilling, the drilling mud supplier provides the proper mud and chemicals for the geological formations encountered. A mud engineer is on duty at all times during drilling, and a separate contractor logs the mud for gas as it returns from the hole, helping to assure well control and to gather information from the cuttings. Firms specializing in electrical well logging are also under contract during drilling. In this operation, information about the formations penetrated is obtained by electronic sensing equipment which is lowered into the hole using wirelines. When a sample of the formation is needed to determine gross structure, a solid core is taken, This core is obtained using a special diamond bit and core barrel provided by a coring vendor. Sidewall coring is conducted by speciality contractors to obtain information about the

formation. Other specialized services which may contribute to the drilling operation include testing tubulars, running casing, wellhead (casinghead) equipment, laboratory core analysis, well testing; fishing (removing jammed tools or equipment from the well core), and plugging the abandoned borehole. The term "Met Ocean" which appear in Table 3-6 and several subsequent tables refer to meteorological and oceanographic -- monitoring stations. These stations were largely automated, needing human labor only for set-up and periodic maintenance.

Weather observers are stationed on most of the drill vessels to collect meteorological and climatological data. In addition to the observers, most drilling vessels use automatic oceanographic and meteorological data sensors. During the study period, ice forecasting services were needed on some of the Norton wells and on the North Aleutian COST well. None of the drilling vessels were rated for operating in the presence of ice so the forecasting service was used to monitor and predict the movement of the pack ice front. To remain on station long enough to complete a well and still allow sufficient time for an orderly demobilization, ice forecasting was needed to provide warning up to 30 days in advance of the time of possible ice encroachment on the drilling site. The ice forecasting program used satellite imagery which was received on a daily basis. In addition, the North Aleutian well used airborne reconnaissance by SLAR (side-looking aerial radar) equipment.

TABLE 3-6

CONTRACTORS ACTIVE IN BERING SEA DRILLING OPERATIONS
1980-1984

	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	N.ALEUTIAN COST #1	NAVARIN COST # 1	NORTON.0436 BIRCH#1	NORTON.0414 TETON#1	NORTON.0430 CHUGACH#1
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON	EXXON
SPUD	6-14-80	5-19-82	6-7-82	5-26-83	9-6-82	6-24-84	6-19-84	7-25-84
DRILLER	DANTEX	SEDCO	KEYDRIL	SEDCO	SEDCO	KEYDRIL	ROWAN	ROWAN
ROUSTABOUT			VECO					
AIR SUPPORT	E.R.A.	E.R.A.	E.R.A.	E.R.A.	COLUMBIA/BOEING	AIR LOG	E.R.A.	E.R.A.
MARINE SUPPORT	BIEHL	BIEHL	OCEAN MARINE	BIEHL	BIEHL	BIEHL	SEAHORSE	SEAHORSE
MARINE SUPPORT				OCEAN MARINE			INT'L MOORING	INT'L MOORING
BARGE SUPPORT	CROWLEY		MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.		MARINE LOGIS.	MARINE LOGIS.
SHORE BASE	NOME/MUNZ	CROWLEY/13REG	NOME	O.S.I./NOME	CROWLEY/13REG	O.S.I.	O.S.I.	O.S.I.
DIVERS	MARTECH	MARTECH	UNDERWTR.CONS.	MARTEC	MARTEC	MARTECH	MARTECH	MARTECH
DEEP GEOPHYS.	TETRATEC				WGC			
SHAL.GEOPHYS.	NEKTON			McCLELLAN				
MUDDER	BAROID	BAROID	MAGCOBAR	BAROID	BAROID	BAROID	BAROID	BAROID
CEMENT	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON
GRAVEL PACK							BAKER	BAKER
MUD LOGGING	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG
WIRE LOGGING	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER
PAPER STUDIES	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE
OIL SPILL	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH
H2S SAFETY							LIFECOM	LIFECOM
CORING			CHRISTIANSON	CHRISTIANSON				
CORE ANALYSIS								
WELL TESTING							NORALCO	NORALCO
TUBING/CASING							FRANK'S CASING	FRANK'S CASING
CATERING			UNIVERSAL SERV.		UNIVERSAL SERV.			
NAVAGATION			ITECH	MARINAV	MARINAV		ITECH	ITECH
WEATHER	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
MEDICAL	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
SECURITY	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL
MET OCEAN	E G & G	E G & G	S.A.I.	E G & G	E G & G	E G & G	E G & G	E G & G
ICE FORCAST			ARCTEC		INTERA		ARCTEC	ARCTEC
WELLHEAD EQUIP		HUGHES OFFSH		HUGHES OFFSH	OTIS	BECHTEL	BECHTEL	BECHTEL

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

TABLE 3-6 CONTINUED

CONTRACTORS ACTIVE IN BERING SEA Exploration OPERATIONS, 1980-1984

	ST.GEO.0537 RAT#1	ST. GEO.0466 BERTHA#1	ST.GEO.0519 INTREPID#1	ST. GEO.0530 TUSTEMENA#1	ST. GEO.0527 TUSTEMENA#2	ST.GEO.0511 SEGULA#1	ST.GEO.0454 FERN # 1	ST.GEO.04 CAMELOT #
LEASE OPER.	ARCO	MOBIL	CHEVRON	EXXON	EXXON	ARCO	SHELL	GU
SPUD	8-4-84	9-29-84	7-20-84	6-29-84	9-13-84	11-6-84	11-20-85	11-27-
DRILLER	SEDCO	SEDCO	SEDCO	WESTERN OCEAN	WESTERN OCEAN	SEDCO	ODECO	WESTERN OCE
ROUSTABOUT								
AIR SUPPORT	E.R.A.	E.R.A.	E.R.A.	AIR LOG	AIR LOG	E.R.A.	E.R.A	E.R.
MARINE SUPPORT	BIEHL	OCEAN MARINE	BIEHL	SEAHORSE	SEAHORSE	BIEHL	OCEAN MARINE	BIE
MARINE SUPPORT				REGAL OFFSH	REGAL OFFSH			
BARGE SUPPORT								
SHORE BASE								
DIVERS	O.S.I. MARTECH	O.S.I. MARTECH	O.S.I. MARTECH	O.S.I.	O.S.I.	O.S.I. MARTECH	O.S.I. MARTECH	O.S. MARTE
DEEP GEOPHYS.		WEST/GSI/GCA						
SHAL.GEOPHYS.		NEKTON						
MUDDER	MILCHEM	MAGCOBAR	BAROID	MAGCOBAR	MAGCOBAR	BAROID	MAGCOBAR	Bnov
CEMENT	HALLIBURTON	HALLIBURTON	HALLIBURTON	DOWELL	DOWELL	HALLIBURTON	HALLIBURTON	HALLIBURT
GRAVEL PACK								
MUD LOGGING	BAROID	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXL
WIRE LOGGING	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERG
PAPER STUDIES	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	NORTEC	WOODWARD-CLY
OIL SPILL	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SHAH	AJIT SH
H2S SAFETY				LIFECOM	LIFECOM			
CORING		CHRISTIANSON		REED AGC	REED AGC			
CORE ANALYSIS		CORE LAB						
WELL TESTING		B.J.HUGHES		NORALCO	NORALCO			
TUBING/CASING				WEATHERFORD	WEATHERFORD			
CATERING								
NAVAGATION		NCS INT'L		OCEANEER.INT'L	OCEANEER, INT'L			
WEATHER	FAIRWEATHER	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NOR?
MEDICAL	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORT
SECURITY	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'----
MET OCEAN	E G & G	E G & G	E G & G	E G & G	E G & G	E G & G		E G &
ICE FORCAST								
WELLHEAD EQUIP	HUGHES OFFSH	HUGHES OFFSH	HUGHES OFFSH	NATIONAL SUP.	NATIONAL SUP,	HUGHES OFFSH	HUGHES OFFSH	

SOURCE; PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

In addition to the services which are directly associated with the drilling operations, there are several other contractor activities. Catering services are used for food preparation on almost all of the drilling vessels, with only the Keydrill company providing its own catering. Catering services were used on the supply barges used for the Navarin and Norton wells. Security services are used at the air support bases and on the vessels.

Safety related services include medical services, air packs for hydrogen sulfide safety, and oil spill cleanup equipment. Medical technicians are also stationed on the drill vessels to provide emergency first aid, treatment of minor injuries, and to stabilize patients for emergency evacuation in case of serious injury.

Hydrogen sulfide is a deadly gas, which is present in some formations, and equipment to monitor and safely vent this gas is installed on the drilling vessels. Oil spill control equipment, including oils skimmers and booms, is provided on a lease-wide basis. During the study period, equipment and trained personnel were stationed at the shorebase at Captain's Bay and were on standby to allow rapid deployment. Some drilling operations had smaller vessels under contract or equipment aboard the vessels to provide assistance at the rig if necessary, for oil spill response and stand-by assistance.

3.5 TRANSPORTATION

3.5.1 Origin of Major Supplies

The point of purchase of major supplies used in the offshore exploration for oil in the Bering Sea played a role in determining the amount of revenue generated in the State of Alaska by OCS development. This section describes the origin of major supplies including drilling mud, cement, tubulars, fuel, water, and wellhead equipment. The supply routes used to transport these goods from the point of origin to their destination are described in Section 3.5.3.

Most mud used for drilling during the study period was purchased outside Alaska. The majority of cement used was supplied out of Anchorage. The remainder was brought up from the Lower 48 by supply barge. Most tubular goods were purchased in the Lower 48 by the oil companies, although some tubular goods remaining from Upper Cook Inlet oil development area were brought to the Bering Sea from Kenai, Alaska.

Almost all fuel used in the offshore oil exploration effort in the St. George, North Aleutian, and Navarin Basins was purchased from distributors in Unalaska. Fuel for Norton Basin activities was brought to the site in the supply barges and some was purchased in Nome. Small quantities of fuel were also delivered by barge from outside of Alaska. Most fresh drill water for Norton Basin wells was delivered from Nome and Dutch Harbor (Captain's Bay). The remainder was shipped by supply barge from the Lower 48. Wellhead equipment was purchased outside Alaska, but most expenditures for maintenance and replacement parts were made in the state.

3 .5.2 Major Carriers

As described below, five major air carriers provide fixed-wing transport of supplies from Anchorage to Dutch Harbor, Cold Bay, St. Paul, and Nome. These airlines are Reeve Aleutian Airways, AIRPAC Inc., Northern Air Cargo, Markair Inc., and ERA Jet Alaska.

Reeve Aleutian Airways provided daily flights to Cold Bay, Dutch Harbor, and St. Paul Island. Major supplies carried to Dutch Harbor and St. Paul for lease operators in the Bering Sea included chilled, frozen, and dried food; drilling equipment and other parts and supplies. Personnel were flown to Cold Bay where they were transported by helicopter to the rigs.

AIRPAC Inc. was contracted by Alaska Airlines to make 10 scheduled flights per week into Dutch Harbor in the summer of 1984. During the study period and in early 1985, 7 trips were made each week through the winter. AIRPAC carried food, personnel, core samples, and other general freight for lease operators.

During the study period, Northern Air Cargo was chartered directly by lease operators to make between 1 and 3 flights per week to Dutch Harbor. Other flights were scheduled as needed. The types of cargo transported included food, drilling equipment, and other general supplies. Northern Air Cargo did not provide any passenger service.

ERA Jet Alaska, a division of ERA Helicopters, has also been flying to Dutch Harbor once a week, with additional flights added as needed. They carried personnel, drilling tools, and other miscellaneous materials. During the summer of 1984, ERA occasionally flew into Nome, and the airline plans service to St. Paul beginning in the summer of 1985.

Markair and Alaska Airlines flew scheduled flights to Nome and drilling operators and contractors used these flights. In the summer of 1984, Markair flew two 737s and four Hercules C-130 cargo planes daily to Nome. They carried food, maintenance parts and equipment, and personnel. Markair did not serve Dutch Harbor, Cold Bay, or St. Paul.

Alaska Airlines provided passenger service for lease operator and subcontractor employees and shipped a small amount of cargo. During the summer of 1984, Alaska Airlines flew two 737s each day from Anchorage to Nome. In early 1985 there were 3 flights per day.

3.5.3 Distribution and Supply Routes

The distribution and supply routes used by lease operators in each of the 4 lease sale planning areas is described below and shown on Figure 3-2. Transshipment routes for marine transportation are also addressed.

3.5.3.1 Norton Sound

Consumable materials, such as mud, cement, .and tubulars were staged by barge to the Norton Basin COST and exploration wells. The barges were

mobilized from the Lower 48. The supply barges were brought up fully loaded with cement, drilling mud, tubulars, and fuel. The barges were resupplied as necessary with food, fuel, and water out of Nome. supply vessels and (for one well) a small shallow draft tanker barge and tug were used for the resupply operations. Local lighter barges and tugs were needed to bring supplies from Nome out to the supply vessels due to the 15-foot draft limitation at Nome. Details on the marine supply equipment appear in Sections 3 .4.3 and 3.4.4.

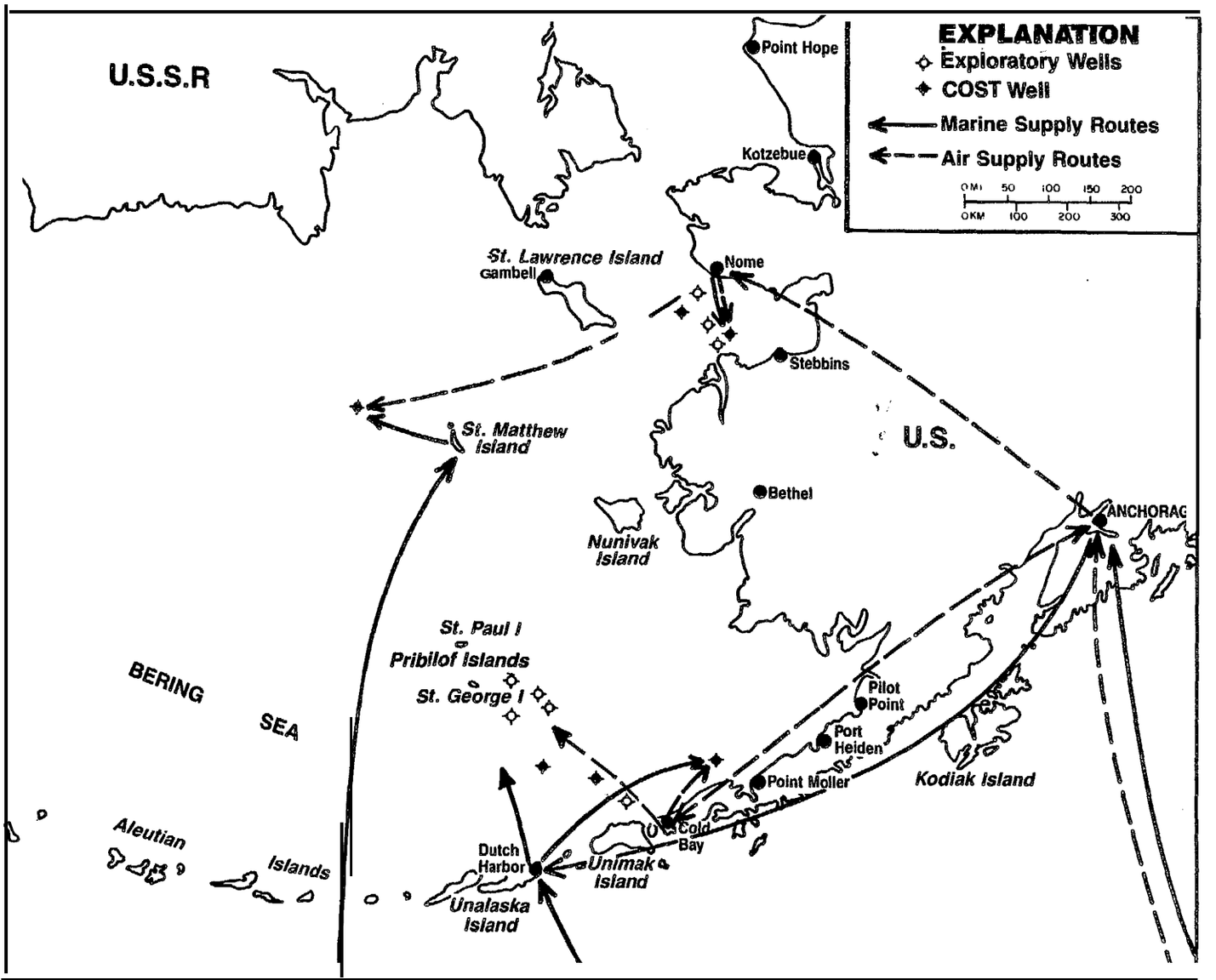
Personnel, and some food and other supplies for exploration in Norton Basin were flown to Nome via Anchorage. Helicopters were used to fly from Nome to the drilling rigs. Those helicopters were operated under contract by ERA and Air Logistics.

3 .5.3.2 St. George Basin

Mud, cement, tubulars, and other heavy drilling equipment bound for the St. George Basin were shipped by scheduled barges or container ships from Anchorage and Seattle to Dutch Harbor. Some materials and equipment were also air freighted to Dutch Harbor. Supply vessels operated by the marine support firms Biehl, Zapata, Ocean Marine, and Seahorse, then shuttled the materials to the rigs as needed. Some of the vessels used were the Biehl Traveler, Biehl Trader, Ocean Tarpon, Ocean Ray , and Constitution SVC.

Other materials, food, and personnel were transported by aircraft from Anchorage to Cold Bay. From this location, ERA and Air Logistics used helicopters to transport personnel and supplies to the drilling rigs.

Figure 3-2
MAJOR SUPPLY ROUTES



Source MMS.

in the Bering Sea. The information presented below focuses on four possible types of interference with commercial or subsistence fishing: (1) harbor congestion; (2) interference with prime fishing areas; (3) competition for water, fuel, and electricity; and (4) vessel collisions or gear loss.

The commercial and subsistence fishing activity in the study area can be broadly categorized into the Norton Sound salmon, herring, and king crab fisheries and the East Aleutian Islands halibut, king and tanner crab, and shrimp fisheries.

Because of an extremely shallow harbor, the Port of Nome was used mainly for lightening water, fuel, and groceries to vessels drilling in Norton Sound, while heavier materials such as mud, cement, and tubulars were supplied to the wells from barges. The Port Manager of Nome stated that there were no adverse effects (including congestion) as a result of geo - physical survey vessels calling at Nome. All other marine support for the Navarin COST well, North Aleutian COST well and St. George COST and exploration wells came out of Dutch Harbor. As of December 1984, no incidents of harbor congestion had been reported to any local government agency by commercial or subsistence fishermen from Dutch Harbor.

The crab industry in western Alaska has suffered serious setbacks over the past few years, a situation unrelated to oil industry activities in the area. Fewer and fewer crabbers have been fishing these waters as compared to previous years. In fact, because of the poor crab fishing in the area, some local crabbing vessels were hired as standby boats for Exxon and ARCO

for the St. George Basin lease sale. Standby vessels are required to be near a drilling rig at all times in case of emergency. The Rosy G. and Polar Lady were hired out of Dutch Harbor as emergency standby vessels, and ARCO used the Sally J, a converted trawler. to obtain soil stability samples in Norton Sound. Crab boats have also been hired by operators of geophysical vessels to transit an area where the survey vessel will be operating to locate and identify fishing gear, thereby reducing the potential for gear conflict.

Commercial fishing vessels generally do not use the same entrance to Captain's Bay that is used by marine support vessels traveling to and from the Crowley Maritime and 0S1 docks. This, in conjunction with the reduced number of vessels in the crab fishing fleet, has reduced the potential for vessel traffic congestion in Dutch Harbor.

It is possible that some disturbance of fishing areas occurred in the Dutch Harbor area. One report from a local resident claimed the drilling rig Key Hawaii was anchored in a prime halibut fishing area of Captain's Bay in the summer of 1984. However, no local, state, or federal agency could cite any report substantiating this incident. No other interference with fishing in the Dutch Harbor or Nome areas was reported.

Large amounts of water and fuel are consumed by drilling rigs, supply boats and other support vessel contractors. Because of Nome's limited use as a marine base, the level of consumption during exploration did not affect local users. In Dutch Harbor, the 0S1 and Crowley Maritime shorebases provided their own electricity and water. Increased vessel

There were 11 wells drilled in the Bering Sea in 1984 and early 1985: 3 were drilled in the Norton Basin and 8 in the St. George Basin. With the exception of Exxon's announcement of a dry hole at its Teton Number 1 well (lease tract 1-OCS-Y-414) in Norton Basin, the results of these 11 wells have been kept confidential. This is not surprising since St. George Lease Sale 89 is scheduled for September 1985, and Norton Basin Lease Sale 100 is scheduled for December 1985.

There were several wells being drilled in late 1984 and early 1985 in the St. George Basin which, because of their late start dates and the fact that data on the wells would not be available until after 1984, are not included in the survey data of this report. These wells are discussed below.

3.6.1 Continued Exploration Plans

3.6.1.1 Lease operator plans

There were three wells being drilled in the St. George Basin at the end of 1984. On November 6, 1984, ARCO spudded its Segula well # 1 (l-OCS-Y-0511) located about 151 miles (256 kilometers) north of Dutch Harbor in 410 feet (125 meters) of water, using the Sedco 708 semisubmersible. The rig was still drilling in February 1985.

Shell was drilling its second St. George well, 1-OCS-Y-0463 Monkshood Number 1 prospect, approximately 120 miles (193 kilometers) north-northeast of Dutch Harbor with the Ocean Odyssey semisubmersible rig. The well was spudded on January 27, 1985 in a water depth of 334 feet (120 meters). Shell has filed two applications for additional drilling in the St. George Basin and received approval for both, but the company has not decided whether or not to drill in 1985 (Yesland, 1985).

In February 1985, Gulf was drilling its Camelot prospect in tract OCS-Y-0477, approximately 90 miles (145 kilometers) north of Dutch Harbor. The company has no plans to operate elsewhere in the Bering Sea in 19S5.

Exploration activity in Norton Basin in 1985 will be less than it was in 1984. ARCO has no plans to drill in the area in 1985 (Hammon, 1985), Exxon has plans to drill two wells during the 1985 season with a third well possible. The third well would be drilled only if it can be completed prior to the ice shutdown date (Jones, 19 85).

Placid Oil has indicated an interest in drilling in the St. George Basin in 1985. Placid had planned to drill an exploratory well in 1984 with the Penrod 77, a new semisubmersible that was constructed in Japan, but the rig was released before drilling commenced. Other operators have indicated that they will be returning to the St. George Basin in 1986, after the second lease sale. The relatively small number of drilling rigs available to operate in the Navarin and St. George basins has been mentioned as a constraint to drilling in the latter basin in 1985. Bidding strategv for the second St. George Lease Sale was also mentioned as a reason for not conducting 1985 operations in the St. George Lease Sale Area.

traffic in the region, part of which was due to exploration activities, resulted in an increased demand for fuel. This demand prompted the opening of a new fuel terminal in Dutch Harbor by Petro Marine in November 1984. Prior to the opening of this 2.8 million gallon facility Chevron had been the only major supplier in western Alaska. Competition between the two suppliers has resulted in fuel prices in Dutch Harbor dropping from $1.15 per gallon in mid-1984 to $0,89 per gallon in early 1985.

No incidents of vessel collisions or gear loss as the result of OCS activity were reported in the Bering Sea through December 1984.

3.5.5 Other Subsistence Resources

In addition to affects on subsistence fishing, OCS activities can effect other subsistence resources through development of onshore facilities or transportation activities. In September 1984, helicopter flights from the Cold Bay airport to rigs operating in the St. George Basin were noticed disrupting feeding by staging black brant and other waterfowl in Izembek Lagoon. Biologists were concerned that extensive disturbances of aircraft would adversely affect these subsistence resources during the critical fall staging period.

An aircraft overflight stipulation had been incorporated into the St. George's plans as part of the Coastal Management Program consistently determination. This stipulation required that helicopter flights conform to flight corridors identified by the U.S. Fish and Wildlife Service which transit around the lagoon or maintain a flight altitude of 1,500 feet when

flying over or near Izembek Lagoon unless human safety or requirements of the Federal Aviation Administration (FAA) dictates otherwise. However, helicopter flights over the lagoon at the 1,500 foot altitude were noted disturbing the waterfowl.

