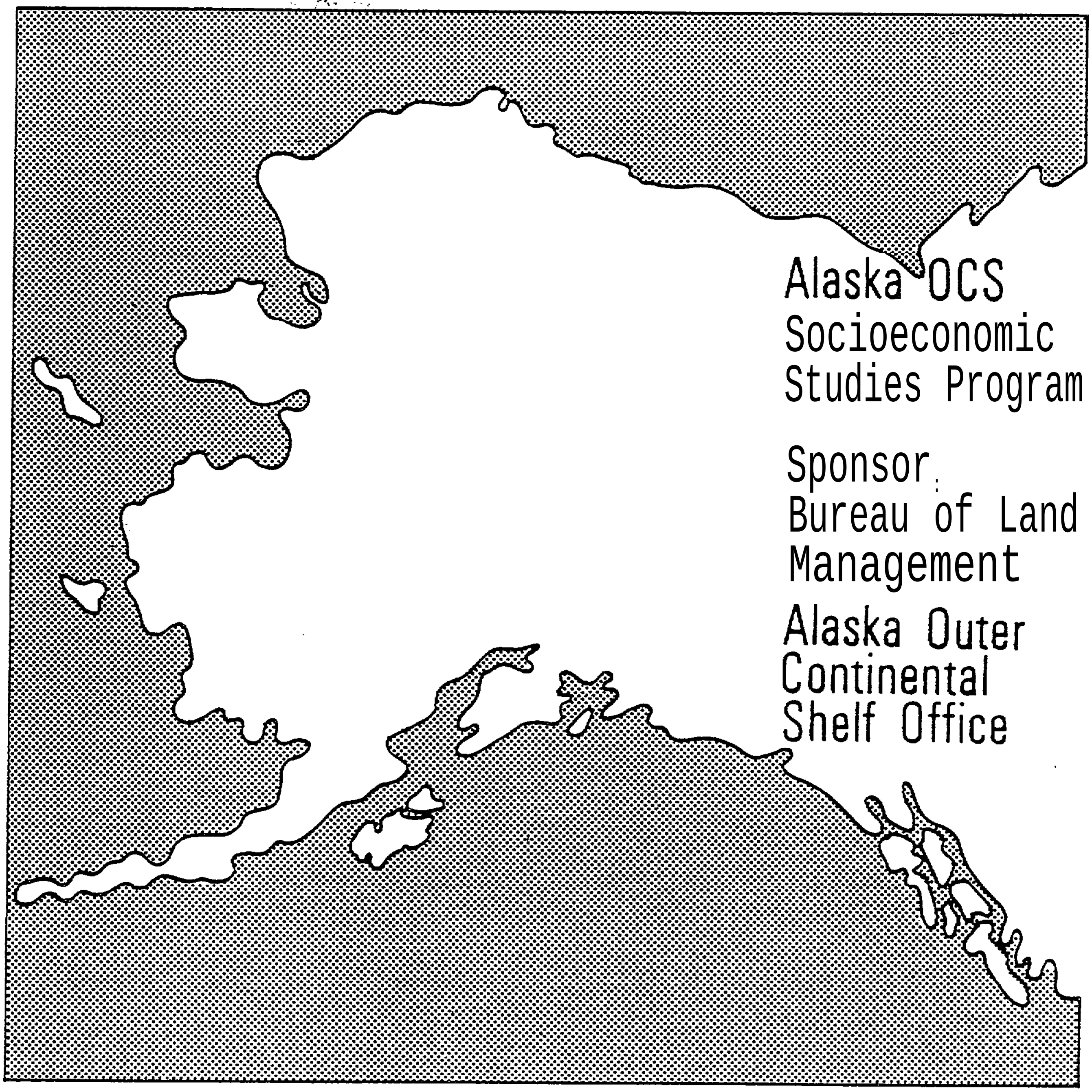
Technical Report Number 58



Alaska OCS
Socioeconomic
Studies Program

Sponsor:
Bureau of Land
Management
Alaska Outer
Continental
Shelf Office

St. George Basin

Petroleum Development Scenarios Transportation Systems Analysis

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of offshore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (NEPA) as well as other legislation and regulations dealing with the effects of offshore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program (SESP).

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The overall methodology is divided into three broad research components. The first component identifies an alternative set of assumptions regarding the location, the nature, and the timing of future petroleum events and related activities. In this component, the program takes into account the particular needs of the petroleum industry and projects the human, technological, economic, and environmental offshore and onshore development requirements of the regional petroleum industry.

The second component focuses on data gathering that identifies those quantifiable and qualifiable facts by which OCS-induced changes can be assessed. The critical community and regional components are identified and evaluated. Current endogenous and exogenous sources of change and functional organization among different sectors of community and regional life are analyzed. Susceptible community relationships, values, activities, and processes also are included.

The third research component focuses on an evaluation of the changes that could occur due to the potential oil and gas development. Impact evaluation concentrates on an analysis of the impacts at the statewide, regional, and local level.

In general, program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decisionmaking. Reports are available through the National Technical Information Service, and the BLM has a limited number of copies available through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

TECHNICAL REPORT NO. 58 CONTRACT NO. AA851-CTO-27

ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

ST. GEORGE BASIN
TRANSPORTATION SYSTEMS IMPACT ANALYSIS

Prepared For

BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

Prepared By

PEAT, MARWICK, MITCHELL & CO.

and

ERE Systems, Ltd.

September 1981

NOTICE

Alaska OCS Socioeconomic Studies Program
ST. GEORGE BASIN
TRANSPORTATION SYSTEMS IMPACT ANALYSIS

Prepared by:

Peat, Marwick, Mitchell & Co., and
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ABSTRACT

This report evaluates potential air and marine transportation systems impacts in Unalaska, Cold Bay, and St. Paul, Alaska following the proposed St. George Basin OCS lease sale (#70), scheduled for February 1983. A detailed description of existing and anticipated transportation facilities and services is included for each of these communities. Forecasts of air and marine transportation demands without the economic influence of the lease sale are developed as a base case for comparative analysis. Petroleum development scenarios, prepared by BLM, serve as forces of economic change following the lease sale. Two scenarios are used: an exploration-only scenario, which assumes exploration takes place but no oil is found; and a "mean" case scenario, which assumes up to 1,200 MMbbl of oil and 3,660 bcf of gas are discovered. A forecast of additional air and marine transportation demands generated by the increased economic activities of OCS development were prepared for each scenario. Impacts were determined by comparing transportation demands with and without OCS development against existing and anticipated transportation facilities and services. Several variations of the mean case scenario were used to evaluate the effects of locating oil and gas terminal facilities at Makushin Bay, Ikatan Bay, or on St. Paul Island. The study also attempted to evaluate future vessel traffic in Unimak Pass.

The Aleutian-Pribilof region surrounding these communities is a relatively isolated area where costs for transportation are high. Freight moves predominantly by water and people travel by air. Unalaska is presently the major marine transshipment point for western and northwestern Alaska and the Aleutian region. Cold Bay is presently the major air transfer point in the region. The general condition of transportation facilities in these two communities ranges from fair to excellent with some facilities having special limitations affecting future usage. Marine facilities at St. Paul are poor. The quality of transportation services vary depending upon available facilities and demand: services at Unalaska are good; at Cold Bay air services are good, marine are fair; at St. Paul air services are fair, marine are poor.

In the absence of any OCS development, the primary source of future economic growth is expected to be the bottomfish industry, which, as shown below, is expected to greatly affect each of these communities, as well as others. Forecast demands exceed the capacity of currently available services. No overall improvement in quality of services is expected, as operators attempt to keep pace. However, possible introduction of jet aircraft could improve interregional air travel times. Both Unalaska and Cold Bay are expected to maintain their regionally dominant roles in, respectively, marine and air transportation. Air facilities at all three communities and marine facilities at Unalaska and Cold Bay appear to have sufficient capacity to handle expected growth, if existing faciity use patterns are maintained. It is unlikely that forecast economic growth for St. Paul can be attained without improving existing marine facilities. Improvements also will be needed in air and marine navigation and communication facilities throughout the region.

Base Case Change From 1980 Levels

	Year	Unalaska level (%)	Cold Bay level (%)	St. Paul level (%)
Population	1985	2,900(34)	330(36)	527(0)
	1990	6,300(185)	420(73)	1,400(185)
	2000	13,200 (500)	650(165)	1,400(185)
Marine Tonnage	1985	510,800(37)	18,400(38)	4,200(0)
	1990	799,000(114)	27,900(110)	33,200(690)
	2000	1,320,000(253)	64,100(382)	33,200(690)
Enplaned Passengers	1985	13,200(32)	26,400(35)	2,400(1)
	1990	29,100 (191)	42,400(117)	6,200(159)
	2000	64,800(548)	105,500(441)	6,200(159)

The additional demands of OCS development suggested by the exploration-only scenario are temporary and short term, lasting only five years after the sale. Most OCS activities peak by 1987. Although the additional transportation demands of OCS in 1987 generally constitute half of the increase in demands that year, the overall increase in demand is expected to be handled through available facilities with minor adjustments to existing services.

The additional demands of the mean case senario are longer term and of greater intensity, but not near the intensity of bottomfishing growth. Generally, OCS impacts are less than might be anticipated. Part of the reason for this is because OCS activities are expected to be confined to enclaves located away from existing communities (i.e. at Makushin Bay, Ikatan Bay, orSt. Paul Island). Another reason is because OCS activities peak in the mid to late 1980's and begin to decline just as bottomfish development begins to take off. For example, with OCS facilities at Makushin Bay, the 1989 peak population increase at Unalaska is expected to be only 19 percent over base case values cited above. Additional throughput tonnage at Unalaska peaks in 1984 at only 13 percent above base case values and additional enplaned passengers peaks in 1989 only nine percent above these values. Depending on location and mode, the addition of OCS activities at their peak is equivalent to advancing the base case forecast 2 to 10 years closer in time. The ability of services and facilities to meet the combined demands of bottomfishing and OCS are similar to those noted earlier regarding the base case. Much of the reason for this is because the oil and gas industry has developed specialized transportation services. These specialized services in combination with the use of enclaves serve to mitigate many potential problems.

I. INTRODUCTION

Purpose

The purpose of this report is to identify and discuss transportation impacts of potential oil and gas development resulting from the proposed federal outer continental shelf (OCS) lease sale number 70. The lease sale area is located between the Aleutian and Pribilof Islands of Alaska in an offshore area labeled the St. George Basin. This study of transportation impacts is one of several key study elements of a larger integrated effort to evaluate the broad range of possible socioeconomic impacts of the St. George Basin lease sale. In turn, the series of St. George Basin studies is part of the Bureau of Land Management's (BLM) Alaska OCS Socioeconomic Studies Program (SESP), which seeks to evaluate all federal OCS lease sales planned for Alaska.

The study of transportation impacts was prepared for use by BLM decision makers in various steps of the Federal OCS leasing process. The study places emphasis on the information needs of the environmental impact statement (EIS) and secretarial issue document (SID), which must be prepared for the St. George Basin lease sale. The study also seeks to develop transportation planning information of use to the Intergovernmental Planning Program (IPP). Through the IPP, the study is expected to aid development of hydrocarbon transportation related lease-sale stipulations and the longer range assessment of the transportation effects of Federal lease-sale policy.

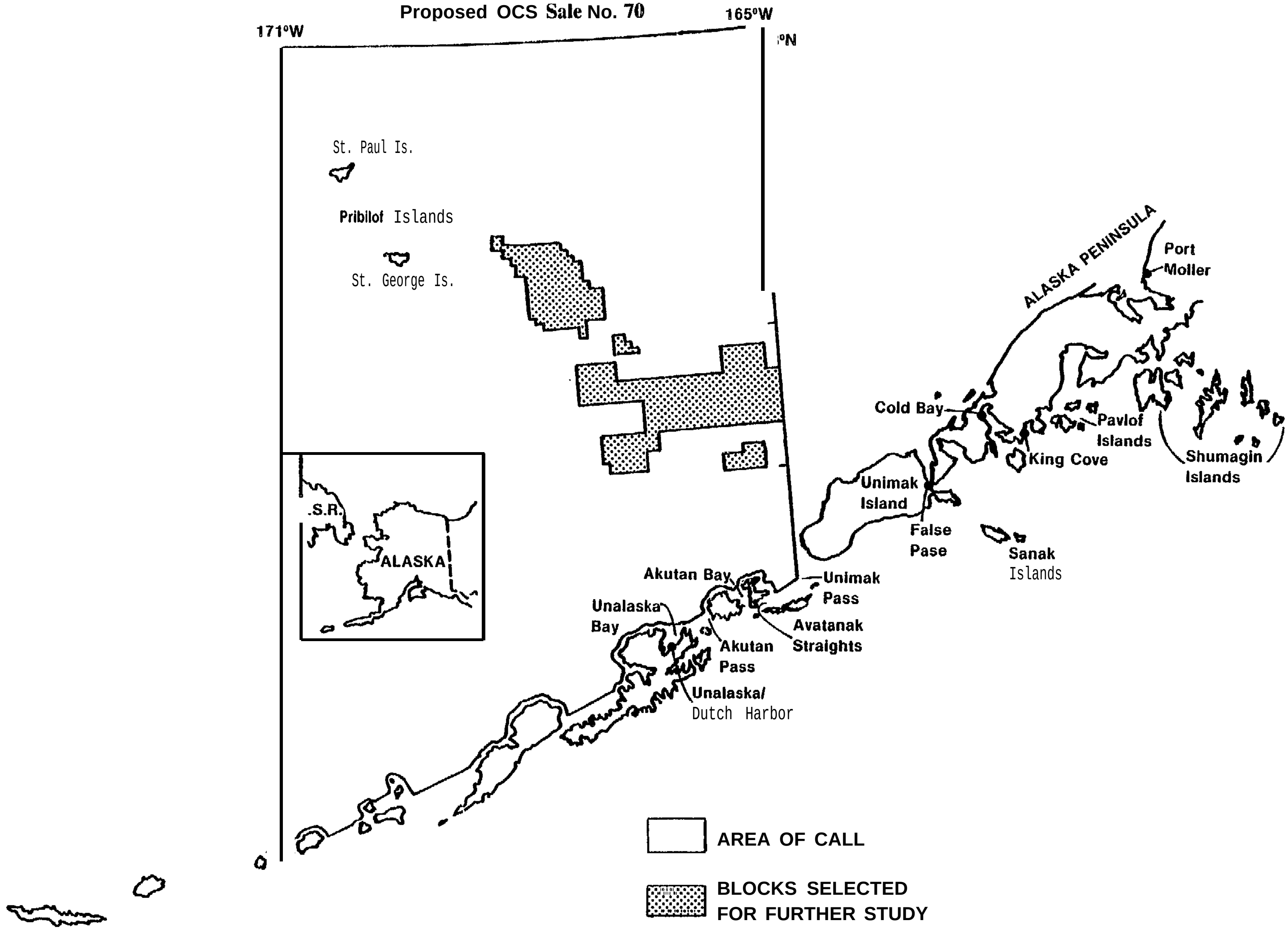
The Proposed OCS Sale

The proposed St. George Basin lease sale, OCS sale number 70, currently scheduled to be held in February 1983, is the first of several proposed OCS sales in southwestern Alaska. It is the second proposed sale in the Bering Sea and comes one year behind the Bering Sea-Norton Sound sale (number 57) scheduled for February 1982. The area initially identified for the sale (the area of call) is bounded in the east by longitude 165°W., in the west by longitude 171°W., in the north by latitude 58°N., and in the south by a line defining the Bering Sea boundary between state and federal lands three nautical miles offshore. The area of call, illustrated in Figure 1, lies within the Aleutian Census Division, which encompasses all of the Aleutian Islands, the Pribilof Islands, and the Alaska Peninsula from Port Moller west. Throughout this report the Census Division will also be referred to as the Aleutian-Pribilof region.

Following the "call for nominations" in 1979, at which time the oil industry was asked to nominate tracts for inclusion in the sale, BLM reviewed the suggested tracts and reduced the call area to those sets of tracts (blocks) shown in Figure 1. These selected tracts are the focus of the EIS and are the assumed location of offshore OCS activities described in this report. The central portion of these tracts lies almost equidistant from the Pribilof Islands and Unalaska-Dutch Harbor, about 241 kilometers (150 miles). Some tracts on the west side of the sale area are as close as 64 kilometers (40 miles) to St. George Island

ST. GEORGE BASIN

Proposed OCS Sale No. 70



Source: U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

in the Pribilofs and on the east side as close as 72 kilometers (45 miles) to the Alaska Peninsula.

Study Scope

In the Aleutian-Pribilof region, as in many regions of Alaska, aviation is the primary mode for moving people, and marine transportation is the primary mode for moving goods. Consequently, the focus of this study is to determine the effects of OCS development on regional air and marine transportation facilities and services.

There are several principal components of this study:

- A description of the present regional aviation and marine transportation systems. This baseline emphasizes facilities, services, usage demands, and capacity limitations, but also provides information about relevant regulatory controls, levels of service, service rates, particular regional issues, and the trends of change affecting facilities, services, and demands.

- A forecast of future aviation and marine transportation demands and service Requirements assuming the lease sale is not held. This forecast, labeled the "Base Case", extrapolates existing trends and conditions unaffected by any OCS events. Its purpose is to provide a comparative base for forecasts that contain OCS events.

The transportation element of this forecast builds upon economic and population forecasts prepared by other BLM contractors. The forecast usage demands and service requirements for each mode are evaluated for their effects on anticipated facility and service capacity.

- A forecast of future aviation and marine transportation demands and service requirements assuming the lease sale is held. This forecast actually consists of several forecasts, one for each level of intensity of OCS development defined in scenarios prepared by BLM. These forecasts, labeled "OCS cases", extrapolate existing trends and conditions as they might be influenced by the addition of OCS activities and new OCS employment opportunities. Revised economic and population fore casts, which reflect the addition of OCS events, serve as the basis for the transportation forecasts. The economic and population forecasts are prepared by other BLM Subcontractors (See Alaska Consultants, 1981 and University of Alaska, 1981).

- Specification of impacts for each of the OCS cases. An evaluation of the positive and negative effects of proposed OCS events is made by comparing each OCS case to the base case and to the anticipated capacity of available facilities and services.

The number of OCS cases to be evaluated can be varied by changing the amount of recoverable resources assumed to be discovered, which affects the overall intensity of development activities, or by changing the locations of key shore-based facilities (oil or gas terminals or support bases), which affect. the concentration of development activities. In this study two scenarios are used to forecast OCS events. One. labeled the "exploration-only" case, assumes exploration takes place, but no oil is found in commercially recoverable quantities. The second scenario, labeled the "mean case", assumes the median statistical estimate of re-coverable oil (determined by the U.S. Geological Survey-USGS) is found and developed. Three possible locations are considered for the various facilities: Unalaska-Dutch Harbor, because of its marine transportation infrastructure; Cold Bay, because of its air transportation infrastructure; and St. Paul Island, because of its closeness to the sale area. In addition to these locations, the international airport at Anchorage, which is the air transportation hub for all Alaska, is included because of the cumulative effects of additiona"l OCS development on that facility, These specific locations are important to the scope of this study because they limit, as well as focus, the level of detail presented about the regional transportation system to only those elements serving the af-fected locations. Other elements of the regional transportation system are then dealt with in a more general manner.

There are two important limitations placed on the scope of this study, which effect a broader usefulness of this report. The development of a "transportation plan" to deal with OCS transportation issues was not a purpose of the study, nor was the study to investigate measures to ameliorate negative impacts. These limitations were imposed by BLM because many other factors, beyond those identified herein, will enter the federal decision-making process. State and local governments, other agencies, or groups and individuals must be provided the opportunity to make independent assessments of alternatives and mitigating factors. In the federal OCS management process, the opportunity to present plans and suggest mitigating measures exists through the mechanism of the EIS. By making this report available, it is hoped the information will be useful to these various non-federal entities as they plan for the proposed sale and respond to the federal government's decisions through the EIS.

Organization of Report

The report commences in Chapter 11 with a discussion of the kinds of demands that OCS oil and gas activities place on transportation systems. This background information is followed in Chapter III with a detailed presentation of the Aleutian-Pribilof region transportation baseline. The communities cited above are included in this description. Chapter IV presents the base case forecast and an analysis of the impacts of expected economic growth on the regional transportation system. The exploration-only scenario and its short time effect on the region is described in Chapter V. In Chapter VI, the mean case scenario is described and the first of three location alternatives for the shorebased facilities is analyzed; Unalaska-Dutch Harbor. In Chapters VII and VIII the mean scenario continues, but the evaluation focuses on the other possible facility locations, respectively Cold Bay and St. Paul Island. The impacts determination is included as a subsection of each of the scenario chapters, V-VIII.

Appendix A provides a glossary of marine transportation and OCS terms used in the report.

Appendix B presents the methods and assumptions used throughout the report and describes some additional analytical data that would be inappropriate in the body of the report.

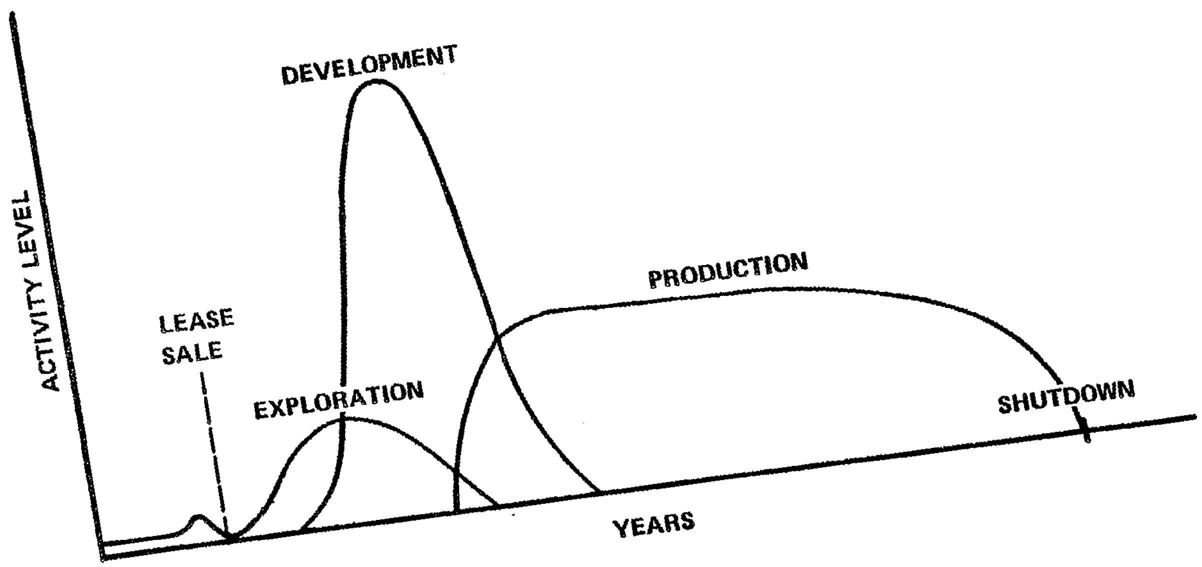
II. OCS DEMANDS ON TRANSPORTATION, GENERALLY

The purpose of this chapter is to provide the reader background information about the kinds of demands that OCS activities place on transportation systems, It is hoped the information will aid understanding of the direction and content of the analysis in chapters IV-VIII and the methodology in Appendix B. The descriptions in this chapter are necessarily superficial, but are assumed to be typical, Actual conditions in each sale area are certain to vary because the equipment, engineering requirements, and working environment, among other factors, are different.

There are four generally recognized phases of OCS development: Exploration, Development, Production and Shutdown. As depicted in Figure 2, which illustrates the relative intensity and duration of each phase, these phases overlap each other. There is no typical span of time to each phase, nor is there a typical activity level. However, the initial lease on Federal offshore lands is only available for a five year time period and the lease can be canceled or renewed depending on the level of activity or results of drilling. In most of BLM's oil and gas scenarios a typical time frame from lease sale to shutdown is 30 to 40 years depending on the level of resources discovered and rate of production. Most of the SESP studies, however, deal with the period between now and 2000 and, therefore, treat only the first 18 years of development activity.

FIGURE 2

PHASES OF OFFSHORE DEVELOPMENT



SOURCE: "Anticipating and Planning for Impacts of Outer Continental Shelf Oil and Gas Development," an ASPO training project, sponsored by U.S. Department of Interior and Environmental Protection Agency. pamphlet presented at "Onshore Impacts of OCS Oil and Gas Development," Each phase of development has its own transportation requirements, as discussed in the following sections of this chapter. However, it should be noted that movement of rigs, platforms, and other special pieces of equipment, as well as other materials associated with OCS development, require specialized transportation services. Offshore oil and gas activities, which occurred first in the Gulf of Mexico and later in the North Sea as well as other parts of the world, have produced specialized technologies and equipment together with companies to operate them. Oil and gas companies contract with these companies when the need arises rather than develop such capabilities in-house. Marine carriers now serving Alaska, it is assumed, would not compete for business where specialized vessels or expertise are required for such activities as moving goods from supply base to offshore work sites, laying underwater pipelines, or in moving and positioning a rig. This degree of specialization has a significant effect on the range of impacts likely to occur in a particular lease sale area.

Exploration Phase

The exploration phase includes pre- and post-lease sale activities to discover and assess the location, quantity, and recoverability of oil and gas reserves. During this state of development, when the prospect for new resources is unknown, oil companies and drilling contractors seek to minimize the investment in permanent facilities or equipment. Some typical presale activities that place demands on transportation resources include environmental and biological testing of waters in the sale area, preliminary sounding to determine subsea geologic structures, possible drilling of a Cost (Continental Offshore Stratigraphic Test) well to varify the geology, and movement of men and materials to support these and other activities. After the sale is held, offshore activities include, among other things, movement and positioning of the exploration drilling rigs and systematic drilling of tracts within the lease sale area. The major onshore requirement is establishment of a temporary service base.

Offshore, there is a need to employ ocean tugs and anchor boats to position the drilling rigs in the tract. During this period, survey crews are making sure the rig is positioned properly. Once in place and anchored, drilling can begin. To support the drilling activities, supply boats deliver casing, drilling mud and other chemicals, fresh water, fuel, and consumable provisions on a regularly scheduled basis. Generally, two supply boats are assigned to each rig, however, if many rigs are operating there is some economy of scale and the number per rig is less. Dimensions and various capacities of a typical supply boat are provided in Appendix B, When crews rotate on the rigs, they may be transported in crew boats or by helicopter. In Alaska, helicopters are more typical.

Onshore, there is a need to establish a temporary support base. The main purpose of this base is the transfer of materials and, in some cases, workers, between shore and offshore operations. A typical temporary base occupies about 5-10 acres on an all-weather harbor; includes berthage of about 200 feet of wharf per rig; dock space for loading and unloading; warehousing; open storage areas for pipe, other tubular goods, and drilling supplies; a helipad; and space to house supervisory and communications personnel. In some areas it may not be possible, nor desirable for competitive reasons, to locate all facilities on a single site. It is also possible that each company drilling will establish its own service base. However, in this analysis a single consolidated base of larger than typical size is assumed. In part, storage requirements are dependent on proximity of the base to material suppliers, and on the pace of drilling activities.

Development Phase

If sufficient recoverable resources are discovered through exploration, the industry may decide to proceed with development of the field. During development, production wells are drilled, and offshore and onshore facilities are completed. Depending on the size of the find, the level of activity could be quite intense (witness the North Sea oil fields). Extremely large expenditures are required before production can begin after a discovery has been made. Once the decision to develop is reached, a field is put into production as soon as practicable, and the oil recovered in as short a period as possible to maximize productivity of costly capital intensive activities. Consequently, oil companies to an extent will sacrifice costs to assure that established schedules are met.

In addition to servicing the drilling and other activities, which are an extension of the exploration phase, transportation services are needed to bring in construction materials for development of onshore facilities such as an expanded service base; a marine terminal for the storage and transshipment of oil; and/or an LNG terminal serving a similar function, if gas is associated with the oil field. The construction activity may also involve the expansion of existing marine facilities to provide the necessary berths and servicing facilities for supply boats and various line-haul carriers bringing in materials. Oil companies working adjacent leases normally agree to jointly operate supply bases, and this practice will be assumed. Unit agreements are also assumed in the development of oil terminals and LNG plants. Pipeline construction, onshore and offshore, also begins during the development phase. Offshore pipes require a heavy cement coating in order to overcome buoyancy, Depending on the location, the pipe could be coated either at a yard outside the lease sale area or at a construction base in the lease area. If the coating is done in the lease sale area, the raw pipe materials as well as cement, aggregate, and associated products must be brought into the area in advance of construction so that the coating can begin. An example of coating material requirements is provided in Appendix B. Once coated, these pipes are then delivered to a lay barge which actually constructs the pipeline and lays it on the ocean floor. Later a bury barge will bury the pipe. The lay and bury barges are serviced by supply boats and anchor boats which position the barge in the correct location for the pipe and which keep the pipe laying/burying process supplied with necessary men and materials.

The development phase, as illustrated in Figure 2, is characterized by its extreme peaking characteristics, largely due to the need to begin production as soon as possible. The construction and field development employment associated with this stage impose significant transportation demands on regional and interstate aviation transportation. The demand for workers typically cannot be met locally, either because a large number of workers are needed, or because special skills are required. For example, the majority of OCS rig workers are highly qualified personnel not generally found in Alaska. They commute from their home of residence somewhere outside the state, work on the rigs for a specified period and return back home.

Production Phase

The production stage may continue for 20 or more years and involves the continuous production and transportation of oil and/or gas. Items of special concern during this stage include the maintenance of sufficient pressure to bring oil and gas to the surface; the prevention of blow-outs, spills and leakages; waste disposal problems; and the monitoring of all production functions. This stage requires long term storage facilities to support off-shore activities as well as support services for workers and their families. Production is characterized by a fairly constant level of demand over a relatively long period of time. OCS employees who operate and maintain the pumps "and related equipment associated with production tend to be Alaska-based personnel due to the duration of this phase of work, and a considerable travel demand is placed on the intrastate aviation system because many of these employees are expected to locate in or near Anchorage and commute to work. In addition to employee transportation, other transportation demands during this stage are related to the use of oil tanker or LNG tanker support in moving the recovered resources from the oil field to the refineries, typically along parts of the U.S. west coast. A fleet of tankers services each type resource on a regularly scheduled basis.

Shutdown Phase

When the petroleum resources cease to be economically or technically recoverable, industry closes down its production operations and plugs and abandons the wells. Many of the support facilities used by the oil companies during the exploration, development, or production phases may also be abandoned. Transportation demands during this phase of development are associated with the movement of recoverable pieces of equipment and machinery that have sufficient salvage value to warrant removal . Once these pieces of equipment are removed, the need for transportation services ceases.

III. EXISTING CONDITIONS

The purpose of this chapter is to establish the current status of transportation facilities, services, routes and regulations affecting the St. George Basin Sale 70 Study Area. The resulting description of baseline conditions and analysis of trends in transportation demand and supply will serve in subsequent chapters as the basis for forecasting transportation demands and/or evaluating potential OCS impacts. Two goals are sought in developing the baseline: 1) to gain an overall perspective of the Aleutian-Pribilof region marine and air transportation systems; and 2) to gain a better understanding of that portion of the regional transportation system serving communities likely to be directly affected by OCS events. In this study three communities are of particular interest: Unalaska-Dutch Harbor, Cold Bay and St. Paul.

The discussion of the marine and air transportation modes, which follows shortly, centers on terminal characteristics, transport services provided, and on 'regulatory agencies. Included within these broad categories are:

- Terminal characteristics
  - facilities available
  - ownership
  - navigation aids in place
  - usage of facilities
  - estimated capacity
- Transport services

- identification of carriers providing services
- kinds of service provided
- schedules and routes
- contract operations and services
- shipping rates and tariffs

- Regulatory agencies
  - identification and role of agencies
  - applicable regulations

From a historic perspective it should be noted that many of the existing marine and air transportation facilities in the region have their origins in World War II, when the Japanese briefly occupied Kiska, Agattu, and Attu islands in the western Aleutians. At that time, the local population was evacuated from the region and the U.S. Army and Navy constructed numerous airfields, pill boxes, barracks, docks, and other military support facilities throughout the islands. At its peak the wartime population numbered several hundred thousand military personnel. When the war ended, virtually all of the facilities and most of the equipment were abandoned in place and remain today in a considerably deteriorated condition. Some facilities have been reclaimed and maintained to support the present transportation system.

Water Mode

The water mode of transportation in the Aleutian-Pribilof region provides a vital link for the movement of various commodities into and out of the region and the three communities under study, With the exception of personal travel by small boats and fishing vessels, water transportation is exclusively freight oriented. Goods shipped into the region include petroleum products and a variety of general freight products, most of which originate at the west coast ports of Richmond, California and Seattle, Washington. Goods shipped out of the region include petroleum products to northwestern Alaska communities and fish and shellfish products to Seattle and Japan. Many goods moving into or out of the region are transshipped through either Kodiak or Unalaska-Clutch Harbor, depending on the service utilized.

The movement of these goods is handled by oceangoing vessels, principally tug-barge combinations and general cargo ships. Goods transshipped within the region and to northwestern Alaska communities typically move by tug and barge due to shallow water depths at many communities. Where facilities are available and water depths permit, communities receive oceangoing vessels directly. Both Unalaska-Dutch Harbor and Cold Bay receive vessels directly. Communities that lack adequate facilities receive goods by lighter, as is the situation in St. Paul, or they receive goods by smaller tug-barge. In both cases, the goods are typically transshipped through Unalaska-Dutch Harbor. In communities where tonnage demands are high service is more frequent and may cost less if single item quantities are large. The situation is reversed in communities where tonnage demands are low. Unalaska-Dutch Harbor has high tonnage demands and frequent service, while Cold Bay and St. Paul have much lower demands and infrequent service.

For each of these ports, this section of the baseline analysis seeks to explain the present conditions in more detail. Included in the analysis will be the identification and evaluation of various terminal facilities, the type and level of services received, the tariff structure, and institutional characteristics affecting each of these. An attempt will also be made to identify any existing or possible future trends that might change facility utilization, services, or tariffs.

MARINE TERMINALS

Several features of each marine terminal point will be examined to determine its present role in the overall marine freight system and its future potential. These features include: (1) available commercial facilities and their characteristics, including docks and unloading facilities; (2) water depth and navigational conditions, which limit the size of ships and barges that can use the facilities; (3) facilities usage and operations; and (4) a description of port and vessel capacity.

Table 1 provides an overview of terminal facilities available for the ports of Unalaska-Dutch Harbor, Cold Bay, and St. Paul. The fact that a port does not have certain facilities should not be interpreted to mean they need those facilities. Each port's needs must be individually determined.

Unalaska-Dutch Harbor

Facilities. The City of Unalaska (which includes Dutch Harbor) is located on a portion of Unalaska Island and on Amaknak Island, approxi-

TABLE 1

MARINE FACILITIES INVENTORY

	Unalaska	Cold Bay	St. Paul
Breakwater	No	No	No
Dock	Yes	Yes	No
Berths	Yes	Yes	No
Floats	No	No	No
Freight Terminal	Yes	No	No
Freight Storage	Yes	No	No
Transshipment Point	Yes	No	No
Passenger Terminal	No	No	No
Boat Repair	Yes	No	No
Boat Launch	No	No	No
Availability of:			
Fueling Facilities	Yes	Yes	No
Customs	Yes	Yes	Yes

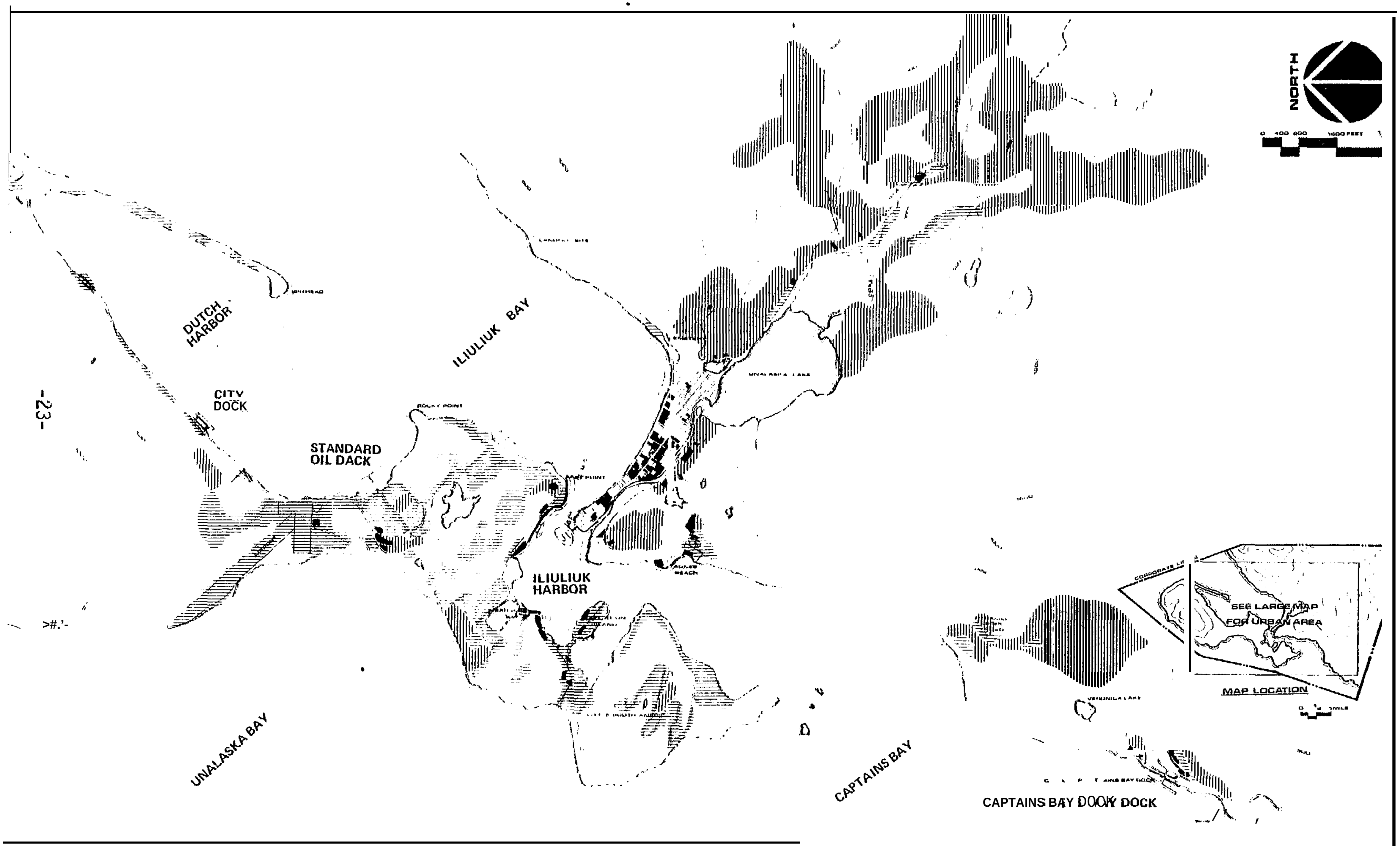
Source: James Lindsay and Associates, 1980.

mately 800 miles west-southwest of Anchorage, Alaska. Dutch Harbor is located on Amaknak 'Island and the two islands are connected by a bridge completed in 1980. The two islands are separated by a narrow strait of approximately 244 meters (800 feet). The natural harbor, which is located adjacent to Alaska's Pacific and Bering Sea fishing grounds, is the only developed deep water port on the Aleutian chain. There are three major moorages located in this area: Dutch Harbor, Iliuliuk Bay, Captain's Bay. Figure 3 shows the general location of each harbor and bay.

The bay known as Dutch Harbor has two principal docks: the City Dock on the northwest side of the bay under Mt. Ballyhoo, and the Standard Oil dock southeast of the City Dock. The City Dock is the site of an abandoned military dock, the remnants of which still exist but are not usable. In November 1980, the City purchased the dock from Sea-Land and has under design a major improvement project. The current facility is the first part of a two-phase construction project and consists of a dock built in 1979 by Sea-Land. The dock is a T-shaped facility with a 9 by 55 meter (30 by 180 foot) loading face. Water depth along the face of the dock is estimated at 9.1 meters (30 feet). Only containerized cargo is handled at this facility, which has the capacity to berth a barge carrying 280 large container vans. They can unload or load approximately 10 to 12 vans per hour, and there is little or no waiting time for the barges because their arrival is scheduled in advance. There are no equipment or covered storage facilities currently available on site; consequently, each barge carries one or more crawler cranes for unloading or loading the containers. Open storage adjacent to the dock

FIGURE 3

LOCATION MAP OF UNALASKA/DUTCH HARBOR PORT FACILITIES



Source: Tryck, Hyman & Hayes, 1977.

will accommodate approximately 100 container vans. Sea-Land has also leased storage space from American President Lines to store an additional 100 vans (Billing, 1980).

In the second phase of the project, the City proposes $2 million of improvements including construction of a new dock south of the existing one. The new dock is expected to be 18 by 61 meters (60 by 200 feet) and the project is expected to include a crawler or overhead crane, a barge ramp for RORO, a 465 square meters (5,000 square feet) warehouse and a 56 square meters (600 square feet) cold storage locker for groceries. Depth alongside the new dock is expected to be 13 to 15 meters (42 to 56 feet). The city is in the process of negotiating an agreement with Sea-Land for operating the dock.

The second dock in Dutch Harbor Bay is "owned by Standard Oil. The dock is part of a major refueling base serving the Aleutian-Pribilof region and all of the western and northwestern Alaska coastal communities. Throughout petroleum product tonnage (inbound plus outbound) at the base exceeds 60 million gallons per year. The dock serving the base is a T-shaped facility extending approximately 122 meters (400 feet) from shore. The dock face is approximately 102 by 15 meters (334 by 50 feet) with water depths alongside of 9.5 to 11.6 meters (31 to 38 feet) at mean lower low water (MLLW). Adjacent to the docking facilities is a number of petroleum storage tanks with total storage capacity of 49.2 million liters (13 million gallons). The base has run out of fuel in the past, but never for more than one day. Back-up fuel can be obtained from the Crowley Maritime base in Captains Bay, if needed.

The facility receives its fuel from many places, but principally from Richmond, California. The fuel is delivered in 35,000 DWT tankers on an as needed basis, but typically in early October in anticipation of the crab season. These tankers cannot offload their petroleum products directly at the Standard Oil dock because the water depth is insufficient to handle these vessels. The oil tankers are anchored 0.8 kilometers (one-half mile) offshore and Crowley Maritime lighters the petroleum products to the Standard Oil dock. Crowley makes two lighter craft available with a capacity of 152,000 barrels or 3,840,000 gallons each. It takes about 2.5 lighter trips and 60 hours to offload a 35,000 DWT tanker. Approximately 8 hours are needed to load a lighter, and 14 to 16 hours are needed to unload the same lighter. Tankers cannot be off-loaded using an offshore pipeline because of the variety of petroleum products transshipped to this facility. According to Standard Oil it is less expensive to lighter these products than to build a causeway one-half mile to depths where the large tankers could be offloaded directly. This class of oil tankers draws approximately 12.2 meters (40 feet) of water (B. Norton, 1980).

The fuel storage tanks provide fuel to all fish processors in the City of Unalaska. Underground fuel lines connect the storage tanks to East Point Seafoods, Whitney Fidalgo, Universal Seafoods, Pacific Pearl and Pan Alaska. Other smaller processors pick up their fuel at the dock.

American Presidents Line (APL) could tap into the existing lines if they wished to provide such services at their facility. The base also provides fuel to foreign vessels traveling in the area, however, most foreign vessels carry sufficient fuel to return to their home ports. On the average, about four foreign vessels are refueled here each year (B. Norton, 1980).

In the past, one concern of fish processors in the Dutch-Harbor area has been congestion caused by fishing boats. To alleviate some of this congestion the City has under construction a boat harbor that will accommodate various size boats up to 61 meters (200 feet). The boat harbor is to be located at the middle of the Dutch Harbor spit. The facility, which is scheduled to be completed by July 1, 1982, will consist of one 6 by 61 meter (20 by 200 foot) transient mooring berth connected by a 2 by 15 meter (6 by 50 foot) gangway to a 4 by 84 meter (12 by 275 foot) float, plus 12 other berths. These additional berths will be provided along a 4 by 244 meter (12 by 800 foot) concrete float with six 5-pile dolphins opposite six 1.5 by 19 meter (5 by 62 foot) concrete stall dividers and seven 0.9 by 12 meter (3 by 40 foot) concrete stall dividers.

Iliuliuk Harbor to the southeast contains only one commercial marine facility, the American President Lines (APL) dock, together with a host of fish processing plant docks. The fish processors include East Point Seafoods, Whitney-Fidalgo, Universal Seafoods (Unisea), Pacific Pearl, and Pan Alaska Fisheries.

The APL dock, completed in 1980, measures approximately 107 by 46 meters (350 by 150 feet). The dock is a wharf structure with access at both ends. In addition, a fishing pier was constructed at the northwest end of the dock. Fishing vessels up to 61 meters (200 feet) can be moored at the fishing pier. Depth alongside the APL dock face ranges from 10.7 to 13.1 meters (35 to 43 feet). The dock face is capable of mooring pacesetters class ships and L-5 class ships that range in length from 184 to 204 meters (605 to 670 feet). Handling equipment includes a Paceco 105T Gantry Crane similar to the type used in the Port of Seattle. This crane has the ability to move up to 30 to 35 containers per hour three times the number of containers moved by conventional crawler cranes. In addition to this large crane, there is a 3100 Manitowac container crane capable of moving 10 to 12 containers per hours; one 6.1 to 7.3 meter (20 to 24 feet) spreader bar for neo-bulk cargo; one 9.1 to 10.7 meter (30 to 35 feet) spreader bar for neo-bulk cargo; one Ford 9000 and two Ottawa yard tractors; two fork-lifts, and one construction crane, in addition to a variety of small equipment.

This facility is jointly used by APL and Foss Alaska Launch (FAL) who lease onshore space from APL and pay a tariff for the use of the dock facility. The entire facility both onshore and offshore belongs to the Ounalashka Native Corporation. APL leases approximately 6.1 acres, 3.6 of which are adjacent to the dock and another 2.5 acres are located about a mile away behind the Standard Oil dock. APL subleases a portion of their space at the dock facility to FAL and the entire remote storage area to Sea-Land.

The storage area adjacent to the dock facility has two large storage buildings, one measuring approximately 18 by 61 meters (60 by 200 feet) and the other measuring 12 by 61 meters (40 by 200 feet). It may be possible to store as many as 400 containers in this storage yard; however, the most containers that have ever been in the yard is 200 and this was estimated to be 40 to 50 percent of the yard capacity (M. Norton, 1980). The remote storage area is an open storage yard used solely for storing empty containers. This yard will hold approximately 140 containers stacked one high; however, it is possible to stack loaded containers two high and unloaded vans three high (M. Norton, 1980).

In addition to containerized cargo the APL facility handles limited amounts of neo-bulk cargo. Neo-bulk service is a dock-to-dock service requiring customers to pick up their goods at the dock upon arrival. FAL has plans to use the storage buildings as a "will call" area for neo-bulk commodities, however, this will not change the type of service; customers will still be required to remove their goods upon arrival or pay additional charges. Cargo arriving in container vans is delivered to customers via truck if the van is for a single customer. However, for partial vans, customers are required to pick up goods upon delivery. This policy of immediate pick up eliminates storage problems that could be encountered if cargo was allowed to stack up.

The fish processing docks are used primarily for loading and unloading fish products. However, these docks do handle limited amounts of neo-bulk cargo. Both Western Pioneer and Alaska Shipping Company offload cargo at these facilities. The cargo is generally commodities ordered by the fish processors themselves, such as the empty cans and boxes used in packing the fish. However, cargo destined for residents of Unalaska is also offloaded at these facilities. These carriers provide a dock-to-dock service and there is no provision for storage of cargo for Unalaska residents at any of the fish processor docks. These carriers may drop cargo off at each processor in a single trip.

To the southwest at Captains Bay, Crowley Maritime owns and operates a dock facility called the Captains Bay Tank Farm located approximately 3,3 km (2 mile) from Unalaska. Crowley uses this facility as a staging area and transshipment point for their "Cool Barge" operations in Western Alaska. (See discussion about this in the later section on marine carriers). The dock facility is a T-shaped pier extending approximately 152 meters (500 feet) offshore with a dock face of 107 meters (350 feet) (Wazola, 1980). Water depths alongside the dock face range from 11.0 to 12.8 meters (36 to 42 feet). The pier was built in 1940 by the Corps of Engineers and was partially reconstructed in 1975. Onshore there are 3 large storage sheds. Each shed has two storage bays measuring approximately 18 by 24 meters (60 by 80 feet). One of the storage sheds is leased to Pacific Pearl Fisheries on a temporary basis. There are four oil storage tanks each with a capacity of 10,000 barrels (406,489 gallons) located approximately 79 meters (260 feet) onshore from the dock. Fuel is offloaded from oil tankers and pumped through a 274 meter (900 feet) buried pipe to the onshore storage. Onshore handling equipment includes a Manitowac crane, forklift and a variety of trucks and related equipment.

Because Crowley uses this facility exclusively for its "Cool Barge" operation, the facility is usually operated only from May 15 through October 15. However, it could become available year-round, if necessary. The typical barge that uses this facility is Crowley barge 101 which is approximately 23 by 91 meters (76 by 300 feet) with a capacity of 100,000 barrels of petroleum products, or barges 567 and 570 also with a 100,000-barrel capacity. Only one tug and barge can be handled at a time at the dock, but during the summer season a maximum of three tug-barges are served per week. Barge delivery to the facility averages approximately one time per month during the summer season (Wazola, 1980).

Navigational Characteristics. Some of the poorest weather in Alaska occurs in the Aleutian Islands. An example of the weather for the coastal area off Unalaska-Dutch Harbor is shown in Table 2. Winds are variable and often strong. Southeasterlies are prevalent on the north side of Unalaska Island from November through February. During August 1980 hurricane-force winds blew through the area in excess of 161 kmph (100 mph) destroying sections of the old submarine dock and overturning boats up to 12 meters (40 feet) in length. Precipitation occurs over a range of 200 to 300 days of the year in the Aleutians generally, but on only about 75 days at Unalaska-Dutch Harbor. At Unlaska, the average rainfall is 1.47 meters (58 inches) and when snowfall is included, reaches 2.06 meters (81 inches) (Denconsult, 1979).

TABLE 2

METEROLOGICAL TABLE FOR COASTAL AREA OFF UNALASKA-DUTCH HARBOR

Boundaries: Between 51°N. and 55°N., from 165°W. to 172°W.

WEATHER ELEMENTS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind ≧ 34 Knots (1)	9.1	9.9	7.4	5.5	3.3	0.8	0.9	1.5	4.3	9.4	12.6	8.5	5.4
Wave Height ≧ 10 feet (1)	35.3	33.0	19.8	21.9	13.9	4.6	5.8	13.0	15.3	27.3	31.0	27.5	20.3
Viability < 2 naut. mi. (1)	9.4	9.8	8.8	9.5	9.8	18.3	25.6	25.3	11.2	5.3	6.2	8.9	13.4
Precipitation (1)	25.3	24.9	18.4	21.9	19.5	16.9	16.1	14.4	16.5	21.0	21.7	24.1	19.5
Temperature ≧ 85°F (1)	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean Temperature (°F)	35.5	35.9	36.1	37.8	41.5	45.2	48.9	51.3	49.6	44.9	40.8	37.3	42.7
Temperature ≦ 32°F (1)	33.2	20.4	17.6	8.5	*	0	0	0	0	*	1.5	10.4	6.1
Mean Relative Humidity (%)	84	85	85	85	85	88	90	90	86	83	83	84	86
Sky Overcast or Obscured (1)	42.3	45.2	53.1	52.4	60.3	74.2	83.9	74.1	58.3	42.4	41.4	44.8	58.5
Mean Cloud Cover (Eights)	6.1	6.2	6.5	6.6	6.8	7.4	7.6	7.3	6.8	6.2	6.1	6.1	6.7
Mean Sea-level Pressure (2)	1001	1001	1011	1012	1011	1012	1016	1013	1009	1006	1003	1002	1009
Extreme Max. Sea-level Pressure (2)	1040	1044	1039	1044	1044	1039	1038	1038	1036	1038	1045	1048	1048
Extreme Min. Sea-level Pressure (2)	958	959	960	969	971	972	986	980	966	965	959	956	956
Prevailing Wind Direction	W	S	W	W	W	W	SW	W	W	W	W	W	W
Thunder & Lightning (1)	0	*	*	0	0	0	*	0	0	0	*	0	*

(1) Percentage frequency.
(2) Millibars.
* 0.0-0.5%

These data are based upon observations made by ships in passage. Such ships tend to avoid bad weather when possible, thus biasing the data toward good weather samples.

Source: U.S. Coast Pilot, 1978.

There are many days with snow, drizzle, and fog. Visibility less than 2 nautical miles occurs about 13.4 percent of the time, but ranges from a high of 25.6 percent of the time in July to a low of 5.3 percent of the time in October. As shown in Table 3, which identifies the mean surface water temperatures in the vicinity of Unalaska-Dutch Harbor, the area is generally ice free. The ice-free condition occurs because of the relatively warm waters of the Japanese Current. The mean range of tide is 0.67 meters (2.2 feet), the diurnal range is 1.13 meters (3.7 feet), and extreme range is 2.77 meters (9.1 feet). The tidal current in Dutch Harbor is inappreciable and in Iliuliuk Harbor the velocity does not exceed 1 knot. Because of the weather and other near shore conditions, pilots are required for all foreign vessels navigating the island waters within the State of Alaska.

The entrance to Iliuliuk Bay and Dutch Harbor from the northwest is approximately 0.8 kilometers (0.5 miles) wide and ranges from 29.3 to 32.9 meters (96 to 108 feet) deep. During spring and fall gales, the bay is subject to violent williwaws making anchorage dangerous. Vessels moored at the Standard Oil dock during the early spring and fall find it necessary to use wire chains and cables in addition to mooring lines during severe gales. Because of limited swinging room, anchorage in Dutch Harbor or Unalaska Bay is not recommended by the U.S. Coast Pilot during severe weather. During the fishing season, this area becomes very congested due to the concentration of fishing boats offloading fish at fish processing plants. During a gale or worse conditions anchored boats could be damaged.

TABLE 3

MEAN SURFACE WATER TEMPERATURES

IN VICINITY OF UN KA-DUTCH HARBOR

	Years	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
		(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C	(T) °C
Unalaska 53°53'N., 166°32'W.	2	2.5	2.0	2.[illegible]	3.6	5.2	7.3	8.9	9.5	8.3	6.1	[illegible].5	3.1	5.3

F (Fahrenheit) = 1.8C (Celsius) + 32

Source: U.S. Coast Pilot 1979.

Iliuliuk reef extending 229 meters (750 feet) in an east-west direction at the mouth of Iliuliuk Harbor is a navigation hazard. The reef is bare in places; however, most of it is covered by kelp. The channel between Iliuliuk Bay and Harbor called east channel has a controlling depth of 6.7 meters (22 feet) and the south channel has a controlling depth of 8.5 meters (28 feet). Vessels with a draft in excess of 28 feet cannot enter Iliuliuk Harbor because of the new bridge.

Iliuliuk Harbor, with an average depth of 18.3 meters (60 feet), offers a good holding ground for vessels and better protection than Dutch Harbor. Although the harbor area is small, there is sufficient room for a moderate size ship (up to 200 feet) to ride at anchor. Vessels under 200 feet in length have ridden out gales, but the short scope of chain allowable usually causes the anchor to drag.

Facilities Usage. In Unalaska-Dutch Harbor ships can offload and load cargo at a variety of docks located in this area. Lightening is required to offload only the 35,000 DWT oil tankers at the Standard Oil dock. Table 4 illustrates the annual level of vessel activity in Iliuliuk Harbor for the period 1972 through 1977.[1/] These numbers include all kinds of vessels - commerce, fishing, domestic and foreign. Specific statistics are not available, however, the vast majority of

1/ It should be noted for this table and others labeled to show only Iliuliuk Harbor that the Corps of Engineers consolidates the activities from all the harbors and bays into this single designation.

TABLE 4

ILIULIUK HARBOR

VESSEL ACTIVITY 1/

1972 - 1977

Year	Inbound			Outbound		
	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Tow or Tug
1972	709	58	50	712	59	53
1973	707	26	27	708	28	27
1974	928	20	52	929	21	52
1975	877	60	4 3	875	62	42
1976	89	64	238	85	66	86
1977	150	54	63	147	45	67

1/ Includes vessel activity at all docks in Unalaska/Dutch Harbor due to the manner in which the Corps of Engineers collects and maintains this data.

Source: Corps of Engineers, Waterborne Commerce Statistics these vessels are fish related. This would account for the dramatic drop in the number of Dry Cargo outbound vessels from a high of 929 in 1974 to a low of 85 in 1976. Because of the increased catch in the fisheries over the past three years, it is estimated that 1980 levels of vessel activity may exceed the 1974 level.

Foreign vessels account for a large percentage of the total vessel activity entering and leaving Iliuliuk Harbor. According to the U.S. Customs, 321 foreign vessels entered this harbor during 1980, Table 5 illustrates foreign vessel activity by month for 1980 and shows foreign vessels originating from U.S. ports and from foreign ports or the high seas. The majority of these foreign vessels are fishing boats (Lyle, 1980; Hipsher, 1981).

The U.S. Customs monitors from Unalaska all foreign vessels operating in western Alaska on both sides of the Aleutian Chain west of Kodiak. All foreign vessels entering U.S. waters must check in at the Customs in Unalaska and obtain a permit. Approximately 20-30 percent of these vessels have no business purpose in Unalaska and enter this port for the purpose of checking with Customs, purchasing supplies, or dropping off a crewman. This monitoring function potentially could be located in another community (Lyle, 1980).

Throughput tonnage for the period 1968 through 1978 is stated in Table 6. This table shows a rapid growth in throughput tonnage between 1968 and 1978; approximately 214 percent. Most, if not all, of this growth

TABLE 5

FOREIGN VESSEL ACTIVITY

ILIULIUK HARBOR[1/]

1980

MONTH	ARRIVING FROM HIGH SEAS OR FOREIGN PORT	ARRIVING FROM U. S. PORTS	MONTHLY TOTAL
January	5	1	6
February	15	1	16
March	20	9	29
April	18	6	24
May	23	17	40
June	34	10	44
July	27	28	55
August	18	7	25
September	19	5	24
October	20	15	35
November	14	0	14
December	‘5	4	9
TOTALS	218	103	321

NOTES : 1/ The term "Iliuliuk Harbor" is used to refer to all harbors and bays in the Unalaska/Dutch Harbor area.

Source: U. S. Customs, Anchorage, Alaska

TABLE 6

TOTAL THROUGHPUT TONNAGE AT ILIULIUK HARBOR[1/]

1968 - 1978

YEAR	TONNAGE
1968	120,980
1969	263,905
1970	251,978
1971	245,163
1972	190,109
1973	163,586
1974	157,477
1975	300,953
1976	349,760
1977	342,324
1978	379,293

Notes: 1/ The term "Iliuliuk Harbor" is used by the Corps of Engineers to refer to all bays and harbors in the Unalaska/ Dutch Harbor area.

Source: Corps of Engineers, Waterborne Commerce Statistics, Part 4, for the period 1968-1978.

is due to the rapid increase in receipts and shipments of petroleum products from the Standard Oil dock and Crowley Maritime "Cool Barge" operation. Table 7 shows total throughput tonnage by major commodity group between 1972 and 1978. In 1976, petroleum products accounted for 91,2 percent of throughput tonnage, by 1977 this increased to 93 percent, and in 1978 decreased to 88 percent. It is clear that petroleum products dominate throughput tonnage in Unalaska-Dutch Harbor.

Between 1972 and 1978, throughput tonnage of fish and shellfish peaked in 1974 with 61,429 tons and dropped to a low of 6,226 tons in 1977. Fishing tonnages have traditionally been cyclical, and while current data are not available, it is expected that for 1979 and 1980 throughput tonnage for fish and shellfish category may exceed the previous high 1974 levels. A change as much as 50 percent per year up or down is the expected change in fish and shellfish tonnage.

Table 8 provides a breakdown of foreign imports and exports versus domestic receipts and shipments for 1978, the most recent year for which data are available, During 1978, foreign carriers delivered 61 tons of goods to Iliuliuk Harbor while 21,125 tons were exported to foreign ports. Approximately 99 percent of exports were fish or shellfish. . Foreign ports (primarily Japan) received approximately 3.3 times more fish than did domestic ports during 1978. Petroleum receipts accounted for 213,149 tons. Approximately 56 percent of these products were shipped to other Alaskan communities and military installations, while

TABLE 7

THROUGHPUT TONNAGE BY MAJOR COMMODITY GROUPS

ILIULIUK HARBOR 1/

1972 - 1977

YEAR	PETROLEUM 2/ PRODUCTS	FOOD 3/ PRODUCTS	FISH 4/ SHELLFISH	ALL OTHER 5/ COMMODITY GROUPS	ANNUAL) TOTAL
1972	173,460	36	14,508	2,105	190,109
1973	144,555	3,224	13,086	2,721	163,586
1974	88,790	3,237	61,429	4,021	157,477
1975	272,222	5,598	20,563	2,570	300,953
1976	321,290	9,241	15,638	3,591	349,760
1977	318,298	10,813	6,226	6,987	342,324
1978	333,240	6,053	28,329	10,879 6/	378,501

Notes: 1/ The term "Iliuliuk Harbor" is used by the Corps of Engineers to refer to all bays and harbors in the Unalaska/Dutch Harbor area.

2/ Includes gasoline, jet fuel, fuel oil and miscellaneous petroleum and coal products.

3/ Includes salt, prepared fish, alcoholic beverages, groceries and miscellaneous food products.

4/ Includes fresh fish and fresh shellfish.

5/ Includes all other commodities.

6/ Excludes local dock-to-dock transfer - 396 tons shipped and 396 tons received.

Source: Corps of Engineers, Waterborne Commerce Statistics, Part 4, for the period 1972 - 1978.

TABLE 8

FOREIGN VERSUS DOMESTIC PRODUCTS

ILIULIUK HARBOR[1/]

1978

Commodity	Foreign		Domestic[2/]		Net
	Imports	Exports	Receipts	Shipments	Receipts-Shipments
Total	61	21,125	224,407	132,908	91,499
Petroleum	--	--	213,149	120,091	93,058
Total Less Petroleum			11,258	12,817	-1,559
Fishery Products	--	20,951	1,054	6,324	-5,270
Other	61	174	10,204	6,493	3,711

Notes: 1/ The term "Iliuliuk Harbor" is used by the Corps of Engineers to refer to all bays and harbors in the Unalaska/Dutch Harbor area.

2/ Excludes local dock to dock transfers - 396 tons shipped and 396 tons received.

Source: Corps of Engineers, Waterborne Commerce Statistics, 1978; Unpublished data assembled by James Lindsay & Associates.

93,058 tons were consumed locally. The primary local consumers are the fishing and marine related industries.

Table 9 provides a more detailed breakdown of throughput tonnage by origin and destination for 1978. The majority of general cargo comes from Seattle directly, or via Alaskan ports from Seattle. The vast majority of liquid bulk (87.0 percent) is shipped directly-from the Standard Oil facility in Richmond, California. Goods that originate in Iliuliuk Harbor, such as fish products, or are transshipped through Iliuliuk Harbor, such as petroleum products, have a variety of destinations in the Aleutian Region, in western and northwestern Alaska, Seattle, and Japan. Differences between inbound and outbound tonnages are due to the consumption of goods in the local community.

Port of Cold Bay

Facilities. Cold Bay is an unincorporated community located approximately 30 miles from the southwest end of the Alaskan Peninsula. The community consists of an airport, a variety of government offices and a small residential area lying south of the airport. As shown in Figure 4, the port facilities, which consist of a fuel pier, are located east of the community on Cold Bay, from which the community derives its name.

