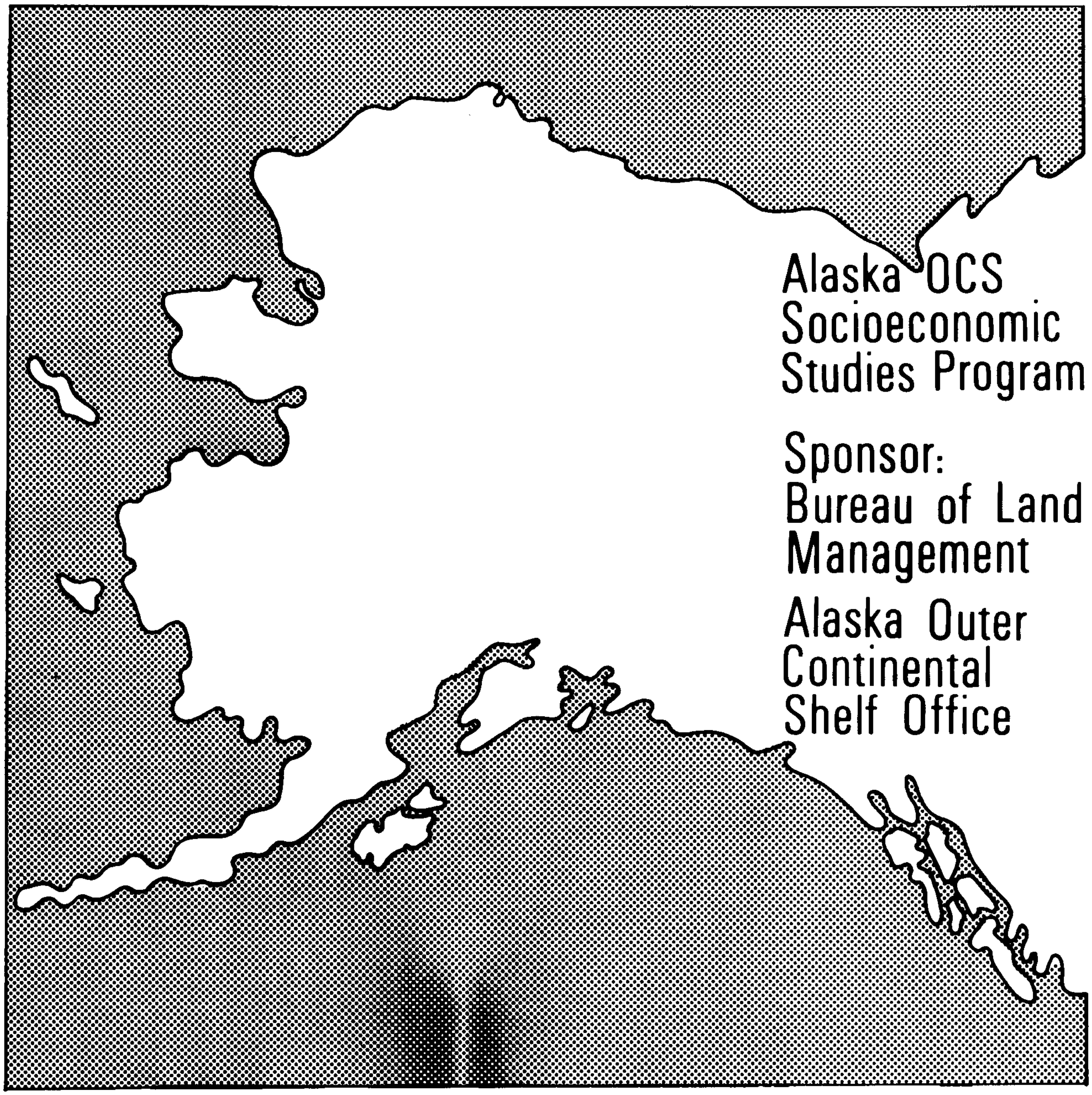
TECHNICAL REPORT NUMBER 66



Alaska OCS Socioeconomic Studies Program

Sponsor:
Bureau of Land Management
Alaska Outer Continental Shelf Office

WESTERN ALASKA 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.