USF&WS flight paths and altitude requirements could be observed during FAA Visual Flight Rule (VFR) procedures but, due to the proximity and alignment of the Cold Bay airport to Izembek Lagoon. Instrument Flight Rule (IFR) procedures dictated flight across Izembek Lagoon when poor weather conditions or visibility were present "for any portion of the flight to or from the rigs.

The industry sought and received accommodation from the FAA to depart "under VFR procedures (when possible) while on an IFR flight plan *to* avoid the lagoon and intercept the IFR flight path seaward of the lagoon. In instances where weather prohibited visual departures from Cold Bay, pilots were provided flight paths to minimize the potential for waterfowl disturbance. These procedures reduced the disturbance to the black brant and other waterfowl.

3.6 FUTURE PLANS

The 1984 drilling season was an active period in the Bering Sea as operators moved quickly to drill exploratory wells to test prospects in the Norton Basin and St. George lease sale areas. It is anticipated that in 1%35 additional drilling will take place in these basins and the first exploration drilling will be conducted in the Navarin Basin.

Exxon plans to drill two wells in the Navarin Basin this season from the semisubmersible rig Big Dipper, (Korean Drilling's Doo Sung, under Western Oceanic Management). However, lease sale stipulations for the Navarin Basin may not allow time to complete the second well (Jones, 1985),

ARCO's exploration activity in the Bering Sea will be limited to one well in the Navarin Basin. A drilling vessel has not yet been contracted- for this activity (Hammon, 1985).

Chevron may continue exploration activity in the St, George Basin during the coming season dependent upon further evaluation of the recently completed Intrepid Number 1 well (1-OCS-Y-0519) (Cook, 1985).

Amoco will drill two or more wells in the Navarin Basin in 1985. Two drilling rigs (SEDCO 708 and Ocean Odyssey) have been contracted to conduct the drilling.

3,6.1.2 Planned support

Logistic support for Exxon's 1985 drilling program in Norton Sound will be similar to the 1984 program. Air support will be provided at Nome and marine support at the Offshore Systems, Inc. (0S1) facility at Captain's Bay, Unalaska. A support barge will be anchored near the rig to serve as the supply point for tubulars, mud, cement, fuel, and other supplies, and will be replenished by work boats from Captain's Bay and by lightening vessels from the Port of Nome.

Pribilof Offshore Support Services, a subsidiary of the Aleut Corporation, signed a contract with Exxon to build and operate a $3 million, 7-acre (3-hectare) base adjacent to St. Paul's 5100-foot (1555-meter) airport with a completion date of spring of 1985. This 112-man camp will serve as the helicopter base to support drilling vessels operating in the Navarin Basin and will have three hangars to house helicopters and a 500,000 gallon aviation gasoline storage facility. Columbia Helicopters and ERA Helicopters will operate out of St. Paul providing services to Exxon, Amoco, and ARCO. The Boeing 234 ER Chinooks used by ARCO during drilling of the 1983 Navarin COST well will be used by both helicopter companies to transport personnel to the rigs.

The majority of fixed-wing air support for Navarin exploration programs will be staged through St. Paul. Aircraft with adequate rang e," and capable of landing on the 5100-foot (1555-meter) runway may fly directly from Anchorage. Other air support will be provided by jets transporting personnel and supplies to Cold Bay and using other aircraft to transport crews and supplies to St. Paul. Marine support for the Navarin Basin will be provided from 0S1's Captain's Bay facility.

Air support for St. George Basin will continue to be staged from the present facility at Cold Bay, the only air strip in the Aleutians capable of accommodating large jets. Equipment and personnel flown in on commercial or chartered flights will be transported by helicopter to the drill rigs which are all equipped with helipads.

The Navarin Basin is the most remote of the Bering Sea planning areas, being located 450 miles (720 kilometers) from Nome and more than 300 miles (480 kilometers) from St. Paul Island. Because of the long distance from shore, a consortium headed by the Cook Inlet Regional Corporation is attempting to establish a shorebase at St. Matthew Island. St. Matthew is an uninhabited marine sanctuary situated less than 100 miles (160 kilometers) from the center of the Navarin Basin. The CIRI group is attempting to conduct a land exchange with the Fish and Wildlife Service (which administers St. Matthew) under the terms of ANILCA (the Alaska National Interest Land Claims Act). A federal court decision ruling against the exchange was rendered in November of 1984.

Amoco plans to support two semi-submersibles with two barge supply ships located approximately midway between the rigs. One of the vessels will be a bulk dry cargo carrier of approximately 35,000 Dead Weight Tons (DWT) used to store tubulars, mud, cement, drilling expendable and aviation fuel. The 30,00 DWT supply tanker will store drill water, marine ocean, and potable water.

3.6.2 Development Concepts

Development of oil production facilities in the Bering Sea will take place under difficult conditions, Most of the region is subject to sea ice conditions, fog and storms are common, and the winters are severe. The St. George and North Aleutian basins are exposed to the risk of earthquakes and their attendant hazards, with the risk increasing proportionately with proximity to the Alaska Peninsula and the Aleutian Chain. The

oil industry is aware of these problems and has considered them during the conceptual engineering phase that is necessary before the lease sale occurs. Many of the concepts considered by the industry have been discussed at length in the EISS for the lease sale areas and in the Bering Sea Summary Report (Rogers, Golden & Halpern, Inc., 1983). The purpose of this section is to summarize the extensive discussions contained in those documents.

Facilities required to support exploration of the Bering Sea OCS are substantially in place. Facilities for producing commercial quantities of oil would involve siting of facilities to transport oil from the wells to refineries in the U.S. or other Pacific Rim countries. Terminals such as those at Valdez for the Trans-Alaska Pipeline, or Drift River for the Cook Inlet fields are representative of the range of size for facilities which may be required if a major oil discovery were made in the Bering Sea lease sale areas. Industry feels that offshore loading facilities such as those used for development of the Fulmar Field in the North Sea would be modified for ice loads and use in the Bering Sea.

Industry estimates for the size of a commercial discovery in the Bering Sea range considerably from basin to basin. A new field in the Norton, St. George. or North Aleutian basins will require from 200 to 300 million barrels (32 to 48 million cubic meters) of recoverable reserves, while a discovery in the Navarin Basin would require 300 to 500 million barrels (48 to 80 million cubic meters) in order to justify the higher cost of development.

Offshore drilling and production facilities for a commercial oil discovery in Norton Sound would likely be either concrete or gravel production islands, or ice resistant steel production structures. Steel jackets, steel monopods or concrete monotowers would probably be used in other lease sale areas. Except for gravel islands, these types of structures could be constructed outside of Alaska and towed to the well site.

Production. treatment, and shipping facilities would also be required either onshore or offshore. The location and areal extent of facilities would be dependent upon the size and location of the oil discovery. Major components of a production treatment complex include: oil dehydration, measurement, and shipping facilities, pipelines, airfields, equipment storage yards, oil storage tanks, tanker berthing facilities, and facilities to accommodate support personnel. Marine service bases would also have to be expanded to service the drilling and production platforms. The tanker berthing facility could be located separately from the production treatment facility.

Development in Norton Basin, Navarin Basin, and the northern part of St. George Basin would require that production systems be designed for operation in a sea ice environment. This includes the terminal or offshore loading facility, and the tankers or marine pipelines. Marine pipelines in the Norton Basin would have to be buried for protection against ice gouging and scouring, and tankers capable of operating during significant ice conditions would be required. The industry feels that substantial experience exists with seasonal and full-year marine operations in ice-infested waters, and that current technology is capable of

providing the necessary design, construction, and operation for ice-capable tankers for year-round operations in the northern Bering Sea.

Although most industry representatives expressed a preference for offshore loading where feasible, a major oil discovery in the Bering Sea would require consideration of a transshipment terminal on the Alaska Peninsula or Aleutian Chain, The distance of the Norton and Navarin basins from this land mass tends to favor offshore loading or an onshore terminal located closer to the discovery, but a commercial field in either St. George or the North Aleutian lease sale areas could rely on a pipeline to an onshore terminal. The preference of the State of Alaska for onshore terminal facilities, as reflected in the state's Coastal Zone Management Plan. and similar preferences stated in plans of local jurisdictions will also influence the onshore siting of a terminal although such a facility may not be the economically or environmentally preferred transportation option. Furthermore, the operation of an offshore loading system under the ice, wind, fog, and wave conditions of the Navarin Basin, and the operation of tanker operations in the ice conditions of the Norton Basin are unproven. Given these factors, prudent planning by the industry mandates that an Alaska Peninsula or Aleutian Chain terminal be evaluated.

Development of an onshore terminal would result in potentially significant changes in the present interaction between the oil industry and local communities. The potential for change would be less at Unalaska Island than at any other location. If another location was selected for an onshore terminal, the marine support base and the survey vessel and workboat fleets would likely relocate from Dutch Harbor to the new

terminal site where petroleum related equipment and supplies would be readily available, and a major airfield could be built in p roximit y to the transshipment terminal for transportation of personnel and supplies. If the new site were an enclave development it could reduce the interaction of the oil industry with local firms and probably reduce the employment opportunities for area residents.

On the other hand, development of a terminal at or near Unalaska Island would result in expansion of the existing business relationship between the oil industry and local firms, more employment opportunities for area residents, and could provide the impetus for implementing the proposed runway extension at Dutch Harbor.

There are a number of factors that will influence design and siting of development facilities for the Bering Sea. These factors include:

- Location and production rates of new discoveries
- Timing of production from multiple basins
- Transportation systems within the Bering Sea
- Regulatory considerations and land ownership
- Costs of offshore development

The location of a commercial discovery is, of course, the primary consideration. Conditions encountered in each basin in the Bering Sea, such as proximity to landfall, water depth, and ice conditions, will be different. Consequently, development concepts will differ among the basins.

Production rates from a reservoir will influence the design and selection of loading, storage, and transportation facilities. In some basins it is possible that storm and other conditions could prevent tankers from calling at loading facilities for periods of 10 to 15 days, and storage facilities would have to be capable of accommodating the produced oil for this time period.

Multiple basin development will also have an effect on the location of development facilities. For example, industry representatives stated that concurrent commercial discoveries in the northern portion of St. George Basin and the southern portion of the Navarin Basin would strongly influence the selection of the Pribilof Islands as an onshore terminal site. However, the likelihood of discovery occurring in more than one basin in a time frame where joint consideration can be made is very low.

There are two general marine transportation systems that are considered reasonable for the Bering Sea: (1) offshore loading from the production site to conventional or ice-capable tankers which would then transport the oil either to an onshore terminal on the Alaska Peninsula/Aleutian Chain for processing and reshipment, or directly to the U.S. or a Pacific Rim country; and (2) transport of the crude oil by marine pipeline to production support sites onshore, and by conventional or ice-capable tanker from there to the refineries.

Permitting of terminal facilities is a lengthy process and the siting of such facilities is subject to lengthy negotiations between the industry, federal and state government, and residents of the region. Industry has

indicated a preference for offshore loading, where possible, but this may be unacceptable to the State of Alaska. In addition, lease sale stipulations for Norton Basin Lease Sale 57 and St. George Basin Lease Sale 70 require that the MMS evaluate the use of pipelines to bring oil ashore under certain conditions.

Economic viability will be a critical factor as the petroleum industry attempts to produce oil in the remote offshore waters of the Bering Sea. The prospect of developing an oil field is diminished by the difficult environmental conditions and the lack of infrastructure, which will necessitate large capital expenditures for field development and transportation. The costs for development will be high, and only large, prolific fields will be candidates for development.

4.0 EXPENDITURE AND EMPLOYMENT EFFECTS OF EXPLORATION ACTIVITIES

This section presents information regarding expenditures and employment associated with the exploration activities described in Section 3.0 of the report. The data presented are for activities occurring from 1980 through 1984, a time frame termed the study period. As described in Section 1.3. the majority of this information was. obtained from representatives' of firms that provide services, materials, supplies, and equipment to the lease operators. Section 4.1 addresses the expenditures that occurred during pre-lease sale activities and drilling phase activities, and Section 4.2 addresses employment during both of these phases of exploration. Section 4.3 summarizes oil exploration employment and expenditures for the study period.

4.1 EXPENDITURES

Expenditures associated with pre-lease sale activities and drilling phase activities are addressed below. The data presented were obtained directly from the firms conducting operations in the Bering Sea, through interviews with individuals in related firms who are cognizant of operational costs for the Bering Sea, or through extrapolation and interpretation of known data. These expenditure data represent best estimates of the costs of major exploration activities. However, some information regarding expen - ditures was considered confidential by the lease operators or service - contractors and was not released for use in this study.

To estimate and predict the economic effects of exploration activities, it was necessary to determine the portion of exploration expenditures accruing to the local economy and the State of Alaska. Unfortunately, the available data did not provide clearly defined divisions between expenditures made locally, or in areas of Alaska beyond the Bering Sea communities, or outside of Alaska. Further, it would be conceptually difficult to determine the boundaries within which expenditures were made, even if detailed cost data were available. For example, if a contractor has a major office and staff in Anchorage, but is headquartered in the Lower 48, it is difficult, without access to proprietary financial records, to determine the percentage of total payments made for various services or supplies that can be considered as Alaska revenue.

As a result of these constraints, this report presents order-of-magnitude estimates of expenditures in Alaska and in the local Bering Sea area. The estimation of Alaskan expenditures includes consideration of the amount of supplies purchased in-state, the extent to which the labor force consisted of Alaskan residents, and the extent of Alaskan support services and facilities.

Estimates of local expenditures were slightly easier to develop since they are more visible and limited geographically. Virtually all Bering Sea expenditures during the study period were made in Dutch Harbor/Unalaska, Cold Bay, and Nome, and primarily included vessel charters, labor (see Section 4.2), lodging and meals, fuel, water, and groceries.

4.1.1 Pre-lease Sale Activities

4. 1.1.1 Background and assumptions

Exploration activities conducted prior to a lease sale consist primarily of geophysical and geological surveys, the installation, operation, and maintenance of the attendant navigation systems and evaluation and interpretation of geophysical data by firms interested in bidding on leases. These surveys are often conducted on a non-exclusive basis by firms specializing in such services, and the results are sold to any interested firm or organization. In other cases, a geophysical or geological survey company will contact a firm or group of firms to determine the level of interest in a survey(s), and seek support and subsequent contractual commitment for the survey. Petroleum companies very often organize a group of companies who hire a contractor to consult the surveys (a "group shoot"), and the companies have also mobilized their own geophysical survey vessels to the Bering Sea.

The data used in calculations of expenditures do not include estimates of expenditures by the petroleum industry for purchases of non-exclusive survey data, or contractual commitments for proprietary geophysical or geological data. These expenditure data also do not include wages and salaries paid by geophysical and geophysical survey firms for analysis of the data. Only the direct costs incurred during the time the vessel was committed to operating in the Bering Sea are included in the estimate.

Certain geophysical and geological surveys conducted during 19$3 and 1984 were undertaken to obtain site specific information for drilling permits in the Norton and St. George basins. These activities were conducted after the lease sales, but the costs associated with them were included in the expenditure data since most of the contractors performed the surveys as a portion of their annual operating program, and it was difficult for company representatives to identify incremental costs for site specific activities while still maintaining confidentiality.

Exploration expenditures made prior to the lease sale were categorized as those made for (1) regional marine surveys, (2) high-resolution surveys, (3) geological surveys, (4) navigation systems, (5) airborne surveys, and (6) industry evaluation. There is some overlap among these categories. For example, it is common for vessels conducting regional marine seismic surveys to also conduct high-resolution geophysical surveys during the operating season, and geological surveys can also be conducted in conjunction with high-resolution geophysical surveys. To simplify data compilation. operations in the Bering Sea were categorized according to the primary survey being conducted, as recorded on permit data summary sheets made available by MMS. The industry evaluation category only includes direct wages and salaries paid by industry to their employees. It does not includes evaluation by contractor or other expenses.

Estimates of expenditures by month for major cost categories were obtained from the companies operating in the Bering Sea. Since port calls and crew changes were generally made on a 28- to 30-day schedule, a monthly basis for costs was established. Food, supplies, air fares and charters, and

other costs were also estimated by company representatives on a monthly basis. Fuel costs were calculated using a 1984 estimate of $1.15 for a gallon of diesel Number 2, which is the common fuel used in marine diesel engines, applied to the average fuel volume purchased per vessel during the regular port call.

4.1.1.2 Total expenditures

Table 4-1 presents estimates of total annual expenditures for pre-lease sale activities. These data are listed by operational activity for each of the 5 years during the study period. These expenditure estimates include only those direct costs incurred by the participants while committed to operations in the Bering Sea and do not include costs for administrative support and related items. Costs for mobilization and demobilization are "included in the expenditure estimates. Industry evaluation expenditures only include direct wages and salaries paid to company employees.To the extent that operators could provide such information, the estimates include all expenditures associated with pre-lease operations during the study period.

Total annual expenditures for these pre-lease activities ranged from approximately $20.2 million in 1980 to $44.8 million in the peak year of 1982. Expenditures during 1981, 1983, and 1984 were $35.1, $36.4 and $32.4 million, respectively. Surveys and navigation accounted for $57.2 million over the 5-year period, while industry evaluation exceeded $111 million. Total expenditures for pre-lease activities during the 1980-1984 period are estimated at greater than $169 million.

TABLE 4-1

TOTAL EXPENDITURES FOR PRE-LEASE ACTIVITIES
1980-1984

	Expenditure by Year ($000)				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	$5,911	$8,146	$12,854	.$6,589	$7,911
High Resolution Surveys	691	705	671	1,010	3.545
Geological Surveys	1,424	999	999	1,406	0
Navigation Systems	408	408	809	1,209	1,345
Airborne Surveys	0	34	67	67	0
Operational Activities Subtotal	8,434	10,291	" 15,399	10,281	12.801
Industry Evaluation	11,772	24,852	29,430	26,160	19,620
TOTAL EXPENDITURES	$20,206	$35,143	$44,829	$36,441	$32,421

Source: Patrick Burden & Associates and Dames & Moore.

NOTES : Totals may not add due to rounding.

4. 1.1.3 Expenditures by operational activity

Regional marine surveys accounted for the largest percentage of pre-lease expenditures during the study period. This is to be expected since. when compared to ether types of surveys, regional marine surveys have a larger number of vessels operating in any given year, a larger vessel size, a larger crew size, and a generally longer operating period. Expenditures by regional marine survey operators ranged from approximately $5.9 million in 1980 to $12.9 million in 1982 and represented 70 percent and 83 percent respectively, of total survey and navigation expenditures during these years.

Expenditures for high-resolution surveys increased significantly in 1984 because of the 10-to n-month operating season dictated by the need to conduct site clearance surveys in the winter of 1983-1984, with operations continuing through the remainder of the 1984 operating season. Expenditures for this activity were at least triple the levels incurred in previous years. In contrast, MMS records indicate that there were no firms conducting principally geological surveys in 1984. In prior years geological surveys accounted for approximately $1 million to $1.4 million.

Expenditures for navigation systems increased from approximately $408,000 to over $1.3 million over the 5-year study period as the number of firms conducting operations increased, and the number of systems was expanded to cover additional basins. Expenditures associated with airborne surveys were relatively minor compared to the above categories, with estimated expenditures of $67,000 in 1982 and 1983.

4.1.1.4 Expenditures for major supplies

Table 4-2 presents estimates of average monthly expenditures for each operational (surveys and navigation] pre-lease sale activity by supply or service category. Fuel represents the largest expenditure for all pre-lease operations except navigation systems. Navigation systems do not require the direct operation of a vessel or aircraft, although vessels and aircraft are chartered to install and maintain the equipment. Fuel costs for these charters are included in the cost estimate for boat or air charter. Similarly, fuel costs for chartered guide boats and standby boats for regional marine and geological surveys are included under the cost of boat charters.

Air fares and air charters are generally the next largest expenditure items for the surveys. These costs result from crew rotation and air freight of food, supplies, and other materials. Food is also a significant cost item, estimated at up to $20 per person per day. Fresh food (vegetables, milk, etc.) is most often purchased in Dutch Harbor, although some firms do purchase these items in Anchorage or Seattle.

Supplies includes maritime supplies, such as buoys, rope. and hand tools, and survey supplies, such as magnetic tape, computer paper, equipment parts, and related items. Estimates of supplies used per month ranged from $1,000 for airborne surveys to $10,000 for regional marine surveys. Survey-related supplies were almost entirely purchased outside of Alaska. Maritime supplies were purchased in Dutch Harbor, with expenditures also made in Anchorage and Seattle.

TABLE 4-2

AVERAGE MONTHLY
PRE-LEASE ACTIVITY EXPENDITURES
1980-1984

	Expenditure by Supply or Service Category ($000)						
Pre-lease Activity	Fuel	Food	Supply	Air Fare/ Charter	Boat Charter	Other	Total
Regional Marine Surveys	$73	$17	$10	$25	$7	$10	$143
High Resolution Surveys	40	10	4	11	0	6	70
Geological Surveys	46	12	2	10	6	5	81
Navigation Systems	0	5	6	8	25	20	64
Airborne Surveys	23	2	1	0	0	3	28

Source: Patrick Burden & Associates and Dames & Moore.

NOTES : Totals may not add due to rounding.

The "other" expenditure category includes costs for an expediter(s) in either Dutch Harbor or Anchorage, and the associated costs of an apartment, office, vehicle rental, per diem expenses or food allowance, and related expenses. Overnight lodging for crews is also included in this category.

Average total monthly expenditures for regional marine surveys is estimated at $143,000. Estimates provided by vessel operators ranged from $125.000 to $175,000 with the average monthly expenditure increasing as the size of the vessel increased. Average total monthly expenditures of $81,000 for geological surveys is larger than the $70,000 per month expenditures of high-resolution surveys due to the larger average vessel size, and the need for a stand-by boat during conventional drilling activities. In basins where water depths do not permit bottom-founded exploration rigs and geotechnical foundation studies are not required. the total monthly expenditure for geological surveys would approximate the expenditures for high-resolution surveys.

Maintenance of navigation systems in the Navarin Basin and other remote basins requires a significant expenditure for boat charter, and for installation and removal of the chain stations. Per diem expenses and food allowances for persons stationed in remote areas were also a significant cost. Total average monthly expenditures were estimated at $64,000.

4.1.1.5 Local and state-wide expenditures

Local expenditures are defined as expenditures made in the communities situated on the Bering Sea and its associated water bodies such as Norton Sound. For all practical purposes, these expenditures were made in Dutch Harbor/Unalaska and Nome, with the vast majority of monies spent in Dutch Harbor/Unalaska. Vessel operators estimated that 5 to 10 percent of their resupply stops were at Nome, and approximately 10 percent of total local expenditures were spent there. Costs of refueling and replenishing are higher in Nome than in Dutch Harbor due to the need to Operate tugs and barges from the shallow draft port at Nome out to the vessels, and the higher cost of fuel and supplies in that community. Consequently, the percentage of total pre-lease expenditures made in Nome was greater than the percentage. of total port calls made at Nome. Some minor expenditures were also made "in other communities, such as Cold Bay, Savoonga, and St. Paul, where air-related exploration or travel occurred. However, these expenditures are relatively modest compared to marine-related expenditures.

Industry contacts provided single-point estimates of monthly local expenditures by percentage of total cost or by actual dollar amount. In most cases, because recall of recent events was better than more distant events, the estimates are weighted toward the later years of a firm's operation in the Bering Sea, and probably overstate the relative level of local expenditures made in the early years of the study period. No attempt has been made to adjust these estimates to reflect this bias, or to take into account the expansion of local businesses during the time period.

Table 4-3 lists the estimated level of local expenditures associated with surveys and navigation activities in the Bering Sea during the study period. Local expenditures ranged from approximately $3.3 million in 1980 to almost $6 million in 1982. Expenditures in 1981, 1983, and 1984 were approximately $4 million. Regional marine surveys accounted for 55 to 79 percent of local expenditures during the 1980 to 1984 period. The percentage of total local expenditures accounted for by navigation systems was larger than the percentage of total annual expenditures made for this support. This situation resulted from the longer operating time of this activity and the on-site support required to maintain the navigation chain stations during the operating season, requiring greater involvement by local labor and services.

Expenditures made in Bering Sea communities totaled $21.4 million, and represented 37 percent of the total operational acitivites expenditures made over the 5-year period. This percentage does not include the expenditures for industry evaluation.