The State of Alaska owns and operates the T-shaped fuel pier, constructed of steel pile piping and pre-stressed deck paneling. The dimensions of

TABLE 9

Iliuliuk Harbor

1978 Commodity Tonnage by Origin and Destination [1/]

Commodity Group	Commodity Origin	Inbound Tonnage	Throughput Tonnage	Outbound Tonnage	Commodities Destination
Food Products	Foreign	11	21,136	21,125	Foreign
	Seattle	757	6,595	5,838	Seattle
	Kodiak	1,421	6,548	S,127	Kodiak
	Aleutain Isl.	135	135		
	Alaska Penin. South Side	89	89		
	Petersbury	10	10		
	Cordova	20	20		
			11	1 1	Pribilof
Lumber and Wood Furniture Products	Local	18	36	18	Local
	Foreign	12	12		
	Seattle	1,167	1,167		
	Kodiak	1,268	1,296	28	Kodiak
	Yukon River	6	6		
	Alaskan Penin South Side	6	6		
chemical Products	Foreign Ports	32			
	Seattie	7	7		
Petroleum Products	Local	-	262	131	
	Richmond, Ca.	84,671	184,671		
	Seattle	3,945	3,945		
	Alaskan Penin SoUth Side	22,400	32,871	10,471	Alaskan Penin. South Side
			4,565	4,565	Kodiak
			3,287	3,287	Pribilof
			16,022	16,022	Naknek
			2,817	2,817	Alaskan Penin. North Side
		-	13,410	13,410	Dillingham
			40,679	40,679	Bethell
	Valdez	2,133	2,375	242	Valdez
			327	327	King Cove
			10,423	10,423	Aleutian Islands
			17,848	17,848	Bering Sea Ports
Building Products and Machinery	Local	69	138	69	Local
	Seattle	2,865	3,315	450	Seattle
	Kodiak	47	47		
			5	5	Yukon River
			25	25	Aleutian Islands
	Alaskan Penin. South Side	25	25		
	Foreign	6	6		
Transportation Equipment	Seattle	30	- - - Tr - -		
			4	4	Anchorage
	Kodiak	29	29		
			15	15	Pribilof
			4	4	Naknek
Commodities NEC	Seattle	729	1,652	923	Seattle
	Kodiak	2,540	2.830	290	Kodiak
			18	18	Homer
			6	6	Anchorage
	Western Ak.	107	180	73	Western Alaska
	Local	178	356	1 7a	Local
Totals		24,864	379,293	154,629	

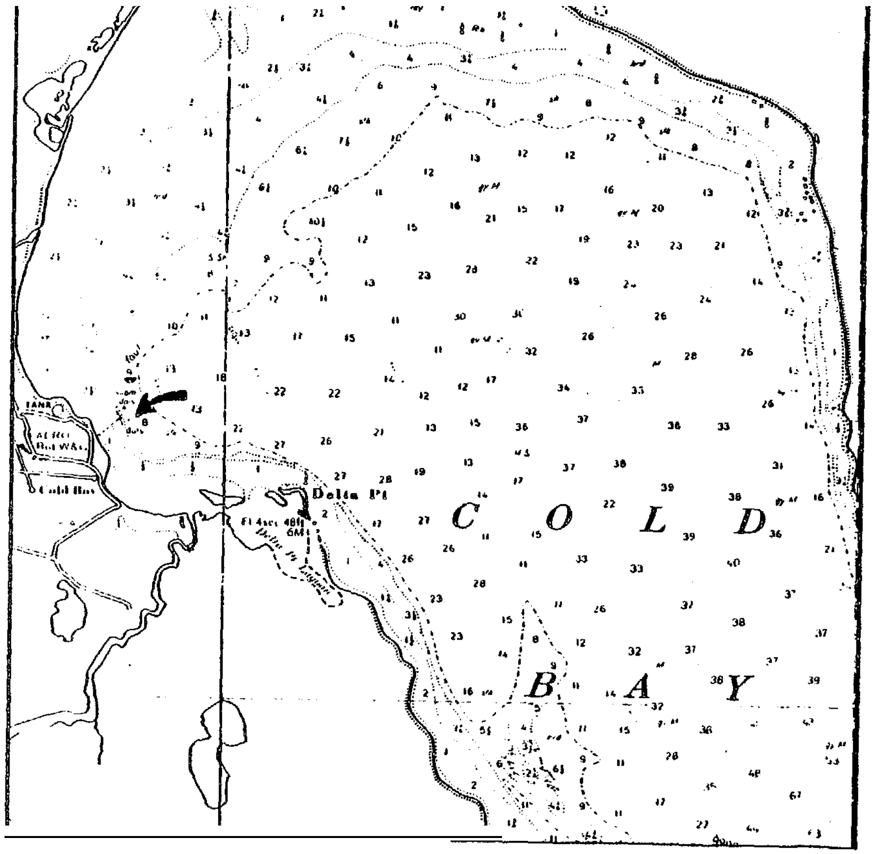
Notes: (1) The term "Iliuliuk l-labor" is used by the Corps of Engineers to refer to all bays and harbors in the Unalaska/Dutch Harbor area

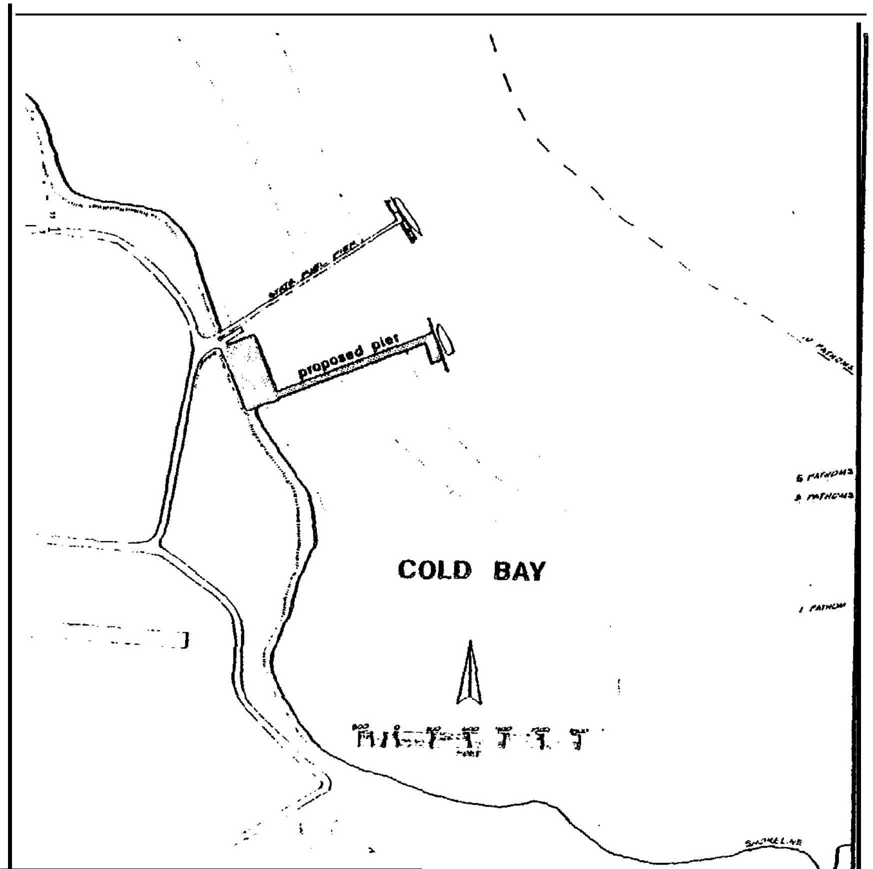
Source: Corps of Engineers, Unpublished Data, 1978 - assembled by James Lindsay & Associates.

FIGURE 4

VICINITY MAP AND TERMINAL LAYOUT

COLD BAY, ALASKA





TERMINAL LAYOUT

SOURCE: DMJM Forssen and Tetra Tech, Inc., 1980 this facility are stated in Table 10. The dock face is 12.1 by 30.5 meters (40 by 100 feet) with catwalks extending to two dolphins, giving the dock face a total length of 122 meters (400 feet). The approach trestle is 556 meters (1,824 feet) long and 3.7 meters (12 feet) wide, with two turnouts. Depths alongside the dock face are 9.1 to 10 meters (30 to 33 feet). The dock was designed and constructed to accept bulk fuel. Maximum vehicle load allowed on the pier approach is 5,000 lbs., (DMJM-Forssen, 1980).

The facility is equipped with two cranes, one with a lift capacity of 35 tons and the other with a 5 ton lift capacity. Cargo is taken directly over the dock. The Cold Bay facility does not have scheduled services such as exist in Unalaska-Dutch Harbor. Bulk fuel is generally delivered on demand while other categories of freight are delivered when demand reaches a point that justifies a stop by one of the cargo ships or barges. Cargo delivery is port-to-port. There are no storage facilities for general cargo. Mr. George Tilbury, who owns the two cranes on site, also has two trucks, a backhoe and two dozers that are available for lease. Trucks are available from this source to deliver goods from the dock to the community, which is less than a mile away. The liquid bulk petroleum products delivered to Cold Bay are piped to one of the four petroleum storage facilities identified in Table 11. The three smaller storage tanks are located near the dock. The larger Standard Oil Tank Farm is connected to the dock via pipeline but is located adjacent to the airport.

TABLE 10

DIMENSIONS OF STATE OF ALASKA FUEL PIER
PORT OF COLD BAY

Deck Elevation 1/	+16.0 ft.
Depth of Berth	-30.0 ft.
Present Depth	-20.0 ft. est.
Mean High Water	7.1 ft.
Extreme Low Water	- 3.5 ft.
Vessel Draft	18.0 ft.
Berthing Tide	- 3.5 ft.
Shoreside Fill	300′ x 600′ +
Shoreside Maximum Depth	18.0 ft. ±
Type of Construction	113 (L)
Causeway Construction	1,000 ft. Piling
Moorage Dolphins	4 - 7 Pile

Notes: 1/ All elevations refer to MLLW = 0.00 ft.

Source: DMJM-Forssen and Tetra Tech, Inc., 1980.

TABLE 11

PETROLEUM BULK STORAGE FACILITIES

Cold Bay, Alaska

Facility	Capacity Gallons	Type of Fuel
United States Air Force	42,000	Diesel
Standard Oil	75,000	Diesel
State of Alaska	225,000	Diesel/Gas
Standard Oil Tank Farm	4,000,000	Aviation
TOTAL CAPACITY	4,342,000	

Source: Alaska DOT/PF, 1978

The State's T-head pier is not a stable facility. In 1969, only 364 feet of the SE section of the pier was usable; the remainder was in partial ruins and condemned for use. In 1972, the State of Alaska, Department of Public Works, Division of Aviation, advised that the Cold Bay Pier may only be used in calm weather, and that vessels using the pier must be prepared to move as quickly as possible in the event of adverse wind and/or sea conditions. This action was necessary for the protection of personnel and to prevent oil pollution should the pier give way (U.S. Coastal Pilot,- 1979). Since 1972 there have been major repairs, but as recent as early 1980, the pier was damaged again by a vessel attempting to moor under poor weather conditions.

Several improvements have been contemplated for this area. A recent study (draft. form) entitled "Aleutian and Southwest Alaska Coastal Ferry Study" prepared for the State DOT/PF by DMJM-Forssen and Tetra Tech, Inc. cited Cold Bay as a possible stop for a proposed cargo ferry to be operated by the State of Alaska. The study recommended a preliminary site and type of operation for a new port facility in Cold Bay, as depicted in Figure 4. 'This study suggested a new dock facility be built 213 meters (700 feet) south of the existing fuel pier. It is proposed that the fuel pier continue to function as it is and that the new pier provide only cargo services with cargo storage located on fill. The face of the pier would be T-shaped, approximately 18.3 meters (60 feet) wide by 42.7 meters (140 feet) long. The dock would extend approximately 457 meters (1,500 feet) from shore. A minimum depth of

7.0 meters (23 feet) is required for a 5.5 meter (18 foot) draft vessel and 9.1 meters (30 feet) for a 7,6 meter (25 foot) draft vessel. Dredging would be required to provide fill for the 107 by 183 meter (350 by 600 feet) shore-side cargo storage area. Additional discussion about the proposed ferry system is included in the Base Case forecast (Chapter IV),

Navigational Characteristics. Cold Bay is a large deep water bay, indenting the Alaskan Peninsula. An 18.3 meters (60 feet) deep channel passes from the sea to Cold Bay, however, this channel is very narrow, and is subject to a current velocity of up to four knots under certain tidal conditions. An aerolight is on the west side of the Bay.

During the winter months the channel leading to Cold Bay is extremely dangerous because of frequent, heavy icing that may distort floating aids causing them to lie on their sides, submerge, be extinguished or off station. In addition, a reef extends almost across the entrance to Cold Bay near Kaslokon point. The north shore of Cold Bay has many boulders. The west shore consists of low bluffs and sand beaches strewn with boulders, backed by rolling tundra. There are portions of Cold Bay with depths to 30.5 meters (100 feet), but the channel to Cold Bay limits its usable depth to 18.3 meters (60 feet) (U.S. Coastal Pilot, 1979).

The weather in Cold Bay is considered to be the worst on the Alaskan Peninsula (Engineering Computer Optecnomics, 1977), but not nearly as severe as experienced in the Unalaska-Dutch Harbor area. Table 12 and Figure 5 each identify various climatic conditions in the vicinity of Cold Bay. Winds blow continually with an average velocity in January of 16 m.p.h. decreasing to 13 m.p.h. in July. The high frequency of cyclonic storms crossing the north Pacific and Bering Sea account for these high winds and the frequent occurrences of low ceilings and low risibilities encountered at Cold Bay. This area averages 13 fog days per month during the winter months increasing to 25 days during the month of August. These factors make navigation difficult on a year around basis.

Facility Usage. Historical data on the level of vessel activity at Cold Bay are not available. There are four major carriers that deliver cargo to Cold Bay: Northland Services, Alaska Cargo lines, Western Pioneer and Standard Oil. Total throughput tonnage at the port of Cold Bay in 1978 was 12,524 tons. Table 13 provides the most recent breakdown of throughput tonnage at Cold Bay by origin--destination. The data are illustrated for a variety of commodity classifications. With the exception of some petroleum products, all commodities are shipped from Seattle or transshipped through Iliuliuk Harbor. Approximately 85 percent of inbound commodities are petroleum products. The bulk of these petroleum products are used in operation of the airport located in Cold Bay. Approximately 96 percent of total throughput tonnage was consumed locally during 1978. The shipment of 458 tons of petroleum products to the south side of the Alaska Peninsula is not something that typically occurs at the Cold Bay facility.

TABLE 12

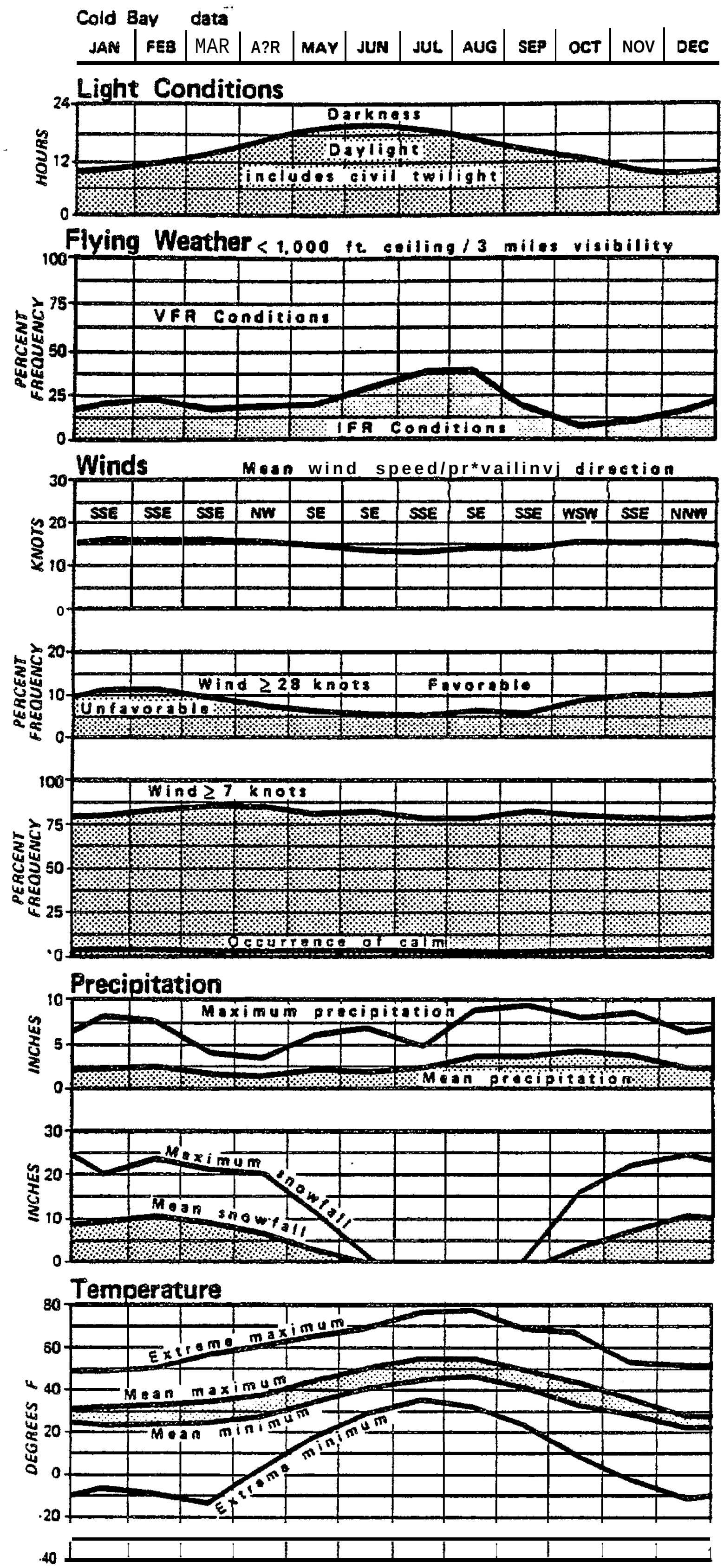
CLIMATIC CONDITIONS IN THE VICINITY OF COLD BAY, ALASKA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp Avg. (°F)	28	28	29	33	40	45	50	51	47	40	34	29
Temp Low (°F)	-5	-9	-13	4	18	29	36	33	27	12	1	-0
Avg. Wind Speed (Knots)	16	16	16	15	14	14	13	14	14	15	15	15
Prevailing Wind Direction				NW	Nw	W	W	SW	SW			
Fog (Avg. Days)	13	13	13	14	14	18	24	25	18	13	13	13
Precipitation (Mean)	2.42	2.59	1.93	1.54	2.19	1.84	2.22	3.89	3.95	4.31	3.90	2.45
Snow (Mean Days)	17	18	19	16	8					10	15	19

Source: U.S. Coast Pilot, 1979.

FIGURE 5

COLD BAY CLIMATE DATA



Source: AEICD for University and Regional Affairs, 1978.

Table 13

Port of Cold Bay

1978 Commodity Tonnage by Origin and Destination

Commodity Classification	Inbound Commodities		Throughput	Outbound Commodities	
Group	Origin	Tonnage	Tonnage	Tonnage	Destination
Food	Seattle	10	10		
Products	Seattle	10	10		
Lumber & Wood Products	Seattle	360	360		
	Seattle	31	31		
	Valdez	399	399		
	Iliuliuk	2,983	2,983		
Petroleum	Valdez	720	720		
Products	Iliuliuk	3,418	3,418		
	Seattle	887	887		
	Iliuliuk	1,798	1,798		
			458	458	Alaska Peninsula South Side
	Seattle	22	22		
	Iliuliuk	3	3		
Building	Seattle	1,000	1,000		
Products	Seattle	244	244		
	Seattle	160	160		
Transportation	Seattle	4	4		
Equipment	Seattle	17	17		
Totals		12,066	12,524	458	

Source: Corps of Engineers, Unpublished Data; assembled by James Lindsay & Associates.

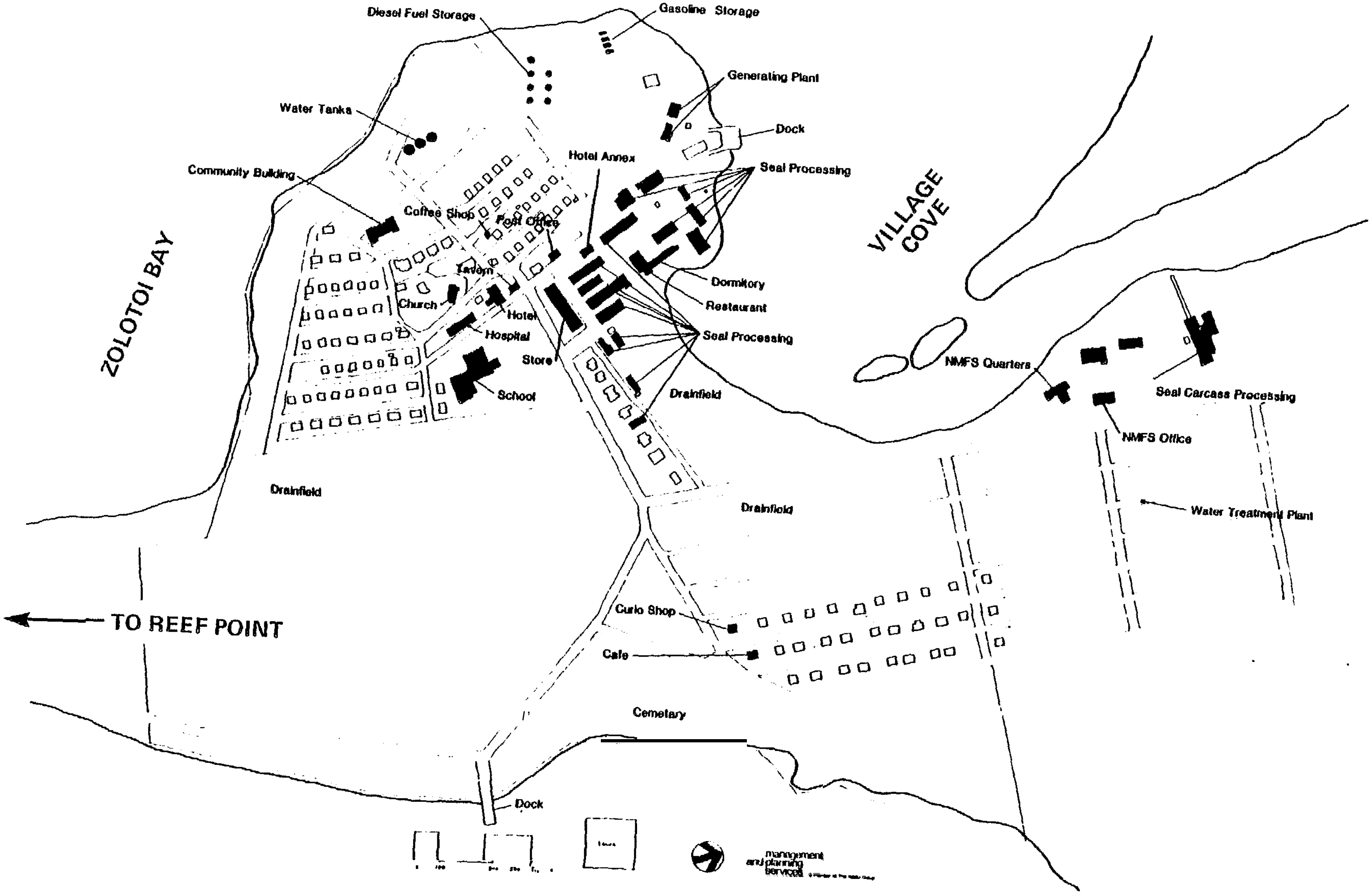
Port of St. Paul

Facilities. St Paul island is one of the Pribilof Islands located in the Bering Sea approximately 200 miles northwest of Unimak Pass. These islands contain the largest and most numerous fur seals in the world. The seal industry, historically an economic function in the Aleutian-Pribilof region, remains the economic base of these islands. Law enforcement to protect the seals is provided by the Coast Guard.

There are no landlocked harbors on any of the Pribilof Islands. Figure 6 illustrates the existing facilities for the community of St. Paul. Although two docks are available, neither is capable of offloading cargo from medium or deep draft vessels. The water along the shoreline is shallow, and presently all cargo must be lightered ashore by power barge or bidarkas (native skin boats) that are said to have a capacity of five tons per trip, One dock is located in Village Cove. It has a reinforced concrete pier with a dock face approximately 30.5 meters (100 feet) long and adjacent water depths of 0.9 to 1.2 meters (3 to 4 feet) at MLLW. The dock has a self-propelled skid crane with a 10 ton skid capacity. There are no storage facilities located at the pier and the marine service is port-to-port. Customers are required to pick up cargo at the time of delivery. The second dock is located on the east side of the island and is only used when prevailing winds preclude the use of the dock facility at Village Cove. Generally, these dock facilities are marginally adequate for shipping and receiving freight, New harbor facilities would be required for the development of a fisheries industry at St. Paul (Management and Planning Services, 1980).

FIGURE 6

EXISTING FACILITIES, ST. PAUL, ALASKA



Source: Management and Planning Services, 1980

Adjacent to the dock facilities at Village Cove are seven diesel storage tanks with a combined capacity of 600,000 gallons and four gasoline storage tanks with a combined capacity of 100,000 gallons. The equipment is in need of constant maintenance, and operators have experienced problems with piping valves and pumps that transport the liquid bulk to the storage tanks. At the present time, one of the gasoline tanks is required for storage of diesel fuel. If any significant expansion takes place, additional fuel storage will be required (Management and Planning Services, 1980).

Anchorage at St. Paul Island is in deeper water west of Village Cove. Here, water depths reach 18.3 meters (60 feet) and the bottom is sandy. In the spring (April-May) icing conditions may cause anchored vessels to become entrapped. Weather is a severe problem for vessels delivering cargo to St. Paul. Vessels are warned not to ride out a storm at any time near the islands unless the anchorage is located on the leward side of the island and is well protected.

During 1980, St. Paul was served four times by the Alaska Marine Shipping Company (AMS); two times by the BIA ship North Star III; and once by the Crowley Cool Barge, for a total of seven trips. There is no marine passenger service available. AMS has a contract with National Marine Fisheries Services which runs another four years and gives this company exclusive private carrier rights to serve St. Paul. AMS is required to use the vessel “Snowbird” because their other ships are assigned to fishery type consignees.

St. Paul could potentially undergo dramatic changes if a bottomfish processing plant is introduced to the Island {See Base Case, Chapter IV.). The harbor facilities that exist are not adequate to handle increased traffic, because all cargo must be lightered due to shallow water adjacent to shore, and vessels are exposed to unpredictable weather delays, thereby increasing operations costs, and the potential for loss or damage to cargo due to weather exposure and handling risks. The National Marine Fisheries Services (NMFS) recently engaged Management and Planning Services of Seattle Washington to prepare a Pribilof Islands Services Plan, Preliminary recommendations for harbor improvements are available in a draft study dated June 17, 1980. (Management and Planning Services, 1980)

The key to improving freight service to St. Paul is improving the docking facilities. The Corps of Engineers has under consideration a new boat harbor that includes a 91.4 meter (300 foot) dock backed by a breakwater. This would eliminate the need for lightering and would allow vessels like the Snowbird, which requires 4.6 meters (15 feet) of water depth plus surge, to offload cargo directly from the barge to the dock. This facility could be built in stages. If 30.5 meters (100 feet) ofa solid fill dock or bulkhead were built as a first phase, tugs, which generally draw more water than the barge, can lay on the outside of the barge in order to reduce water depth requirements. In addition to the dock, there is a requirement for warehouse storage and a marshaling area. The warehouse would be heated and raised above the level of the dock for the delivery of cargo to truckers. Dock equipment could include a 25 ton forklift and two 5 ton forklifts. A crane would be desirable, but not necessary, because most marine carriers have cranes on board their vessels. One tractor and several trailers would be required to deliver containerized cargo.

If new dock facilities are not built, additional freight capacity can be achieved by taking advantage of the Snowbird container capacity in combination with the lighters. Alaska Shipping Company recently installed a hydraulic crane on the Snowbird with a lifting capacity of 45 tons and a 6.1 meter (20 foot) reach, which is more than adequate for placing the heaviest of the 6.1 meter (20 foot) containers on a lighter. However, lack of adequate onshore unloading/loading equipment presents a problem with respect to the containers -- there is no way to lift the containers out of the lighter at the shore. Alternatively, containers could be run ashore, doors open while remaining in the landing craft, and palleted cargo slung off with existing shore side cranes.

Navigational Characteristics. Fogs are especially thick around St. Paul during the summer months, and on an annual basis. St. Paul has an average of 190 days of fog, making navigation extremely difficult. Navigation in the summer months is made by landfalls as land is usually not visible. A typical summer day is dense fog at daylight, visibility less than 200 yards, calm seas; at noon intermittent sun, a wet drifting fog, gentle breeze; by evening a dense fog, winds increasing to 6 knots. Dense fog with visibility less than 0.5 mile is more common around St. Paul than St. George Island. Winds are not constant from any direction for any length-of time. September through March, gales are frequent and blow from any direction making anchorage difficult and dangerous.

The Pribilofs are near the southern limit of the Bering Sea ice fields. Ice typically has not required navigation to be suspended, however, the potential exists for St. Paul to become ice bound in any given year.

The climate around St. Paul is typical maritime resulting in considerable c"loudiness, heavy fog, and high winds as can be identified in Table 14 and Figure 7. The diurnal range of the tide at Village Cove is 3.2 feet.

The currents run east on a flood tide and west on the ebb. Currents reach a velocity of 1 to 2 knots, and with high winds may reach 3 knots. The tides and tidal currents are strongly influenced by the winds (U.S. Coast Pilot, - 1978).

TABLE 14

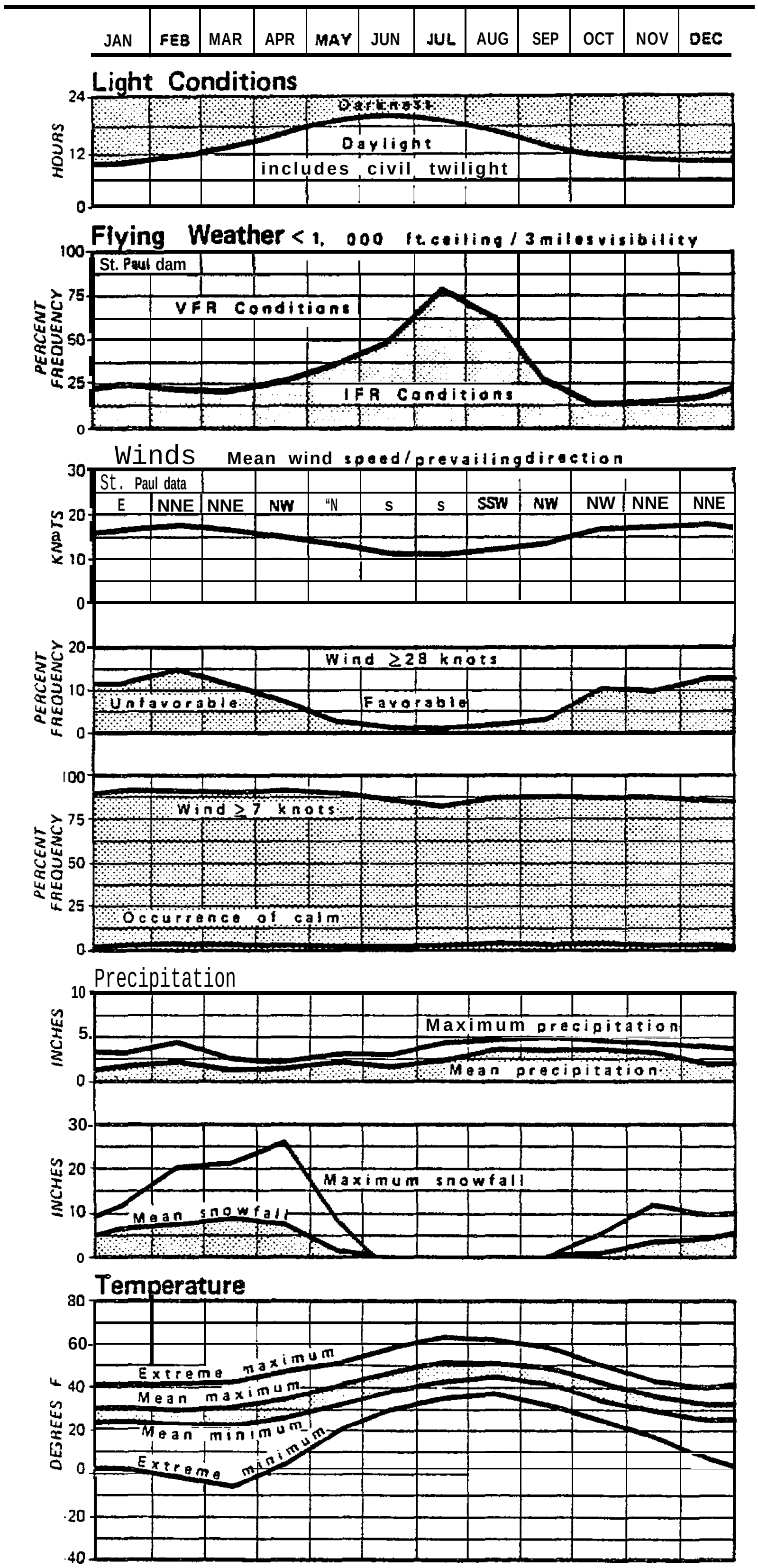
CLIMATIC CONDITIONS IN THE VICINITY OF ST. PAUL ISLAND, ALASKA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temp. Avg. (°F)	26	23	24	29	35	41	46	48	44	38	33	28
Temp. Low (°F)	-26	-15	-19	-2	8	24	28	30	25	13	9	-5
Avg. Wind Speed (Knots)	17	18	16	15	13	11	11	12	13	17	17	17
Prevailing Wind Direction				Nw	N	Nw	Sw	W	NW	NW	-	-
Fog (Avg. Days)	12	10	12	15	20	24	28	26	15	9	10	9
Cloud Cover (Tenths)	8.0	8.0	8.0	8.5	9.0	9.1	9.5	9.5	8.8	8.3	8.2	8.1

Source: U.S. Coast Pilot, 1978.

FIGURE 7

ST. PAUL CLIMATE DATA



Source: University of Alaska, AEIDC, 1978b

Facilities Usage. Historical data on the level of vessel activity are not available for the Port of St. Paul. As mentioned previously, three major carriers serve St. Paul typically making a collective total of seven trips each year.

Table 15 identifies throughput tonnage at St. Paul by origin and destination for each commodity code. In 1978, total throughput tonnage at St. Paul Harbor was 4,175 tons. Inbound commodities made up 97 percent of total throughput tonnage, of which petroleum accounted for 58.8 percent while the remaining inbound tonnage is distributed between food products (13.6 percent); lumber and wood furniture (10.5 percent); building products (9.7 percent); and other commodities (7.4 percent). Outbound commodities are primarily seal skins and carcasses, which make up 3 percent of total throughput tonnage.

MARINE CARRIERS

Marine freight carriers serving the study area can be divided into three general categories, as follows: (1) interstate, (2) intrastate coastal shipping, and (3) lightening transportation. Table 16 identifies the carriers that serve the Aleutian-Pribilof and Bristol Bay regions. The carriers are regulated by either the Federal Maritime Commission (FMA), Interstate Commerce Commission (ICC) or both, with the exception of the North Star III.

TABLE 15

Port of St. Paul
1978 Commodity Tonnage by Origin and Destination

Commodity Classification Group	Inbound Commodities Origin	Inbound Commodities Tonnage	Throughput Tonnage	Outbound Commodities Tonnage	Outbound Commodities Destination
Food Products	Iliuliuk	11	11		
			37	37	Seattle
	Seattle	64	64		
	Seattle	72	72		
	Seattle	1	1		
	Seattle	1	1		
	Seattle	146	146		
	Seattle	143	143		
	Seattle	107	107		
	Seattle	6	6		
Lumber and Wood Furniture	Seattle	195	195	-	
	Seattle	38	38	-	
	Seattle	122	122	-	
	Pribilof	39	39	-	
	Seattle	25	25	-	
	Seattle	5	5	-	
			1	1	Seattle
Petroleum Products	Iliuliuk	228	228	-	
	Seattle	3	3	-	
	Iliuliuk	2129	2129	-	
	Seattle	21	21	-	
Building Products	Pribilof	39	39		
	Seattle	141	141		
	Seattle	20	20		
	Seattle	20	20		
	Seattle	52	55	3	Seattle
	Seattle	39	39		
	Seattle	4	4		
	Seattle	18	18		
	Seattle	39	39		
	Seattle	19	19		
Commodities NEC.	Seattle	137	137		
	Seattle	135	215	80	Seattle
	Pribilof	1	4	3	Pribilof
	Seattle	28	31	3	Seattle
Totals		4048	4175	127	

Source: U.S. Corps of Engineers Unpublished Data, assembled by James Lindsay and Associates.

TABLE 16 "

Marine Carriers Serving
St. George and Bristol Bay Regions

	Carrier	Type of Service	Regulating Agency
1.	U.S. Government Bureau of Indian Affairs	North Star III General Cargo	None
2.	Sea Land	Container	FMC
3.	American President Lines	Container/General Cargo	FMC
4.	Sorenson's Barge Service	Tug & Barge	ICC & FMC
5.	Moodyrs Sea Lighterage	Lighterage	ICC & FMC
6.	Northland Services	Tug & Barge	FMc
7.	Alaska Cargo Lines	Container/General Cargo	FMc
8.	Foss Alaska Line	Container/General Cargo	FMC
9.	Crowley Maritime	(Coal-Container/General Cargo Barge/Pol-West)	FMC
10.	Alaska Shipping Co.	General Cargo	FMC
11.	Western Pioneer Line	General Cargo	FMC
12.	Standard Oil	Liquid Bulk	FMC
13.	Foreign Vessels	Fish Products	

Source: James Lindsay and Associates

Common and Contract Carriers

Common carriers and linehaul contract tug-barge operations can be divided into two categories: (1) scheduled common-carriers, and (2) contract carriers.

Scheduled Common-Carriers. Typical examples of this type of marine service are Foss Alaska Lines, Sea-Land, American President Lines, Western Pioneer, and Alaska Marine Shipping Co. With respect to western Alaska operations, each line publishes scheduled routes and sailing dates and provides service from Seattle to western Alaska ports including Cold Bay, Unalaska, and St. Paul. Western Pioneer and Alaska Marine Shipping carry general cargo (breakbulk) and the other marine companies cited above carry primarily containerized cargo and limited breakbulk cargo. The following provides a description of the activities of each marine carrier cited above. These carriers were selected because they provide the bulk of the marine service to the communities under study.

Western Pioneer formerly called Pioneer Alaska Lines commenced water carrier service to western Alaska from Seattle in 1958. Operating to and from the Pacific Northwest, Western Pioneer primarily serves the fisheries and fishery-related communities from Kodiak Island to the Aleutian Islands, including Cold Bay, on a year-round basis, and the salmon fisheries of Bristol Bay, Kiskokwim River, Yukon River and Norton Sound during the summer salmon season. During 1979, they operated four vessels having a total of 145,000 cubic feet of refrigerated cargo space. These vessels are former navy-yard oilers which were converted specifically to meet the needs of the fishing industry. Western Pioneer plans to add a fifth vessel to its fleet that will have a capacity of 40,000 cubic feet. Cost of the conversion of this vessel is estimated to be approximately $2.2 million.

During 1979, Western Pioneer maintained a weekly service between the Pacific Northwest and western Alaska, with Unalaska-Dutch Harbor being the terminus. In 1980, the schedule called for a vessel to leave Seattle for Unalaska-Dutch Harbor every six days, commencing in mid-April and running as long as demand dictates, which is normally through the end of October, the end of crab season. According to Western Pioneer, the schedule of a vessel departing every six days cannot be maintained year-round on an economical basis due to lack of demand in the off-season (fish), During the off-season, Western Pioneer has excess capacity for at least a five-month period from November until the end of March, during which time they normally run two to three sailings a month.

Western Pioneer is an unsubsidized domestic carrier, that, in addition to serving traditional fisheries has attempted to gear up for the advent of the bottomfish industry in western Alaska. To date, however, bottomfishing activities have yet to materialize in the transportation of significant tonnage (Western Pioneer Co., 1980).

Alaska Shipping Company (ASC) began serving Alaskan ports from Seattle in 1977, operating both as a common carrier and as a contract carrier. During the 1977-1979 period, ASC provided service between Seattle and Bellingham, Washington, and 44 Alaskan ports. Unalaska-Dutch Harbor is their principal Alaskan port-of-call. ASC is the only common carrier serving the Pribilof Islands (St. Paul) and does so under an exclusive contract.

ASC provided 23 sailings to Dutch Harbor in 1978 and 24 sailings in 1979. They average from four to six trips per year to St. Paul. In its 2.5 year history, ASC has operated three vessels. The Snowbird, owned by Alaska Marine Charters, Inc., an affiliate of ASC, is capable of carrying 16 six-meter (20 foot) reefer containers on deck. The two other vessels are the Aleut Packer and Aleut Provider, which are owned by subsidiaries of the Aleut Corporation. Ports-of-call include Seattle, Kodiak, Old Harbor, Chignik, Sand Point, Squaw Harbor, King Cove, Cold Bay, False Pass, Akutan, Dutch Harbor, Herendeen Bay, Port Moller, Port Heiden, Egigik, Naknek, Clarks Point, Togiak and the Pribilof Islands. Collectively, the three vessels provide a total cubic capacity of approximately 88,000 cubic feet, 100 percent of which is refrigerated space. ASC provides year-round sailings. On an annual basis, their load factors have been approximately 80 percent leaving 20 percent vacant capacity.

The principal cargo northbound consists of supplies of all sorts for fisheries processing facilities and fishing vessels. The principal cargo southbound is seafood products.

The Aleut Corporation is obligated, under a contract with the National Marine Fisheries Service (U. S. Department of Commerce - NOAA) to transport cargo on at least four sailings annually from Seattle to the Pribilof Islands, and to transport sealskins and seal carcasses southbound on three of those sailings. This contract is performed on behalf of the Aleut Corporation by ASC in conjunction with its operations to other Alaskan ports and extends through calendar year 1984. Vessels transporting cargo to St. Paul carry their own LCM lighters, because no docking facilities exist, and the water is too shallow for deep draft vessels.

ASC has also engaged in private carriage on a time or voyage charter basis to seafood processors, who require use of the entire reach of the vessel for their cargoes for one or more voyages. While so engaged, the vessels continue to be operated by ASC (Alaskan Shipping co., 1980) .

Foss Alaska Lines (FAL) provides three service links from Seattle to Alaskan ports. FAL provides weekly scheduled common carrier service to Southeast Alaska and regularly scheduled service to Adak, Unalaska-Dutch Harbor and other Aleutian Chain ports, and Kodiak. During the summer months of May through August, FAL service extends to western Alaska, including the communities of Bethel and Dillingham.

The Adak/Aleutian Island service from Seattle via Sitka is a regular 21-day freight service to Adak. This service is available to any Alaska port having a harbor with a depth of at least 4.3 meters (14 feet) and a bulkhead or dock 12.2 meters (40 feet) wide with a crawler crane available on site. They can offload 10-20 tons per hour with a crawler crane. The service is offered as an inducement for communities to utilize the facilities that FAL has to offer.

FAL utilizes a variety of tug and barge combinations. The FAL-286 is an 87 by 23 meter (286 by 76 foot) barge capable of carrying approximately 107, 6 and 7.3 meter" (350, 20 and 24 foot) containers. They also have FAL-343 class barges that measure 104 by 23 meters (343 by 76 feet) capable of carrying more than 420 containers. The barges are pulled by Foss tugs 36.5 meters (120 feet) long and 9.4 meters (31 feet) wide that draw about 4.3 meters (14 feet) of water They are rated at 3,000 to 4,000 hp. and are capable of pulling loaded barges at a speed in excess of 10 knots.

FAL carries both dry and refrigerated containers. Exterior container dimensions are 2.4 by 2.6 by 6 to 7.3 meters (8 by 8.5 by 20 to 24 feet). In addition, FAL carries auto carriers for automobiles and small trucks; platform containers designed for handling cargoes such as machinery, lumber, plywood, pipe, masonry and other building materials and noncontainerized cargo. They do not transport liquid bulk.

FAL currently serves Unalaska-Dutch Harbor, but not St. Paul or Cold Bay. Service cannot be provided to Cold Bay for two reasons: (1) the tug and barges used to serve the Aleutians cannot offload due to shallow water at Cold Bay, and (2) the low level of demand. FAL stated that if demand increased, for example through bottomfish development, new equipment could be brought in to service Cold Bay, however, demand is so low that it is not economically feasible to call on Cold Bay on a regular schedule.

Sea-Land (SL) provides linehaul services directly from Seattle to Kodiak and Seattle to Anchorage. They utilize three vessels on these routes and provide year-round service. The average is two trips per week in the summer (May through September) and one trip per week the remainder of the year. Cargo bound for the Aleutian Chain is shipped from Seattle to Kodiak and offloaded at Kodiak and transferred to a feeder vessel named Aleutian Developer.

The Aleutian Developer provides service to the Aleutian Chain every 8 to 10 days. Regular ports of call are King Cove, Chignik, Sand-point, and Unalaska-Dutch Harbor. Like other carriers serving this area, Sea-Land will provide service to any community if sufficient demand exists, The Aleutian Developer is 105 meters (345 feet) in length, with a draft of 5.8 meters (19 feet) loaded and the capa-city to carry 83 containerized vans. The vessel carries its own crawler crane, which is capable of offloading or loading six vans per hours. It requires a dock with a minimum 61 meter (200 feet) berth in order to offload containers. Communities without this type of facility cannot be served by Sea-Land unless new equipment is transferred to the-area.

Sea--Land does not transport liquid bulk to the Aleutians, however, it does provide a tug and barge service exclusively to the fishing industry. This service calls on ports in Bristol Bay and communities such as False Pass and King Cove. The barge has a capacityof 100 vans, and they primarily transport seafood or related support equipment for the fishing industry. This service is direct from Seattle.

Sea-Land dropped its service from the Aleutian Chain to Japan in March 1980 because it was not economically feasible to continue this service. They adopted what they term a Seattle relay system.

Fish products from Alaska are shipped to Seattle and then relayed from Seattle to Japan. Sea-Land states this is more efficient and more economical.

Sea-Land has the capacity to provide a large increase in the volume of containerized cargo service to the Aleutian Chain, especially at Unalaska-Dutch Harbor, if the demand existed. Together with Sea-Land's lease of the proposed new City dock, Sea-Land could use C-4 class cargo vessels to meet additional demands. These vessels are similar to those in use between Seattle and Anchorage. A C-4 cargo class vessel is capable of carrying approximately 365 containers and approximately 12,000 barrels (504,000 gallons) of liquid bulk. These vessels are approximately 158 meters (520 feet) long, have a draft of 7.3 meters (24 feet) loaded, and gross tonnage of 11,389 tons. The C-4 class ship requires a minimum berth of 107 meters (350 feet) to offload cargo (Billing, 1980).

American President Lines (APL) is a federally subsidized carrier operating deep-draft container steamships that export fishing products from Unalaska-Dutch Harbor and Kodiak to Japan. These vessels provide a weekly service to Unalaska-Dutch Harbor on a year-round basis. Due to its federal subsidy, APL is prohibited from transporting cargo between U.S. ports.

They have four pacesetter class container ships in operation between Seattle, Kodiak, Unalaska-Dutch Harbor, and Japan. The pacesetter class ships have a length of approximately 204 meters (669 feet), a width of 27 meters (90 feet), draft of 10 meters (33 feet) loaded, and capacity for 1,482 Ton Equivalent Units (TEU). One TEU equals a container van 2.4 by 2.6 by 6.1 meters (8 by 8.5 by 20 feet) or 23,200 ST. APL also operates C-5 class breakbulk vessels to Unalaska-Dutch Harbor. The typical length is 184 meters (605 feet), width 25 meters (82 feet), draft 10.7 meters (35 feet), and capacity 35,000 short tons.

APL has proposed an amendment to sections 506 and 605(e) of the Merchant Marine Act, 1937, which would enable subsidized carriers to enter for the first time the domestic trade between the Pacific Northwest and Alaska. If APL is successful in its attempt to amend the Merchant Marine Act, it would be in a position to provide a tremendous increase in carrier capacity over what presently exists (APL, 1980). Nonsubsidized carriers are generally opposed to modifications to this act because they feel it prompts unfair competition, and they do not feel there is sufficient demand at the present time to warrant an increase in capacity to the Aleutian Chain, Contract Carriers. Contract or charter carriers are used by major shippers, such as petroleum companies, to move specialized and oversized cargo throughout Alaska as the need develops. An example of this type of service is the movement of supplies to Prudhoe Bay between 1968 and 1975 for the development of oil and gas on Alaska's North Slope. During this period, Arctic Marine Freighters shipped 594,000 tons to the North Slope. Their largest shipment was made in 1975 when they shipped 153,000 tons using 24 tugs and 48 barges. Alaska Puget-United Transportation Company (APUTCO), a division of Crowley Maritime, also provides contract tug and barge service in Alaska. Their principal place of operations to date have centered in the Gulf of Alaska. However, Crowley maintains a large transfer station at Captains Bay in Unalaska-Dutch Harbor and could expand their contract barge service in Aleutian-Pribilof and Bristol Bay regions if demand existed.

Crowley's "Cool Barge" makes deliveries of dry and reefer cargo, as well as bulk petroleum to Department of Defense and other federal agencies throughout western Alaska. Their vessels stop at the Captains Bay Tank Farm in Unalaska-Dutch Harbor three times per week from May 15 through October 15 and pick up goods bound for various federal installations in western Alaska. A barge is offloaded with supplies from Seattle at the Captains Bay Tank Farm approximately once a month during this season. Table 17 provides a list of

TABLE 17

LOCATIONS AND AGENCIES SERVED BY
U.S. MILITARY SEA LIFT COMMAND "COOL BARGE"

Location	Agency	Location	Agency
Akhiok	PHS	Nome	AKARNG , NWS
Atka	PHS	N.E. Cape	ASL
Attu	USCG	Oliktuk Point	DEW
Barter Island	DEW, FWS ,NWS	Perryville	PHS
Bethel	AKARNG BIA, PHS, NWS	Point Barrow	PHS ,AKARNG NPRA,ARL,DEW
Cape Lisburne	AAc	Point Hope	PHS
Cape Newenham	AAc	Point Lay	DEW, AKARNG
Cape Romanzof	AAc	Port Clarence	USCG
Captains Bay	FWS	St. Elias	USCG
Chignik Lake	PHS	St. George	NMF
Cold Bay	AAC,FWS,NWS	St. Michael	AKARNG
Dillingham	PHS	Sarichef	FWS
English Bay	PHS	Sheldon Point	PHS
Fire Island	FAA	Shemya	AAC
Hinchinbrook	FAA, USCG	Tatalina	AAC
Karluk	FAA, USCG	Teller	AKARNG
King Salmon	AAc , Nws	Tin City	AAC
Kotzebue	AAC , AKARNG	Togiak	AKARNG
Level Island	FAA	Unalakleet	AKARNG
Lonely	NPRA,DEW	Wainwright	DEW,AKARNG
McGrath	Nws	Wales	ASL
Middletown Island	FAA	Yagataga	FAA
Naknek	NPS , PHS	Unalaska	Staging Area

Abbreviations used:

AAc	Alaska Air Command
AKARNG	Alaska Army National Guard
ARL	Arctic Research Laboratory
ASL	Arctic Submarine Laboratory
BIA	Bureau of Indian Affairs
DEW	Distant Early Warning Station
FAA	Federal Aviation Agency
FWS	Fish & Wildlife Service
NMF	National Marine Fisheries
NPRA	National Petroleum Reserve
NPs	National Park Service
Nws	National Weather Service
USCG	U.S. Coast Guard

Source: L. Berger & Associates, 1979, Vol. III locations and agencies served by Cool Barge. Crowley employs three barges in this service, each measuring 91 meters (300 feet) in length and 23.2 meters (76 feet) wide with a 100,000 barrel capacity for liquid bulk.

Puget Sound Tug and Barge Company is a contract operator that makes bulk petroleum deliveries on a scheduled basis to redistribution centers in western Alaska. This service is performed for Standard Oil in Unalaska-Dutch Harbor. Their ports of call are Seattle, Unalaska-Dutch Harbor, St. Michael, Nome and Kotzebue. Puget Sound Tug and Barge also moves a substantial amount of construction material and contractor equipment on a non-scheduled contract basis.

Standard Oil operates the Alaska Standard, a 35,000 DWT tanker which hauls bulk fuel on a contract basis from Unalaska-Dutch Harbor to Dillingham, Naknek, Cold Bay, King Cove, Sand Point, Chignik, Kodiak, Old Harbor, Larsen Bay, Ouzinkie and Port Lions. The delivery of fuel is made directly to the dock face.

Other contract carriers providing similar services in the Bristol Bay and St. George Basins are Soreson's Barge Service, Moody's Sea Lighterage, Foss Tug and Launch Company, Marine Leasing, Wick Construction Company, Dunlop Towing and other smaller companies.

At the present time the only cargo ship regularly serving the smaller communities in western Alaska is the Bureau of Indian Affairs ship, North Star III. The characteristics of this ship are shown in Table 18. The Bureau of Indian Affairs' resupply program is a non-profit, self-sustaining operation, serving approximately 60 remote villages that are not generally served by common commercial carriers. Two voyages are made each year. The first voyage serves people living from the Aleutian Islands to Cape Prince of Wales, and the second voyage serves coastal communities north of Wales, Little Diomede Island and the Pribilof Islands. Table 19 identifies the communities served by the North Star III during the 1980 season.

The North Star III stops at Dutch Harbor to pick up bulk petroleum on each voyage. It generally purchases approximately one million gallons per trip from the Standard Oil dock in Unalaska-Dutch Harbor. BIA began providing service to St. Paul in 1979, but does so only when it is necessary to provide service. The Pribilof Islands present serious schedule problems for BIA. The weather around St. Paul is totally unpredictable, and the North Star III cannot afford to be weather bound. Typically, St Paul cargo is loaded first, and if it cannot be offloaded when they arrive at St. Paul, then the vessel must either return to Dutch Harbor and try again when the weather clears or leave the cargo in Dutch Harbor. If too much time is lost trying to reach St. Paul, the entire North Star 111 schedule may be affected.

TABLE 18

CHARACTERISTICS OF BUREAU OF INDIAN AFFAIRS
SHIP NORTH STAR III

Length	138.7 meters (455 ft.)
Full Load Draft	8.7 meters (28.5 ft.)
Deadweight Tonnage	11,431 ST (10,206 LT)
Cargo Space	
- Dry	11,894 cubic meters (420,000 cu. f
- Liquid Bulk	4.54 million liters (1.2 million g
Lighterage Craft	4 LCM
Power Plant	5,850 'rip-diesel
Crusing Speed	14 knots
Ship's Crew	41 crew members
Passenger Space	2
Hospital Space	4

Source: Peterson, 1980.

TABLE 19

PORTS OF CALL
U. S.M. S. NORTH STAR III

1980 SEASON

April-August Voyage - From Seattle

Anchorage
Perryville
Ivanoff Bay
Kire Cove
Akutan
Umnak
Nikolski
St. Paul
Nelson Lagoon
Togiak
Goodnews Bay
Tunurak
Toksook Bay
Mekoryuk
Scamman Bay
Hooper Bay
Golovin
Dutch Harbor
Stebbins
St. Michael
Unalakleet
Shaktoolik
Koyule
Elim
Ganbil
Savoonga
Nome
Tin City
Wales
Little Diomede
Seattle

August-October Voyage - From Seattle

Point Wells
St. George/St. Paul*
St. Michael
Kotzebue
Barrow
Wainwright
Point Lay
Point Hope
Kilwalina
Derring
Sheshmaref
Diomede
Teller
Tin City
Nome
Seattle

* Only if necessary

Source: BIA - 1980 Tentative Sailing Schedule

Therefore, BIA chooses to serve St. Paul only if necessary (Peterson, 1980) ,

Carrier Rates

Marine shipping rates established by the carriers reflect the characteristics of demand in a given community, Among these characteristics are total tonnage, length of haul, kinds of commodities, the characteristics of the handling category, relationship between inbound and outbound demands, and the degree of competition. Comprehensive rate data from each carrier operating in the Aleutian-Pribilof Region are not readily available on a carrier-by carrier basis. Direct quotes for specific commodities can be obtained on a case-by-case basis. Table 20 shows linehaul rates for a selected number of goods between Seattle and the Aleutian ports of Akutan, Captains Bay, Unalaska-Dutch Harbor, False Pass, King Cove, Sand Point, and Squaw Harbor. Foss Alaska Lines provided this data. These rates are representative of shipment costs in a competitive market. General freight rates for St. Paul are shown in Table 21 for several different carriers and include air freight rates for comparison. The marine rates will vary with wharfing costs, special handling for shipping, etc. Rates are based upon shipment from Seattle.

TABLE 20

SELECTED COMMODITY RATES BETWEEN

SEATTLE AND POINTS IN ALASKA

(In $ Per Hundred Pounds)

Commodity	Rate	Min. Weight In Lbs.
Building Materials - Cement, Sand, Gravel	$ 4.96	36,000
Building or houses	9.07	18,000
Crab traps wire or metal	11.06	11,000
Dairy products	11.19	10,000
Fishing equipment (nets)	19.02	12,000
Canned fish	4.66	20,000
Frozen fish	7.07	20,000
Shellfish - Southbound only	7.07	24,000
Groceries - Northbound	6.01	20,000
Groceries - Southbound	6.20	20,000
Iron and steel	6.45	24,000
Liquor - Ale, beer, stout	6.84	24,000
Liquor - alcoholic, wine	13.26	10,000
Lumber	7.03	10,000
Machinery	8.03	20,000
Machinery parts	5.45	20,000
Oil, Petroleum and petroleum products	4.78	120,000
Oilfield equipment	5.92	84,000
Paint	7.85	20,000
Motor vehicles	21.29	10,000

Source: Foss Alaska Line, Inc. Tariff 308; effective February 28, 1979

TABLE 21

APPROXIMATE
GENERAL CARGO RATES
ST. PAUL ISLAND

Carrier	Approximate Cost Per Ton
Alaska Shipping Company	$209
B. I.A.	$376
Cool Barge	$105
Air Freight (Reeve Aleutian Airways)	$467

Source: Management and Planning Services, 1980.

The trend in marine tariff rates seems to be always upward for various reasons. One reason is inflation, which affects fuel costs, salaries, and operating expenses generally, as well as the cost of borrowing capital investment money. Inflation also increases the dollars available to transportation consumers, but the time lag between price increases and salary increases typically translates as a loss of purchasing power and commodities become more expensive to ship in real terms. In addition to national inflation, regions or smaller areas undergoing rapid change and growth often suffer's local scarcity of goods or services and a local inflation develops driving up costs and salaries. Because of its remoteness, the Aleutian-Pribilof region would appear to be highly susceptible to local inflation pressures, particularly in light of rapid bottomfish development or OCS oil and gas development.

From the marine carriers perspective, bottomfish development could be a tremendous boon to tonnage demands and profits on both coastal and foreign trade routes. In anticipation of capturing a part of these markets, shipping firms have begun to improve their facilities or build new facilities at key points such as Unalaska-Dutch Harbor. In part, the carriers are developing some excess capacity and capabilities in order to be able to handle future demands when they arise. They also have begun to posture themselves with respect to routes. The efforts by APL to change federal restrictions on coastal trade by subsidized carriers is one example of this posturing. However, until these new markets materialize transportation consumers pay for the excess capacity.

The lack of adequate marine facilities in the Aleutian-Pribilof region also imposes added tariffs on transportation consumers who are served through such facilities. Typically these added tariffs are in the form of handling charges which vary from port to port depending on the kind of special handling needed to overcome limitations of the local facility. The state and federal governments could, in effect, subsidize the cost of transportation in this region by upgrading the facilities to some minimum standard of performance. However, neither group has yet to establish what this minimum standard might be. Regardless of the standard, the public cost is great. The remoteness of the region means that mounting a major maintenance effort can be very expensive. To offset future maintenance costs new facilities must be designed to higher standards, thereby increasing the initial capital costs and reducing the number of new facilities that can be constructed each year. From the government's perspective, a relatively small population would be receiving a very large benefit, a point whose merits politicians are inclined to argue shout,

There are few, if any, alternatives available to the people whose transportation costs are too high. Air freight is not an optional alternative if the rates shown for St. Paul in Table 21 are indicative of the differences between marine and air freight. Air mail is an alternative and a growing one since the service is heavily subsidized in Alaska. However, packages must meet specified size and weight limitations and delivery is not necessarily faster given the poor air freight performance of many western Alaska air taxi operations (Parker, 1979).

The fact that tariff rates are inversely based on demand also penalizes smaller communities whose demands tend to be low. Typically, communities with small demands tend to also be those with inadequate facilities, thus compounding the effects of the marine tariff structure.

As marine tariffs continue to rise, consumers who cannot afford the increases either forego the purchase, seek a substitute item, or find another less expensive way to ship the article. Not all articles lend themselves to alternative modes of travel (e.g., an automobile). A point is reached where the cost of living at a particular location affects real or expected life styles and people leave. This further reduces demands and leads to still higher costs.

Regulations

The regulation of navigation and maintenance of navigable waters are functions performed by agencies of the Federal government. The Corps of Engineers handles the permit process for channel and harbor improvements. The Corps, with the participation of local and state agencies, funds the construction of breakwaters and channel improvements. The U. S. Coast Guard has multiple sea-oriented missions including the establishment and maintenance of navigational aids, carrying out search and rescue missions, policing fishing treaties and the 200-mile limit, enforcing water pollution laws, and conducting marine inspections.

The nearest Coast Guard facility is located at Kodiak. From this point the Coast Guard patrols the Aleutian Islands and Bering Sea. In the community of Unalaska, both private and public interests would like a permanent Coast Guard base located in Unalaska. A meeting was held in Juneau in the Spring of 1980 at which time the Coast Guard outlined two possible alternatives to meet the needs of this area:

1. The Coast Guard can continue to support operations in the Aleutians and Bering Sea from its present base in Kodiak; or

2. Sometime after 1985 at the earliest, the Coast Guard could establish a base in Unalaska with a maximum possible force to include an Air Station with a maximum of three helicopters, two 378-foot high endurance cutters, one vessel in the 200-225 foot range, one 180-foot buoy tender, and a dry storage area for buoys (U.S. Coast Guard, 1980).

The Coast Guard has already documented its intentions to establish a Marine Safety Detachment at Unalaska/Dutch Harbor and an Air Station at Cold Bay, but these were not scheduled to be in place until after 1985. Because of this timing, these plans were subject to re-evaluation. Thus, the ground work for such a move to Unalaska has already been laid. The two most critical missions for the Coast Guard would be search and rescue and the provision of aids to navigation, but facilities might also include support for law enforcement, marine safety, and environmental protection activities. (U.S. Coast Guard, 1980). The major road block in accelerating these plans may be the availability of funds.

Since these hearings were held the Coast Guard has sent two Coast Guard personnel to observe activities in the Unalaska area. Their primary mission is to observe vessel movement and check for marine violations. It was unknown how long this arrangement would last or whether it was temporary or permanent (Frederic R. Harris, 1979).

Several federal agencies regulate interstate commerce and are pushing ahead with deregulation of freight rates in all modes. These actions will cause rates to reflect the distribution of costs, rather than what the "traffic will bear" (Frederic R. Harris, 1979).

The Jones Act prevents foreign-built ships from carrying freight or passengers between U.S. ports. In authorizing construction of the Trans-Alaska pipeline, Congress mandated that none of the oil could be exported. At the present time this legislation only affects the size of tankers serving Valdez.