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ALASKA OCS SOCIOECONOMIC STUDIES PROGRAM

WESTERN ALASKA TRANSPORTATION SYSTEMS ANALYSIS

Prepared for

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BUREAU OF LAND MANAGEMENT
ALASKA OUTER CONTINENTAL SHELF OFFICE

Prepared by

ERE SYSTEMS, LTD.

February 1982

NOTICE

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Alaska OCS Socioeconomic Studies Program
WESTERN ALASKA TRANSPORTATION SYSTEMS ANALYSIS

Prepared by
ERE SYSTEMS, LTD.

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I. INTRODUCTION

Purpose

This report was prepared for the Bureau of Land Management (BLM), Alaska Outer Continental Shelf (OCS) Office, as one of the early steps in BLM's evaluation of potential OCS impacts in the North Aleutian Shelf and Navarin Basin federal lease sale areas. The purpose of this report is to identify and evaluate existing transportation trends and issues in Bethel and Dillingham, Alaska and the western Alaska regional areas served through these communities. In addition to defining existing trends of change for these two regional areas, the report also forecasts the potential affects of these trends on the Dillingham area to the year 2000. In future efforts by others, a similar forecast will be prepared for Bethel using the baseline information developed herein.

The data in this report attempts to address some of the transportation information needs of the environmental impact statement (EIS) and secretarial issue document (SID), which must be prepared by BLM prior to any OCS lease sale. The report also attempts to address the information needs of the Intergovernmental Planning Program (IPP), through which transportation related lease sale stipulations are developed and the longer-range assessment of the transportation effects of Federal lease sale policy are conducted.

Scope

In the Bristol Bay and Kuskokwim regions of Alaska, as in most other areas of the state, air transportation is the primary mode for moving people and marine transportation is the primary mode for moving goods. Consequently, the focus of this study is on identifying existing trends and the future implications of these trends on regional air and marine transportation facilities and services.

There are two principal components of this study:

- A description of the present regional aviation and marine transportation systems serving Bethel and Dillingham, Alaska. This baseline emphasizes facilities, services, `age demands, and capacity limitations of the two transportation sy^tems. Also included is information about relevant regulatory controls, levels of service, service rates, particular regional issues, and the trends of change affecting facilities, services, and demands. The information included in this baseline description is largely based on a collection of current documents, studies, and reports supplemented by interviews with people involved in providing transportation services to these communities.

- A forecast of future aviation and marine transportation demands and service requirements based on an extrapolation of existing trends and conditions. This forecast is expected to provide a comparative baseline in subsequent evaluations of

OCS events. Portions of the transportation forecast build upon socioeconomic and socio-cultural forecasts prepared by other BLM contractors (see Alaska Consultants, Inc, 1981; and J. Payne and S. Braund, 1981).

There is one important limitation placed on the scope of this study that effects a broader usefullness of this report: the development of a "transportation plan" to deal with potential OCS transportation issues was not a purpose of the study. This limitation was imposed by BLM because many other factors, beyond those identified herein, will enter the federal OCS decision making process. State and local governments, other agencies, as well as private 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 exist through the mechanism of the EIS. It is hoped the information in this report will be useful to the various non-federal entities as they plan for proposed OCS sales and respond to the Federal government's decisions through the EIS.

II. EXISTING CONDITIONS

The purpose of this chapter is to establish the current status of regional transportation facilities, services, routes and regulations effecting the Bethel and Dillingham areas. The resulting description of baseline conditions and analysis of present trends in transportation demand and supply for Dillingham will serve in Chapter III as the basis for what BLM refers to as the "Base Case" forecast of demands for that community. In subsequent studies by others, the data developed for Bethel is expected to be used to prepare a Base Case demand forecast for Bethel.

The discussions of the marine and air transportation modes centers on terminal characteristics, transport services provided, and on relevant regulatory agencies. Included within these broad catagories are:

- Terminal characteristics
  - Facilities available
  - Ownership
  - Navigation characteristics
  - Usage of facilities
  - Estimated capacity
- Transport services
  - Identification of carriers providing services
  - Kinds of services provided
  - Schedules and routes
  - Contract operations and services

- Examples of shipping rates and tariffs

- Regulatory agencies
  - Identification of potentially involved regulatory agencies
  - Potential affects on existing trends

General Economic Background

This section provides a capsule summary of present economic conditions in the Bethel and Dillingham areas as background to understanding current trends in transportation demand and supply. The brief summary presented here is developed from socioeconomic information compiled by Alaska Consultants (ACI, 1981) and socio-cultural information compiled by Messers: James Payne and Steve Braund (Payne, J and S. Braund, 1981).