Table 4-4 presents estimates of the total amount of money spent in Alaska for pre-lease operations and industry evaluation. These data include monies spent in local Bering Sea communities, as well as expenditures in other communities throughout the state. Anchorage is the principal community where expenditures for operational activities and industry evaluation are made, although funds were spent in Homer, Seward, and Kenai for vessel or helicopter charters and the purchase of supplies or services. Expenditures in Anchorage include wages and salaries for resident

TABLE 4-3

LOCAL PRE-LEASE ACTIVITY EXPENDITURES
1980-1984

	Expenditure by Year ($000)				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	$2,116	$2,880	$4,645	$2,243	$2,782
High Resolution Surveys	284	284	283	425	716
Geological Surveys	595	437	437	535	0
Navigation Systems	329	329	494	659	659
Airborne Surveys	0	23	46	46	0
TOTAL EXPENDITURES	$3,325	$3,953	$5,905	$4,088	$4,157

Source: Patrick Burden & Associates and Dames & Moore.

NOTE : Totals may not add due to rounding.

TABLE 4-4

ALASKA PRE-LEASE ACTIVITY EXPENDITURES
1980-1984

	Expenditure by Year ($000)				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	$3,225	4,462	$6,943	$3,591	$4,562
High Resolution Surveys	545	572	470	729	1.352
Geological Surveys	918	708	708	860	0
Navigation Systems	535	535	813	1,075	1.159
Airborne Surveys	0	27	55	55	0
Operational Activities Subtotal	5,223	6,305	8,989	6,310	7,073
Industry Evaluation	1,184	2,499	2,959	2,630	1,973
TOTAL EXPENDITURES	$6,406	$8.804	$11,948	$8,940	$9,046

Source: Patrick Burden & Associates and Dames & Moore.

NOTE : Totals may not add due to rounding.

oil industry personnel involved in evaluating exploration p respects. and operational expenditures for air charters and air fares, overnight lodging. food, and other supplies. Spending by expeditors stationed in Anchorage for the time period that the vessels are operating in the Bering Sea was another source of funds for the community.

Total expenditures made in Alaska during pre-lease activities ranged from about $6.4 million in 1980 to almost $12 million in 1982, and totaled S45.1 million over the study period. Operational expenditures totaled $33.9 million and the oil industry paid an estimated $11.2 million in wages and salaries for evaluation. Approximately 80 percent of the total operational expenditures made during the 1980-1984 time frame were made in the State of Alaska. About 10 percent of industry evaluation expenditures (principally wages and salaries) were made in Alaska.

During the 1980 to 1984 time period, local expenditures accounted for 59 to 66 percent of the total annual Alaskan expenditures made by surveys and navigation operations, or 46 percent to 52 percent of total annual expenditures made by all pre-lease sale activities in the State of Alaska.

4.1.2 Expenditures During the Drilling Phase

4.1 .2.1 Total Expenditures By Well

This section reports estimated expenditures for all COST and exploratory wells completed in the Bering Sea from 1980 through 1984. Average expenditure data expressed in current-year dollars for these wells are

summarized in Table 4-5. Detailed well-by-well estimates on which the averages presented in Table 4-5 are based are listed in Table 4-6. These expenditure estimates include only those costs incurred by the participants during the actual drilling period. The estimates encompass all of the expenditures made directly by the lease operators or COST well participants, as well as the value of contract services, labor, and equipment rentals. Except in the case of the COST wells, the expenditure estimates reported on Tables 4-5 and 4-6 do not include costs incurred for pre-drilling activities related to logistics or administration. Nor do these estimates include the costs of pre-drilling and post-drilling resource evaluation or analysis.

Drilling phase expenditures from 1980 through December 1984 totaled nearly $300 million with an average expenditure of about $23 million per well. COST wells were far more costly than exploratory wells. COST wells averaged $45 million per well, whereas exploratory well expenditures were only $9.4 million per well. This cost difference would be even larger if expressed in constant dollar terms, since the COST wells were drilled in earlier years, and these expenditures were in less inflated dollars.

The above exploratory well cost data were based on preliminary (prior to drilling) cost estimates which were provided by industry representatives. Updated final cost data were obtained from ARCO Alaska (Steiger, 1985) during the review process. These final cost data are shown on the bottom line of Tables 4-5 and 4-6. Although the cost for the Norton Basin wells are essentially unchanged, St. George Basin exploratory wells are significantly more costly than originally reported. The preliminary

TABLE 4-5

AVERAGE DRILLING EXPENDITURES BY COST CATEGORY ($000)

	TOTAL BY CONTRACTOR TYPE	AVERAGE FOR ALL WELLS	AVERAGE FOR COST WELLS EXPLORATION	AVERAGE FOR ALL WELLS EXPLORATION	AVERAGE FOR NORTON WELLS EXPLORATION	AVERAGE FOR ST.GEO. WELLS
Lease OPER. DRILLING DAYS	975	75	116			
TANGIBLE COST:						
TUBULAR GOODS	6756	0	1259	460	460	NO OATA
CASEHEAD & ACCESS,	1879	313	361	75	75	NO DATA
	0		0	0	0	0
TOTAL TANGIBLE:	12767	98!	1620	583	535	612
	0	0	0	0	0	0
INTANGIBLE COST:						
CASING ACCESSOR.	1253	96	189	39	70	20
PERMITS	160	12	16	10	10	10
SITE SURVEY	5090	204	558	338	400	300
MOVING EXPENSE	9242	1155	1184	1108	1108	NO DATA
BOAT& BARGE RENTAL	30579	2352	4882	771	917	684
SHORE BASE	3172	244	244	244	22	377
AIR FREIGHT & TRANS.	7035	541	795	383	73	568
CHARTER AIRCRAFT	16851	1296	2647	452	319	532
DRILLING CONTRACT	69566	5351	9302	2882	1375	3787
MOBE/DEMOBE STDBY	71579	5965	13098	870	1030	750
RENTAL OF TOOLS	2157	166	172	162	73	216
WELL CONTROL EQUIP	1045	80	150	37	37	NO DATA
DRILLBITS	2571	198	202	195	195	NO DATA
FUEL & DRAYAGE	14285	1099	1987	544	550	540
WATER & DRAYAGE	954	73	112	49	37	57
OPENHOLE SURVEYS	8470	1694	1694	NO DATA	NO DATA	NO DATA
DATA RECORDING	2107	421	421	NO DATA	NO DATA	NO DATA
DRILLING MUD & SVC	3959	305	635	98	98	98
FORMATION MONITOR'G	788	99	0	99	73	114
HOLE SVY & PERF	2519	194	184	200	200	200
WELL TESTING	177	35	23	86	NO DATA	86
WIRELINE SVC	264	20	21	20	20	20
MUDLOGGING	3550	273	390	200	200	200
CORING	1350	270	270	NO DATA	NO DATA	NO DATA
CASING CMT & RUN	2283	176	388	43	43	43
DIVERS	2243	187	344	75	75	75
COMM & NAV AIDS	2514	193	361	89	66	102
OTHER EQUIP & SUPP.	8663	666	1253	300	423	226
OVERHEAD	11522	886	1747	349	297	380
SUPERV.--LEASE OPER	3023	233	353	157	110	186
TOTAL INTANGIBLES:	288812	22216	43502	8913	7821	9568
TOTAL WELL COST:	301579	23198	45122	9496	8356	10190 Prelim.
						16200 Final

SOURCE: Dames & Moore and Patrick Burden & Associates

NOTES:
a== Estimated based on the actual number of day; between spud and completion times the cost per day.
a== Estimated based on expenditure data from 6 her wells in the area.
c== Estimated based on the expenditure data from othe wells in the lease sale area.
p== Preliminary estimate made prior to drilling.

TABLE 4-6

DRILLING EXPENDITURES BY WELL [$000)

	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST #2	N.ALEUTIAN COST # 1	NAVARIN COST # 1	NORTON.0436 BIRCH#1	NORTON.0414 TETON#1
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON
DRILLING DAYS	104	103	98	128	148	54	34
TANGIBLE COST:							
TUBULAR GOODS	638	1435	1210	1377	1636	460	0
CASEHEAD & ACCESS.	218	476	90	476	544	75	0
TOTAL TANGIBLE:	856	1911	1300	1853	2180	535	535 e
INTANGIBLE COST:							
CASING ACCESSOR.	217	155	233	153	185	700	70
PERMITS	20	15	15	15	15	10 e	10 e
SITE SURVEY		340	980	340	570	boo p	400 e
MOVING EXPENSE	66!	.468	3500	468	821	1108 p	1108 e
BOAT& BARGE RENTAL	4607	154	4819	5747	9083	1350 a	850 b
SHORE BASE	169	99	176	222	555	32 a	20 b
AIR FREIGHT & TRANS.	718	692	784	675	1106	108 a	68 b
CHARTER AIRCRAFT	429	3246	470	3164	5926	470 a	296
DRILLING CONTRACT	3791	10197 a	4900	12672 a	14948 a	2025 a	1275>
MOBE/DEMOBE STDBY	1997	12116	8000	24788	18588	1030 p	1030 b
RENTAL OF TOOLS	165	138	252	135	168	108 a	68 e
WELL CONTROL EQUIP	103	155	154	150	188	54 a	34 e
DRILLBITS	119	233	200	208	251	195 p	195 e
FUEL & DRAYAGE	1224	1814 a	1333	2255 a	3308 a	810 b	510 b
WATER & DRAYAGE	151	82	147	80	100	54 b	34 b
OPENHOLE SURVEYS	1315	1642	2000	1642	1871	NO DATA p	NO DATA -
DATA RECORDING	324	401	504	391	487	NO DATA p	NO DATA -
DRILLING MUD & SVC	569	613	647	598	748	98 c	98 c
FORMATION MONITOR'G	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	108 c	68 c
HOLE SVY & PERF	149	197	140	193	240	200 c	200 c
WELL TESTING	10	14	0	14	53	86 c	86 c
WIRELINE SVC	16	19	28	19	22	20 e	20 e
MUDLOGGING	323	400	350	390	487	200 c	200 c
CORING	300	261	230	261	298	NO DATA N	NO DATA NO
CASING CMT & RUN	308	409	347	408	467	43 c	43 c
DIVERS	138	461	60	499 a	560	75 c	75 c
COMM & NAV AIDS	90	301 a	200	374 a	840	97 p	61 c
OTHER EQUIP & SUPP.	1161	728	1996	736	1593	423 p	423 e
OVERHEAD	1014	1416	1500	2264 a	2539 a	364 p	286
SUPERV.-- LEASE OPER	505	334 a	84	374 a	467 a	162 a	102 e
TOTAL INTANGIBLES:	20593	37150	34049	59235	66484	9614 p	7545
PRELIM TOTAL COST:	21449	39061	35349	61088	68664	10149 p	8080-
FINAL TOTAL COST:	21449	39061	35349	61088	68664	10149	9600 f

SOURCE: Patrick Burden & Associates and Dames & Moore

NOTES:

a== Estimated based on the actual number of days between spud and completion times the cost per day.
e== Estimated based on expenditure data from other wells in the area.
c== Estimated based on the expenditure data from othe wells in the lease sale area.
p==Preliminary estimate made prior to drilling.
b==Estimate based on both the number of drilling days and data from other wells in the area,
f==Based on information provided by ARCO Alaska (Personal communication, James Steiger, 5-85)

TABLE 4-6 CONTINUED

EXPLORATION EXPENDITURES BY WELL ($000)

	NORTON.0430 CHUGACH#1	ST.GEO.0537 RAT#1	ST.GEO.0466 BERTHA#1	ST.GEO.0519 INTREPID # 1	ST.GEO.0530 TUSTEMENA#1	ST.GEO.0527 TUSTEMENA#2
LEASE OPER.	EXXON	ARCO	MOBIL	CHEVRON	EXXON	EXXON
DRILLING DAYS	22	57	33	63	65	66
TANGIBLE COST :						
TUBULAR GOODS	0	0	0	0	0	0
CASEHEAD & ACCESS.	0	0	0	0	0	0
TOTAL TANGIBLE:	535 e	600 e	662	600 e	600 e	600 e
INTANGIBLE COST:						
CASING ACCESSOR.	70	20	20 e	20 e	20 e	20 e
PERMITS	10 e	10 e	10 e	10 e	10 e	10 e
SITE SURVEY	400 e	300 e	300 e	300 e	300 e	300 e
MOVING EXPENSE	1108 e	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BOAT& BARGE RENTAL	550 b	741 a	429 b	819 b	845 b	585 b
SHORE BASE	13 b	285 e	500 e	500 e	300 e	300 e
AIR FREIGHT & TRANS.	44 b	570 a	330 b	630 b	650 b	660 b
CHARTER AIRCRAFT	191 b	513 a	400 b	567 b	585 b	594 b
DRILLING CONTRACT	825 b	3705 p	2618	4095 b	4225 b	4290 b
MOBE/DEMOBE STDBY	1030 b	INCLUDED	INCLUDED	1000 e	500 e	500 e
RENTAL OF TOOLS	44 e	217 b	125	239 b	247 b	251 b
WELL CONTROL EQUIP	22 e	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
DRILLBITS	195 e	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
FUEL & DRAYAGE	330 b	570 a	192	630 b	650 b	660 b
WATER & DRAYAGE	22 b	57 b	33 b	63 b	65 b	66 b
OPENHOLE SURVEYS	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA NO DATA
DATA RECORDING	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA NO DATA
DRILLING MUD & SVC	98 c	110 p	86	98 e	98 e	98 e
FORMATION MONITOR'G	44 c	114	66 b	126 b	130 b	132 b
HOLE SVY & PERF	200 c	200	200 e	200 e	200 e	200 e
WELL TESTING	86 c	86 p	0	0	0	NO DATA
WIRELINE SVC	20 e	20 e	20 e	20 e	20 e	20 e
MUDLOGGING	200 c	200 e	200	200 e	200 e	200 e
CORING	NO DATA N	NO DATA N	NO DATA N	NO DATA N	NO DATA	NO DATA
CASING CMT & RUN	43 c	25	61	43	43	43
DIVERS	75 c	75 p	NONE	75 e	75 e	NONE
COMM & NAV AIDS	40 c	103 p	59 b	113	117	119
OTHER EQUIP & SUPP.	423 e	95 p	750 e	95 e	95 e	95 e
OVERHEAD	240 e	370 e	292 e	427 e	408 e	402 e
SUPERV.-- LEASE OPER	66 e	171 e	176 e	189 e	195 e	198 e
TOTAL INTANGIBLES:	6303	9788	7100	10692	10210	10050
PRELIM TOTAL COST:	6838	10388	7762	11292	10810	10650
FINAL TOTAL COST:	8800 f	20900 f	13000 f	11292	22100 f	14750 f

SOURCE: Patrick Burden & Associates and Dames & Moore

NOTES:

a==Estimated based on the actual number of days between spud and completion times the cost per day,
e==Estimated based on expenditure data from other wells in the area,
c==Estimated based, on the expenditure data from othe wells in the lease sale area,
p==Preliminary estimate made prior to drilling,
b==Estimate based on both the number of drilling days and data from other wells in the area,
f==Based on information provided by ARCO Alaska (Personal communication, James Steiger, 5-85)

exploratory well cost average rises from $10.2 million to $16.2 million. This figure is consistent with the total average exploratory well cost of $14 million reported by Shell (Bernard, 1985 and Boytim, 1985). The higher expenditures associated with COST wells are due to their unique character. With the exception of the St. George No. 2 COST well, each of these wells was the first well drilled in their respective lease sale area. The oil field support, and transportation infrastructure in these remote frontier regions ranges from minimal to nonexistent. Logistical and administrative costs are, to some extent, included in the COST well expenditure estimates but not in the exploration well data. These costs are monitored so that they can be divided (along with the direct expenditures) among all participants.

Exploratory well logistics, although complex, were somewhat simpler than those of the COST wells, since the latter wells served as prototypes, showing what would and would not work in these remote areas. The COST well programs also resulted in reduced costs to the exploratory wells by providing the well drilling and service contractors with experience in the area. On the basis of this experience, the contractors were able to bid more competitively, allowing less margin for uncertainty. Also, as more contractors gained working experience in the area. competition among contractors drove down prices.

A further reason COST wells are more expensive than exploratory wells is the length of time between spud and completion dates. In general, COST wells take more time because of the greater depth of drilling and the larger amount of coring and sampling which is conducted. The purpose of

the COST wells is to obtain stratigraphic information in a new exploration region. This information can only be gained by extensive coring and sampling programs.

Table 4-5 also provides a comparison between the cost of exploration wells in the Norton Basin and those of the St. George Basin. On the average, the Norton wells were about 18 percent less expensive than those in the St. George. This difference is due in part to the shallower waters in the Norton Basin and the much shorter drilling period required. The cost difference would have been even greater were it not partially offset by the higher costs of transporting the rig and materials to the more distant Norton Sound. Although the well sites in Norton Basin are located much closer to a coastal city (Nome) than the drilling locations in other basins, the shallow draft of the port of Nome makes it expensive to provide marine support.

The total costs of the Navarin and North Aleutian COST wells stand out as much higher than the other COST wells. This is due to the longer period of time necessary to complete these wells, and to the high mobilization, demobilization, and standby costs.

4.1.2.2 Major drilling phase expenditures

Table 4-6 shows a detailed estimate of the expenditures for each Bering Sea COST and exploratory well by cost categories. The cost categories are based on the Authorization For Expenditure (AFE) forms used by major oil companies in estimating the cost of drilling activities. These categories

differ somewhat from the contractor type categories used in Section 4.2. The data used in Table 4-6 were obtained either directly from the lease operators or by extrapolation and interpretation of known data. Although these data are based on the best available info"rmation, they are only estimates. Individual entries within this table should be used with discretion. As noted above, estimates were often necessary since some lease operators and service contractors considered certain data to be confidential.

Estimates in several of the cost categories are based on the duration of the drilling period. These cost categories include drilling day rates, air charter, fuel usage, and marine support. For wells with these types of data, expenditures were calculated using the day rates times the actual number of days between the spud and completion dates. (Estimates based on this method are indicated by a footnote "a" in Table 4-6.) If data for an expenditure which is normally day-rated were not available for a given well but were available for another well in the same lease sale area, such data were estimated using the day rate from the known well times the actual number of days for the well in question. (Footnote "b" was used in this case in Table 4-6.)

Expenditures for non-day-rated items (such as casing, tubulars, cement. etc.) were based on cost estimates from lease operators, or from other wells in the area. (Footnote "e" was used in this case.) If data were unavailable for an expense category in the same lease sale area, but were available from another lease sale area, a "c" footnote was used in the table. Finally, preliminary estimates of non-day-rated items are indicated by footnote "p".

The reliability of data on the COST wells is generally much greater than that on the exploratory wells since COST wells are subject to less restric - tive confidentiality measures. In general the reliability of footnoted data is less than that of unfootnoted data. Among the footnoted items, those footnoted "b" or "c" should be regarded as rough approximations, useful only in generating the averages shown in Table 4-5.

The first column in Table 4-5 shows the magnitude of total expenditures by contractor type. Rig mobilization and demobilization and moving expense was the largest single expense--$72 million of the total $295 million expenditure. Mobilization and demobilization costs were incurred mainly during the COST well program when there were very long standby periods between wells. The total expenditure for this category is underestimated since data on this expense type were incomplete.

Contract drilling expenditures ranked second in total expense, and these costs were the largest average cost component for the exploratory wells. Day rates for the jack-up rigs used in the Norton Basin were usually in excess of $50,000 per day. The large semisubmersibles used in the other Bering Sea lease sale areas had day rates as high as approximately $100.000. The drilling rates between the Norton and St. George basins were also different, and the average number of days required to complete wells in the St. George Basin was greater.

Boat and barge rentals represent another large cost category. Again, costs in this category for the Norton Basin wells are generally higher than for wells in the other planning areas. This higher cost results from barges being used as a staging area in the Norton Basin with the barges and their crews adding to the expense of marine support. However, the shorebase expense for this basin was less than for other areas, since the barges to some extent substituted for shore bases. The $22,000 average expense reported for the Norton exploration wells (Table 4-5) was based on a single data point and may be low.

Charter aircraft service--almost exclusively helicopter service--is the next largest expense category. This expense was especially significant in the case of the Navarin COST well. Due to the extreme remoteness of that well, twin rotor craft specially equipped for extended range flights were based in Nome. The cost of this operation was reported as $6 million, although some sources indicated that the actual cost was even higher.

Another major expense category includes costs of operator supervision and overhead. Operators typically maintained two supervisors on the rig at all times, as well as additional onshore supervision dedicated to the drilling operation as long as it was in progress. Overhead, largely administering the numerous contract activities and logistic support, was generally based on 4 percent of the out-of-pocket expense of the operation.

4.1.2.3 Major supplies

Major consumables represent a significant expense during exploration drilling. Total estimated expenditures for all wells in the Bering Sea during the study period are presented below in order of decreasing cost.

- fuel and drayage = $14.3 million
- tubular goods = $6.7 million
- drilling mud and service = $4.0 million
- cement and run casing = $2.3 million
- water and drayage = $1 million

Fuel is typically supplied by the lease operator for all marine operations, and at least a portion of the helicopter support operations. During the study period, almost all fuel was purchased locally in either Dutch Harbor or Nome. A small portion was brought from the Lower 48 during marine mobilization. The same supply situation applied to water. Cement was obtained from suppliers in the Anchorage area, and drilling muds, chemicals, and tubulars were obtained principally from Lower 48 suppliers.

4.1 .2.4 Local and statewide expenditures

As discussed in the introductory statements in Section 4.1, estimating expenditures within Alaska and within the local Bering Sea area is difficult due to data limitations. Order-of-magnitude estimates of these expenditures are presented in Table 4-7. The Alaska expenditures take

into account the amount of supplies purchased in-state, the extent to which the labor force consisted of Alaska residents, and the extent of Alaska support services and facilities. The total expenditures were abstracted from Table 4-5 and include some consolidation. Based on these data, approximately 30 percent of the total expenditures accrued to Alaska. The data in Table 4-7 are based on preliminary exploratory well COST data. As shown on the bottom of Table 4-6, final expenses for St. George exploratory wells were significantly higher than the preliminary estimates. Therefore, local expenditures shown in Table 4-7 are low estimates.

The local expenditures are slightly more amenable to estimation, since they are more visible and limited geographically. Virtually all Bering Sea expenditures during the study period were made in Dutch Harbor/ Unalaska, Cold Bay, and Nome. The local expenditures were limited aimost exclusively to labor (see Section 4.2.2), lodging and meals, fuel, water, and groceries. A marine support base in Captain's Bay and air support bases in Cold bay and Nome were also major sources of local expenditures. An estimating procedure similar to that done for Alaska-wide expenditures indicates that about 7 percent of total drilling phase expenditure can be considered local to the Bering Sea Region, Local expenditures represent approximately 27.8 percent of the drilling phase expenditures made within the State of Alaska.

TABLE 4-7

ALASKA AND LOCAL DRILLING EXPENDITURES

	Total	Percent Alaska	Total Alaska	Percent Local	Total Local
Total Tangible:	12767	10	1277	0	0
Intangible Cost:					
Casing Accessor.	1253	10	125	0	0
Permits	160	100	160	10	16
Site Survey	5090	10	509	2	102
Moving Expense	9242	20	1848	2	135
Boat & Barge Rental	30579	20	6116	5	1529
Shore Base	3172	90	2855	40	1269
Air Freight & Trans.	7035	50	3518	5	352
Charter Aircraft	16851	75	12639	10	1685
All Drilling Rig	141145	10	14115	2	2823
Rental of Tools	2157	75	1618	0	0
Fuel & Drayage	14285	90	12857	90	12857
Water & Drayage	954	95	906	95	906
Drilling Mud & SVC	3959	30	1133	5	198
Mudlogging	3550	60	2130	0	0
Comm & Nav Aids	2514	75	1886	2	50
Coring	1350	50	675	0	0
Casing Cmt & Run	2283	90	2055	2	46
Divers	2243	100	2243	2	45
Overhead	11522	50	5761	0	0
Superv. --Lease Oper.	3023	50	1512	0	0
Other Equip. & Supp.	26444	25	6611	2	529
TOTAL	301579	27	81324	7	22591

Source: Patrick Burden & Associates and Dames & Moore

ARco Alaska estimated that the two Norton Sound COST wells and the Navarin COST well resulted in total direct expenditures of $1.5 million in Nome. The estimates per well were:

Norton Sound COST Well No. 1	$460,000
Norton Sound COST Well No, 2	$480,000
Navarin Basin COST Well No. 1	$560,000

Labor expenditures accounted for $840,000 or 56 percent of the total, and lodging and meals, and other local expenses accounted for $240,000 (16%). and $420,000 (28%) respectively. This figure does not include vendors with operations in Dutch Harbor or Cold Bay whose administrative address is located elsewhere.