Air Mode

The air mode of transportation in the Aleutian and the Pribilof Islands provides an important year-round interstate, intrastate and interregional service. Although aircraft landing facilities are found throughout the study area, many are privately owned, and several are in a poor state of maintenance. The airport at Cold Bay serves as a "hub" for the eastern Aleutians and the Pribilofs. Direct service is available from Cold Bay to Anchorage and to Seattle, with feeder service available from Cold Bay to St. Paul, to Dutch Harbor, and to other communities. St. Paul is also served directly from Anchorage. Contract services are also available. The types of aircraft regularly used along these routes are Lockheed L-188 A/C four-engine turbo-prop and Nihon YS-11A two-engine turbo-prop.

The following discussion identifies relevant terminal characteristics, including facilities and services available; as well as the carriers providing aviation services to Cold Bay, Unalaska-Dutch Harbor, and St. Paul. Rates charged for services and applicable institutional factors are also presented.

AIR TERMINALS

This description of existing airports will focus on major terminal facilities and examine four categories of data as follows: (1) ground facilities which aircraft utilize, including runways, taxiways, and aprons for loading and unloading freight and passengers; (2) visual and instrument landing aids; (3) service-related activities such as control towers, fuel and maintenance, and weather reporting; and (4) passenger and freight handling facilities, terminals and their Utilization.

Two measures of capacity exist for airports -- the size and type of aircraft that can be accommodated and the numbers of operations (take-offs and landings) that can take place. The first measure relates to ground facilities and the second to all four categories listed above. Once ground facilities are in place, introduction of additional landing aids and services can increase the number of possible operations. The governing constraint for each airport should be recognized. For a specified annual amount of freight/passenger tonnage, inadequate runway length may reduce aircraft payloads, thereby increasing the number of annual operations and adversely affecting airport capacity. In such cases, the runways may need to be lengthened. In some cases, the runway configuration will govern and new runways may be required to improve capacity. In other cases, the landing aids and facilities may limit operations and need to be upgraded. Finally, geographical constraints in the form of obstructions or lack of level land for development can be the ultimate constraint.

The State of Alaska has established for Alaska three major categories of airports. <u>International Airports</u> provide the interface between combinations of international, interstate, and intrastate service. <u>Trunk Airports</u>, which are usually served by jet aircraft, distribute goods and passengers to outlying <u>Secondary Airports</u> approximately [illegible] Km (150 miles) to 323 Km (200 miles) away. All other airports fall into the secondary airport category. The designation assigned an airport represents the highest use of the airport. Air taxi operators co-exist with jet aircraft at trunk and international airports. Unalaska-Dutch Harbor, Cold Bay, and St. Paul are trunk terminals. Anchorage is an international airport. For each airport, minimum visibility and ceiling guidelines are established for different types of aircraft based on available landing aids and nearby obstructions. These guidelines and local prevailing weather conditions affect the reliability of operations which, in turn, affect the capacity of the airports. Table 22 identifies the navigation aids and other aid facilities at Cold Bay, Dutch Harbor and St. Paul airports. All three airports are designated as air carrier service level airports by the Federal Aviation Administration (FAA) . Table 23 identifies runway characteristics and ground facilities at these airports.

The existing routes and distances between city pairs are shown on Figure 8. Mr. Richard Reeve of Reeve Aleutian provided estimated load factors by city pairs which are shown in Figure 8. According to him, load factors do not vary between seasons. However, to maintain constant load factors when demand declines off season, fewer flights are scheduled during the winter months which reduces available seating capacity 40 percent (Reeve, 1980),

TABLE 22

AIRPORT AND RUNWAY CHARACTERISTICS AND AIDS
AT COLD BAY, DUTCH HARBOR AND ST. PAUL

AIRPORT	COLD BAY Runway 14-32 Runway 08-26	DUTCH HARBOR Runway 12-30	ST. PAUL Runway 18-36
Airport Role -Service Level -Design Type	Air Carrier Air Carrier	Air Carrier Air Carrier	Air Carrier Air Carrier
Lighting	REIL (32) VASI-4 (8/26,32) SALSR (14)	REIL (12/30)	VASI-4 (18-36)
Navigational Aids	LOC (14) GS (14) OM, MM (14) VORTAC FSS RCAG NDB LOM (14)	NDB DME SFO	NDB (3)

Source: FAA, Ten Year Plan, 1979.

Legend

DME - Distance Measuring Equipment
FSS - Flight Service Station
GS - Glide Slope
LOC - Localizer
LOM - Outer Compass Locator Co-1ocated with Outer Marker (OM)
MM - Middle Marker
NDB - Nondirectional Radio Beacon
OM - Outer Marker
RCAG - Remote Center Air-Gound Facility
REIL - Runway End Identification Lights
SALSR - Short Approach Light System
SFO - Single Frequency Outlet
VASI - Visual Approach Slope Indicator
VORTAC - Combined very high frequency (VHF) omnirange (VOR) and tactical air navigation (TACAN)

TABLE 23

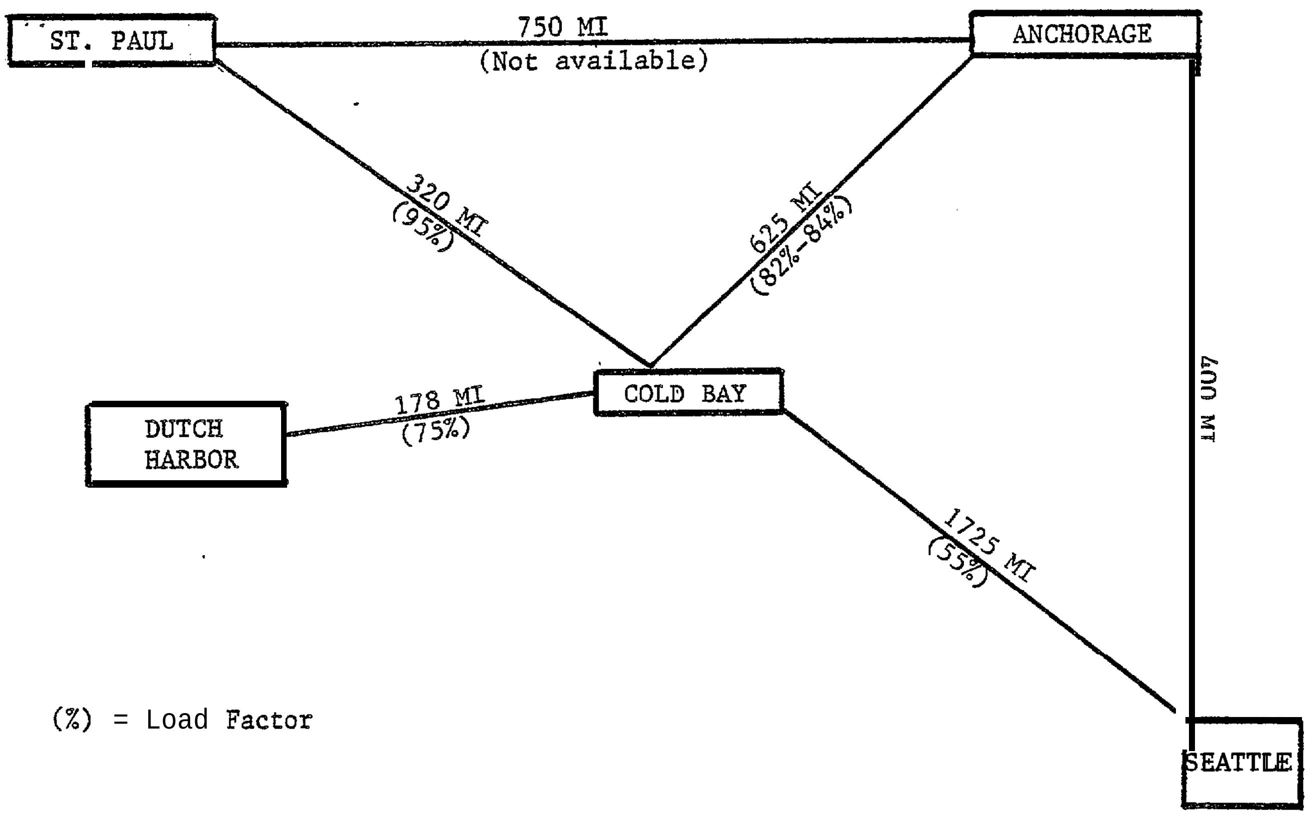
RUNWAY AND GROUND FACILITIES
COLD BAY, DUTCH HARBOR AND ST. PAUL

Community	Location	Owner	Runway Heading	Length Meters (ft)	Width Meters (ft)	Surface Type	Heliport	Terminal Building	Hangers	Fuel	Maintenance	Storage	Weather Information
Cold Bay	No town nearby	State of Alaska	8-26	1562 (5126)	46 (150)	Asphalt	Yes	Yes	No	Yes	Yes	Yes	Yes
			14-32	3174 (10,415)	46 (150)	Asphalt							
Dutch Harbor	On Amanak Island, 1 mile north of Unalaska Ferry Crossing	State of Alaska (Surface estate	12-30	1311 (4300)	30 (100)	Gravel	Yes	Yes	Yes	Yes	Yes	Yes	Yes
St. Paul	2½ miles north-east of St. Paul Village	US. National Marine Fisheries Service	18-36	1547 (5075)	46 (150)	Gravel	No	No	No	Yes	No	Yes	Yes

Sources: (1) State of Alaska, DOTPF, Division of Aviation, Airport Layout Plans;
(2) USDOT, FAA, Airport Master Record;
(3) USDOT, FAA, Ten Year Plan, July, 1979;
(4) Field visit and interview, August, 1980.

FIGURE 8

ROUTE STRUCTURE, DISTANCES AND ESTIMATED LOAD
FACTORS FOR CITY PAIRS



(%) = Load Factor

for City Pairs

Source: R. Reeve, 1980.

Cold Bay

Landing facilities at Cold Bay Airport consist of two asphalt runways: runway 8-26 is 1,562 meters (5,162 feet) long by 46 meters (150 feet) wide; runway 14-32 is 3,174 meters (10,415 feet) by46 meters (150 feet) wide. The airport is located on the west shore of Cold Bay, 625 air miles southwest of Anchorage on the Alaska Peninsula. Figure 9 shows the Cold Bay airport layout plan. The airport is owned and operated by the State of Alaska. Terminal facilities include a flight service station, quonset huts for storage and minor maintenance, a post office and general store. Fuel storage tanks are located near the city docks. The ownership and size of these tanks are: U.S. Air Force (42,000 gallons diesel); Standard Oil (75,ooo gallons diesel); and State of Alaska (22,500 gallons diesel and gasoline). In addition, Standard Oil has facilities for storing four million gallons of jet fuel.

Scheduled service to Cold Bay from Anchorage or Seattle is provided only by Reeve Aleutian Airways. From Seattle they fly three times per week in the summer and fall (May 1 to November 15) and twice per week other times of the year using Lockheed L-188 Electra aircraft. The flying time from Seattle to Cold Bay is four and a half hours. From Anchorage, Cold Bay is served twice a day, Monday through Saturday. Aircraft used on this route are either Lockheed L-188 or Nihon YS-11A. Flying time by L-188 between Anchorage and Cold Bay

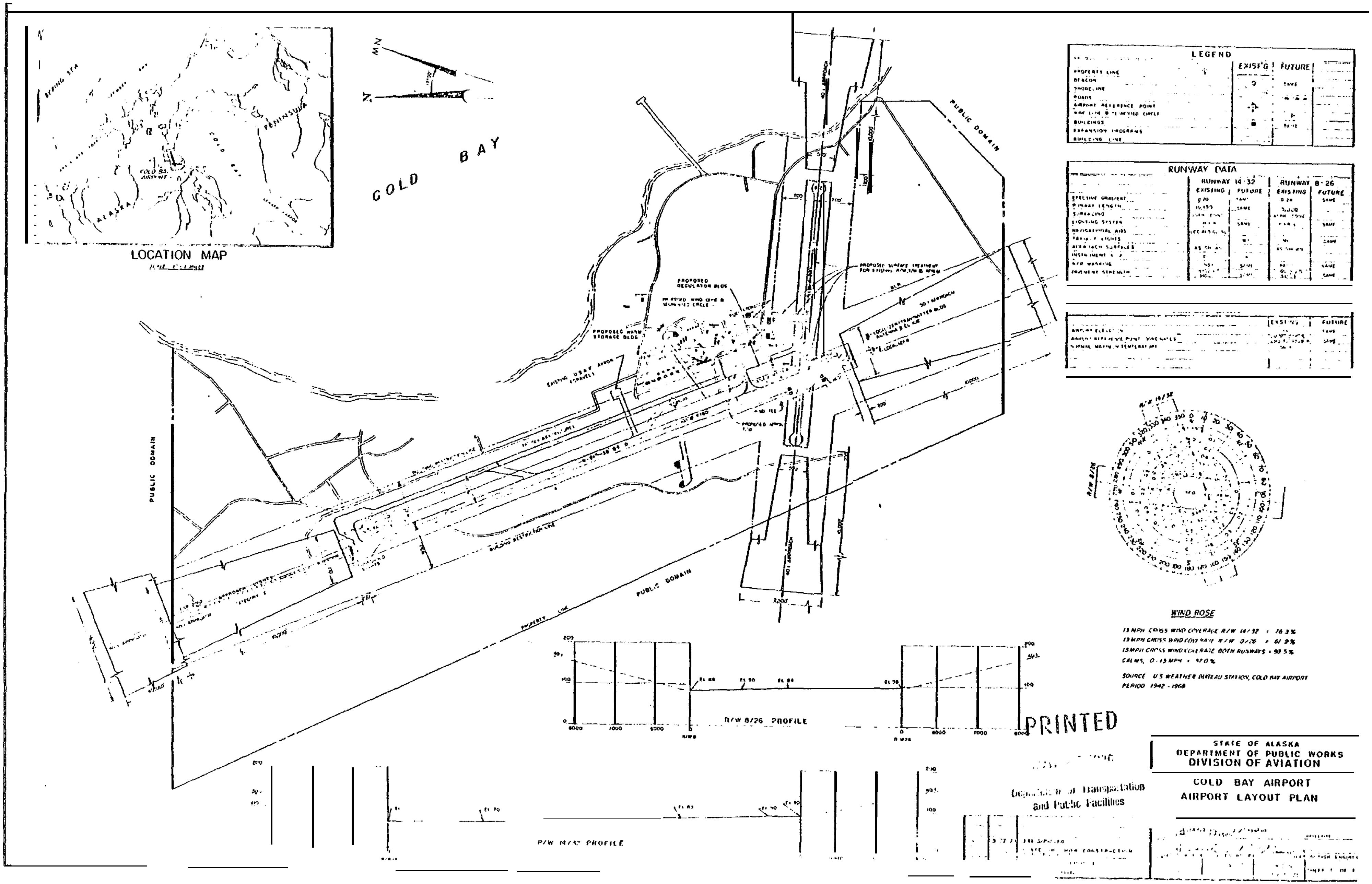


FIGURE 9. COLD BAY AIRPORT LAYOUT PLAN

is two hours. Since YS-11A flights from Anchorage to Cold Bay stop at King Salmon and/or Port Heiden and/or Sand Point, time taken by these flights is between three and a half to four and a half hours. Traffic data for the Cold Bay airport over the period 1974 to 1979 is provided in Table 24.

In addition to Reeve Aleutian Airways, Flying Tiger Service's cargo flights stop here on their way to the Orient and back. Reeve Aleutian does not have any scheduled cargo-only flights to Cold Bay from either Anchorage or Seattle.

Main air taxi services are provided by Peninsula Airways, based at Pilot Point, Airpac Inc. based at Unalaska-Dutch Harbor, and Gifford Aviation based at Anchorage.

Peninsula Airways, under contract to Reeve Aleutian, also provides scheduled service out of Port Heiden and Cold Bay. From Port Heiden they serve Chignik Lake, Chignik Lagoon, Perryville and Ivanof Bay. From Cold Bay they have scheduled service, at least once a week, to King Cove, False Pass, Akutan and Nikolski. Equipment used on these latter flights are largely amphibian planes because the communities lack adequate airport facilities. Airpac, besides having two amphibians, has one 8-passenger Conquest jet, which it flies to Anchorage.

TABLE 24

TRAFFIC DATA FOR COLD BAY AIRPORT

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	Non-Scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	6488	814.38	244.17	RV[1]	1291	195	1486	1059	910	85.93
1975	6877	338.95	301.82	RV	1251	47	1298	1138	887	77.94
1976	7942	427.93	252.33	RV	1244	56	1300	982	894	91.03
1977	9233	293.21	182.71	RV	1021	11	1032	961	821	85.43
1978	10436	240.77	177.13	RV	1146	7	1153	949	925	97.47
1979	21216	398.25	327.91	RV	1272	13	1285	1137	1080	94.98

[1] RV = Reeve Aleutian Airways

Source: CAB Airport Activity Statistics, Annual

In 1980, the CAB tentatively granted rights for a number of airlines to initiate service to the Aleutians and the Pribilofs, and their consideration of other requests for similar routes may increase service to Cold Bay, Unalaska-Dutch Harbor and St. Paul. Airlines desiring to provide service to Cold Bay and Unalaska-Dutch Harbor include Great Northern Airlines and Kodiak-Western Alaska Airlines. Klondike Air and Peninsula Airways would also like to provide scheduled service in this market but they must undergo "fitness" hearings before being granted the rights they seek. These hearings were completed last year. The right to fly to Cold Bay has been granted to Kodiak-Western Alaska Airlines and Great Northern, the latter of which recently merged with Alaska International Airways. Beginning November 1, 1980, Great Northern was scheduled to provide all cargo service three times a week between Anchorage, Cold Bay and Dutch Harbor using Hercules aircraft. Subsequently, Great Northern has closed its Unalaska operations.

The breakdown of 8000 operations for FY 1978 for the Cold Bay Airport is as follows:

Air Carriers	25 percent
Air Taxi	13 percent
General Aviation	50 percent
Training (Touch and Go)	12 percent
	100 percent

The capacity of the Cold Bay airport in terms of aircraft operations per hour and per annum can be calculated from the runway configuration, which is divergent and intersecting. Based on theoretical calculations as reported in Horonjeff (1975), the runway configuration should be able to support 55 operations per hour in good weather conditions. Since one runway has all-weather capabilities and approach lighting, presumably the airport can operate 24-hours a day. Thus, without any adjustments for weather, aircraft mix, or other items, daily capacity could be as high as 1,320 operations and annual capacity as high as 481,800 operations. During the summer months, when IFR conditions exist 40 percent of the time, daily operations are greatly reduced, perhaps to 792 operations per day or less (i.e., to 60 percent of normal). Since other airports in the region are restricted to VFR conditions, aircraft operations at Cold Bay tend to concentrate in the daylight hours. In the winter with only seven hours of daylight, daily capacity might be constrained to 385 operations; in the summer months with 16 or more hours of daylight, daily capacity might be constrained to only 880 operations.

In its Ten Year Plan for Alaska, the FAA has forecast increases of 50 percent in air carrier operations and 100 percent in air taxi operations between FY 1978 and FY 1990. Through FY 1990, FAA has recommended construction of a new terminal and acquisition of a CFR (Crash and Fire Rescue) vehicle. Air navigation and air traffic control facilities planned through 1990 include an ODAL (omnidirectional approach lighting system) on Runway 14-32.

Major limitations of the Cold Bay Airport are due to climatological factors and the characteristics of airport facilities and services. Cold Bay's climate is maritime with not much variation between mean maximum and minimum temperature (see Figure 5). On an annual basis the sky is overcast or obscured 50 percent of the time. Generally, visual flying (VFR) is not possible twenty percent of the time. In the three summer months, fog is frequent and VFR conditions exist about 60 percent of the time or less. Strong and hazardous winds (28 knots or higher) occur year-round but are most frequent in fall and winter when conditions for flying otherwise are most favorable. Limitations of airport facilities and services include a poor fire fighting system largely due to inadequate water supply. The fire fighting force consists of voluntary personnel. Medical facilities are non-existent.

Unalaska-Dutch Harbor

Figure 10 illustrates the airport layout plan for Unalaska-Dutch Harbor. The airport is located approximately 1,287 kilometers (800 miles) southwest of Anchorage and approximately 282 kilometers (175 miles) west of Cold Bay. It is presently classified as part of the state system of secondary airports. The airport is located on

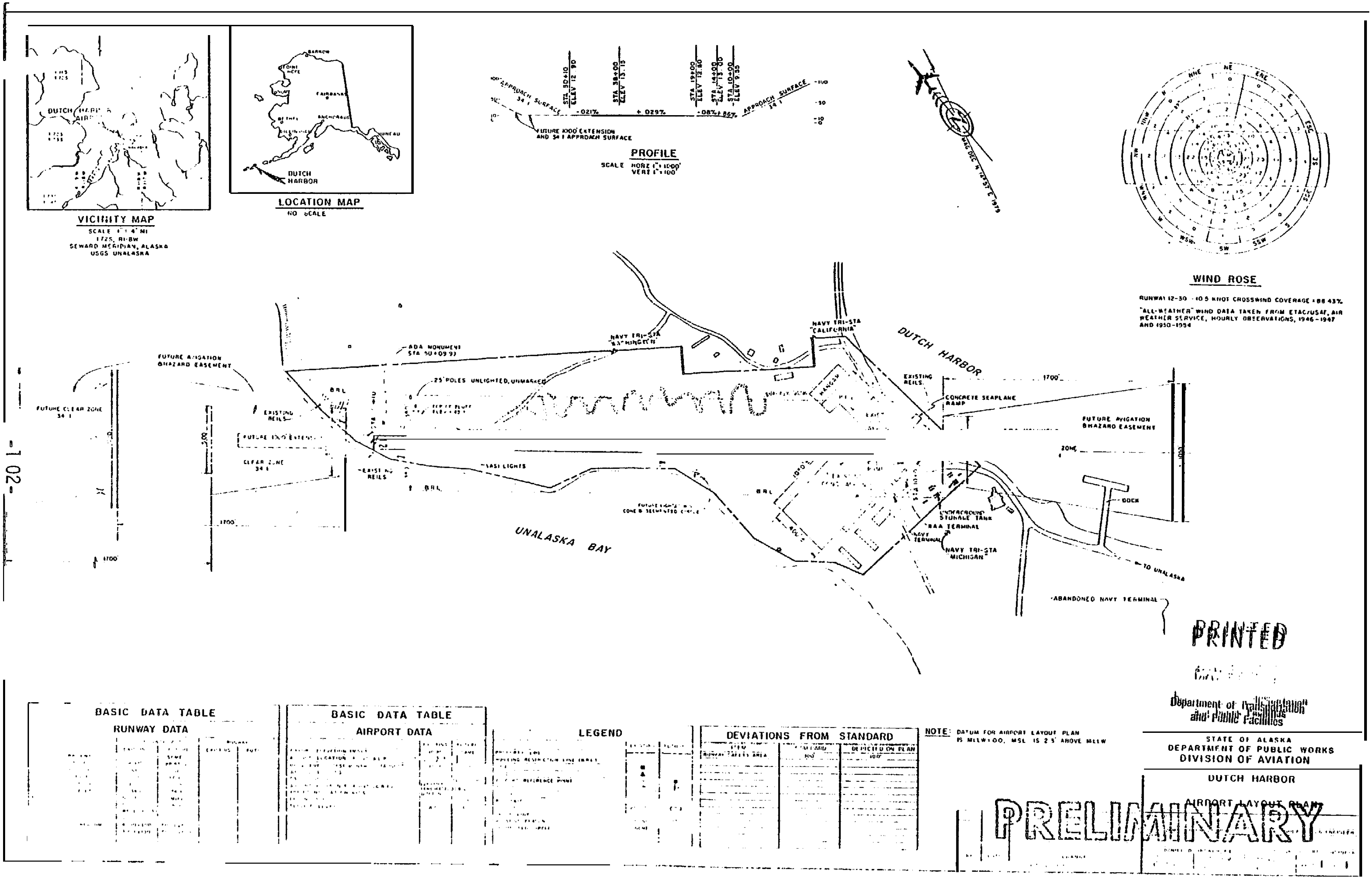


FIGURE 10. UNALASKA-DUTCH HARBOR AIRPORT LAYOUT PLAN

Amaknak Island, which is adjacent to Unalaska Island. The airport is within the city limits of Unalaska. The existing gravel runway is 1,311 meters (4,300 feet) long by 30 meters (100 feet) wide and was originally built by the Navy during World War II. Traffic data for the Unalaska-Dutch Harbor airport are shown in Tab"le 25. The air port has several limitations. Among these, the main one is that the length of the single runway precludes it from handling larger aircraft. Extension of the runway would be expensive because it would mean extending over filled land. Another limitation is the safety hazard created by the 75 to 85 foot high bluff located approximately 100 feet northeast of the runway centerline. Further, the mountainous terrain on Amaknak and other nearby islands create navigational hazards, especially during poor visibility conditions. Taking off southeast from the runway is particularly hazardous due to a mountain located on Unalaska Island about one and a half miles from the end of the runway.

The theoretical capacity of the Unalaska-Dutch Harbor airport is guided by the fact that it is a single runway with no taxiway and that it is generally restricted to VFR conditions. A single runway with no restrictions can theoretically handle somewhere between 45 and 60 operations per hour (Horonjeff, 1975). The lack of a taxiway reduces these limits to half their values and VFR conditions further reduces operations to a '7-hour (winter) or 16-hour (summer) period.

TABLE 25

TRAFFIC DATA FOR DUTCH HARBOR AIRPORT

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	I'Jon-Scheduled Service	All Services	Departures Scheduled	Scheduled Departures *Completed*	Percent of Departures Scheduled
1974	3878	65.49	37.17	RV [1]	316	18	334	312	253	81.08
1975	3947	101*33	37.99	RV	359	12	371	325	257	79.07
1976	5711	116.32	38.35	RV	391	34	425	340	306	90.00
1977	7227	89.49	39.42	RV	3s0	5	385	364	292 .	80.21
1978	8565	65.73	40.36	RV	405	1	406	317	288	90.85
1979	11666	68.11	41.22	RV	518	5	523	401	375	93.51

[1] RV = Reeve Aleutian Airways

Source: CAB Airport Activity Statistics, Annual

Weather minimums also reduce operations, perhaps as much as 40 percent in the summer. If the lower theoretical value of 45 operations is used in the calculations, daily capacity is about 158 operations in the winter and 144 operations in the summer. If the higher theoretical capacity is used, daily capacity ranges from 210 operations in winter to 192 operations in summer. From all of these, a mean average capacity of 176 daily operations and 64,240 annual operations results.

Facilities at the airport include an old terminal building, now exclusively used by Reeve Aleutian Airways. Other facilities include a hangar, half of which is presently occupied by a tenant and the other half is being held vacant pending a Coast Guard offer to occupy. There is an underground storage tank for fuel.

Major scheduled passenger service to Dutch Harbor, from Anchorage via Cold Bay, is provided daily, except Sunday, by Reeve Aleutian Airways. There also is a scheduled cargo flight from Anchorage, via Port Heiden, every Wednesday. For both the passenger and cargo scheduled flights aircraft used are Nihon YS-11's. Flight time between Anchorage and Dutch Harbor is approximately four hours and between Cold Bay and Dutch Harbor about 55 minutes on a YS-11.

Other schedule and/or charter services from Unalaska to outlying Aleutian villages such as King Cove, Akutan and False Pass are provided by amphibian aircraft owned by Peninsula Airways, headquartered at Pilot Point. Peninsula Airways also holds the portal services contract for smaller Aleutian communities.

Air taxi services to Dutch Harbor are provided by air taxi services based at Sand Point. Charter services to Dutch Harbor are also available at Anchorage. No data is available on number of total aircraft operations at Dutch Harbor airport, although Reeve had 518 scheduled and 5 nonscheduled departures in 1979 for at least 1,046 operations.

The airport has several limitations that affect its utilization. The relatively short runway length is the major limitation to increased traffic at Dutch Harbor. Intrusion on the northside bluff into the shoulder of the runway is also considered a significant obstacle and FAA in its ten year plan has recommended its removal. Standing water on the runway is another major problem that has caused at least one crash of a Learjet in December 1979. In addition to these man-made problems, Unalaska-Dutch Harbor, like Cold Bay, possesses climatological problems that reduce visibility and disrupt scheduled services.

Several proposals have been studied by DOT/PF to realign the runway or extend it to a total length of 1,829 meters (6,000 feet) (Dames & Moore, 1980). The City of Unalaska has received an appropriation of $2.1 million from the State of Alaska for preparation of construction drawings and specifications for a 518 meter (1,700 feet) extension of the runway. The City anticipates submitting a request to the legislature for an appropriation of approximately $25 million in February 1982. If funded, the City foresees construction to be completed by October 1983. The extended runway would allow 727/737 jet aircraft to use the facility, however aircraft loads are likely to be limited due to mountains east of the airport, which affect the turning radius available to aircraft on takeoffs to the east. The proposed extension of the runway would include removal of the bluff obstacle and resurfacing of the runway.

In addition to recommending removal of the bluff obstacle, FAA has recommended in its ten year plan improving the runway lighting, distance measuring equipment (DME) and visual approach slope indicator (VASI); and has identified construction of new terminal building as a needed improvement.

St. Paul

St. Paul airport has a 1,547 meter (5,075 feet) long by 46 meters (150 feet) wide runway constructed during World War II. It is surfaced with hard-packed volcanic materials (scoria) and cannot accommodate jets. The airport is currently owned by the U. S. National Marine Fisheries Service.

Figure 11 illustrates the airport layout plan for St. Paul. The airport is located about 4.3 km (3 miles) northeast of the community of St. Paul and 362 km (225 miles) northwest of Cold Bay. Traffic data for the St. Paul airport are shown in Table 26, No data on the number of total aircraft operations are available for the St. Paul airport, although Reeve had 86 scheduled and 3 nonscheduled departures in 1979 for at least 178 operations. The theoretical capacity of the St. Paul airport is similar to that of Unalaska-Dutch Harbor.

The airport's main limitation has to do with climate (see Figure 7). The climate of St. Paul Island is largely controlled by the cold waters of the Bering Sea. The mean monthly temperature varies from a low of about 19°F in February to a high of about 51°F in August. Heavy fog is prevalent from May through August. Flying under VFR conditions is possible less than 35 percent of the time in summer and up to 82 percent of the time from October through December. When ceiling and visibility are most favorable for flying, strong and gusty winds are most likely to occur.

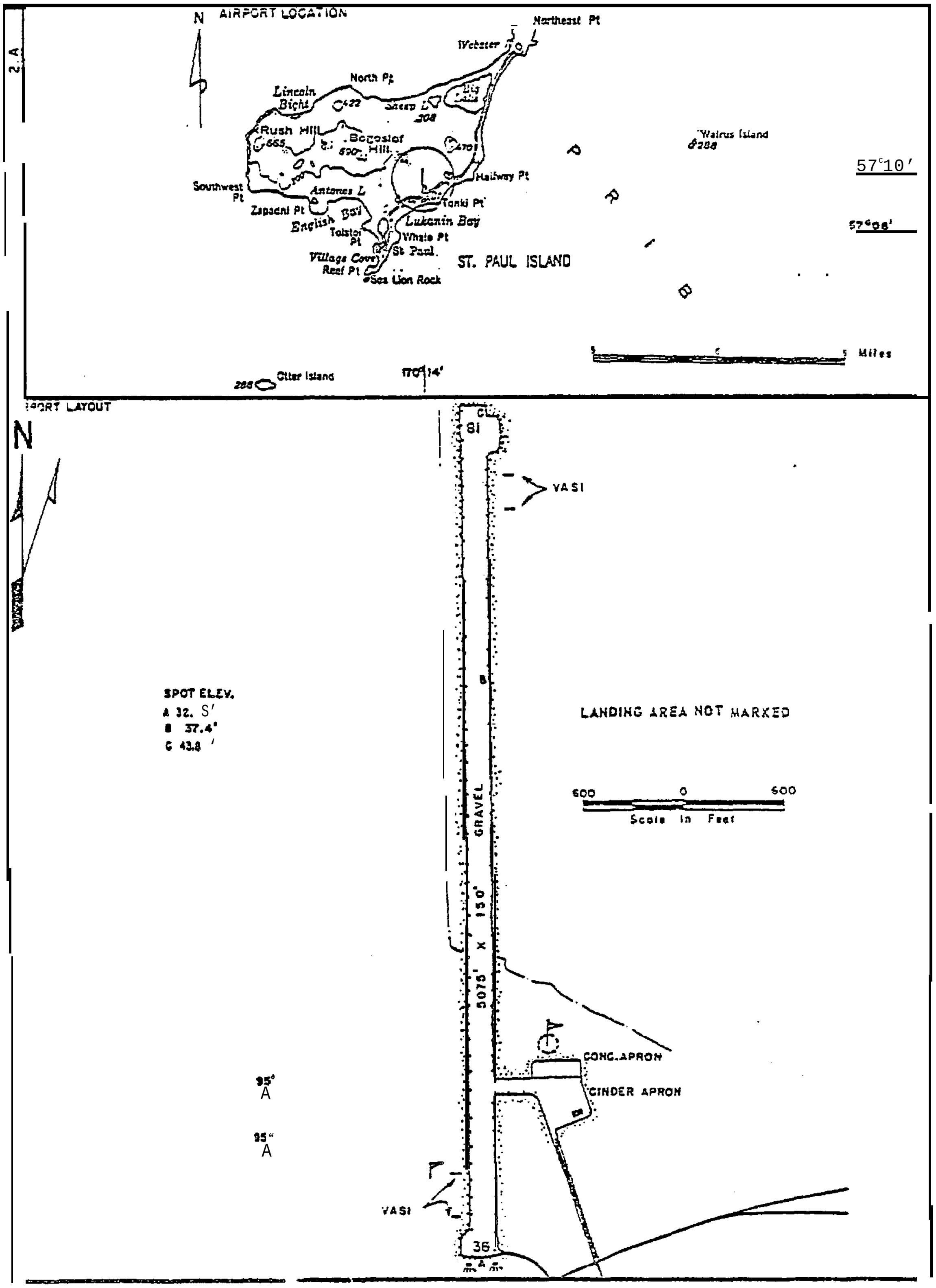


FIGURE 11

AIRPORT LAYOUT PLAN - ST. PAUL, ALASKA

TABLE 26

TRAFFIC DATA FOR ST. PAUL AIRPORT

Year	Enplaned Passengers	Freight (Revenue Tons)	Mail (Revenue Tons)	Airline	Scheduled Service	Non-Scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	1329	28.23	31.34	RV[1]	83		83	89	83	93.25
1975	1505	14.47	25.90	RV	76		76	75	72	96.00
1976	1994	27.26	30.08	RV	82	3	85	79	74	93.67
1977	2083	23.95	25.57	RV	83	1	84	80	73	91.25
1978	2080	10.73	19.98	RV	81	2	83	78	69	88.46
1979	2335	23.67	17.67	RV	36	3	89	81	78	96.29

[1]RV = Reeve Aleutian Airways

Source: CAB Airport Activity Statistics, Annual

There is no terminal building or hangars at the airport and no maintenance or repair facilities. Fuel is available only from National Marine Fisheries Service. The runway is equipped with medium intensity lights, a rotating beacon, a lighted windsock, an approach light system and a nondirectional beacon.

Scheduled passenger service is provided three times a week by Reeve Aleutian Airways. Flying time from Cold Bay is one hour and ten minutes. Equipment used on this run is the L-188 Electra. From St. Paul the aircraft flies directly to Anchorage a distance of about 1,207 kilometers (750 miles).

Charter flights to St. Paul are available from many operators (the main one being Peninsula Airways) providing a variety of load capabilities, prices and aircraft types.

FAA's ten year plan recommends construction of a new terminal building, paving the runway, and construction of a new apron and stud turnway. Approach aids proposed are medium intensity approach lighting system (MALSF) on runway 36, visual approach slope indicator (VASI) on 18-36, and distance measuring equipment (DME).

Anchorage International Airport

This facility handled 236,000 operations (landing and take-offs) in

1976 which is 77 percent of the capacity estimated in the 1971 Master Plan (Quinton-Budlong, 1971). Since then a new north-south runway has been constructed to accommodate larger jets in cross-wind conditions and to alleviate aircraft noise impact east of the airport by placing the majority of aircraft operations over water. The completed runway raises the airport operational capacity to 334,000 operations, a 9 percent increase. The runway will be used primarily for air carrier arrivals and one of the east-west runways will be used for air carrier departures. The three existing asphalt runways include two that are greater than 3,048 meters (10,000 feet) in length.

During 1976, enplaned passengers totaled 944,467. Certified air carriers accounted for 86.4 percent, commuter services for 10.2 percent, and international carriers for the remaining 3.4 percent of the enplanements (Moore, 1978). In 1979, passenger enplanements were approximately 1.12 million persons. The Alaska Department of Transportation and Public Facilities (ADOT/PF) is forecasting 3.6 million enplanements and 3.2 million through passengers for its current airport master plan. No specific horizon year is specified in the plan, although ADOT/PF expects these levels of passenger movements to occur by 1995 or 2000 (ADOT/PF, 1981).

The facility serves an important role in moving freight and passengers to, from, and within Alaska. In 1976, throughput tonnage at the airport amounted to 107.8 thousand metric tons (118.8 thousand tons), which was 11.1% of the Port of Anchorage's throughput for general cargo in that year. By 1979, cargo entering or leaving Anchorage reached one-quarter billion pounds (125 thousand tons) and is forecast by ADOT/PF to reach 1.1 billion pounds (550 thousand tons) by 1996. Transiting cargo, which in 1979 was about 1 billion pounds (500 thousand tons), is forecast to reach 6.2 billion pounds (3.1 million tons) in 1996.

AIR TRANSPORTATION OPERATORS

Air Carriers

The Alaska Transportation Commission (ATC) regulates all common air carriers operating within the State of Alaska and jointly regulates with the Civil Aeronautics Board (CAB) those carriers that operate interstate routes.

The only air carrier presently servicing Cold Bay, Dutch Harbor and St. Paul is Reeve Aleutian Airways. As mentioned earlier, the CAB has tentatively granted Great Northern Airlines (freight only) and Kodiak-Western Airlines to operate to Cold Bay and Dutch Harbor. Klondike Air and Peninsula Airways has also requested permission to operate scheduled passenger service to these points. Great Northern, which merged with Alaska International, was to commence all-cargo flights to Cold Bay and Dutch Harbor on November 1, 1980 using Hercules aircraft, but has subsequently dropped that service.

Air Taxi

Air taxi carriers operate from fixed bases of operation that are specified in their operating rights.. Although most operate aircraft with certified gross take-off weights less than 5,670 kilograms (12,500 pounds), the ATC has authority 'to grant air taxi certificates to operators having larger aircraft. Operators must provide "safe, adequate, efficient, and continuous service from and maintain bases of operation at listed locations (in their operating rights)" (Alaska Transportation Commission, 1978). Air taxi operators specialize in serving locations inaccessible by highway. Examples of air taxi operators serving this area are Sand Point Air Service based at Sand Point, Peninsula Airways based at Pilot Point, Air Pac based at Dutch Harbor, and Gifford Aviation based at Anchorage.

Contract Carriers

Contract carriers are private for-hire carriers which are not generally restricted by location in their operating authorities. They operate under one or more contracts of a continuing nature for a limited number of persons (charter) or perform a specialized service for specific individuals or concerns. The principal contract carrier in the study area is Peninsula Airways.

Scheduled Carriers

Scheduled carriers offer services to the public generally and operate aircraft between paired points. The primary source of revenue is individual passenger fares of per pound cargo rates. The Alaska Transportation Commission has only one category of scheduled carriers, but the CAB makes a distinction between major trunk airlines and commuter services. - Commuter services are considered to fly aircraft with gross weights less than 5,670 kilograms (12,500 pounds), and trunk airlines are those that offer flights greater than 805 kilometers (500 miles), usually with jet service.

Trunk Airlines. As stated previously, Reeve Aleutian Airlines is the only trunk airline operating scheduled service in the area, Due to airline deregulation, at least three other airlines would like to enter this market.

Commuter Airlines. There is no commuter airline providing service to Cold Bay, Dutch Harbor or St. Paul at the present time.

EQUIPMENT OPERATIONS

The only airline operating in the study area (Reeve Aleutian Airways) uses mainly the Nihon YS-11A and L-188 Electra for their scheduled passenger and cargo service. Traffic data by type of aircraft for the three communities of interest are shown in Table 27. The YS-11A has a capacity of 44 passengers, whereas the L-188 can carry up to 91 passengers. For cargo-only flights Reeve uses the YS-11A.

TABLE 27

1978 TRAFFIC DATA BY TYPE OF AIRCRAFT, BY CARRIER, BY AIRPORT FOR COLD BAY, DUTCH HARBOR, AND ST. PAUL

Airport	Carrier	Type of Aircraft	Scheduled Service	Non-Scheduled Service	All Ser
Cold Bay	RV	C-46 Series (Discontinued in 1980)	84	3	
		DC-6	8	1	
		Ys-11	729	1	
		L-188A/C	325	2	
		All Types	1146		
Dutch Harbor	RV	C-46 Series	41		
		YS- 11	362	1	
		L-188A/c	2		
		All Types	405	1	
St. Paul	RV	DC-6	1	1	
		L-188A/c	76	1	
		YS-11	4		
		All Types	81	2	

Notes:

(1)

Model	Manufacturer
C-46	Curtiss
DC-6	Douglas
YS-11	Nihon
L-188A/c	Lockheed

(2) RV = Reeve Aleutian Airways

Source: CAB, Airport Activity Statistics

Cargo capacity of YS-11A is 11,000 to 13,000 pounds. Cargo rates charged by Reeve Aleutian is $1 per ton-mile.

REGULATIONS

The Federal Aviation Administration within the U.S. Department of Transportation, through its flight standards program, "promotes safety of flight of civil aircraft in air commerce by assuring the airworthiness of aircraft, the competence of airmen, the accuracy of navigational aids and the adequacy of flight procedures in air operations, " (Federal Aviation Administration, 1979). To accomplish these goals, its personnel inspect, evaluate, review and certify as appropriate, aircraft, air carriers, general aviation activities, and navigational aids. Also, FAA provides a large percentage of funds used in Alaska to upgrade runways and landing aids at airports. Grants can be provided to either the State of Alaska or local governments or other eligible politics"l subdivisions. The State of Alaska Department of Transportation has jurisdiction over the Cold Bay, Dutch Harbor and St. Paul airports.

Fares and routes fall under the jurisdiction of the Civil Aeronautics Board for interstate carriers and the Alaska Transportation Commission for intrastate carriers, In the spring of 1979, decisions were made in the West Coast Service Investigations, and additional routes were authorized for all certified carriers which were a party to the investigations. The Board's policy of deregulation is designed to increase service yet, at the same time, maintain acceptable profits for the carriers. Guidelines are being established which will guarantee essential service to small communities. Communities served by none or one certified air carrier would be eligible for subsidies. For planning purposes, the CAB recognizes Anchorage, Fairbanks, and Juneau as the State's transportation hubs.

Interstate air freight transportation has been deregulated by the CAB; deregulation of interstate air passenger transportation is proceeding on a five-year timetable.

TECHNOLOGY

Table 28 shows the service characteristics of scheduled carriers serving the study area. The data show the impact that technology has on the level of service as distance. increases. For the Seattle to Cold Bay link, Reeve Aleutian charges passengers 8.82 cents per kilometer (14.2 cents per mile) compared to 21.13 cents per kilometer (34 cents per mile) between Cold Bay and St. Paul, a'lthough the equipment (L-188) used for both links is the same. Generally, as distance increases, unit distance cost drops.

Northwest Orient's fare to Chicago from Anchorage represents a cost of 4.7¢/km (7.5¢/mi), which is between one-fourth and one-fifth of

TABLE 28

CHARACTERISTICS OF SCHEDULED SERVICE
BY REEVE ALEUTIAN AIRWAYS
IN THE ALASKA PENINSULA AND ALEUTIAN ISLANDS

Link	Carrier	Kilometers	Miles	One way Coach Fare ($) 1/	cost ¢/Km	¢/Mile	Time Elapsed Hours	Minutes	Average Speed (mph)
Seattle - Cold Bay	Rv	2776	1725	245	8.82	14.20	5 hrs.	30 min.	314
Anchorage - Cold Bay	RV	1006	625	182	18.10	29.12	2 hrs.		313
Cold Bay - Dutch Harbor	RV	282	178	54	19.18	30.86		55 min.	191
Cold Bay - St. Paul	RV	483	320	102	21.13	34.00	1 hr.	10 min.	257
St. Paul - Anchorage	RV	1207	750	253	20.97	33.73	2 hrs.	20 min.	321

NOTES : 1/ These fares were in effect in November 1980 and have increased since.

Source: James Lindsay and Associates, 1980.

what Reeve charges for the Cold Bay - St. Paul trip. Jumbo jet aircraft, with their large capacities and efficiency at high altitudes, provide fast and economical service for long distances. Aircraft used by commuter airlines are unable to compete economically at medium or long distance when adequate demand exists.

Major trunk carriers, because of the long distances they serve, can benefit from new generations of aircraft that have increased performance and lower operating costs. The purchase of these new aircraft in large part depends on the airline's financial capacity.

Technology improvements are occurring in rotary wing as well as fixed wing aircraft. Boeing-Vertol is marketing the commercial version of its Chinook helicopter developed originally for the military. Fitted for passenger use, it has a capacity of 44 passengers and a range of 982 km (600 miles). Firm orders have already been received for use in transporting personnel to and from platforms in the North Sea. The cargo version has a shorter range, but it has lifting capability of up to 12.7 metric tons (14 ST) (Louis Berger & Associates, 1979).

According to the WAATS study, major breakthroughs are not expected in aviation technology which could have a significant impact on aviation in western Alaska. However, modest improvements in short take-off and landing (STOL) capabilities are expected to continue, along with a slow but steady improvement in aircraft operating characteristics and economy. It is probable that increased application of existing technologies in terms of ground-to-ground communications and weather reporting will have greater impact on increased aircraft utilization, economy and reliability of service in western Alaska than will new technologies.

IV. BASE CASE

Introduction

The base case is an important facet of the impact assessment process because it provides a foundation upon which transportation demands and facility requirements of each of the St. George Basin oil and gas scenarios can be added and to which the resultant conditions can be compared. As explained in the Methodology (Appendix B), the base case portrays a future situation that might occur if the St. George Basin sale is not held and existing trends and conditions continue. The base case is not a non-OCS case because the economic and population forecasts reflect OCS activities associated with lease sales occurring prior to the St. George Basin sale in other areas of the state.

The base case represents a conservative perspective in that no particular response to events is presumed on the part of the transportation industry, affected communities, or public regulatory agencies. Any addition to or improvement of existing conditions, including routes or services, is not considered in development of the base case unless funds are already committed or the improvement appears in a capital improvement program and will likely be funded. Projects identified as being needed, but which are not committed for implementation, are cited and discussed as part of the presentation of relevant issues for each transportation mode.

Economic Factors Affecting Growth

One inherent assumption in this study is that changes in demands for transportation services come about as a result of changes in economic activities. This section briefly describes some of the more significant economic factors that are expected to influence growth in the Aleutian-Pribilof region in the absence of proposed OCS activities in the St. George Basin. The material contained in this section reviews the economic activities at the state, region, and community levels as developed by others. Specifically, this material draws on the work of the University of Alaska, Institute of Social and Economic Research (U of AK, ISER, 1981) and Alaska Consultants, Inc. (ACI, 1981). A more detailed discussion of this material can be found in these references.

REGIONAL AND RELATED STATEWIDE GROWTH

The economic forecasting methodology used to develop the base case, as well as the OCS cases, revolves about the assumption that the regional economy is influenced by statewide and regional events and special projects that affect basic sector employment and by the expenditure patterns of state government. The methodology also assumes that basic sector employment affects secondary or supporting services employment and that both basic and secondary employment affect population. The economic model comes full circle by also assuming that employment and population affect government spending patterns. In this discussion, however, we want to focus on: the major statewide and regional events and projects affecting basic employment, particularly those that might also affect regional transportation demands; state government expenditure patterns; and the ultimate effect all of the economic factors have on total regional employment and population.

Statewide Growth

At the statewide level,- the most significant changes are expected to occur in the mining, agricul ture-forestry-fisheries, manufacturing, and construction sectors. The mining sector (which is dominated by the petroleum industry) is assumed to continue to be a major factor in statewide growth. Mining sector projects assumed to have an effect on statewide growth "include: continued onshore development of Prudhoe Bay and the Kuparik formation; ancillary improvements to the TAPS Line, including the addition of several pumping stations] construction of the Northwest Gas Pipeline; continuing development of the existing Kenai fields, particularly for gas resources; development of Beluga coal field production for export purposes; and development of federal OCS petroleum resources in the Beaufort Sea, Eastern Gulf of Alaska, Lower Cook Inlet, and Bering-Norton lease sale areas.

In the agricul ture-forestry-fisheries sector, which is, in reality, three distinct subindustries representing Alaska's renewable resource industries, fishing holds the greatest promise for the future. The major determinant of future increases in fisheries employment will be expansion of the Alaska bottomfish industry. Since a domestic bottomfish industry has been enhanced through creation of the 200 mile limit, it is assumed the fishing industry will undergo rapid expansion. Consequently, total employment in fishery more than doubles over the projection period, while employment in fish processing (which is in the manufacturing sector) expands by 259 percent. The domestic fishery is assumed to completely replace the foreign fishery operating within the 200 mile limit by 2000 and is expected to expand to catch the allowable biological catch (U of AK, Sea Grant, 1980; E.R. Combs, Inc., 1981). It should be noted that not all fishery-related employment is assumed to have full economic impact on the state and regional economy. Some boats and crews may be from outside the state and only fish Alaska waters; these crews have limited impact on the economy. Similarly, processing employees brought in from outside the state have little statewide economic effect. However, as discussed later in this chapter, these transient fishermen and processing employees do affect the regional aviation system.

In addition to growth derived from increased seafood processing, the manufacturing sector at the statewide level is expected to change due to growth in the petrochemical industry and in the lumber-wood-paper-pulp industry group. The petrochemical industry, which currently consists of the developments in Kenai, is assumed to expand with construction of the Pacific liquid natural gas (LNG) facility, as currently planned, and development of a new petrochemical facility that uses the state's royalty oil and gas. The lumber-wood-paper-pulp industrial group is expected to grow because of an assumed 50 percent increase (over the 1970 level) in the Forest Service's allowable annual cut and because of expected changes in Japanese market conditions.

Growth in the state's construction sector is largely due to the special projects mentioned above, including construction of bottomfish processing facilities. In addition to the-Northwest gas pipeline and a new petrochemical facility, another major construction project is the Susitna Dam and hydro-electric project.

Some growth is also expected in state and federal employment, transportation employment, and state capital expenditures. The federal government employment is expected to expand slowly following traditional low levels of growth. Transportation sector employment is expected to respond to the demands of the special projects and secondary growth requirement. Growth in state government and capital project expenditures, however, largely depend upon state fiscal policy, which can have a far-reaching effect on the subregions of the state.

Over the period of study, state government will receive revenues from oil development which far exceed current levels of expenditure. The rate at which the government chooses to spend these revenues (or to offset existing revenue sources with them) will serve to determine direct employment in the government sector and, through the multiplier effects of such expenditures or tax reductions, will produce impacts on all endogenous sectors, affecting the growth of employment, income, prices, and migration into the state. In addition, increasing levels of economic activity, as forecast for other sectors of the state's economy, generate new demands for government services. As prices and population rise, increased expenditure is required to simply maintain services at a constant level.

Two factors affect current state policy: First, revenues have already overtaken expenditures as a consequence of the onset of oil production from Prudhoe Bay and will continue to increase as a consequence of both increased production and price increases. Second, establishment of the Permanent Fund places constitutional constraints on the use of at least 25 percent of certain petroleum revenues, particularly mineral lease rentals, royalties, royalty sale proceeds, federal mineral revenue sharing payments, and bonuses received by the state. Based on the past performance of the state, the SESP assumes that state expenditures will rise within the bounds set by revenue quantities and statutory constraints. Since the range of possibilities within these bounds is very large, a middle-range policy was selected. This policy is set midway between maintenance of expenditures at existing levels and operation at a level in which only the legislated minimum is saved (see U of AK, ISER, 1981).

Regional Growth

In the Aleutian-Pribilof region, economic activities are expected to continue to revolve about the fishing industry. Historically, the economy of the region has been almost totally dependent upon fish harvesting and processing. Regional economic activities during the forecast period are expected to include rapid development of the bottomfish industry, construction activities associated with on-shore bottomfish processing facilities, some continued growth early in the period of traditional shellfish and salmon fishing activities, and expansion of state and local government in response to regional growth. Federal government military-related employment, currently concentrated at Shemya and Adak, is expected to remain at current levels throughout the forecast period. As a consequence, military-related employment will decline in relative importance from both an economic and demographic perspective.

Since virtually all of the growth in the Aleutian-Pribilof region is expected to come from bottomfishing activities, it is useful at this point to digress momentarily to explain the expected changes in bottomfishing. This information is also useful in understanding changes to marine and aviation transportation demands presented later in this chapter. The advent of the 200 mile commercial limit presented a unique opportunity to United States fishermen to become involved in the bottomfish (or groundfish) industry, which has heretofore been dominated by foreign fishermen. Two of the most prolific groundfish fisheries are the vicinity of the Aleutian Islands and in the Bering Sea area between the Aleutian Islands and St. Matthew Island (171° W and 60.5° N). In 1978, the foreign fleet catch in the Bering Sea and Aleutians area was 1.34 mil lion metric tons (E. R. Combs, 1981). By the year 2000, 1.7 million metric tons of groundfish are forecast to be harvested in the Bering Sea and Aleutians area (U. of AK, Sea Grant, 1980). More important than this growth is the anticipation and assumption that, because of the 200 mile limit, a U.S. groundfishing fleet will replace the foreign fleet in this area between now and 2000. This replacement has great implications for regional growth since the U.S. fleet, as well as needed processing facilities, for the most part does not currently exist.

Growth of the U.S. groundfish industry in the Bering Sea/Aleutians area is expected to follow an "S" shaped growth curve between 1981 and 2000. It was assumed that half of the expected bottomfish harvest would be processed in on-shore plants serviced by a fleet of trawlers, and half would be processed off-shore by catcher-processor vessels. Table 29 shows expected changes in the bottomfish harvest by year, together with respective changes in on-shore and off-shore related physical plant, vessels, and employment. Of major significance to future transportation demands is the increase in groundfish employment to 17,814 in 2000 from zero in 1981.

TABLE 29

EXPECTED GROWTH IN GROUNDFISH ACTIVITIES
BERING SEA ALEUTIAN ISLANDS AREA
1981-2000

		ONSHORE PORTION					OFFSHORE PORTION		
YEAR	BOTTOMFISH HARVEST (1,000 m.t.)(2)	NUMBER OF TRAWLERS(3)	HARVEST EMPLOYMENT(4)	NUMBER OF ONSHORE PLANTS(5)	PROCESS EMPLOYMENT(6)	TOTAL EMPLOYMENT	NUMBER OF CATCHER-PROCESSORS(7)	EMPLOYMENT(8)	TOTAL EMPLOYMENT
1981	0	0	0	0	0	0	0	0	0
1982	50	9	54	1	606	606	3	240	900
1983	100	19	114	1	606	720	5	400	1,120
1984	150	28	168	1	606	774	8	640	1,414
1985	200	37	222	2	1,212	1,434	11	880	2,314
1986	250	46	276	2	1,212	1,488	14	1,120	2,608
1987	350	65	390	3	1,818	2,208	19	1,520	3,728
1988	450	83	498	4	2,424	2,922	25	2,000	4,922
1989	600	111	666	5	3,030	3,696	33	2,640	6,336
1990	750	139	834	6	3,636	4,470	41	3,280	7,750
1991	900	167	1,002	8	4,848	5,850	49	3,920	9,770
1992	1,000	185	1,110	8	4,848	5,958	55	4,400	10,358
1993	1,150	213	1,278	10	6,060	7,338	63	5,040	12,378
1994	1,300	241	1,446	11	6,666	8,112	71	5,680	13,792
1995	1,350	250	1,500	11	6,666	8,166	74	5,920	14,086
1996	1,400	259	1,554	12	7,272	8,826	77	6,160	14,986
1997	1,500	278	1,668	13	7,878	9,546	82	6,560	16,106
1998	1,600	296	1,776	13	7,878	9,654	88	7,040	16,694
1999	1,650	306	1,836	14	8,484	10,320	91	7,280	17,600
2000	1,700	315	1,890	14	8,484	10,374	93	7,440	17,814

Notes: (1) The University of Alaska Sea Grant Program prepared the original estimate of year 2000 total bottomfish harvest (Bering-Norton Petroleum Development Scenario's Commercial Fish Industry Impact Analysis - Sea Grant, 1980). The shape of growth was derived by Earl R. Combs, Inc. (Combs, 1981).

(2) Figures represent total harvest. For purposes of analysis, however, half of harvest is assumed to be processed onshore, half offshore (Sea Grant, 1980).

(3) Capacity of each trawler assumed to be 2,700 m.t. (Combs, 1981).

(4) Based on an assumed average crew size of 6 persons (Combs, 1981).

(5) Capacity of each onshore plant assumed to be 60,000 m.t. round weight (Combs, 1981).

(6) Based on an assumed average plant crew of 606 persons (Combs, 1981).

(7) Capacity of each catcher-processor assumed to be 9,100 m.t. round weight (Combs, 1981).

(8) Based on an assumed average crew size of 80 persons (Combs, 1981)

Source: E.R. Combs, 1981

Based upon these expected changes in bottomfishing, together with expected state government expenditure patterns and various other statewide and regional events and projects, the population and employment levels in the Aleution-Pribilof region are expected to change as shown in Table 30. As illustrated for purposes of this report, employment figures are categorized to include: resident employees, combining both basic and secondary residential employment; military and defense employment, which includes related civilian employees; non-resident construction employment; and non-resident fishing employment, which includes both harvesting and processing employment. The reader should note that the employment figures show full-time-annual-equivalent employment, which is an attempt to account for the seasonality of many of these jobs. During a particular fishing season, the actual number of people employed is much higher than the annual figures. Total regional employment increases almost five-fold over the forecast period' - from an estimated 1980 level of 6,500 employed to a forecast of almost 32,000 employed in 2000. Fifty-six percent of employment in 2000 is due to the bottomfish industry. However, of greater significance is the fifteen-fold change in resident employment brought about because of the bottomfish industry, which operates year-round. This year-round employment opportunity is expected to increase the desire for more permanent residence in the region, as illustrated in the column labeled "Non-resident Fishing Employment" in Table 30.

The residence changes will also greatly influence regional population levels as shown on the right side of Table 30. From a 1980 level of

TABLE 30

ALEUTIAN-PRIBILOF REGION EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN BASE CASE
1981-2000

YEAR	EMPLOYMENT: TOTAL RESIDENT EMPLOYMENT	EMPLOYMENT: MILITARY AND DEFENSE EMPLOYMENT (1)	EMPLOYMENT: NONRESIDENT CONSTRUCTION EMPLOYMENT	EMPLOYMENT: NONRESIDENT FISHING (2) EMPLOYMENT	EMPLOYMENT: TOTAL REGIONAL Employment	POPULATION: RESIDENT CIVILIAN POPULATION	POPULATION: MILITARY AND DEFENSE POPULATION (3)	POPULATION: NONRESIDENT ENCLAVE POPULATION (4)	POPULATION: TOTAL REGIONAL POPULATION	REGIONAL GROWTH FACTOR
1981	1,572	2,523	115	2,313	6,523	3,777	4,390	2,428	10,595	1.09
1982	1,854	2,523	134	2,872	7,383	4,169	4,390	3,006	11,565	1.19
1983	1,934	2,523	140	2,890	7,478	4,239	4,390	3,030	11,659	1.20
1984	2,028	2,523	148	2,903	7,602	4,447	4,390	3,051	11,888	1.22
1985	2,331	2,523	167	3,464	8,485	5,056	4* 390	3,631	13,077	1.34
1986	2,528	2,523	187	3,480	8,718	5,316	4* 390	3,667	13,373	1.37
1987	2,952	2,523	221	3,984	9,680	6,179	4,390	4,205	14,774	1.52
1988	3,584	2,523	281	4,413	10,801	7,295	4,390	4,694	16,379	1.68
1989	4,390	2,523	362	4,815	12,090	8,712	4,390	5,177	18,279	1.88
1990	5,579	2,523	486	5,139	13,727	10,860	4,390	5,625	20,875	2.15
1991	7,124	2,523	640	5,789	16,076	13,551	4,390	6,429	24,370	2.50
1992	8,199	2,523	757	5,541	17,020	15,092	4,390	6,298	25,780	2.65
1993	10,165	2,523	955	5,978	19,621	18,934	4,390	6,933	30,257	3.11
1994	12,266	2,523	1,167	5,976	21,932	22,343	4,390	7,143	33,876	3.48
1995	13,186	2,523	1,254	5,576	22,539	23,423	4,390	6,830	34,643	3.56
1996	15,348	2,523	1,464	5,413	24,748	27,939	4,390	6,877	39,206	4.03
1997	17,321	2,523	1,662	5,206	26,712	30,961	4,390	6,868	42,219	4.34
1998	19,286	2,523	1,823	4,742	28=374	34,501	4,390	6,565	45,456	4.67
1999	21,387	2,523	2,002	4,410	30,322	38,199	4,390	6,412	49,001	5.04
	23,350	2,523	2,162	3,891	31,926	41,597,	4,390	6,053	52,040	5.35

Notes: (1) Category includes related civilian employees.

(2) Category includes both harvesting and processing employees.

(3) Category includes military and defense employees plus dependents.

(4] Category includes nonresident construction and nonresident fish harvesting and processing employees living in company provided housing.

Source: ISER, 1981

about 3,600 persons (exclusive of military and defense population), the resident civilian population increases almost twelve-fold to over 41,000 persons in 2000. When the military and defense population and non-resident worker population is included, total regional population increases five-fold from approximately 9,700 people in 1980 to more than 52,000 in 2000. The greatest net change in population is expected to occur in the 1990's when the bottomfish industry is undergoing its fastest growth.

Local communities in the Aleutian-Pribilof region will each be affected differently by these regional changes. Generally, those with an. exisiting fishing infrastructure are likely to receive the greatest growth from bottomfish expansion. However, other communities without infrastructure may also participate in the regional growth, particularly if they lie near the bottomfish fishery. In order to evaluate local level effects of bottomfishing, BLM directed its contractors to identify that portion of bottomfish industrial growth likely to occur within the proposed OCS lease sale area; to allocate this proportion of growth to the specific communities under study; and to use those allocations as the basis for local economic forecasts. To identify the portion of bottomfish industrial growth within the lease sale area, BLM directed that harvest data for the St. George and North Aleutian Shelf Basins be specified as the same percentage of bottomfish caught by the foreign bottomfish fleet in the area bounded by latitudes 54° N and 58° N, and longitudes 158° W and 172° W. In 1978, 43.758

percent of the foreign catch came from this area. When applied to the tonnage forecasts in Table 29 for the year 2000, 743,886 metric tons are assumed to be available from this area. Thins approach ignores the fact that bottomfish development activities outside this narrowly defined area may also affect the communities under study. Thus, bottomfish growth at the local level probably understates the true potential vis-a-vis the regional potential, assuming all other industrial assumptions are valid.

The allocation of bottomfish growth to the various communities was based on the assumption that trawlers serving the on-shore processing plants would operate within a 150 mile range of their home ports and beyond this area catcher-processors would operate. The results for St. Paul and Unalaska-Dutch Harbor are shown in Table 31. Cold Bay was determined to be too far from the allocation area fishing grounds to benefit directly from bottomfish activities.