BETHEL

The city of Bethel is located on the north bank of the Kuskokwim River about 400 air miles west of Anchorage. Bethel's economy is based upon the community's function as the government, trade, service and transportation center of the Yukon-Kuskokwim delta region. Commercial salmon fishing is also an important source of economic strength, but a comparatively recent element in Bethel's economy. Since World War II, locational decisions by federal and state governmental agencies for facilities designed to serve the Yukon-Kuskokwim delta region have encouraged other quasi-governmental and public entities with regional functions to base their activities in the community. The City has the region's only hospital and serves as the regional education center due to presence of the Kuskokwim Community College and administrative functions for the region's public education system.

The availability of services such as health and education, have served to attract an in-migration of persons from smaller centers of the region into Bethel, thus, the population of Bethel has kept pace with the economic development. These economic activities, together with improvements in air and water transportation facilities, described later in this chapter, have served to make Bethel the regional hub for transportation services. Preliminary 1980 Census figures indicate that over 20 percent of the population in the Yukon-Kuskokwim delta region now live in Bethel. However, the community's population grew less rapidly in the 1970s than during the previous two decades. The U.S. Census figures show a population of 3,503 in 1980, which represents a 45 percent increase over the 1970 population of 2,416. The city of Bethel disputes the 1980 census figures, however, and estimates the present population is closer to 4,000 persons. If this is the case, Bethel's population realized a 50 percent growth during the 1970 to 1980 decade.

DILLINGHAM

The city of Dillingham is located at the head of Nushagak Bay on the Nushagak River, near its confluence with the Wood River, which is approximately 350 air miles southwest of Anchorage. Nushagak Bay is an arm of the larger Bristol Bay, the world's largest red salmon producing area and the dominant factor in Dillingham's economy. During the past few years, the red salmon runs are near some of the largest levels observed during peak periods in the 97-year history of the fishery and this has affected the pace of economic development in Dillingham. Aside from fishing and fish processing, Dillingham functions as the government, service, and trade center for much of the Bristol Bay region. The community has the only hospital in the region and is headquarters for one of the regional school districts, as well as several health and social services organizations. The City also functions as the regional shopping and financial center serving both local and non-local Bristol Bay residents. In part because of these activities and in part in support of these activities, Dillingham has also grown as the major marine and air transportation center for a regional area generally coterminous with the Dillingham Census area.

Population and employment levels in Dillingham are affected by the highly seasonal fishing and fish processing industry established in the Dillingham area since the turn of the century. Although the community declined between 1950 and 1960, probably due to relatively poor salmon harvests during that decade, the community population has consistently increased during the subsequent two decades. The 1970 Census showed a total of 914 persons in the community. The 1980 Census estimates the population of the City at 1,535 persons representng a 57.9 percent increase during the last census period. Primary factors in this healthy rate of growth are believed to be the community's continued importance as a regional service center, and apparent recovery of the Bristol Bay Red Salmon fishery.

Water Mode

The water mode of transportation in western Alaska provides an important service although operations are confined to the summer season due to ice conditions. Virtually all commodities having relatively low value to weight ratios, such as construction materials, chemical and petroleum products, and transportation and construction equipment, are shipped by this mode to and within western Alaska. With the exception of personal travel by small boats and fishing vessels, water transportation in western Alaska, and particularly in the Bethel and Dillingham areas, is exclusively freight oriented.

Two types of vessels service western Alaska ports: tug-barge combinations and general cargo ships. Most of the goods originate in Seattle and are shipped either directly to the many western Alaska communities, or indirectly through transshipment hub ports, which include Bethel and Dillingham. The line haul movement of goods from Seattle is typically handled by ocean going tug-barge combinations because direct access to many western Alaska communities is restricted by shallow coastal areas. In Bethel and Dillingham tug-barge combinations prevail. Bethel is an exception in that medium draft ocean vessels can reach port. The transshipment of goods from the hub ports to other coastal communities is handled by shallow draft coastal or riverine lighters. Due to the lack of adequate public facilities at many coastal and riverine communities, goods are delivered over private cannery docks or over the beach.