Similar data were not available for other communities in the Bering Sea. but a survey conducted by ARCO of vendor addresses and the amounts charged to specific projects revealed that ARCO spends an average of $70.000 per month per well, in the zip codes that comprise Dutch Harbor and Cold Bay. This figure includes expenditures for labor, hardware, groceries, shore-base support, and fuel for supply boats.

4.2 EMPLOYMENT

Employment associated with both pre-lease activities and drilling phase activities is addressed below in terms of the following figures: total employment, employment by type of cent ractor, wages and salaries, residency of employees, the effects of exploration activities on the local labor force, and company hiring policies.

4.2.1 Pre-Lease Activities

This section presents employment-related data that were developed for the pre-lease sale activities described in Section 3.2. These activities include regional and high-resolution geophysical surveys, regional geological surveys, and navigation system installation and operation.

4.2.1.1 Total employment

Table 4-8 presents estimates of the total man-months of employment associated with pre-lease sale activities. These estimates were calculated by multiplying the estimates of man-months for each operation (or vessel) of each contractor by the number of surveys conducted, or navigation systems operated by that company during the year (see Table 3-1 for a listing of total operations per year).

Total employment is estimated at 39,559 man-months, or 3,297 man-years during the 1980-1984 study period. Annual employment estimates range from 4,750 man-months (396 man-years) in 1980 to 10,597 man-months (883 man-years) in 1982.

4.2.1.2 Employment by contractor type

Vessels conducting regional marine surveys have the largest crews, averaging 26 persons per vessel, with roughly half of the crew conducting seismic and related studies, and the other half operating the ship. Other

persons on board the vessel include client representatives and agents. Regional marine surveys provided an estimated 9,303 man-months of employment over the study period, or approximately 80 percent of the total man-months of employment generated by operations in the Bering Sea.

High-resolution geophysical surveys use smaller crews and can be conducted with smaller vessels. The total number of persons onboard averages 17 persons, with an equal split between ship's crew and. survey crew. High-resolution geophysical surveys accounted for an estimated 964 man-months (80 man-years) of employment over the study period. This was approximately 8 percent of total operational employment.

Geological surveys typically have a larger crew than high-resolution geophysical surveys. Even though no geological operations were conducted in 1984, this operational activity accounted for 1,000 man-months of employment, or approximately 9 percent of total operational employment over the study period.

The number of persons required to operate the navigation systems used for positioning by geophysical and geological surveys can vary according to the area in which the system is operating. For example, navigation systems for the St. George and North Aleutian basins can be supported from Dutch Harbor by helicopter, while systems in Norton Sound are supported from Nome. One person can maintain a navigation system with a helicopter-supported program, although additional people are required during installation and removal of the stations, Systems in the Navarin Basin can be supported by helicopter, but in recent years they have been vessel

TABLE 4-8

TOTAL PRE-LEASE ACTIVITY EMPLOYMENT
1980-1984

	Man-Months by Year				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	1,326	1,834	2,855	1,476	1.812
High Resolution Surveys	136	136	136	204	352
Geological Surveys	300	200	200	300	0
Navigation Systems	45	45	45	45	144
Airborne Surveys	0	2	4	4	0
Operational Activities Subtotal	1,807	2,217	3,240	2,029	2,308
Industry Evaluation	2,943	6,213	7,358	6,540	4,905
TOTAL MAN-MONTHS	4,750	8,430	10,597	8,569	7,213

Source: Patrick Burden & Associates and Dames & Moore.

NOTE : Totals may not add due to rounding.

supported for two main reasons: (1) the great distances between land masses require the use of relatively expensive long-range helicopters, and (2) to provide adequate coverage with the navigation chain, it was necessary to install and service large buoys equipped with navigation stations. A vessel-supported installation program typically requires a maintenance person plus a crew of 4 for a large part of a month.

Navigation systems accounted for approximately 324 man-months of employment from 1980 through 1984, with 14,4 man–months (44 percent) of that occurring in 1984. Total navigation systems employment was about 3 percent of total operational employment during the study period.

Airborne surveys are conducted with a crew of two persons for periods of time ranging from several weeks to more than a month. These surveys accounted for an estimated 10 man-months of total employment.

Regional marine surveys are conducted from sometime in May or June, to September or early October when the weather worsens, with an average operating time of 3 months in the Bering Sea. Mobilization and demobilization time adds another month to the time the vessel and ships crew are committed to the Alaska assignment.

High-resolution and geological surveys are conducted during the same period of the year. Operating time for these vessels ranges from 1.5 to 3 months, and mobilization and demobilization requires an additional month for the ship’s crew.

Navigation systems have to be in place before the first vessel can start operating and cannot be removed until the last survey vessel completes operation. The operational time for these systems is about 4.5 months during an average year, with mobilization and demobilization time adding approximately 2 weeks. Mobilization and demobilization of airborne survey crews and airplanes requires only a few days and is included in the estimated operating time of 1 month.

Most companies indicated that their staffs worked 60 days on and 30 days off* Mobil indicated that their crew worked 56 days on and 28 days off, while several firms conducting high-.resolution and geological surveys, and navigation systems stated that their crews worked through the entire season without a substantial number of days off, Airborne survey crews also work until the survey is completed. These factors have been calculated into the man-month estimates.

The information presented in this section reflects the estimates of industry representatives (where such data were provided), and professional judgement based upon interpretation and extrapolation of known data. The estimates shown in Table 4-8 do not include employment associated with support of pre-lease activities, such as air charter for crew transport, or shore bases. Only those persons directly involved in geophysical and geological operations, navigation systems, charter of guide boats and standby boats, and similar activities are included in these calculations.

Pre-lease activities in the Bering Sea have resulted in employment estimates ranging from 395 man-years in 1980 to 883 man-years in 1982. As shown in" Table 4-8, employment associated with pre-lease operations is significantly smaller than the employment associated with the petroleum industry's evaluation of geologic prospects in the various basins. Manyears of employment for evaluation ranged from 245 in 1980 to 613 in 1982. These man-year estimates include employment for persons who were generally located outside of Alaska, whereas employment figures generated for pre-lease operational activities in the Bering Sea reflect only those persons that were physically present in Alaska and directly participated in the operation.

4.2.1.3 Wages and salaries

Wage and salary data are generally considered to be among the more confidential information that a company possesses. Responses to questions concerning wages and salaries were limited, and even those firms that answered these questions placed the answer in terms of a general industry wage. The companies have different wage structures which makes analysis difficult and, in addition, some firms hire contract labor for operational crews. To maintain confidentiality, wages paid per person per month by all contractors for each type of activity were averaged and presented in Table 4-9. In calculating the total wages and salaries paid by each activity the actual wage data where available for each contractor were multiplied by employment estimates for each contractor. Where wage and salary data were not divulged the average wage rate shown in Table 4-9 were used to calculate total wages paid by each firm. The wage and salary

TABLE 4-9

AVERAGE MONTHLY PRE-LEASE ACTIVITY WAGE RATES

Pre-lease Activity	Average Monthly Wage ($000),
Regional Marine Surveys	$2.0
High Resolution Surveys	3.6
Geological Surveys	3.2
Navigation Systems	1.2
Airborne Surveys	2.8
Industry Evaluation	4.0

Source: Patrick Burden & Associates and Dames & Moore

information presented in Table 4-9 includes wages and salaries paid while an employee was on leave rotation. For example, if an employee was paid $3,000 per month for each month onboard a vessel, but was not paid while on leave rotation, the monthly wage (assuming a standard 60 days on, 30 days off) was calculated as $2,000. This wage estimate does not include fringe benefits. Table 4-10 presents data on total wages and salaries attributable to pre-lease sale activities in the Bering Sea during the study period.

Total annual wages and salaries paid for pre-lease operations in the Bering Sea have ranged from approximately $3.5 million to $6.4 million during the 5-year study period. Wages and salaries paid by the oil industry for evaluation of prospects ranged from about $11.8 million in 1980 to $29.4 million in 1982. Total annual wages and salaries peaked at almost $36 million in 1982. Total wages and salaries paid by pre-lease activity participants over the 5-year study period totaled $136.3 million.

The average wage on a regional seismic vessel was estimated to be $2,000 per month. According to one firm, the wages for an entry level position onboard a vessel is roughly $1,200 per month. This entry level wage is similar for the ship's crew and seismic crew employees. Some geophysical companies lease or contract for vessels, and wages for the ship's crew on board these vessels is generally less than for company-owned vessels. Several firms indicated that Alaskan residents are generally hired at entry-level positions. Regional marine surveys paid an estimated $15 million in wages and salaries during the 5-year study period. This represented about 61 percent of total wages and salaries paid by surveys and navigation activities during the same time frame.

TABLE 4-10

TOTAL PRE-LEASE ACTIVITY WAGES AND SALARIES
1980-1984

	Wages and Salaries by Year ($000)				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	$2,618	$3,632	$5,666	$2,862	$3,534
High Resolution Surveys	258	272	258	381	2,466
Geological Surveys	600	400	400	658	0
Navigation Systems	57	57	57	57	193
Airborne Surveys	0	6	11	11	0
Operational Activities Subtotal	3,534	4,367	6,393	3,968	6,193
Industry Evaluation	11,772	24,852	29,430	26,160	19,620
TOTAL WAGES & SALARIES	$15,306	$29,219	$35,823	$30,128	$25,813

Source: Patrick Burden & Associates and Dames & Moore.

NOTE : Totals may not add due to rounding.

Wage estimates for high-resolution geophysical survey crews ranged from S2.500 to $3,200 per month. Contract personnel, who are not employees of the company, received an average of about $200 per day, or approximately $4,000 per month. The ship's crew of Alaska-based vessels averaged $120 to $130 per day, or approximately $3,750 per month while working onboard ($2,500 per month during a 3-month survey period). Crews of non-Alaska based vessels were paid approximately $2,000 per month for the 3-month survey period.

High-resolution surveys were conducted for a much longer period of time in 1984 than in previous years with the result that wages and salaries paid in 1984 were more than double the total amount of wages and salaries paid in the previous 4 years. Wages and salaries amounted to approximately $1.2 million for the first 4 years, and $2.5 million in 1984. Total wages and salaries paid during the time period amounted to $3.6 million, or almost 15 percent of total operational wages and salaries.

A geological survey vessel generally carries the ship's crew and specialized data acquisition personnel such as geotechnical engineers, geologists, geophysicists, geochemists, and drilling crews. Wages for geotechnical engineers, geophysicists, and geochemical specialists range from $3,500 to $4,700 per month. Ship's crew wages are similar to those estimated for non-Alaska based high-resolution survey vessels. Wages and salaries paid for geological surveys are estimated at $2.1 million, or about 8 percent of total operational wages and salaries.

Vessels engaged in the installation, operation, and maintenance of the navigation systems require both technical crew and ship's crew. The average wage was estimated to be $1,800 per month. Total wages and salaries of $421,000 were about 2 percent of total wages and salaries paid by the survey and navigation operations. Airborne survey crews include a pilot and technician, with an average wage of $2,500 per month. Estimated wages of $28,000 were less than 1 percent of total wages paid over the 5-year study period.

An average wage or salary paid to oil industry personnel involved directly in evaluation (excluding administrative support and overhead personnel) was estimated by several persons at $4,000 per month. Wages paid to Alaska residents are higher than this estimate. Total wages and salaries paid to these persons is estimated at over $110 million, and represented about 82 percent of total wages and salaries associated with pre-lease activities in the Bering Sea.

4.2.1.4 Residency

Table 4-11 provides an estimate of the number of man-months that Alaska residents were employed for pre-lease activities. Alaska residents are estimated to have been employed for 1,532 man-months by operational activities during the 5-year period. Operations employment of Alaska residents decreased from 13 percent in 1980 to 10 percent at the peak of activity in 1982, and then increased to 18 percent in 1984. Alaska residents accounted for approximately 13 percent of operational employment during the study period. Alaska residents accounted for about 10 percent of employment in the industry evaluation process.

TABLE 4-11

ALASKA PRE-LEASE ACTIVITY MAN-MONTHS
1980-1984

	Man-Months by Year				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	116	171	227	116	235
High Resolution Surveys	59	66	33	59	85
Geological Surveys	53	53	53	62	0
Navigation Systems	8	8	21	21	90
Airborne Surveys	0	0	0	0	0
Operational Activities Subtotal	235	298	333	256	410
Industry Evaluation	296	625	740	658	493
TOTAL MAN-MONTHS	531	923	1,073	914	903

Source: Patrick Burden & Associates and Dames & Moore.

NOTE : Totals may not add due to rounding.

Members of marine geophysical survey crews must have technical training to qualify for employment. Most major operators are headquartered in the Lower 48 and fill crew positions before the vessel departs for Alaska. The result is that there are very few Alaska residents in these jobs even though many Alaska residents participate in land-based geophysical surveys on the North Slope and elsewhere in Alaska. Another reason for low levels of Alaskan employment is that the Norwegian flag ships of the Geophysical Company of Norway (G EC O), and the Canadian flag ships of Digicon are required by the laws of their countries to have all Norwegian or Canadian ship's crew members. Non-local residents who are marine geophysical survey crew members generally live in the Anchorage, Kenai Peninsula, and Mat-Su Borough areas of the state,

Vessel operators estimated that Alaska residents comprised from O to 35 percent of the crews of regional marine survey vessels. Several marine geophysical firms indicated that while operating in Alaskan waters during the summer, two to three jobs in the ship's crew were filled by Alaska residents. However, most Alaskans hired during the summer quit before completing 1 year of employment. The average entry-level pay rate for the ship's crew was about $1,200 per month (including time off the vessel), and few Alaska residents appeared willing to remain in these positions for that wage. These jobs offered an opportunity for an individual to earn an airplane ticket to a location identified as "home", including locations claimed to be home previous to Alaska residency. Those who wish to leave Alaska may have used these jobs to do so, and several operators stated that a ticket out of the state was

the primary motivation for some Alaska residents to take these positions.

High-resolution and geological survey firms tend to employ Alaska residents as members of ship's crew when their vessels are from Alaska. These persons generally resided at the port-of-call (Dutch Harbor, Kodiak, etc) but some persons were hired from Seward, Homer, Kenai, and other locations that were not a port-of-call. These firms also hire Alaskans (typically Anchorage residents) as members of the professional and drilling crews. Navigation systems employment includes Alaska residents; however, airborne surveys are conducted exclusively by non-residents. About 15 percent of the Alaska residents employed in the prelease operations activities are estimated to be local residents.

Table 4-12 presents estimates of the wages and salaries paid to Alaska residents by each operational activity and by the petroleum industry for lease evaluation work. Alaska residents received almost $4 million in 1982, about 11 percent of the total wages and salaries paid for pre-lease activities in that year. In 1984, Alaska residents received approximately 20 percent of the wages, and salaries paid for operations activities conducted in the Bering Sea, and about 10 percent of the wages and salaries paid by the petroleum industry for evaluation.

Operational activities paid an estimated $4.5 million in wages and salaries to Alaska residents during the study period, and the petroleum industry paid $11.2 million to its Alaska employees for evaluation of petroleum prospects. Total wages and salaries paid to Alaska residents for pre-lease sale activities exceeded $15.7 million.

4.2.1.5 Employment effects on the local labor force

Pre-lease sale activities have had detectable effect on local labor supplies in any Bering Sea community. Additional employment generated by pre-lease activities has been marginally incremental to the existing employment in the region. Expansion of pre-lease operations has occurred at a time when commercial fishing operations have declined in the region. Consequently, the effect of the increased survey vessel traffic has helped to offset the decline in economic activity in the Dutch Harbor/Unalaska area.

Pre-lease activities such as geotechnical and geophysical surveys require high levels of expertise and knowledge, and few Alaskans have had access to training for this work. Most employees who are sufficiently well trained to perform this work are residents of Anchorage or other cities where this training may be available.

4.2.1.6 Company hiring policies

With the exception of the ships crew of a few regional survey firms, employment for pre-lease sale activities was non-union. Most employees were from Texas, Louisiana, California, Oklahoma, and other states with long histories of petroleum activity and large numbers of trained personnel. Some firms stated that their crews must reside in proximity to the office where the company is based, but most firms would employ people from anywhere in the world. Regional marine survey vessels conduct international operations, while other survey vessels concentrate their operations

TABLE 4-12

ALASKA PRE-LEASE ACTIVITY WAGES AND SALARIES
($000)

	Salary by Year				
Pre-lease Activity	1980	1981	1982	1983	1984
Regional Marine Surveys	$378	$560	$730	$365	$781
High Resolution Surveys	150	177	88	150	353
Geological Surveys	140	140	140	158	0
Navigation Systems	10	10	26	26	109
Airborne Surveys	0	0	0	0	0
Operational Activities Subtotal	678	887	984	698	1,253
Industry Evaluation	1.184	2,499	2,959	2,630	1,973
TOTAL WAGES & SALARIES	$1,861	$3,386	$3,943	$3,328	$3.226

Source: Patrick Burden & Associates and Dames & Moore.

NOTE : Totals may not add due to rounding.

in the U.S. and along the west coast of North America. If a vessel is conducting operations in a region and has need of a crew member, they may hire a local person while in port. Most employment of Alaska residents has been for ship's crew.

4.2.2 DRILLING PHASE

Employment associated with drilling operations, including support activities, is addressed in the following portions of this section. Major categories of discussion include total employment, employment by contractor type, wages and salaries, and employment of Alaska residents and residents of the Bering Sea communities.

4.2.2.1 Total Employment

The total man-months of employment by contractor type and by well is presented in Table 4-13. The total man-months of employment for all wells drilled in the Bering Sea from 1980 through 1984 was approximately 7,550. The total employment level per well in the Bering Sea ranged from about 1,260 man-months for the Navarin COST well to only 164 man-months for Exxon's Chugach No. 1 in Norton Basin. The difference in the two figures can be directly attributed to the drilling time needed to achieve the desired depth, and the level of testing and sampling required. The Navarin COST well, spudded on May 26, 1983, and completed on October 24, 1983, involved nearly 5 months of drilling activity. COST wells involve extensive coring and sampling programs which significantly increase the time required to drill a well.

Exxon's Chugach No. 1 in Norton Basin was spudded on July 25, 1984 and completed just 23 days later on August 17 after reaching the target formation. The well was plugged and abandoned as a dry hole at a depth of 3,636 feet (1,112 meters). This relatively shallow drilling depth, combined with the shallower water depths of Norton Sound and limited, if any, testing contributed to a short duration drilling effort.

The number of man-months required to drill exploration wells varied significantly, *even* for wells completed in the same basin. ARCO's Birch No. 1 well in Norton Basin showed significantly higher labor effort (351 man-months) when compared with the total man-months for Exxon's Teton No.1 (242 man-months) and Chugach No. 1 (164 man-months). ARCO's Rat No. 1 well in St. George Basin required 666 man-months while Mobil's Bertha No. 1 was completed with 259 man-months. Exxon's Intrepid No. 1 and Tustumena No. 1 required slightly less than 600 man-months each and Chevron's Endeavor No. 1 was completed for under 500 man-months. Comparison of the level of effort data for these wells indicates that the primary difference is the amount of labor used by the drilling and marine support contractors.

4.2.2.2 Employment by contractor type

Table 4-13 also presents data on the number of man-months of employment by contractor type during drilling. These data indicate that four contractor types accounted for about 75 percent of employment during the drilling phase. These include (in descending order) the drilling operator (43 percent), marine support (16 percent), the lease operator (9 percent), and

TABLE 4-13

TOTAL DRILLING EMPLOYMENT (YIN-MONTHS)

CONTRACTOR TYPE	NORTON COST #1	ST.GEORGE COST # 2	NORTON COST #2	N.ALEUTIAN COST #1	NAVARIN COST	NORTON.0436 # 1 BIRCH#1	NORTON.0414 TETON#1
LEASE OPER.	58.2 ARCO	57.7 ARCO	54S9 ARCO	71.7 ARCO	82.9 ARCO	30.2 ARCO	44.9 EXXON
DRILLER	249,6 DANTEXe	377.7 SEDCO	235.2 KEYDRIL	469.3 SEDCO	542.7 SEDCO	129.6 KEYDRIL	72.5 ROWAN
ROUSTABOUT	0.0 NONE	0.0 NONE	16.3 VECO	NONE	NONE	NONE	NONE
AIR SOPPORT	34.7 ERA	41.2 ERA	32.7 ERA	51.2 ERA	192.4 COLUMBIA/BOEING	14.4 AIR LOG	11.3 ERA
MARINE SUPPORT	138.7 BIEHL	137.3 BIEHL			197.3 BIEHL	72.0 BIEHL	27.3 SEAHORSE
MARINE SUPPORT	34.7 CROWLEY			170.7 BIEHL			
BARGE SUPPORT	12.0 OFFSHORE LOGIS.		37.7 CROWLEY	MARINE LOGIS.	MARINE LOGIS.	16.2 MARINE LOGIS.	10.2 MARINE LOGIS.
SHORE BASE	13.9 CROWLEY/NOMEe	13.7 CROWLEYe	13.1 CROWLEY/NOMEe	17.1 CROWLEYe	29.6 O.S.I./NOME	22.9 O.S.I./NOME	14.4 O.S.I./NOME
DIVERS	13.9 MARTECH	13.7 MARTECH	13.1 UNDERWTR.CONS.e	17.1 MARTEC	19.7 MARTEC	7.2 MARTECH	4.5 MARTECH
MUDDER	6.9 BAROID	6.9 BAROID	6.5 MAGCOBAR	8.5 BAROID	9.9 BAROID	3.6 BAROID	2.3 BAROID
CEMENT	6.9 HALLIBURTON	6.9 HALLIBURTON	6.5 HALLIBURTON	8.5 HALLIBURTON	9.9 HALLIBURTON	3.6 HALLIBURTON	2.3 HALLIBURTON
PLUG WELL	0.3 TRISTATE	0.3 TRISTATE	0.3 TRISTATE	0.3 TRISTATE	0.3 TRISTATE	0.3 0.0	0.3 0.0
MOD LOGGING	19.0 EXLOGe	22.6 EXLOG	18.0 EXLOGe	27.6 EXLOG	31.6 EXLOG	10.7 EXLOGe	7.3 EXLOGe
WIRE LOGGING	13.9 SCHLUMBERGER	13.7 SCHLUMBERGER	13.1 SCHLUMBERGER	17.1 SCHLUMBERGER	19.7 SCHLUMBERGER	7.2 SCHLUMBERGER	4.5 SCHLUMBERGER
PAPER STUDIES	0.3 WOODWARD-CLYDE	0.8 WOODWARD-CLYDE	0.8 WOODWARD-CLYDE	0.8 WOODWARD-CLYDE	0.8 WOODWARD-CLYDE	3.0 HOOKS McCLOSKYe	3.0 E G & Ge
CORE ANALYSIS	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB
WELL TESTING	NONE	NONE	NONE	NONE	NONE	4.0 NORALCO	4.0 NORALCO
CATERING	41.6 UNIVERSAL	41.2 UNIVERSAL	INCLUDED KEYDRIL	51.2 UNIVERSAL	59.2 UNIVERSAL	INCLUDED KEYDRIL	13.6 UNIVERSAL
NAVIGATION	2.0 ITECH	2.0 ITECH	2.0 ITECH	3.0 ITECH	2.0 OCEANEER.INT'L	2.0 ITECH	2.0 ITECH
WEATHER	27.7 NORTEC	27.5 NORTEC	26.1 NORTEC	34.1 NORTEC	39.5 NORTEC	14.4 NORTEC	9.1 NORTEC
MEDICAL	3.5 NORTEC	3.4 NORTEC	3.3 NORTEC	4.3 NORTEC	4.9 NORTEC	1.8 NORTEC	1.1 NORTEC
SECURITY	6.9 O'NEILL	6.9 O'NEILL	6.5 O'NEILL	8.5 O'NEILL	9.9 O'NEILL	3.6 O'NEILL	2.3 O'NEILL
MET OCEAN	1.4 S.A.I.e	1.4 E G & Ge	1.4 S.A.I.e	1.4 E G & Ge	1.4 E G & Ge	1.4 E G & Ge	1.4 E G & Ge
ICE FORCAST	3.5 ARCTEC	NONE	3.3 ARCTEC	24.0 INTERA	NONE	NONE	1.1 ARCTEC
WELLHEAD EQUIP	2.0 ?? e	2.0 HUGHES OFFSH	2.0 ?? e	2.0 OTIS	2.0 HUGHES OFFSH	2.0 BECHTEL	2.0 BECHTEL
TOTAL FOR WELL	692,6	777,4	488.3	988,9	1256,2	350.7	242.1