There are several inconsistencies in this allocation, which are noted here in passing. The results for St. Paul show a catch size that is only 57 percent of the standard 60,000 metric ton capacity established for on-shore processing plants. It must be presumed that the remainder of the 60,000 m.t. needed to operate the on-shore plant will come from the area outside, that established by BLM. Thus, the volume of fish landed and number of trawlers at St. Paul appears to be understated. A second potential inconsistency is the assignment of 9 catcher-processors

TABLE 31

YEAR 2000 ALLOCATION OF ST. GEORGE AND NORTH ALEUTIAN BASIN BOTTOMFISH CATCH AND VESSEL ACTIVITY
BLM BOTTOMFISH SCENARIO - BERING SEA/ALEUTIAN ISLANDS

LOCATION[1]	SHORE BASED PROCESSOR: FISH LANDED	SHORE BASED PROCESSOR: NUMBER OF TRAWLERS	CATCHER - PROCESSOR: NUMBER OF CATCHER-PROCESSORS[2]	CATCHER - PROCESSOR: FISH LANDED	TOTAL FISH LANDED
Unalaska - Dutch Harbor	229;478 m.t.	85	9	81,900 m.t.	311,378 m.t.
St. Paul	38,427 m.t.	14	--	--	38,427 m.t.
Chernofski/Ft. Glenn	19,141 m.t.	7	--	--	19,141 m.t.
Akutan	84,897 m.t.	31	--	--	84,891 m.t.
TOTALS	371,943 m.t.	131	9	81,900 m.t.	453,843 m.t.

Notes: (1) Cold Bay was determined to be too far from the allocation area fishing grounds (bounded by latitudes 54°N and 58°N, and longitudes 158°W and 172°W) to benefit directly from bottomfish activities.

(2) Beyond the allocation of 9 catcher-processors to Unalaska-Dutch Harbor and none to St. Paul, no other allocation to a specific port was made.

SOURCE: E.R. Combs, 1981.

to Unalaska-Dutch Harbor. It may be economically advantageous for catcher-processors to deliver processed fish cargoes to shippers at a single location like Unalaska-Dutch Harbor because of the cost of cold storage facilities needed at each location, the need to reprovision the ship for the next trip, and the need to rotate crew members to their home of residence. Food and fuel, and perhaps some maintenance facilities for ships the size of catcher-processors are not likely to be found in any other place. Thus, catcher-processors and related landed fish at Unalaska-Dutch Harbor may be understated.

Based in part on the information in Table 31, together with a separate assessment of local trends and patterns, Alaska Consultants, Inc. (1981) developed economic and population forecasts for Unalaska-Dutch Harbor, Cold Bay, and St. Paul. These forecasts are individually presented in the following sections.

UNALASKA-DUTCH HARBOR

In the 1980's and 1990's, the City of Unalaska and surrounding Dutch Harbor area will continue the rapid growth experienced during the last half of the 1970's. In the early 1980's this growth will be due to the final stages of expansion in the traditional shellfish industry and some moderate expansion into salmon fishing. The bottomfish industry during this early period is expected to be growing, slowly. As the bottomfish industry gathers momentum in the latter half of the 1980's, the pace of change will increase, and this growth will continue through the 1990's. Throughout the forecast period, the Unalaska-Dutch Harbor area's role as the central transshipment point in the region will continue to be enhanced, adding to overall growth.

With growth in the bottomfish industry comes growth in associated construction employment and rapid growth in services employment. The impact of this growth on employment and population in the Unalaska-Dutch Harbor area is illustrated in Table 32. Resident employment increases almost eight-fold over the forecast period while total community employment expands almost six-fold. Because of the expected residence trend in bottomfish employment, the total community population is expected to increase more than six-fold from the 1980 population of 2,147 persons, resulting in a population of over 13,000 persons in 2000.

As will be discussed inthe chapter subsection on expected transportation activities, the transshipment function of Unalaska-Dutch Harbor will contribute to the growth illustrated in Table 32. The source of this support comes from the movement of fish and shellfish to both domestic and foreign markets; from the continuing need to supply petroleum products to growing western and northwestern Alaska communities; and from the need to supply petroleum products for the exploration and early development activities in the Bering-Norton OCS lease sale area off Nome, Alaska.

TABLE 32.

UNALASKA-DUTCH HARBOR EMPLOYMENT AND POPULATION FORECAST'
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

	EMPLOYMENT(1)					POPULATION			
YEAR	TOTAL RESIDENT EMPLOYMENT	NONRESIDENT FISH HARVESTING EMPLOYMENT(2)	NONRESIDENT FISH PROCESSING EMPLOYMENT(2)	NONRESIDENT CONSTRUCTION EMPLOYMENT(3)	TOTAL COMMUNITY EMPLOYMENT	RESIDENT CIVILIAN POPULATION	NONRESIDENT ENCLAVE POPULATION(4)	TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTOR
1981	786	101	723	30	1,812	1,281	1,026	2,307	1.07
1982	841	121	817	47	2,024	1,283	?,183	2,466	1.15
1983	897	141	910	65	2,237	1,286	1,340	2,626	1.22
1984	954	160	1,002	83	2,449	1,290	1,495	2,785	1.30'
1985	1,011	180	1,096	99	2,661	1,295	1,650	2,945	1.37
1986	1,139	219	1,281	123	3,065	1,666	1,946	3,612	1.68
1987	1,253	262	1,476	146	3,509	2,023	2,256	4,279	1.99
1988	1,414	295	1,634	169	3,932	2,428	2,518	4,946	2.30
1989	1,592	326	1,777	193	4,356	2,849	2,764	5,613	2.61
1990	1,833	345	1,871	215	4,780	3,333	2,947	6,280	2.93
1991	2,121	371	1,985	240	5,309	3,961	3,180	7,141	3.33
1992	2,467	385	2,054	263	5,838	4,631	3*371	8,002	3.73
1993	2,815	399	2,120	287	6,367	5,312	3,552	8,864	4.13
1994	3,226	403	2,136	309	6,896	6,055	3,670	9,725	4.53
1995	3,632	407	2,154	333	7,425	6,793	3,793	10,586	4.93
1996	3,958	395	2,106	330	7,733	7,338	3,775	11,113	5.18
1997	4,345	373	2,007	327	8,042	7*943	3,697	11,640	5.42
1998	4,703	355	1,928	327	8,350	8,520	3,647	12,167	5.67
1999	5,080	334	1,837	325	8,659	9,115	3,579	12,694	5.91
2000	5,477	310	1,731	320	8,967	9,731	3,490	13,221	6.16

Notes: (1) Employment data is annual full-time equivalent employment.

(2) Category includes traditional and bottomfish employment. In the traditional fisheries, which are highly seasonal, nonresident employment is assumed to be 54 percent of full-time equivalent employment. In bottomfishing, which is assumed to be a year-round industry, nonresident employment is assumed at 80 percent of full-time equivalent employment for the period 1981-1985. Thereafter, nonresident employment in bottomfishing declines to 24 percent by 2000.

(3) Nonresident construction employment is assumed to decline from 95 percent of total construction employment in 1981 to 85 Percent in. 2000.

(4) Combines nonresident fish harvesting and processing employment, nonresident construction employment and the nonresident component of other employment sectors not specifically identified.

Source: ACI, 1981; U. of AK., ISER, 1981; as modified by PMM & Co.

COLD BAY

Cold Bay possesses few economic resources upon which to develop and sustain a permanent economy (ACI, 1981). It is assumed, however, that because of other economic activity in the region, the community will continue as the primary center of air traffic to and from the Aleutian Pribilof region. Specifically, expected growth in the bottomfish industry and associated increases in population should stimulate a steady increase in air passenger and air cargo traffic. Assuming the air routes remain the same, Cold Bay's aviation activities should increase, thereby enhancing, public and private employment opportunities in air transportation services.

Bottomfish development is not expected to come to Cold Bay because it is too far from fishing grounds - an important factor in locating onshore processing facilities (Combs, 1981). However, the base case does assume establishment of a shore-based plant to process crab, salmon, and other species on a year-round basis (ACI, 1981).

The U.S. Coast Guard is expected to establish a new base at Cold Bay sometime after 1985, as proposed in their current long-range plan. The purpose of this base is to better patrol the Aleutian and Bering Sea areas in light of the increasing fishing vessel activity. Although, as mentioned in Chapter III, the Coast Guard may reconsider its current plans to locate the Air Station at Unalaska instead of Cold Bay, until those plans are changed it was assumed the base would be located at. Cold Bay.

The effect of these economic events on future employment and population in Cold Bay is illustrated in Table 33. Resident employment expands more than three-fold from about 100 in 1980 to over 300 in 2000. Most of this growth is due to the Coast Guard base and to increases in air transportation services. Military employment is assumed to remain stable throughout the forecast period. Other non-resident employment is largely oriented to the new fishing and fish processing activities. Alaska Consultants, Inc. assumed an annual growth rate of 5 percent over the forecast period (ACT, 1981). The non-residential portion of fish harvesting and processing employment was assumed to decline from 100 percent in 1980 to 54 percent in 2000. The 54 percent represents approximately the current mix of residents to non-residents in Unalaska based on full-time equivalent employment. As a result of these various employment changes, total employment in Cold Bay increases only a little over two-fold between '1980 and 2000.

The resident population change is as significant as the resident employment change, as shown on the right side of Table 33. The resident civilian population increases almost four--fold between 1980 and 2000 for the same reasons as the employment change. When all non-resident employees are included and treated as year-round population, the total population expands almost three-fold over the forecast period, as

TABLE 33.

COLO BAY EMPLOYMENT ANO POPULATION FORECAST
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

	EMPLOYMENT (1)						POPULATION			
YEAR	TOTAL RESIOENT EMPLOYMENT	MILITARY AND OEFENSE EMPLOYMENT(2)	NONRESIDENT CONSTRUCTION EMPLOYMENT(3)	NONRESIDENT FISH HARVESTING EMPLOYMENT(4)	NONRESIDENT FISH PROCESSOR EMPLOYMENT(4)	TOTAL COMMUNITY EMPLOYMENT	RESIDENT CIVILIAN POPULATION	NONRESIDENT ENCLAVE POPULATION(5)	TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTOR
1981	104	47	1	25	31	208	157	104	261	1.07
1982	109	47	3	27	31	217	171	108	279	1.15
1983	115	47	4	27	33	226	185	111	296	1.22
1984	121	47	6	28	33	235	200	114	314	1.29
1985	128	47	7	28	34	244	216	116	332	1.37
1986	139	47	7	29	34	256	233	117	350	1.44
1987	150	47	7	30	35	269	249	119	368	1.51
1988	159	47	8	30	37	281	264	122	386	1.59
1989	171	47	8	31	37	294	281	123	404	1.66
1990	180	47	9	32	38	306	296	126	422	1.72
1991	193	47	10	32	39	321	316	128	444	1.83
1992	207	47	10	33	39	336	337	129	466	1.92
1993	220	47	11	34	40	352	355	132	487	2.00
1994	235	47	11	34	40	367	377	132	509	2.09
1995	248	47	12	34	41	382	397	134	531	2.19
1996	262	47	11	35	42	398	418	136	554	2.28
1997	278	47	12	35	42	414	441	136	577	2.37
1998	292	47	12	35	43	429	463	137	600	2.47
1999	307	47	13	35	43	445	485	138	623	2.56
2000	322	47	13	36	43	461	507	139	646	2.66

Notes: (1) Employment data is annual full-time equivalent employment.

(2) Category includes all personnel at Cold 8ay Air Force Station.

(3) Nonresident construction employment is assumed to decline from 95 percent of total construction employment in 1981 to 85 percent in 2000.

(4) Nonresident fish harvesting and processing employment is assumed to decline from 100 percent of total fish fish harvesting and processing employment in 1980 to 54 percent in 2000.

(5) Combines military and defense employment, nonresident construction employment, and nonresident fish harvesting and processing employment.

Source: ACI, 1981; University of Alaska; TSER, 1981; as modified by Peat Marwick.

illustrated by the community growth factors.

ST. PAUL

St. Paul is a traditional Aleut community. The economy of St. Paul has historically centered about the fur seal industry. If efforts to stop the fur seal harvest are unsuccessful, it is assumed that the industry will continue to, be a part of the island's economy. However, it would appear that St. Paul's primary opportunity for future economic growth lies in development of the region's bottomfish resources. The island has a developable harbor and the community could become a base of operations for harvesting activities and a site for on-shore processing facilities. In addition, the island is an attraction to tourists and recreational visitors wishing to observe the exceptional avian and marine mammal populations. The accommodation of these visitors has potential to support some further growth in local commercial establishments catering to tourist demands. The ability to capitalize on these various opportunities depends on the village's ability to choose between its desire to maintain itself as a traditional Aleut village and the need for a more open community in order to gain the economic growth, which would probably require physical and social change as well.

The base case assumes a middle ground in this situation. During the first ten years of the forecast period the community is expected to follow its traditional fur seal and tourist orientation, gradually moving to embrace the bottomfish development opportunity. This also allows time for development of the harbor necessary to serve bottomfish activities. In 1989, it is further assumed a bottomfish processing plant is constructed on the island and becomes operational in 1990. From 1990 to 2000 the bottomfish activities are the economic mainstay of the community, although fur seal activities continue through the period. Since the Aleut residents control local governing institutions and local land supply it is assumed they can maintain an enclave characteristic for the fishing activities and control settlement of newcomers on the island. Thus, the resident population will grow more slowly than in other communities affected by bottomfish development. The effects of these assumptions on employment and population growth are shown in Table 34.

Resident employment grows only slightly between 1980 and 1990 and then increases abruptly in 1990 when the processing plant opens. Resident employment continues growing slowly to 2000 when bottomfish activities reach full development. Employment associated with the Coast Guard Loran Station and with the National Marine Fisheries Service (NMFS) is assumed to remain stable. Initial employment in the bottomfish harvesting and processing activities are assumed to be 133 persons and 606 persons, respectively. The non-resident component of this employment is assumed to decline over time at the rate of about one-half percent per year. Total community employment increases almost eight-

TABLE 34

ST. PAUL EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN BASE CASE
1981-2000

	EMPLOYMENT					POPULATION			
YEAR	TOTAL RESIDENT EMPLOYMENT	COAST GUARD AND N.M.F.S. EMPLOYMENT(I)	NONRESIDENT BOTTOMFISH HARVESTING EMPLOYMENT(2)	NONRESIDENT BOTTOMFISH PROCESSING EMPLOYMENT(3)	TOTAL COMMUNITY EMPLOYMENT	RESIDENT CIVILIAN POPULATION	NONRESIDENT ENCLAVE POPULATION(4)	TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTOR
1981	83	41		--	124	486	41	527	1.00
1982	85	41			126	486	41	527	1.00
1983	87	41			128	486	41	527	1.00
1984	88	41			129	486	41	527	1.00
1985	90	41			131	486	41	527	1.00
1986	92	41			133	484	41	525	1.00
1987	93	41			134	484	41	525	1.00
1988	95	41			136	484	41	525	1.00
1989	97	41	-		138	484	41	525	1.00
1990	176	41	133	606	956	643	780	1,423	2.70
1991	178	41	133	604	956	645	778	1,423	2.70
1992	181	41	133	601	956	648	775	1,423	2.70
1993	185	41	132	598	956	652	771	1,423	2.70
1994	189	41	131	595	956	656	767	1,423	2.70
1995	192	41	131	592	956	659	764	1,423	2.70
1996	200	41	130	589	960	663	760	1,423	2.70
1997	209	41	129	586	965	667	756	1,423	2.70
1998	216	41	129	583	969	670	753	1,423	2.70
1999	225	41	128	580	974	674	749	1,423	2.70
2000	233	41	127	577	978	678	745	1,423	2.70

Notes: (1) Category includes 22 Coast Guard personnel and 19 National Marine Fisheries Service (NMFS) personnel.

(2) It is assumed that a bottomfish processing plant is constructed during 1989 and becomes operational in 1990. Harvesting employment is estimated to be 133 persons, processing plant employment is estimated to be 606 persons (ACI, 1981). For purposes of this study PMM & Co. assumes that the nonresident portion of both harvesting and processing plant employment declines (and the resident portion increases) at a rate of one-half percent per year.

(3) Category includes Coast Guard and N. M.F. S. employment plus nonresident bottomfish harvesting and processing employment..

Source: ACI, 1981 as modified by PMM &Co.

fold over the forecast period with most of the increase concentrated around opening of the bottomfish plant in 1990. Construction employment associated with development of the harbor and the bottomfish processing plant is not included in Table 34.

The resident population increases only 40 percent during the forecast period, also experiencing its greatest change when the processing plant opens. When the enclave population is included, total community population changes almost three-fold from a level of 527 persons in 1981 to an estimated 1,423 persons in 2000.

Water Mode

This section discusses the likely marine activities in the Aleutian-Pribilof region and the effect these may have on each of the three communities of interest over the 20 year forecast period. Three aspects of marine activities are of particular interest: one, the tonnage demands and associated vessel requirements in Unalaska-Dutch Harbor, Cold Bay, and St. Paul; two, the adequacy of available marine facilities in each community to meet anticipated demands; and three, the levels of ship traffic passing through Unimak Pass.

FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

The following discussion seeks to translate the population and economic growth presented earlier into an assessment of marine transportation demands and vessel requirements for each community, and an assessment of vessel traffic in Unimak Pass. The discussion is organized to present first the forecast for each community, and second, the forecast for Unimak Pass. A discussion of the positive and negative impacts of these changes to the marine transportation system is offered in the next subsection.

Unalaska-Dutch Harbor

One historic role of the Unalasks-Dutch Harbor fishing port in the region's economy has been to support during the recent past the rapid expansion of the king and tanner crab industry. Anticipated development of the bottomfish industry will likely mean continued rapid growth as new processing plants and docks are constructed together with housing and other buildings. From a marine transportation perspective, the trawlers serving these processing plants, the catcher-processors that deliver processed products for shipment to market, and the additional cargo ships that bring food, construction materials and other products and move the fish products to market will add to the fishing boat and cargo ship traffic already in the harbor. Also, demands for fuel should increase in response to the energy needs of these additional vessels and the growth in industry and housing, bringing a related increase in tanker traffic.

Another historic role of this community is its function as a transshipment port for fuel products and some other items shipped to other Aleutian ports and to hub ports in western and northwestern Alaska. This transshipment function is expected to continue and to grow in part because of regional growth, in part because other areas served are also growing and, in part, because served communities have limited capacity to store all the fuel they consume and require periodic replacement of supplies rather than a one-time annual delivery.

Inbound, outbound, and throughput tonnage forecast for Unalaska-Dutch Harbor for the period 1981-2000 is shown in Table 35. This forecast was developed by evaluating, forecasting, and summing the individual components of outbound and local consumption tonnage demands. From these summed demands, inbound and throughput tonnage were calculated. The individual components that make up outbound and local consumption demands are described in the following paragraphs.

- Outbound Petroleum Tonnage to western and northwestern Alaska. Unalaska-Dutch Harbor serves as the transshipment point for petroleum products shipped to coastal and river-accessible communities in western and northwestern Alaska. To assess future petroleum products demand for these communities it was assumed that such demands are proportional to population. To represent population growth in these communities it was further

TABLE 35

UNALASKA-DUTCH HARBOR MARINE TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALS 70 SASS CASS
1988-2000

	OUTBOUND TONNAGS DEMANDS							LOCAL CONSUMPTION DEMANDS (6)			INBOUND TONNAGE DEMANDS			THROUGHPUT TONNAGE DEMANDS (9)		
YEAR	WESTERN AND NORTHWESTERN ALASKA (1)	OTHER ALEUTIAN REGION COMMUNITIES (2)	BERING-NONTON 0SS ACTIVITIES (3)	TOTAL PETROLEUM PRODUCTS	FISH PRODUCTS (4)	OTHER PRODUCTS (5)	TOTAL OUTBOUND TONNAGE DEMANDS	PETROLEUM PRODUCTS	DRY CARGO RODU	TOTAL INBOUND TONNAGE DEMAN	PETROLEUM PRODUCTS (7)	DRY CARGO PRODUCTS (8)	TOTAL INBOUND TONNAGE DEMAN	PETROLEUM PRODUCTS	DRY CARGO	TOTAL THROUCHPUT TONNAGE DEMANDS
1981	105,400	20.500	-	125,900	33,000	2.400	161,300	101,700	10.400	112,100	221,600	12.800	240,400	353.500	48,200	401,700
1982	111,600	22,300		133.900	36.900	2,600	173,400	109,300	11,200	120,500	243.200	13,800	25?,000	377.100	53,300	430,400
1983	116,800	24,000	4s300	145,100	40,800	2.S00	18s.700	115.900	31,800	121,700	261,000	14,600	275,600	406.100	58,200	464,3072
1984	122,000	25,900	7,s00	155,700	44,600	3.000	203,300	123.500	12.600	136,100	279,200	15,600	294,800	434,900	61,200	497I,1OO
1985	11 8,900	2s,000	9,300	156,200	48,500	3,200	207,9s0	130.200	13,300	243.500	286,400	16,500	302.900	442,600	60,200	510,800
1986	120.900	30,100	7,800	158,800	52.400	3,s00	214,700	159,600	16,300	175.900	31s.400	19,800	338,200	411,200	75.700	552,900
1901	118,900	32,600	10,300	161,S.00	39,800	3,700	225.300	389.100	19,300	208,400	350,900	23,000	373,900	512,100	86,500	599,200
1908	119,900	35,300	27,S00	183,000	67,200	4,000	254.200	218, s00	22.300	240.800	401,300	26,300	427,800	5s4,500	97,500	682,000
1989	116, S00	38,400	60,500	215,704	78,200	4,400	29S.300	24000	25,300	273,300	463.100	29.700	493.400	679,400	112,300	791,700
1990	124.000	43,500	31,200	196,100	89,200	4.800	290.700	270,400	28.400	306.800	475.100	33.200	508,300	671.800	127,200	799,000
1991	126,100	44,900	2a,700	199,700	100,800	5,100	304,900	316,400	32,300	348•700	516.100	37,400	533,500	715,800	142.600	858,400
1992	129,200	48,800	24,200	202,200	107,600	5,600	315.400	3s4,400	36,200	390.600	556,600	41,000	598,400	758,800	155,000	913,s00
1993	124.000	53,000	24,200	201,200	118,600	6.100	325,900	392.400	40,100	432,500	593.600	4S,200	639,800	794,800	170,900	965,700
1994	123,000	57,400	24,200	204,600	129,500	6.600	-340,100	430.400	43,900	414.300	635,000	>0,500	6SS.500	639,600	196,600	1,026,200
1995	126,100	62,400	24,200	212,700	133,400	7,200	353.300	468,400	47.800	S16,200	681,100	55,000	736,100	893,800	195,600	1,089,400
1996	126,100	67,600	24,200	217.900	837,300	7.700	362,900	492.100	50,200	542,300	310.000	37.900	767.900	927,900	202,900	1,130,800
1997	128,200	73,500	24, 20D	225,900	144,800	8,400	379,100	514,900	52.600	567.500	740.800	61,000	801,800	966.700	214,200	1.180,900
1998	129,200	?7.200	24,200	230,600	152.300	8,800	391,700	538,700	5s,000	593,700	169,300	63,800	833,100	999,900	224,900	1,224,800
1999	127,100	86,800	24,200	23 B,1OO	156,100	9,900	404.100	S61 .500	51,300	618.800	399,600	67,200	866,800	3,037.700	233,200	1,270,900
2000	128,200	94,300	24,200	246,100	160.000	10,.900	417.500	5S5,200	59.s00	645,000	831,900	10.600	902.500	.1,070,600	241,400	1.320,004S

NOTES: (1) Based upon Western and Northwestern Alaska composite growth factors (See table 36) ❑ ultiplied by estimated 1980 outbound petroleum tonnage shipped to these areas (103.400 ST). The 1980 estimate was derived by a straight line projection of historic data from 1972-1978; r^2 = 0.68.

(2) Based upon growth factors for Aleutian-Pribilof region without Unalaska-Dutch Harbor (see Appendix B) multipl led by estimated 1980 outbound petroleum tonnage shipped to other parts of the region. The 1980 estimate was derived using the same historic growth curve discussed in Note (1).

(3) Based upon BLM's Mean Case Scenario developed for the Bering-Norton Lease Sale (see Appendix 0).

(4) Based upon BLM's Bottom fish Scenario plus an estimate of growth in tbe traditional fisheries (see Appendix B) tonnage shown is processed weight.

(5) Based upon same growth factors in Note 2 ❑ ultiplied by 1980 estimate of other products outbound (see Appendix B).

(6) Based upon Unalaska-Dutch Harbor Growth Factors (Table 30) multipl led by estimated 19.90 local consumption demands.

(7) Derived by adding outbound and local tonnage demands.

(8) Derived by adding "other products" outbound and "dry cargo products" under local consumption demands.

(9) Oer 1 ved by adding inbound and outbound tonnage demands.

SOURCE: ERE Systems Ltd.

assumed that a composite growth factor could-be developed from available regional population forecasts prepared by the University of Alaska Institute of Social and Economic Research (ISER) as part of their evaluation of statewide and regional OCS impact (see U ofAK, ISER, 1981).

Within the ISER economic model, portions of three model regions are served through Unalaska-Dutch Harbor: North Slope, Northwest, and Southwest. The Southwest region contains the Aleutian-Pribilof region as a subarea, so additional adjustments were needed to remove the Aleutian-Pribilof portion of the forecast, which was handled separately. ISER's St. George Basin Low Case forecast (not otherwise analyzed in this report) was used as the basis for population growth in the North Slope and Northwest regions. A guesstimate was made of the percentage of population in each region served through Unalaska-Dutch Harbor: 80 percent in the North Slope and 90 percent in the Northwest region. ISER's St. George Basin base case forecast was used to represent the Southwest region and the Aleutian-Pribilof subregion. After subtracting one from the other, an estimate was made of the percentage of population served in the remainder of the region: 80 percent. The details of this analysis and the resultant composite growth factors are shown in Table 36.

The growth factors in Table 36were multiplied by the estimated 1980 outbound petroleum tonnage shipped to these areas from Unalaska-Dutch Harbor (103,400 St.). The resultant outbound tonnage demands are shown in Table 35. Population growth, and, consequently, growth in petroleum products sold to communities in western and northwest Alaska, changes only 24 percent over the forecast period. The 1980 estimate of outbound tonnage was derived by a straight line regression projection of historic data from 1972 - 1978. The coefficient of determination r^2, which indicates the quality of fit achieved by the regression, was 0.68.

- Outbound Petroleum Tonnage to Aleutian region communities. For this assessment, it was also assumed that petroleum product consumption in Aleutian-Pribilof region communities served through Unalaska-Dutch Harbor was proportional to population. Growth factors representing the Aleutian-Pribilof region without the population of Unalaska-Dutch Harbor were developed (not shown), These growth factors were

TABLE 36

ESTIMATED POPULATION GROWTH FACTORS FOR COASTAL AREAS IN MESTERN AND NORTHWESTERN ALASKA SERVED THROUGH UNALASKA-DUTCH HARBOR

	NORTH SLOPE REGION		NORTHWEST REGION		SOUTHWEST REGION				TOTAL	
YEAR	REGIONAL POPULA-TION(1)	POPULATION IN SERVED COASTAL AREAS(2)	REGIONAL POPULA-TION(1)	POPULATION IN SERVED COASTAL AREAS(3)	REGIONAL POPULATION(4)	ALEUTIAN CENSUS DIVISION POPULATION (4)	POPULATION IN REMAINDER OF REGION	POPULATION IN SERVED COASTAL AREAS(5)	POPULATION IN SERVED COASTAL AREAS	COMPOSITE GROWTH FACTORS
1980	11,046	8,837	11,685	10,517	26,950	10,000	16,950	13,560	32,913	1.00
1981	12>089	9,671	11,808	10,627	27,186	10,595	16,591	13,273	33,571	1.02
1982	15,329	12,263	11,784	10,606	27,451	11,565	15,886	12,709	35,578	1.08
1983	17,784	14,227	11,767	10,590	27,017	11,659	15,358	12,286	37,104	1.13
1984	20,533	16,426	11,895	10,706	26,424	11,888	14,536	11,629	38,761	1.18
1985	18,706	14,965	12,494	11,245	27,694	13,077	14,617	11,694	37,903	1.15
1986	17>617	14,094	12,662	11,396	29,690	13,373	16,317	13,054	38,543	1.17
1987	16,888	13,510	12,845	11,561	30,724	14,774	15,950	12,760	37,831	1.15
1988	16,824	13,459	13,628	12,265	31,805	16,379	15,426	12,341	38,065	1.16
1989	16,060	12,848	13,754	12,379	33,339	18,279	15,060	12,048	37,275	1.13
1990	15,861	12,689	16,511	14,860	35,776	20,875	14,901	11,921	39.470	1.20
1991	16,695	13,356	17,298	15>568	38,535	24,370	14,165	11,332	40,256	1.22
1992	17,036	13,629	17,086	15,377	41,014	25,780	15,234	12,187	41,193	1.25
1993	16,859	13,487	16,385	14,747	44,451	30,257	14,194	11,355	39,589	1.20
1994	16,244	12,995	16,128	14,515	48,475	33,876	14,599	11,679	39,190	1.19
1995	16,660	13,328	16,232	14,609	49,981	34,643	15,338	12,270	40,207	1.22
1996	17,604	14,083	16,438	14,794	53,414	39,206	14,208	11,366	40,244	1.22
1997	18,094	14,475	16,644	14,980	56,398	42,219	14,179	11,343	40,798	1.24
1998	17,936	14,349	16,811	15,130	59,934	45,456	14,478	11,582	41,061	1.25
1999	17,382	13,906	16,980	15,282	63,101	49,001	14,100	11,280	40,468	1.23
2000	17,973	14,378	17,150	15,435	65,993	52,040	13,953	11,162	40,976	1.24

Notes: (1) From ISER St. George Basin Low Case Forecast.
(2) Assumed to be 80 percent of regional population.
(3) Assumed to be 90 percent. of regional population.
(4) From ISER St. George Basin Base Case Forecast.
(5) Assumed to be 80 percent of the population in remainder of region.

Source: ISER, 1981; ERE Systems, Ltd.

then multiplied by the estimated 1980 outbound petroleum tonnage shipped to these communities (19,200 s.t.). The resultant tonnage demands are shown in Table 35 in the column labeled "Other Aleutian Region Communities." The remainder of the Aleutian region is expected to grow at a slightly slower pace than Unalaska; as a result, growth in 2000 in just below a five-fold increase and, consequently, tonnage shipped increases about five-fold.

- Outbound Petroleum Tonnage to OCS activities in the Bering-Norton lease sale area. The shipment of petroleum products to support oil and gas exploration and development in the Bering-Norton basin is dependent upon the pace and intensity of industry activities in the sale area. The sale is currently scheduled for November 1982 with exploration activities beginning in 1983. BLM's mean case scenario for the Bering-Norton basin assumes that oil and gas are discovered and that production of these resources begins in 1990. Several tables detailing BLM's scenario and brief accompanying text are included in Appendix B. The need for refined fuels (particularly diesel) is continuous throughout the scenario period (1983-2000'). However, depending on the quality of crude oil found, some power equipment can operate on unrefined fuel, thereby reducing refined oil needs. In this scenario it is assumed refined fuels " are needed on the drilling and production platforms, and for the supply boats throughout the forecast period (to 2000). Assumptions about drilling fuel requirements, platform fuel consumption, and supply boat fuel needs are detailed in the tables in Appendix B and are summarized in Table 35. The fuel needs of construction camps and helicopters are assumed to be included in the western and northwestern Alaska forecast described earlier.

- Total Outbound Petroleum Products Tonnage. When the petroleum products transshipped to various areas are summed, as shown in Table 35, the increase in tonnage over the 20-year forecast period is about 100 percent. However, due to Bering-Norton OCS development, a sharp increase in fuel demands occurs in 1989. Fuel demands for that year constitute a 71 percent increase over expected 1981 demands. That tonnage level is not reached again until about 1996.

- Outbound Fish Products Tonnage. The fish products category deals with the shipment of shellfish and other traditional species, as well as bottomfish, to both foreign and domestic markets. For analysis purposes the forecast of fish product tonnage was divided into bottomfish and traditional sub-components. The bottomfish subcomponent forecast was based on the allocation of a portion of the total expected bottomfish catch as discussed earlier and presented in Table 37. The Unalaska-Dutch Harbor area is expected to land 311,378 metric tons (343,232 s -t.). of bottomfish in 2000. The processed weight of this catch at 35 percent recoveryisabout 109,000 metric tons (119,900 s.t.). As shown in Table 37, this level of processed catch was allocated by year on the basis of expected percentage of development of the Bering Sea bottomfish industry.

The traditional species were forecast assuming a one percent annual growth in processed weight, which reflects the fact that the industry is approaching full utilization of available resources. This forecast is also shown in Table 37. Some additional diversification into salmon processing contributes to this expansion (Alaska Consultants, Inc., 1981).

The results of both the traditional species forecast and bottomfish species forecast were then combined to produce the results summarized in Tables 37 and 35.

TABLE 37

FISH PRODUCT TONNAGE AND FISHING VESSEL REQUIREMENTS
AT UNALASKA-DUTCH HARBOR
1981-2000

YEAR	PERCENT OF BOTTOMFISH DEVELOPMENT (1)	BOTTOMFISH LANDED: BY TRAWLERS (2)	BOTTOMFISH LANDED: BY CATCHER-PROCESSOR (3)	BOTTOMFISH LANDED: TOTAL METRIC TONS	BOTTOMFISH LANDED: TOTAL SHORT TONS (4)	BOTTOMFISH PROCESSED WEIGHT SHORT TONS (5)	TRADITIONAL FISH PRODUCTS PROCESSED WEIGHT (6)	TOTAL FISH PRODUCTS	VESSEL REQUIREMENTS: TRAWLERS (7)	VESSEL REQUIREMENTS: CATCHER-PROCESSOR (8)	VESSEL REQUIREMENTS: CRABBERS (9)
1981	0	0	0	0	0	0	33,000	33,000	0	0	400
1982	2.94	6,747	2,408	9,155	10,091	3,500	33,400	36,900	2	1	400
1983	5.88	13,493	4,816	18,309	20,182	7,100	33,700	40,800	5	1	400
1984	8.82	20,240	7,224	27%464	30,273	10,600	34,000	44,600	7	1	400
1985	11.76	26,987	9,631	36,618	40,364	14,100	34,400	48,500	10	2	400
1986	14.71	33,756	12,047	45,804	50,489	17,700	34,700	52,400	13	2	400
1987	20.59	47,250	16,863	64,113	70,671	24,700	35,100	59,800	18	2	400
1988	26.47	60,743	21,679	82,422	90,854	31,800	35,400	67,200	23	3	400
1989	35.29	80,983	28,903	109,885	121,127	42,400	35,800	78,200	30	4	400
1990	44.12	101,246	36,134	137,380	151,434	53,000	36,200	89,200	38	4	400
1991	52.94	121,486	43,358	164,844	181,707	63,600	36,500	100,100	45	5	400
1992	58.82	134,979	48,174	183,153	201,889	70,700	36,900	107,600	50	6	400
1993	67.65	155,242	55,405	210,647	232,196	81,300	37,300	118,600	58	7	400
1994	76.47	175,482	62,629	238,111	262,469	91,900	37,600	129,500	65	7	400
1995	79.41	182,228	65,037	247,265	272,561	95,400	38,000	133,400	68	8	400
1996	82.35	188,975	67,445	256,420	282,652	98,900	38,400	137,300	70	8	400
1997	88.24	202,491	72,269	274,760	302,868	106,000	38,800	144,800	75	8	400
1998	94.12	215,985	77,084	293,069	323,050	113,100	39,200	152,300	80	9	400
1999	97.06	222,731	79,492	302,223	333,141	116,600	39,500	156,100	83	9	400
2000	100.00	229,478	81,900	311,378	343,232	120,100	39,900	160,000	85	9	400

Notes; (1) Percent of bottomfish development = Bottomfish Harvest (from Table 29)]1,700 or ÷ 1,700
(2) Bottomfish landed by trawlers = percent of bottomfish development x 229,478 m.t.
(3) Bottomfish landed by catcher-processor = percent of Bottomfish Development x 81,900 m.t.
(4) 1 metric ton = 1.1023 short tons
(5) Processed weight is assumed to be 35 percent of landed round weight
(6) Weight of processed traditional fish products (crab, shrimp, etc.) is assumed to grow one percent annually over the forecast period. The 1980 base is estimated at 32,700 s.t. based on historic growth patterns.
(7) Capacity of each trawler assumed to be 2,700 m.t.
(8) Capacity of each catcher-processor assumed to be 9,100 m.t.
(9) The level of crabbers illustrates the 1979-80 fishing season. It is assumed the number of vessels will not grow further since resource utilization is approaching the biological limit. Number disregards two or more season vessels. It includes 236 vessels for King crab, 118 vessels for Tanner crab, and 15 vessels for other species plus 31 floating processors.

Source: E. R. COMBS, 1981; assembled by ERE Systems, Ltd.

Total fish products shipped increases almost five-fold by 2000, and could go higher depending on what ports other catch-processor vessels eventually select for sending their products to market.

- Other Outbound Products Tonnages. Several miscellaneous products, such as construction equipment, are shipped through Unalaska-Dutch Harbor to Aleutian-Pribilof region ports. In addition, weather delays at a particular port might require a shipping company to drop the cargo at Unalaska for delivery at a later time rather then hold up the ship waiting for a break. Since relatively small amounts of tonnage fall into this "other" category, no attempt was made to further identify the nature of the cargoes. It was assumed for forecasting purposes that such tonnage was a function of the growth and development of the region as expressed through the regional growth factors (Table 30). These growth factors were multiplied by an estimate of the 1980 tonnage in this category (approximately 2,200 s.t.), the latter figure being based on a straight line regression of historic tonnage data that was not included in other outbound tonnage categories.

- Total Outbound Tonnage. The sum of petroleum products, fish products, and other outbound goods is shown in Table 35. Largely due to the growth of fish products, petroleum product tonnage declines from 78 percent in 1981 to 59 percent in 2000. Fish products over the same period rise from 20 percent to 38 percent.

- Local Consumption Tonnage. Local consumption demands include petroleum products, food, construction materials, automobiles, appliances and miscellaneous other products. It was assumed that local comsumption would increase in proportion to total population gains in the Unalaska-Dutch Harbor area. The magnitude of the population gain is illustrated by the growth factors in Table 30. Multiplying these growth factors respectively by the estimated 1980 tonnage for petroleum products (approximately 95,000 s.t.) and by the estimated 1980 tonnage for all dry cargo products (approximately 9,700 s.t.) produces the results in Table 35. Like population, local consumption increases more than five-fold over the forecast period.

- Inbound Tonnage Demands. These demands necessarily equal the outbound transshipment tonnage demands plus .

those related to local consumption. Products originating at Unalaska-Dutch Harbor, such as fish, are not included. Thus, while the community itself is growing more than six-fold, inbound tonnage demands grow less than four-fold. The bulge in petroleum products transshipped in 1989 has no appreciable effect on inbound tonnage demands.

When outbound tonnage is compared to inbound tonnage the pattern reflects the changing residence characteristic of the community. In 1981 outbound tonnage is 67 percent of inbound tonnage, but by 2000 outbound is only 46 percent of inbound.

- Throughput Tonnage Demands. Throughput tonnage is defined as the total of inbound and outbound tonnage. Throughput tonnage increases just over three-fold between 1981 and 2000. Despite the dramatic increase in fish products shipped, petroleum products continue to be a substantial percentage of throughput tonnage, dropping from 88 percent in 1981 to only 82 percent in 2000.

Using the tonnage demands of Table 35, an estimate of marine transportation requirements was prepared. These requirements, expressed as round trips by various types of vessels, are shown in Table 38. Both commercial cargo ship and tanker trips, as well as fishing boat trips, are identified. Petroleum products are assumed to arrive via a 35,000 DWT tanker, typically from Seattle, Washington or Richmond, California. Petroleum products that are transshipped to other areas are assumed to be transported via tanker barge with average capacity of 7,000 s.t. (50,050 b. b.l.). Dry cargo products arrive and depart in a number of different ways. Some products come directly from Seattle; some are transshipped through Kodiak; a very small amount comes from foreign countries; all of these products arrive or depart on general cargo and container ships or barges. Fish products sent to Unalaska-Dutch Harbor for transshipment to foreign countries and products delivered to outlying communities that are transshipped through Unalaska-Dutch Harbor are typically picked up or delivered by barge. Because few, if any, vessels devote their entire capacity to a single harbor, it was assumed that the average commercial cargo vessel carries 65 s.t. inbound and ?50 s.t. outbound.

Fishing boat trip-making is divided into several categories: bottomfish trawlers, catcher-processors and others, which includes traditional crabber and seiners. Bottomfish trawlers were assumed to make 28 trips per year and catcher-processors 9 trips per year (E.R. Combs, 1981). Traditional fishing boat trips were developed by multiplying traditional fish product processed weight (Table 37) by the recovery factor of 2.41 (E.R. Combs, 1981) to get round weight and then dividing by an assumed average boat capacity of 28 tons round weight per round trip.

From Table 38 it can be seen that bottomfishing will have a significant effect on commercial shipping and fishing boat movements. Commercial general cargo vessel round trips increase almost five-fold over the 20 year forecast period while fishing boat trips increase two-fold. Over-all vessel trips at Unalaska-Dutch Harbor more than double during the period. In 2000, trips by bottomfish trawlers and catcher-processors make up 35 percent of total expected vessel round trips, traditiona? fishing vessels account for 48 percent, and general cargo commercial vessels account for 16 percent.

Cold Bay

Cold Bay will not be directly affected by bottomfish development; however, the community will play an important role in regional aviation activities. Because of this role, fuel consumption is expected to increase at a faster rate than community population and thus demands on marine transportation will grow by several orders of magnitude. Al SO contributing to increased marine transportation demands is the proposed shellfish and salmon processing plant. The plant will produce fish products for both the domestic and foreign markets, each requiring marine transportation. Fishing boats serving the plant may or may not affect fuel consumption in the community depending on where they currently purchase fuel.

TABLE 38

UNALASKA-DUTCH HARBOR MARINE TRANSPORTATION REQUIREMENTS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

YEAR	COMMERCIAL VESSEL ROUND TRIPS: TANKERS (1)	TANKER BARGES (2)	GENERAL CARGO (3)	TOTAL	FISHING BOATS: TRAWLERS (4)	CATCHER-PROCESSOR (5)	OTHERS (6)	TOTAL	TOTAL ROUND TRIPS (7)
1981	7	18	236	261	-	-	2,840	2,840	3,101
1982	7	20	264	291	56	9	2,874	2,939	3,230
1983	8	21	291	320	140	9	2,900	3,049	3,369
1984	8	23	318	348	196	9	2,926	3,131	3,479
1985	9	23	345	377	280	18	2,960	3,258	3,635
1986	10	23	373	406	364	18	2,986	3,368	3,774
1987	11	24	424	459	504	18	3,020	3,542	4,001
1988	12	26	475	513	644	27	3,046	3,717	4,230
1989	14	31	551	596	840	36	3,081	3,957	4,553
1990	14	29	627	670	1,064	36	3,115	4,215	4,885
1991	15	29	702	746	1,260	45	3,141	4,446	5,192
1992	16	29	755	800	1,400	54	3,175	4,629	5,429
1993	17	29	832	878	1,624	63	3,210	4,897	5,775
1994	19	30	90B	957	1,820	63	3,236	5,119	6,076
1995	20	31	938	989	1,904	72	3,270	5,246	6,235
1996	21	32	967	1020	1,960	72	3,304	5,336	6,356
1997	22	33	1022	1077	2,100	72	3,339	5,511	6,588
1998	22	33	1074	1129	2,240	81	3,373	5,694	6,823
1999	23	35	1107	1165	2,324	81	3,399	5,804	6,969
2000	24	36	1139	1199	2,380	81	3,433	5,894	7,093

NOTES:
(1) Based on 35,000 DWT tankers
(2) Assumes each barge carries 7,000ST (50,050 bbl .)
(3) Assumes the average commercial cargo vessel carries 65 s. t. inbound and 150 s, t. outbound.
(4) Assumes 28 trips per based trawler (Combs, 1981)
(5) Assumes 9 trips per catcher-processor (Combs, 1981)
(6) Assumes crabbers, seiners, and others average 28 tons round weight/round trip.
(7) Excludes general cargo arrivals, which are assumed to be a part of general cargo departures.

SOURCE : ERE Systems, Ltd.

To evaluate marine transportation demands in Cold Bay the various tom. ponents of demand were each evaluated separately. These components and the resulting forecast are shown in Table 39 and described in the following paragraphs.

- Outbound Tonnage. Outbound tonnage is expected to consist entirely of fish products for foreign and domestic markets. In the absence of specific output data for the proposed processing plant, it was assumed the plant would produce the same processed weight as the average of the 13 plants at Unalaska-Dutch Harbor. Based on data developed for the traditional fishery at Unalaska-Dutch Harbor, these plants currently average about 1,300 s.t. of fish products. The forecast in Table 39 assumes a straight line growth curve between 1980 and 2000. Some of the tonnage shown is expected to be shipped to Unalaska-Dutch Harbor for subsequent export to foreign countries; the tonnage destined for domestic markets is expected to be picked up directly at Cold Bay. Half of the fish plant output is assumed destined for foreign markets, half for domestic markets.

- Inbound Tonnage. In the absence of transshipment requirements, inbound tonnage and local consumption are the same. The petroleum products category was forecast

TABLE 39

COLD BAY MARI NE TRANSPORTAT ION DEMANDS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

Y E A R	OUTBOUND TONNAGE DEMANDS	INBOUND TONNAGE OEMANDS			THROUGHPUT TONNAGE DEMANDS (4)		
		PETROLEUM PRODUCTS (1)	ORY CARGO PRODUCTS (2)	TOTAL INBOUND TONNAGE (3)	PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	TOTAL THROUGHPUT TONNAGE
1981	1,390	11,400	1,900	13,300	11,400	3,290	14,690
1982	1,480	12,500	2,100	14,600	12,500	3,580	16,080
1983	1,570	12,600	2,200	14,800	12,600	3,770	16,370
1984	1,660	12,800	2,300	15,100	12,800	3,960	16,760
1985	1,750	14,100	2,500	16,600	14,100	4,250	18,350
1986	1,840	14,400	2,600	17,000	14,400	4,440	18,840
1987	1,930	16,000	2,700	18,700	16,000	4,630	20,630
1988	2,020	17,600	2,900	20,500	17,600	4,920	22,520
1989	2,110	19,700	3,000	22,700	19,700	5,110	24,810
1990	2,200	22,600	3,100	25,700	22,600	5,300	27,900
1991	2,290	26,300	3* 300	29,600	26,300	5,590	31,890
1992	2,380	27,800	3,500	31,300	27,800	5,880	33; 680
1993	2,470	32,700	3,600	36,300	32,700	6,070	38,770
1994	2,560	36,500	3,800	40,300	36,500	6,360	42,860
1995	2,650	37,400	3,900	41,300	37,400	6,550	43,950
1996	2,740	42>300	4,100	46,400	42,300	6,840	49,140
1997	2,830	45,600	4,300	49,900	45,600	7,130	52,730
1998	2,920	49,000	4,400	53,400	49,000	7, 320	56,320
1999	3,010	52,900	4,600	57,500	52,900	7,610	60,510
2000	3,100	56,200	4,800	61,000	56,200	7,900	64,100

NOTES: (1) Outbound demands consist of only fish products. Forecast based on assumed processed weight output of a single shore-based processor packaging traditional shel 1 f ish and salmon species.

(2) Based on Aleutian-Pribilof region growth factors multiplied by estimated by 1980 inbound tonnage (10,500 ST).

(3) Based on Cold Bay growth factors multiplied by estimated 1980 inbound tonnage (1800 ST).

(4) Derived by adding inbound and outbound tonnage demands.

SOURCE: ERE Systems, Ltd.

using regional growth factors multiplied by estimated 1980 petroleum product tonnage (approximately 10,500 s.t.). The dry cargo products category was forecast using Cold Bay growth factors (Table 33) multiplied by estimated 1980 dry cargo tonnage (approximately 1,800 s.t.).

- Throughput Tonnage. Throughput tonnage combines inbound and outbound tonnage. In Cold Bay, total throughput tonnage increases more than four-fold during the forecast period, largely due to petroleum products. In 1981, petroleum products constitute 78 percent of throughput tonnage, but by 2000 petroleum products constitute 88 percent.

From the tonnage forecasts in Table 39, an estimate of marine transportation requirements was developed. This estimate is shown in Table 40, where vessel requirements are expressed as round trips. Included are commercial tankers and dry cargo ships, as well as fishing boats.

Cold Bay receives petroleum products from three sources: Richmond, California, Valdez, Alaska, and from Unalaska-Dutch Harbor. Consequently, the fuel may arrive on large 35,000 DWT tankers and on much smaller tanker barges operated throughout the region. To reflect the various origins of the products, the equipment, and the mix of products, it was assumed that the average fuel load delivered at Cold Bay was 3,000

TABLE 40

COLD BAY MARINE TRANSPORTATION REQUIREMENTS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

COMMERCIAL VESSEL ROUND TRIPS

YEAR	TANKERS[1]	GENERAL CARGO DEPARTURES (2)	FISHING BOAT ROUND TRIPS (3)	TOTAL ROUND TRIPS
1981	4	14	142	160
1982	5	15	152	172
1983	5	16	161	182
1984	5	17	170	192
1985	5	18	179	202
1986	5	19	188	212
1987	6	20	197	223
1988	6	21	207	234
1989	7	22	216	245
1990	8	22	225	255
1991	9	23	234	266
1992	10	24	243	277
1993	11	25	253	289
1994	13	26	262	301
1995	13	27	271	311
1996	15	28	280	323
1997	16	29	289	334
1998	17	30	298	345
1999	18	31	308	357

NOTES : (1) Assumes 3000 ST of fuel arrives each trip.
(2) Assumes 400 ST of Dry Cargo arrive and, 100 ST of Dry Cargo depart each trip.
(3) Assumes an average of 28 tons round weight per round trip.

SOURCE: ERE Systems, Ltd.

St. Although the average petroleum products load is likely to increase because the community is served on demand, this fact is not reflected in the tables. With a constant delivery rate, the number of tankers grows in proportion to fuel demands, which is about a five-fold increase over the 20 year forecast period.

General cargo arrivals are similar to petroleum products in that ships call when the demand is great enough to justify stopping. Without knowledge of the average economic break-even point, which itself should change over time as operating and maintenance costs vary, it was assumed that 400 s.t. arrive on each ship that stops. Over the forecast period, the net result is a doubling of general cargo ship arrivals. Until the shore-based processing plant is operating there is effectively no backhaul cargo. The figures in Table 40 assume the plant becomes operational in 1981. The backhaul cargo should improve the economics of stopping at Cold Bay. In this analysis it is assumed that half of the outbound cargo is destined for export and is shipped to Unalaska-Dutch Harbor. The remaining half is available for domestic carriers to backhaul. Regardless of destination, it was assumed that 100 s.t. was an average economic break point for the pickup of fish products at this location, Like dry cargo products, the shipping requirements at Cold Bay in 2000 increase about 2.2 times the estimated requirements for 1981.

Fishing boat trips were estimated on the basis that the average boat round weight catch was 28 s.t. This average will vary by year and season depending on the makeup of the catching fleet serving Cold Bay. This average represents the entire Bering Sea fleet average in 1979. The boat trips are derived by adjusting fish plant output to round weight (using a 2.41 recovery factor) and dividing by 28 s.t. Because of the constant relationship, fishing boat trips are proportional to plant output. Total change in the number of fishing boat trips per year over the forecast period is 2.3 times the estimated 1981 level.

St. Paul

During the first decade of the forecast period little if any changes are expected in St. Paul. However, construction of a bottomfish plant and dock in 1989 and the accompnaying demands of the fishing boats are expected to cause a sharp increase in fuel demands, as will the growing population increase demands for food and other materials. At the same time, the shipment of processed fish should increase outbound tonnage significantly over the fur seal products currently shipped.

To evaluate marine transportation demands in St. Paul the various components of demand were evaluated separately. These components and the resultant forecast are shown in Table 41 and described in the following paragraphs.

- Outbound Tonnage, Outbound tonnage is expected to consist of fur seal products and, after 1989, fish products.

TABLE 41

ST. PAUL MARINE TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

YEAR	OUTBOUND TONNAGE DEMANDS (1)	INBOUND TONNAGE DEMANDS (2)			THROUGHPUT TONNAGE DEMANDS (3)		
		PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	TOTAL INBOUND TONNAGE	PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	TOTAL THROUGHPUT TONNAGE
1981	110	2,400	1,700	4,100	2,400	1,810	4,210
1982	110	2,400	1,700	4,100	2,400	1,810	4,210
1983	110	2,400	1,700	4,100	2,400	1,810	4,210
1984	110	2,400	1,700	4,100	2,400	1,810	4,210
1985	110	2,400	1,700	4,100	2,400	1,810	4,210
1986	110	2,400	1,700	4,100	2,400	1,810	4,210
1987	110	2,400	1,700	4,100	2,400	1,810	4,210
1988	110	2,400	1,700	4,100	2,400	1,810	4,210
1989	110	2,400	1,700	4,100	2,400	1,810	4,210
1990	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1991	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1992	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1993	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1994	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1995	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1996	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1997	23,210	6,500	3,500	10,000	6,500	26,710	33,210
1998	23,210	6,500	.3,500	10,000	6,500	26,710	33,210
1999	23,210	6,500	3,500	10,000	6,500	26,710	33,210
2000	23,210	6,500	3,500	10,000	6,500	26$710	33,210

Notes: (1) Outbound demands consist of fur seal products at 110 st and after 1989 include 23,100 st of fish products.

(2) Based on St. Paul growth factors multiplied by estimated 1980 inbound tonnage (2,400 st. of petroleum products and 1,700 st of dry cargo products).

(3) Derived by adding inbound and outbound tonnage demands.

Source: ERE Systems, Ltd.

Fur seal products are estimated to be about 110 s.t. and are not expected to increase during the forecast period. The proposed fish plant is rated at a capacity of 60,000 metric tons round weight. At 35 percent recovery, which is the minimum recovery level, the plant should produce for shipment about 23,100 s.t. of processed fish products.

- Inbound Tonnage. Inbound tonnage consists of petroleum products and dry cargo products, the latter of which includes food, appliances, and other items. These items are generally assumed to increase in proportion to population growth. However, the community is expected to utilize worker enclaves in order to maintain traditional values. The cargo tonnage demands of enclave personnel are about 60 percent those of permanent residents. To account for this difference, it was assumed that enclave personnel require only 300 pounds per month (1.8 s.t. per year). Because of the fish plant, outbound tonnage, which today constitutes only about three percent of inbound tonnage, will grow to surpass inbound tonnage (2.3 times as much beginning in 1'390).

- Throughput Tonnage. Throughput tonnage is calculated by adding inbound and outbound commodity tonnages. In St. Paul throughput tonnage increases almost eight-fold with operation of the processing plant and its accompanying population changes.

From the tonnage forecasts in Table 41, an estimate of marine transportation requirements was developed. This estimate is shown in Table 42, where vessel requirements are expressed as round trips. The table is based on the assumption that existing conditions continue throughout the forecast period. As discussed in Chapter 111, the community has no adequate dock, and arriving and departing cargos are lightening between ship and shore. Arriving average cargo volumes are based on existing contract vessels serving St. Paul. Similar vessels, most likely serving under a long-term contract with one or more federal agencies, are expected to continue to operate until the fish processing plant becomes operational. At that point, backhaul volume may make St. Paul an economical stopping place, if the carriers can overcome the literaging requirements and associated delays.

Based on the forecast population and economic conditions, tanker arrivals will triple and general cargo arrivals and departures will increase six-fold when the processing plant is fully operational. Associated lightering trips beginning in 1990 increase 2.7 times over current requirements. Of greater significance is the thirteen-fold increase in outbound lighteraging requirements at the same time. The new bottom-fishing boats will also contribute to increased boat trip-making, Based on E.R. Combs (1981) bottomfish forecasts, an average of 22 trawlers

TABLE 42

ST. PAUL MARINE TRANSPORTATION REQUIREMENTS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

	COMMERCIAL VESSEL ROUND TRIPS			LIGHTER TRIPS				
YEAR	TANKERS (1)	GENERAL CARGO (2)	TOTAL	SERVING TANKERS (3)	SERVING DRY CARGO (4)	TOTAL LIGHTER TRIPS	FISHING BOAT ROUND (5) TRIPS	TOTAL ROUND TRIPS
1981	3	4	7	64	71	135		142
1982	3	4	7	64	71	135		142
1983	3	4	7	64	71	135		142
1984	3	4	7	64	71	135		142
1985	3	4	7	64	71	135		142
1986	3	4	7	64	71	135		142
1987	3	4	7	64	71	135		142
1988	3	4	7	64	71	135		142
1989	3	4	7	64	71	135		142
1990	9	24	17	172	968	1140	330	1503
1991	9	24	17	172	968	1140	330	1503
1992	9	24	17	172	968	1140	330	1503
1993	9	24	17	172	968	1140	330	1503
1994	9	24	17	172	968	1140	330	1503
1995	9	24	17	172	968	1140	330	1503
1996	9	24	17	172	968	1140	330	1503
1997	9	24	17	172	968	1140	330	1503
199B	9	24	17	172	968	1140	330	1503
1999	9	24	17	172	968	1140	330	1503
2000	9	24	17	172	968	11,40	330	1503

Notes: (1) Assumes an average of 800 st (5,700 bbl) arrives each trip.

(2) Assumes an average of 450 st arrives each trip 'and 1000 st departs each trip.

(3) Assumes a capacity of 38 st (270 bbl).

(4) Assumes a capacity of 24 st. Since lighter works in both directions, inbound cargo dictates upper limit prior to 1990, outbound cargo dictates upper limit beginning 1990.

(5) Assumes 22 trawlers per shore-based processing plant at 15 trips each (Combs, 1981).

Source: ERE Systems, Ltd.

are expected to serve each shore-based processing plant. Each trawler is expected to make 15 trips a year or about 350 trips for each plant. When all of the vessels are treated collectively, total round trips increase 10.6 times the levels expected prior to the fish processing plant.

Vessel Traffic in Unimak Pass

Unimak Pass is the most used of the principal passes through the Aleutian Islands and provides a major travel way for ships transiting between the Bering Sea and Pacific Ocean (see Figure 1). Because the pass lies astride the great circle route between U.S. West Coast ports, including Alaskan ports, and Japanese and Korean ports, the pass is used extensively by U.S. and foreign vessels plying the trade routes between these ports. Anticipated economic growth in the Aleutian-Pribilof region, in northern and western Alaska, and in international trade with Asia is expected to increase traffic through Unimak Pass. Since oil and gas tankers from the St. George Lease Sale Basin, as well as from the North Aleutian Shelf and Bering-Norton Basins are expected to use Unimak Pass in reaching west coast ports, the purpose of this anlaysis is to establish a future base line against which increases in OCS traffic can be judged.

Relatively little information is available about current traffic using Unimak Pass, and much less is available on future traffic using the Pass. Consequently, the initial thrust of this assessment is focused on establishing an estimate of current use and on developing a basis for forecasting future use. For purposes of this analysis, the discussion on use of the Pass has been divided into three components representing major user groups: the fishing fleet; the commercial fleet, including scheduled and contract general cargo and tanker shipping; and the natural resource contract shipping fleet, which includes ships used for agriculture, coal, oil, gas, and timber. The format for analyzing each of these components is initially to discuss existing conditions and current usage of Unimak Pass, and secondly to discuss future events and assumed changes in conditions that lead to increased traffic. Due' to the nature of these data a low and high estimate of vessel trips was prepared.

Fishing Fleet

The fishing fleet component includes two subcomponents: the traditional fleet and the bottomfishing fleet (both foreign and domestic). The traditional fishing fleet operating in the Aleutian-Pribilof region consists of an assortment of boats of different sizes ranging from twelve to sixty meters (40 to 200 feet) each designed to hold gear for one or more of the crab, salmon, halibut, shrimp or other fish or shellfish species available. Generally, there are three fishing seasons: King Crab, which begins in September and runs through January; Tanner Crab, which begins in January and runs through July; and the salmon season, whick fills the gap between June and September. As the fleet has become more efficient, however, the length of the seasons has been shortened because the allowable catch is reached sooner.

The size of the fleet changes from season to season and from year to year. During the 1979-1980 season 236 vessels participated in the King Crab catch and 180 participated in the Tanner Crab catch (U.S. Coast Guard, 1980). Many vessels participated in both seasons. In addition to the fishing vessels, 31 processing boats are scattered throughout the region (E.R. Combs, 1981). Few of the traditional fishing boats come from home ports in the Aleutian Islands or Bering Sea areas as illustrated in Table 43 for the King Crab and salmon catch. The North Pacific Fishing Vessel Owners Association has estimated that 236 King Crab and 118 Tanner Crab vessels generated 5,300 round trips during the 1979-1980 season, an average of about 15 trips per vessel per year (U.S. Coast Guard, 1980). The peak periods for movements by fishing vessels are September-October and March-July.

As illustrated in Table 43, approximately four percent of the vessels fishing King Crab came from the Aleutian Islands and 96 percent came from outside of the region. With respect to the salmon catch, approximately 23 percent are assumed to come from the Aleutian-Pribilof region and 77 percent are assumed to come from outside that region.

Once a fishing season begins, each fishing vessel seeks to maximize its fishing effort. In doing so, it seeks to reduce the amount of time required to get to fishing grounds and to return to processor facilities.

TABLE 43

RESIDENCE OF BOATS AND GEAR LICENSE
HOLDERS FISHING THE ALEUTIANS

PROPORTION OF KING CRAB CATCH VALUE BY BOAT RESIDENCE

Place	Percentage
Kodiak	26.8
Alaska Peninsula	4.0
Dutch Harbor	4.3
Out of State	64.9

PROPORTION OF SALMON CATCH BY RESIDENCE OF GEAR LICENSE HOLDER

Place	Percentage
Kodiak	41.5
Aleutians	20.0
South Central Alaska	3.2
Anchorage	2.6
Other Alaska	7.1
Nonresident	19.2
Unknown	6.5

SOURCE : University of Alaska, ISER, 1981.

The relatively small size of these fishing boats allows them to be selective, to some degree, of the Aleutian passes they utilize. As a consequence, with respect to the fishing fleet, analysis of the use of Unimak Pass must also consider the potential use of smaller passes in the immediate vicinity. At least two other passes and possibly more are potentially available to the size of vessels typical in the fishing fleet. These passes are Akutan Pass and passage through Avatanak Straits and Akutan Bay (see Figure 1).

In developing the low estimate, it was assumed that, regardless of where the fishing vessel originates, each vessel makes at least one trip in each direction through the pass each year. If the fleet consists of 236 King Crab vessels, 118 Tanner Crab vessels, and 187 salmon vessels, then the minimum total number trips through the pass, regardless of direction, is 1,082.

In developing "the high estimate, size of catch by species was used to "define fleet activities on both the north and south side of the Aleutian Islands in the vicinity of Unimak Pass. Size of catch data by species are available in E.R. Combs' report {15431). It was assumed that the total number of round trips made by each fleet fishing a particular species was proportional to the volume of catch on either side of the Islands. As an upper limit, fishermen originating on the south side of the Islands or from out-of-state were assumed to make all their trips to the north side and vice versa for fishermen originating on the north side of the islands. In transiting the islands, any one of the three passes cited earlier were assumed to be used. For example, 95 percent of the King Crab catch in the vicinity of Unimak Pass is on the Bering Sea side of the Pass; therefore, it was assumed that 95 percent of the round trips generated by 96 percent (Table 43) of the 236 King Crab vessels would take place on the north side of the pass.

The percentage data for each species is provided below and the results for 1980 levels of vessel traffic in Unimak Pass are provided in Table 44.