MARINE TERMINALS

Several features of the marine terminals at Bethel and Dillingham are examined here to determine their present roles in the overall marine freight system. In addition to identifying current issues affecting each terminal, the evaluation includes: (1) available commercial facilities and their characteristics, including docks and unloading facilities; (2) water depth and navigational conditions that may serve to limit the size of ships and barges that can use the facility; and (3) facility usage and operations.

Bethel

Facilities. The port of Bethel, which lies about 105 kilometers (65 miles) from the mouth of the Kuskokwim River is considered the head of ocean navigation. Ocean going vessels drawing up to 4 meters (13 feet) can be brought to the port. From here cargoes destined for many smaller communities in the region are transshipped by coastal barges and smaller river boats to coastal areas as far away as Scammon Bay and up river to McGrath. McGrath is 644 kilometers (400 miles) from the mouth of the Kuskokwim River and is considered as the furthest point on the river navigable by commercial shipping.

Docking facilities at Bethel consist of a bulkheaded wharf 61 meters (200 feet) long with water depth at the face of 3.7 meters (12 feet). The wharf was built by the city of Bethel in 1975 and is constructed of earth-filled cellular sheet steel piles with a concrete base reinforcement. The wharf is located on the downstream side of the junction of Brown's Slough and the main river. Equipment at the dock consists of a single 70-ton crawler mounted crane with a 30.5 meter (100 foot) boom and other smaller lift equipment. The crane can be assisted by similar size crawler cranes typically carried on each barge.

A 3.5 acre sand-surfaced open storage apron lies adjacent to the dock structure and two unheated warehouses are located three or four blocks (about 0.4 kilometers - 0.25 miles) from the dock. These warehouses include 892 square meters (9,600 square feet) of storage space in one building 24.4 by 36.6 meters (80 by 120 feet) and 465 square meters (5,000 square feet) of storage space in a second building 15.2 by 30.5 meters (50 by 100 feet). When an ocean barge is being unloaded container vans are placed on the open storage apron and/or trucked to one of the warehouses. At these locations, individuals and merchants in Bethel who have goods in the vans come to claim their merchandise. Goods being transshipped to other communities are typically loaded in the same vans with local goods. The transshipment goods must be unloaded at the same time and, depending on the nature of these goods, they are either repacked in vans, which are subsequently loaded on river barges, or such goods are loaded as breakbulk directly on to the river barges. When ocean barges arrive too late in the shipping season, the rivers may be frozen and the river barges cannot reach outlying villages. In this situation, nonperishable goods are stored in the warehouses or, if necessary, in vans on the apron until the next shipping season. Perishable goods or other goods needed before the next spring are sent to outlying communities by air, if they fit on the aircraft.

The port, including the dock and warehouses, is managed and operated by United Transportation, Inc. under an agreement with the City. United Transportation is a private company that provides coastal and riverine transportation services in the Yukon-Kuskokwim delta region. Villages served by United Transportation are identified later in this chapter under marine carriers.

In addition to the City dock, Chevron anchors a floating pier on the river each year between June and October. The pier consists of two breasting barges, each approximately 6.1 by 12.2 meters (20 by 40 feet) located in about 5 meters (16 feet) of water 1.6 kilometers (one mile) downstream of the wharf. Pumps on these breasting barges are u[illegible] to pump petroleum products from ocean going barges to onshore pipes and thence to the Standard Oil Tank Farm. Gravity feed is used to load petroleum products into the smaller barges for distribution to other villages (L. Berger & Assoc., WAATS, 1979).

The small size of the dock allows only one ocean-going barge to unload at a time. Smaller boats have difficulty loading cargo when a larger barge is at the dock. Although designed for three to five barges a year, the port is estimated to service twenty-two to twenty-four barges a year. Due to the volume of incoming traffic the redistribution of cargoes to the smaller barges for shipment to outlying villages has been hampered. This situation is aggrevated by the lack of adequate warehousing and the short shipping season. The demand for warehouse space has grown steadily each year. It is estimated that current demands could fill twice the space presently available - a total demand for about 2,787 square meters (30,000 square feet). United Transportation had proposed building additional private warehouse space during 1982 on available land away from the dock. However, the City also decided to build warehouse space this year, but closer to the dock. As a result, United Transportation dropped its plans. Details of the new warehouse are still being developed.