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e==ESTIMATED USING DATA FROM OTHER CONTRACTORS

TABLE 4-13 CONTINUED

TOTAL DRILLING EMPLOYMENT (MAN-MONTHS)

CONTRACTOR TYPE	NORTON.0430 CHUGACH#1	ST.GEO.0537 RAT#1	ST.GEO.0466 BERTHA#1	ST.GEO.0519 INTREPID#1	ST.GEO.0530 TUSTEMENA#1	ST.GEO.0527 TUSTEMENA#2	TOTAL BY TYPE
LEASE OPER.	29.0 EXXON	48.7 ARCO	13.2 MOBIL	36.0 CHEVRON	91.0 EXXON	92.4 EXXON	710,8
DRILLER	46.9 ROWAN	319.0 SEDCO	121.0 SEDCO	231.0 SEDCO	238.3 WESTERNe	242.0 WESTERNe	3274.9
ROUSTABOUT	NONE	NONE	NONE	NONE	NONE	NONE	16.3
AIR SUPPORT	7.3 ERA	34.8 ERA	13.2 ERA	16.8 ERA	28.2 AIR LOG	28.6 AIR LOG	506.8
MARINE SUPPORT	19.3 SEAHORSE	116.0 BIEHL	39.6 OCEAN MARINE	75.6 OCEAN MARINE	100.0 SEAHORSE	101.3 SEAHORSE	1195.2
MARINE SUPPORT			3.0 OFFSHORE LOGIS	12.6 ARCTIC ALASKA	1.5 INT'L MOORING	1.5 INT'L MOORING	118.9
BARGE SUPPORT	6.6 MARINE LOGIS.						12.0
SHORE BASE	9.3 O.S.I./NOME	36.9 O.S.I.	14.0 O.S.I.	26.7 O.S.I.	27.6 O.S.I.	28.0 O.S.I.	267.3
DIVERS	2.9 MARTECH	11.6 MARTECH	4.4 MARTECH	8.4 MARTECH	8.7 NONE	8.8 NONE	134.0
MODDER	1.5 BAROID	8.1 BJHUGHS/MILCHEM	2.2 MAGCOBAR	4.2 BAROID	4.3 MAGCOBAR	4.4 MAGCOBAR	69.3
CEMENT	1.5 HALLIBURTON	5.8 HALLIBURTON	2.2 BJ HUGHESe	4.2 BJ HUGHESe	4.3 DOWELL	4.4 DOWELL	67,0
PLUG WELL	0.3 0.0	0.3 TRISTATE	0.3 TRISTATE	0.3 TRISTATE	0.3 TRISTATE	0.3 TRISTATE	3.3
MUD LOGGING	5.3 EXLOGe	16.2 BAROIDe	7.2 EXLOGe	12.2 EXLOG	10.0 EXLOG	10.1 EXLOG	197.8
WIRE LOGGING	2.9 SCHLUMBERGER	11.6 SCHLUMBERGER	4.4 SCHLUMBERGER	8.4 SCHLUMBERGER	8.7 SCHLUMBERGER	8.8 SCHLUMBERGER	134.0
PAPER STUDIES	3.0 E G & Ge	3.0 BOOKS McCLOSKYe	2.6 NORTEC	3.0 BOOKS McCLOSKYe	3.0 E G & Ge	3.0 E G & Ge	21s6
CORE ANALYSIS	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	0.6 CORE LAB	7,8
WELL TESTING	4.0 NORALCO	4.0 NORALCO	B.J, HUGHES	0.0	4.0 NORALCO	4.0 NORALCO	24,0
CATERING	8.8 UNIVERSAL	34.8 UNIVERSAL	13*2 UNIVERSAL	25.2 UNIVERSAL	26.0 UNIVERSAL	26.4 UNIVERSAL	341.2
NAVAGATION	2.0 ITECH	2.0 NCS INT'Le	2.0 NCS INT'Le	2.0 OCEANEER.INT'L	1.0 OCEANEER.INT'L	1.0 OCEANEER.INT'L	25,0
WEATHER	5.9 NORTEC	FAIRWEATHER	8.8	16.8 NORTEC	17.3 NORTEC	17.6 NORTEC	244.8
MEDICAL	0.7 NORTEC	2.9 NORTEC	1.1 NORTEC	2.1 NORTEC	2.2 NORTEC	2.2 NORTEC	33.5
SECURITY	1.5 O'NEILL	5.8 O'NEILL	2.2 O'NEILL	4.2 O'NEILL	4.3 O'NEILL	4.4 O'NEILL	67.0
MET OCEAN	1.4 E G & Ge	1.4 E G & Ge	1.4 E G & Ge	1.4 E G & Ge	1.4 E G & Ge	1.4 E G & Ge	18.2
ICE FORCAST	0.7 ARCTEC	NONE	NONE	NONE	NONE	NONE	32.6
WELLHEAD EQUIP	2.0 BECHTEL	2.0 HUGHES OFFSH	2.0 HUGHES OFFSH	2.0 NATIONAL SUP.	2.0 NATIONAL SUP.	2.0	26.0
TOTAL FOR WELL	163.6	665.5	258,5	493.7	584,7	593.2	7555.3 7555.3

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e== ESTIMATED USING DATA FROM OTHER CONTRACTORS

air support (7 percent). All of these groups employed personnel both onshore and offshore in the Bering Sea, as well as large numbers in Anchorage and outside Alaska.

Drilling operators accounted for over 3,200 man-months of employment for exploration in the Bering Sea during the study period. Marine support was the next largest employer, accounting for over 1,300 man-months. Lease operators and air support used 710 and 507 man-months of labor between 1'380 and 1985. Catering, weather forecasting, shorebases, mudlogging, and wire logging were also significant components.

4.2.2.3 Wages and salaries

The wages contractors paid to their employees was sensitive topic. To maintain confidentiality, wages paid per person per month by each type of contractor were averaged and then applied to all contractors of that type. Many contractors did not wish to divulge wage data. In those cases, wages were averaged for the contractors of that type who did provide data, and the average was assumed to be applicable to all contractors of that type. These average monthly wage rates are presented in Table 4-13.

The wage rates presented in this section are gross pay for position. Thus, if a $4,000 per month position involves a leave rotation of 2 weeks on and 2 weeks off, each individual would receive $2,000 per month employed ($24,000 per year), and would be on duty for half of the year. The wages do not include fringe benefits, overhead, or profit.

Wages paid per person per month ranged from $5,700 for divers to $2,000 for core analysts. The non-weighted average monthly payment to employees was $3,800. Divers receive a relatively high wage as a result of their high-risk work and their status as union employees. Other contractor types with high average wage rates include well plugging contractors ($5,000) and navigation contractors ($4,500).

As noted above, drilling contractors used a greater amount of labor than any other type of contractor. Since the wage rate for drilling contractor employees ($4,000 per man-month) was higher than the average wage rate for all contractor employees ($3,800 per month), the total wage expenditure ($13 million) for this category exceeded that of all other contractor activities (See Table 4-15). Shorebase operators provided the second highest wage expenditures at $4.4 million in total wages. Note that Table 4-15 refers to gross wage expenditures only. In addition, contractors paid for fringe benefits and overhead.

A comparison of wage expenditures per well indicates that the ARCO Navarin COST well had the largest total wage expenditure ($4.8 million) and the highest wage expenditure for Alaska employment ($1.4 million). This was due to the extended length of time required to drill the well, nearly 5 months. Exxon's Chugach No. 1 Well in Norton Sound had the lowest total wage expenditure ($0.6 million). This was a direct result of the relatively short amount of time (23 days) spent drilling.

TABLE 4-14

AVERAGE MONTHLY DRILLING WAGE RATES
(PER PERSON BY CONTRACTOR TYPE)

Contractor Type	Average Monthly Wage Per Person ($000)
Lease Operator	4.4
Driller	4.2
Roustabout	3.8
Air Support	2.6
Marine Support	2.8
Shorebase	3.0
Divers	5.7
Mudder	5.0
Cement	4.2
Plug Well	5.5
Mud Logging	5.0
Wire Logging	3.9
Paper Studies	3.3
Core Analysis	2.0
Well Testing	4.5
Catering	3.2
Navigation	4.5
Weather	3.2
Medical	3.2
Security	3.2
Met Ocean	3.2
Ice Forecasting	3.7
Wellhead Equipment	3.3
Non-Weighted Average	3.8

Source: Patrick Burden & Associates and Dames & Moore.

TABLE 4-15

TOTAL DRILLING WAGE EXPENDITURES
($000)

CONTRACTOR TYPE	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	N.ALEUTIAN COST # 1	NAVARIN COST	NORTON.0436 # 1 BIRCH#1	NORTON.0414 TETON#1
LEASE OPER.	458.1 ARCO	453.7 ARCO	431.7 ARCO	563*8 ARCO	651.9 ARCO	237.9 ARCO	149.8 EXXON
DRILLER	1048.3 DANTEXe	1586.2 SEDCOe	980.0 KEYDRIL	1971.2 SEDCOe	2279.2 SEDCOe	540.0 KEYDRIL	304.6 ROWANe
ROUSTABOUT	0.0 NONE	0.0 NONE	62.7 VECO	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE
AIR SUPPORT	80.8 ERA	91.3 ERA	76*1 ERA	113.5 ERA	558.7 COLUMBIA/BOEING	45.7 AIR LOG	26.4 ERA
MARINE SUPPORT	323.6 BIEHL	320.4 BIEHL	0.0 0.0	398.2 BIEHL	460.4 BIEHL	168.0 BIEHL	63.8 SEAHORSE
MARINE SUPPORT	138.7 CROWLEY						
BARGE SUPPORT	38.4 OFFSHORE LOGIS.		130.7 CROWLEY			51.8 MARINE LOGIS.	32.6 MARINE LOGIS.
SHORE BASE	33.3 CROWLEY/NOME	33.0 CROWLEY	31.4 CROWLEY/NOME	41.0 CROWLEY	94.7 O.S.I./NOME	73.4 O.S.I./NOME	46.2 O.S.I./NOME
DIVERS	78.5 MARTECH	77.8 MARTECH	74.0 UNDERWTR.CONS.	96.7 MARTEC	111.8 MARTEC	40.8 MARTECH	25.7 MARTECH
MUDDER	34.7 BAROID	34.3 BAROID	32.7 MAGCOBAR	42.7 BAROID	49.3 BAROID	18.0 BAROID	11.3 BAROID
CEMENT	28.9 HALLIBURTON	28.6 HALLIBURTON	27.2 HALLIBURTON	35.6 HALLIBURTON	41.1 HALLIBURTON	15.0 HALLIBURTON	9.4 HALLIBURTON
PLUG WELL	1.4 TRISTATE	1.4 TRISTATE	1.4 TRISTATE	1.4 TRISTATE	1.4 TRISTATE	1.4 0.0	1.4 0.0
MUD LOGGING	95.0 EXLOGe	113.0 EXLOG	90.0 EXLOGe	138.0 EXLOG	158.0 EXLOG	53.3 EXLOGe	36.7 EXLOGe
WIRE LOGGING	54.1 SCHLUMBERGER	53.6 SCHLUMBERGER	51.0 SCHLUMBERGER	66.6 SCHLUMBERGER	77.0 SCHLUMBERGER	28.1 SCHLUMBERGER	17.7 SCHLUMBERGER
PAPER STUDIES	3.0 WOODWARD-CLYDE	3.0 WOODWARD-CLYDE	3.0 WOODWARD-CLYDE	3.0 WOODWARD-CLYDE	3.0 WOODWARD-CLYDE	9.0 HOOKS McCLOSKYe	9.0 E G & Ge
CORE ANALYSIS	1.2	1.2	1.2	1.2	1.2	1.2	1.2
WELL TESTING	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	18.0 NORALCO	18.0 NORALCO
CATERING	131.0 UNIVERSAL	129.8 UNIVERSAL	0.0 KEYDRIL	161.3 UNIVERSAL	186.5 UNIVERSAL	0.0 KEYDRIL	42.8 UNIVERSAL
NAVIGATION	10.8 ITECH	10.8 ITECH	10.8 ITECH	16.2 ITECH	5.0 OCEANEER.INT'L	10.8 ITECH	10.8 ITECH
WEATHER	86.5 NORTEC	86.5 NORTEC	82.3 NORTEC	107.5 NORTEC	124.3 NORTEC	45.4 NORTEC	28.6 NORTEC
MEDICAL	11.1 NORTEC	11.0 NORTEC	10.5 NORTEC	13.7 NORTEC	15.8 NORTEC	5.8 NORTEC	3.6 NORTEC
SECURITY	22.2 O'NEILL	22.0 O'NEILL	20.9 O'NEILL	27.3 O'NEILL	31.6 O'NEILL	11.5 O'NEILL	7.3 O'NEILL
MET OCEAN	4.5 S.A.I.e	4.5 E G & Ge	4.5 S.A.I.e	4.5 E G & Ge	4.5 E G & Ge	4.5 E G & Ge	4.5 E G & Ge
ICE FORCAST	16.6 ARCTEC	0.0 NONE	15.7 ARCTEC	72.0 INTERA	0.0 NONE	0.0 NONE	5.4 ARCTEC
WELLHEAD EQUIP	6.7	6.7 HUGHES OFFSH	6.7	6.7 OTIS	6.7 HUGHES OFFSH	6.7 BECHTEL	6.7 BECHTEL
TOTAL FOR WELL	2620.7	3068.6	2144.2	3881.7	4862.0	1386.1	863.4

SOURCE: DAMES & MOORE AND PATRICE BORDEN & ASSOCIATES

e= Estimated USING DATA FROM OTHER CONTRACTORS

TABLE 4-15 CONTINUED

TOTAL DRILLING WAGE EXPENDITURES
($000)

CONTRACTOR TYPE	NORTON.0430 CHUGACH#1	ST.GEO.0537 RAT#1	ST. GEO.0466 BERTHA#1	ST. GEO.0519 ENDEAVOR#1	ST. GEO.0530 INTREPID#1	ST.GEO.0527 TUSTEMENA#1	TOTAL BY TYPE
	96,9	383.2	145.4	277.5	286.3	290.7	4426.8
LEASE OPER.	EXXON	ARCO	MOBIL	CHEVRON	EXXON	EXXON	
	197.1	1339.8	508.2	970.2	1001.0	1016.4	13742.3
DRILLER	ROWANe	SEDCOe	SEDCOe	SEDCOe	WESTERNe	WESTERNe	
	0.0	0.0	0.0	0.0	0.0	0.0	62.7
ROUSTABOUT	NONE	NONE	NONE	NONE	NONE	NONE	
	17.1	81.1	30.8	39.1	94.9	96.4	1351.8
AIR SUPPORT	ERA	ERA	ERA	ERA	AIR LOG	AIR LOG	
	45,1	270.7	92.4	176.4	233.3	236.4	2788.8
MARINE SUPPORT	SEAHORSE	BIEHL	OCEAN MARINE	OCEAN MARINE	SEAHORSE	SEAHORSE	
			0.0	34.7	4.5	4.5	418.6
MARINE SUPPORT			OFFSHORE LOGIS	ARCTIC ALASKA	INT'L MOORING	INT'L MOORING	
	21.1						38.4
BARGE SUPPORT	MARINE LOGIS.						
	29.9	118.2	44.8	85.6	88.3	89.7	809.3
SHORE BASE	O.S.I./NOME	O.S.I.	O.S.I.	O.S.I.	O.S.I.	O.S.I.	
	16.6	65.7	26,9	47.6	49.1	49.8	758.9
DIVERS	MARTECH	MARTECH	MARTECH	MARTECH	NONE	NONE	
	7.3	40.7	11.0	21.0	21.1	22.0	346.7
MUDDER	BAROID	BJHUGHS/MILCHEM	MAGCOBAR	BAROID	MAGCOBAR	MAGCOBAR	
	6.1	24.2	9.2	17.5	18.1	18.3	279.2
CEMENT	HALLIBURTON	HALLIBURTON	BJ HUGHESe	BJ HUGHESe	DOWELL	DOWELL	
	1.4	1.4	1.4	1.4	1.4	1.4	17.9
PLUG WELL	0.0	TRISTATE	TRISTATE	TRISTATE	TRISTATE	TRISTATE	
	26.7	80.8	35.8	60.8	50.0	50.7	988.8
MUD LOGGING	EXLOGe	BAROIDe	EXLOGe	EXLOG	EXLOG	EXLOG	
	11.4	45.2	17.2	32.8	33.8	34.3	522.6
WIRE LOGGING	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	
	9.0	9.0	9.1	9.0	9.0	9.0	86.9
PAPER STUDIES	E G & Ge	HOOKS McCLOSKYe	NORTEC	HOOKS McCLOSKYe	E G & Ge	E G & Ge	
	1.2	1.2	1.2	1.2	1.2	1.2	15.6
CORE ANALYSIS			CORE LAB				
	18.0	18.0	0.0	0.0	18.0	18.0	108.0
WELL TESTING	NORALCO	NORALCO	B.J.HUGHES		NORALCO	NORALCO	
	27.7	109.6	41.6	79.4	81.9	83.2	1074.8
CATERING	UNIVERSAL	UNIVERSAL	UNIVERSAL	UNIVERSAL	UNIVERSAL	UNIVERSAL	
	10.3	8.9	8.9	8.9	2.5	2.5	117.6
NAVIGATION	ITECH	NCS INT'Le	NCS INT'Le	OCEANEER.INT'L	OCEANEER.INT'L	OCEANEER.INT'L	
	18.5	0.0	27.7	52.9	54.6	55.4	683.8
WEATHER	NORTEC	FAIRWEATHER	NORTEC	NORTEC	NORTEC	NORTEC	
	2.3	9.3	3.5	6.7	6.9	7.0	107.2
MEDICAL	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	
	4.7	18.6	7.0	13.4	13.9	14.1	214.4
SECURITY	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	
	4.5	4.5	4.5	4.5	4.5	4.5	58.2
MET OCEAN	E G & Ge	E G & Ge	E G & Ge	E G & Ge	E G & Ge	E G & Ge	
	3.5	0.0	0.0	0.0	0.0	0.0	113.3
ICE FORCAST	ARCTEC	NONE	NONE	NONE	NONE	NONE	
	6.7	6.7	6.7	6.7	6.7	6.7	86.7
WELLHEAD EQUIP	BECHTEL	HUGHES OFFSH	HUGHES OFFSH	HUGHES OFFSH	NATIONAL SUP.	NATIONAL SUP.	
TOTAL FOR WELL	583.7	2636.7	1031.2	1947*2	2081.5	2112 .2	29219.2

SOURCE: DAMES & MOORE AND PATRICK BURDEN & ASSOCIATES

e=ESTIMATED USING DATA FROM OTHER CONTRACTORS

4.2.2.4 Residency

Table 4-16 presents data on the employment of Alaskan residents by contractor type. The bottom row indicates the weighted average percent of Alaska resident employment by well. These data indicate that the employment of Alaskans (expressed as a percentage of total employment) ranged from 45 percent during drilling of the second Norton Basin COST well to 22 percent for the ARCO Rat No. 1 well. These percentages indicate a very significant level of Alaskan participation in the well drilling phase of exploration.

The extent of Alaska resident hire is dependent on several factors. First, the amount of skill required to perform the majority of the contractors' work plays an important role in determining whether or not Alaskans will be hired. If the expertise required by a job is difficult to find in Alaska, employees are brought up from outside of Alaska to perform that job.

A second major consideration involved in determining the level of Alaska resident hire is the location of the contractor's office. Often, contractors do not have offices in Alaska and the employment data show little or no hiring of Alaska residents for these firms. Conversely, contractors with offices in Alaska tend to show a higher percentage of Alaska residents as employees. Some examples of these latter types of contractors include lease operators (70 percent Alaska residents), divers (Martech 100 percent), electrical logging (Schlumberger 100 percent), and weather forecasting (Nortech 100 percent). The rightmost column on Table 4-15 reports the average percent Alaska resident hire by contractor type.