	Species		
	King Crab	Tanner Crab	Salmon
Percent Catch on Bering Sea Side	95%	86%	18%
Percent Catch on Pacific Ocean Side	5%	14%	82%

The forecasts for 1990 and 2000 were prepared in a similar manner. The low estimate did not change because the size of the fleet is not expected to change (E.R. Combs, 1981). The high estimate increased only slightly although these fisheries are at or near maximum sustained annual yield. The traditional catch and related number of fishing trips were assumed to increase about one percent per year over the forecast period.

The bottomfish subcomponent of the fishing fleet includes both the

TABLE 44

ESTIMATE OF VESSEL TRAFFIC IN UNIMAK PASS 1980, 1990, 2000

	ESTIMATED VESSEL TRIPS		
	1980	1990	2000
VESSEL TRIP CATEGORIES	LOW-HIGH	LOW-HIGH	LOW-HIGH
Fishing Fleet			
Traditional	1080-3570	1080-3600	1080-3630
Bottomfish (1)	480-1800	560-1850	660-1920
Commercial Shipping			
Domestic	430-490	710-980	920-1460
Foreign	310-540	340-580	380- 640
Natural Resource Shipping			
Agriculture	Note (2)	10- 11	20- 30
Coal	Note	170-270	340- 530
Gas/Oil	20-40	390-400	90- 100
Timber	50-60	60-80	70- 90
TOTALS	2370--6500	3320-7771	3560-8400
Median	4435	5546	5980

Notes : (1) Includes Foreign and domestic fleets.
(2) Quantities shipped constituted less than 10 trips, the rounding factor.

Source: ERE Systems, Ltd.

foreign and domestic fishing activities. Virtually all bottomfishing at present is done by a foreign fleet made up of trawlers, catcher-processors, and large processing mother ships from many countries, including Russia, Korea, Japan, and others. In 1979, this foreign fleet numbered 252 vessels. A domestic bottomfishing fleet does not presently exist, although some bottomfishing boats have been constructed and several crabbers have been modified for bottomfishing purposes. A basic assumption about growth of the U.S. bottomfishing fleet is that the U.S. fleet will expand to catch the sustainable yield by the year 2000 and, thereby, will completely eliminate foreign fleet activity by 2000. At that point in time, the U.S. fleet in the Bering Sea is expected to consist of 408 boats: 315 of which are trawlers with an assumed average annual capacity of 2,700 metric tons (about 6,000,000 pounds); and 93 catcher-processors with an assumed capacity of 9,100 metric tons (about 20 million pounds). Each trawler is expected to make about 28 trips per year in support of shore-based processors, while each catcher-processor is expected to make about 9 trips a year between the fishing grounds and at least one Aleutian port for the purpose of sending this fish to market.

An estimate of the 1980 level of bottomfish fleet usage of Unimak Pass centers about activities of the foreign fleet, about which relatively little is documented. For purposes of this analysis, it was assumed that 85 percent of the foreign fleet is engaged in fishing exclusively, and 15 percent of the fleet is engaged in processing exclusively. This assumption results in 214 fishing vessels and 38 processing vessels. These vessels were also assumed to have the same trip characteristics as anticipated for the future U.S. bottomfishing fleet. Consequently, the foreign fleet fishing vessels would generate 5,992 round trips (214 vessels x 28 trips/vessel) and processors would generate 342 round trips (38 vessels x 9 trips/vessel). Since the foreign vessels are not based in the Aleutians, trawlers are assumed to operate in the fishing grounds near the processing ships. When the processing ships have filled their holds to capacity, the ships either transfer their cargo to a foreign freighter at sea or the processing vessel must return its catch to its country of origin. As a result, it was assumed that up to one-third of the trips generated by processing vessels are used for moving processed catch to the country of origin and the other two-thirds of the round trips are used to support the fishing effort.

Based on the forecast bottomfish activities developed by the University of Alaska Sea Grant Program (1980) and E.R. Combs (1981), 85 percent of the bottomfishing effort is located in the Bering Sea and 15 percent of the bottomfishing effort is either in the Gulf of Alaska or off-shore Kodiak Island. To estimate the low level of trips through Unimak Pass it was assumed that the entire fleet or at least a representative number of vessels would move through the pass in the process of shifting from the Bering Sea to the Gulf of Alaska fishing grounds and over the course of several weeks or months would shift back again. This movement was assumed to be represented by all of the fishing vessels and two-thirds of the processing vessels, about 239 ships. One trip in each direction through Unimak Pass resulted in a low estimate of 480 trips.

With respect to the high estimate, it was assumed that none of the processing ships would leave the Bering Sea area, but that the foreign fishing fleet would expend 15 percent of its fishing efforts (consistent with the percent of bottomfish catch expected) in the Gulf of Alaska/Kodiak area. Fifteen percent of 5,992 round trips is approximately 1800 one-way trips all of which were assumed to go through Unimak Pass because the ships would require pilots if they entered Alaskan waters in the narrower alternative passes.

The forecast for 1990 was developed by interpolating the decline of the foreign fishing fleet and growth of the U.S. domestic bottomfishing fleet, since the U.S. fleet replaces the foreign fleet by 2000. For this analysis, it was therefore necessary to calculate the 2000 forecast before the 1990 forecast. In 2000, the U.S. domestic fleet will consist of trawlers serving shore-based processing plants within a 150 mile range of the plant with catcher-processing vessels fishing in areas beyond the 150 mile range of the trawlers. The 315 trawlers and 93 catcher-processors identified earlier are that portion of the U.S. bottomfish fleet located in the Bering Sea-Aleutian area. This fleet fishes approximately 85 percent of the total bottomfish catch. It was estimated that an additional 56 trawlers and 16 catcher-processors would be located in the Kodiak/Gulf of Alaska area and would be fishing for the remaining 15 percent of total bottomfish catch.

In estimating the minimum level of trip-making through Unimak pass by the U.S. bottomfish fleet, it was assumed that each of the catcher-processors, regardless of location, would make at least one trip through the pass in both directions and that trawlers located at Unalaska-Dutch Harbor, St. Paul, and Akutan, as well as catcher-processors in the Bering Sea, would each make one additional trip through the pass in both directions in the process of seeking a Lower 48 port for annual overhaul. A minimum of 218 trips are made by catcher-processors while fishing and 260 trips by trawlers and 186 trips by catcher-processors are made for maintenance. The result is a minimum level of about 660 trips through Unimak Pass in 2000.

In estimating the upper level of trip-making through Unimak Pass by the U.S. bottomfishing Fleet, it was assumed 15 percent of the trips by trawlers based at Unalaska-Dutch Harbor and Akutan, plus 15 percent of the Bering Sea-based catcher-processor trips, plus 85 percent of the Kodiak/Gulf of Alaska-based catcher-processor trips would be made through the pass. These percentages are based on the bottomfish catch distribution described earlier. Maintenance trips by trawlers and catcher-processors, as described for the low estimate in 2000, would also be included. The result is a potential maximum level of 1,920 trips through the pass in 2000.

The interpolation for 1990 low and high estimates was performed respectively on both the foreign and domestic fleet trips through the pass and then combined. The interpolation is based on the Combs assumption that the domestic bottomfish fleet is 44.12 percent developed in 1990 and therefore only 55.88 percent of the foreign fleet is then operational. The results in Table 44 show the low estimate in 1990 is expected to be 560 vessels and the high estimate is expected to be 1,850 vessel trips.

Commercial Shipping

The commercial shipping component includes both domestic and foreign cargo and tanker vessel activity. Domestic commercial shipping is largely oriented toward Unalaska-Dutch Harbor and other communities in western and northwestern Alaska including Kotzebue, Nome, Bethel, and Dillingham. Information about trips to these communities is largely based on information gleaned through interviews with different shipping companies and available published schedules. From this information it was learned that from 217 to 245 round trips are made in the process of serving these various communities. The majority of these trips are made to Unalaska-Dutch Harbor because the harbor is available on a year-round-basis. In order to convert these round trips to trips through Unimak Pass, the round trips were multiplied by a factor of two. The resulting range of domestic shipping trips for 1980 is from 432 to 490 trips.

Future levels of traffic for the domestic commerical shipping fleet in Unimak Pass were based in large part on the Unalaska-Dutch Harbor forecast illustrated in Table 38. To obtain a range of values from this table it was assumed the high and low values were respectively plus and minus 20 percent of the stated value, except that the forecast illustrated for the year 2000 was halved to reflect the fact cited earlier, that as the demand for shipping increases, shipping companies are more likely to devote a greater percentage of a given ship to serve a particular harbor or are more inclined to utilize larger ships as a way to continue the service to all communities. The result of that shift lowers the number of vessel trips required to move the same volume of cargo. With the adjustments for other shipping activities to the western and mid-western communities (taken from Peat Marwick, 1980) domestic commercial shipping activities using Unimak Pass in 2000 are expected to be in the range between 920 and 1,460 vessel trips per year. The estimate for 1990 was made by straight line interpolation between the 1980 and 2000 values.

The foreign commercial fleet consists of scheduled service to Unalaska-Dutch Harbor, together with both scheduled and unscheduled service between west coast ports and Asian ports following the great circle route through Unimak Pass. These foreign sailings originate in Seattle, San Francisco, Portland or Los Angeles in the U.S., and in Japan, Korea and possibly Taiwan. Not all shipping between Asia and the U.S. west coast takes place along the great circle route and not all ships traveling this route are inclined to use Unimak Pass. Exactly what percent of foreign shipping uses the great circle route and Unimak Pass is not readily known. However, the following is an attempt to identify some portion of foreign shipping likely to use the pass. Service to Unalaska-Dutch Harbor ranges from 52 to 61 trips per year, or about one round trip every six to seven days. With respect to foreign sailing to and from the U.S. west coast, it was assumed that as a minimum one ship travels in each direction every two weeks to each of the ports mentioned above, and as a maximum one ship travels in each direction every week to each port. This resulting range of foreign vessel trips for 1980 is from 310 to 540.

The estimate of future foreign commercial shipping was based on an assumed growth rate in demand for ships of approximately one percent per year throughout the entire forecast period. The actual level of tonnage moved between Asian and U.S. west coast ports is likely to grow at a much faster rate than the demand for ships, but again, larger and more efficient vessels are expected to be utilized, consequently reducing the actual growth in the number of vessels. Based on the one percent per year growth rate, trip. making by foreign commercial shipping in Unimak Pass is expected to range between 340 to 580 trips in 1990 and between 380 to 640 trips in 2000.

Natural Resources Shipping

The category of natural resources shipping was an attempt to separately identify vessel traffic operating between Alaska and Asia. Four product categories are of particular interest: agriculture, coal, gas/oil and timber. Alaska's export agriculture industry is just emerging. It was not until the Delta Barley Project was conceived in 1976 that interest developed in taking advantage of the export market., Since the project was approved by the State Legislature in June 1978, 60,000 acres of agricultural land has been sold to Alaskan residents. Two crops are viewed as essential to the success of this project: barley and rapeseed. Principal markets for the barley and rapeseed crops are Japan, South Korea, and Taiwan. In addition, barley can be used in livestock feeds for Alaskan and other U.S. herds. It is anticipated that by 1986 some 170,000 acres in the Delta Junction area will be in some form of agriculture production or in the process of being cleared for use. Rapeseed will be the major cash crop. The potential also exists for increasing the total acreage. A 20,000 acre development at point McKenzie near Anchorage has been suggested and an additional 300,000 acres could be developed for grain, rapeseed, forage, or potato production near Nenana, sixty miles south of Fairbanks. Based on a yield of 14,000 - 15,000 tons of barley from 14,000 acres of land (Alaska Journal of Commerce, December 1, 1980), it appears that each acre of production yields approximately one ton of product.

In establishing the 1990 range of vessel trips, it was assumed that the lower end of the range represented 80 percent of approximately 170,000 acres of land and the upper end of the range represented 90 percent of the available land. It also was assumed the average shipload of agricultural product was approximately 30,000 DWT, which results in 10 to 11 vessel trips assumed to go through Unimak Pass. In 2000, it was assumed 470,000 acres are under cultivation, but that the minimum number of acres available for export crops was only twice that available in 1990. The upper end of the range in the year 2000 assumed that 80 percent of the available acreage was used for export crop production. Eighty percent was chosen for the upper limit rather than 90 percent in order to reflect increases in the in-state need for these crops, as well as increases in the diversity of crops. A similar ship size was assumed, resulting in a range of vessel trips through Unimak Pass of 18 to 26.

Coal production in Alaska began at the turn of the century, and although coal mining has been conducted continuously throughout most of this century, the industry has advanced little. Coal reserves in the state are tremendous: approximately 600 billion tons based on official estimates. Coal quality ranges from sub-bituminous to small deposits of anthracite. The largest deposits are sub-bituminous steam coal. Recently, there has been renewed interest in the export of coal to Japan and Taiwan. A Japanese electric company has signed a nine-year contract to purchase coal from the Usibelli Coal Mines near Heally and ship it via the Alaska Railroad out of Seward (Seattle Journal of Commerce, October 24, 1980). More recently the Taiwan Power Company indicated that they could be interested in purchasing Alaskan coal sometime after 1985 (The Anchorage Times, August 27, 1981). Taiwan's coal import needs are estimated to be approximately 8 million tons in 1986, the first year Alaskan coal is likely to be purchased. Also recently, a Korean firm signed a contract with Usibelli to purchase 7 million metric tons of coal over the next ten years. Other coal companies in Alaska are preparing a test shipment of 1,200 tons of Beluga Coal to be sent to Japan (The Anchorage Times, August 27, 1981). For purposes of estimating vessel trips in Unimak Pass related to coal resource transportation, it was assumed that by 1990, Alaska would export 5 to 8 million tons of coal and that by 2000 the state would export 10 to 16 million tons per year. Assuming the coal is carried in 60,000 DWT ships, these ships would make approximately 170 to 270 trips in 1990 and from 340 to 530 trips in 2000.

Gas and oil development on the North Slope and in the Beaufort Sea OCS area currently affect the level of vessel traffic in Unimak Pass. During periods of open water in the Beaufort Sea, oil companies operating on the North Slope and in the Beaufort Sea transport equipment that is too large to be carried by airplane or truck from Anchorage or Seward. Approximately 6 to 10 ships (tug barge combinations) make this vaoyage each year, resulting in 12-20 trips through Unimak Pass. In addition, the oil companies buy pipe from Japan, some of which is delivered directly to Prudhoe Bay and some of which is delivered through Unimak Pass to Seward. It is estimated that the deliveries of pipe to Seward results in 6 to 10 vessel trips each year. In total, gas and oil activities in the Beaufort Sea and North Slope currently contribute 20 to 40 vessel trips to traffic in Unimak Pass.

In the future, additional OCS lease sales in the Bering-Norton, St. George, and North Aleutian Shelf areas will also contribute to traffic through Unimak Pass. Due to the structure of the analysis in this report, however, only those activities associated with the Bering-Norton OCS sale are included in this base case estimate of vehicle traffic in Unimak Pass. Subsequent chapters will develop a range of vessel traffic associated with the St. George Sale. Subsequent studies by others are expected to develop the range of vessel traffic for the North Aleutian Shelf area. With respect to the Bering-Norton Lease Sale, the petroleum development scenario described in Appendix B of this report indicates that in 1990, approximately 190 round trips may be made in providing services to the lease sale area and in moving gas and oil to west coast ports. By 2000 this level of activity should drop to 45 round trips per year. The reason for the decline is due to the drop in gas/oil resources as the field is pumped down. In 1990 it is also anticipated that supply vessels will continue to service the North Slope and Beaufort Sea areas, although by 2000 it is expected that most of the oversized equipment will have been moved to the North Slope and that most tonnage will be moved through Seward, Anchorage, or Whitter. When the figures for 1990 are collected, it is anticipated that approximately 390 to 400 vessel trips will be added to traffic through Unimak Pass. In 2000 it is anticipated that from 90 to 100 vessel trips will be added to traffic through the pass.

Timber and forest product exports primarily include logs and pulp sent to Japan. Round log exports have doubled between 1979 and 1980 and quadrupled over the 1975 level. However, in 1980, the round log export market declined due to declining housing investment in Japan and less favorable currency exchange relationships. Alaska wood chips on the other hand have almost doubled in price as demand remains strong for pulp in Japan (Alaska Pacific Bankcorporation, 1980). It is estimated that from 1.3 to 1.5 million tons of timber and pulp were shipped to Japan during 1980. Using ships whose average size is approximately 50,000 DWT, this would have resulted in 50 to 60 vessel trips through Unimak Pass. Growth of timber exports through 2000 is expected to be about two percent per year (Energy Resources Co. and E.G. Frankel, 1978). Although larger ships may be employed in the future to handle the increased resource availability, this same size ship produces 60 to 80 vessel trips through the pass in 1990 and 70 to 90 additional trips through the pass in 2000.

To get a sense of the total range of vessel trips in Unimak Pass, the results of each of the above vessel trips categories must be combined. This information appears in Table 44. The reader should note that there is a large difference between the low and high estimated vessel trips. This is largely due to the uncertainty of through-pass trips generated by the fishing fleet. In 1980 the range of Unimak Pass Traffic is 2,370 to 6500 trips. For 1990, the range is from 3,320 to approximately 7,770. Between 1980 and 1990 the low end of the range increases 40 percent and the high end increases only 20 percent. By 2000, the low range estimate of Unimak Pass Traffic is 3,560 and the high range estimate is 8,400. The low estimate in 2000 represents an increase of 50 percent over 1980 estimates and the high estimate in 2000 represents a 29 percent increase over the high estimate for 1980.

If the median values of the range are considered, the median for 1980 is 4,435; for 1990 it is 5,546; and for 2000 it is 5,980 trips. The 1990 median value represents an increase of 25 percent over the 1980 value and the year 2000 median value represents an increase of 35 percent over the 1980 value.

MARINE TRANSPORTATION IMPACTS AND ISSUES

The large and small communities in the Aleutian-Pribilof region each receive different levels of marine transportation services. The different levels are influenced in part by the community's demands for marine transportation, in part by the marine infrastructure available in each community, and in part by the tariff structure of the shipping companies. The prospect of rapid growth due to bottomfish development may or may not improve the existing situation. Because such an outcome could mask the effects of OCS development and because bottomfishing activities could be a harbinger of similar effects by OCS activities, this section of the base case briefly explores the impact of bottomfish development on marine transportation services and facilities from a regional perspective.

There is a general concern in the Aleutian-Pribilof region that shipping rates are too high and that the quality and frequency of services provided, particularly to the smaller communities, are inadequate given the high cost. Among several factors that influence level of service, two elements of the community itself are important: specifically, tonnage demand and available marine facilities. The kinds of facilities available in each community vary considerably in size, age, and ownership. A few communities have public docks adequate for their intended purpose - for example, the city dock at Unalaska or the fuel pier at Cold Bay. However, the docks and cargo handling facilities in many communities are privately owned and may or may not be available for use as the community's major cargo facility, even though it is used in that fashion. Because of such use, inadequate facilities are difficult to maintain and due to the remoteness maintenance becomes an expensive undertaking. Facilities that are old and/or not maintained are restricted from full utilization. Some facilities are simply too small to be of any use as a cargo dock. Where facilities are inadequate or missing, the cost of providing transportation services increases because of the need for special equipment (such as lighters), because the operation becomes more labor-intensive, or because of the delay costs associated with large ships. Small inbound tonnage demands and little or no outbound tonnage, a characteristic of the small communities, compounds the cost of services on a per-pound basis. Communities that are larger because of seasonal fishing activities have higher inbound demands and fish products for outbound shipment. As a result, these larger communities can command more frequent service and, if the marine facilities are adequate, service at a lower cost.

Another element affecting the level of service is the shipping company tariff schedule, To increase the efficiency of ships assigned to a particular route, shipping companies develop their tariff schedules to reflect operations costs, as well as delay costs and special handling problems. As part of the rate structure, minimum load sizes are established and lower rates are available to shippers whose load sizes exceed a specified threshold value. These threshold values vary by commodity, but usually reflect full container loads or other economical handling unit of the commodity. In addition, rates vary with the direction of sailing: northbound or southbound. Generally, rates are lower southbound. For shipments of less than container loads, the shipper pays a premium for handling and packing, if necessary. As a result of the tariff structure, shipping companies serve ports directly only when the shipment size (as determined by the company) make it relatively economical to stop. Consequently, some of the smaller communities receive no commercial marine service. Instead, they must rely on the BIA ship North Star III for service, which is, in essence, a subsidized service and an infrequent one.

Yet another factor affecting level of service from both the supplier's and consumer's perspective is inflation, which is hidden, but always present. From the supplier's perspective, inflation increases the costs of fuel, maintenance, and labor. Shipowners and operators must constantly adjust tariffs to cover rising operational costs and maintain a competitive position. From the consumer's perspective, particularly in the small communities with no products to sell, purchasing power for transportation services declines, reducing tonnage demand. The result of inflation is an increasing discrepancy in the range of transportation services available to large and small communities.

The influence of the bottomfish industry on level of service in the region in large part will depend upon location decisions made by the industry. There is little in the way of harvesting and processing facilities for the various bottomfish species in place in Alaska at present. Existing processing plants and the logistics system serving them are based on a low volume, high value resource. The bottomfish industry produces a high volume, relatively low value resource. Large investments in high volume operations follow a pattern different from existing plants and, consequently, logistical considerations may be different. In the bottomfish assumptions used to forecast base case growth, it was assumed that half of the allowable catch would be processed by shore-based plants and half the catch would be processed by sea-based plants. Shore-based plants will be located in places dictated by physical needs (e.g. harbor space for trawlers and transports, among other factors). The degree to which shore-based plants can concentrate finished products for shipping is limited by these same physical needs. Sea-based processors, on the other hand, have a tremendous economic flexibility in that they could concentrate the delivery of processed fish products at a single location. This would provide great leverage in negotiating shipping rates.

The greater the level of concentration sought by the bottomfish industry, fewer communities will be directly affected by such development, and it becomes less likely that the existing level of service problems can be treated by new economic development. Such intense concentration is likely to create four or five very large communities, perhaps each about half the size forecast for Unalaska-Dutch Harbor. If both shore-based and sea-based processors concentrated their products at these four or five locations, the tonnage demands thus created would far exceed present large community demands. As a result, the communities benefiting from bottomfish development are likely to create a third and much higher level of service, exacerbating many of the existing problems. If an intense form of concentration isn't important or is unattainable for other reasons, new bottomfish plants could be enticed to spread among the many communities that meet minimum locational criteria. The State could offer incentives such as low interest loans, or could construct infrastructural improvements, including transportation facilities.

As a way of offsetting poor marine freight service and as a way of attracting bottomfish plants to some communities, the Alaska Department of Transportation and Public Facilities (ADOT/PF) recently completed a study of an Aleutian and Southwest Alaska Coastal Ferry System (DMJM Forssen, 1980.) The study covered the areas from Adak to Kodiak focusing on service to the isolated villages that generally receive poor transportation services. The study proposed the establishment of a coastal cargo ferry system with limited passenger accommodations serving two routes eastward from Unalaska-Dutch Harbor. One route would traverse the north side of the Alaska Peninsula to Dillingham stopping at Port Heiden and Naknek in each direction. One way travel time is estimated at seven days. A second route would traverse the south side of the Peninsula, stopping both directions at Akutan, Cold Bay, King Cove, Sand Point, Chignik, Larsen Bay/ Old Harbor, Port Lions, Ouzinkie, Kodiak, and Anchorage. One way travel time for this route is 13 days. Containerized cargo service based on standard 8 foot x 8 foot x 20 foot modules is proposed. The north side vessel would carry 25 passengers and 40 container equivalents up to an 800 s.t. payload. The south side vessel would carry 50 passengers and 85 container equivalents up to a 1,700 s.t. payload. The system could require extensive improvements to existing berthing facilities in all but Anchorage, Kodiak, Port Lions, Naknek and Unalaska-Dutch Harbor. At Unalaska-Dutch Harbor the ferry would use either a planned new city dock or the APL dock. Estimated cost of the ferries is $15.1 million and for the berthing facility improvements is $45.3 million excluding debt service, design fees, administration and other items. Excluding port costs, the cost of operating and maintaining the two ferries would be $2.74 million per year. Anticipated revenues would be $14,1 million per year creating an $11.6 million surplus, less costs for shoreside services which were not estimated. ADOT/PF has made no decision to commit funds to the system or the proposed improvements at this time. The principal advantages cited for this proposed system is that westbound trips provide improved access to foreign markets through Unalaska-Dutch Harbor, and eastbound trips, particularly on the south side of the Peninsula, improve access to domestic shipping at Kodiak or Anchorage. Certainly, the level of service to the various affected communities would be improved by this effort.

Due to the volume of fish products and other tonnage demands resulting from rapid bottomfish industry growth, consideration must be given to the effects of these demands on available facility capacity. Of particular interest are the capacities of the shore side facilities (docks, storage, and cargo handling equipment) and those of the marine carrier fleet. Shore side facilities in each affected community are discussed later in this analysis. The focus here is on the marine carrier fleet serving the Aleutian-Pribilof region; which consists of an assortment of foreign and domestic ships and barges. At present, the foreign built ships are restricted from coastwise trade by the Jones Act, thus, the domestic fleet is responsible for cargo movements northbound and southbound between U.S. ports. The authors crudely estimate that commodity flows northbound and southbound are almost balanced during a good fishing year, and may be slightly higher southbound. The authors also estimate that the existing domestic fleet uses only 60 to 80 percent of available capacity on an annual basis and that the rate for each carrier, route, direction and time of year vary considerably from this estimate. Historically, fish products tonnages moving through some ports have fluctuated as much as 50 percent from one year to the next (Combs, 1978). Consequently, shipping companies are reluctant to reroute or reschedule vessels or to purchase new vessels unless the demands are real and somewhat sustained. In the Aleutian-Pribilof region peak flows are offset in part because processing plant storage facilities buffer the flow of fish products to the ships and because processors use contract marine carriers to increase fleet capacity when it is needed.

The advent of bottomfish development should bring more stable southbound commodity flows, but it will greatly unbalance the northbound-southbound relationship. In a way, such an imbalance in the Aleutian region will offset the historic imbalance northbound in other regions of the State. This statewide balance might serve to reroute southbound traffic from other regions in order to obtain necessary additional capacity. However, fleet capacity might also be increased by other means. If only four or five communities are the recipients of bottomfish industry activities, direct service to these communities with fewer intermediate port calls would increase the frequency of service and, thereby, also the capacity. Continued use of contract carriers on a year-round basis also adds capacity, as needed. Capacity could also be added by introducing new competitors. For example, if American President

Lines (APL) is successful in its efforts to obtain an exception to the Jones Act, thereby allowing foreign ships to conduct coastal trade, additional domestic capacity is available with no increase in the number of vessels. The additional capacity achieved by streamlining or by changes in law should provide a favorable shipping climate for bottomfish processors, but such actions may contribute to overall degradation of the level of service, if such efforts add capacity to large tonnage communities at the expense of the middle and smaller tonnage communities.

Another area of marine transportation subject to capacity constraints are the vessel traffic routes, The capacity of a route has been defined as its ability to accommodate the frequency of marine traffic at a satisfactory level of service. In addition to traffic, the environmental integrity and economic efficiency of the route must also be considered (Energy Resources Co. & E.G. Frankel, 1978). If capacity is truly contained this means the collision losses and congestion delay costs exceed the cost of implementing a safer or more efficient traffic control plan. One area of the region where traffic controls should be considered in the future is in Unimak Pass. Either a fairway or other traffic separation scheme might be appropriate as traffic increases during the forecast period. The objective of traffic separation schemes is to reduce the risk of collision in converging areas, dense traffic areas, or where restricted sea room limits freedom of movement by shipping. One of the primary criteria considered in establishing traffic lanes are the navigational conditions in the area. These conditions are influenced by visibility, current, severity of weather, ice, availability of aids to navigation, and the ability to identify radar targets (assuming ships are equipped with loran and radar equipment). Based on the weather conditions likely to be encountered in the Aleutians most of the time, Unimak Pass appears a likely candidate for some traffic control or separation scheme. The U.S. Coast Guard which has responsibility to propose and establish traffic separation schemes, is monitoring the pass and other potential areas as part of their routine operations.

Unalaska-Dutch Harbor

The community of Unalaska and the nearby Dutch Harbor areas enjoy the highest level of service in the Aleutian-Pribilof region because the port serves as the major transshipment point for export fish products and for goods inbound to other Aleutian communities. To enhance this role, the Unalaska-Dutch Harbor area has developed good dock facilities and cargo handling equipment at several locations in Unalaska Bay. However, the forecast levels of tonnage demands and transportation requirements appear to strain the capacity of existing docks and significantly increase crowding and the potential for accidents in the Dutch Harbor area. Part of these apparent impacts are inherent in the methodology. For example, the average cargo size per port call was assumed constant at 65 s.t. inbound and 150 s.t. outbound throughout the forecast period. More likely an upward shift in average cargo size could be expected as Unalaska-Dutch Harbor grows in importance as a transshipment point. Since the existing fleet has additional capacity, it seems reasonable to observe that Table 38 probably overstates transportation requirements. By how much is impossible to determine, because other factors come into play, such as employment of contract carriers, the use of larger ships, and routing changes that increase the proportion of a ship's capacity available in Unalaska-Dutch Harbor.

Perhaps a more critical aspect of these transportation movements is the berthing space requirements at the various docks. In 2000, the forecast cargo departures/arrivals imply one vessel uses each dock each day (1,139 departures ÷ 3 docks ÷ 365 days per year = 1.0). With an average load of 150 s.t. (about 10 T.E.U.) and an average unloading capacity of about 10 T.E.U.'s per hour (the range is about 5 to 25 T.E.U.'s per hour), each ship will require about 4 to 5 hours at the dock including docking and undocking time. Assuming tides, currents, and weather are generally tolerable, there appears to be sufficient berths so that no delays occur. However, this analysis assumes that all ships use only the three docks, which is incorrect. Contract carriers are likely to dock at the fish processing plant, instead of the commercial docks so that there may be considerably more berth capacity available at the commercial docks than indicated by the above analysis.

The addition of bottomfish trawlers, catcher-processors and additional marine transport vessels can be expected to create considerable over-crowding in the Dutch Harbor area. A potential outcome of the over-crowding is likely to be an increased rate of accidents and higher marine insurance costs. The construction of a small boat harbor will allow consolidation of moored vessels away from the major traffic corridors in the Bay. Provision of a small boat harbor may also increase the year-round presence of fishing boats, since many boats that normally return to their home ports between seasons could find accommodations and services in Unalaska.

The city of Unalaska was identified by the Alaska DOT/PF as one terminus of the proposed cargo ferry system, specifically the proposed new Unalaska city dock or the APL dock. Although this system is unlikely to improve the level of service to Unalaska-Dutch Harbor, the foreign market linkage provided to smaller communities served by the ferry enhances the transshipment function of the Unalaska-Dutch Harbor area.

Cold Bay

Cold Bay is not expected to be affected directly by the bottomfish . . industry, The present level of service for fuel shipments appears adequate, but general cargo shipments are infrequent. The available dock is currently adequate for fuel shipments, but the approach to the dock is restricted to a five-ton load creating cargo handling problems. Proposed construction of a traditional processing plant might provide an improved dock for cargo shipments, however, this dock would be privately operated. It is unlikely that the tonnage output of the new processing plant would significantly increase the frequency of port calls and thereby raise the overall level of service.

The community was identified as one of several to be served by the proposed Aleutian coastal ferry system, provided that a new public dock would be constructed. The proposed ferry would considerably improve the level of service to Cold Bay by increasing the frequency and reliability of service and potentially lowering the cost of service. Service to Cold Bay may affected negatively by bottomfish development because rapidly rising tonnage demands at bottomfish ports would make stopping at Cold Bay an opportunity cost. As a result, service may become more infrequent and, without adequate facilities, more expensive.

St. Paul

Although several small docks exist at St. Paul, none are adequate to provide direct unloading of the barges or other vessels calling on the community. As a result, cargo and fuel are lightered from ship to shore and the fur seal skins and other animal byproducts are lightered the other way. Mere it not for the federally subsidized shipping contract to haul seal skins and other animal byproducts, service to St, Paul would rely solely on the BIA ship Northstar 111 and the Cool Barge. If the contract is not renewed for the 1985-1989 period, or if the seal harvest is halted, the level of service to the community may decline further.

On the other hand, the suggested construction of a bottomfish plant at St. Paul could significantly improve the level of service and likely reduce shipping costs. The plant dock, although privately owned, could handle cargo and fuel shipments for the community. Also, the Corp of Engineers (COE) recently completed a study ofa new boat harbor at St. Paul that includes a 91 meter (300 foot) dock backed by a breakwater. The design for this new "facility eliminates the need for lighteraging cargo and allows seagoing barges to off-load and load at the dock (Management and Planning Services, 1980). No commitment has been made to construct the facility. However, if constructed, it would greatly improve the quality of service and would likely reduce shipping costs.

Air Mode

As the primary people mover, air transportation is expected to play an increasingly important role as growth in the bottomfish industry changes the Aleutian-Pribilof region. Of particular interest to this study, and the focus of this section of the base case, is determination of the magnitude of air transportation effort needed to move forecast populations and the adequacy of available facilities and equipment to meet expected demands. For each of the communities of interest, several determinants of demand are forecast and evaluated including: enplaned passengers, air freight, air mail, and airport operations. As discussed below certain parts of the regional air system have been left out of the quantitative analysis because OCS events are unlikely to have a direct effect on them. Where effects are indirect or secondary, such as at the Anchorage International Airport, these have been included qualitatively in the impacts discussion.

FORECAST OF AIR TRANSPORTATION DEMANDS AND REQUIREMENTS

The forecast of regional air transportation demands and requirements is built upon the regional and community level population and economic growth forecasts presented earlier in this chapter, Assumptions about the overall system and about system operational characteristics are presented first, followed by a detailed forecast of demands for the three communities of interest.

The existing regional aviation system serves passenger and air freight movements within the region, as well as between the region and the cities of Anchorage and Seattle. Principal orientation of this regional system is to Anchorage along two corridors. The first corridor links western Aleutian military bases at Adak and Shemya directly to Anchorage; the second corridor links eastern Aleutian and Alaska Peninsula communities along a spine route from Unalaska through Cold Bay to Anchorage. A secondary orientation of the system is to Seattle, which is linked to the region through Cold Bay. Because the eastern Aleutians (east of Unalaska-Dutch Harbor) are most likely to be affected by OCS development and because the military population is not expected to change significantly, if at all, during the forecast period, this analysis deals with only the eastern Aleutian linkages.

The air route structures for air carriers and air taxi operators were assumed not to change. Cold Bay is expected to continue as the regional transfer point. Air carriers are assumed to base their aircraft in Anchorage while air taxi operators will continue to base their aircraft in the region. The air carrier routes considered in this study were those linking the three communities of interest with Anchorage and Seattle. Specifically, the air carrier routes included the following linkages: Unalaska-Dutch Harbor and Cold Bay; Cold Bay and Anchorage with an intermediate stop at St. Paul (northbound only); Cold Bay and Anchorage directly; and Cold Bay and Seattle directly. No specific air taxi routes were examined, however, air taxi operations were forecast at each community airport by assuming ten percent of passenger enplanements use air taxi.

The kinds of equipment used on air carrier routes are expected to continue to be turboprop YS-11A and L-188 Electra aircraft, or replacement aircraft of similar size and capacity. The YS-11A was assumed to be the only air carrier aircraft flying the link between Unalaska-Dutch Harbor and Cold Bay. Both the L-188 and YS-11A are expected to fly the Anchorage to Cold Bay direct linkage, while only the L-188 is used on the Seattle to Cold Bay route or through St. Paul. Turbojet aircraft, such as the 737 or 727, might replace, or even compete on the longer routes between Cold Bay and Anchorage or Seattle. However, these jets are assumed to be unable to use other regional airports due to short runway lengths, which limit capacity and reduce the ability to meet high operating expenses.

Both capacity and load factor characteristics of the air carrier and air taxi aircraft were considered. For analysis purposes, the capacity of the air carrier aircraft were assumed to be 44 passengers for the YS-11A and 91 passengers for the L-188. These capacities were reduced by assumed load factors of 90 percent on the Unalaska-Cold Bay link and 80 percent on the other links. Since air taxi aircraft have a considerable range of sizes, it was assumed that the average air taxi aircraft had a capacity of five passengers, but operated at 80 percent load factor with four passengers.

In general, the growth in enplaned passengers and freight might be expected to increase proportionally with economic and population growth. However, different elements of air travel demands are likely to grow at different rates. In this analysis, travel by local residents (which includes business travel and non-fish related trips originating outside a community, but with a destination in the community) is forecast to grow at a faster rate than non-resident travel for several reasons: 1) the increasing residence factor in population growth; 2) the fact that many functions of state government and business activities are currently coordinated in Anchorage, and are likely to continue to be in the future; and 3) the climate and remoteness of the region in combination with high salaries supports increased recreational travel. With respect to non--resident labor, the air travel demands of harvesting, processing, and construction employment were each treated separately. A heuristic relationship was established between full-time equivalent annual employment and aviation trips based on sample data from existing harvesting, processor operations, and from assumed rotation characteristics of the construction trades. As a result of these various assumptions, the following trip generation data were used where applicable in each community forecast:

- Resident population, business travel, and non-fishing related trips attracted from outside the community--
  5.6 trips per year per resident civilian.
- Nonresident harvest sector employees--
  3,0 trips per year per employee,

- Nonresident processing sector employees-- . 4.4 trips per year per employee.
- Nonresident construction sector employees-- 5.2 trips per year per employee,

The forecast of airport operations, including peak daily operations, was derived from passenger enplanements and adjusted aircraft passenger capacity. Ninety percent of passenger enplanements were assumed to use air carrier aircraft and the remaining ten percent were assumed to use air taxi aircraft. The respective air carrier/ air taxi enplanements were converted to departures by dividing by the different aircraft capacities. These departures were then doubled to get total air carrier/air taxi operations, the assumption being that enplanements represent round trips. Total airport operations were forecast assuming the mix of air carrier/air taxi operations constituted a certain percentage of total operations. For Unalaska-Dutch Harbor and Cold Bay, the air carrier/air taxi mix was assumed to be 40 percent of total operations; at St. Paul 50 percent was assumed. Peak daily operations were assumed to be twice annual average daily operations. Because Cold Bay is a transfer point for air carrier operations, the forecast attempted to account for both enplaned and through passengers. From available existing operations data and load factors it was estimated that through passengers on air carrier flights were about 55 percent of enplaned passengers. This figure was factored into the passenger forecast before determining air carrier operations. No through-passenger characteristics were considered for the air taxi operations because Cold Bay was assumed to be an origin or destination for such flights.

Unalaska-Dutch Harbor

The airport at Unalaska-Dutch Harbor has a relatively short single gravel runway about 1311 meters (4,300 feet) in length with a bluff obstruction along its northern side. Although the Alaska Department of Transportation and Public Facilities have studied the runway extension problem (Dames and Moore, 1980b) and FAA suggests removal of the obstruction in the National Airport Systems Plan (FAA, annually), there has been no commitment of funds to either lengthen the runway or to remove the obstruction. The City has received money for design of a 518 meter (1700 foot) extension and is expected to ask the State legislature for a $25 million appropriation for construction of the extension and removal of the obstruction. However, this study assumes that most of the existing problems at the airport will remain. These problems currently limit the type of commercial aircraft that can safely operate from the airport. As explained above, this study assumes the use of YS-11A aircraft or similar aircraft on air carrier flights to and from Cold Bay. These aircraft have an adjusted capacity of 40 passengers at a load factor of 90 percent. Air taxi aircraft are not specifically identified, but are assumed to average four passengers at a load factor of 80 percent.

The forecast of annual passenger enplanements and other air transportation demands and requirements for Unalaska-Dutch Harbor are shown in Table 45. Annual passenger enplanements are seen to increase from about 11,000 in 1981 to almost 65,000 in 2000, a sixfold increase over the forecast period. Enplanements by residents (not shown in Table 45), which are 66 percent of total enplanements in 1981, increase to 84 percent of total enplanements by 2000. Trips by selected non-residents make up the difference and have a reversed relationship over time from that of residents. Enplanements during an average week of the peak month are also shown in Table 45, The peak month is assumed to constitute 15 percent of annual enplanements.

Also shown in Table 45 are forecasts for air freight tonnage and air mail tonnage. Both forecasts follow FAA's Alaska-wide assumptions for growth in these demands: 5 percent per annum on air freight and 3 percent per annum on air mail USDOT (FAA, 1979). As a result of these assumptions air freight increases almost threefold and air mail doubles. The historic pattern for air freight at Unalaska-Dutch Harbor has been erratic, however, with wide fluctuations year to year. At times air freight tonnage has increased as much as 55 percent from one year to the next and at other times has dropped 27 percent. With rapid growth of the bottomfish industry and population it would seem the erratic character of air freight tonnage will continue. Airmail on the other hand has a history of very steady growth which is also expected to continue.

TABLE 45

UNALASKA-DUTCH HARBOR AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

YEAR	PASSENGER ENPLANEMENTS: ANNUAL[1]	PASSENGER ENPLANEMENTS: PEAK MONTH[2] AVERAGE WEEK	ANNUAL AIR FREIGHT TONNAGE DEMANDS(3)	ANNUAL AIR MAIL TONNAGE DEMANDS(4)	ESTIMATED AIRCRAFT OPERATIONS: AIR CARRIER OPERATIONS(5)	ESTIMATED AIRCRAFT OPERATIONS: AIR TAXI OPERATIONS(6)	ESTIMATED AIRCRAFT OPERATIONS: TOTAL AIRCRAFT OPERATIONS[7]	ESTIMATED AIRCRAFT OPERATIONS: PEAK DAILY OPERATIONS(8)
1981	10,830	374	76	43	488	542	2,575	15
1982	11,410	394	80	44	514	571	2,713	15
1983	12,000	414	84	46	540	600	2,850	16
1984	12,580	434	88	47	567	629	2,990	17
1985	13,170	454	92	49	593	659	3,130	18
1986	16,310	563	97	50	734	816	3,875	22
1987	19,430	670	102	52	875	972	4,618	26
1988	22,620	780	107	53	1,018	1,131	5,373	30
1989	25,840	891	112	55	1,163	1,292	6,138	34
1990	29,140	1,005	118	56	1,312	1,457	6,923	38
1991	33,370	1,151	124	58	1,502	1,669	7,928	44
1992	37,600	1,297	130	60	1,692	1,880	8,930	49
1993	41,880	1,445	136	62	1,885	2,094	9,948	55
1994	46,250	1,595	143	63	2,082	2,313	10,988	61
1995	50,610	1,746	150	65	2,278	2,531	12,023	66
1996	53,400	1,842	158	67	2,403	2,670	12,638	70
1997	56,260	1,941	166	69	2,532	2,813	13,363	74
1998	59,100	2,039	174	71	2,660	2,955	14,038	77
1999	61,950	2,137	183	74	2,788	3,098	14,715	81
2000	64,830	2,237	192	76	2,918	3,242	15,400	85

Notes: (1) Based on 5.6 trips per year for resident civilians, 3.0 trips per year for nonresident fish harvesting employees, 4.4 trips per year for nonresident fish processing employees, and 5.2 trips per year for nonresident construction employees.

(2) Peak-month is assumed to be 15 percent of annual enplaned passengers. Average week is 23 percent of peak month enplanements."

(3) Assumes five percent increase per annum based on FAA assumptions for entire State (FAA, 1979).

(4) Assumes three percent increase per annum based on FAA assumptions for entire State (FAA, 1979).

(5) Derived from the relationship: air carrier operations = $\frac{\text{Annual Enplanements} \times 0.9 \times 2}{40}$ where the factor 0.9 assumes 90 percent of enplanements are on air carrier aircraft; the factor 2 assumes arrivals equal departures; and the factor 40 the adjusted capacity of a YS-11A aircraft assumed as standard.

(6) Derived from the relationship: air taxi operations = $\frac{\text{Annual Enplanements} \times 0.1 \times 2}{4}$ where the factor 0.1 assumes 10 percent of enplanements are on air taxi aircrafts; the factor 2 assumes arrivals equal departures; and the factor 4 is the adjusted capacity of a typical air taxi aircraft.

(7) Air carrier operations plus air taxi operations are assumed to constitute 40 percent of total operations. The sum is divided by 0.4 to obtain total aircraft operations.

(8) Peak daily operations are assumed to be twice annual daily average operations.

The airport operations forecast shown in Table 45 was developed using the method described earlier. Air carrier operations are seen to increase from 488 annual operations in 1981 to 2,918 annual operations by 2000. Similarly, air taxi operations increase from 542 annual operations to 3,242. Over the same period, total annual operations grow from 2,575 to 15,400. Peak daily operations expand from 15 flights daily in 1981 to 85 flights daily in 2000. Runway capacity appears adequate as discussed in the impacts section.

Cold Bay

The airport facility at Cold Bay is considered to be among the best in the State. Cold Bay serves and is expected to continue serving as the major transfer point in the region. No major improvements to the 1,562 meter (5,126 feet) paved runway are planned. The forecast of annual and peak month average week passenger enplanements is shown in Table 46. Annual enplanements increase from 21,490 in 1981 to 105,481 in 2000, while the peak period enplanements increase from 741 in 1981 to 3,639 in 2000, almost a fivefold increase in both.

Annual air freight and air mail tonnage, also shown on Table 46, increase almost threefold and twofold respectively. Air freight expands from 335 tons in 1981 to 847 in 2000, while air mail expands from 253 tons to 443 in 2000.

TABLE 46

COLD BAY AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 BASE CASE
1981 -2000

YEAR	PASSENGER ENPLANEMENTS: ANNUAL (1)	PASSENGER ENPLANEMENTS: PEAK MONTH (2) AVERAGE WEEK	ANNUAL AIR FREIGHT TONNAGE DEMANDS (3)	ANNUAL AIR MAIL TONNAGE DEMANDS (4)	ESTIMATED AIRCRAFT OPERATIONS: AIR CARRIER OPERATIONS (5)	ESTIMATED AIRCRAFT OPERATIONS: AIR TAXI OPERATIONS (6)	ESTIMATED AIRCRAFT OPERATIONS: TOTAL AIRCRAFT OPERATIONS (7)	ESTIMATED AIRCRAFT OPERATIONS: PEAK DAILY OPERATIONS (8)
1981	21,490	741	335	253	2,138	1,075	8,033	44
1982	23,462	809	352	260	2,273	1,173	8,615	47
1983	23,659	816	370	268	2,293	1,183	8,690	48
1984	24,054	B30	388	276	2,326	1,203	8,823	49
1985	26,419	911	407	284	2,486	1,321	9,518	53
19B6	27,011	932	428	293	2,532	1,351	9,708	54
19B7	29,968	1,034	449	302	2,730	1,499	10,573	58
1988	33,123	1,143	472	311	2,940	1,657	11,493	63
1989	37,066	1,279	495	320	3.202	1,853	12,638	70
1990	42,389	1,462	520	330	3,552	2,120	14,180	78
1991	49,290	1,701	546	339	4,003	2,465	16,170	89
1992	52,247	1,803	573	350	4,202	2,613	17,038	94
1993	61,317	2,115	602	360	4,793	3,066	19,648	108
1994	68,612	2,367	632	371	5,270	3,431	21,753	120
1995	70,189	2,422	664	382	5, 3B0	3,510	22,225	122
1996	79,455	2,741	697	393	5,984	3,973	24,893	137
1997	85,567	2,952	732	405	6,385	4,279	26,660	147
1998	92,074	3,177	76B	415	6,812	4,604	28,540	157
1999	99,369	3,428	807	430	7,290	4,969	30,648	168
2000	105,4B1	3,639	847	443	7,691	5,274	32,413	178

Notes: (1) Based on estimated 1980 enplanements at Cold Bay multiplied by regional growth factors.

(2) Peak month is assumed to be 15 percent of annual enplaned passengers. Average week is 23 percent of peak month enplanements.

(3) Assumes five percent increase per annum based on FAA assumptions for entire State (FAA, 1979).

(4) Assumes three percent increase per annum based on FAA assumptions for entire State (FAA, 1979).

(5) Derived from the relationship: Air Carrier Operations = $\frac{\text{Annual Enplanements} \times 0.9 \times 2 + 750(1+i)^n}{0.55}$ where the factor 0.55 adjusts passenger enplanements to represent both enplaned and through passengers; the factor 0.9 assumes 90 percent of enplaned and through passengers are on air carrier aircraft; the factor 2 assumes arrivals equal departures; the factor 51 represents the weighted average adjusted capacity of aircraft using Cold 8ay; the factor 750 represents assumed international air carrier operations in 1980; and the factor $(1+i)^n$ represents a compounding characteristic where i is assumed as one percent and n is the number of years from 1980.

(6) Derived from the relationship: Air Taxi Operations = $\frac{\text{Annual Enplanements} \times 0.1 \times 2}{4}$ where the factor 0.1 assumes 10 percent of enplanements are on air taxi aircraft; the factor 2 assumes arrivals equal departures; and the factor 4 is the adjusted capacity of a typical air taxi aircraft.

(7) Air carrier operations plus air taxi operations are assumed to constitute 40 percent of total operations. The sum is divided by 0.4 to obtain total aircraft operations.

(8) Peak daily operations are assumed to be twice annual daily average operations.

Source: ERE Systems, Ltd.

Due to regional growth, aircraft operations increase equally significantly. Air carrier operations, as seen on Table 46, grow from 2,138 in 1981 to 7,691 in 2000. Air taxi operations grow from 1,075 to 5,274 over the same period. Total aircraft operations increase from 8,033 in 1981 to 32,413 in 2000. Peak daily operations, occurring during the summer months, increase from 44 operations in 1981 to 178 operations in 2000,

St. Paul

In St. Paul, little change is expected to occur before the assumed bottomfish plant is built in 1989. Annual enplanements actually decline slightly in response to a declining population as shown in Table 47. This ‘forecast does not recognize a possible increase in tourism to St. Paul, which might serve to keep enplanements steady or growing. Once the plant is put into operation in 1990, air travel demands increase sharply. Over the forecast period annual enplanements increase almost threefold from 2,424 in 1981 to 6,227 in 2000. A similar increase takes place with peak month average week enplanements.

Air freight and air mail tonnage follow almost similar change patterns. Over the period 1981 to 1989 it was assumed such tonnage demand would grow only one percent per year. After 1989, demand returns to five percent and three percent, respectively. As a

TABLE 47

ST. PAUL AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 BASE CASE
1981-2000

YEAR	PASSENGER ENPLANEMENTS: ANNUAL[1]	PASSENGER ENPLANEMENTS: PEAK MONTH (2) AVERAGE WEEK	ANNUAL AIR FREIGHT TONNAGE DEMANDS(3)	ANNUAL AIR MAIL TONNAGE DEMANDS[4]	ESTIMATED AIRCRAFT OPERATIONS: AIR CARRIER OPERATIONS(5)	ESTIMATED AIRCRAFT OPERATIONS: AIR TAXI OPERATIONS(6)	ESTIMATED AIRCRAFT OPERATIONS: TOTAL AIRCRAFT OPERATIONS(7)	ESTIMATED AIRCRAFT OPERATIONS: PEAK DAILY OPERATIONS(8)
1981	2,424	84	18	16	151	122	546	3
1982	2,424	84	18	16	151	122	546	3
1983	2,424	84	18	17	151	122	546	3
1984	2,424	84	18	17	151	122	546	3
1985	2,424	84	19	17	151	122	546	3
1986	2,415	83	19	17	150	121	542	3
1987	2,415	83	19	17	150	121	542	3
1988	2,415	83	19	17	150	121	542	3
1989	2,415	83	19	18	150	121	542	3
1990	6,211	214	20	18	386	311	1,394	8
1991	6,212	214	21	19	386	311	1,394	8
1992	6,212	214	22	19	386	311	1,394	8
1993	6,215	214	23	20	386	311	1,394	8
1994	6,217	215	25	20	386	311	1,394	8
1995	6,218	215	26	21	386	311	1,394	8
1996	6,219	215	27	22	386	311	1,394	8
1997	6,222	215	29	22	387	311	1,396	8
1998	6,223	215	30	23	387	312	1,398	8
1999	6,225	215	31	24	387	312	1,398	8
2000	6,227	215	33	24	387	312	1,398	8

Notes: (1) Based on 5.6 trips per year for resident civilians, 3.0 trips per year for nonresident fish harvesting employees, 4.4 trips per year for nonresident fish processing employees, and 5.2 trips per year for nonresident construction employees.

(2) Peak month is assumed to be 15 percent of annual enplaned passengers. Average week is 23 percent of peak month enplanements.

(3) Assumes one percent per year growth between 1981 and 1990, five percent growth after 1990.

(4) Assumes one percent per year growth between 1981 and 1990, three percent growth after 1990.

(5) Derived from the relationship: air carrier operations = $\frac{\text{Annual Enplanements} \times 0.9 \times 2}{29}$ where: the factor 0.9 assumes 90 percent of enplanements are on air carrier aircraft; the factor 2 assumes arrivals equal departures; and the factor 29 represents the seats available to boarding passengers on flights from Cold Bay to Anchorage with an intermediate stop at St. Paul.

(6) Derived from the relationship: air taxi operations = $\frac{\text{Annual Enplanements} \times 0.1 \times 2}{4}$ where: the factor 0.1 assumes 10 percent of enplanements are on air taxi aircraft; the factor 2 assumes arrivals equal departures; and the factor 4 is the adjusted capacity of a typical air taxi aircraft.

(7) Air carrier operations plus air taxi operations are assumed to constitute 50 percent of total operations. The sum is divided by 0.5 to obtain total aircraft operations.

(8) Peak daily operations are assumed to be twice annual daily average operations.

Source: ERE Systems, Ltd.

result of early slow growth, air freight increases less than twofold during the forecast period from 18 tons to 33 tons, and air mail increases only 50 percent from 16 tons to 24 tons.

Annual aircraft operations are similarly affected. Air carrier operations change from 151 in 1981 to 387 in 2000, while air taxi operations grow from 122 to 312 during the same period. Total annual operations increase from 546 in 1981 to 1,398 in 2000 with peak daily operations growing from 3 to 8 at the same time.

Anchorage International Airport

Since the Aleutian-Pribilof region air transportation system is principally oriented to Anchorage, the Anchorage International Airport is likely to receive some indirect secondary effects of growth in the Aleutians. Of particular interest is whether or not anticipated growth in the Aleutian-Pribilof region creates a significant change in the forecast demands for Anchorage International Airport. For purposes of this analysis, it was assumed the Anchorage forecast is based on the premise that growth in the State is evenly distributed both in the base year and horizon year of the forecast, and that only the magnitude of activities increase year to year, From this premise two points in time can be compared to determine if the Aleutian-Pribilof region is taking a greater or lessor share of the future forecast. The years selected were 1979, when Anchorage had about 1.1 million enplaned passengers, and 1996, when Anchorage Airport is forecast to have 3.6 million enplaned passengers. Using the earlier assumption that 70 percent of Aleutian-Pribilof residents and 10 percent of the nonresidents have an Anchorage destination (and origin), it was determined that in 1979, the Aleutian region probably accounted for about 11,000 or one percent of Anchorage enplanements that year. Using the figures in Table 46 for 1996, about 41,500 enplanements in the Aleutian-Pribilof region had a destination/origin in Anchorage. This is about 1.15 percent of the Anchorage 1996 forecast.

While this approach is simplistic, a more rigorous analysis is unjustified given the nature of the assumptions about travel to Anchorage. It impossible, for example, to assume that the resident based Aleutian region trips might be oriented more to Seattle than Anchorage because many of the new residents may come from the northwestern states. Regardless, the results seem to indicate that the Anchorage Airport forecast has sufficient flexibility to account for anticipated growth in the Aleutian-Pribilof region.

AIR TRANSPORTATION IMPACTS AND ISSUES

The forecast intensity of bottomfish development can have both positive and negative effects on the existing air transportation sys tern. In part, the nature of these effects depends upon location decisions yet to be made by the bottomfish industry, and in part on state government's response to existing air transportation problems. This section of the base case discusses these positive and negative effects and their potential influence on existing problems and-issues.

As discussed in Chapter III, air transportation service in the Aleutian-Pribilof region suffers from many problems. The existing service levels, while considered adequate by the military and faster developing fishing communities, is considered inadequate by the small fishing communities and smaller villages. The inadequate service is caused by many factors, the more important of which are: 1) poor weather conditions, which cause delays, diversion of flights to other alternative communities, or cancellation and rescheduling of passengers and freight; 2) lack of sufficient air travel demand to make it economical to provide the service; 3) inadequate and poorly maintained airport facilities that limit the aircraft capacity and the type of aircraft that can use the facilities; and 4) high air fares that discourage use of the available system. Generally, little can be done about the weather, although airport facilities equipped with appropriate instrument flight controls could eliminate many of the cancellations and diversions of flights. The FAA, who is responsible for air navigation and safety, lacks full navigational coverage in the Aleutians (and other places in Alaska), but is faced with the fact that improved navigation cannot overcome the limitations of the ground facilities.

The combination of low air travel demand and high air fares is not necessarily coincidental, but both factors are affected by lack of subsidies. Air travel demands at the military bases and in the large fishing communities are subsidized because the military and the fish companies provide transportation for employees traveling for business reasons. Since both have a high transient population traveling for business reasons, travel demands are maintained artificially high. In the small fishing communities where seasonal populations are not as big and subsidized travel demands are few, and in both these communities and the smaller villages where the permanent populations are very small, there is no subsidy at all. Several communities receive no scheduled air service and must rely on the much more expensive air charters for transportation. Reeve Aleutian Airways (RAA) is the only air carrier serving the Aleutians and is still the only air carrier in Alaska that is not subsidized. It receives no subsidy by choice because it wants neither the "hassle" nor the conditions and terms associated with a subsidy. Consequently, in all communities RAA charges presumably the full cost of providing the service plus a reasonable profit. Rates are high in every community except that that normal effects on demand are offset by the military and fish companies in certain communities.

The air fares are also affected by other characteristics of the regional air system, principally through increased operating costs. Not only are operating costs influenced by inflation, but also by the physical condition of the runways and various lengths of runway. Inflation has affected the cost of fuel and spare parts, as well as salary demands. If the physical condition of the runway is deteriorated by potholes, standing water, or considerable unevenness, stresses on parts and frames are increased together with maintenance downtime and frequency of spare parts usage. The length of a runway also affects operating costs if it reduces the capacity of an aircraft and affects revenue tonnage. The type of aircraft used also influences operating costs. In 1978, the YS-11 twin turbo cost $560.00 per operating block hour; and the L-188 four turbo Electra cost $1,033 per operating block hour. Based on a comparison of eleven aircraft types, it was found that in 1978 it was 20 percent more costly on a block hour basis and 45 percent more costly on aircraft mile basis to operate an aircraft in Alaska than in the lower 48 (Louis Berger & Assoc., 1979a). The combination of weather delays and facility limitations certainly increases these costs.

Changing the aircraft equipment in and of itself does not provide a solution. Smaller aircarft with lower costs would have to make more trips, but it is difficult to get increased utilization when landing facilities cannot be used around-the-clock. Larger and more efficient aircraft, such as the Boeing turbo jet 737-200, which have operating block hour costs of $1,260 and 115 seats could not use the landing facilities at any of the region's airports except Cold Bay without having a tremendous loss of capacity, if in fact there is sufficient runway length even under minimal conditions.

The Alaska Department of Transportation and Public Facilities (DOT/PF) has responsibility for maintenance and construction of airport facilities. Many of the runways and terminals were inherited from the military following World War II. Runways in some communities were made of landing mats that have rusted away and fallen into disuse. Due to the remoteness of the area and age of some facilities, major maintenance efforts are difficult to perform and are costly. Because maintenance is expensive, standards for new construction are set higher than normal, thus increasing the initial costs, This in turn means that fewer new projects can be constructed.

Given this broad set of regional air transportation problems and issues, what impacts will the bottomfish industry have on the Aleutian-Pribilof region transportation system? Generally, the advent of the bottomfish industry, because of its intensity and concentration, offers new opportunities to provide the economic incentives that lead to improved air service. However, much depends on the locations selected for such activities. Even though the industry is likely to increase residency in communities it touches, initially it will rely on a transient work force. Consequently, aviation services will be an important factor in determining adequate locations, as will proximity to the fishing grounds. In the absence of other criteria, the need for adequate air transportation would appear to lead the industry to those communities already bustling with fisheries' activities. The arrival of the bottomfish industry in these communities can be expected to dramatically increase the demand for air travel because of the large number of workers at each plant. The aviation system may respond in several ways. If additional capacity was already available in the air fleet in the form of extra planes, they would likely be pressed into service. For example, aircraft currently doing charter work might be refitted, if necessary, for use on scheduled routes. If additional capacity in the existing fleet is insufficient or does not exist the airlines might lease additional aircraft or, at worst, reduce transportation services at communities with less demand in order to get added capacity to the newly affected communities. The latter action would reduce the level of service to one or more communities and increase the disparity among different levels of services that exist today.

Yet another alternative of the airlines is to increase the utilization of each aircraft by flying more each day. Since most airports in the region are limited to visual flight rules (VFR) this restricts the extra utilization to daylight hours. When weather is accounted for, considerable delays would occur because the aircraft could not make enough trips in a day. The next day, freight would be set aside and passengers would fly. Eventually, the freight situation would rival that experienced by air taxi operators in other parts of western Alaska -- Christmas presents would be delivered in May.

Overall, the level of service in the region will not improve much. Communities without a runway will still be without services or will still be served via amphibian aircraft. Communities where demands are too small to economically justify services will continue to rely on chartered aircraft. Communities that today are receiving adequate air service may or may not enjoy continuation of this service depending upon actions of the bottomfish industry and the air carriers. For those communities impacted by the bottomfish industry the frequency of service is likely to increase. For all communities, the delays caused by weather will likely continue in the absence of improved navigation equipment and facilities. Al SO for all communities the costs will go up,

Unalaska-Dutch Harbor

Many of the current aviation problems at Unalaska-Dutch Harbor reflect the region's facilities problems. The runway is 1,311 meters (4,300 feet) long, made of gravel , and is obstructed on the north side by a large bluff. The navigational aids located on the airport allow only VFR operations. Contrary to many communities in the region the frequency of air service is good with 6 to 8 trips per week. No service is provided on Sundays. The theoretical runway capacity under VFR conditions for a single runway is somewhere between 45 and 60 operations per hour (Horonjeff, 1975). Based on a seven-hour winter day in good weather, and using the low end of the theoretical capacity range, the runway at Unalaska could handle 315 operations per day or about 98,550 operations per year. However, the airport lacks a taxiway so this estimate should be halved since arriving aircraft may need the runway to taxi to the terminal.

Both FAA and Alaska DOT/PF have considered improvements at Unalaska-Dutch Harbor. The FAA, in addition to removal of the obstruction, has suggested installment of:

- New terminal building
- Medium intensity runway lights (MIRL)
- Apron Lights
- Visual Approach Slope Indicator (VASI)
- Runway End Identification Lights (REIL)
- Wind Altimeter Voice Equipment (WAVE)
- Crash, Fire, Rescue (CFR) vehicles and building
- Lighted Wind Cone (LWC)
- Power Supply

All of these improvements aid navigation or safety. None of these improvements have been funded. (USDOT-FAA, 1979).

The advent of bottomfish development at Unalaska-Dutch Harbor is expected to increase air travel demands and aircraft operations generally as shown in Table 45. The volume of passengers is expected to exceed the capacity of existing terminal facilities creating a significant delay if no improvements are made. Annual aircraft arrivals and departures in 2000, which are expected to be about 15,400 operations, use about 31 percent of the theoretical capacity of 49,300 operations. The 85 peak daily operations use about 54 percent of summer time daylight capacity (based on 14 hours of daylight).

The proposed runway extension is not expected to alter the theoretical capacity of the runway. However, the runway extension could significantly alter the route structure and competitive aspect of air carrier operations to Unalaska-Dutch Harbor and Cold Bay. Reeve Airways presently enjoys a monopoly position in part because competitors operate all-jet fleets. Under present conditions competitors could serve Cold Bay because it has an adequate runway, but passengers would have to transfer to Reeve if they were going to any community other than Cold Bay. If the Unalaska-Dutch Harbor runway were extended to accommodate jets, competitors could fly directly to the main Aleutian community from Anchorage and Seattle. A 6,500 foot runway would allow direct return service to Anchorage and probably would allow direct return service to Seattle, depending on the gross take-off weight of the aircraft. Such direct service to and from Anchorage is not a significant event since RAA does this routinely with YS-11A aircraft, but the present runway is too short to allow direct trips to Seattle. The advent of jet traffic, however, would provide a different time dimension to Aleutian travel. In addition, competing jets could, if the new runway length allowed, carry more passengers more efficiently and could affect air travel rates on routes between Unalaska-Dutch Harbor and Anchorage or Seattle and between Cold Bay and Anchorage or Seattle.

Unfortunately, weather delays may still hamper operations at the airport because the navigation improvements do not provide for an instrument landing system (ILS). Such delays could be quite expensive for a Boeing 737, which needs to keep flying to pay for itself. Waiting for three or more days to land at Unalaska may make jet travel only a dream.

Cold Bay

Cold Bay is not directly affected by bottomfish development except that the airport becomes a transfer point for passengers coming from or headed toward Anchorage and Seattle. The airport has two runways, one 3,174 meters (10,415 feet) and one 1,562 meters (5,126 feet), both of which are asphalt paved. Available navigational aids permit all weather operations. Frequency of service is very good because of its role as a transfer point. The theoretical capacity of the airport is estimated at 55 operations per hour because the runways are divergent and intersecting (Horonjeff, 1975). Based on 24 hour operations, the airport can handle 1,320 operations per day or 481,800 operations per year.

No major improvements are planned for the airport. FAA has recommended and funded a direction finder and has also recommended but not funded the following:

- omnidirectional approach lighting system (ODALS)
- installation of frangible light towers
- purchase of a crash, fire, rescue vehicle
- construction of a new terminal

Neither the enplanements forecast nor operations forecast appears to pose a problem, based on the above discussed capabilities. If the runway at Unalaska-Dutch Harbor is extended to accommodate jet flights, the estimates of enplanements and operations might be adjusted downward. Depending on actual demand at Unalaska-Dutch Harbor and the competitive situation on routes to and from there, service to Cold Bay could drop considerably. Because of Cold Bay's connections to other regional points, this decrease could seriously affect the level of service to many eastern Aleutian communities, unless these connections moved to Unalaska-Dutch Harbor, or the Unalaska routes continued to include Cold Bay as an intermediate stop.

St. Paul

The community of St. Paul is affected by bottomfish development only during the last half of the forecast period. The airport at St. Paul consists of a single gravel surfaced runway 1,547 meters (5,075 feet) long. Available navigational aids permit only VFR operations, Current. frequency of service is three times a week, but only to Anchorage. The theoretical capacity of the runway is similar to Unalaska-Dutch Harbor: 49,300 annual operations and 158 daily operations.

The FAA has recommended paving of the runway and construction of a stub taxiway and parking apron. FAA has funded distance measuring equipment (DME), a remote center air-ground communications facility, and medium intensity approach lights. They have also recommended construction of a new terminal.

Based on future enplanements and operations data in Table 47, the airport appears to have sufficient runway capacity to meet forecast demands. When bottomfishing arrives in 1990, some restructuring of the route might take place to increase the capacity of arriving and departing aircraft. Since the current flight goes from Cold Bay through St. Paul to Anchorage it was assumed that some Anchorage bound passengers would be on the plane, thereby reducing the aircraft capacity to St. Paul arriving and departing passengers. Use of an additional aircraft to fly the Cold Bay-St. Paul and return route would reduce the number of Seattle bound St. Paul boarding passengers being routed through Anchorage, particularly after the bottomfishing plant is operational.

V. EXPLORATION-ONLY SCENARIO IMPACTS

As explained earlier in this report, the analysis of OCS impacts will deal with two OCS situations respectively labeled the "Exploration-Only case" and the "Mean case." This chapter presents a forecast and analysis of the exploration-only case, which by definition is based on the assumption that no commercially recoverable oil or gas resources are discovered during exploration activities. The OCS events used in this analysis follow a specific "exploration-only scenario" developed by BLM for the St. George Basin studies. The exploration-only case is constructed by combining the incremental economic and population changes triggered by the OCS scenario with the base case forecast presented in Chapter IV. The analysis of the scenario seeks to determine the beneficial and adverse effects of the incremental changes on marine and air transportation facilities and services. The analysis is performed by directly comparing the combined forecast of the exploration-only case with that of the base case.

Expected OCS Events

The scenario of exploration-only OCS events follows a five-year exploration program commencing in 1983, the first year after the sale. As shown in Table 48, which summarizes the exploration-only development schedule, exploration activity reaches a peak by 1985 and terminates in 1987 after discouraging results. A total of 21 wells are expected to be drilled to an average depth of 4,054 meters (13,300 feet) by two rigs operating in each of the five years. The type of rigs used during explo-

TABLE 48.

DEVELOPMENT SCHEDULE
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1981-1988

YEAR	YEAR AFTER LEASE SALE	EXPLORATION AND DELINEATION RIGS(1)	EXPLORATION AND DELINEATION WELLS(2)	ON SHORE FACILITY CONSTRUCTION	TRANSPORTATION EQUIPMENT SUPPLY/ ANCHOR BOATS(3)	TRANSPORTATION EQUIPMENT HELICOPTERS(4)
1981						
1982	0					
1983	1	2	3	Note 5	4	3
1984	2	2	5		4	3
1985	3	2	6		4	3
1986	4	2	5		4	3
1987	5	2	2		4	3
1988	6					

Notes: (1) Large size semisubmersibles or possibly drillships.
(2) Wells are expected to drill to 4,054 meters (13,300 feet).
(3) All boats are assigned to marine service base assumed located at Unalaska-Dutch Harbor.
(4) Two helicopters are assigned to Cold Bay; one helicopters assigned to Unalaska-Dutch Harbor.
(5) Construction of temporary service base.

Source: USDOI-BLM, Alaska OCS Office, 1980.

ration will likely be the larger sized semisubmersibles, or possibly drill ships.

It is anticipated that exploration support will come from temporary support bases at Unalaska-Dutch Harbor and Cold Bay. Marine transportation support is assumed to be based at Unalaska-Dutch Harbor because it offers the best port facilities and marine transportation services in the region, an adequate fresh water supply, and other community infrastructural elements. Aviation support is divided between Unalaska-Dutch arbor and Cold Bay. Because of its superior airport facilities and existing air route linkages to Anchorage and Seattle, Cold Bay is a more economical and more efficient transfer point for offshore personnel and light supplies needed at offshore locations. Two of three helicopters needed for exploration are assigned to Cold Bay. The remaining helicopter is assigned to provide direct support to the marine service base at Unalaska-Dutch Harbor.

Two supply/anchor boats are assigned to each drilling vessel. These boats ferry supplies from the Unalaska-Dutch Harbor service base to the vessel. These supplies include drilling materials such as mud, cement, casing and other items, which are shipped to the support base via contract marine carrier and stored until needed. Fuel and fresh water required by the rigs are expected to be purchased from local suppliers in Unalaska-Dutch Harbor (most likely fuel from Standard Oil, water from the City). Consumable items such as hand tools, food, etc., may reach the rigs by sea or air. Nonperishable products and normal replacement items are assumed to be shipped by marine general cargo carrier to Unalaska, stored at the temporary support base until needed, and transshipped to the rig via supply boat. , Perishable products and emergency replacement items are assumed to be shipped air freight to Cold Bay and moved to the rig via helicopter.

Economic Factors Affecting Growth

The principal changes in economic activity between the base case and this OCS case are the OCS events occurring after the proposed 1982 lease sale. These OCS events further enhance employment opportunities in the Aleutian-Pribilof region. However, due to the short-term nature of these activities and no construction of any major new industrial support facilities, these opportunities are temporary. Labor to fill these various jobs will come from the affected communities, other communities in the region, other parts of the state, and from outside the state. The best opportunities for local or regional employment are associated with construction and operation of the marine service base and with some of the supply boat activities. The increased specialization of many offshore jobs and some in the marine and air transportation sectors limits those jobs to qualified people. Based on residency assumptions made by the Institute of Social and Economic Research (ISER, 1981), employment and population in the Aleutian-Pribilof region are expected to change as shown in Table 49. Both employment and population rise during the five-year exploration program but subsequently decline to levels associated with the base case. At the peak of exploration activities in 1985, additional regional employment totals 361 persons, a four percent

TABLE 49.

ALEUTIAN-PRIBILOF REGION EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1981-2000

		EMPLOYMENT					POPULATION					
			ADDED EMPLOYMENT					ADDED POPULATION				
YEAR	YEAR AFTER LEASE SALE	BASE CASE REGIONAL EMPLOYMENT	ADDITIONAL RESIDENT EMPLOYMENT (1)	ADDITIONAL ENCLAVE EMPLOYMENT (2)	TOTA ADDITIONAL EMPLOYMENT	EXPLORATION ONLY CASE SCENARIO TOTAL EMPLOYMENT	BASE CASE REGIONAL POPULATION	AODITIONAL RESIDENTIAL CIVILIAN POPULATION	ENCLAVE POPULATION	TOTAL ADDITIONAL POPULATION	EXPLORATION ONLY CASE SCENARIO TOTAL POPULATION	REGIONAL GROWTH FACTORS
1981		6,523				6,523	10,595				10,595	1.09
1982	0	7,383				7,383	11,565				11,565	1.19
1983	1	7,478	10	188	198	7,676	11,659	15	188	203	11,862	1.22
1984	2	7,602	16	292	308	7,910	11,888	25	292	317	12,205	1.26
1985	3	8,485	19	342	361	8,846	13,077	30	342	372	13,449	1.38
1986	4	8,718	17	292	309	9,027	13,373	27	292	319	13,692	1.41
1987	5	9,680	7	117	124	9,804	14,774	11	117	128	14,902	1.53
1988	6	10,801				10,801	16,379				16,379	1.68
1989	7	12,090				12,090	18,279				18,279	1.88
1990	8	13,727				13,727	20,875				20,875	2.15
1991	9	16,076				16,076	24,370				24,370	2.50
1992	10	17,020				17,020	25,780				25,780	2.65
1993	11	19,621				19,621	30,257				30,257	3.11
1994	12	21,932				21,932	33,876				33,876	3.48
1995	13	22,539				22,539	34,643				34,643	3.56
1996	14	24,748				24,718	39,206				39,206	4.03
1997	15	26,712				26,712	42,219				42,219	4.34
1998	16	28,374				28,374	45,456				45,456	4.67
1999	17	30,322				30,322	49,001				49,001	5.04
2000	18	31,926				31,926	52,040				52,040	5.35

Notes: (1) Includes resident construction and mining employment due to OCS activities.

(2) Includes all nonresident employment due to OCS activities.

Source: University of Alaska, ISER, 1981.

increase over the base case for the same year; additional regional population that same year totals 372 persons, a three percent increase over the base case.

Only Unal aska-Dutch Harbor and Cold Bay are directly affected by the OCS activities described earlier. Principal new employment opportunities at Unalaska-Dutch Harbor are attributed to the supply base, supply boats, and part of the helicopter support group. It is assumed that all employment on the supply boats will be filled by new or short-term residents (USDOI-BLM, Alaska OCS Office 1980; ACI, 1980). The remaining positions will be filled by transient personnel living in company-provided housing (enclave). These employment figures and resulting population changes are shown in Table 50. At the peak of exploration in 1985, 132 additional employees are working in Unalaska-Dutch Harbor. Of this number, 120 are engaged in OCS activities, and 12 are employed in secondary support sectors of the local economy, The associated population changes, also shown in Table 50, reflect an increase of seven percent over the base case during the peak year. However, the OCS-related increase in population between 1984 and 1985 accounts for 56 percent of the increase in population between those two years.

Principal new employment opportunities at Cold Bay are attributed to the other part of the helicopter support group. As shown in Table 51, in 2985, when activities peak, 20 additional people will be employed in helicopter services in Cold Bay. Four of these are expected to take up residence in Cold Bay, the remaining 16 are assumed to be transients

TABLE 50

UNALASKA-DUTCH HARBOR EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1981-2000

CALENDAR YEAR	YEAR AFTER LEASE SALE	BASE CASE TOTAL COMMUNITY EMPLOYMENT	EMPLOYMENT: ADDED EMPLOYMENT: RESIDENT: DIRECT EMPLOYMENT	RESIDENT: INDIRECT EMPLOYMENT	NONRESIDENT ENCLAVE EMPLOYMENT	TOTAL ADDED EMPLOYMENT	EXPLORATION CASE TOTAL COMMUNITY EMPLOYMENT	POPULATION: BASE CASE TOTAL COMMUNITY POPULATION	ADDED POPULATION: RESIDENT CIVILIAN POPULATION	ADDED POPULATION: OCS ENCLAVE POPULATION	EXPLORATION CASE TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTORS
1981		1,812					1,812	2,307			2,307	1.07
1982	0	2,024					2,924-	2,466			2,466	1.15
1983	1	2,237	44	9	32	85	2,322	2,626	106	32	2,764	1.29
1984	2	2,449	53	11	54	118	2,567-	2,785	128	54	2,967	1.38
1985	3	2,661	58	12	62	132	2,793	2,945	140	62	3,147	1.46
1986	4	3,085	53	11	54	118	3,203	3,612	128	54	3,794	1.76
1981	5	3; 509	35	7	10	52	3,562	4,279	84	10	4,373	2.03
1988	6	3,932					3,932	4,946			4,946	2.30
1989	7	4,356					4,356	5,613			5,613	2.61
1990	8	4,780					4,780	6,280			6,280	2.93
1991	9	5,309					5,309	7,141			7,141	3.33
1992	10	5,838					5,838	8,002			8,002	3.73
1993	11	6,367					6,367	8,864			8,864	4.13
1994	12	6,896					6,896	9,725			9,725	4.53
1995	13	7,425					7,425	10,586			10,586	4.93
1996	14	7,733					7,733	11,113			11,113	5.18
1997	15	8,042					8,042	11,640			11,640	5.42
1998	16	8,350					8,350	12,167			12,167	5.67
1999	17	8,659					8,659	12,694			12,694	5.91
2000	18	8,967					B,967	13,221			13,221	6.16

Source: ACI, 1981

TABLE 51.

COLD BAY EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1981-2000

CALENDAR YEAR	YEAR AFTER LEASE SALE	BASE CASE TOTAL COMMUNITY EMPLOYMENT	EMPLOYMENT: ADDED EMPLOYMENT: RESIDENT: DIRECT EMPLOYMENT	EMPLOYMENT: ADDED EMPLOYMENT: RESIDENT: INDIRECT EMPLOYMENT	EMPLOYMENT: ADDED EMPLOYMENT: NONRESIDENT ENCLAVE EMPLOYMENT	EMPLOYMENT: ADDED EMPLOYMENT: TOTAL ADDED EMPLOYMENT	EXPLORATION CASE TOTAL COMMUNITY EMPLOYMENT	POPULATION: BASE CASE TOTAL COMMUNITY POPULATION	POPULATION: ADDED POPULATION: RESIDENT CIVILIAN POPULATION	POPULATION: ADDED POPULATION: OCS ENCLAVE POPULATION	EXPLORATION CASE TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTORS
1981		208					20B	261			261	1.07
1982	0	217					217	279			279	1.15
1983	1	226	2		9	11	237	296	2	9	307	1.26
1984	2	235	3		14	17	252	314	3	14	331	1.36
1985	3	244	4		16	20	264	332	4	16	352	1.45
1986	4	256	3		14	17	273	350	3	14	367	1.51
1987	5	269	1		4	5	274	368	1	4	373	1.53
1988	6	281					281	386			386	1.59
1989	7	294					294	404			404	1.66
1990	8	306					306	422			422	1.72
1991	9	321					321	444			444	1.83
1992	10	336					336	466			466	1.92
1993	11	352					352	487			487	2.00
1994	12	367					367	509			509	2.09
1995	13	382					382	531			531	2.19
1996	14	398					398	554			554	2.28
1997	15	414					414	577			577	2.37
1998	16	429					429	600			600	2.47
1999	17	445					445	623			623	2.56
2000	18	461					461	646			646	2.66

Source: ERE Systems Ltd.

living in an enclave environment provided by their employer. No indirect employment is expected since the, number of resident OCS employees is not a large enough group to change service sector employment. During the peak year, 1985, the associated population changes only five percent from the base case forecast. Not shown in Table 51 are the offshore workers living on the rig. These personnel are expected to rotate between their homes and the rig about every two weeks. Average monthly employment on the rigs is expected to vary as follows:

Year	Average Monthly Employment
1983	101
1984	168
1985	202
1986	168
1987	67

Source: USDOI-BLM, Alaska OCS Office, 1980

Water Mode

FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

Additional demands on the marine transportation system are expected to be made at Unalaska-Dutch Harbor and Cold Bay and in the sea lanes between the offshore rigs and the service base. The more significant changes will take place at Unalaska-Dutch Harbor due to addition of the service base and accompanying supply-anchor boats, which can be expected to contribute to crowded conditions in the harbor during certain periods of the crab fishing season. It is unlikely that the oil industry will want a guaranteed 24-hour supply boat berth at an existing dock and the ability to construct the service base nearby. Failing these conditions, they are likely to build their own dock and service base or to attempt to refurbish an old dilapidated military dock, if that is possible.

The additional tonnage demands at Unalaska-Dutch Harbor due to proposed OCS activities are summarized in Table 52. The demands for OCS drilling materials were developed by multiplying the number of wells by the various material requirements for a single well as presented in the notes of Table 52. The forecast of OCS consumables demand is based on a consumption level of 300 pounds (0.15 ST) per month for every nonlocal onsite employee. The onsite-offshore employees on the rigs are also included in the consumables forecast. All of the OCS dry freight and OCS consumables are assumed to be delivered directly to the supply base by contract barge from Seattle or other west coast port. Fuel and drill water are assumed to be purchased locally. Because some OCS employees become short-term local residents, the normal demands of the local population for petroleum and dry cargo products are expected to increase as shown in Table 52. Generally, the demands shown represent a proportional increase over the base case, except that petroleum demands were adjusted downward by 50 percent before proportioning to account for the industrial influence on petroleum consumption. When the additional inbound tonnage forecasts in Table 52 are compared to those for the base case for Unalaska-Dutch Harbor, inbound tonnage is found to have

TABLE 52.

OCS MARINE TRANSPORTATION DEMANDS AT UNALASKA-DUTCH HARBOR
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1981-2000

YEAR	YEAR AFTER LEASE SALE	DRILLING MATERIAL DEMANDS (1) DRILL PIPE	DRY BULK	TOTAL DRY FREIGHT	FUEL (2)	DRILL WATER (3)	OCS CONSUMABLES DEMAND (4) NONLOCAL OCS POPULATION	ANNUAL CONSUMABLES DEMAND	ADDITIONAL LOCAL POPULATION DEMANDS (5) PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	TOTAL	INBOUND TONNAGE DENANDS BASE CASE	REVISED TOTAL
1981															
1982														257,000	
1983	1	1,212	3,102	3,789	2,472	14,406	177	319	3,045	620	5,517	5,253	10,770	275,600	286,300
1984	2	2,020	5,170	6,315	4,120	24,010	275	495	4,035	823	8,155	8,508	16,663	294,800	311,500
1985	3	2,424	6,204	7,578	4,944	28,812	322	580	4,465	912	9,409	10,120	19,529	302,900	322,500
1986	4	2,020	5,170	6,315	4,120	24,010	275	495	4,020	821	8,140	8,506	16,646	338,200	354,900
1987	5	808	2,068	2,526	1,648	9,604	112	202	2,077	424	3,725	3,502	7,227	373,900	381,200
1988	6													427,800	

Notes: (1) Drilling Material Demands based on following tonnage requirements per well:

	Exploration well (13,300 ft)
Tubular Goods	404
Drilling Mud (Dry)	776
Cement	249
Fuel	824
Fresh Water	4,802
Misc. Consumables	9
Total	7,064 Tons

(2) Fuel demands include supply boat consumption.

(3) Drilling water is obtained in Unalaska-Dutch Harbor.

(4) Consumables demand based on consumption level of 300 pounds (0.15st) per onsite-nonlocal employee per month. This includes offshore personnel as well, but not persons located onshore at Cold Bay.

(5) Based on a proportion increase over base case demands. Petroleum products for the fishing industry (assumed to be 50 percent) were removed before proportional increase was calculated.

Source: ERE Systems, Ltd.

increased four percent. over the base case in 1983; six percent over the base case in 1985, the peak year; then declined to only two percent of the base case in 1987. When OCS activities begin in 1983, the 10,770 ST of demand attributed to OCS events represent 36 percent of the expected increase in inbound tonnage from 1982 to 1983; in 1984, OCS events represent 23 percent of the increase in inbound tonnage from 1983 to 1984; and in 1985, 25 percent of the increase from 1984 to 1985.

Based on these additional OCS demands at Unalaska-Dutch Harbor, transportation requirements will change little as shown in Table 53. The dry freight and consumables demand attributed to OCS activities would be moved via contract barge, assumed to have a capacity of 6,000 ST. At the peak of activities in 1985, only two barges are required. The increase in demands attributed to local population changes creates a requirement for about 11 additional general cargo arrivals (based on a 90 ST average size cargo). The combined petroleum demands of OCS activities and local population may require one additional tanker arrival. In 1985, these additional 13 trips constitute only a 1.6 percent increase in commercial shipping. Of greater significance to harbor operations are the supply boat trips, which are assumed to number 13 trips per boat per month. Based on this level of activity, the four supply boats are expected to generate 624 trips per year during the 1984-1986 period and less than that in 1983, when activities are still increasing, or in 1987, when activities are winding down. During 1985, taking into account fishing boats and supply boats, as well as commercial activities, OCS activities increase trip requirements by 16.5 Percent. During a Peak

TABLE 53.

ADDITIONAL MARINE TRANSPORTATION REQUIREMENTS AT UNALASKA-DUTCH HARBOR
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1983-1987

YEAR	YEAR AFTER LEASE SALE	OCS REQUIREMENTS: DRY CARGO BARGE TRIPS(1)	OCS REQUIREMENTS: SUPPLY BOAT TRIPS(2)	INDUCED POPULATION REQUIREMENTS: TANKER TRIPS(3)	INDUCED POPULATION REQUIREMENTS: DRY CARGO TRIPS(4)
1981					
1982					
1983	1	1	624	1	7
1984	2	2	624	1	10
1985	3	2	624	1	11
1986	4	2	624	1	10
1987	5	1	624	1	5
1988	6				

Notes: (1) Assumed to move on 6,000 ST capacity barges.
(2) Based on 13 trips per assigned boat per month.
(3) Assuming a 35,000 DWT tanker, only 27 percent of the ship is required to move all additional fuel requirements during the peak year 1985.
(4) Based on 90 ST per port call.

Source: ERE Systems Ltd.

period day, which is measured at twice the annual average day, OCS activities account for about three trips, which is an 11 percent increase over the figure of 28 trips per day withcut OCS.

The additional tonnage demands at Cold Bay due to proposed OCS activities are summarized in Table 54. Demands at Cold Bay increase because of the additional personnel assigned there and because of the increased demands on fuel for increased air travel. The forecast demands were derived generally as described above, except the petroleum products forecast was made using regional population data rather than local population data to reflect increased air travel demands. When the additional inbound tonnage demands are compared to base case demands it is found that the increase is only three percent in 1985, the peak activity year. However, when OCS activities begin in 1983, OCS activities account for 56 percent of the increase in marine tonnage demands for that year. In subsequent years, OCS activities are a declining percentage of the annual increase (only five percent in 1985). The transportation requirements associated with these levels of demands are almost insignificant. Based on the assumed capacity available per stop for ships serving Cold Bay, no additional trips are required. However, it is possible one additional fuel shipment and one dry cargo shipment would be made.

MARINE TRANSPORTATION IMPACTS AND ISSUES

The exploration activities depicted in the exploration-only case are

TABLE 54.

OCS MARINE TRANSPORTATION DEMANDS AT COLD BAY
ST. GEORGE BASIN SALE 70 EXPLORATION - ONLY CASE
1981-1988

YEAR	YEAR AFTER LEASE SALE	OCS CONSUMABLES DEMAND: NONLOCAL OCS POPULATION	OCS CONSUMABLES DEMAND: ANNUAL CONSUMABLES DEMAND(1)	ADDITIONAL LOCAL POPULATION DEMANDS(2): PETROLEUM PRODUCTS	ADDITIONAL LOCAL POPULATION DEMANDS(2): DRY CARGO PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS: PETROLEUM PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS: DRY CARGO PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS: TOTAL	INBOUND TONNAGE DEMANDS: BASE CASE	INBOUND TONNAGE DEMANDS: REVISED TOTAL
1981										
1982									14,600	
1983	1	9	16	219	15	219	31	250	14,800	15,050
1984	2	14	25	341	22	341	47	388	15,100	15,488
1985	3	16	29	401	30	401	59	460	16,600	17,060
1986	4	14	25	344	22	344	47	391	17,000	17,391
1987	5	4	7	139	7	139	14	153	18,700	18,853
1988	6								20,500	

Notes: (1) Consumables demand is based on consumption level of 300 pounds (0.15 ST) per onsite-nonlocal employee per month.

(2) Based on a proportional increase over base case demands. Petroleum products are based on the proportional increase in regional population due to increased regional air travel demands affecting Cold Bay.

Source: ERE Systems, Ltd.

of short duration and occur at a time just before bottomfish development activities begin to accelerate. No permanent changes are made as a result of OCS exploration and, at the end of exploration activities in 1987, the pace of development returns to that described and evaluated in the base case.

OCS supply vessels are expected to use the Standard Oil dock when obtaining fuel, the City dock when obtaining water, and possibly one of the commercial dock when picking up supplies (although use of the commercial dock is likely to depend on the location of the supply base itself). Time spent at these docks is not expected to affect normal operations, since these supply boat visits would be scheduled in advance. The presence of the supply boats could contribute to crowding in Dutch Harbor during the peak of the fishing season, but Dutch Harbor itself could be avoided if the service base was located in another area of Unalaska Bay. In 1985, at the peak of exploration activities, trip-making attributed to vessels directly supporting OCS activities and those supporting OCS-induced activities, when added to the base case forecast for the same year, is equivalent to base case demand forecast for 1988. Thus, the exploration-only case causes future demands to occur approximately three years sooner than under the base case.

Since the oil industry is expected to depend upon contract marine carriers for transportation services, no negative impacts are expected on the frequency or quality of service provided Unalaska-Dutch Harbor or Cold Bay. However, the rapid growth of bottomfish and the sudden increase in OCS activities might cause the price of transportation services to rise, particularly to the affected communities. The price rise would not reflect a true scarcity of equipment or space, however. The marine carriers are not expected to have to divert equipment or other resources to move OCS materials since sufficient capacity appears to be available for contract services. Unfortunately, OCS activities and their demands for services are not expected to contribute any positive improvements to existing regional transportation inequalities or problems as described in the base case (Chapter IV).

Air Mode

FORECAST OF AIR TRANSPORTATION DEMANDS AND REQUIREMENTS

As discussed earlier, aviation activities supporting OCS development are expected to be located at Cold Bay and Unalaska-Dutch Harbor.' The two helicopters at Cold Bay are used to ferry personnel and light supplies to the rigs, while the single helicopter at Unalaska-Dutch Harbor provides back-up support to the marine service base. In addition to these aviation demands, the transient nature of OCS employees will increase demands on commercial air transportation.

The forecast of aviation demands and aircraft operations at Unalaska Dutch Harbor is shown in Table 55. At the peak of OCS activities in 1985, about 1,564 additional emplacements are expected. This is a 12 percent increase over the base case for the same year. Peak period

TABLE 55.

UNALASKA-DUTCH HARBOR AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
1981-2000

YEAR	YEAR AFTER LEASE SALE	PASSENGER ENPLANEMENT / ANNUAL ENPLANEMENTS: BASE CASE	INDUCED POPULATION (1)	NONRESIDENT OCS EMPLOYMENT (2)	TOTAL	PEAK MONTH AVERAGE WEEK (3)	ESTIMATED AIRCRAFT OPERATIONS: OCS HELICOPTER OPERATIONS (4)	AIR CARRIER OPERATIONS (5)	AIR TAXI OPERATIONS (6)	TOTAL AIRCRAFT OPERATIONS (7)	PEAK DAILY OPERATIONS (8)
1981		10,830			10,830	374		488	542	2,575	15
1982		11,410			11,410	394		514	571	2,713	15
1983	1	12,000	594	420	13,014	450	548	592	606	3,543	20
1984	2	12,580	717	6B4	13,981	485	548	636	637	3,731	21
1985	3	13,170	784	780	14,734	511	548	671	667	3,893	22
1986	4	16,310	717	672	17,699	613	548	803	823	4,613	26
1987	5	19,430	470	156	20,056	693	548	906	977	5,256	29
1988	6	22,620			22,620	780		1,018	,131	5,373	30
1989	7	25,840			25, 840	891		1,163	,292	6,138	34
1990	8	29,140			29,140	1,005		1,312	,457	6,923	38
1991	9	33,370			33,370	1,151		1,502	1,669	1,928	44
1992	10	37,600			37,600	1,297		1,692	1,880	8,930	49
1993	11	41,880			41,880	1,445		1,885	2,094	9,948	55
1994	12	46,250			46,250	1,595		2,082	2,313	10,988	61
1995	13	50,610			50,610	1,746		2,278	2,531	12,023	66
1996	14	53,400			53,400	1,842		2,403	2,670	12,683	70
1997	15	56,260			56,260	1,941		2,532	2,813	13,363	74
1998	16	59,100			59,100	2,039		2,660	2,955	14,038	77
1999	17	61,950			61,950	2,137		2,788	3,098	14,715	81
2000	18	64,830			64,830	2,237		2,918	3,242	15,400	85

Notes: (1) Includes enplanements of: OCS employees who are local residents; additional indirect employment, all of whom are assumed to be local residents; and the dependents of both groups.

(2) Includes enplanements of non-local Aleutian region OCA employees, other Alaskan regions OCS employees, and non-Alaskan OCS employees.

(3) Peak month average week is assumed to include 3.45 percent of base case and induced population enplanements plus 3.83 percent of nonresident OCS employment enplanements.

(4) OCS helicopter operations based on 1.5 trips per day.

(5) Derived from the relationship: Air Carrier Operations = $\frac{\text{Annual Enplanements} \times 0.9 \times 2}{40}$ where the factor 0.9 assumes 90 percent of enplanements are on air carrier aircraft; the factor 2 assumes arrivals equal departures; and the factor 40 is the adjusted capacity of a YS-11A aircraft assumed as standard.

(6) Derived from the relationship: Air Taxi Operations = $\frac{\text{Annual Enplanements} \times 0.1 \times 2}{4}$ where the factor 0.1 assumes 10 percent of enplanements are on air taxi aircraft; the factor 2 assumes arrivals equal departures, and the factor 4 is the adjusted capacity of a typical air taxi aircraft.

(7) Air carrier operations plus air taxi operations are assumed to constitute 40 percent of total operations. The sum is divided by 0.4 to obtain total aircraft operations.

(8) Peak. daily operations are assumed to be twice annual daily average operations.

Source: ERE Systems, Ltd.

enplanements in 1985 increase by 57 per average week, which is a 13 percent increase over the base case. Aircraft operations generally are affected to the same degree particularly air carrier and air taxi operations. Air carrier operations in 1985 increased by 71 operations over the base case, a 12 percent increase. Air taxi operations during the same year also increase by 12 percent, for 78 operations. However, total aircraft operations throughout the period of exploration increase more significantly due to the helicopter operations. At Unalaska-Dutch Harbor it was assumed the base helicopter makes 1.5 operations per day in support of the service base. On an annual basis that trip rate generates 548 operations. During the first year of OCS activities in 1983, total aircraft operations increase by 791 operations, a 28 percent increase. Of these 791 operations, helicopter operations constitute 69 percent. When OCS activities peak in 1985, total aircraft operations increase by 921 operations, a 29 percent increase, and of those, OCS helicopter activities account for 60 percent.

Forecast aviation activities at Cold Bay are shown in Table 56. Aviation activities at Cold Bay are stimulated by both the OCS personnel stationed at Cold Bay, including the offshore workers, and those stationed at Unalaska-Dutch Harbor, as well as by resident population changes in both locations. Assuming that 55 percent of the additional enplanements at Unalaska-Dutch Harbor change aircraft at Cold Bay, additional passenger emplacements at Cold Bay reach 3,246 in 1985, a 12 percent increase over the base case. Peak month average week enplanements for the same

TABLE 56.

COLD BAY AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 EXPLORATION-ONLY CASE
8981-2000

YEAR	YEAR AFTER LEASE SALE	PASSENGER ENPLANEMENTS: ANNUAL ENPLANEMENTS: BASE CASE	INDUCED POPULATION (1)	NONRESIDENT OCS EMPLOYMENT (2)	TOTAL	PEAK MONTH AVERAGE WEEK (3)	ESTIMATED AIRCRAFT OPERATIONS: OCS HELICOPTER OPERATIONS (4)	AIR CARRIER OPERATIONS (5)	AIR TAXI OPERATIONS (6)	TOTAL AIRCRAFT OPERATIONS (7)	PEAK DAILY OPERATIONS (8)
1981		21.490			21,490	741		2,138	1,075	8,033	44
1982		2 3 , 4 6 2			23,462	809		2,273	1,173	8,615	48
1983	1	23,659	338	1 4i9	25,416	882	2,920	2,406	1,271	)2.)13	66
1984	2	24,054	411	2,344	26,809	934	2,920	2,503	1,341	12,530	69
1985	3	26,419	453	2,193	29,665	1.016	2,920	2,694	1.484	13,365	73
19a6	4	27,011	411	2,338	29,760	1,036	2,920	2,708	1,498	13,410	73
19a7	5	29,96a	265	a54	31,087	1,076	2,920	2,801	1,655	13,810	16
1988	6	33,123			33.123	1,143		2,940	1.657	11,493	63
1 989	7	37,066			31.066	1,279		· 3,202	1,853	12.630	70
1990	8	42,389			42,389	1,462		3,552	2,120	14,100	78
1991	9	49,290			49,290	1,701		4.003	2.465	16.170	89
1992	10	52.241			62,241	1 ,803	—	4.202	2,613	17,038	94
1993	11	61 ,317			61,317	2,115		4.?93	3,066	19.64a	1 08
1994	12	68,612			68,612	2,367		5,270	3,431	21,753	120
1995	13	70.189			70,189	2,422		6,380	3,510	22,225	122
1996	14	79,465			79,456	2,741		5,984	3.973	24,893	137
1997	15	85,567			85,56?	2,952		6,365	4,279	26.660	147
1998	16	92,074			92,074	3,177		6,812	4,604	28,540	157
1999	17	99.369			99,369	3,428		7,290	4,969	30,648	168
2000	18	105.481-			105,481	3,639		7',691	5,274	32,413	178

Notes: (1) Includes enplanements of: OCS employees who are local residents; additional indirect employees. all of whom are assumed to be local res idents; and dependents of both groups. Figures include both Cold Bay enplanements and 55 percent of similar enplanements at Unalaska-Dutch Harbor, which are ● sstaned to change flights In Cold Bay.

(2) Includes enplanements of: non-local Aleutian region OCS employees, OCS employees from other Alaskan regions. and non-Alaskan OCS *employees.* Figures include both Cold Bay enplanements and 55 percent of simi lar enplanements at Unalaska-Dutch Harbor, which are assumed to change flights 1 n Cold Bay.

(3) Peak month average week Is assumed to Include 3.45 percent of base case and induced population enplanements plus 3.83 percent of nonres I dent OCS employment enplanements.

(4) OCS helicopter operations based' on 2.0 trips per rig per day.

(5) Derived from tha relationship: Air Carrier Operations = $\frac{\text{Annual Enplanements} \times 0.9 \times 2.0 + 750(1+i)^n}{}$ where the factor 0.55 adjusts annual enpl anements to represent both enpl aned and through passengers; the factor 0.9 assumes 90 percent of enplaned and through passengers are on air carrier ● ircraft; the factor 2.0 assumes arrivals equal departures; the factor 51 represents the weighted ave rage ad justed capaci ty of aircraft us ing Cold Bay; the factor ?60 represents assumed international a ir carrier operations in 1980; and the factor $(1+i)^n$ represents ● compounding characteristic where iis assumed as one percent and n is the number of years from 1980.

(6) Derived from the relat ionship: Air Tax i Operat ions "S $\frac{\text{Annual Enplanements} \times 0.1 \times 2.0}{4}$ where the factor 0.1 assumes 10 percent of enplanements are on air taxi aircraft; the factor 2 assumes arrivals equal departures; and the factor 4 is the adjusted capacity of a typical air taxi aircraft.

(7) Air carrier operations plus air taxi operations are assumed to constitute 40 percent of total operations. Tbe sumisdividedby 0.4 to obtain total aircraft operations.

(a) Peak daily operations are assumed to be twice annual daily average operations.

source: ERE Systems, Ltd.

year increase by 105, also 12 percent. Air carrier operations in 1985 increase only eight percent in 1985 and air taxi operations increase 12 percent. Due to helicopter activities, which are estimated to be two trips (4 operations) per rig per day, total operations increase 3,847, a 40 percent increase. During the first year of OCS activities in 1983, OCS-influenced aviation activities account for 90 percent of the total increase in emplacements and 98 percent of the total increase in operations.

AIR TRANSPORTATION IMPACTS AND ISSUES

The increase in passenger emplacements due to OCS activities in combination with expected growth in base case emplanements could potentially have a detrimental effect on the level of aviation services provided some communities in the region. Aircraft flying scheduled service between Cold Bay and Unalaska-Dutch Harbor is currently operating at a load factor of about 75 percent, leaving 25 percent of the route capacity available for growth. Based on existing schedules, there is sufficient capacity available to meet base case demands up to 1985. When OCS activities are included there is still sufficient capacity to meet the combined demands through 1985. Beyond 1985, additional equipment must be added to this route to meet expected demands. If the equipment is borrowed from other routes, scheduled operations to other communities may be reduced and the overall level of service to these other communities would decline. If the airlines have extra equipment, such as that used for charters, or standby equipment used to supplement aircraft with maintenance problems, demands for several years beyond 1985 can be met. But here, too, the overall quality of service may decline if maintenance down time increases and standby equipment is not available to fill the gap.

Certainly the better solution is to purchase or lease additional aircraft. However, the commitment of capital resources in this direction requires more careful planning to ensure that financial investors are confident aviation demands will hold up and that a reasonable return can be made on the investments. The short-term nature of OCS activities suggested by this scenario is, in and of itself, insufficient justification for long-term investments. Another factor considered in financing new aircraft is the financial integrity of the airline. Air taxi operations in western Alaska are hampered in part because the operators are too small or already so much in debt that they cannot qualify for the financial aid needed to improve their services. Equipment purchases also have to take into account the competitive aspect of aviation. Air service in the Aleutians today is solely by propeller driven aircraft. However, if several of the major communities had their runways lengthened or otherwise improved to handle jet aircraft, the purchase of another propeller aircraft may not be a wise investment.

Since there is sufficient capacity in existing airline operations to offset increases in demand for several years, it is impossible to determine the approach likely to be taken by the airlines. Generally, it is safe to say that if the demand exists, whether precipitated by OCS or bottomfishing, one or another of the airlines will try to fulfill that demand. If the demands can be filled without reducing services to other communities, the impacts are greatly reduced. If the demands can be filled only by reducing services to other communities, the impacts are greatly magnified.

The theoretical capacity of existing runway configurations at both Unalaska-Dutch Harbor and Cold Bay appear to be more than adequate to handle the increase in aircraft operations due to OCS events. However, the increased operations include the use of the helicopters, and FAA may be required to review and approve how these aircraft operate at the airfield, if they have not done so already for other reasons. As part of FAA's procedures, they review and approve the approach and departure patterns for helicopters and designation of a location on the airport for helicopter landings and take-off. Several factors that must be considered include the characteristics of the helicopters to be employed, together with the effects of wind, location of the terminal, and the location of obstacles in the flight path. Although helicopters have a steeper ascent and departure path, and can operate in higher cross winds, these paths must be evaluated with respect to existing air carrier and air taxi approach and departure patterns. Until FAA conducts its review, the effect on airport capacity cannot be determined. However, even if capacity is reduced as a result of helicopter operations, it is unlikely that the reduction would be great enough to affect forecast operations. In fact, the greater impact may be on FAA itself. At the start of exploration activities, the oil industry is very much interested in obtaining FAA approval on a relatively short time basis, yet FAA has public safety procedural guidelines that must be followed. Thus, while helicopter operations themselves may not pose a problem for an airport, the approval process and time frame impose a short-term capacity problem on FAA.

VI. MEAN CASE SCENARIO IMPACTS
FACILITIES AT LOCATION ALTERNATIVE ONE

The mean case scenario is the second of two scenarios being analyzed in this study. Unlike the exploration-only scenario presented in Chapter V, the mean case scenario assumes that commercially recoverable quantities of gas and oil are discovered and produced. However, because of the geographic location of the St. George Basin it is possible that the development and production facilities (the permanent service base and shore-based oil and gas terminals) might be located at either of three locations: the vicinity of Unalaska-Dutch Harbor, the vicinity of Cold Bay, and on St. Paul Island. To adequately treat these possibilities, the mean case scenario will be viewed from each alternative location. This chapter focuses on the potential impacts of location alternative one--vicinity of Unalaska-Dutch Harbor. Subsequent chapters deal with the impacts associated with placing the facilities at each remaining location.

Expected OCS Events

The mean case scenario is based on what BLM refers to as the "most likely" level of resource finds. These most likely values are derived statistically from many independent estimates of high, low, and most likely resource finds. For the St. George Basin, the most likely level of resource find is 1,200 MMbbl of oil and 3,660 bcf of gas. When translated through the economics of oil and gas development the result is a development and production schedule as shown in Table 57. This table illustrates only the first 18 years of development and production. Full production of the resources is not achieved until 2019, an additional 19 years which are not part of this analysis.

As described in Chapter II, OCS oil and gas development takes place in four stages: exploration, development, production, and shut down. The first 18 years of this scenario wholly include the first two stages and part of the third. The exploration stage is expected to last five years. To support exploration activities a temporary support base is established at Unalaska-Dutch Harbor. This base will be used to provide marine and limited air transportation to the rigs. The primary aviation support base during exploration is established at Cold Bay. Since commercially recoverable resources are discovered during the first year of exploration, a decision is made early to proceed with field development. Before the second year of exploration ends, construction-of a permanent support complex at Makushin Bay begins. Makushin Bay is also located on Unalaska Island approximately 22 air miles due west of Unalaska. Initially, construction activities are focused on the permanent marine service base and a 6,500 foot gravel runway to provide heavy airlift capacity. This construction is expected to take almost three years. Ultimately, the support complex is expected to contain pipeline and terminal construction camps, possibly a pipe coating yard, as well as the oil and gas terminals with supporting marine infrastructure. The airfield proposed at Makushin Bay will not replace the offshore air " support base at Cold Bay. The permanent marine support base is expected

TABLE 57.

DEVELOPMENT AND PRODUCTION SCHEDULE
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

CALENDAR YEAR	YEAR AFTER LEASE SALE	EXPLORATION AND DELINEATION RIGS	PLATFORMS INSTALLED	WELLS DRILLED: EXPLORATION AND DELINEATION	WELLS DRILLED: PRODUCTION AND SERVICE	WORKOVER	PIPELINE CONSTRUCTED (MILES)	ONSHORE FACILITY CONSTRUCTION	TRANSPORTATION EQUIPMENT: SUPPLY/ ANCHOR BOATS	TRANSPORTATION EQUIPMENT: HELICOPTERS	PRODUCTION: OIL (MMbbl.)	PRODUCTION: GAS (bcf)
1981												
1982	0											
1983	1	3		8				Note 1	6	4		
1984	2	5		13				Note 1	10	6		
1985	3	5	1	15				Note 1	12	8		
1986	4	5	3	13					18	8		
1987	5	2	4	6	50		348	Note 2	20	7		
1988	6		2		60		349	Note 2	20	5		
1989	7		1		60			Note 2	22	6		
1990	8				40			Note 2	11	6	1:;	1:;
1991	9				21				11	6	242	219
1992	10					40			11	6	186	248
1993	11					64			11	6	119	256
1994	12					48			11	6	81	251
1995	13					32			11	6	57	239
1996	14					17			11	6	41	231
1997	15					40			11	6	31	226
1998	16					64			11	6	24	223
1999	17					48			11	6	19	220
2000	18					32			11	6	15	218

Notes: (1) Initially construction effort is focused on temporary service base at Unalaska-Dutch Harbor. Following early discovery and decision to develop the field, emphasis switches to construction of a jointly operated permanent service base at Makushin Bay,

(2) Construction of oil and gas terminals at Makushin Bay.

Source: USDOI-BLM, Alaska OCS office, 1980.

to become operational during 1984, and the airfield within two years after that, by 1986. If pipeline coating is to be accomplished in the Aleutians, the coating yard will need to be in operation in 1986 in order to meet pipeline construction requirements in 1987 and 1988. Construction of the oil and gas terminals is expected to begin in 1987 and to be completed in 1990.

The development stage is expected to begin in 1985 and ends seven years later in 1991. In addition to development activities at Makushin Bay, production platforms, drilling rigs, and other equipment must be installed in the field, and production and service wells must be drilled. A total of 11 platforms are expected to be installed over a five year period. It is possible that one of the platforms will serve as a pipeline booster station; however, that depends on which geologic structures prove productive (USDOI-BLM, Alaska OCS Office 1980). The installation of drilling rigs and drilling of production and service wells begins in 1987. Over a period of five years, 251 wells are drilled to an average depth of 3,170 meters (10,400 feet).

The production stage begins in 1989. Oil production builds to a peak in three years (1991) and begins a steady decline. Gas production builds to a peak in five years (1993) and also begins a steady decline. By 2000, 1,056 MMbbl of oil (about 94 percent of the recoverable oil) and 2,486 bcf of gas (about 68 percent of the recoverable gas) are produced and shipped to west coast or Gulf of Mexico ports. It is anticipated that 120,000 DWT oil tankers are employed for crude oil transportation while 130,000 cubic meter (2.8 bcf) LNG tankers are employed for LNG transportation.

Economic Factors Affecting Growth

Changes occurring in response to a recoverable find of oil or gas are more permanent, longer-range, and of greater magnitude than if no recoverable resources are found. In the mean base case situation portrayed above, both primary and secondary employment opportunities due to OCS activities are the driving force behind additional economic change from the base case. Because of the skills required, virtually all of the labor needed to fill the many jobs is expected to originate outside the Aleutian-Pribilof region. Some laborers in the construction trades, those participating in the operation of marine services, and some in offshore production activities are expected to become short-term residents in the Unalaska-Dutch Harbor area. Other laborers in these categories and, particularly, those working offshore on the rigs and platforms, or with pipeline construction, are expected to commute from outside the state and from other areas of Alaska (most likely from the Anchorage and Kenai areas of Southcentral Alaska).

Based on the range of OCS activities depicted earlier, regional employment and population are expected to change as shown in Table 58. OCS construction employment is a principal activity in the regional economy from about 1985 through 1990. Employment due to OCS activities reaches a peak in 1987. During this peak year, total OCS employment and OCS-

TABLE 58.

ALEUTIAN-PRIBILOF REGION EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

		EMPLOYMENT					POPULATION					
			ADDED EMPLOYMENT					ADDED POPULATION				
YEAR	YEAR AFTER LEASE SALE	CASE BASE REGIONAL EMPLOYMENT	ADDITIONAL RESIDENT(1) EMPLOYMENT	ENCLAVE EMPLOYMENT(2)	TOTAL ADDITIONAL EMPLOYMENT	MEAN CASE SCENARIO TOTAL EMPLOYMENT	BASE CASE REGIONAL POPULATION	ADDED RESIDENT CIVILIAN POPULATION	ENCLAVE POPULATION	TOTAL ADDITIONAL POPULATION	MEAN CASE SCENARIO TOTAL POPULATION	REGIONAL GROWTH FACTORS
1981		6,523				6,523	10,595				10,595	1.09
1982	0	1,383				7,383	11,565				11,565	1.19
1983	1	7,478	26	497	505	7,983	11,659	39	479	518	12,177	1.25
1984	2	7,602	46	803	849	8,451	11,888	69	803	872	12,760	1.31
1985	3	8,485	112	1,589	1,701	10,186	13,077	148	1,589	1,737	14,815	1.52
1986	4	8,718	209	2,636	2,845	11,563	13,373	286	2,636	2,922	16,294	1.67
1987	5	9,680	543	5,775	6,319	15,999	14,774	1,032	5,775	6,807	21,581	2.22
1988	6	10,801	850	4,902	5,753	16,554	16,379	1,565	4,902	6,467	22,846	2.35
1989	7	12>090	1,133	3,859	4,992	17,082	18,279	2,033	3,859	5,892	24,172	2.48
1990	8	13,727	954	2,365	3,319	17,046	20,875	1,852	2,365	4,217	25,092	2.58
1991	9	16,076	838	998	1,835	17,911	24,370	1,596	998	2,594	26,964	2.77
1992	10	17,020	854	1,144	1,998	19,018	25,780	1,612	1,144	2.756	28,537	2.93
1993	11	19,621	869	1,328	2,197	21,818	30,257	1,586	1,328	2,914	33,171	3.41
1994	12	21,932	863	1,205	2,068	24,000	33,876	1,559	1,205	2,764	36,639	3.77
1995	13	22,539	862	1,082	1,944	24,483	34,643	1,572	1,082	2,654	37,297	3.83
1996	14	24,748	858	967	1,825	26,573	39,206	1,49'3	967	2,466	41,672	4.28
1997	15	26,712	878	1,144	2,023	28,735	42,219	1,534	1,144	2,678	44,898	4.61
1998	16	28,374	903	1,328	2,231	30,605	45,456	1,556	1,328	2,884	48,340	4.97
1999	17	30,322	901	1, 2(J5	2,106	32,428	49,001	1,539	1,205	2,744	51,745	5.32
2000	18	31,926	900	1,082	1,982	33,908	52,040	1,52?	1,082	2,609	54,649	5.62

Notes: (1) Includes resident construction and mining employment due to OCS activities.

(2) Includes all nonresident employment due to OCS activities.

Source: University of Alaska, ISER, 1981.

induced employment reaches 6,319 persons, which is approximately 39 percent of total employment expected in the region that year. By 1991, OCS and OCS-induced employment declines to only 1,135 persons, only 10 percent of total employment expected in the region that year. For the years between 1991 and 2000, OCS and OCS-induced employment fluctuates slightly year to year, but centers on approximatley 2,000 employees. By 2000, growing employment in the fisheries industry reduces the OCS component to only six percent of total employment in the region.

Regional population is similarly affected. In 1987, OCS and OCS-induced population peaks at 6,807 persons, approximately 32 percent of total regional population for that year. Due to OCS employment changes, the enclave population declines rapidly after 1987 and fluctuates around 1,150 persons between 1990 and 2000. Over that same period the total additional population contributed by OCS fluctuates around 2,700 persons. By 2000, the OCS and OCS-induced population is only five percent of total population in the region.

When the regional employment growth shown in Table 58 is compared to the base case, OCS and OCS-induced employment during the peak year, 1987, increases 65 percent over forecast base case employment for the same -. year. By 2000, OCS and OCS-induced employment declines to only six percent of base case regional employment. Similarly, when regional population growth shown in Table 58 is compared to the base case, OCS and OCS-induced population in 1987 is 46 percent of forecast base case regional population, but by 2000 the OCS component declines to five percent of forecast base case regional population.

Both Unalaska-Dutch Harbor and Cold Bay are directly affected by OCS activity with Unalaska-Dutch Harbor bearing the brunt of the employment and population changes, particularly during the early years of exploration before the Makushin Bay support base is constructed. The effects of OCS and OCS-induced employment and population on Unalaska-Dutch Harbor are illustrated in Table 59. Initially, following the lease sale, new employment opportunities arise when the temporary service base is established at Unalaska-Dutch Harbor. Later, in the following year when service base activities shift to Makushin Bay, people who become residents at Unalaska-Dutch Harbor are expected to commute to Makushin Bay. Unlike the region, peak OCS resident employment is not reached until 1989, when production activities begin. OCS employment reaches 525 persons that year. These employees constitute 11 percent of total community employment and 12 percent of the base case total community employment forecast for 1989. In 1990, resident employment falls slightly and stabilizes at 448 persons over the last decade of the forecast period. By 2000, resident OCS employment remains steady but declines to 58 percent of total employment and five percent of the forecast base case employment for that year, largely due to growth in the fishing industry. Employment at the Makushin Bay enclave follows a similar trend, peaking in' 1988 at 2,650 persons, declining to 853 persons by 1991, and remaining steady throughout the last decade.

TABLE 59,

UNALASKA-DUTCH HARBOR EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

		EMPLOYMENT				POPULATION			
CALENDAR YEAR	YEAR AFTER LEASE SALE	BASE CASE TOTAL COMMUNITY EMPLOYMENT	OCS DIRECT/INDIRECT RESIDENT EMPLOYMENT	MEAN CASE TOTAL COMMUNITY EMPLOYMENT	MAKUSHIN BAY ENCLAVE EMPLOYMENT	BASE CASE TOTAL COMMUNITY POPULATION	OCS RESIDENT POPULATION	MEAN CASE TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTORS
1981		1,812		1,812		2,307		2,307	1.07
1982	0	2,024		2,024		2,466		2,466	1.15
1983	1	2,237	121	2,358	193	2,626	209	2,835	1.32
1984	2	2,449	226	2,675	341	2,785	343	3,128	1.46
1985	3	2,661	377	3,038	532	2,945	558	3,503	1.63
1986	4	3,085	163	3,248	400	3,612	326	3,938	1.83
1987	5	3,509	264	3,773	1,996	4,279	528	4,807	2.24
1988	6	3,932	366	4,298	2,650	4,946	723	5,669	2.64
1989	7	4,356	525	4,881	2,442	5,613	1,050	6,663	3.10
1990	8	4,780	454	5,234	1,849	6,280	908	7,188	3.35
1991	9	5,309	448	5,757	853	7,141	896	8,037	3.74
1992	10	5,838	448	6,286	852	8,002	896	8,898	4.14
1993	11	6,367	448	6,815	852	8,864	896	9,760	4.55
1994	12	6,896	448	7,344	853	9,725	896	10,621	4.95
1995	13	7,425	448	7,873	853	10,586	896	11,482	5.35
1996	14	7,733	448	8,181	853	11,113	896	12,009	5.59
1997	15	8,042	448	8,490	852	11,640	896	12,536	5.84
1998	16	8,350	448	8,798	852	12,167	896	13,063	6.08
1999	17	8,659	448	9,107	853	12,694	896	13,590	6.33
2000	18	8,967	448	9,415	853	13,221	896	14,117	6.58

Sources: ACI, 1981; USDOI-BLM, Alaska OCS Office, 1980.

Population changes in Unalaska-Dutch Harbor follow a pattern similar to employment, with a peak of 1,050 occurring in 1989. The population increase has the effect of advancing expected population demands by approximately 18 months, although the OCS population that year constitutes 19 percent of the community population forecast. The reason the impacts are not more dramatic is due to rapid growth in fishing industry-related population over the same period. After 1989, OCS resident population declines to about 896 persons in 1991 and remains steady. By 2000, the OCS resident population constitutes only six percent of the total community population and a seven percent increase in expected base case population for the same year.

The employment and population effects on Cold Bay are shown in Table 60. Although Cold Bay is affected by a greater number of OCS-related employees, virtually all of these are in transit to Unalaska-Dutch Harbor, or in later years to Makushin Bay, or are in transit to offshore locations. Employment in Cold Bay peaks in 1985 with 40 additional people employed in the community. Most of these people are associated with the helicopter function located at the Cold Bay Airport. During 1985 those 40 people constitute 14 percent of total community employment for that year and are a 16 percent increase over the forecast base case total community employment for the same year. Employment at Cold Bay declines over the next three years, leveling at 30 employees in 1989 and remaining at that level through 2000. Due to growth in the community in non-OCS sectors, by 2000, these 30 employees constitute six percent of total community employment and are only a seven percent increase over forecast base case community employment.

TABLE 60.

COLD BAY EMPLOYMENT AND POPULATION FORECAST
ST. GEORGE BASIN SALE 70 MEAN CASE
1981-2000

CALENDAR YEAR	YEAR AFTER LEASE SALE	EMPLOYMENT: BASE CASE TOTAL COMMUNITY EMPLOYMENT	ADDED EMPLOYMENT: RESIDENT DIRECT EMPLOYMENT	ADDED EMPLOYMENT: RESIDENT INDIRECT EMPLOYMENT	ADDED EMPLOYMENT: NONRESIDENT ENCLAVE EMPLOYMENT	ADDED EMPLOYMENT: TOTAL ADDED EMPLOYMENT	MEAN CASE TOTAL COMMUNITY EMPLOYMENT	OFFSHORE OCS EMPLOYMENT	POPULATION: BASE CASE TOTAL COMMUNITY POPULATION	ADDED POPULATION: RESIDENT CIVILIAN POPULATION	ADDED POPULATION: OCS ENCLAVE POPULATION	MEAN CASE TOTAL COMMUNITY POPULATION	COMMUNITY GROWTH FACTORS
1981		208					208		261			261	1.07
1982	0	217					217		279			279	1.15
1983	1	226	2		16	18	244	269	296	3	16	315	1.30
1984	2	235	3		23	26	261	438	314	4	23	341	1.40
1985	3	244	4		36	40	284	1,036	332	6	36	374	1.54
1986	4	256	4		32	36	292	1,527	350	6	32	388	1.60
1987	5	269	4		31	35	304	3,923	368	6	31	405	1.67
1988	6	281	4		31	35	316	2,635	386	6	31	423	1.74
1989	7	294	4		26	30	324	2,043	404	6	26	436	1.80
1990	8	306	4		26	30	336	1,147	422	6	26	454	1.87
1991	9	321	4		26	30	351	788	444	6	26	476	1.96
1992	10	336	4		26	30	366	934	466	6	26	498	2.05
1993	11	352	4		26	30	382	1,118	487	6	26	519	2.14
1994	12	367	4		26	30	397	995	509	6	26	541	2.23
1995	13	382	4		26	30	412	872	531	6	26	563	2.32
1996	14	398	4		26	30	428	757	554	6	26	586	2.41
1997	15	414	4		26	30	444	934	577	6	26	609	2.51
1998	16	429	4		26	30	459	1,118	600	6	26	632	2.60
1999	17	445	4		26	30	475	995	623	6	26	655	2.70
2000	18	461	4		26	30	491	872	646	6	26	678	2.79

Sources: USDOI-BLM, Alaska OCS Office, 1980; ERE Systems, Ltd.

Population in Cold Bay is similarly affected. The population attributed to OCS peaks in 1985 with 42 people. These 42 people constitute 11 percent of the total community population that year and are an increase of 13 percent over the forecast of base case population. The added population stabilizes at 32 by 1989 and continues unchanged to 2000. In 2000, the 32 additional people make up five percent of the total community population for that year and are also a five percent increase over the community population forecast for the base case.

Also shown in Table 60 are OCS employment levels at offshore locations. Offshore employment peaks in 1987 at 3,923 persons, but declines rapidly to a little over 1,100 persons by 1990. Thereafter, offshore employment oscillates between approximately 800 and 1,100 employees due to the changing number of workover wells being drilled year to year. None of the offshore employees are expected to live in the Cold Bay area, or other parts of the Aleutian-Pribilof region.

Water Mode

FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

Proposed OCS activities at Unalaska-Dutch Harbor and Cold Bay are expected to affect regional marine transportation facilities and services, particularly during the early years of exploration. Tonnage demands at both communities will rise in response to the intensity of OCS activities and level of OCS-induced population changes. Overall, the number of vessel trips in the region will increase sharply due to supply boat operations. Also, the average size of vessels operating in the region will increase due to supply boats, rigs, platforms, and presence of oil and LNG tankers. Some of the effects on regional and community facilities and services are likely to be mitigated by oil industry actions, and possibly those of regulatory agencies.

OCS commodities inbound to Unalaska-Dutch Harbor and later to Makushin Bay include drilling and pipeline construction materials plus consumable supplies for OCS workers. Drilling material demands, which are a function of the type, number, and depth of wells being drilled each year, include such items as drill pipe, drilling mud, cement, fuel, fresh water, and miscellaneous consumables required by activities on the rigs and platforms. Based on the drilling activities described earlier (Table 57), drilling materials demands are expected to follow the pattern shown in Table 61. The drilling material tonnage demands shown are based on the tonnage requirements per well as illustrated in the table footnotes. These, in turn, represent a proportional part of standard wells described in Appendix B. Based on well activity, drilling material demands are expected to peak in 1988, when 80 wells are drilled. The drill pipe, mud, cement, and miscellaneous consumables that constitute dry freight drilling materials, are expected to be shipped directly to the service base on contract barges. Fuel for the rigs, platforms, supply boats, and construction camp electrical generators is expected to be initially purchased through the Standard Oil facility in Unalaska-Dutch Harbor. After phase-out of the temporary support base, tankers are expected to deliver fuel supplies directly to the permanent service base.

TABLE 61.

OCS MARINE TRANSPORTATION DEMANDS AT UNALASKA-DUTCH HARBOR AND MAKUSHIN BAY, ST. GEORGE BASIN SALE 70 MEAM BASE CASE 1981-2000

YEAR	YEAR AFTER LEASE SALE	DRILLING MATERIAL DEMANDS(1): DRILL PIPE	DRY BULK	TOTAL DRY FREIGHT	FUEL(2)	DRILL WATER(3)	PIPELINE CONSTRUCTION DEMANDS(4): INBOUND PIPE	COATING MATERIALS	TOTAL PIPE AND MATERIALS	INBOUND COATED PIPE	CONSUMABLES DEMAND(5): NON LOCAL OCS POPULATION	ANNUAL CONSUMABLES DEMAND	TOTAL INBOUND OCS TONNAGE DEMANDS: PETROLEUM PRODUCTS	DRY CARGO PRODUCTS
1981														
1982														
1983	1	3,232	6,872	10,104	6,584	38,416					341	614	6,585	10,118
1984	2	5,252	11,167	16,419	10,699	62,426					553	995	10,699	17,414
1985	3	6,060	12,885	18,945	12,345	72,030					1,191	2,144	12,345	21,089
1986	4	5,252	11,167	16,419	10,699	62,426	264,461	358.736	623,217		1,764	3,175	10,699	19,594
1987	5	18,974	33,654	52,628	39,538	176,812	265,241	359,76?	625,008	623,217	5,655	10,179	39,538	686,024
1988	6	26,480	45,600	72,080	55,360	236,800				625,008	4,919	8,854	55,360	705,942
1989	7	19,860	34,200	54,060	41,520	177,600					3,960	7,128	41,520	61,188
1990	B	13,240	22,800	36,040	29,546	118,400					2,542	4,576	29,546	40.616
1991	9	6,951	11,970	18,921	29,546	62,160					1,193	2,147	29,546	21,068
1992	10	80	1,920	2,000	29,546	60,080					1,338	2,408	29,546	4,408
1993	11	128	3,072	3,200	29,546	96,128					1,522	2,740	29,546	5,940
1994	12	96	2,304	2,400	29,546	72,096					1,400	2.520	29,546	4,920
199s	13	64	1,536	1,600	29,546	48,064					1,277	2,299	29,546	3,899
1996	14	34	816	850	29,546	25,534					1,162	2,092	29,546	2,942
1997	15	80	1,920	2,000	29,546	60.080					1,338	2,408	29,546	4,4013
1998	16	12B	3,072	3,200	29,546	96,128					1,522	2,740	29,545	5,940
1999	17	96	2,304	2,400	29,546	72,096					1,400	2,520	29,546	4,920
2000	18	32	1,536	1,600	29,546	48,064					1,277	2,299	29,645	3,899

NOTES: (1) Drilling Material Demands based on following tonnage requirements per well:

	Exploration Well (13s300 ft.)	Production Well (10,400 ft.)	Workover Well (10,400 ft.)
Tubular Goods	404	331	2
Drilling Mud (Dry)	776	320	28
Cement	249	178	17
Fuel	823	692	32.$
Fresh Water	4,802	2,960	1,502
Misc. Consumables	9	7	3
TOTAL	6,888	4,553	1,940

(2) All fuel demands include supply boat consumption. When oil/gas production begins, fuel demand remains constant at 2,686 st per platform (19,200 bbl per platform).