TABLE 4-16

ALASKA DRILLING EMPLOYMENT
(Percentage)

CONTRACTOR TYPE	NORTON COST # 1	ST. GEORGE COST # 2	NORTON COST #2	N. ALEUTIAN COST #1	NAVARIN COST #1	NORTON, OCS 436 BIRCH #1	NORTON, OCS 0414 TETON #1
	1.0	1.0	1.0	1.0	1.0	1.0	0.5
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON
	0.0	0.0	0.0	0.0	0.0	0.0	0.1
DRILLER	DANTEX	SEDCO	KEYDRIL	SEDCO	SEDCO	KEYDRIL	ROWAN
	0.0	0.0	1.0	0.0	0.0	0.0	0.0
ROUSTABOUT	NONE	NONE	VECO	NONE	NONE	NONE	NONE
	0.9	0.9	0.9	0.9	0.1	0.8	0.9
AIR SUPPORT	ERA	ERA	ERA	ERA	ERA/BOEING	AIR LOG	ERA
	0.1	0.1	0.0	0.1	0.1	0.1	0.0
MARINE SUPPORT	BIEHL	BIEHL	0.0	BIEHL	BIEHL	BIEHL	SEAHORSE
	0.0						
MARINE SUPPORT	CROWLEY						
	0.0		0.6	0.0	0.0	0.0	0.0
BARGE SOPPORT	OFFSHORE LOG IS.		CROWLEY	MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.
	1.0	1.0	1.0	1.0	0.9	0.9	0.9
SHORE BASE	CROWLEY/NOME	CROWLEY	CROWLEY/NOME	CROWLEY	O.S.I./NOME	O.S.I./NOME	O.S.I./NOME
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
DIVERS	MARTECH	MARTECH	UNDERWTR.CONS.	MARTEC	MARTEC	MARTECH	MARTECH
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
MUDDER	BAROID	BAROID	MAGCOBAR	BAROID	BAROID	BAROID	BAROID
	0.2	0.2	0.2	0.2	0.2	0.2	0.2
CEMENT	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON
	0.8	0.8	0.8	0.8	0.8	0.8	0.8
PLUG WELL	TRISTATE	TRISTATE	TRISTATE	TRISTATE	TRISTATE	0.0	0.0
	0.5	0.3	0.5	0.4	0.7	0.5	0.5
MUD LOGGING	EXLOGe	EXLOG	EXLOGe	EXLOG	EXLOG	EXLOGe	EXLOGe
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
WIRE LOGGING	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER
	1.0	1.0	1.0	1.0	1.0	0.0	0.0
PAPER STUDIES	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	HOOKS McCLOSKYe	E G & Ge
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CORE ANALYSIS							
	0.0	0.0	0.0	0.0	0.0	0.5	0.5
WELL TESTING	NONE	NONE	NONE	NONE	NONE	NORALCO	NORALCO
	0.3	0.3	0.3	0.3	0.3	0.3	0.3
CATERING	UNIVERSAL	UNIVERSAL	KEYDRIL	UNIVERSAL	UNIVERSAL	KEYDRIL	UNIVERSAL
	0.8	0.8	0.8	0.8	0.2	0.0	0.0
NAVAGATION	ITECH	ITECH	ITECH	ITECH	OCEANEER.INT'L	ITECH	ITECH
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
WEATHER	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
MEDICAL	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SECURITY	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL
	1.0	1.0	1.0	1.0	1.0	0.0	0.0
MET OCEAN	S.A.I.e	E G & Ge	S.A.I.e	E G & Ge	E G & Ge	E G & Ge	E G & Ge
	0.5	0.0	0.5	1.0	0.0	0.0	0.0
ICE FORCAST	ARCTEC	NONE	ARCTEC	INTERA	NONE	NONE	ARCTEC
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELLHEAD EQUIP		HUGHES OFFSH		OTIS	HUGHES OFFSH	BECHTEL	BECHTEL
WEIGHTED AVG.	31%	28%	45%	30%	24%	33%	36%

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e==ESTIMATED USING DATA FROM OTHER CONTRACTORS

TABLE 4-16 CONTINUED

ALASKA DRILLING EMPLOYMENT
(Percentage)

CONTRACTOR TYPE	NORTON.0430 CHUGACH#1	ST.GEO.0537 RAT#1	ST.GEO.0466 BERTHA#1	ST. GEO.0519 INTREPID#1	ST .GEO.0530 TUSTEMENA#1	ST. GEO.0527 TUSTEMENA#2	TOTAL BY TYPE
LEASE OPER.	0.5 EXXON	0.1 ARCO	0.0 MOBIL	0.8 CHEVRON	0.5 EXXON	0.5 EXXON	0.7
DRILLER	0.1 ROWAN	0.0 SEDCO	0.0 SEDCO	0.0 SEDCO	0.0 WESTERN	0.0 WESTERN	.0
ROUSTABOUT	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0'1
AIR SUPPORT	0.9 ERA	0.9 ERA	0.9 ERA	0.9 ERA	0.8 AIR LOG	0.8 AIR LOG	0.8
MARINE SUPPORT	0.0 SEAHORSE	0.1 BIEHL	0.2 OCEAN MARINE	0.2 OCEAN MARINE	0.0 SEAHORSE	0.0 SEAHORSE	0.1
MARINE SUPPORT			0.0 OFFSHORE LOGIS	0.5 ARCTIC ALASKA	0.0 INT'L MOORING	0.0 INT'L MOORING	O*1
BARGE SUPPORT	0.0 MARINE LOGIS.		0.0	0.0	0.0	0.0	0.0
SHORE BASE	0.9 O.S.I./NOME	0.9 O.S.I.	0.9 O.S.I.	0.9 O.S.I.	0.9 O.S.I.	0.9 O.S.I.	1.0
DIVERS	1.0 MARTECH	1.0 MARTECH	1.0 MARTECH	1.0 MARTECH	1.0 NONE	1.0 NONE	1.0
MUDDER	1.0 BAROID	0.8 BJHUGHS/MILCHEM	1.0 MAGCOBAR	1.0 BAROID	1.0 MAGCOBAR	1.0 MAGCOBAR	1.0
CEMENT	0.2 HALLIBURTON	0.2 HALLIBURTON	0.2 BJ HUGHESe	0.2 BJ HUGHESe	0.0 DOWELL	0.0 DOWELL	0.2
PLUG WELL	0.8 0.0	0.8 TRISTATE	0.8 TRISTATE	0.8 TRISTATE	0.8 TRISTATE	0.8 TRISTATE	0.8
MUD LOGGING	0.5 EXLOGe	1.0 BAROIDe	0.5 EXLOGe	0.6 EXLOG	0.5 EXLOG	0.5 EXLOG	0.5
WIRELOGGING	1.0 SCHLUMBERGER	1.0 SCHLUMBERGER	1.0 SCHLUMBERGER	1.0 SCHLUMBERGER	1.0 SCHLUMBERGER	1.0 SCHLUMBERGER	1.0
PAPER STUDIES	0.0 E G & Ge	0.0 HOOKS McCLOSKYe	1.0 NORTEC	1.0 HOOKS McCLOSKYe	0.0 E G & Ge	0.0 E G & Ge	O*5
CORE ANALYSIS	1.0	1.0	1.0 CORE LAB	1.0	1.0	1.0	1.0
WELL TESTING	0.5 NORALCO	0.5 NORALCO	0.0 B.J.HUGHES	0.0	0.5 NORALCO	0.5 NORALCO	0.2
CATERING	0.3 UNIVERSAL	0.3 UNIVERSAL	0.3 UNIVERSAL	0.3 UNIVERSAL	0.3 UNIVERSAL	0.3 UNIVERSAL	0.3
NAVAGATION	0.0 ITECH	0.0 NCS INT'Le	0.0 NCS INT'Le	0.0 OCEANEER.INT'L	0.2 OCEANEER.INT'L	0.2 OCEANEER.INT'L	0.3
WEATHER	1.0 NORTEC	0.0 FAIRWEATHER	1.0 NORTEC	1.0 NORTEC	1.0 NORTEC	1.0 NORTEC	0,9
MEDICAL	1.0 NORTEC	1.0 NORTEC	1.0 NORTEC	1.0 NORTEC	1.0 NORTEC	1.0 NORTEC	1.0
SECURITY	1.0 O'NEILL	1.0 O'NEILL	1.0 O'NEILL	1.0 O'NEILL	1.0 O'NEILL	1.0 O'NEILL	1.0
MET OCEAN	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.4
ICE FORCAST	0.5 ARCTEC	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.2
WELLHEAD EQUIP	0.0 BECHTEL	0.0 HUGHES OFFSH	0.0 HUGHES OFFSH	0.0 HUGHES OFFSH	0.0 NATIONAL SUP.	0.0 NATIONAL SUP.	O*0
WEIGHTED AVG.	36%	22%	26%	31%	26%	26%	13.0

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e==ESTIMATED USING DATA FROM OTHER CONTRACTORS

Lease operators paid the highest wages to employees residing in Alaska. Although lease operators appear to have fewer employees involved in drilling activities than the drilling contractors, they have more employees that are residents of Alaska. Other contractor types with high wage expenditures for Alaska residents include air support, shorebase support, and divers (see Table 4-17).

Table 4-17 reports the approximate wages paid to Alaskan residents during the drilling operations, Table 4-17 is based on the average wage rate by contractor type shown in Table 4-14. Thus, although special contractors are named, the wage rate and actual wages paid reflect the industry average to protect confidentiality. Table 4-16 was calculated as the product of Table 4-15 (Total Wages) and percent of Alaska employment. This implicitly assumes that Alaskans working in a given industry are paid the same as all workers in that industry. To the extent that more highly skilled workers may have been 'Lower 48 residents, this Table may overestimate Alaska wages.

4.2.2.5 Effect on local labor

The following paragraphs present an evaluation of the degree to which local labor was used in the exploration activities in the Bering Sea. Each of the four lease sale areas is addressed, with the hiring of local residents discussed by lease sale area and in relation to the location where employment took place (Nome, Dutch Harbor, St. Paul or Cold Bay).

TABLE 4-17

ALASKA RESIDENT DRILLING WAGES AND SALARIES ($000)

CONTRACTOR TYPE	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	N.ALEUTIAN COST # 1	NAVARIN COST # 1	NORTON.0436 BIRCH#1	NORTON.0414 TETON#1
LEASE OPER.	458.!	453.7	431.7	563.8	651.9	237.9	74.9
	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON
DRILLER	0.0	0.0	0.0	0.0	0.0	0.0	30.5
	DANTEX	SEDCO	KEYDRIL	SEDCO	SEDCO	KEYDRIL	ROWAN
ROUSTABOUT	0.0	0.0	62.7	0.0	0.0	0.0	0.0
	NONE	NONE	VECO	NONE	NONE	NONE	NONE
AIR SUPPORT	72.7	82.2	68.5	102.1	77.4	34.3	23.8
	ERA	ERA	ERA	ERA	COLUMBIA/BOEING	AIR LOG	ERA
MARINE SUPPORT	32.4	32.0	0.0	39.8	46.0	16.8	0.0
	BIEHL	BIEHL	BIEHL	BIEHL	BIEHL	BIEHL	SEAHORSE
MARINE SUPPORT	0.0		78.4	0.0	0.0	0.0	0.0
BARGE SUPPORT	CROWLEY		CROWLEY	MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.
SHORE BASE	33.3	33.0	31.4	41.0	85.2	69.0	43.4
	CROWLEY/NOME	CROWLEY	CROWLEY/NOME	CROWLEY	O.S.I./NOME	O.S.I./NOME	O.S.I./NOME
DIVERS	78.5	77.8	74.0	96.7	111.8	40.8	25.7
	MARTECH	MARTECH	UNDERWTR.CONS.	MARTEC	MARTEC	MARTECH	MARTECH
MUDDER	34.7	34.3	32.7	42.7	49.3	18.0	11.3
	BAROID	BAROID	MAGCOBAR	BAROID	BAROID	BAROID	BAROID
CEMENT	5.8	5.7	5.4	7.1	8.2	3.0	1.9
	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON
PLUG WELL	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	TRISTATE	TRISTATE	TRISTATE	TRISTATE	TRISTATE	0.0	0.0
MUD LOGGING	47.5	28.3	45.0	48.3	110.6	26.7	18.3
	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG	EXLOG
WIRE LOGGING	54.1	53.6	51.0	66.6	77.0	28.1	17.7
	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER
PAPER STUDIES	3.0	3.0	3.0	3.0	3.0	0.0	0.0
	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	HOOKS McCLOSKYe	E G & Ge
CORE ANALYSIS	1.2	1.2	1.2	1.2	1.2	1.2	1.2
WELL TESTING	0.0	0.0	0.0	0.0	0.0	9.0	9.0
	NONE	NONE	NONE	NONE	NONE	NORALCO	NORALCO
CATERING	32.8	32.4	0.0	40.3	46.6	0.0	10.7
	UNIVERSAL	UNIVERSAL	KEYDRIL	UNIVERSAL	UNIVERSAL	KEYDRIL	UNIVERSAL
NIVAGJTION	8.6	8.6	8.6	12.9	0.8	0.0	0.0
	ITECH	ITECH	ITECH	ITECH	OCEANEER.INT'L	ITECH	ITECH
WEATHER	0.0	86.5	82.3	107.5	124.3	45.4	28.6
	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
MEDICAL	11.1	11.0	10.5	13.7	15.8	5.8	3.6
	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
SECURITY	22.2	22.0	20.9	27.3	31.6	11.5	7.3
	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL
MET OCEA%	4.5	4.5	4.5	4.5	4.5	0.0	0.0
	S.A.I.e	E G & Ge	S.A.I.e	E G & Ge	E G & Ge	E G & Ge	E G & Ge
ICE FORCAST	8.3	0.0	7.8	72.0	0.0	0.0	0.0
	ARCTEC	NONE	ARCTEC	INTERA	NONE	NONE	ARCTEC
WELLHEAD EQUIP	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		HUGHES OFFSH		OTIS	HUGHES OFFSH	BECHTEL	BECHTEL
TOTAL FOR WELL	909,7	970.8	1020.6	1291.5	1446.2	548.3	308.9

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e==ESTIMATED USING DATA FROM OTHER CONTRACTORS

TABLE 4-17 CONTINUED

ALASKA RESIDENT DRILLING WAGES AND SALARIES ($000)

CONTRACTOR	TYPE	NORTON.0430 CHUGACH#1	ST.GEO.0537 RAT#1	ST.GEO.0466 BERTHA#1	ST.GEO.0519 INTREPID#1	ST.GEO.0530 TUSTEMENA#1	ST.GEO.0527 TUSTEMENA#2	TOTAL BY TYPE
LEASE OPER.		48.5 EXXON	38.3 ARCO	0.0 MOBIL	222.0 CHEVRON	143.2 EXXON	145.4 EXXON	3469.2
DRILLER		19.7 ROWAN	0.0 SEDCO	0.0 SEDCO	0.0 SEDCO	0.0 WESTERN	0.0 WESTERN	50,2
ROOSTABOUT		0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	62,7
AIR SUPPORT		15.4 ERA	73.0 ERA	27.7 ERA	35.2 ERA	71,2 AIR LOG	72.3 AIR LOG	755,6
MARINE SUPPORT		0.0 SEAHORSE	27.1 BIEHL	18.5 OCEAN MARINE	35.3 OCEAN MARINE	0.0 SEAHORSE	0.0 SEAHORSE	247.9
MARINE SUPPORT					17.3 ARCTIC ALASKA	∩.∩ INT'L MOORING	0.0 INT'L MOORING	95*7
BARGE SUPPORT		0.0 MARINE LOGIS.						0,0
SHORE BASE		28.1 O.S.I./NOME	111.1 O.S.I.	42.1 O.S.I.	80.4 O.S.I.	83.0 O.S.I.	84.3 O.S.I.	765,2
DIVERS		16.6 MARTECH	65.7 MARTECH	24.9 MARTECH	47.6 MARTECH	49.1 NONE	49,8 NONE	758.9
MUDDER		7.3 BAROID	30.5 BJHUGHS/MILCHEM	11.0 MAGCOBAR	21.0 BAROID	21.7 MAGCOBAR	22*O MAGCOBAR	336.5
CEMENT		1.2 HALLIBURTON	4.8 HALLIBURTON	1.8 BJ HUGHESe	3.5 BJ HUGHESe	0.0 DOWELL	0.0 DOWELL	48, $
PLUG WELL		1.1 0.0	1.1 TRISTATE	1.1 TRISTATE	1.1 TRISTATE	1.1 TRISTATE	1.1 TRISTATE	14.3
MUD LOGGING		13.3 EXLOG	80.8 BAROID	17.9 EXLOG	36.5 EXLOG	25.0 EXLOG	25.3 EXLOG	523.6
WIRE LOGGING		11.4 SCHLUMBERGER	45.2 SCHLUMBERGER	17.2 SCHLUMBERGER	32.8 SCHLUMBERGER	33.8 SCHLUMBERGER	34.3 SCHLUMBERGER	“522,6
PAPER STUDIES		0.0 E G & Ge	0.0 HOOKS McCLOSKYe	9.1 NORTEC	9.0 HOOKS McCLOSKYe	0.0 E G & Ge	0.0 E G & Ge	32.9
CORE ANALYSIS		1.2	1.2	1.2 CORE LAB	1.2	1.2	1.2	15.6
WELL TESTING		9.0 NORALCO	9.0 NORALCO	0.0 B.J.HUGHES	0.0	9.0 NORALCO	9.0 NORALCO	54.0
CATERING		6.9 UNIVERSAL	27.4 UNIVERSAL	10.4 UNIVERSAL	19.8 UNIVERSAL	20.5 UNIVERSAL	20.8 UNIVERSAL	268.7
NAVAGATION		0.0 ITECH	0.0 NCS INT'Le	0.0 NCS INT'Le	0.0 OCEANEER.INT'L	0.4 OCEANEER.INT'L	0.4 OCEANEER.INT'L	40.3
WEATHER		18.5 NORTEC	0.0 FAIRWEATHER	27.7 NORTEC	52.9 NORTEC	54.6 NORTEC	55.4 NORTEC	683.8
MEDICAL		2.3 NORTEC	9.3 NORTEC	3.5 NORTEC	6.7 NORTEC	6.9 NORTEC	7.0 NORTEC	107,2
SECURITY		4.7 O'NEILL	18.6 O'NEILL	7.0 O'NEILL	13.4 O'NEILL	13.9 O'NEILL	14.1 O'NEILL	214.4
MET OCEAN		0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	0.0 E G & Ge	22.4
ICE FORCAST		1.3 ARCTEC	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	0.0 NONE	89,9
WELLHEAD EQUIP		0.0 BECHTEL	0.0 HUGHES OFFSH	0.0 HUGHES OFFSH	0.0 HUGHES OFFSH	∩.0 NATIONAL SUP.	0.0 NATIONAL SUP.	0,0
TOTAL FOR WELL		207.1	543.1	221.2	635.8	534.4	542.4	9180,2

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e== ESTIMATED USING DATA FROM OTHER CONTRACTORS

A local resident is defined as a resident of a community located on or near the Bering Sea. If an Alaskan resident living in Dutch Harbor was hired to do OCS-related work in Dutch Harbor, this individual was included in the local employment figure, If a person residing in Anchorage was hired to perform OCS-related work in Dutch Harbor, this individual was included in the state employment estimate but not in the local employment estimate.

Data on local hiring during drilling by contractor type are presented in Table 4-18. These data indicate 495 man-months (6.5 percent of the 7,550 total man-months) were attributed to local employees.

This total figure for employment of local Alaska residents is also referred to in the tables for this section as local level of effort. The local level of effort by well ranged from 13.3 man-months on the North Aleutian COST well to 77.9 man-months for Chevron's Intrepid No. 1 well. Of the 1,930 total man-months of employment for COST and exploration wells drilled in Norton Sound, 174 man-months (9 percent) can be attributed to local employees. Most employment of local residents in Nome was related to the air support activities at the City of Nome Airport.

Drilling activities in St. George Basin required approximately 3,375 man-months of employment. Of this amount, 250 man-months (7 percent) were identified as local. The majority of this local employment was involved in marine support activities in Dutch Harbor and air support activities in Cold Bay.

TABLE 4-18

LOCAL DRILLING EMPLOYMENT (MAN-MONTHS)

CONTRACTOR TYPE	NORTON COST # 1	ST.GEORGE COST # 2	NORTON COST # 2	N.ALEUTIAN COST # 1	NAVARIN COST # 1	NORTON.0436 BIRCH#1	NORTON.0414 TETON#1
	0.0	0.0	0.0	0.0	0.0	0.0	3.8
LEASE OPER.	ARCO	ARCO	ARCO	ARCO	ARCO	ARCO	EXXON
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DRILLER	DANTEXe	SEDCO	KEYDRIL	SEDCO	SEDCO	KEYDRIL	ROWAN
	0.0	0.0	16.3				
ROUSTABOUT	NONE	NONE	VECO	NONE	NONE	NONE	NONE
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIR SUPPORT	ERA	ERA	ERA	ERA	COLUMBIA/BOEING	AIR LOG	ERA
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MARINE SUPPORT	BIEHL	BIEHL	OCEAN MARINE	BIEHL	BIEHL	BIEHL	SEAHORSE
							0
MARINE SOPPORT							INT'L MOORING
	20.8		19.6	0.0	0.0	0.0	0.0
BARGE SOPPORT	CROWLEY		CROWLEY	MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.	MARINE LOGIS.
	6.9	6.9	6.5	8.5	26.6	21.5	13.6
SHORE BASE	CROWLEY/NOME	CROWLEYe	CROWLEY/NOMEe	CROWLEYe	O.S.I./NOME	O.S.I./NOME	O.S.I./NOME
	13.9	13.7	13.1	0.0	0.0	0.0	0.0
DIVERS	MARTECH	MARTECH	UNDERWTR.CONS.e	MARTEC	MARTEC	MARTECH	MARTECH
	6.9	6.9	6.5	0.0	0.0	0.0	0.0
MUDDER	BAROID	BAROID	MAGCOBAR	BAROID	BAROID	BAROID	BAROID
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CEMENT	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON	HALLIBURTON
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PLUG WELL	TRISTATE	TRISTATE	TRISTATE	TRISTATE	TRISTATE	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MUD LOGGING	EXLOGe	EXLOG	EXLOGe	EXLOG	EXLOG	EXLOGe	EXLOGe
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WIRE LOGGING	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAPER STUDIES	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	WOODWARD-CLYDE	HOOKS McCLOSKYe	E G & Ge
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORE ANALYSIS	CORE LAB	CORE LAB	CORE LAB	CORE LAB	CORE LAB	CORE LAB	CORE LAB
	0.0	0.0	0.0	0.0	0.0	4.0	4.0
WELL TESTING	NONE	NONE	NONE	NONE	NONE	NORALCO	NORALCO
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CATERING	UNIVERSAL	UNIVERSAL	KEYDRIL	UNIVERSAL	UNIVERSAL	KEYDRIL	UNIVERSAL
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NAVIGATION	ITECH	ITECH	ITECH	ITECH	OCEANEER.INT'L	ITECH	ITECH
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WEATHER	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEDICAL	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SECURITY	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MET OCEAN	S.A.I.e	E G & Ge	S.A.I.e	E G & Ge	E G & Ge	E G & Ge	E G & Ge
	0.7		0.7	4.8			0.2
ICE FORCAST	ARCTEC	NONE	ARCTEC	INTERA	NONE	NONE	ARCTEC
	0:0	0.0		0.0	0.0	0.0	0.0
WELLHEAD EQUIP		HUGHES OFFSH		OTIS	HUGHES OFFSH	BECHTEL	BECHTEL
TOTAL FOR WELL	49.2	27.5	62.7	13.3	26.6	25.5	21,6

SOURCE: PATRICK BORDEN & ASSOCIATES AND DAMES & MOORE

e==ESTIMATED USING DATA FROM OTHER CONTRACTORS

TABLE 4-18 CONTINUED

LOCAL DRILLING EMPLOYMENT (MAN-MONTHS)

CONTRACTOR	TYPE	NORTON.0430 CHUGACH#1	ST.GEO.0537 RAT#1	ST, GEO.0466 BERTHA#1	ST, GEO.0519 INTREPID#1	ST. GEO.0530 TUSTEMENA#1	ST. GEO.0527 TUSTEMENA#2	TOTAL BY TYPE
		2.5	0.0	0.0	36.0	7.4	7.5	57.2
LEASE OPER.		EXXON	ARCO	MOBIL	CHEVRON	EXXON	EXXON	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
DRILLER		ROWAN	SEDCO	SEDCO	SEDCO	WESTERNe	WESTERNe	
								16.3
ROUSTABOUT		NONE	NONE	NONE	NONE	NONE	NONE	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIR SUPPORT		ERA	ERA	ERA	ERA	AIR LOG	AIR LOG	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
MARINE SUPPORT		SEAHORSE	BIEHL	OCEAN MARINE	OCEAN MARINE	SEAHORSE	SEAHORSE	
		0			0.0	0.0	0.0	40.4
MARINE SUPPORT	INT'L	MOORING			ARCTIC ALASKA	INT'L MOORING	INT'L MOORING	
		0.0						0.0
BARGE SOPPORT		MARINE LOGIS.						
		8.8	34.7	13.2	25.1	25.9	26.3	224.7
SHORE BASE		O.S.I./NOME	O.S.I.	O.S.I.	O.S.I.	O.S.I.	O.S.I.	
		0.0	0.0	0.0	0.0	0.0	0.0	40.7
DIVERS		MARTECH	MARTECH	MARTECH	MARTECH	NONE	NONE	
		0.0	0.0	0.0	0.0	0.0	0.0	20,3
MUDDER		BAROID	BJHUGHS/MILCHEM	MAGCOBAR	BAROID	MAGCOBAR	MAGCOBAR	
		0.0	0.0	0.0	0.0	2.2	2.2	4.4
CEMENT		HALLIBURTON	HALLIBURTON	BJ HUGHESe	BJ HUGHESe	DOWELL	DOWELL	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
PLUG WELL		0.0	TRISTATE	TRISTATE	TRISTATE	TRISTATE	TRISTATE	
		0.0	0.0	0.0	0.0	0.0	0.0	0,0
MUD LOGGING		EXLOGe	BAROIDe	EXLOGe	EXLOG	EXLOG	EXLOG	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
WIRE LOGGING		SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	SCHLUMBERGER	
		0.0	0.0	0.0	0.0	0.0	0.0	0*0
PAPER STUDIES		E G & Ge	HOOKS McCLOSKYe	NORTEC	HOOKS McCLOSKYe	E G & Ge	E G & Ge	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORE ANALYSIS		CORE LAB	CORE LAB	CORE LAB	CORE LAB	CORE LAB	CORE LAB	
		4.0	4.0			4.0	4.0	24.0
WELL TESTING		NORALCO	NORALCO	B.J.HUGHES	0.0	NORALCO	NORALCO	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
CATERING		UNIVERSAL	UNIVERSAL	UNIVERSAL	UNIVERSAL	UNIVERSAL	UNIVERSAL	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
NAVIGATION		ITECH	NCS INT'Le	NCS INT'Le	NCS INT'Le	OCEANEER.INT'L	OCEANEER.INT'L	
		0.0		8.8	16.8	17.3	17.6	60,5
WEATHER		NORTEC	FAIRWEATHER		NORTEC	NORTEC	NORTEC	
		0.0	0.0	0.0	0.0	0.0	0.0	0,0
MEDICAL		NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	NORTEC	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
SECURITY		O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	O'NEILL	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
MET OCEAN		E G & Ge	E G & Ge	E G & Ge	E G & Ge	E G & Ge	E G & Ge	
		0.1						6.5
ICE FORCAST		ARCTEC	NONE	NONE	NONE	NONE	NONE	
		0.0	0.0	0.0	0.0	0.0	0.0	0.0
WELLHEAD EQUIP		BECHTEL	HUGHES OFFSH	HUGHES OFFSH	HUGHES OFFSH	NATIONAL SUP.	NATIONAL SUP,	
TOTAL FOR WELL		15.4	38.7	22,0	77,9	56,8	57.6	495.0 495.0

SOURCE: PATRICK BURDEN & ASSOCIATES AND DAMES & MOORE

e==ESTIMATED USING DATA FROM OTHER CONTRACTORS

The level of local hiring for the Navarin and North Aleutian COST wells was from 1 to 3 percent of the total man-months associated with those wells. Most of the employment of local residents was in Dutch Harbor, Cold Bay, and Nome where marine and air support was provided,

Although the amount of local labor used during drilling is low, there will probably be an increase in local employment as the oil industry moves toward the development and production of the oil resource, and as the local labor force gains experience in oil-related employment. So far, a relatively high level of skill and expertise has been needed during exploration, and in general this need could not be met. on a local basis. The types of employment required in the development and production of offshore oil resources tends to be less skilled, allowing for more hiring of local residents in the future.

4.2.2.6 Company hiring policies

Only 3 contractors involved in the OCS Bering Sea activity hired union employees. These included Martech, Crowley Maritime, and Columbia/ Boeing. The point of hiring for Martech's union divers was Anchorage. Most of Crowley 's union employees were from Anchorage with a few employed as barge workers in the Dutch Harbor area. Columbia/Boeing hired its pilots and maintenance crews from union halls in the Lower 48.

Non-union employees were primarily hired at the location of a company's offices. If a company maintained an office in Alaska a significant number of employees could be Alaska residents. If the firm did not have an

office in Anchorage or elsewhere in the state, the employees were generally non-resident.

4.3 SUMMARY

Exploration activity in the Bering Sea during the study period has required a substantial commitment by the petroleum industry. Operating in these remote OCS waters with a limited infrastructure in place to support the pre-lease and drilling activities has required the industry to commit substantial levels of personnel and money to explore the region. This section summarizes the expenditures and employment for pre-lease and drilling activities from 1980 through, to the extent possible, 1984.

4.3.1 Expenditures

Table 4-19 presents annual expenditure data for pre-lease activities and the drilling phase activities for the study period. These are order-of-magnitude estimates and, as discussed in Section 4.0, the data used to develop these estimates were often estimates as well.

The levels of intensity of exploration activities were varied during the study period, reflecting the early stages of exploration in the Bering Sea. Drilling activities prior to 1984 were solely COST wells, and the absence of any COST well drilling program in 1981 resulted in a low level of expenditures for exploration activities. The $470 million figure shown in Table 4-19 is a conservative estimate of exploration expenditures since there are costs such as lease purchases, overhead, and administration which are not contained in this analysis. It can be safely assumed that

total expenditures related to exploration activity in the Bering Sea OCS exceeded half a billion dollars during the 5-year study period.

Table 4-20 shows the geographic distribution of the total $470 million exploration expenditures. Exploration expenditures made in the State of Alaska, including wages and salaries and goods and services, were about $126 million for the period 1980 through 1984. Local expenditures, those made in communities on or near the Bering Sea, approached $44 million during the study period. In-state expenditures were about 27 percent of total expenditures, and local expenditures accounted for about 9 percent of total expenditures and 35 percent of those expenditures made within the State of Alaska.

4.3.2 Employment

Petroleum exploration in the Bering Sea has involved a large number of personnel. With the exception of oil industry efforts in evaluating survey data, most of the pre-lease and drilling phase activities occurred during the relatively short summer operating season. Estimated labor months for exploration activities are shown in Table 4-21. These estimates are for direct employment in exploration activities and do not include employment generated in secondary industries (i.e., the "multiplier" concept). Pre-lease activities accounted for a larger number of man-months of employment than drilling phase activities for all 5 years. The evaluation of prospects by the oil industry is the largest labor component of pre-lease activities. Except for 1984 when 11 wells were drilled, pre-lease operational activities (principally surveys] accounted for a larger number of man-months than drilling activities.

TABLE 4-19

TOTAL ANNUAL EXPLORATION EXPENDITURES
1980-1984

	Expenditure by Year ($000)					
Exploration Activity	1980	1981	1982	1983	1984	Total
Pre-lease	$20,206	$35,143	$44,82'3	$36,441	$32,421	$169.040
Drilling	21,449	0	135,498	68,664	75,967	301,578
TOTAL EXPENDITURES	$41,655	$35,143	$180,327	$105,105	$108,388	$470,618

Source: Patrick Burden & Associates and Dames & Moore.

TABLE 4-20

GEOGRAPHIC DISTRIBUTION OF EXPLORATION EXPENDITURES

Expenditure	Amount (million $)	Percent of Total
Total	470	100
Alaska	126	27
Local	44	9

Source: Patrick Burden & Associates and Dames & Moore

TABLE 4-21

TOTAL ANNUAL EXPLORATION EMPLOYMENT
1980-1984

	Man-Months by Year					
Exploration Activity	1980	1981	1982	1983	1984	Total
Pre-lease						
Operations	1,807	2,217	3,240	2,029	2,308	11,601
Evaluation	2,943	6,213	7,358	6,540	4,905	27,959
Drilling	690	0	2,254	1,256	3,350	7,550
TOTAL MAN-MONTHS	5,440	8,430	12,852	9,825	10,563	47,110

Source: Patrick Burden & Associates and Dames & Moore.

TABLE 4-22

GEOGRAPHIC DISTRIBUTION OF EXPLORATION EMPLOYMENT

Employment	Number of Man-Years	Percent of Total
Total	3,926	100
Alaska	510	13
Local	60	2

Source: Patrick Burden & Associates and Dames & Moore.

Total man-years of labor associated with exploration in the Bering Sea OCS ranged from 453 in 1980, to 1,071 in 1982, the peak Year of exploration activity. Total man-years of employment during the study period are estimated at 3,'326. Approximately 13 percent (510 man-Years) of all employment related to exploration activities in the Bering Sea OCS went to Alaska residents, and 2 percent (60 man-years) went to local residents (see Table 4-22).

5.0 REFERENCES AND CONTACTS

Information used to prepare the estimates and evaluations presented in this report were obtained from published and unpublished documents and interviews with representatives of lease operators, support contractors. and government agencies. Information on these sources is presented in the following sections.

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5.2 CONTACTS

Contacts made with representatives of agencies and firms involved in or familiar with exploration activities are listed in Table 5-1.

TABLE 5-1
CONTACT PERSONS

COMPANY/AGENCY	CONTACT
ADF&G	JIM MAGDANZ
ADF&G	JUDY MORRIS
AEROSERVICES	BUCK MATEKER
AIR LOG	ANDY FALLETTO
AIR PAC	BRIAN WICK
AIRBORNE SYSTEMS	RICHARD SUMMERFELT
AJIT SHAH	AJIT SHAH
ALASCOM	LOU GERIKE
AMOCO PRODUCTION	JIM PITCHFORD
AOGA	E. GALBRAITH
ARCO	D. HONEYMAN
ARCO	GARY HAMMON
ARCO	J. STEGER
ARCO	RICHARD OGAR
ARCO	DARREL HUMPHREY
ARCO	SUSAN ANDREWS
ARCTEC	JOE COBURN
ARCTIC ALASKA	TERRY BAKER
ARCTIC LIGHTERAGE	RICHARD ROTH
BAKER PACKERS	PAT MULCAHY
BAROID	JOHN ROSE
BI EHL	RC GRINDELAND
BJ HUGHES	MICHAEL BROWN
CHEVRON	TOM COOK
CHRISTIANSON	DAVID
CIRI	KIRK MCGEE
COLD BAY AIRPORT	BOB LEE
COLD BAY, CITY	JESS BURTON
COMAP	DON BOWMAN
COMAP	DWIGHT WILLARD
CORE LAB	WINTON PARKER
CROWLEY	BOB ZIEGLER
DAMES & MOORE	THOMAS KREWINSKI
DIGICON	ALISTAIR CARREL
DIGICON	GLENN AVILA
DIGICON	JOHN MUELLER
DOWELL	BILLY JOHNSON
DUTCH HARBOR, CITY	ARNE ERICKSON
DUTCH HARBOR, HARBOR	BYRON RIORDAN
EG&G	FRANK ROSE
ENERGY ANALYSTS	STEVE MOBLEY
ENGINEERING EQ	BOB HANSON
EPA	KERRI SCHURR
ERA	JOHN McCAMISH
ERTEC	LARRY MAHAR
EXLOG	BERNIE LEAS
EXXON	DAN JONES
EXXON	FRANK McCOLLUM
FAIWEATHER	BRUCE WEBSTER
G.S.I.	GARY BARTLETT
GECO	OLAF EINSTAT
GECO	TOPPE ENGEBRIT
GEOCUBIC	BOB ADELSACK

GS I	JOHN CLINK
GS I	REED JOHNSON
GULF OIL	JERRY LAYTON
HALLIBURTON	PAUL PRESTON
HARDING-LAWSON	LARRY TOIMIL
HUGHES OFFSH.	FRED BEEBE
INT'L MOORING	LARRY VIATOR
INTERA	RAY LOWERY
ITECH	STAN KING
JOE'S CASING	LAYFAYETTE LA OR NEW ORLEANS
KEYDRIL	JOE PEKAREK
MAGCOBAR	ROGER SEIBERT
MARINAV OCEANEER	KEN BROWN
MARINE LOGIS.	NORM DAVIS
MARTEC INT'L	BEN TISDALE
MILCHEM	DEREK
MMs	BOYD BENNETT
MMs	JEFF WALKER
MMs	JERRY SHEARER
MMS	JOE LEVINE
MMs	LEROY STRINGFELLOW
MMs	NANCY MORRIS
MMS	PHYLLIS CASEY
MOBIL	GEO ANDERSON
MOBIL	PHILLIP BRAITHWITE
MOBIL	RAY FLURRY
MOBIL	ROGER TAYLOR
MOBIL	R.V.GUENTHER
MUNTZ	RICH GALLIGHER
McCLELLAN	ARSHUD MAHMOOD
NCS INT'L	REX WOOLEN
NEKTON	DEAN GOODMAN
NMFS	BYRON MORRIS
NOME, CITY OF	CHUCK COYLE
NOME, CITY OF	TIM HOLDER
NOME, CITY OF	LYLE LARSON
NORALCO INT'L	ERWIN DEWALD
NORTEC	JOE OSTRAM
NORTEC	PAUL RASANOWSKI
O'NEILL SECURITY	MIKE O'NEILL
OCEAN MARINE	JOHN DECKER
OCEANEERING INT	DICK FREESBIE
OFFSHORE LOGIS	BILL BRIGHT
OFFSHORE NAVIGATION	JOSEPH DELERNO
OTIS	STEVE HOLLAND
PELAGOS	CHUCK CHAMBERLAIN
PETTY RAY	NANCY NEEL
REEVE AIR ALEUTIAN	JACK BUSCHMAN
ROWAN	VM BRIDGES
SCHLUMBERGER	ELTON HEAD
SEAHORSE	RICH CARLINE
SEDCO	BOBBY LYNCH
SHELL WESTERN	DAVE YESLAND
SITNASAUK	JACK CARPENTER
SOHIO	PETER HANLEY
ST.PAUL IRA COUNCIL	MAX LESTENKOF
TART CONSULTANTS	RUPERT TART
13TH REG.CORP.	KATHLEEN

TRISTATE TOOL	JOHN DAVIS
UNIVERSAL SERV	JIM McGRAW
US COAST GUARD	ED PAGE
VECO	VAL MOLYNEAUX
WEATHERFORD TOO	ROD BAXTER
WESTERN GEOPHY	ORVILLE BRANNON
WESTERN OCEANIC	FRANCIS KUEHN
WOODWARD-CLYDE	J.M. COLONELL
WOODWARD-CLYDE	MIKE JOYCE
ZAPATA	STEVE BRADSHAW

APPENDIX A

EXCERPTS FROM LEASE SALE STIPULATIONS AND CLARIFICATIONS FOR ARCO'S BIRCH WELL (No. 1-OCS-Y-0436)

13. Lease Terms and Stipulations:

a. All leases issued as a result of this sale will be for an initial term of 10 years. Leases issued as a result of this sale will be on Form MMS-2005 (August 1982), available from the Regional Manager, Alaska Outer Continental Shelf Region, at the first address stated in paragraph 2.

b. For leases resulting from this sale for tracts offered on a cash bonus basis with fixed sliding scale royalty, listed in paragraph 4(a), Form MMS-2005 will be amended as follows:

Sec. 6. Royalty on Production. The lessee agrees to pay the lessor a royalty of that percent in amount or value of production from the leased area as determined by the sliding scale royalty formula as follows. When the quarterly value of production, adjusted for inflation, is less than or equal to $16.697566 million, a royalty of 12.50000 percent in amount or value of production will be due on the unadjusted value or amount of production. When the adjusted quarterly value of production is equal to or greater than $16.697567 million, but less than or equal to $11822.537759 million, the royalty percent due on the unadjusted value or amount of production is given by

Rj = b[Ln (Vj/S)] where

Rj = the percent royalty that is due and payable on the unadjusted amount or value of production in quarter j

b = 8.0

Ln = natural logarithm

Vj = the value of production in quarter j, adjusted for inflation, in millions of dollars

s = 3.50

When the" adjusted quarterly value of production is equal to or greater than $11822.537760 million, a royalty of 65.00000 percent in amount or value of production will be due on the unadjusted quarterly value of production. 'Thus, in no instance will the quarterly royalty due exceed 65.00000 percent in amount or value of quarterly production.

In determining the quarterly percent royalty due, Rj, the calculation will be carried to five decimal places (for example, 18.56224 percent). This calculation will incorporate the adjusted quarterly value of production, Vj, in millions of dollars, rounded to the sixth digit, i.e., to the neatest dollar (for example, 35.624831 millions of dollars). Gas of all kinds (except helium) is subject to royalty. The lessor shall determine whether production royalty shall be paid in amount or value.

c. Except as otherwise noted, the following stipulations will be included in each lease resulting from this sale. In the following stipulations and information to lessees in paragraph 14, below, the term RS refers to the Regional Supervisor, Offshore Field Operations, Minerals Management Service, formerly Deputy Conservation Manager, Field Operations, U.S. Geological Survey.

Stipulation No. 1:

If the RS has reason to believe that a site, structure or object of historical or archaeological significance, hereinafter referred to as a "cultural resource", may exist in the leased area and gives the lessee written notice that the lessor is enforcing the provisions of this stipulation, the lessee shall, upon receipt of such notice, comply with the following requirements:

(1) Prior to any dredging or drilling activity or the construction or placement of any structure for exploration or development on the lease, including, but not limited to, well drilling, and pipeline and platform placement, hereinafter in this stipulation referred to as "operation", the lessee shall conduct remote sensing surveys and/or prepare a report, as specified by the RS, to determine the potential existence of any cultural resource that may be affected by such operation. All data produced as well as other pertinent natural and cultural environmental data shall be examined by an archaeologist and geophysicist to determine if indicators are present suggesting the existence of a cultural resource that may be adversely affected by any lease operation. A report of such surveys and assessments prepared by an archaeologist and geophysicist shall be submitted by the lessee to the RS.

(2) If they determine such cultural resource indicators are present, the lessee shall: (a) locate the site of the lease operation so as not to adversely affect the identified location; or (b) establish to the satisfaction of the RS, on the basis of further archaeological investigation conducted by an archaeologist and geophysicist using such survey equipment and techniques as deemed necessary by the RS, either that such operation will not adversely affect the location identified or that the potential cultural resource suggested by the occurrence of the indicators does not exist.

(3) A report of the latter investigation prepared by the archaeologist and geophysicist shall be submitted to the RS for review. Should the RS determine that the existence of a cultural resource which may be adversely affected by such operations is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the RS has given directions as to its protection.

In addition, the lessee agrees that if any cultural resource should be discovered during the conduct of any operations on the lease area, he shall report immediately such findings to the RS and make every reasonable effort to protect the cultural resource until the RS gives directions as to its protection.

Stipulation No. 2:

The lessee shall include in any exploration and development plans submitted under 30 CFR 250.34 a proposed environmental training program for all person-

nel involved in exploration or development activities (including personnel of the lessee's contractors and subcontractors) for review and approval by the RS. . The program shall be designed to inform each person working on the project of specific types of environmental, social, and cultural concerns which relate to the individual's job. The program shall be formulated by qualified instructors experienced in each pertinent field of study, and shall employ effective methods to insure that personnel are informed of archaeological, geological, and biological resources including bird colonies and sea mammal haul-out areas, to insure avoidance and non-harassment of wildlife resources. The program shall also be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating.

The lessee shall also submit for review and approval a continuing technical environmental briefing program for supervisory and managerial personnel of the lessee and its agents, contractors, and subcontractors.

Stipulation No. 3: (To be included only in the leases resulting from this sale for the fixed sliding scale royalty tracts identified in paragraph 4(a) of this notice.)

(a) The royalty rate on production from this lease is subject to consideration for reduction under the same authority that applies to all other oil and gas leases on the Outer Continental Shelf (30 CFR 250.21]. The Director, Minerals Management Service, may grant a reduction for only one year at a time and, reduction of royalty rates will not be approved unless production has been under way for one year or more.

(b) Although the royalty rate specified in section 6(a) of this lease or as subsequently modified in accordance with applicable regulations and stipulations is applicable to all production under this lease, not more than 16-2/3 percent of the production from the lease area may be taken as royalty in amount, except as provided in sec. 15(d); the royalty on any portion of the production from the lease in excess of 16-2/3 percent may only be taken in value of the production from the lease area.

Stipulation No. 4:

Exploratory drilling and other downhole activities above a predetermined threshold depth, as determined by the RS, will be allowed year-round areawide (subject to the limitations of other applicable stipulations).

Exploratory drilling and other downhole activities below a predetermined threshold depth, with the exception of testing through casing, are prohibited in broken and pack ice conditions unless the lessee first demonstrates to the satisfaction of the RS, with concurrence of the State of Alaska, the theoretical, experimental and physical capability to detect, contain, clean up and dispose of spilled oil in broken and pack ice conditions.

Stipulation No. 5:

The RS has the authority to suspend oil and gas drilling operations whenever bowhead whales are near enough to be affected by oilspills or other disturbances which would be likely to adversely affect the species. If bowhead

whales are east of St.. Lawrence Island, the RS may prohibit exploratory drilling and other downhole activities below a predetermined threshold depth (except testing through casing), as determined by the RS. Such prohibition would continue until it is determined that the whales are outside the zone of probable influence or are no longer subject to likely risk from disturbances or oil spills, unless the RS determines that continued operations are necessary to prevent a loss of well control or to ensure human safety. The period when bowhead whales are most likely to migrate through or be present in the area is generally, but not limited to, April 15 through June 15 and November 1 through January 1.

Stipulation No. 6:

Pipelines will be required (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technically and economically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production be placed in certain designated management areas. In selecting the means of transportation, including any loading facilities, consideration will be given to any recommendation of the Regional Technical Working Group or other similar advisory group with participation of Federal, State, and local government and industry..

All pipelines, including both flow lines and gathering lines for oil and gas, shall be designed and constructed to provide for adequate protection from water currents, storms and ice gouging, subfreezing conditions, and other hazards as determined on a case-by-case basis.

Following the development of sufficient pipeline capacity, no crude oil will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the RS.

Where the three criteria set forth in the first sentence of this stipulation are not met and surface transportation must be employed, all vessels used for transporting hydrocarbons from the leased area must conform with all standards established for such vessels, pursuant to the Ports and Waterways Safety Act for 1972 (46 U.S.C. 391a), and the Port and Tanker Safety Act of 1978, as amended (33 U.S.C. 1221).

Stipulation No. 7: (This stipulation will be included in leases only for tracts 57-317 through 57-366, and 57-374 through 57-377.)

In order to protect the wildlife and subsistence resources of the Yukon Delta, offshore loading on this tract of produced oil, except during testing for well producibility or in the case of an emergency, is prohibited if such a prohibition on offshore loading is technically and economically feasible, safe, and environmentally preferable.

Stipulation No. 8:

In the event of production, discharge of produced waters into open or ice-covered water areas of less than 10 meters is prohibited, unless the RS determines, with the concurrence of the State of Alaska, that such produced waters are non-polluting, in the following tracts: 57-350 through 57-358, 57-365, 57-366, and 57-374 through 57-377.

The following restrictions apply on all tracts: the discharge of oil-based or oil contaminated drilling muds and/or cuttings into the marine environment is prohibited. The discharge of non oil-contaminated drilling muds and cuttings shall be consistent with National Pollutant Discharge Elimination System (NPDES) permit conditions.

14. Information to Lessees: a) Bidders are advised that during the conduct of all activities related to leases issued as a result of this lease sale, the lessee and its agents, contractors, and subcontractors will be subject to the provisions of the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, as amended, and International Treaties.

The lessee or its contractors should be aware that disturbance of wildlife could constitute harassment and could thereby be in violation of existing laws. Violations of these Acts and Treaties may be reported to the National Marine Fisheries Service or U.S. Fish and Wildlife Service, as appropriate.

Behavioral disturbance of most birds and mammals found in or near the Sale 57 area would be unlikely if ocean vessels and aircraft maintained at least a 1-mile distance from observed wildlife or known wildlife concentration areas such as bird colonies, marine mammal haul-out areas, and peregrine falcon nests. Therefore, in concurrence with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, it is recommended that aircraft or vessels operated by lessees maintain at least a 1-mile distance from observed or known wildlife concentration areas. Human safety will take precedence at all times over these provisions. Major wildlife concentration areas are depicted on Graphics Nos., 4A, 4B, and 5A of the Final Environmental Impact Statement for this sale and additional maps available from the RS and appropriate resource agencies.

b) Some of the tracts offered for lease may fall in areas which may be included in fairways, precautionary zones, or traffic separation schemes which may be established, among other reasons, to protect maritime commerce. Bidders are advised that the United States reserves the right to designate necessary fairways through leased tracts pursuant to the Ports and Water Ways Safety Act, as amended (33 U.S.C. 1221 et seq.).

c) Bidders are advised that portions of the Iditarod Trail, from Kaltag to Nome, following along Norton Sound and crossing the ice between Shaktoolik and Bald Head and between Ungalik and Bald Head, are managed by the Bureau of Land Management, U.S. Department of Interior. The management and protection of the Historic Trail is subject to the following laws:

(1) the National Trails System Act, as amended (16 U.S.C. 1241 et seq.);

(2) the National Historic Preservation Act, as amended (16 U.S.C. 470 et seq.);

(3) the Historic Sites Act of 1935 (16 U.S.C. 461 et seq.);

(4) the Antiquities Act of 1906 (16 U.S.(3. 431-433); and,

(5) other State and Federal laws.

d) Lessees are advised that oil and gas exploration and production operations should be conducted so as to minimize interference with subsistence harvests.

e) Lessees are notified that adequate oilspill contingency plans are required under Alaska OCS Operating Order No. 7, under 30 CFR 250.11 and 250.43, prior to approval of Exploration or Development and Production Plans. In accordance with 30 CFR 250.34-1 the Minerals Management Service is required to review oilspill contingency plans. Lessees are advised that the Yukon Delta is an area of special Biological Sensitivity under Alaska OCS Operating Order No. 7 and will require protection in oilspill contingency plans. Review of oilspill contingency plans under 30 CFR 250.34-1 for tracts 57-317 through 57-366 and 57-374 through 57-377 may result in the requirement of special measures to protect the biological resources and associated subsistence values of the Yukon Delta. Also, the leads and polynyas close to St. Lawrence Island are areas of Special Biolgical Sensitivity under Alaska OCS Operating Order No. 7, and will require protection in oilspill contingency plans. Such protection should not include dispersant usage unless such usage has been approved in advance.

f) Lessees are advised that, after identifying potential OCS-related facility sites" and activities, they should consult with the local and State planning agencies involved in coastal zone area review in order to provide coordination on coastal zone development and the siting of energy facilities. The State has indicated that State approval of Coastal Management Programs (CMP's) for Nome, Bethel, and the Yuko"n-Kuskokwim Coastal Resource Service Area (CRSA) is expected in 1983 and that the Bering Straits CRSA Program should be completed andreceive State approval sometime in 1984. Federal approval of CMP's may require as much as one additional year after State approval. Early coordination with these planning groups will assist in the identification of suitable facility siting.

g) Bidders are advised that drilling or emplacement of bottom-founded structures will not be allowed on tract 57-387 unless or until the lessee has demonstrated to the RS'S satisfaction that drilling or bottom-founded structures can be safely designed to control possible high-pressure, thermogenic gas at the proposed location or that the hazard is not present at the site.

h) Corps of Engineers permit-s are required for construction of any artificial islands, installations and other devices permanently or temporarily attached to the seabed located on the Outer Continental Shelf in accordance with Section 4(e) of the Outer Continental Shelf Lands Act of 1953, as amended.

i) Bidders are advised that the Departments of the Interior and Transportation have entered into a Memorandum of Understanding, dated May 6, 1976, concerning the design, installation, operation and maintenance of offshore pipelines. Bidders should consult both Departments for regulations applicable to offshore pipelines.

j) Bidders are also advised that in accordance with Sec. 16 of each lease offered at this sale, the lessor may require a lessee to operate under a unit, pooling or drilling agreement, and that the lessor will give particular consideration to requiring unitization in instances where one or more reservoirs underlie two or more leases with either a different royalty rate or a royalty rate based on a sliding scale.

k) Revisions of Department of Labor regulations on Affirmative Action requirements for government contractors (including lessees) have been deferred, pending review of those regulations (see Federal Register of August 25, 1981, at 46 F.R. 42865 and 42968). Should those changes become effective at any time before the issuance of leases resulting from this sale, Section 18 of the lease form, Form MMS-2005 (August 1982), would be deleted from leases resulting from this sale. In addition, existing stocks of the affirmative action forms described in Section 5 of this notice contain language that would be superseded by the revised regulations at 41 CFR 60-1.5(a)(l) and 60-1.7(a)(l). Pending the issuance of revised versions of Forms 1140-7 and 1140-8, submission of Form 1140-7 (June 1982) and Form 1140-8 (June 1982) will not invalidate an otherwise acceptable bid, and the revised regulations' requirements will be deemed to be part of the existing affirmative action "forms.