(3) Drilling water is obtained locally during the first two years.

(4) Pipeline construction demands are based on the following tonnage requirements per mile:

Pipe Diameter	Uncoated Pipe (a)	Coating Materials (a): Corrosion Protection	Cement	Iron Ore Aggregate	Wire Mesh	Total	Total Coated Pipe (b)
32"	723	159.1	100.3	701.7	4.9	966.0	1,689.0
34"	797	168.8	115.2	806.6	5.1	1,095.7	1,892.7

(a) Used if pipe is coated in the Aleutian-Pribilof region. Uncoated pipe and coating materials must be transported year before actual pipeline construction. Materials transported are increased 10 percent to account for wastage, spillage, and contamination.

(b) Used If pipe is coated in lower 48 states and shipped directly to construction site.

(5) Consumables demand based on consumption level of 300 pounds (0.15st) per onsite-nonlocal employee per month. Onsite employees served through Makushin Bay include those located at the enclave and those located offshore.

Source: ERE Systems. Ltd.

Alternatively, the industry could continue to buy fuel supplies from the Standard Oil Dock in Unalaska-Dutch Harbor using a tanker barge or the supply boats as a means of delivery. For analysis purposes in this study, it was assumed the oil industry would seek to minimize contact and exposure to fishing industry activities, and would therefore seek direct delivery of supplies to Makushin Bay after closure. of the temporary support base. Similarly with drill water requirements, the industry is expected to purchase the water locally during operation of the temporary service base. However, wells and water containment facilities are expected to be constructed at Makushin Bay, where the water supply would be used to support the local population and offshore drilling activities. Later, when production activities begin, the water supply would also be used as a backup system in fire emergencies.

The quantities of pipeline construction materials vary with the location of the pipe coating yard. Coating of the pipe is intended to add weight in order to overcome the natural buoyancy of the pipe when placed on the sea bottom. The location of a pipe coating yard in the Aleutian Islands makes sense if the yard also supports pipe coating activities in the Bering-Norton sale area and other future lease sales in the Bering Sea, Aleutian, or Bristol Bay areas. If pipe is coated in the Aleutians, the uncoated pipe and raw coating materials must be transported a year ahead of actual pipeline construction to allow time for the coating and curing process. If the coating yard cannot support other lease sales, it is more likely that fully coated pipe will be shipped directly to the construction site from coating plants in the continental U.S. The pipeline tonnage demands for the St. George Basin sale are shown for both possible situations in Table 61. However, it was assumed for analysis purposes that a Lower 48 coating plant and direct shipment of finished pipe was the preferred solution.

The demand for consumable commodities, which includes food, typewriters, desks, paper, clothing, and other such items, is largely a function of the on-site onshore and offshore population. Table 61 illustrates this population together with an estimate of consumables demand. The demand is based on a consumption level of 300 pounds (0.15 ST) per employee per month. Because of this relationship, annual consumable demands peak in 1987 and decline to a relatively steady rate by 1991.

The total of all inbound OCS tonnage demands for petroleum products and dry cargo products is also shown in Table 61. Since drill water is obtained locally it is not included in the summary. The years 1987 and 1988 are the most significant relative to OCS dry cargo tonnage demands due to shipment of pipeline materials. During these two years, dry cargo product demands approach or exceed 700,000 tons peaking in 1988 at 705,942 tons, an increase of more than 35 times the annual OCS shipments expected in 1986. In subsequent years, however, OCS dry cargo demands decline and by 1992 remain level at about an annual average of 5,000 tons. Petroleum products follow a similar, though not as dramatic increase in 1987, and peak in 1988 at 55,360 tons. By 1990, the demands for refined petroleum products stabilize as the pace of activity declines to production phase levels.

The effects of these OCS demands on Unalaska-Dutch Harbor are confined to the two year period immediately following the lease sale when the temporary support base is operating. Added to these short duration OCS demands are the tonnage demands of the OCS-induced population, which are of longer duration and of greater magnitude. Both the OCS and OCS-induced demands created at Unalaska-Dutch Harbor are shown in Table 62. The OCS tonnage demands at the temporary service base in 1983 and 1984 reflect those shown in Table 61. The tonnage demands of the OCS-induced population reflect a proportional increase in tonnage demand over base case values using forecast population figures developed previously in Table 59. When these two sets of tonnage demands are added, two peak years can be identified. The first occurs in 1984 when additional inbound tonnage demands peak at 37,270 tons. This tonnage represents a 13 percent increase over the base case forecast for that year and is equivalent to advancing the base case forecast demands by two years. The second peak occurs in 1989 when additional inbound tonnage totals 27,929 tons, a six percent increase over the expected base case tonnage forecast for that year, and equivalent to advancing the base case forecast about 18 months. By 1991, total additional inbound tonnage becomes steady at 23,903 tons and remains so through 2000. In 2000, this tonnage level constitutes only three percent of forecast base case tonnage demands.

When the various OCS and OCS-induced tonnage demands are translated into vessel requirements, the results are as shown in Table 63. As noted

TABLE 62.

ADDITIONAL TONNAGE DEMAND AT UNALASKA-DUTCH HARBOR
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

YEAR	YEAR AFTER LEASE SALE	OCS INDUCED POPULATION TONNAGE DEMANDS(1)		OCS TEMPORARY SERVICE BASE TONNAGE DEMANDS(2)		ADDITIONAL INBOUND TONNAGE DEMANDS			TOTAL INBOUND TONNAGE DEMANDS	
		PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	PETROLEUM PRODUCTS	DRY CARGO PRODUCTS	TOTAL	BASE CASE	REVISED TOTAL
1981									240,400	
1982									257,000	
1983	1	4,612	939	6,585	10,718	11,197	11,657	22,854	275,600	298,500
1984	2	7,605	1,552	10,699	17,414	18,304	18,966	37,270	294,800	332,100
1985	3	12,335	2,520			12,335	2,520	14,855	302,900	317,800
1986	4	7,202	1,471			7,202	1,471	8,673	338,200	346,900
1987	5	11,667	2,381			11,667	2,381	14,048	373,900	387,900
1988	6	15,970	3,260			15,970	3>260	19,230	427,800	447,000
1989	7	23,196	4,733			23,196	4,733	27,929	493,400	521,300
1990	8	20,126	4,106			20,126	4,106	24,232	508,300	532,500
1991	9	19,850	4,053			19,850	4,053	23,903	553,500	577,400
1992	10	19,850	4,053			19,850	4,053	23,903	598,400	622,300
1993	11	19,850	4,053			19,850	4,053	23,903	639,800	663,700
1994	12	19,850	4,053			19,850	4,053	23,903	685,500	709,400
1995	13	19,850	4,053			19,850	4,053	23,903	736,100	760,000
1996	14	19,850	4,053			19,850	4,053	23,903	767,900	791,800
1997	15	19,850	4,053			19,850	4,053	23,903	801,800	825,700
1998	16	19,850	4,053			19,850	4,053	23,903	833,100	857,000
1999	17	19,850	4,053			19,850	4,053	23,903	866,800	890,700
2000	18	19,850	4,053			19,850	4,053	23,903	902,500	926,400

Notes: (1) Based on a proportional increase over base case demands. Petroleum products tonnage demands are based on the percentage increase in regional population due to increased regional air travel demands, the location of OCS support helicopters at Cold Bay and increased fuel needs of the OCS induced population. Dry cargo products tonnage demands are based on the percentage increase in local population.

(2) From Table 61.

Source: ERE Systems, Ltd.

TABLE 63.

ADDITIONAL TRANSPORTATION REQUIREMENTS AT UNALASKA-DUTCH HARBOR AND MAKUSHIN BAY
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

YEAR	YEAR AFTER LEASE SALE	OCS VESSEL REQUIREMENTS: DRY CARGO BARGE TRIPS(1)	TANKER TRIPS INBOUND(2)	MODULE BARGE ARRIVALS(3)	PIPELINE LAY & BURY BARGES (4)	SUPPLY BOAT TRIPS(5)	RESOURCES TANKER DEPARTURES: OIL(6)	GAS(7)	INDUCED POPULATION VESSEL REQUIREMENTS: TANKER TRIPS(2)	DRY CARGO TRIPS(8)
1981										
1982										
1983	1	2		3		936			1	11
1984	2	3		5		1,560			1	18
1985	3	4		4		1,800			1	28
1986	4	4	1	2		2,376			1	17
1987	5	11	2	4	93	4,267			1	27
1988	6	14	2	5	93	3.864			1	37
1989	7	11	2	6		2,637	60	11	1	53
1990	8	7	1	3		1,960	192	47	1	46
1991	9	4	1			1,980	252	80	1	46
1992	10	1	1			660	194	91	1	46
1993	11	1	1			660	124	94	1	46
1994	12	1	1			660	85	92	1	46
1995	13	1	1			660	60	88	1	46
1996	14	1	1			660	43	85	1	46
1997	15	1	1			660	33	83	1	46
1998	16	1	1			660	25	82	1	46
1999	17	1	1			660	20	81	1	46
2000	18	1	1			660	16	80	1	46

Notes :

(1) Dry freight and consumables are assumed to move on 6,000 ST capacity barges.

(2) Tankers delivering processed fuels at Makushin Bay and Unalaska-Dutch Harbor are assumed to have 35,000 DWT capacity.

(3) Module barges include an estimate of barges required for construction equipment, modular housing used at the permanent support base, large pieces of machinery shipped in modular form, and other such items.

(4) Two lay barge spreads operate each year; one on the oil line, one on the gas line. Each lay barge spread consists of a lay barge; bury barge, two or three supply boats, and several supply barges (capacity 6,000 ST) to haul pipe to the lay barge. Only barge requirements are shown.

(5) Supply boats support the drilling rigs, platform installation, production platform operations; and pipeline lay and bury barge activities. Monthly supply boat trips for each type support is 26 trips per rig for exploration drilling, 15 trips per platform during developmental drilling; 24 trips per platform during installation, 5 trips per platform during production, 75 trips per lay barge and 25 trips per bury barge.

(6) Based on 120,000 DWT oil tankers.

(7) Based on 2.74 BCF LNG tankers.

(8) Based on 90 ST per cargo ship per port call.

Source: ERE Svstems. Ltd.

in Table 63, there are several categories of vessels serving OCS tonnage demands. The assumed capacity and purpose of each type of vessel is discussed in the table footnotes. The more important categories are the supply boats, due to their large volume of trip-making, and the oil and gas resources tankers, which are significant because of the size of the vessels and volume of trip-making. Supply boat activities are expected to peak at about 4,287 trips in 1987, when the combination of pipeline construction and drilling are near their highest levels. Total OCS vessel trips for 1987 are 4,397. Since OCS activities in 1987 are focused at Makushin Bay, little direct impact will be felt at Unalaska-Dutch Harbor. However, if the supply base had been maintained at Unalaska-Dutch Harbor, the expected level of OCS activities in 1987 would be slightly more than double the volume of trip-making forecast for the base case, 4,283 trips per year. Resources tanker activities peak when respective oil and gas production peak. Due to the size of the St. George Basin oil field and the economics of oil resource recovery, trips by oil resources tankers have a sharply defined peaking characteristic. Annual trips by oil resources tankers peak at 252 trips in 1991, two years after production begins. Within two more years, by 1994, annual trips by oil resource tankers decline to 85 trips per year, almost a third of peak year activities. By 2000, oil resource tanker trips have declined to approximately 16 per year. LNG tanker activities exhibit a different, more even, pattern due to the large volume of gas resources assumed to be discovered in the mean case scenario. LNG tanker activities peak in 1993 at 94 annual round trips and decline to 85 annual round trips by 2000, a 15 percent decline over seven years.

The number of vessel trips required to handle OCS-induced population demand are also shown in Table 63. Only one additional 35,000 DWT capacity tanker trip is required each year to handle induced population petroleum demands. Vessel trips required to handle dry cargo demands peak briefly in 1985 at 28 annual trips and again in 1989 at 53 annual trips. Once production begins and the number of OCS workers remains relatively steady, additional dry cargo trips also stabilize at 46 trips per year and remain at that level throughout the remainder of the forecast period.

Marine tonnage demands at Cold Bay, shown in Table 64, are considerably less in magnitude than those at Makushin Bay or Unalaska-Dutch Harbor. Much of the reason for these lower demands is due to the fact that OCS activities at Cold Bay are primarily transportation oriented and increases due to OCS employment and OCS-induced population are relatively small. Because of these characteristics only the consumables demands of shore-based OCS employees and the demands of the additional local population are important. OCS consumables demand at Cold Bay is expected to peak in 1985, when the non-local OCS employment is also at a maximum. Additional tonnage demands arising from the OCS-induced local population are based on proportional increases of petroleum and dry cargo products over respective base case forecasts. Each peaks at a different point in time. The additional demand for petroleum products is partly created by OCS-related helicopters located at Cold Bay, by the increased trip-making of OCS employees and OCS-induced population on the regional air transportation system, and by the increased use of

TABLE 64.

OCS AND OCS INDUCED MARINE TRANSPORTATION DEMANDS AT COLD BAY
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

CALENDAR YEAR	YEAR AFTER LEASE SALE	OCS CONSUMABLES DEMAND: NONLOCAL OCS POPULATION	OCS CONSUMABLES DEMAND: ANNUAL CONSUMABLES DEMAND	ADDITIONAL LOCAL POPULATION DEMANDS: PETROLEUM PRODUCTS	ADDITIONAL LOCAL POPULATION DEMANDS: DRY CARGO PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS: PETROLEUM PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS: DRY CARGO PRODUCTS	ADDITIONAL INBOUND TONNAGE DEMANDS: TOTAL	REVISED INBOUND TONNAGE DEMANDS: BASE CASE	REVISED INBOUND TONNAGE DEMANDS: REVISED TOTAL
1981									13,300	
1982									14,600	
1983	1	16	29	560	23	560	52	612	14,800	15,400
1984	2	23	42	939	30	939	72	1,011	15,100	16,100
1985	3	36	65	1,873	46	1,873	111	1,984	16,600	18,600
1986	4	32	58	3,146	45	3,146	103	3,249	17,000	20,200
1987	5	31	56	7,372	45	7,372	101	7,473	18,700	26,200
1988	6	31	56	6,949	45	6,949	101	7,050	20,500	27,600
1989	7	26	47	6,350	45	6,350	92	6,442	22,700	29,100
1990	8	26	47	4,565	45	4,565	92	4,657	25,700	30,400
1991	9	26	47	2,799	45	2,799	92	2,891	29,600	32,500
1992	10	26	47	2,972	45	2,972	92	3,064	31,300	34,400
1993	11	26	47	3,149	45	3,149	92	3,241	36,300	39,500
1994	12	26	47	2,978	45	2,978	92	3,070	40,300	43,400
1995	13	26	47	2,865	45	2,865	92	2,957	41,300	44,300
1996	14	26	47	2,661	45	2,661	92	2,753	46,400	49,200
1997	15	26	47	2,892	45	2,892	92	2,984	49,900	52,900
1998	16	26	47	3,109	45	3,109	92	3,201	53,400	56,600
1999	17	26	47	2,962	45	2,962	92	3,054	57,500	60,600
2000	18	26	47	2,818	45	2,818	92	2,910	61,000	63,900

Notes: (1) Consumables demand is basedon consumption level of 300 pounds (0.15 ST) per onsite-nonlocal employee per month.

(2) Based on a proportional increase over base case demands. Petroleum products are based on proportional increase in regional population due to increased regional air travel demands affecting Cold Bay, and location there of helicopter support base.

Source: ERE Systems, Ltd.

heating fuel and gasoline by the OCS-induced population. These petroleum product demands were forecast on the basis of a proportional ‘ increase in regional population, as was done in the base case. Clue to this relationship the demand for petroleum products peaks in 1987 at about 7,400 tons. Dry cargo products, on the other hand, respond to changes in local population. As a result, dry cargo product demands peak in 1985 at 111 tons, decline slightly through 1988 and remain relatively steady at 92 tons throughout the remainder of the forecast period.

Total additional tonnage demands credited to OCS or OCS-induced activities at Cold Bay follow a pattern identical to petroleum products, since petroleum products constitute 97 to 99 percent of the total. At its peak in 1987, total additional tonnage demand reaches 7,473 tons almost a 40 percent increase over the base case tonnage forecast for that year, During this peak year, three additional tanker trips and one additional dry cargo trip are necessary to provide transportation for the petroleum and dry cargo products. By 2000, total additional inbound tonnage demand due to OCS declines to only about 2,900 tons, which in that year is only five percent of forecast base case inbound tonnage. Only two additional vessel trips, one each for petroleum and dry cargo products, are required in 2000 to satisfy OCS and OCS-induced demands.

Marine Transportation Impacts and Issues

The OCS events suggested by the mean case scenario are relatively moderate in scope, and tend to be concentrated at only three or four locations in the Aleutian-Pribilof Region. These areas of concentration include the offshore field itself and onshore areas at Unalaska-Dutch Harbor, Cold Bay, and Makushin Bay. As discussed in the preceding text and tables, the intensity of OCS activities at each location and associated demands for marine transportation services vary considerably. The beneficial and adverse impacts of these activities on transportation services and facilities also differ from one location to the next.

In the offshore areas, the interactions of OCS vessels and equipment with non-OCS activities such as fishing or other transportation services are topics of particular interest. Some potential fishing-related impacts including loss of access to fishing grounds, loss of and damage to fishing gear, and potential collision impacts were investigated by Earl R. Combs, Inc. as part of their evaluation of the St. George Basin fishing industry (Earl R. Combs, 1981). In their report, Combs researchers estimated that only 163 metric tons of ground fishery resources (bottomfish) would be rendered inaccessible by the year 2000. This was felt to be insignificant in the context of over two million metric tons of ground fish that are assumed to be available in the Bering Sea and Aleutian areas. Other potential fishing ground losses include 2.0 metric tons of King Crab and 1.4 metric tons of tanner crab, which were also felt to be insignificant. The Combs report went on to point out that loss of access to some fishing grounds does not necessarily lead to a loss of catch.

With respect to fishing gear losses and damages, Combs estimated that up to about 1,150 claims per year can be expected from fisherman alleging damage to and loss of fishing gear. On an annual basis, the corresponding claim value was estimated at $450,000 by 2000, based on 1980 dollars. Combs' report also noted, with respect to gear losses, that the number of claims might be reduced if the fishing and oil industries provided better charts and markings identifying respective obstacles and, in general, attempted to maintain acceptable codes of conduct. With respect to real and potential collisions, Combs' results indicate that the number of potential collisions among all vessels of the fishing and OCS fleets would grow each year as traffic volume increased.

Approximately 1,233 potential collisions are possible each year, although the actual collision rate was estimated to be only one collision every seven years. Combs' report went on to state that this rate of collisions (O. 14 per year) was rather low, and its impact uncertain with regard to the value of possible damages, injuries, or loss of lives.

The Combs study also attempted to treat collision possibilities in the more confining harbors, such as Unalaska-Dutch Harbor. However, based on the premise that OCS supply boats will be operating from Makushin Bay rather than Unalaska-Dutch Harbor for most of the forecast period, the probability of an OCS fleet-fishing fleet collision at Unalaska-Dutch Harbor would appear small, even during the two year period when the temporary service base is operating in that location.

In addition to the above impacts, other impacts can be expected both "offshore and onshore. In the offshore areas, not only will the number of ships increase with OCS activities, but also the average size of vessels in the region will increase due to their presence. For example, the typical supply boat is about 200 feet in length, with a 40 foot beam and a maximum draft of about 14 feet. Another example is the 120,000 DWT tankers carrying about 961,000 barrels of oil with a length of about 950 feet, a beam of about 144 feet and loaded draft of approximately 53 feet. Because of their location at Makushin Bay and their expected use of Unimak Pass, these large ships will be operating across the busiest parts of vessel routes leading to Unalaska and Akutan. This increases the potential for collisions, particularly in fog and other bad weather situations. These ships could use Samalga Pass, 125 miles west of Makushin Bay, at potentially less risk. Such routing could add a day's steaming time to the route, however, and over the life of the field add costs that affect the economics of field development. The smaller OCS supply boats are expected to operate between Makushin Bay and the offshore field without the need to transit the Aleutians. However, these vessels are also expected to cross major shipping lanes enroute between these points. Such routing of the supply ships was included in Combs' collision assessment, but the routing of the larger tankers was not included.

Since the St. George lease sale area lies astride the major north-south shipping lanes, the placement of rigs and platforms in the area may pose additional hazards to navigation, particularly in light of the bad weather conditions prevalent in this region. In this situation, the U.S. Coast Guard would consider establishing a fairway either through the lease sale area or immediately adjacent to it, Depending on a variety of conditions discussed in the base case, the U.S. Coast Guard may also implement a vessel traffic service (VTS) similar to that employed at Valdez in order to control the movement of oil and gas tankers. In considering the vessel traffic service for-the Unimak Pass area, consideration might also be given to the oil and gas tankers serving the Bering-Norton lease sale area. Regardless of the VTS, however, the designation of fairways at key locations and use of federal stipulations in the sale lease, if utilized, could provide a high degree of control over the routes of the various OCS tankers.

The effects of OCS and OCS-induced activities at, or near, shore base facilities are also expected to affect marine transportation. During the two years of OCS activities at Unalaska-Dutch Harbor, supply boat activities steadily increase. Depending on the location of the support base within Unalaska Bay, considerably crowded conditions might ensue at the peak of each fishing season, particularly in the absence of a small boat harbor or other mechanism for controlling vessel berths. However, seasonal crowding is expected to be much worse in later years of the forecast period when the bottomfish industry is more matured.

One benefit that might be derived from the location of the temporary service base at Unalaska-Dutch Harbor would be oil industry participation in the construction of a new dock facility, which, after the oil industry leaves, would be made available to commercial shipping. The economics of such a situation, however, may dictate that the oil industry maintain its lease at Unalaska-Dutch Harbor for a longer period of time than suggested by the petroleum development scenarios. If extended for only three additional years, through 1987, the peak period for supply boat activity will occur at Unalaska-Dutch Harbor instead of Makushin Bay. As discussed earlier, under these conditions, total annual vessel trips at Unalaska-Dutch Harbor would more than double.

The construction of the permanent marine support base at Makushin Bay serves to concentrate most OCS marine transportation demands at that location. To meet these demands, the oil industry will need to build new dock facilities at the supply boat service base and at the marine terminals. The service base dock will need to have sufficient number of berths to handle peak operating conditions. Approximately 200 feet of marginal wharf or pier, used for loading and unloading the supply boats, are required for each drilling rig or platform being serviced. However, when more than one rig is in operation, less space per rig is needed (New England River Basin Commission, 1976). It is estimated that approximately 366 meters (1,200 feet) of wharf or 183 meters (600 feet) of pier usable on both sides would provide berths and may be adequate. A minimum water depth of 15 to 20 feet would be required at the face of the dock at all levels of tide.

Berthing facilities must also be constructed at Makushin Bay to handle the crude oil and LNG tankers. Either a shoreside fixed pier or a sea island pier is likely to be constructed as an oil tanker berthing facility. A shoreside pier can be either perpendicular or parallel to the shore line depending on the channel current, prevailing wind direction, and other factors. The major components of this facility include a loading platform, breasting dolphins, mooring dolphins, and a trestle connecting the loading platform to shore. In a shoreside fixed pier, oil pipelines to the loading platform are contained in the trestle. The sea island pier structure contains similar components but moorings are available on both sides of the pier, which is accessible only by water craft. Crude oil is pumped to the pier via submarine pipeline. Generally, the oil industry would be expected to design and size the facilities to meet their needs and those of various regulatory bodies.

At Cold Bay, OCS activities have an extremely small effect on marine transportation services at Cold Bay. In fact, with a minor change in the assumed standards of ship capacity employed in the analyses herein, it is likely the four additional vessel trips at the peak of OCS activities could be greatly reduced or eliminated. If the present capacity standards are maintained, the only advantage offered by OCS activities is that the frequency of service to Cold Bay increases slightly. However, without substantial increases in commercial shipping volume, it is unlikely that any meaningful improvement will be made to the level of service at Cold Bay.

With respect to levels of service elsewhere, the additional tonnage demand at Unalaska-Dutch Harbor, created by the OCS-induced population, will continue to increase the frequency of visits by commercial carriers. However, as discussed in the base case, it is likely that the amount of cargo space dedicated to the Unalaska-Dutch Harbor area will increase, thereby reducing the overall number of vessel trips. The frequency of service at Unalaska-Dutch Harbor is not presently a problem, and should not be in the future. Nor is capacity at the docks a problem now or within the forecast period. If, however, the marine shipping companies have to reassign existing vessels from other ports to handle OCS-induced cargo demands, then the level of service to other communities. may be affected as described in the base case.

Although the presence of OCS activities in the Aleutian-Pribilof region create significantly large demands for marine tonnage movement, it is unlikely that OCS activities will contribute any improvement to the overall level of marine transportation service provided the Aleutian-Pribilof Region. One reason for this is that most, if-not all, of the OCS direct tonnage demands are being transported by contract carriers. Although some of the existing marine shipping companies may be recipients of OCS transportation contracts, full and exclusive use of the contract barges for OCS purposes will preclude use of that equipment for improving service to other communities in the region. None of the marine carriers would be expected to shift any of their regularly scheduled vessels to serve OCS contract needs, unless a vessel was severely underutilized. Another reason that OCS will not contribute to level of service improvements is that the OCS-induced population growth takes place at locations where level of service is already high, as at Unalaska-Dutch Harbor. At locations where levels of service are relatively low, as at Cold Bay, the size of induced population growth is insufficient to generate the large volumes of tonnage that would improve commercial transportation services.

Air Mode

FORECAST OF AIR TRANSPORTATION DEMANDS AND REQUIREMENTS

The mean case will significantly increase demands on the region's aviation facilities, but is expected to have only a minor effect on existing aviation services. This situation is created in part because the oil industry is expected to use charter flights between Cold Bay and Makushin Bay. This approach provides the o-ii industry the aviation accessibility they require without seriously impacting the existing transportation services and at the same time avoids the present runway problems at Unalaska-Dutch Harbor.

Unalaska-Dutch Harbor

From the start-up of OCS activities in 1983 until the runway at Makushin Bay is completed in late 1985, OCS employees working at the temporary support base in Unalaska-Dutch Harbor and on construction activities at Makushin Bay are expected to be transported between Cold Bay and Unalaska-Dutch Farber on scheduled air carrier flights. OCS construction personnel bound for Makushin Bay are expected to travel between

Unalaska-Dutch Harbor and Makushin Bay by helicopter. The effect of these additional emplacements on the Unalaska-Dutch Harbor airport for the first three years after the lease sale, together with emplacements related to the local OCS-induced population for the same period are shown in Table 65. Annual emplacements on flights between Cold Bay and Unalaska-Dutch Harbor due to nonlocal OCS employment increases from about 1,100 in 1983 to about 3,100 in 1985. Over the same period, emplacements due to OCS-induced population increase from about 500 emplacements in 1983 to almost 900 emplacements in 1985. When compared to base case emplacements, the total additional emplacements in 1983 constitute a 13 percent increase, while those in 1985 constitute a 30 percent increase over expected base case values. The effect of these increased emplacements is equivalent to shifting the forecast base case emplacements closer in time by slightly less than two years.

When direct flights to Makushin Bay are initiated in 1986, OCS passenger emplacements fall off at Unalaska-Dutch Harbor. For the most part, only OCS employees living in Unalaska-Dutch Harbor require transportation to Makushin Bay. Consequently, between 1985 and 2000, annual emplanements due to OCS employment and induced population peak in 1989 at 2,290 persons, a nine percent increase over the base case forecast for that year. Since resident OCS employment stabilizes when oil and gas production begins, emplacements due to OCS activities decline over time as a percentage of total emplacements. By 2000, OCS-related emplacements decline to three percent of the forecast base case

TABLE 6S.

UNALASKA-OUTCH HARBOR AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1981-2000

YEAR	YEAR AFTER LEASE SALE	BASE CASE	PASSENGER ENPLANEMENTS: ANNUAL ENPLANEMENTS: OCS INDUCED POPULATION (1)	PASSENGER ENPLANEMENTS: ANNUAL ENPLANEMENTS: NON LOCAL OCS P13P131-ST10*(2)	PASSENGER ENPLANEMENTS: TOTAL	PEAK MONTH AVERAGE WEEK (3)	ESTIMATED AIRCRAFT OPERATIONS: 0s3 HELICOPTER OPERATIONS (4)	AIR CARRIER OPERATIONS (5)	AIR TAXI: MAKUSHIN BAY (6)	AIR TAXI: OTHER LOCATIONS (7)	TOTAL AIRCRAFT OPERATIONS (8)	PEAK O%10N3(91
1981		10,830			10,830	374		488		542	2,575	L5
1982		11,410			11,410	394		514		571	2,113	L5
1983	1	12,000	470	1,068	13,538	471	548	617		605	3,603	20
1984	2	12 .s80	655	2,016	1S,251	535	646	699		636	3,984	22
1985	3	13,170	879	3.108	17,157	605	1,008	792		668	4,658	26
1986	4	16,310	902		17,212	594	986	779	56s	825	S,561	31
1987	5	19.430	1,512		20,942	722	1,095	949	926	987	6,861	38
1988	6	22,620	1.?75		24,335	842	1,0'15	L,105	1,008	1,149	1,738	43
1989	7	25,840	;,:::		28.130	970	1.205	1.27S	1,2s1	1.31s	8.931	49
1990	8	29,140	.		30,982	1,069	1,054	L,402	973	1.476	9.222	51
1991	9	33.370	1.854		3s ,224	1,21s	600	1,593	882	1.688	9,68S	54
1992	10	37,600	1,854		39,454	1,361	600	1,783	8s2	1,899	10,687	59
1993	11	41.884	1,854		43,714	1,509	600	1,976	882	2,113	11.705	65
1994	12	46,2S0	1,854		48,104	1,660	600	2,173	882	2.332	12,745	70
1995	13	50.610	1,854		52,464	1.810	600	2,369	882	2,S50	13.780	76
1996	14	53.4043	1.854		55,2S4	1,906	600	2,494	682	2.689	14,440	80
1997	15	56.260	1,854		58,114	2.005	600	2,623	882	2,832	15,120	93
1998	16	59.100	1,854		60,954	2.103	600	2,751	882	2,974	15,795	87
1999	17	61,950	1,854		63,804	2.201	600	2,87?	882	3,117	16,472	91
2000	18	64,830	1.854		66,684	2.301	600	3,009	882	3,261	17,157	94

NOTES: (1) includes enplanements associated with: 02S employees who are local residents; additional indirect Employees. who are assumed to be local residents; and dependents of both groups. Trip rate Is 5.6 trips per year per person. See Table 59.

(2) Includes enplanements of: non-local Aleutian region OCS employees. OCS employees from other Alaskan regions. and non-Alaskan OCS employees. Trips shown are cumulative trips from each OCS employee classification. The trip rate for each classification is based upon crew rotation factors. See Appendix B.

(3) For Base Case and OCS induced local population, peak month enplanements are IS percent of annual enplanements. for non-local OCS employees peak month enplanements are twice annual monthly average. Average week is determined by dividing peak month by 4.345.

(4) OCS Helicopter' operations based on L. 5 trips per day until helicopter operations are transferred to Makushin Bay in 1986. In addition, over the period 1983.1985, helicopters are used to ferry OCS construction employees from Unalaska-Outch Harbor to construction camps at Makushin Bay. Beginning in 1986. helicopter use of Unalaska-Outch Harbor declines to about I 5 percent of Makushin Bay helicopter trips.

(5) Derived from the relationship:

$$\frac{\left[\left(\frac{\text{Base Case}}{\text{Annual Enplanements}} \times 0.9\right) + \left(\frac{\text{OCS Induced Local Population}}{\text{Annual Enplanements}} \times 0.98\right) + \left(\frac{\text{Non-Local OCS Employees}}{\text{Annual Enplanements}}\right)\right] \times 2.0}{40}$$

Where: The factor 0.9 assumes 90 percent of base case enplanements are on air carrier aircraft; the factor 0.98 assumes 98 percent of OCS induced local population enplanements are on air carrier aircraft; the factor 2.0 assumes arrivals equal departures; and the factor 40 is the adjusted capacity of a YS-11A aircraft assumed as standard.

(6) The airfield at Makushin Bay is not available until 1986. At that time, an air taxi service shuttles local OCS employees between Unalaska-Dutch Harbor and Makushin Bay.

(7) Al. taxi operations to Other loations are based on the relationship:

$$\left[\left(\frac{\text{Base Case}}{\text{Annual Enplanements}} \times 0.1\right) , \left(\frac{\text{OCS Induced Local Population}}{\text{Annual Enplanements}} , 0.02\right)\right] \times \cdot 20$$

Where: the factor 0.1 assumes 10 percent of base case enplanements are on air taxi aircraft, the factor 0.02 assumes 2 percent of OCS induced local population enplanements other than those to Makushin Bay are on air taxi aircraft; the factor 2.0 assumes arrivals equal departures; and the factor 4 is the adjusted capacity of a typical air taxi aircraft.

(8) Air carrier operations plus air taxi operations to other locations are assumed to constitute 40 percent of total operations before accounting for OCS induced operations.

(9) Peak daily operations are assumed to be twice annual daily average operations.

SOURCE: ERE Systems, Ltd.

enplanements for that year. Peak month average week enplanements at Unalaska-Dutch Harbor, which in the base case showed relatively steady growth throughout the forecast period, now show a plateau effect in 1985 and 1986, due to OCS-added emplanements. Beyond 1986, peak month average week enplanements continue to show the steady growth pattern of the base case. In 1985, peak month average week enplanements constitute a 33 percent increase over peak period base case enplanements for the same year.

Changes in annual aircraft operations at Unalaska-Dutch Harbor due to OCS activities follow a pattern similar to that of passenger enplanements. One significant change is the introduction of helicopters used to provide offshore support to the marine service base and to move construction personnel to and from Makuskin Bay. Annual helicopter operations grow from 550 in 1983 to just over 1,000 operations in 1985. In 1986, the helicopter base is relocated to Makushin Bay and the shuttle of construction workers ceases. Between 1986 and 2000, helicopter operations at Unalaska-Dutch Harbor consist of stop-overs for parts, key personnel, or visiting dignitaries. It is assumed that 15 percent of the operations at Makushim Bay include a stop-over at Unalaska-Dutch Harbor. This accounts for the forecast for 1986-2000 in Table 65.

Other classes of aircraft operations increase as well. Air carrier operations in 1985 increase 34 percent over the base case, but by 2000 exceed the base case forecast by only three percent, due to the use of charter aircraft by the oil industry. When resident OCS employees at Unalaska-Dutch Harbor begin commuting to Makushin Bay in 1986, it is assumed an air taxi will be used for transportation. These air taxi flights peak in 1989, decline slightly by 1991, and remain steady through 2000. At their peak in 1989, these air taxi flights represent a 97 percent increase over the base case. Other air taxi activities are not as greatly affected by OCS activities. During 1989, other air taxi operations constitute only two percent of base case air taxi operations. Combined air taxi operations in 1989 increase 99 percent over the base case.

Total aircraft operations continue to increase annually throughout the forecast period in a pattern similar to the base case. When OCS activities begin in 1983, total operations increase 26 percent over the base case estimate; by 1989, when OCS activity peaks, total operations increase to 46 percent over the base case estimate; by 2000 total operations have declined to only 11 percent of base case values.

Makushin Bay

At Makushin Bay, passenger emplacements increase several orders of magnitude when the airfield becomes operational in 1986 as shown in Table 66. Within three years, by 1989, when OCS employment peaks, annual enplanements at Makushin Bay exceed 15,900 persons. Thereafter, enplanements decline more than 50 percent within two years to a steady level of slightly more than 6,200 persons. Peak month average week enplanements at Makushin Bay follow a similar pattern, peaking in

TABLE 66.

MAKUSHIN BAY AIR TRANSPORTATION DEMANDS
ST. GEORGE BASIN SALE 70 MEAN BASE CASE
1986-2000

CALENDAR YEAR	YEAR AFTER LEASE SALE	PASSENGER ENPLANEMENTS: ANNUAL ENPLANEMENTS: DUTCH HARBOR(1)	COLD BAY(2)	TOTAL	PEAK MONTH AVERAGE WEEK(3)	ESTIMATED AIRCRAFT OPERATIONS: OCS HELICOPTER OPERATIONS(4)	AIR TAXI: COLD BAY(5)	DUTCH HARBOR(6)	OTHER CHARTER(7)	TOTAL AIRCRAFT OPERATIONS	PEAK DAILY OPERATIONS(8)
1981											
1982											
1983	1										
1984	2	582		582	23	62				62	1
1985	3	3,791		3,791	146	460				460	3
1986	4	1,130	2,532	3,662	141	6,570	126	565	691	7,952	44
1987	5	1,852	11,652	13,504	518	7,300	582	926	1,508	10,316	57
1988	6	2,016	12,960	14,976	575	7,300	648	1,008	1,656	10,612	59
1989	7	2,503	13,440	15,943	612	8,030	672	1,251	1,923	11,876	66
1990	8	1,947	9,732	11,679	448	7,027	486	973	1,459	9,945	55
1991	9	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1992	10	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1993	11	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1994	12	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1995	13	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1996	14	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1997	15	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1998	16	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
1999	17	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35
2000	18	1,765	4,476	6,241	240	4,015	224	882	1,106	6,227	35

NOTES: 1) Before 1986 opening of Makushin Bay airfield, all OCS employees enplane for Unalaska-Dutch Harbor. After 1986, only residents of Unalaska-Dutch Harbor enplane for that location.

2) Direct enplanements from Cold Bay begin when airfield is available, 1986.

3) Based on twice annual monthly average divided by 4.345 weeks per month.

4) Based on 1.0 trip per day per rig/patform to 1990. After 1990, based on 0.5 trips per day per rig/platform.

5) Based on aircraft with adjusted capacity of 40 passengers,

6) Based on aircraft with adjusted capacity of 4 passengers.

7) Assumes Cold Bay plus Unalaska-Dutch Harbor operations are 50 percent of industry air taxi charters. Other charters include Hercules heavy airlifters, executive jets, and other aircraft. types.

8) Peak daily operations are assumed to be twice annual daily average operations.

SOURCE : ERE Systems, Ltd.

1989 at 612 per week and declining to a steady rate after production begins.

Aircraft operations at Makushin Bay, also shown in Table 66, are expected to consist of helicopter operations, scheduled charter flights to and from Cold Bay, air taxi operations to Unalaska-Dutch Harbor, and other aircraft operations for equipment and material movements. Initially, helicopters would be the only means of access to Makushin Bay. With completion of the aviation facilities in 1986, all helicopter operations formerly at Unalaska-Dutch Harbor would relocate to Makushin Bay. In contrast to the helicopter support at Cold Bay, which is oriented primarily toward the movement of employees between offshore and shore locations, helicopter operations at Makushin Bay are oriented more toward equipment and supply requirements. During the construction phase and during installation of the platforms, helicopter operations are expected to be at a level of one round trip per day, per week, per platform. After production begins in 1989, operations are expected to decline to one round trip every other day. Industry charter flights between Makushin Bay and Cold Bay are expected to utilize an aircraft similar to the YS-11A, with an adjusted capacity of 40 passengers. At the height of OCS activities in 1989, it is anticipated that this charter would operate once a day in each direction, probably originating in Cold Bay. When oil and gas production begins and employment levels decline, only one round trip every other day is required. The air taxi between Makushin Bay and Unalaska-Dutch Harbor is expected to be a smaller aircraft with an adjusted capacity of 4 passengers. As discussed earlier, these air taxi trips peak in 1989, decline in two years to a constant state, and remain constant for the period 1991 through 2000.

The oil industry is also expected to use other charter aircraft, such as Hercules C-130'S, executive jets, and other fixed winged aircraft, to move equipment, men and materials. There is insufficient historical data available to make an accurate assessment of the magnitude of such other charter activity. For purposes of developing a total operations forecast, it was assumed that other charters constitute at least 50 percent of OCS aviation needs. As a result of these various aircraft activities, total aircraft operations at Makushin Bay increase from almost zero in 1986 to a peak in 1989 of almost 12,000 annual operations. Annual operations exceed 10,000 in 1987 and 1988, as well. Once production begins, total aircraft operations decline to a steady level of about 6,200 annual operations. peak daily operations follow a Similar pattern. Daily operations exceed 55 per day for the period 1987 to 1990, peaking in 1989 at 66 daily operations.

Cold Bay

Aviation activities at Cold Bay become much more intense as a result of OCS development in the St. George Basin. As illustrated in Table 67, there are three categories of OCS enplanements: (1) the OCS-induced population, who are OCS employees and dependents resident in Cold Bay; (2) nonlocal OCS employment, whose primary contingent is the offshore

TABLE 67.

cow BAY AIR TRANSPORTATION DEMANDS
37. GEORGE BASIN SALE 70 MEAN 8A3E CASE
1981-2000

			PASSENGER ENPLANEMENTS					ESTIMATED AIRCRAFT OPERATIONS					
			ANNUAL ENPLANEMENTS				PEAK						
YEAR	YEAR AFTER LEASE SALE	BASE CASE	OCS INDUCED POPULATION (1)	NONLOCAL OCS EMPLOYMENT (2)	MAKUSHIN BAY (3)	TOTAL	MONTH AVERAGE WEEK (4)	OC3 HELICOPTER OPERATIONS (5)	AIR CARRIER OPERATIONS (6)	MAKUSHIN W (7)	OTHER LOCATIONS (8)	TAL AIRCRAFT OPERATIONS (9)	P5AK DAILY OPERATIONS (10)
1981		21,490				21 ,4s0	741		2.137		1,075	8,028	44
1982		23,462				23.462	809		2.2n		1,173	8,610	48
1983	1	23.659		3.683		27,612	967	2,190	2.573		1,186	11,586	64
1964	2	24,054		6.221		30.652	1,081	3.650	2.794		1.207	13.651	75
1965	3	26.419		13.433		40,358	1,444	4,380	3.477		1,326	16,387	90
1986	4	27,011	519	24.768	2,532	54,830	1 ,s97	6,570	4,332	126	1,356	20,915	115
1987	5	29,968	654	38.926	11,652	81 ,402	3,004	7,300	5,563	582	1 .s07	25.556	141
1988	6	33.123	996	29,976	12,950	77,068	2.824	7,300	5,145	648	1,667	24,976	137
1989	7	37.066	1,282	21 ,000	13.440	7.2,73S	2,644	8,030	4,786	672	1 ,867	25,332	139
1s90	8	42.343	1,0s6	11.232	9,73.2	64,x6	2,302	4,015	4.422	486	2,130	20,881	115
1991	9	49.290	1,042	7,336	4,476	62.164	2.190	4,015	4,597	224	2.475	21.919	121
1992	10	62.247	1,042	8.928	4,476	66 ,693	2,353	4,015	4,90a	224	2,623	23,065	127
1993	11	61,317	I ,042	10,947	4,476	77,767	2,743	4,015	5,642	224	3,077	26,034	143
1994	12	68.612	1.042	9,612	4,476	63.742	2,943	4.015	6,024	224	3.441	27.9017	153
199s	13	70.189	1,042	8.256	4,476	63,963	2,946	4.015	6,037	224	3,S20	28,130	155
19%	14	79,455	1,042	7,020	4,416	91 ,993	3,216	4,015	6.552	234	3,964	30.576	168
1997	15	85,56?	1,042	8.938	4,476	103,013	3.s02	4.015	7.069	224	4,289	32.663	180
1998	16	92,074	1,042	10,947	4,476	108.S39	3,804	4,015	7.659	224	4,61S	24,922	192
1999	17	99,369	1,042	9.612	4..476	114 ,499	4,005	4,015	8,041	224	4,979	36,789	202
2000	18	105.481	1,042	8..255	4,476	119,255	4,163	4,015	8,346	224	5,265	38,314	210

Notes: (1) Includes enplanements associated with: OCS employees who are local residents; additional indirect employees, who are assumed to be local residents; and dependents of both groups. Trip rate is S.6 trips per year per person.

(2) Includes only Cold Bay based ● nplm&ts associated with: nonlocal Aleutian region OCE employees, 023 employees from other Alaska regions, and non-Alaskan OCS employees. Trips shown are cumulative trips from ● ach of BLM's OCS employee Classifications. The trip rate for each classification is bared upon crew rotation factors discussed in Appendix 6.

(3) When the Makushin Bay airfield becomes accessible in 1956, the oi 1 industry is expected to operate a charter between Cold 6ay and Makushin Bay and Anchorage. The figures shown are Cold Bay to Makushin Bay enplanements.

(4) For base case and 023 induced local population, peak month enplanements are 15 percent of annual enplanements. For non-loca 1 0C3 employees, peak month enplanements are twice annual monthly average. Average week is determined by dividing peak month enplanements by 4.345 weeks/month.

(5) 023 helicopter operations are based on 1.0 trips per day per rig/platform. When production starts heli tooter trips decline to 0.5 trips per day per rig/platform.

(6) Air Carrier operations are derived from the relationship:

$$\frac{\left[\left(\frac{\text{Base Case}}{\text{Annual Enplanements}} \times 0.9\right) + \left(\frac{\text{OCS Induced Local Population}}{\text{Annual Enplanements}} \times 0.98\right) + \left(\frac{\text{Non Local OCS Employees}}{\text{Annual Enplanements}}\right)\right]}{0.55 \times 51} \times 2.0 + 750\ (1+i)^n$$

Where: the factor 0.9 assumes 90 percent of base case enplaned and through passengers are on air carrier aircraft; the factor 0.98 assumes 98 percent of OCS induced local population ● aimed and through passengers are on air carrier aircraft: all non local OCS employees are enplaned m air carrier aircraft; the factor 2.0 assumes arrivals equal departures; the factor 0.55 adjusts enplanements to represent both enplaned and through passengers; the factor 51 represents the weighted average adjusted capacity of aircraft using Cold Bay; and the factor (1+i)n represents a compounding characteristics where i is assumed as one percent and n is the number of years from 1 980.

(7) The Makushin Bay charter flights aY6 expected to use YS-11A or similar aircraft with an adjusted capacity of 40 seats. Operations shown are derived from Makushi n Bay enplanements .

(8) Air taxi operations to other locations are based on the relationship:

$$\left[\left(\frac{\text{Base Case}}{\text{Annual Enplanements}}\ 0.1\right) + \left(\frac{\text{OCS Induced Local Population}}{\text{Annual Enplanements}} \times 0.02\right)\right] \times 2.0$$

Where: the factor 0.1 assure 10 percent of base case enplanements are on air taxi aircraft. the factor 0.02 assumes 2 percent of OCS induced local population enplanements other than those to Makushin Bay are on air taxi ai l-craft: the factor 2.0 assumes arrivals equal departures: and the factor 4 is the adjusted capacity of a trypical ai r taxi aircraft.

(9) Air carrier operations Pius air taxi operations co other locations are assumed to constitute 40 percent of toca 1 operations before accounting for 02S induced operations.

(10) Peak dai 1 y operations are assumed to be twice annual daily average operations.

Source: ERE Systems, Ltd.

labor force working on the rigs, platforms, and pipeline, and includes OCS employees in the shorebase helicopter support group; and (3) Makushin Bay enplanements representing OCS employees working at Makushin Bay. Because of the large offshore contingent, the peak year for OCS activities at Cold Bay is 1987. During 1987, approximately 51,434 enplanements, 1.72 times as much as the base case, are attributed to OCS activities. Total passenger enplanements in 1987 reach approximately 81,400, with OCS activities making up 63 percent of this figure. This level of enplanements is equivalent to advancing the base case forecast almost 10 years forward in time. Although OCS activities decline substantially following the end of offshore activities and start-up of production, enplanements continue to rise throughout the forecast period due to growth in the fishing industry. By 2000, OCS enplanements constitute only 12 percent of total annual enplanements and represent a 13 percent over anticipated base case enplanements for that year. Peak month average week enplanements follow a similar pattern, peaking in 1987 at approximately 3,000 enplanements per week, a figure 4.5 times greater than the base case for the same year. In 2000, peak period enplanements exceed those forecast for the base case by a factor of 1.9.

Because of the offshore OCS work force, helicopter operations are introduced to Cold Bay. These OCS helicopter operations are a function of the number of rigs and platforms operating, the number of employees, and transportation demands of other miscellaneous commodities. The trip rate for these operations was assumed to be 2 trips per day, per rig.

As a result, OCS helicopter operations peak in 1989, rather than 1987 when enplanements peak. However, once production starts, helicopter operations decline 50 percent and remain stable throughout the remainder of the forecast.

In response to the annual changes in employment, air carrier operations rise to a peak in 1987, decline slightly as production activities begin, and continue to rise steadily again over the period 1990 to 2000. During the first seven years of OCS development, most of the OCS-related trips are made by transient employees commuting to out-of-state residences through Seattle. For example, in 1987 there are 50,580 OCS enplanements by persons living outside the region. Of these, 9,972 enplanements, or 20 percent, are by Alaska residents, and 40,608 enplanements, or 80 percent, are by non-Alaskans. By the eighth year, 1990, many of the long-term employees will have relocated to Alaska and the more significant orientation of trip-making beyond the eighth year is toward Alaskan communities, most likely Anchorage and its surrounding area, or the Kenai Peninsula.

Air taxi trips between Makushin Bay and Cold Bay were already discussed earlier for Makushin Bay. The use of air taxi to other locations within the region will not be affected significantly, from the standpoint of OCS enplanements. It is assumed that only two percent of the OCS-induced population and that virtually none of the transient OCS employees will use air taxi services.

Total aircraft operations at Cold Bay follow a pattern not unlike annual enplanements. Between 1983 and 1989, total operations increase rapidly reaching a plateau in the period 1987-1989 centered around 25,000 annual operations. A slight decline occurs in 1990 and then total aircraft operations increase again to over 38,314 by 2000. The level of total aircraft operations at Cold Bay in the 1987-1989 period represents from 2.42 to 2.00 times as many operations as were forecast for the base case for that period. By 2000, total aircraft operations at Cold Bay for the mean case exceed forecast base case operations by only 18 percent. Similar changes occur in peak daily aircraft operations at Cold Bay, which peak at 141 daily operations in 1987, decline slightly through 1990, and then increase to 178 daily operations in 2000.

Anchorage International Airport

In the analyses of prior lease sales (in prior OCS studies), the Anchorage International Airport was evaluated because air route structures in other parts of the state of Alaska are such that all nonresident OCS employees had to pass through to the Anchorage Airport on the way to Seattle. In the St. George Basin sale, because of the direct linkage to Seattle from Cold Bay, Anchorage International Airport is not affected by out-of-state workers. However, Anchorage International Airport is affected by OCS employees destined for the Anchorage or Kenai areas, and potentially other areas in western or interior Alaska. By 1996, the Alaska Department of Transportation and Public Facilities (ADOT/PF) is forecasting 3.6 million enplanements and 3.2 million through passengers for the Anchorage International Airport. The base case forecast for 1996 assumed that 41,500 enplanements at Cold Bay had a destination in Anchorage and also assumed that there would be enplanements in Anchorage on the reverse trip. No attempt was made to separate enplanements from through passengers; all were assumed to be in the first category. Based on BLM's petroleum development scenario from 1996, together with ISER assumptions about statewide residency patterns, approximately 6,480 additional OCS-related enplanements at Cold Bay have a destination at or through Anchorage. When compared to the base case, OCS enplanements with an Anchorage destination cause a 16 percent increase in such trips. However, based on the projected growth at Anchorage International Airport, those 6,480 enplanements constitute only 4 percent of one year's growth.

OCS-related enplanements from the St. George sale at Anchorage do not peak in 1996, however; they peak in 1987. Assuming steady growth between 1979, when Anchorage had slight"ly over 1 million enplanements, and 1996, when Anchorage is forecast to have 3.6 million, enplanements in 1987 should be approximately 2.2 roil'lion. From the information in Chapter IV, base case enplanements at Cold Bay in 1987 with a destination at or through Anchorage International Airport are estimated to be about 15,650 persons, less than one percent of expected enplanements at Anchorage for that year. OCS enplanements at Cold Bay in 1987 with a destination at or through Anchorage International Airport are estimated to be 9,970 persons, a 64 percent increase over base case enplanements that same year. Total enp"lanements at Cold Bay in 1987 with a destination to or through Anchorage International Airport are 25,620 persons. Assuming all of these to be enplanements at Anchorage International Airport, they would constitute about 1.18 percent of expected enplanements for that year, a relatively small percentage.

Air Transportation Impacts and Issues

The advent of OCS development at the intensity suggested by the mean case scenario can be expected to increase demands on existing aviation facilities and services over and above expected base case demands. At times, the demands will be quite large due to the timing of OCS events vis-a-vis bottomfish development. In general, within the Aleutian-Pribilof region the problems of poor weather, low air travel demand, poor facilities and services, and high air-fares (as discussed in Chapter IV) are not going to be solved by the presence of OCS development. Since OCS development is concentrated in only a few communities any benefits are likely to be similarly concentrated, while the negative aspects of such sharply increased demands are more likely to be spread around the region.

In the mean scenario it was assumed the oil industry would utilize a charter aircraft to transport OCS employees between Cold Bay and Makushin Bay. The charter was assumed to be in operation from the opening of

Makushin Bay"in 1986 up to and through 2000. Between 1986 and 1989, when production begins, the charter's principal orientation is the linkage between Cold Bay and Makushin Bay, since most OCS employees are expected to arrive from Seattle during this period. Service to Anchorage can be worked into the route schedule but is not the focus of the service. Once production begins, and the character of OCS employment becomes one of a greater number of Alaskan versus non-Alaskan employees, the linkage to Anchorage becomes much more important. Thus, during the last decade of the forecast period, the charter is assumed to serve the Anchorage-Makushin Bay route with an intermediate stop at Cold Bay.

If the oil industry does not utilize a charter aircraft, the burden of transporting OCS employees would fall on the scheduled air carriers. Based on the existing schedules, and load factors, the airlines could continue to operate the existing service and meet both expected bottom-fish and OCS demands for approximately five more years (until 1985), at which point they will be required to increase the capacity along virtually all existing routes used by OCS activities: Cold Bay to Unalaska-Dutch Harbor, Cold Bay to Seattle, and Cold Bay to Anchorage. The initial reaction of the airlines would be to increase the utilization of aircraft now serving the routes, if possible. Alternatively, they could divert underutilized aircraft from other routes, or make unused charter aircraft available a limited percentage of time, thus maximizing the utilization of other available equipment.

In addition to increasing utilization, the airlines could proceed to lease or purchase additional aircraft. A careful assessment of future demands would be required to justify either long-term leases or outright purchase. The increase in bottomfish demand, although rapid, is spread out over a relatively long period of time, allowing air transportation services to evaluate demands year to year and to make appropriate responses in a timely way. Since OCS activities during the first six or seven years build more rapidly, peak sharply, and then fall off, the differences from one year to the next create a situation in which the airlines and potential lenders are unsure about the growth in demands. If an airline lacks the financial ability to convince lenders that additional capacity is a good investment, airlines might be expected to curtail or otherwise reduce services at low demand communities in order to get additional aircraft or greater frequency on high demand routes. In addition to enhancing airline profits, such a move would be designed to address concerns about inviting competition into high volume areas they cannot serve effectively, a point that is particularly important for their long-range financial well-being.

The extent to which competition could enter the Aleutian-Pribilof air transportation market may depend on facility improvements along key routes. Jet aircraft cannot economically, or physically in many cases, operate in the A"leutian-Pribilof region due to the short runways. Competitor fleets,largely made up of 737 and 727 aircraft,· would find it difficult to add one or more turbo-prop aircraft to their fleet except in long-term high demand areas because the aircraft lacks flexibility to be competitive on other routes'. If, however, existing runway facilities and airspace controls were improved to the point where jet aircraft could navigate to a location, land, and take off without reduced payload problems, the competitive situation could change significantly. Turbo-prop and other similar equipment would be relegated to feeder services, largely within the Aleutian-Pribilof and Bristol Bay regions. Simple extension of the runways to handle jets, however, is not the answer to improved air services. At some communities the provision of any runway might be an improvement; at others the need for instrument approach and landing systems could lead to improved services.

The advent of OCS activities is also expected to exert upward pressure on airfares generally. Since the peak of OCS activities occurs at approximately the same time as bottomfish development begins to accelerate, the combination of these two events and the rapid pace of change associated with them is expected to create a boom-town atmosphere in the affected communities. This boom-town atmosphere is expected to create inflationary characteristics in the local economies, driving the price of both goods and services upward. Since-this atmosphere will affect salaries and other costs to the airlines, they can be expected to respond by increasing air fares. Whether the increases in air fares are a legitimate recovery of costs or other expenses, or are an attempt to take advantage of the boom to make more Profit, is perhaps irrelevant to the impact that increased air fares have on communities not affected by either bottomfish or OCS development. Artificially increased prices would be expected to decrease demands or depress the growth in demands in non-affected communities. That in turn will be met with less frequent or unimproved services, and overall the quality of service available to the communities not participating in the "action" is likely to decline absolutely or relatively.

Unalaska-Dutch Harbor

As in the base case, no additional improvements of the Unalaska-Dutch Harbor runway are anticipated for the mean case. Instead, the scenario assumed construction of a new runway at Makushin Bay. One possible alternative to a new runway at Makushin Bay would be to have the oil industry contribute to runway improvements at Unalaska-Dutch Harbor. The improved runway would have to be linked by highway to Makushin Bay, however. Consequently, the cost of improving Unalaska-Dutch Harbor airport from the oil industry's perspective would have to include the cost of an unimproved road to Makushin Bay. Such an approach might be to the community's advantage over the long run. Capacity alone is not justification for the improvement, based on the estimate of capacity developed in the base case: 45 operations per hour, 49,300 operations per year. When these figures are compared to the forecast level of operations in Table 65, it appears that the runways have sufficient capacity throughout the forecast period both on an annual basis as well as a daily basis.

Construction of the runway at Makushin Bay could trigger adverse reactions by the residents of Unalaska-Dutch Harbor, particularly if jet aircraft are used to provide charter service from Cold Bay. OCS employees would have the privilege of jet transportation and the community could feel disadvantaged with its "inadequate" facility. Such a reaction would tend to increase pressure on public agencies to improve the Unalaska-Dutch Harbor airport so that a similar level of service can be provided there, or such a reaction might trigger a desire to get the oil industry to allow commercial aircraft to use the Makushin Bay facilities with additional pressure on DOT/PF to construct an improved road between Unalaska-Dutch Harbor and its "new" airport.

The introduction of helicopters to the Unalaska-Dutch Harbor airport can be expected to create some initial pressure on FAA regarding rapid approval of airspace approach and departure patterns and identification of a helicopter landing area on the airport. Since helicopters can operate in higher cross winds and have steeper ascent and descent slopes, their use at Dutch Harbor airport would not appear to be a problem; however, FAA's analysis would seek to identify any potential obstacles. Similar approvals would be required at Makushin Bay.

Cold Bay

The airport at Cold Bay will be directly affected by the movement of transient OCS workers. Most of these workers, and those of the bottom-fish and traditional fisheries as well, only change planes in Cold Bay, although some OCS workers may be overnight guests while awaiting assignments.

As discussed in the base case, the operational capacity at the airport is estimated at 55 operations per hour based on the theoretical capacity of the runway configuration, daily capacity could be as high as 1,320 operations and annual capacity as high as 481,800 operations. Even when corrected for IFR conditions, during summer months the runway could be expected to have a capacity exceeding 528 daily operations, which means that there is sufficient capacity to handle projected Cold Bay aircraft operations throughout the twenty-year forecast period.

Based on FAA's ten-year plan for Alaska, the operations forecast for the mean case in 1990 exceeds FAA's forecast by about 35 percent. Though no major improvements are planned for the airport, the rapid increase in enplaned passengers at Cold Bay may serve to increase the priority of improvements for the airport.

The introduction of OCS helicopters at Cold Bay are not expected to have as great an impact on FAA's review and approval process as those at Unalaska-Dutch Harbor, because a helipad area has already been identified. However, FAA will still need to conduct the review because the type of helicopters introduced could be quite different than those for which the airport is currently qualified.

VII. MEAN CASE SCENARIO IMPACTS
FACILITIES AT LOCATION ALTERNATIVE TWO

The mean case scenario presented in the previous chapter dealt with only one of several possible locations for shore base service facilities and oil and gas terminals. In this chapter, the analysis focuses on possible impacts at a second location for these facilities. Since the only substantial change between the mean case in Chapter VI and this chapter is the location of the permanent support base and oil/gas terminals, the development and production schedule as presented in Table 57 continues to guide OCS activities. In determining the impacts of this modified scenario we are not looking at the entire range of issues, but rather at changes to the positive and negative effects already identified in Chapter VI. Consequently, the analysis presented in this chapter will not duplicate the various tables presented in Chapter VI. Instead, part of the discussion will attempt to show how information in the tables of Chapter VI can be recombined or modified to support the analysis; and part of the discussion will present qualitative conclusions or inferences about how the effects of the sale are different when the location of these facilities changes.

As in the location alternative one situation, initial exploration activities will probably be supported by a temporary marine service base at Unalaska-Dutch Harbor. When the decision is made to develop the St. George Basin field, Ikatan Bay is chosen as the site for the permanent support base. Ikatan Bay is situated approximately 35 to 40 air miles southwest of Cold Bay. The permanent base at Ikatan Bay would be identical to that suggested for Makushin Bay, ultimately supporting a complex containing pipeline and terminal construction camps, the offshore support facility, possibly a pipe coating yard, marine oil and gas terminals with supporting marine infrastructure, and a 6,500 foot gravel runway to provide heavy airlift capacity. Initial construction activities would be oriented to getting the marine service base and the runway operational. Pipelines linking the oil and gas terminals at the Ikatan Base to the offshore field would traverse Isanotski Strait and Bechevin Bay.

With respect to economic factors affecting growth at the regional level, the employment and population characteristics of the Aleutian-Pribilof region identified in Table 58 remain unchanged. At the local level, the communities of Unalaska-Dutch Harbor and Cold Bay are expected to be directly affected by OCS activities, while the community of False Pass is likely to be at least indirectly affected. The temporary service base would be located at Unalaska-Dutch Harbor only three years; thus growth in employment and population due to OCS activities can be represented by the period 1983 through 1985 in Table 59. Actual growth in OCS employment is expected to be somewhat less than that shown in Table 59, however, due to the fact that construction workers for the permanent support base will go to Cold Bay instead of Unalaska-Dutch Harbor. Beyond 1985, when OCS activities move to the permanent support base, Unalaska-Dutch Harbor would be expected to grow and change following the pattern established for the base case forecast. This pattern is represented by the period 1986 through 2000 in Table 32.

The community of Cold Bay plays a role in this situation identical to that portrayed in Chapter VI. The OCS helicopter support group established at Cold Bay continues, as does the community's role as the regional aviation hub. The employment and population growth in Cold Bay throughout the entire forecast period is expected to remain as shown in Table 60 (Chapter VI), despite the build-up of construction workers for the permanent support base. This is because the community of Cold Bay does not have the infrastructure to attract or support residents in the manner that Unalaska-Dutch Harbor does; consequently, many more workers are expected to be transients.