1) Easements for the use of sand and gravel on oil and gas leases may be granted by the Secretary. The appropriate vehicle for this is approval of exploration plans and development and production plans requiring these easements. These easements may extend across tract boundaries to any leasehold covered by a plan. Such plans may apply to more than one lease held by a lessee or by a group of lessees acting under a unitization, pooling, or drilling agreement.

Where sand and gravel sources exist on tracts not leased for oil and gas or not appropriately included in an exploration plan or development and production plan, the right to use sand and gravel from these tracts can only be obtained through competitive leasing under Section 8(k) of the OCS Lands Act, as amended.

On tracts where the oil and gas lessee and the sand and gravel lessee are not the same, the correlative rights of the holder of an easement to use sand and gravel in connection with an oil and gas lease, and a lessee of the sand and gravel itself, have yet to be determined. Either the regulations concerning easements, or the Notice of Sale for a sand and gravel lease sale, or both, could define the rights of those parties.

m) Bidders are advised that pursuant to 30 CFR 250.34-l(a)(3), the lessee shall submit to Minerals Management" Service either an exploration plan or a general statement of exploration intentions prior to the end of the ninth lease year.

n) Lessees are advised that the RS has the authority to suspend oil and gas exploratory drilling activities on any lease whenever grey whales are present in the migratory corridor or sale area and are near enough to be subject to probable oilspill risk or probable risk from other disturbances. The Department of the Interior has determined that grey whales migrate through or are in the vicinity of Norton Sound generally from late May through July and from September through October. If grey whales are east of St. Lawrence

Island, the RS may order the cessation of exploratory drilling below a threshold predetermined by the RS until it is determined that the whales are outside the zone of likely influence or no longer subject to risk from probable oilspills or other disturbances.

o) In addressing biological concerns the RS will receive recommendations from a Bering Sea Biological Task Force (BTF). The BTF will be composed of designated representatives of the MMS, U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Environmental Protection Agency. The Bering Sea BTF should consult with representatives of the State of Alaska before making recommendations to the RS.

p) Lessees should design the environmental training program required by Stipulation No. 2 to incorporate the views and concerns of local individuals and communities. Lessees are encouraged to provide opportunities to local individuals, organizations and governments, including local coastal districts to participate in the development of the environmental training programs.

q) Lessees are encouraged to hire Alaska residents to perform work done by and for them within the State of Alaska. Lessees are advised that there is considerable local interest in employment associated with petroleum exploration, development and production activities. Lessees are encouraged through affirmative action programs or otherwise, to provide opportunities to local individuals and organizations to acquire the skills necessary to participate in exploration, development and production activities and are encouraged to provide, through affirmative action programs or otherwise, employment opportunities for qualified local individuals and organizations. Lessees are also advised that employment of local individuals and organizations may be one method of mitigating certain local social and economic impacts.

r) Lessees are advised that exploration, development and production activities may directly and indirectly have significant social and economic impacts on local individuals and communities. Lessees are encouraged to consult with local individuals, organizations and governments, including local coastal districts, to identify direct and indirect social and economic impacts of exploration, development and production activities prior to undertaking those activities. Lessees are encouraged to consult with and enter into agreements with local individuals, organizations and governments to compensate for direct and indirect social and economic impacts of exploration, development and production activities. Lessees are advised that this may include, among others, support to or provision of local community recreation facilities, mental health, drug and alcohol treatment services and facilities, or community safety services and capital improvement projects.

s) Lessees are informed that, pursuant to 15 CFR 930.70 et seq., the State has the authority to review for concurrence or objection consistency certifications for all federal license and permit activities described in detail in OCS plans and which affect the coastal zone. Lessees are reminded that the State has permitting authority for activities in its coastal zone pursuant to the provisions of the approved Alaska Coastal Management Program.

Lessees

The Information to Lessees, subpart (n), identifies similar restrictions on activities which might be imposed during gray whale migration.

MMS intends to have, or require lessees to have, a monitoring program in place to determine the status of bowhead and gray whale migration in the Sale 57 area if operations are proposed during those periods when whales are expected to be present.

Stipulations Nos. 6 and 7 (Pipelines and Offshore Loading of Produced Oil and Gas): These stipulations address the use of pipelines and offshore loading in the Sale 57 area. The MOA between the Department of the Interior (DOI) and the State provides that the DOI will coordinate and consult with the State and obtain its concurrence to the extent permitted by law on decisions regarding the method of transportation of produced oil and gas. The procedures and guidelines for coordinating these activities with the State will be developed as necessary.

Stipulation No. 8 (Discharge of Produced Waters): This stipulation provides that the discharge of produced waters into water depths of less than 10 meters is prohibited in tracts 57-350 through 57-358, 57-365, 57-366, and 57-374 through 57-377, unless the RS-FO, with concurrence of the State of Alaska, determines that such produced waters are nonpolluting. The MMS will develop guidelines to implement State concurrence responsibilities prior to activities reaching the production stage. This stipulation is also addressed in the MOA between the DOI and the State of Alaska.

Biological Surveys/Biological Task Force: Item "O" under the Information to Lessees, recognizes the Bering Sea Biological Task Force (BTF). This BTF will include representatives of the MMS, U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the Environmental Protection Agency (EPA). The notice also recommends that the BTF consult with the State of Alaska before making recommendations to the RS-FO. The MOA between the DOI and the State further states that the DOI will notify at least three State representatives and designated representatives from local communities in the sale area and encourage their participation in all of the BTF deliberations. State and local representation on the BTF are nonvoting. State representatives to the BTF have been designated from the Division of Minerals and Energy Management (DMEM), Department of Fish and Game (DF&G), Department of Environmental Conservation (C)EC), and Division of Governmental Coordination (DGC). Local representation will be provided from the Nome City Council, Bering Straits Coastal Resource Service Area, Cenaliulriit Coastal Resource Service Area, and Kawerak Inc.

Lessees

The need to conduct biological surveys will be reviewed on a case-by-case basis. The following leases have not been cleared of the biological survey requirements at this time:

OCS-%		OCS-Y	
	0382		0403
	0384		0412
	0385		0423
	0387		0435
	0388		0437
	0389		0438
	0390		0439
	0402		0440

Current regulations, Notices to Lessees, and guidelines issued by this office are listed below and can be obtained from the office of the RS-FO (any reference to USGS should now be read as MMS).

- Alaska Outer Continental Shelf Orders Governing Oil and Gas Operations, November 1982.
- 30 Code of Federal Regulations, Part 250.34, Federal Register Volume 44, No. 180, September 14, 1979.
- Guidelines for Outer Continental Shelf Exploration Plans, Environmental Reports, and Application for Permit to Drill Exploratory Wells, March 30, 1982.
- Notice No. 80-1 NTL on Furnishing Food, Quarters, and Transportation to USGS [MMS] Personnel, February 5, 1980.
- Notice 80-2 NTL on Guidelines for Preparing Outer Continental Shelf Environmental Reports, June 13, 1980.
- Notice 83-2 NTL on Preliminary Activities Conducted on Leased Areas - Bering Sea, April 21, 1983.
- Notice No. 83-5 NTL on Minimum Requirements, Shallow Drilling Hazards Survey, Alaska OCS Area.
- Notice No. 82-1 NTL on Interim Minimum Requirements for Marking of Equipment, August 2, 1982.
- Guidelines on Collection of Meteorological/Oceanographic Data, April 29, 1983.

UNITED STATES
DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

ALASKA OCS REGION

Mailing Address: P.O. Box 101159
Anchorage, AK 99510

In reply refer to:

Area Code -907
Regional Manager 271-4304
Resource Evaluation 271-4361
Field Operations 271-4303
800 A Street
Anchorage, AK

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Leasing & Environment
620 E. 10th. Ave.
Anchorage, AK
Ph: 907-276-2955

To: Lessees in Sale 57 Area [Norton Sound)

Subject: Clarification of Information Listed in the Notice of Sale for Oil and Gas Lease Sale 57

Gentlemen:

The following information further clarifies some of the stipulations and information to lessees and lease terms as outlined in the Notice of Sale for Oil and Gas Lease Sale 57:

Stipulation No. 1 (Cultural Resource Survey): The Regional Supervisor, Field Operations (RS-FO), has determined hat this stipulation will not be invoked on leases in-the Sale 57 area. It is the opinion of the RS-FO that cultural resources have low probability of occurrence, survivability, or detectability in the Sale 57 area. The State of Alaska, through the State Historic Preservation Officer, has been advised that this stipulation will not be invoked, and concurs with our decision.

Geohazard surveys will be required for proposed exploration activities and, when possible, will include side-scan sonar and subbottom profilers. Such surveys will be reviewed by the Minerals Management Service (MMS) for any object which might indicate the presence of cultural resources.

The above stipulation will not release the lessee from reporting any site, structure, or object of historical or archeological significance discovered during the conduct of any operations and immediately ceasing such operations until the RS-FO has made a determination as to the disposition of the cultural resource.

Stipulation No. 2 (Environmental Training Program): All drilling personnel, support personnel, and contractor and subcontractor personnel involved in Outer Continental Shelf (OCS) activities, conducted under an approved exploration plan, must have environmental training. Stipulation No. 2 requires the lessee to provide an environmental training program before drilling activities commence. The program shall inform each person of specific types of environmental, social, and cultural concerns which relate to the individual's job. The program shall be formulated by experienced and qualified personnel. Input into the program from local sources is

encouraged. Lessees should submit the program for MMS review and approval along with their Exploration Plan package. Lessees may develop a cooperative training program such as has been done for the BF and LCI sale areas.

Stipulation No. 2 also requires the lessee to provide a continuing environmental briefing program for its supervisory and managerial personnel, agents, contractors, and subcontractors. The intent of this requirement is to provide a vehicle by which supervisory and managerial personnel can continue to develop knowledge of and sensitivity for the protection of the environment. The program should be more detailed than the environmental training program and should be be updated at least once a year.

Stipulation No. 4 {Suspension of Exploratory Drilling and Downhole Activities Below Predetermined hreshold Depth During Broken Ice and Pack Ice (onditions): Stipulation No. 4 prohibits exploratory drillin g and other downhole activities below a predetermined threshold depth during periods of broken ice cover, unless the lessee/operator demonstrates to the RS-FO, with the concurrence of the State of Alaska, his ability to clean up and dispose of spilled oil in broken and pack 'ice conditions. Downhole testing activities through casing perforations in cased holes are permitted year-round. The Tier II demonstrations recently completed for demonstrating broken ice contingency technology for the BF Sale area may be applicable in demonstrating broken-ice and pack-ice technology as required by this stipulation. However, different types of ice conditions and duration of various ice conditions will also have to be taken into consideration.

The MMS is developing guidelines with the State of Alaska to implement the State "concurrence" responsibilities identified in the stipulation. A copy of the Memorandum of Agreement (MOA) between the State of Alaska and the Secretary of the Interior for implementing the stipulation is enclosed. The MOA further delineates State involvement in OCS activities.

Stipulation No. 5 (Exploratory Drilling and Downhole Activities During Bowhead hale Migration Periods): Stipulation No. 5 grants the RS-FO the authority to prohibit exploratory drilling and other downhole activities, except testing through casing, below a predetermined threshold depth during the bowhead whale migration periods (generally from April 15 through June 15 and November 1 through January 1), unless the RS-FO determines that continued operations are necessary to prevent a loss of well control or to ensure human safety. It should be noted that timing of the bowhead whale migration is a floating period and, based upon actual migration status, may not necessarily be the dates indicated.

Lessees

- o MMS booklet on "Use of Best Available and Safest Technologies (BAST) During Oil and Gas Drilling and Producing Operations on the Outer Continental Shelf," April 1980.

- 0 Training and Qualifications of Personnel in Well Control Equipment and Techniques for Drilling on Offshore Locations, MMSS-OCS-T1 second edition, May 1982.

- 0 Planning Guidelines for Approval of Oilspill Contingency Plans, July 29, 1982.

- 0 Booklet Copies of Operating Orders Governing Oil and Gas Lease Operations in the Alaska Outer Continental Shelf, November 22, 1982.

- 0 OCS Oil and Gas Operations; Personnel Safety and Protection in Hydrogen Sulfide-Prone Areas, Federal Register Vol. 47, No. 127 July 1, 1982.

- 0 Outer Continental Shelf Standard MMSS-OCS-1 formerly (GSS-OCS-1), "Safety Requirements for Drilling Operations in a Hydrogen Sulfide Environment." First Edition, February 1976.

As a matter of record, the following titles have been authorized for use in the Alaska OCS Region Office:

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Lessees

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Sincerely,

Barry A Boudreau
for Rodney A. Smith
Regional Supervisor
Field Operations

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1 Use this number for information on submitting Exploration Plans.
2 Use this number for information on submitting APD's.

APPENDIX B

GEOPHYSICAL AND GEOTECHNICAL PERMITS ISSUED BY BASIN

1980 - 1984 GEOLOGICAL AND GEOPHYSICAL PERMITS ISSUED BY MINERALS MANAGEMENT SERVICE IN THE NORTON BASIN

PERMIT	PERMITTEE	CONTRACTOR	TYPE
80-07	ARCO	TETRA TECH	COST WELL
80-18	SHELL	GECO	CDP MARINE
80-25	GS I	GS I	CDP MARINE
80-29	WGC	WGC	CDP MARINE
80-37a	AMOCO	GECO	CDP, GR, MAG
80-39	ARCO	NEKTON	GEOLOGICAL
81-09	AMOCO	MILE-HI	CDP HW
81-10a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
81-28	SHELL	GECO	CDP MARINE
81-33a	CITIES SER	WGC	CDP MARINE
81-36	ENERGY ANA	ENERGY ANA	CDP MARINE
81-39	EXXON	GS I	CDP, GR, MAG
81-46	SOHIO	GS I	CDP MARINE
81-54	CHEVRON	AEROSERVIC	MAGNETIC
82-16	ARCO	ARCO	GEOLOGICAL
82-21	PHOTOGRAV	CHEVRON	GRAVITY
82-23	ENERG ANAL	ENERG ANAL	CDP MARINE
82-36	GS I	GS I	CDP MARINE
82-50	CHEVRON	DIGICON	CDP MARINE
82-54	ARCO	GECO	CDP, GR, MAG
82-62	WGC	WGC	CDP, GR, MAG
82-65	SOHIO	GSI	CDP MARINE
82-70	SHELL	GECO	CDP, MAG
82-75	INTEROCEAN	INTEROCEAN	HRD
82-76a	TEXACO	DIGICON	CDP, MAG
82-78	AEROSERVIC	AEROSERVIC	MAGNETIC
82-79	AEROSERVIC	AEROSERVIC	MAGNETIC
83-13	INTEROCEAN	INTEROCEAN	GEOLOGICAL
83-46	ARCO	ARCO	CDP, GR
84-27	WGC	WGC	CDP, GR, MAG
84-29	ARCO	GECO	CDP, GR, MAG
84-63	EXXON	GSI	CDP, GR, MAG

1980 - 1984 GEOLOGICAL AND GEOPHYSICAL PERMITS ISSUED BY MINERALS MANAGEMENT SERVICE IN THE ST. GEORGE BASIN

80-11	EXXON	MCCLELLAND	HRD
80-12	EXXON	MCCLELLAND	GEOLOGICAL
80-20	SHELL	GECO	CDP, MAG
80-30	WGC	WGC	CDP MARINE
81-15a	MCCLELLAND	MCCLELLAND	HRD
81-16a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
81-26	SHELL	GECO	CDP MARINE
81-30a	EXXON	MTS	HRD
81-31a	EXXON	MTS	GEOLOGICAL
81-38	EXXON	GS I	CDP, GR, MAG
81-40a	MOBIL	WGC	CDP, GR, MAG
81-42a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
82-10a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
82-19	ARCO	ARCO	GEOLOGICAL
82-25a	MCCLELLAND	MCCLELLAND	HRD
82-29	SHELL	GECO	CDP, MAG
82-39	MOBIL	MOBIL	CDP, GR
"82-42	INTEROCEAN	INTEROCEAN	HRD
82-45	EXXON	WGC	CDP, GR, MAG
82-46a	ARCO	GECO	CDP, GR, MAG
82-49	CHEVRON	DIGICON	CDP MARINE
82-56a	ARCO	GECO	CDP, GR, MAG
82-61	SOHIO	GS I	CDP MARINE
82-63	WGC	WGC	CDP, GR, MAG
82-72	GS I	GS I	CDP MARINE
83-15	INTEROCEAN	INTEROCEAN	HRD
83-25	GSI	GS I	CDP MARINE
83-32	SHELL	GECO	CDP, MAG
83-4.3	ARCO	ARCO	CDP MARINE
83-51	GEOCUBIC	GEOCUBIC	GEOLOGICAL
83-55	GEOCUBIC	GEOCUBIC	HRD
83-59	GEOCUBIC	GEOCUBIC	GEOLOGICAL
83-63a	AEROSERVIC	AEROSERVIC	MAGNETIC
83-95	NEKTON	NEKTON	CDP MARINE
83-108	MTS	MTS	HRD
84-04	MTS	MTS	CDP
84-07	MTS	MTS	HRD
84-09	HARDING LA	HARDING LA	HRD
84-12	COMAP	COMAP	CDP
84-31	AMOCO	WGC	CDP, GR, MAG
84-34	WGC	WGC	CDP, GR, MAG
84-52	CHEVRON	DIGICON	CDP MARINE
84-56	EXXON	GS I	CDP, GR, MAG
84-64	DIGICON	DIGICON	CDP, GR, MAG
84-71	ARCO	WGC	CDP

1980 - 1984 GEOLOGICAL AND GEOPHYSICAL PERMITS
ISSUED BY MINERALS MANAGEMENT SERVICE
IN THE NAVARIN BASIN

80-14a	EXXON	WGC	CDP MARINE
80-19	SHELL	WGC	CDP, MAG
80-28	WGC	WGC	CDP, MARINE
80-32a	MCCLELLAND	MCCLELLAND	HRD
80-33a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
80-35	AEROSERVIC	AEROSERVIC	MAGNETIC
80-38	ARco	NEKTON	HRD
81-18	GS I	GSI	CDP MARINE
81-21	WGC	WGC	CDP MARINE
81-27	SHELL	GECO	CDP MARINE
81-37	EXXON	WGC	CDP, GR, MAG
81-43	AEROSERVIC	AEROSERVIC	MAGNETIC
82-17	ARco	ARco	COST WELL
82-24a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
82-34	GSI	GSI	CDP MARINE
82-39	MOBIL	MOBIL	CDP, GR, MAG
82-41	INTEROCEAN	INTEROCEAN	HRD
82-44	EXXON	WGC	CDP MARINE
82-51	CHEVRON	DIGICON	CDP MARINE
82-55	ARco	GECO	CDP, GR, MAG
82-58	WGC	WGC	CDP, GR, MAG
82-64	EXXON	MTS	HRD
82-66	SOHIO	GS I	CDP MARINE
82-69	SHELL	GECO	CDP, MAG
83-12	INTEROCEAN	INTEROCEAN	HRD
83-23	EXXON	MTS	HRD
83-34	SHELL	GECO	CDP, MAG
83-35	EXXON	MCCLELLAND	CDP MARINE
83-36	EXXON	MCCLELLAND	GEOLOGICAL
83-45	ARco	ARco	CDP, GR
83-49	GEOCUBIC	GEOCUBIC	GEOLOGICAL
83-53	GEOCUBIC	GEOCUBIC	HRD
83-57	GEOCUBIC	GEOCUBIC	GEOLOGICAL
83-61	DIGICON	DIGICON	CDP MARINE
83-71	GULF	WOODWARD	HRD
83-72	GULF/AMOCO	WOODWARD	GEOLOGICAL
83-75	EXXON	GS I	CDP MARINE
83-79	NEKTON	NEKTON	CDP MARINE
83-107	DIGICON	CHEVRON	CDP
84-19	NEKTON	MOBIL	HRD
84-35	WGC	WGC	CDP

1980 - 1984 GEOLOGICAL AND GEOPHYSICAL PERMITS
ISSUED BY MINERALS MANAGEMENT SERVICE
IN THE N. ALEUTIAN BASIN

80-21	SHELL	GECO	CDP, MAG
81-11a	ARCO	WESTERN	CDP MARINE
81-14	GECO	GECO	CDP MARINE
81-17	GS I	GSI	CDP MARINE
81-19a	WGC	WGC	CDP MARINE
81-25	SHELL	GECO	CDP MARINE
81-52	EXXON	GS I	CDP MARINE
82-18	ARCO	ARCO	COST WELL
82-28	SHELL	GECO	CDP MARINE
82-33	GS I	GSI	CDP MARINE
82-40	MOBIL	MOBIL	CDP, GR, MAG
82-43	INTEROCEAN	INTEROCEAN	HRD
82-52	CHEVRON	DIGICON	CDP MARINE
82-57a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
82-67	SOHIO	GS I	CDP MARINE
82-68	SOHIO	GS I	CDP MARINE
83-14	INTEROCEAN	INTEROCEAN	GEOLOGICAL
83-26	GS I	GSI	CDP MARINE
83-29	MCCLELLAND	MCCLELLAND	GEOLOGICAL
83-30	MCCLELLAND	MCCLELLAND	GEOLOGICAL
83-31	PHOTOGRAV	BERRY DATA	GRAVITY
83-33	SHELL	GECO	CDP, MAG
83-39a	MCCLELLAND	MCCLELLAND	CDP MARINE
83-40a	MCCLELLAND	MCCLELLAND	GEOLOGICAL
83-44	ARCO	ARCO	CDP, GR
83-47	ARCO	ARCO	CDP, GR
83-62	WGC	WGC	CDP, GR, MAG
83-78	SOHIO	NEKTON	CDP MARINE
84-23	NEKTON	NEKTON	HRD
84-25	WGC	WGC	CDP, GR, MAG
84-28	ARCO	GECO	CDP, GR, MAG
84-30	AMOCO	WGC	CDP, GR, MAG
84-62	ARCO	ARCO	CDP, GR

1980 - 1984 GEOLOGICAL AND GEOPHYSICAL PERMITS ISSUED BY MINERALS MANAGEMENT SERVICE IN THE ST. MATTHEW HALL BASIN

82-31	GS I	GS I	CDP MARINE
83-85	GS I	GS I	CDP MARINE
93-96	MCCLELLAND	MCCLELLAND	CDP MARINE