The community of False Pass has not been discussed previously in this report. The following brief description of the community is derived mostly from the pamphlet "False Pass" prepared by the University of Alaska, Arctic Environmental Information and Data Center for the Alaska Department of Community and Regional Affairs in May 1978 and partially from FAA's Ten Year Plan (USDOT-FAA, 1979). False Pass is an unincorporated community located on the eastern side of Unimak Island on the easternmost strait connecting the waters of the Gulf of Alaska with those of the Bering Sea, about one mile west of the end of the Alaska Peninsula across Isanotski Strait. The name False Pass was derived from the fact that the Bering Sea portion of the strait is extremely shallow and cannot accommodate large vessels. The year-round population has varied over the years; however, in 1970 the community had 6.2 persons. The local economy depends mainly on seasonal salmon fishing and employment at the cannery. Fifteen or twenty local residents were employed in various capacities by the cannery during the summer of 1977. About 120 seasonal workers are housed at the cannery when it is operating. The Alaska Marine Shipping Company stops at False Pass once and perhaps twice a year to unload cargo. Sea Land occasionally serves False Pass during the summer fishing season, and Western Pioneer Lines bring in supplies for the fishing boats and the cannery. Sometimes freight is dropped at King Cove and brought to False Pass by a fishing boat when convenient. Fuel is delivered by Standard Oil (Chevron) to an oil dock located in the community. The community receives air service by weekly amphibious aircraft operated by Peninsula Airways under contract to Reeve Aleutian Airways. These flights carry passengers, mail and light cargo. The original 4,300 foot gravel runway has been split into two by stream erosion since 1963. The FAA's Ten Year Plan identified the False Pass runway as being 792 meters (2,600 feet) long and 30 meters (100 feet) wide. Thus, the runway can only accommodate small aircraft. Air access to False Pass depends on VFR flying conditions. These conditions occur approximately 75 percent of the time, with the best months being October and November and the poorest July and August.

It seems unlikely that False Pass would be directly impacted by OCS development, in part because the oil industry may want to avoid such a small village and, in part, because the village may want to avoid the oil industry. Neither viewpoint is truly known. On the other hand, if both groups desired direct involvement there seem to be several points of interest to both. For example, the oil industry could repair and extend the runway greatly improving air service for both groups. Also, the oil industry might be interested in a long-term lease of native-owned lands away from the community for the permanent support base. Of mutual interest would be a 6.1 meter (20 feet) navigable channel through Bechevin Bay, which, at present, is as shallow as two feet in many places. The channel would provide direct access to Bering Sea fishing grounds for all vessels including bottomfish trawlers and would provide direct access to the St. George and North Aleutian Shelf OCS lease sale areas for supply boats.

Water Mode

The marine facilities and services, including docks described in Chapter VI for Makushin Bay are assumed to be duplicated at Ikatan Bay. Separate oil and gas pipelines would connect the offshore fields to respective terminals following a route through Isanotski Strait and

Bechevin Bay. In order to achieve this operating mode, a relatively broad two-way channel clearly marked with appropriate navigation devices would need to be dredged through Bechevin Bay and maintained year-round. During the winter months, traffic will need to be maintained in the channel in order to keep a lead open in the sometimes ice-choked bay and strait. In the absence of this channel, all supply boat trips would be routed through Unimak Pass, causing a significant increase in traffic through the pass: 4,287 additional round trips in 1987 (see Table 44), a doubling of traffic in the pass. This routing of the supply boats would add 200 miles to each round trip, and would increase the amounts of fuel consumed by these boats by as much as 50 percent.

Oil and gas resource tankers should be able to move directly from sea routes to their respective terminals in Ikatan Bay without using any of the Aleutian passes. However, the sea route and anchorage area in Ikatan Bay is located near several major International Wildlife Refuges including the Izembek, portions of the Aleutian Islands National Wildlife Refuges and other refuges at Caton Island, Sand Man Reefs, and areas in the Shumagin Islands. Although there appears to be more than adequate sea room for navigating the approach to Ikatan Bay, weather conditions may dictate the need for a vessel traffic service (VTS) as used at Valdez and discussed in Chapter VI. Additionally, need for a VTS at Ikatan Bay may be enhanced if supply boats are required to use the longer route around Unimak Island.

In addition to the tankers and supply boats, all incoming supply barges would dock at the Ikatan Bay supply base. The exceptions to this rule are the pipeline lay and bury barges and pipeline supply barges which would be expected to use Unimak Pass for delivery of completed pipe materials to the pipeline construction site. If a pipe coating yard is built at Ikatan Bay, then all incoming uncoated pipe and raw coating materials would be delivered at Ikatan Bay,and subsequent pipeline supply barges would move through either Isanotski Strait (if the channel is cut) or through Unimak Pass (if the channel is not cut),

Compared to the base case, OCS activities at Unalaska-Dutch Harbor are expected to increase tonnage demands and vessel requirements during the period 1983-1985. The magnitude of these demands and requirements over this three year period is expected to be slightly less than that shown in Tables 61, 62, and 63 (Chapter VI). The reason the effects will be slightly less is that the build-up of construction workers for the permanent service base takes place at Cold Bay. The peak year and the last year for OCS activities at Unalaska-Dutch Harbor is 1985. OCS-related transportation demands that year are expected to constitute only a four or five percent increase over expected base case demands. For the period 1986-2000, tonnage demands and transportation requirements can be represented by Tables 35 and 38 (Chapter IV). Changes over this period are the same as reported in the base case.

Tables 61 and 63 (Chapter VI) also serve to identify demands and requirements at the Ikatan Bay support base, beginning in 1986. Of particular interest from these two tables are the supply boat trips in Table 63. Supply boat trips peak in 1987 at 4,287 round trips. If routed through Isanotski Strait and Bechevin Bay, this level of trip-making averages 23.5 trips per day (both directions included), or one trip per hour around the clock. This level of traffic is at least a tenfold increase over fishing boat traffic that might be expected there today. In addition, the boats are considerably larger and noisier. Alternatively, the boats could be routed through Unimak Pass. Since this route adds almost 161 km (100 miles) to the trip in each direction, turnaround time for the boats will be increased and more boats and crews than originally identified in the scenarios may be need ed. More important, however, is the effect on Unimak Pass traffic, which in the base case was estimated at between 3,560 and 8,400 one-way trips annually by 2000 (see Table 44). The supply boats would add 8,574 one-way trips in 1987, an increase of 1.7 times the expected base case value. Based on the mix of boat sizes, cargo, the weather, and other factors, a VTS system may be required for Unimak Pass.

Tonnage demands and vessel requirements at Cold Bay should be for the most part identical to those forecast in Table 64 (Chapter VI). The text in Chapter VI describing these demands is appropriate to this discussion and the reader is referred to that description.

The changes in marine transportation demands and requirements brought about by the mean case scenario with facilities at Ikatan Bay differ only slightly from those identified when the facilities were located at Makushin·Bay (Chapter VI). Overall the level of demands may have declined slightly because neither Cold Bay nor False Pass is a community that can" support much added population; thus there are likely to be more transient and less resident OCS employees. Nowhere in the region does the level of service improve as a result of this location shift. Unalaska-Dutch Harbor can be expected to lose some OCS demands, which could be a positive benefit due to expected rapid growth in bottomfishing and the community's role as transshipment hub. Cold Bay gains some added demands but only for one year with the net effect being no difference-in impacts or service levels, At False pass the community may or may not improve marine transportation services depending on their attitude toward the oil industry and economic growth generally. If the oil industry and economic growth are unwanted, the existing physical conditions in the community and native control over land use could be used to maintain and control OCS activities at a location that minimizes change in the community. If the industry is wanted and if the community sees the oil industry as a means to other economic goals, goals that are attainable, then potential for change in the community is very great and both transportation demand and service should increase.

Elsewhere in the region, with the exception of Unimak Pass, the change in location has little or no effect on impacts already identified in Chapter VI. The remarks made in that chapter are applicable here.

Air Mode

From an aviation perspective, during the first five years of the forecast period (1981-1985), the relationship between Cold Bay and Ikatan Bay are almost identical, respectively, to the Cold Bay and Unalaska-Dutch Harbor relationship and Cold Bay-Makushin Bay relationship, as discussed in Chapter VI. The air transportation demands-between Cold Bay and Unalaska-Dutch Harbor for the first five years of the forecast period are shown in Table 65 (Chapter VI). Actual demands are likely to be slightly less than those shown due to the shift away from Unalaska-Dutch Harbor of permanent support base construction personnel. When OCS activities shift fully to the permanent support base at Ikatan Bay in 1986, the transportation demands between Cold Bay and Unalaska- Dutch Harbor follow the pattern shown in Table 45 (Chapter IV) for the remainder of the forecast period. Under these circumstances, OCS activities in Unalaska-Dutch Harbor peak in 1985 and disappear altogether thereafter. Based on this slightly reduced role of Unalaska-Dutch Harbor in the early stages of exploration, it is anticipated that fewer OCS employees would be traveling between Unalaska-Dutch Harbor and Cold Bay and that they would likely travel on commercial airlines. Sufficient capacity exists in the present operations to handle this requirement.

At Cold Bay, aviation activities can generally be represented by the entirety of Table 67 (Chapter VI). The only exception to this table occurs over the period 1984 to 1985, when helicopters are utilized to transport permanent shore base construction crews from Cold Bay to Ikatan Bay. The resultant increase in operations at the airport is insignificant; no additional impacts are foreseen. The aviation demands at Ikatan Bay are identical to those suggested for Makushin Bay in Table 66 (Chapter VI). Anticipated enplanements between Cold Bay and Ikatan Bay, as illustrated in Table 66, remain the same. However, since Cold Bay has a more limited infrastructure and is unlikely to support many local residents, enplanements formerly identified as between Unalaska-Dutch Harbor and Makushin Bay in Chapter VI, now become Ikatan Bay transients. The overall effect of that change would reduce the local air taxi demands at Ikatan Bay, since these additional transient trips would now rely on the oil industry charter service.

Visibility is expected to be a problem at Ikatan Bay, particularly during the summers when construction activity is greatest. Due to the short distance between Cold Bay and Ikatan Bay, it is likely that the use of chartered aircraft between these points could be supplemented with a crew boat on bad days when fog hampers aviation activity at Ikatan Bay. A crew boat would pick up OCS employees at Cold Bay and bring them to Ikatan Bay and vice versa. Two crew boats and men to operate them would be minimum requirements for this service. By air, the distance between Cold Bay and Ikatan Bay is approximately 56 to 64 kilometers (35 to 40 miles); by sea, the distance is approximately 97 kilometers (60 miles). A typical crew boat can handle 59 passengers at a speed of approximately 28 miles per hour (New England River Basin Commision, 1976). Although the trip would be several hours longer than by air, the time spent waiting for the fog to clear could be several days,

The change in location of the permanent support base and oil/gas terminals has very little, if any, effect. on OCS air transportation demands or requirements except perhaps at Unalaska-Dutch Harbor. These changes could have an effect on False Pass similar to that discussed for the marine mode above, but equally applicable to the air mode. At other locations in the region, the location change would be largely unnoticed. The same problems discussed in the base case and in Chapter VI are expected to persist; the OCS changes offer the same impacts discussed in Chapter VI.

VIII. MEAN CASE SCENARIO IMPACTS
FACILITIES AT LOCATION ALTERNATIVE THREE

In this Chapter, the study focuses on a third possible location for the permanent shorebase and marine oil and gas terminals. The oil and gas development and production schedule for the mean base case, as presented in Table 57, (Chapter VI) guides anticipated OCS events. In determining the impacts of this locational change, heavy reliance is placed on the analysis of the mean base case presented in Chapter VI. Only changes in the magnitude and location of impacts associated with the shift of facility location are considered. Other aspects of the analysis as discussed in Chapter VI are also applicable but not not specifically reiterated here.

Due to the infrastructural advantages at Unalaska-Dutch Harbor, the oil industry is expected to establish a temporary service base there during exploration. Soon after the discovery a decision is made to develop the St. George Basin field and construction begins on a permanent service base on St. Paul Island. A decision is also made to locate the marine oil and gas terminals on St. Paul Island. With the exception of the runway, all facilities and services located on St. Paul are identical to those discussed for Makushin Bay in Chapter VI. It is assumed the existing runway can be connected by road to the proposed support base site and that the oil industry would participate in improvements to the airport. Port facilities for the tankers and supply boats would be extended offshore to avoid existing shallow areas. A breakwater would also be constructed to provide protection against wind driven wave actions.

The magnitude of employment and population changes in the Aleutian-Pribilof region remain as shown in Table 58 (Chapter VI). However, pipeline construction employment is expected to be less due to shortened pipe length and this would reduce regional OCS employment levels slightly for 1987 and 1988. At the local level, the Tanadgusix Corporation (local native corporation) can be expected to control access to the community of St. Paul in order to preserve traditional values. This is likely to affect the relationship between the number of resident OCS employees and enclave OCS employees, particularly at the local level. The Corporation can also be expected to control access between the OCS enclave and the community, which can slow economic growth in the community to acceptable limits. There is insufficient information available to forecast population change under OCS conditions in St. Paul, but such change can be expected to be kept to a minimum.

The community of Cold Bay is expected to play a role identical to that discussed in Chapter VI: a jumping off point for all offshore personnel and the regional aviation hub. Expected employment and population growth in Cold Bay are as shown in Table 60 (Chapter VI).

Growth in employment and population at Unalaska-Dutch Harbor for the period 1983 through 1985 can be represented by Table 59 (Chapter VI) and for the period 1986-2000 by Table 32 (Chapter IV). Actual growth in OCS employment during the period 1983-1985 is expected to be somewhat less than that shown in Table 59 since construction workers on the permanent support base would go to St. Paul instead. Once the permanent base opens, little or no OCS activity is expected at Unalaska-Dutch Harbor, and growth is expected to follow base case patterns.

Water Mode

The marine facilities and services provided through the St. Paul support base include the docks and fuel islands discussed in Chapter VI. An artificial harbor would most likely need to be constructed to protect the anchorage and docks from wave actions. In addition, it may be necessary to construct the docks and fuel islands to higher design standards in order to withstand higher wind forces. The oil and gas pipelines connecting the offshore field to respective terminals are expected to be 305 miles long, a reduction of 45 miles or about 13 percent from pipelines to Makushin Bay or to Ikatan Bay.

Oil and gas resource tankers should be able to move directly from sea routes to their respective terminals at St. Paul, although fog affects visibility from May through September. Due to the location of St.

Paul Island, resource tankers are expected to use Unimak Pass. The 332 additional tanker vessels using Unimak Pass in 1991 are expected to contribute a six percent increase in traffic in the Pass. By 2000, the 96 additional tankers associated with the St. George sale would add only two percent to total traffic in Unimak Pass.

Tonnage demands and transportation requirements at St. Paul are not likely to increase substantially over those forecast in Tables 34 and 42 (Chapter IV), if the native corporation can effectively control growth in the community. Otherwise, tonnage demands might grow in proportion to population growth. These statements ignore the effects of additional income to the native corporation stockholders which might be translated into increased purchases of goods and, thereby, increasing marine tonnages. If the oil industry constructs its port facilities before the Corps of Engineers or ADOT/PF provide dock facilities, the community should negotiate for use of the docks for community bound goods. This should improve the level of marine service to the community, although growth in the community may not change demand levels sufficiently to improve the frequency of service. Tonnage demands and transportation requirements at the permanent support base are shown in Tables 61 and 63 (Chapter VI). Activities begin in 1986 and continue throughout the forecast period. One possible exception to these demands relates to the shipment of coated pipe in 1987 and 1988. In the absence of a pipe coating yard in the region, it seems unlikely that pipe would be shipped to St. Paul and then back to the pipeline construction site. More likely, coated pipe would be shipped directly to the lay barge.

Tonnage demands and vessel requirements at Cold Bay are expected to be identical to those shown in Table 64 (Chapter VI). The related discussion in Chapter VI about the demands and requirements at Cold Bay is applicable.

At Unalaska-Dutch Harbor tonnage demands and vessel requirements during the period 1983-1985 are expected to be slightly less than those shown in Tables 61, 62, and 63 (Chapter VI) because permanent support base construction workers shift to St. Paul. The last year and peak year for OCS activities at Unalaska-Dutch Harbor is 1985, at which time OCS demands exceed expected base case demands by only four or five percent. For the remainder of the forecast period to 2000, tonnage demands and requirements can be represented by Tables 35 and 38 (Chapter IV). Changes over this later period follow the base case pattern.

In other communities in the region, OCS activities are not expected to improve or degrade transportation demands or services beyond levels discussed in Chapter VI.

Air Mode

Air transportation demands due to OCS activities are expected to affect St. Paul beginning in 1984. Initially, during 1984 and 1985 these demands will probably he met by commercial aviation services, although seasonal and annual load factors on the route between Cold Bay and St. Paul are already quite high. With the opening of the support base and completion of runway and other airport improvements in 1985 or 1986, the oil industry is expected to begin charter operations between Cold Bay and St. Paul. It is assumed the oil industry would contribute to improvements at the St. Paul airport including: paving and possible lengthening of the runway, construction of a new terminal, addition of a helipad (at both the airport and the service base), and possibly provision of an instrument landing system. The latter would be extremely important during the summer months May through September when IFR conditions exist 30 to 75 percent of the time. Helicopters would be expected to operate primarily from the support base. The addition of charter activities to airport operations at the rate of one flight per day would double total annual operations at the airport between 1986 and 1989. After 1989, when charter aircraft operate every other day, the increase in annual operations constitutes only a 25 percent increase because bottomfish activities are assumed to begin in 1990. The theoretical capacity of the airfield, as discussed in Chapter IV, is not expected to be exceeded by the increase in operations.

At Cold Bay, aviation activities are expected to be the same as shown in Table 67 (Chapter VI). Charter operations would be oriented to St. Paul and helicopter operations would be oriented to the offshore services, principally movement of OCS employees between offshore locations and Cold Bay. Depending upon routing between Cold Bay, St. Paul and Anchorage, some or all of the Anchorage bound passengers might fly directly to Anchorage from St. Paul, as current flights do. This could reduce the enplanements at Cold Bay, but only for the return-to-Anchorage leg of the trip. Charter flights from Anchorage would stop in Cold Bay to collect additional OCS employees coming from Seattle. These flights would have a more significant affect during the 1990's when the majority of OCS employees are Alaska residents headed to or through Anchorage.

At Unalaska-Dutch Harbor, OCS events affecting the period 1983-1985 are represented in Table 65 (Chapter VI). Actual demands maybe somewhat less than these, however, because no air support is needed to move permanent service base construction personnel. Beyond 1985, air transportation demands at Unalaska-Dutch Harbor should follow the base case pattern shown in Table 45 (Chapter IV).

At other communities in the region, the effects of moving the support base and marine terminals from Makushin Bay to St. Paul are likely to be identical to those described in Chapter VI. OCS development will put pressure on parts of the air system that already have a relatively good level of service. No real improvement to level of service is likely to be realized in other communities as a result of OCS activities. The presence of both bottomfish and OCS activities may strain the ability of the existing system to keep pace with demands.

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APPENDIX A

GLOSSARY

Breakbulk: Loose freight which requires manual manipulation.

Breakwater: A structure constructed for the purpose of forming an artificial harbor with a water area so protected from the effect of sea waves as to provide safe accommodations for shipping.

Containerized: Used to refer to the packing, storage, and shipment of cargo in standard sized containers or van-type trailers. Three major groups of sizes of containers are in use in the commercial maritime service:

- 275 cubic feet, measuring seven feet, nine inches by six feet, five inches by six feet, five inches. .
- 900 cubic feet, measuring seventeen feet, zero inches by eight feet, zero inches by eight feet, zero inches,
- 2,000 cubic feet, measuring thirty-five feet - zero inches by eight feet, zero inches by eight feet. zero inches.

Crawler Crane: A crane that travels on endless chain belts like those of a caterpillar tractor.

Dead-Weight Tonnage (DWT): The carrying capacity of a ship in long tons and the difference between displacement light and displacement when loaded. It is the weight of cargo, fuel, and stores, which a ship carries when fully loaded.

Diurnal: Used in reference to tides having a daily cycle.

Dock: A general term to describe a marine structure with a mooring for tieing up of vessels for loading and unloading cargo or for embarking and disembarking passengers. Specifically, a dock is referred to as a pier, wharf, bulkhead, or, in Europen terminology, a jetty, quay, or quay wall.

Dolphins: Marine structures for mooring vessels. They are commonly used in combination with piers and wharves to shorten the length of these structures. Dolphins are of two types: breasting and mooring. Breasting dolphins are designed to absorb the impact of a ship when docking and to hold the ship against a broadside wind or against the current, but are not very effective in holding a ship normal to the dock. Mooring dolphins are not designed for the impact of a ship and are located in back of the face of the dock. Mooring dolphins provide the additional holding power normal to the dock.

Draft: The depth of the keel of the ship below water level for a particular condition or loading.

Dry Bulk: Refers to nonliquid bulk commodities that can be moved by various types of conveyor systems.

Enclave: As used herein, a shore-based camp or series of camps housing transient workers directly involved in the development or operation of OCS facilities or related services,

Fairway: For marine vessel traffic, an open pathway devoid of obstructions through which two-way traffic is maintained.

Lighter: A large flat-bottomed barge used for loading or unloading ships.

Linehaul: The transporting of cargo between major distribution terminals.

Liquid Bulk: Cargo that can be offloaded or loaded by pipeline.

Littoral: In a coastal region, the shore zone between high and low water marks.

Marine Terminal: That part of a port or harbor which provides docking, cargo-handling, and storage facilities. When traffic is mainly cargo carried mainly by freighters, the terminal is commonly referred to as a Freight or Cargo terminal, but may also be the Bulk Cargo Terminal when such products as petroleum, cement, or grain are stored and handled.

Neobulk: Cargo which has been preloaded into boxes, crates, slings, pallets, or strapped to allow unloading by machinery.

Pier or Jetty: A dock which projects into the water.

Port: A sheltered harbor where marine terminal facilities are provided, consisting of piers or wharve at which ships berth while loading or unloading cargo, transit sheds or other storage area where ships may discharge incoming cargo, and warehouses where goods may be stored while awaiting distribution or sailing.

Port-of-Entry: A designated location where foreign goods and foreign citizens may be cleared through the customs house.

RORO: Roll on Roll off service. Ships providing this service have side or end doors to permit vehicles to be driven on or off, Typically, in cargo applications, trailers are loaded hv driving tractor-trailer combinations. onto the ship. The tractors are disconnected, driven off the ship and left behind. At the destination, a different set of tractors is driven on board, connected to the trailers and the combinations are driven off. In some applications, the tractors stay on board the ship and are used at both ends of the journey. Piers and wharves servicing such ships must be specially equipped with movable approach ramps, such as those used at ferry slips, capable of adjusting to varying tides and varying ship draft.

Shoal: A sand bank or sand bar that makes the water become shallow.

Steel Sheet Piles: Typically, prefabricated interlocking vertical piles made of sheet steel.

T-l-lead Pier: A pier more or less parallel to the shore and connected to it by a mole or tressel, generally at right angles to the pier, May also be called L-shaped pier depending upon whether the approach is at the center or at the end.

Wharf or Quay: A dock which parallels the shore.

Williwaw: A sudden violent wind.

APPENDIX B

TECHNICAL METHODOLOGY

Introduction

This appendix presents the background technical aspects of the methodology employed in this study. The task of assessing the transportation impacts of oil and gas development in the St. George Basin lease sale area requires an integrated methodology that forecasts transportation demands and requirements within the context of the Socioeconomic Studies Program (SESP). For this reason, the methodological discussion begins with a brief summary of the SESP impact and its application to the St. George Basin.

Significant within the SESP process is the relationship to and dependence upon other studies in the program. Although bits and pieces of other applicable studies appear at appropriate spots in the body of this report, some data from these other studies must also be presented in a consolidated form to provide a complete background to understanding the data that were used. Of special interest in this regard is BLM's Bering-Norton Mean Case Scenario, which is a key element in the base case forecast.

The value of impact assessment in the federal decision-making process is the ability to pinpoint the cause of impacts and to relate causes to effects. The desirability of establishing causal relationships between demands and impacts requires that the methodology disaggregate transportation demands and requirements as much as possible so that details of the impact can be examined. In this appendix, an attempt has been made to present the individual methodologies employed in forecasting the four key components of OCS transportation demand: industrial freight, consumables, resource production, and air passenger demands. Also included are several categories of non-OCS related locally based demands, each of which are driven by economic or population factors other than OCS.

To assess the magnitude of forecast changes on transpiration facilities and services, threshold or capacity values for existing and planned facilities and services must be established. The general methods, standards, and assumptions employed in developing these threshold values provides closure to this appendix.

SESP Process

SESP studies have historically been organized into two major groupings: Core Technical Studies and Special Technical Studies. Core studies are labeled as such because they form the nucleus of the program and are directed at a lease sale specific analysis of change induced by OCS activities. Special studies include case study analyses and other special investigations that tend to be program-wide in nature but may be concentrated on a specific lease sale. This assessment of transportation impacts is a core study.

The organization of core studies is based upon an SESP study method which focuses on a "longitudinal investigation of the OCS oil and gas development process. This methodology encompasses the assembly of predevelopment information and pre-sale forecasting of impacts and continues through post-sale monitoring of oil industry development actions and the actual effects on specific communities, regions, or the state as a whole. This evaluation of Aleutian region marine and air transportation systems is a pre-sale impacts study. However, prior post-sale studies have contributed to preparation of this report in that past responses of industry and affected communities have become standards and the basis for assumptions about industry or community behavior in the future.

The pre-sale impacts analysis moves forward in three steps. The first step is the analysis and projection of OCS petroleum development activities, commonly referred to as scenarios. These scenarios provide a description of expected OCS actions for several levels of resource finds and serve as the impacting agent in the second and third steps. The second step is the forecast of relevant technical variables, which in this transportation study includes inbound or throughput tonnage, air passenger emplanements, and other factors. At many stages in preparing the forecast, researchers are dependent upon work being done by other SESP contractors. In this study, for example, virtually all of the socioeconomic assumptions and forecasts of fishing industry growth were prepared by other SESP contractors in separate studies. The third step is impact evaluation, which is based upon a comparative analysis of forecast OCS effects. In this step, a contrast is made between forecast OCS effects and forecast effects that are likely to come about in the absence of the specific OCS sale. Both positive and negative changes are identified.

Of particular interest to each of the pre-sale impact studies are the oil and gas development hypotheses which drive the impact analysis. In the SESP, the oil and gas scenario is defined as the sequence of petroleum development events in a lease sale area corresponding to a given level of potentially recoverable oil and/or gas resources. The forecast of petroleum development activities takes into account the particular needs of the petroleum industry in each development region and projects the human, material, economic, and environmental requirements of the offshore development. Historically in the SESP, in order to provide a range of potential direct employment and equipment characteristics, up to four levels of resource find were initially identified and at least one scenario was prepared for each level. These resource levels/scenarios were labeled "Exploration," "Low," "Mean," and "High" in order of increasing magnitude of activities. Each level/scenario situation is mutually exclusive of the others. In the St. George Basin studies only the Exploration and Mean scenarios were used, since these focus more directly on BLM's information needs in the Environmental Impact Statement (EIS), and within a limited budget allowed sensitivity testing of several other variables. For the transportation study, BLM asked researchers to explore in a general manner the effects of changing the location of shore-based oil and gas terminals and service bases. These effects are discussed in Chapters VII and VIII of the body of the report.

Also of critical importance to the study process because of its use in the final comparative analysis is the forecast of changes likely to take place without the proposed lease sale. In this regard, the baseline analysis of historic trends, existing conditions, and reasons for change becomes an important tool. Since several SESP contractors are looking at the same historical events, but each from a different perspective, there needs to be an overall consistency in the results and conclusions drawn. A similar consistency problem surrounds the forecast assumptions and standards used in developing the no-sale future situation. The required consistency is achieved through comprehensive reviews of interim baseline and base case forecast reports within BLM and by appropriate state and local agencies.

General Assumptions Concerning Baseline Data

There are several general assumptions concerning the availability of information and use of available data in this study. First, it is assumed that there exists a strong set of historical information and data which can form the base for projections and analysis. Although portions of the available data set need to be verified or added to, without a good base or-the assumption ofa good base, the ability to carry the analysis into the future becomes more tenuous than the process has already made it. The second assumption is that the data that are available possess some predictable pattern or trend, or set of trends which can be utilized in forecasting. If the historical record has been fairly dynamic, or if unpredictable activities have created random patterns, or if such actions are anticipated in the future, the historical record contributes little toward developing an accurate future perspective. A third assumption is that there are reasonable methods or assumptions available to describe expected changes and to substitute for information that is not available.

General Assumptions Concerning Forecast Data/Impacts Analysis Process

There are several general assumptions associated with the forecast data that govern the use of the data in this study. The first of these is the assumption of scope, which refers to the identification of analysis areas and the extent or level of detail of the analysis. It is important to remember that the analysis being conducted in this study is based on a set of extremely hypothetical and highly speculative scenarios of OCS oil and gas development. Those scenarios have an accuracy variation of plus or minus 100 percent. When those scenarios are then extended through the SESP process and forecasts of population and economic changes are made, further assumptions and further extensions from the original set of values come about and the hypothetical character of the events becomes more acute. When that data is stretched still further with additional assumptions in this study, the credibility of the results is stretched considerably thinner. That statement is not intended as an apology for the approach, but is rather a qualification that should be borne in mind when using the results. The objective of the study is to delimit the range of the most significant impacts, and the methodology achieves that.

Because of the extended approach, an overly detailed analysis of the transportation system is unwarranted. How far to extend the analysis or how superficially to treat certain aspects of the evaluation are judgments made as the study progresses. To the extent possible these decisions are documented throughout this report. The lack of reliable and detailed information not only in the transportation sector, but in those activities on which the transportation analysis depends clearly precludes overly sophisticated approaches to the analysis.

The impact analysis method is based on a comparison between forecast transportation demands and forecast transportation supply. Although the provision of transportation services is dynamic, an important, but implicit assumption is made in this methodology that an imbalance of demand over supply is an indicator of potential negative impact. Also implicit in the methodology is an assumption that the dynamics can be frozen at one or several points in time and that certain categories of total demand and associated total supply can be isolated and evaluated. These categories, hereinafter generally referred to as impact categories, are each labeled to identify the impacting agency, and consequently fall into two groups: direct impacts and indirect impacts.

Direct impacts are those arising from the schedule and nature of OCS activities themselves. Some examples include movement and placement of a large drilling platform, movement of quality drill water and drilling supplies, or movement of materials and men for construction of a service base or pipeline. In this study, such events fall into the following direct impacts categories:

- OCS Industrial Freight
- OCS Consumables
- OCS Resource Production
- OCS Air Passengers

Indirect impacts are those arising when OCS activities stimulate economic change by influencing employment and population growth, and, consequently, increase demands for transportation services. For example, during the production phase of oil field development, some industry employees may relocate their families to the local community or region adjacent to the lease sale area. In doing so, the demand increases for personal transportation, particularly air travel, and for foodstuffs and other necessary commodities, which require air or marine transportation not directly attributable to OCS activities. In this study, such events fall into the following indirect impacts categories:

- Induced Freight and Liquid Bulk; and
- Induced Air Passengers.

Assumptions Concerning Selected Base Case Data

Several elements of the base case forecast are drawn or calculated from other studies and information sources. Although only part of these analyses were used in developing the base case forecast, the methods employed and intermediate results provide background to the base case evaluation and to this discussion of methodology. Of particular interest is BLM's Bering-Norton OCS Lease Sale 57 petroleum development scenario, which influences tonnage forecasts at Unalaska-Dutch Harbor and ship traffic in the Aleutian-Pribilof region. A brief explanation of each of these scenarios with supporting data follows.

The Bering-Norton OCS lease sale, number 57, is important to the St. George OCS lease sale for several reasons. One reason is that the fuel needed to operate the rigs, platforms, supply boats, construction camp generators and other equipment associated with the Bering-Norton sale will most likely be transshipped through Unalaska-Dutch Harbor, thus affecting marine transportation activities at that port. A second reason for the importance of Sale 57 is that the various supply ships and barges as well as resource tankers plying between Lower 48 ports and the Bering-Norton lease sale area will increase ship traffic in Unimak Pass, a key route through the Aleutian Islands.

BLM's mean case scenario, which is based on a "most likely" level of resource find was used to represent events and activities associated with the Bering-Norton sale. This scenario is summarized in Table B-1. From this scenario the transportation demands in Table B-2 and transportation requirements in Table B-3 were developed using the methodology described later in this Appendix. Although the mean case scenario described in Tables B-1 through B-3 is slightly different from the one evaluated in the Bering-Norton studies, the reader is invited to review as a source of background information the "Petroleum Development Scenarios" and "Transportation Impact" Studies conducted for the Bering-Norton lease sale (respectively, Dames and Moore, 1980; and Peat Marwick, 1980). Since the information in these tables is important only for the reasons stated above, and since the tables provide the needed data, no additional discussion of specific features of the Bering-Norton sale is included. Footnotes in the table provide sufficient supporting detail.

TABLE B-1

DEVELOPMENT AND PRODUCTION SCHEDULE
BERING-NORTON SALE 57 MEAN BASE CASE
1981-2000

CALENDAR YEAR	YEAR AFTER SALE	EXPLORATION AND DELINEATION RIGS	PLATFORMS INSTALLED	WELLS DRILLED		PIPELINE CONSTRUCTED (miles)	ONSHORE FACILITY CONSTRUCTION	PRODUCTION	
				EXPLORATION AND DELINEATION	PRODUCTION AND SERVICE			OIL (mmbbl)	GAS (bcf)
1981									
1982	0								
1983	1	2		6			Note 1		
1984	2	4		11					
1985	3	5	1	13					
1986	4	4	2	11					
1987	5	2	3	4	15	93	Note 2		
1988	6		3		45	93	Note 2	25	25
1989	7				89		Note 2	78	78
1990	8				14		Note 2	100	123
1991	9				9			78	142
1992	10							51	135
1993	11							35	119
1994	12							26	108
1995	13							19	103
1996	14							14	97
1997	15							11	95
1998	16							9	91
1999	17							7	90
2000	18							6	89

NOTES: (1) Begin construction of permanent service base.

(2) Construction period for oil and LNG terminal.

SOURCE: U.S. DOI - BLM, Alaska OCS Office, 1980.

TABLE B-2

OCS MARINE TRANSPORTATION DEMANDS
BERING-NORTON SALE 57 MEAN BASE CASE
1981 - 2000

CALENDAR YEAR	YEAR AFTER SALE	DRILLING MATERIAL DEMANDS (1): DRILL PIPE	DRY BULK	TOTAL DRY FREIGHT	FUEL (2)	DRILL (3) WATER	PIPELINE CONSTRUCTION DEMANDS (4): INBOUND PIPE	COATING MATERIALS	TOTAL PIPE AND MATERIALS	INBOUND COATED PIPE	CONSUMA DEMA
1981											
1982	0										
1983	1	2,094	4,458	6,552	4,272	24,912					53
1984	2	3,839	8,173	12,012	7,832	45,672					1,43
1985	3	4,537	9,659	14,196	9,256	53,976					2,70
1986	4	3,839	8,173	12,012	7,832	45,672	26,319	15,345	41,664		2,28
1987	5	4,981	9,137	14,118	10,333	48,633	26,319	15,345	41,664	41,850	2,62
1988	6	10,755	18,495	29,250	27,827	96,075				41,850	2,89
1989	7	21,271	36,579	57,850	60,527	190,015					1,35
1990	8	3,346	5,754	9,100	31,160	29,890					83
1991	9	2,151	3,699	5,850	28,665	19,215					47
1992	10				24,174						46
1993	11				24,174						47
1994	12				24,174						48
1995	13				24,174						46
1996	14				24,174						46
1997	15				24,174						46
1998	16				24,174						47
1999	17				24,174						48
2000	18				24,174						46

Notes: (1) Drilling Material Demands based on following tonnage requirements per well :

	EXPLORATION WELL (11, 500 ft.)	PRODUCTION WELL (7,500 ft.)
Tubular Goods	349	239
DRILLING MUD(DRY)	671	248
CEMENT	216	129
FUEL	712	499
FRESH MATER	4,152	2,135
MISC. Consumables	8	5
TOTAL	6,108	3,255

(2) When production begins fuel consumption remains constant at 2,686 tons/platform (19,200 bbl/platform) . Al T fu demands include supply boat consumption.
(3) Drilling water is obtained locally.
(4) Pipeline construction demands based on a composite pipe made up of 5D percent - 12 inch diameter, 25 percent - 18 inch diameter, and 25 percent - 20 inch diameter. Resultant tonnage requirements per mile are:

INBOUND UNCOATED PIPE(a)	COATING MATERIALS (a)	TOTAL(a)	INBOUND COATED PIPE(b)
283	165	448	.450,

a) Assumes uncoated pipe is shipped to service base and coated there, and that gravel is available locally. must be shipped and coated year before needed.
b) Assumes already coated pipe is shipped from a coating yard in Lower 48 states.

(5) Consumables demand based on consumption 1 evel of 300 pounds (0.15 ST) per onsite employee per month.

Source: ERE *Systems,* Ltd.

TABLE B-3

OCS MARINE TRANSPORTATION REQUIREMENTS
BERING-NORTON SALE 57 MEAN BASE CASE
1981-2000

CALENDAR YEAR	YEAR AFTER SALE	DRY CARGO (1)	TANKER BARGE (2)	MODULE BARGE (3)	RESOURCE TANKERS		TOTAL ROUND TRIPS
					OIL (4)	GAS (5)	
1981							
1982	0						
1983	1	2	1	3			6
1984	2	3	2				5
1985	3	3	2				5
1986	4	3	2				5
1987	5	9	2	15			26
1988	6	11	4	25	33	9	82
1989	7	10	9	10	101	28	158
1990	8	2	5	9	130	44	190
1991	9	2	5		101	51	159
1992	10	1	4		66	4 9	120
19'33	11	1	4		46	43	94
1994	12	1	4		34	39	78
1995	13	1	4		25	37	67
1996	14	1	4		19	35	59
1997	15	1	4		15	34	54
1998	16	1	4		12	33	50
1999	17	1	4,		10	33	48
2000	18	1	4		B	32	45

NOTES:

(1) Category includes drill pipe, dry bulk. coated pipe, and consumables. These commodi ties are expected to be shipped on 60,000 ST capacity contract barges

(2) Assumes an average of 7,000 ST (50,050 bbl) arrives on each tanker barge.

(3) Module barges include an estimate of barges required for construction equipment and materials used in constructing the support base and marine oil and gas terminals.

(4) Assumes 70,000 DWT (500,500 bbl) oi l tankers are employed for crude oi l transportation.

(5) Assumes 130,000 cubic meter (2.8 bcf) LNG tankers are employed for gas transportation.

SOURCE: ERE Systems, Ltd.

Forecast Methodology of OCS Transportation Demands

OCS activities have no historic reference in most of the areas of Alaska being studied. This is particularly true in the St. George Basin lease sale area. Use of growth factor characteristics or other history-based methodology as a forecast mechanism would be inappropriate in projecting OCS activities, because those activities are related more to the magnitude of the discovered and recoverable resources rather than to any function of the local economy. Thus, a forecast of OCS activities requires a more specialized treatment of each of the major OCS activity areas. The following sections discuss the individual assumptions and aspects of these areas of analyses:

- OCS Marine Industrial Freight;
- OCS Consumables;
- OCS Resource Transportation; and
- OCS Air Passengers and Freight.

OCS MARINE INDUSTRIAL FREIGHT

Transportation services are required to move and position the rigs and platforms necessary for development and production of oil and gas resources. Transportation services are also required for materials and equipment used in the process of drilling OCS wells, and in the construction and operation of the service bases, terminals, and other OCS facilities. Collectively, these demands are treated as marine industrial freight, although each type of demand is evaluated separately.

Movement and Siting of Rigs and Platforms

The movement and siting of rigs or platforms is part of the pre-drilling activities that take place before exploration begins and before field development begins. During this phase oil companies are required to conduct certain studies, such as seismic investigations and archeological or biological investigations, as prerequisites to being issued a variety of permits. Each block (tract) must be "cleared." The necessary surveys are typically done through subcontractors who own or lease boats for their survey. The level of effort for these surveys is relatively small, and two to four boats can simultaneously work on several blocks covering many potential wells. This number of boats is easily accounted for in the rounding error of this methodology; consequently, survey transportation demands are ignored in the detailed analysis.

Specialized transportation services exist for the movement and siting of the rigs and platforms. The rigs/platforms are towed into the sale area and carefully positioned in a predetermined location in the block. Anchor boats (tugs) and supply boats assist in this work. For purposes of this assessment it was assumed that at least one supply boat, four to six tugboats, and two to three barges are involved in platform installation (New England River Basin Commission, 1976).

Movement of Drilling Materials

Drilling materials typically are stored at the service base and moved periodically to the rig or platform as needed. Since wells are drilled almost continuously over the life of an oil field, demands for such transportation services are continuous. Table B-4 summarizes the estimated material requirements for individual exploration, production, and workover wells at a depth of 4,572 meters (15,000 feet). Based on BLM's scenarios, however, exploration and delineation wells are expected to have depths averaging 4,054 meters (13,300 feet), while production and workover wells are expected to have depths averaging 3,170 meters (10,400 feet). The data in Table B-4 were adjusted proportionally for each respective anticipated average depth. Total drilling materials requirements per year is based on the adjusted pre-well requirements multiplied by BLM's projection of the annual number of wells to be drilled (from the scenarios).

During exploration, the fuel component of these materials is assumed to be purchased at the Standard Oil dock. Fuel reaches the dock on 35,000 DWT tankers, but is transported to the rigs/platforms on supply/support vessels. When a permanent support base is established, processed fuel is shipped directly to the base using similar sized tankers. Nonfuel items are assumed to be delivered directly to the service base by barge. These barges are assumed to have the capacity to carry 6,000 short tons of dry bulk, neo-bulk, or containerized cargo. Drill water is expected to be provided in part by the rigs through on-board equipment; in part by the nearest community with acceptable water supplies (quality and quantity), particularly during exploration; and in part by the collection of water through wells and reservoirs at the permanent service base.

TABLE B-4

DRILLING MATERIALS REQUIREMENTS
for a 4,572 Meter (15,000 Foot) Well

MATERIALS	EXPLORATION WELL	PRODUCTION WELL	WORKOVER WELL
Tabular Goods	455 tons	477 tons	2 tons
Drilling Mud 1/ (Dry Weight)	984 tons	403 tons	41 tons
Cement	363 tons	274 tons	25 tons
Fresh Water 2/	5,415 tons	4,269 tons	2,166 tons
Fuel for Drilling 3/	464"tons	499 tons	280 tons
Miscellaneous Consumables 4/	10 tons	10 tons	4 tons
TOTAL WEIGHT	7,690 tons	5,932 tons	2,518 tons

Notes: 1/ Drilling mud can be reused from well to well on given platform. Amount shown assumes mud is used in four wells.

2/ Based on 1 gallon water = 8.33 lbs.

3/ Based on 1 ton Fuel = 7.15 bbls. Excludes supply boat fuel.

"Includes tools, and parts.

Sources: New England River Basin Commission, 1976; Kramer, et.al, 1978; Alaska Dept. of Highways, 1976; Mr. Steve Lewis, ARCO, 1981; and Peat Marwick for consumables data.

The focus of this analysis is also on the impacts created by vessels carrying these supplies. The commercial tug barges and ships serving Aleutian-Pribilof communities are described as part of the baseline. The characteristics of a typical supply/support vessel are shown in Table B-5. Usually, two such boats are assigned to each rig or platform--one stands by for emergency evacuation purposes, the other runs for supplies. From the cargo capacity data and forecast of drilling supply needs, an estimate can be made of the number of round trips likely to be required each year.

However, trips by supply boats are made for all sorts of reasons other than supply. Empiric data gathered on supply boat trips during exploration activities indicate a monthly average of about 13 round trips for each of the two boats assigned to a rig (Northern Resource Management, 1980). This and other related information compiled by the Alaska Department of Community and Regional Affairs is shown in Table B-6.

Movement of Construction Materials

Materials are required for construction of offshore pipelines and for construction of the various onshore facilities including support bases, LNG plant, oil terminal, and onshore pipelines. In the St. George Basin scenarios, offshore pipelines are used to bring crude oil and natural gas to the respective terminals. It was assumed that necessary pipe materials will be coated in the Lower 48 states and shipped directly to the lay barge at the time of construction. If, however, the

TABLE B-5

TYPICAL SIJPPLY/SUPPORT VESSEL CHARACTERISTICS 1/

BOAT DIMENSIONS	
Length:	210′
Beam:	40 ′
Depth Loaded:	18.5′
ENGINE	
Horsepower:	7,100
Fuel Consumption:	4,500 to 7,000 gal./day depending on hours of operation.
CARGO CAPACITIES	
Deck Cargo:	350 long tons 2/ (392 short tons)
Bulk Cargo:	4,500 cu. ft.
Fuel :	175,600 gals.
Drill Water:	155,300 gals.
Potable Wager:	15,000 gals.
CREW SIZE	
No. of Personnel:	11

Notes: 1/ Typically, two such boats service each drilling vessel. One remains at the rig/platform if needed for emergency evacuation, the other goes for supplies.

2/ Long ton = 2240 lbs. = 1.12 short tons.

Source: New England River Basin Commission, 1976

TABLE B-6

TYPICAL MONTHLY SUPPLY BOAT MOVEMENTS
For Various Offshore Operations

OFFSHORE OPERATION	MONTHLY SLIPPLY BOAT MOVEMENTS (Round Trips)
Exploratory Drilling	26 per rig
Platform Installation	24 per platform
Developmental Drilling	15 per platform
Production Platform	5 per platform
Pipeline Lay Barge	75 per barge
Pipeline Bury Barge	25 per barge

Sources: Northern Resource Management, 1980; and Alaska Department of Community and Regional Affairs, 1977.

Aleutian service base is used to support other offshore sales in the Bering Sea, a pipe coating yard might be established at or near the service base. If the pipe coating yard was established in the region, uncoated pipe must be shipped a year earlier than needed in order to apply the coating. Table B-7 provides an idea of the pipe and coating material needs for several sizes of pipe. During actual construction of the pipeline, two lay barge spreads are assumed to be used. One mile of pipewill be onshore and the pace of offshore construction is assumed to be .75 miles/day.

Careful planning for construction of onshore facilities will be required because of the oversized shipments involved and the need to move a large amount of tonnage. For the most part, shipments will be delivered directly to work sites, and, if needed, construction docks will be built. Standard 6,000 ton barges are assumed to be used to haul construction equipment, housing modules, piping, storage tanks, and other pieces of functional equipment that make up permanent onshore installations.

OCS CONSUMABLES

OCS consumables consist of day-to-day items including food, tools, and the other parts and equipment necessary to keep the rigs, platforms, service bases, pipelines and other facilities operating. Depending on urgency of need consumable items travel different modes. Things like office furniture, nonperishable foods or canned goods, and normal

TABLE B-7

PIPELINE CONSTRUCTION TONNAGE DEMANDS

PIPE SIZE	UNCOATED PIPE TONNAGE (t/km)	(t/mi)	COATING MATERIALS TONNAGE (t/km)	(t/mi)	COATED PIPE TONNAGE (t/km)	(t/mi)
12"	133.6	215	60.89	98	194.5	313
14"	155.3	250	73.32	118	228.7	368
16"	180.2	290	110.6	178	290.8	468
18"	205.1	330	134.8	217	339.9	547
20"	229.9	370	152.9	246	382.8	616
24"	295.2	475	399.5	643	694.7	1118
32"	447.4	720	600.2	966	1048.	1686
34"	490.9	790	681.0	1096	1172.	1886

Source: Derived from New England River Basin Commission, 1976 and Adams, 1980.

restocking of spare parts typically move by the marine mode from Seattle to the sale area. Perishable food items and tools, parts, or equipment needed on an emergency basis are shipped by commercial air carrier or chartered aircraft. From the service base, such consumable goods move to offshore facilities by either supply boat or helicopter; goods required onshore move by road or helicopter.

No empiric information has been gathered on the use of one mode over the other in the shipment of these supplies. Both helicopter trip-making and supply boat trip-making are based on rules of thumb which recognize that these goods are included, but these goods are not the independent variable (see Table B-6). However, consumables data are used as *one* of several variables dictating linehaul marine transportation requirements.

The quantities of consumable items are based on two rules of thumb. With reference to the tools and parts needed offshore, it is assumed 10 tons of consumable items are needed for each exploration or production well being drilled (see Table B-4). A lesser quantity is needed for workover wells. A second rule of thumb is that food, clothing and miscellaneous consumption averages 4.54 kilogram (10 pounds) per on-site person per day or 136.08 kilogram (300 pounds) per on-site person per month.

OCS RESOURCE TRANSPORTATION

When oil and gas production begins, there is a need to transport the crude oil and LNG products to refineries and markets. Although production peaks in the early years of the field and annual production gradually decline over time, the demand for transportation remains continuous. The number of tanker trips required per year is determined for oil tankers and LNG tankers by dividing annual production by tanker capacity. Projections of annual production are developed as part of BLM's scenarios. It is assumed that a typical oil tanker has a capacity of 70,000 DWT to 120,000 DWT while a typical LNG tanker has a capacity of 130,000 cubic meters (2.74 bcf).

Tanker routings are also considered a part of the evaluation of resource production. Particular emphasis is placed on evaluating the volume of ship traffic moving through Unimak Pass in the Aleutian chain. The cumulative effects of prior OCS sales in the Bering-Norton and Beaufort Sea lease sale areas is also considered. Based on data provided by BLM it is assumed:

- oil and gas resources shipped from the potential terminal at Makushin Bay will transit Unimak Pass in the Aleutians on the way to Lower 48 refineries.
- oil and gas resources shipped from Ikatan Harbor do not need to pass through the Aleutian chain, since the harbor is located on the south side.

- oil and gas resources shipped from St. Paul are expected to transit Unimak Pass in the Aleutians. Unimak is the pass favored by fishing boats and is the pass likely to be used by OCS traffic headed to and from Bering-Norton and Beaufort Sea oil fields.

Ocs PASSENGER MOVEMENTS

The forecast of OCS employment-related transportation demands requires employment information from the scenarios, and population data from the regional and local socioeconomic studies. Other information needs include crew rotation factors and residency characteristics for each classification of OCS employment. This information is summarized in Table B-8. From this information the process outlined in Figure B-1 was followed to determine passenger volumes for each air route.

Because of the infrastructural characteristics at Cold Bay, it was assumed that all offshore personnel would be based through this community. Offshore personnel would arrive at Cold Bay on a commercial airline flight and board a helicopter there for a flight to the offshore rig, platform or other vessel. Onshore personnel are assumed to use commerical flights to get to Cold Bay, where they board a charter flight to Makushin Bay. During early exploration activities onshore personnel would continue on commercial airlines to Unalaska-Dutch Harbor where those working at Makushin Bay would be transported by helicopter. At the end of their rotation period both offshore and onshore personnel travel the route in the other direction.

TABLE B-8

CHARACTERISTICS OF OCS EMPLOYMENT TRI P-NAKING
ST. GEORGE BASIN SALE 70

STAGE OF EVELOPMENT	EMPLOYMENT SECTOR	ACTIVITY LOCATION	LOCAL RESIDENCY RULE(1)	SHARE OF EMPLOYMENT TO ALASKA RESIDENTS (SEAR) 1979-1984	1985-1989	1990-2000	CREW ROTATION FACTOR(2)	TRIP FACTOR(3)
xploration	Dril 1 ing Rigs (Mining)	Off shore	N/A	0.200	0.210	0.231	2	0.9053
	Shore Bases (Mintng)	Onshore	2	1.000	1.000	1.000	1.5	0.7242
	Supply Support Aircraft/Vessels (Transportation)	Onshore	2 (Aircraft) 3 (Vessels)	0.400	0.420	0.462	2	0.9053
envelopment	Platform Instal 1 at ion (construction)	Offshore	N/A	0.100	0.105	0.116	2	0.9053
	Shore Base (construction)	Onshore	1	0.500	0.525	0.578	1.11	0.4345
	Pipel fne (construction)	Offshore	N/A	0.200	0.210	0.231	1.11	0.4345
	Oil Terminal (construction)	Onshore	1	0.200	0..210	0.231	1.11	0.4345
	LNG Terminal (construction)	Onshore	1	0.500	0.525	0.578	1.11	0.4345
reduction	Development Dril 1 ing (Mining)	Off shore	N/A	0.100	0.300	0.330	2	0.9053
	Suppl y Support Aircraft/Vessels (Transportation)	Onshore	3	0.800	0.880	0.962	1.5	0.7242
	Shore Base (M ining)	Onshore	2	1.000	1.000	1.000	1.5	0:7242
	Headquarters (Mining)	Onshore	N/A	1.000	1.000	1.000	.-	.-
	Oil /LNG Terminal (Transportation)	Onshore	3	1.000	1.000	1.000	1.5	0.7242
	Production Operations (Mining)	Offshore	N/A	1.000	1.000	1.000	1.5	0.7242

tes: (1) Residency Rules **developed by BLM** were:

1. Two percent of construction workers at onshore facil ities are local residents.
2. All employees at onshore facil i ties are local residents.
3. Twenty-five percent of transportation sector employees are local residents, but only during production stage of development.

(2) Crew Rotation factor is defined as:

$$1 + \frac{\text{number of days off site}}{\text{number of days onsite}}$$

Multiplying the onsite employment by the rotation factor produces total employment for a given employment category.

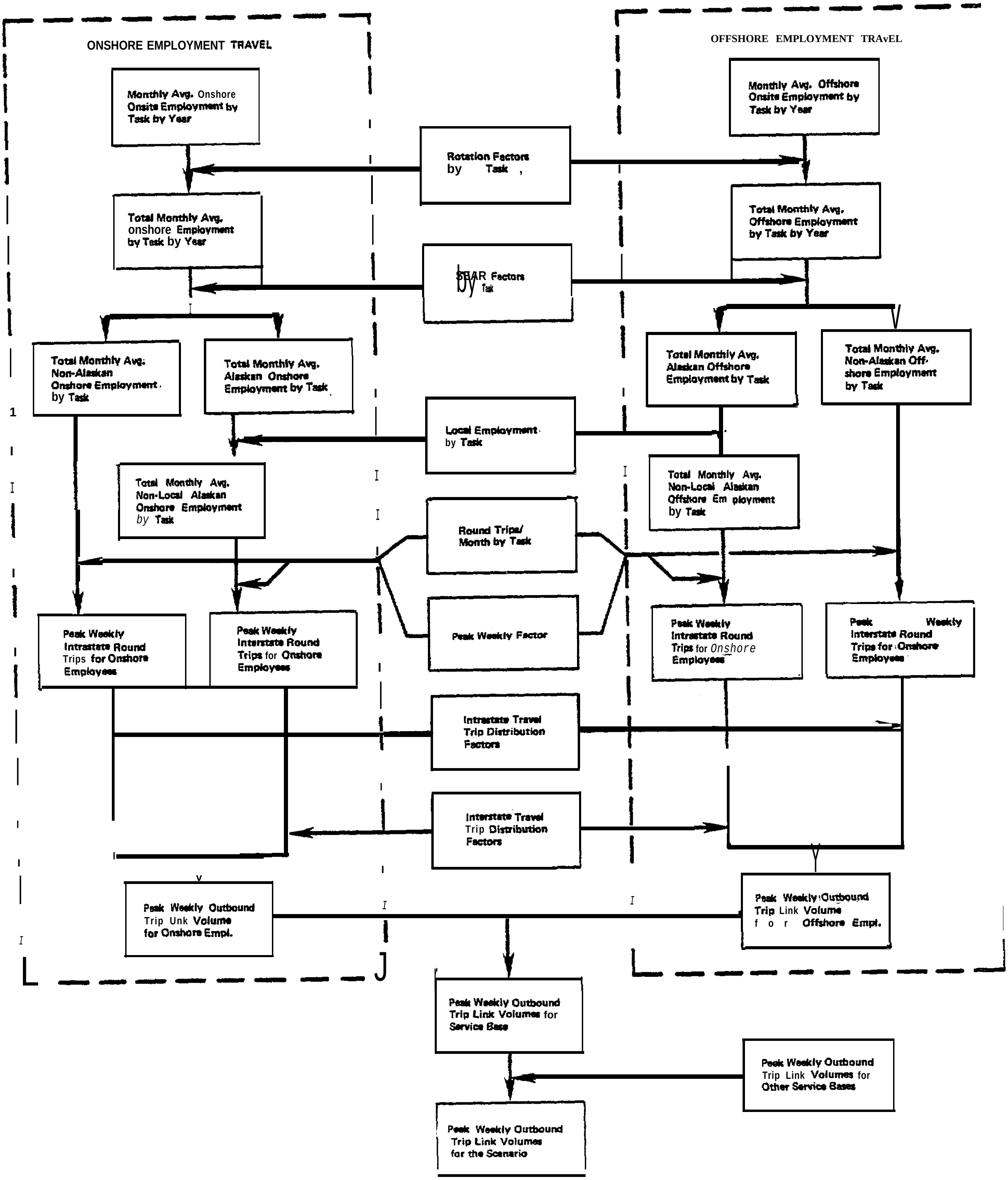
(3) Trip factor is trips per average month and is defined as:

$$\frac{\text{30.4167 days per month}}{\text{number of days off site + number of days onsite}}$$

urces: Employment Categories and Residency Rules - BLM, Alaska OCS Office, 1980 '
SEAR factors - University of Alaska, ISER, 1980
Crew Rotation Factors - Dames & Moore, 1980
Trip Factors - ERE Systems, Ltd.

FIGURE B-1 .

OCS EMPLOYMENT INTRASTATE& INTERSTATE TRIPMAKING



Helicopters used to move personnel are expected to have capacity for 12 persons and 3,000 lbs. of cargo. Such helicopters are similar to the Bell 212. Commercial jets and turbo-Prop aircraft are expected to bring OCS personnel to Cold Bay; however, based on the assumption that few improvements are expected at affected airports, only the turbo-prop has the capability to land on and take off from the sort of runways available in St. Paul and Unalaska-Dutch Harbor (see base case discussion in Chapter IV). Such commercial flights are assumed to originate in Anchorage and in Seattle.

OCS passenger movements on commercial flights are additive to local resident, government, etc., demands of the general population. In the Aleutian region, these other-than-OCS demands are expected to be relatively dynamic due to fishing industry growth expectations. The changing transient character of the fishing industry is discussed in more detail in Chapter IV.

Based on forecast passenger emplacements for each airport, an estimate of aircraft operations is developed. In this regard a model is developed for each airport, and contract helicopter service, air taxi and charter, and air carrier flights are forecast. These forecast operations are used to determine impacts on aviation facilities.

Impact Thresholds

Impact thresholds are used to identify a practical limit in the use of existing facilities, equipment, or routes. When transportation demands and/or requirements exceed these threshold values, some aspect of the service or the facility might reasonably be expected to be changed since it is presumed the quality of the service has declined from overuse. A specific response by owners of the service or facility is not assumed because for a single transportation function owners may include one or several 'public agencies and/or private corporations, each with its own perspective of threshold values and of the kinds of improvements necessary.

The methods for determining threshold values differ with each type of service or facility. In some situations established industry standards or original design characteristics can be used directly; in others more detailed quantitative analyses may be required, or only a qualitative analysis can be rendered. The circumstances of the situation and the availability of information typically determine the best approach.

Impact threshold methods used in this study are discussed by mode in the following sections.

WATER MODE

Port. Capacity

Available information about the flow of commodities through the ports examined in this study is limited to the Corps of Engineer's "Waterborne Commerce statistics" or the shipping manifests of the various marine carriers. In locations with a single dock, such as at Cold Bay, it can reasonably be assumed that the designated commodities flow over the dock in question. *In* locations with many docks, such as at Unalaska-Dutch Harbor with both commercial and fishing docks, the Corps of Engineers' data do not distinguish among the different facilities. Shipping manifests are of too fine a detail and are difficult to obtain. Data for single function docks such as the Standard Oil dock can be inferred from the Corps data, however, Crowley also maintains fuel storage facilities for its "Cool Barge" operations.

As part of the Corps of Engineers' Southcentral Deep Draft Navigation Study (Stage 2), some estimates of threshold values have been made for each of the three commercial docks at Unalaska-Dutch Harbor and the pier at Cold Bay. These values, shown in Table B-9, are established as an annual range since commodity mixes may have similar volumes but different weights. In Unalaska-Dutch Harbor, however, these values are only of limited use when compared against inbound and outbound

TABLE B- 9

CAPACITY OF FACILITIES

(1 ,000 TONS PER ANNUM)

LOCATION/ FACILITY	CONTAINERS HIGH	LOW	NEOBULK HIGH	LOW	LIQUID BULK HIGH	LOW
UNALASKA-DUTCH HARBOR						
STANDARD OIL					1,711	821
APL TERMINAL	384	184	209	100		
CROWLEY MARITIME	384	184	209	100		
TOTALS	768	368	418	200	1,711	821
COLD BAY						
STATE FUEL PIER	255	122	139	67	285	136

Source: Fredrick Harris and Alaska Consultants, Southcentral Deep Draft Navigation Studies, Stage 2, Draft Report, prepared for Corps of Engineers, Alaska District, August 20, 1980.

tonnage demands because a portion of the tonnage is delivered to or picked up at the fishing docks. This i's particularly true during peak periods when shipping demands for the most part are created by the fish processors. To the extent possible the numbers in Table B-9 will be used in determining port impact thresholds, but with cognizance of the distribution of demands among all the docks.

Vessel Routes

Criteria do not exist regarding the level of vessel traffic that is required to justify the establishment of formal traffic lanes. Factors to be used in whether to set up such lanes include the following: numbers of vessels by size and cargo; navigational conditions; nature and location of obstructions; and potential interference with fishing operations. A recommended width for traffic lanes in the Gulf of Alaska, should they be established, is 4.0 Kilometers (2.5 miles) (ERCO, 1978). This distance is recommended whether or not separation zones are provided. A common width would enable a two-way safety fairway to be upgraded to a traffic separation system at a later date. (See discussion in the base case, Chapter IV.)

The use of fairways or other control systems may be needed for Unimak Pass and an attempt has been made to forecast ship movement in the pass (See Chapter IV). Further OCS exploration and development in the Bering Sea area may require such control systems as the number of tankers and cargo ships, barges and fishing boats passing through the Aleutian Islands increases.

AIR MODE

Two kinds of impact thresholds are developed for the air mode evaluations: terminal thresholds, which look at runway operations capabilities and passenger terminal facilities; and route thresholds, which look at existing service levels over specified city-pair links.

Terminal Thresholds

Airport operations thresholds could be established through use of the FAA airport capacity manual, but the procedure is relatively complex given the use of the results in this study, and certain data needed to use this analysis method are not readily available for each airport. An alternative approach based on the theoretical capacity of the runway configurations, as presented in Mr. Robert Horonjeff's definitive text on airport planning, seems more appropriate to this evaluation (Horonjeff, 1975). These threshold estimates are included in the base case discussion, Chapter IV, for each community.

Although techniques exist for determining threshold values for baggage systems, ticketing, terminal automotive access, and other aspects of terminal operations, the nature of this study and the nature of the terminals being evaluated does not require the level of sophistication represented by these methods.

Also, no easily applied rules of thumb exist, since the terminal configurations vary considerably. As a consequence, qualitative assessments of the facilities will be made on the basis of forecast enplanements and observations made during site visits.

FAA has developed criteria for establishing and discontinuing facilities and services. For an airport to be considered for establishment of an airport traffic control tower, the sum of three ratios, which are computed as follows, must be one or greater; (1) air carrier operations/15,000; (2) air taxi operations/25,000; and (3) general aviation and military operations (local plus itinerant)/200,000 (FAA, 1964).

Route Thresholds

Route thresholds developed for selected city-pair links are based on aircraft capacity, load factors, and scheduled flight operations. These are developed for only air carrier activities, since OCS employees typically use only scheduled air service. Air taxi activities could be included, if applicable. Aircraft capacity is based on seating configurations for the types of aircraft employed along a route. This seating capacity is adjusted by assumed load factors.

Typically, 80 percent is used on most routes, although higher factors are warranted on some routes. Scheduled flight operations come from the airlines themselves. Route thresholds are derived by multiplying each of these factors.