The Bethel Comprehensive Plan (Darbyshire and Assoc., 1980) made several suggestions for improvements to the dock and port facility:

- Increase the river frontage of the wharf to allow off-loading of at least two ocean-going barges at the same time.
- Identify special locations for loading and off-loading river barges.
- Develop procedures for off-loading, storage and redistribution of cargo to improve the efficiency of the transshipment activities. To the extent that off-loading, ocean-going barges can be coordinated with loading of river barges, warehousing needs may be reduced.

One of the more significant restraints to waterfront development in Bethel is erosion caused by occasional flooding, drifting ice, tides, wind, and the strong current of the Kuskokwim River. Floods occurred in

1941, 1963, 1967, and 1974. At the turn of the century, the original Bethel Mission and the town occupied a site located on relatively high ground along a side stream of the Kuskokwim River. However, due to erosion, the townsite stood on the main channel of the river itself by 1939. Since then, continued erosion by the river has forced the frequent relocation of structures adjacent to or in the water. The Corps of Engineers (COE) estimate erosion rates of eight feet per year in front of the old town site and as much as twenty-five feet per year in front of the Standard Oil Tank Farm (last relocated during the mid-1960's). Efforts to control the erosion have not been successful and permanent measures required to do so have been beyond the financial ability of the community. The COE has looked at the erosion problem on several occasions. While these studies demonstrate a need for erosion control measures, their recommendations for improvements have not met congressional cost-benefit criteria (a cost to benefit ratio equal to or less than 1.0). The current recommendation is placement of rock riprap along 1,524 meters (5,000 feet) of water front between Brown's Slough and the Standard Oil Tank Farm. The cost-benefit ratio associated with this recommended project is 1.7 exceeding acceptable criteria . Consequently, it may be difficult to get congressional funding for this project in the near future.

During 1981 the City requested and received a legislative appropriation of $5.25 million for extension of the dock facilities, construction of a fuel dock, and construction of an erosion control system. The State participated in an earlier, but unsuccessful effort to stop erosion in the mid 1960's. The proposed dock extension, which has already been let out to bid, will consist of a steel and timber bulkhead begining on the dock side of Brown's Slough and extending up the slough far enough to accomodate two river barges. This construction should improve existing problems related to the redistribution of cargoes for outlying villages. The City has already purchased the necessary land. The project is expected to be completed by April 1982, in time for the shipping season. The proposed fuel dock and erosion control system are still in the design stage and should go to bid early in 1982. (Tundra Drums, November 5, 1981)

There are no facilities for docking small boats in Bethel. At present, Brown's Slough is used as a temporary facility for boat docking, but it is not adequate since the channel is shallow and silted. The shore of the Kuskokwim River below the City dock is also used as a small boat landing, however, wave and river action are likely to capsize boats at that location. At least twelve nearby villages have river access to Bethel and could use small boat docking facilities. The COE have studied a small boat harbor for Bethel and two alternative plans were developed after several alternative sites were examined. In the draft environmental impact statement for the project, the COE recommended a plan to develop a 29.7 hectare (12-acre) harbor at Lousetown Slough east of the City. The project would provide moorage for 1,200 boats. This alternative was recommended because it was considered the most cost effective, would cause the least environmental impact, and produce fewer conflicts with private land uses in the area. The second plan for a site at Hanger Lake north of Bethel was considered too costly (Seattle Journal of Commerce, Feb. 6, 1981a).

Navigation. The marine approach to Bethel includes approximately 64 kilometers (40 miles) of sandbars and shoals in Kuskokwim Bay and 105 kilometers (65 miles) of the Kuskokwim River. Each spring the moving ice and water shift the location of these obstructions due to the effects of erosion, flooding, and redeposition of silt and soil materials. The State of Alaska requires a pilot for all vessels navigating the inland waters and the Bay and River are included. However, commercial cargo vessels, including tug-barge combinations are exempt from this requirement if they are continuously engaged in coastwise trade from west coast ports to Alaska.

Tidal action in Kuskokwim Bay reaches to Bethel. The diurnal range of the tide at Kuskokwak Creek near the mouth of the Kuskokwim River is 3.7 meters (12.2 feet) and at Bethel is 1.2 meters (4.0 feet). The currents of Kuskokwim Bay and River are strong, attaining velocities of 5 knots at times. By arriving at the entrance to Eek Channel on the last of the ebb, a favorable current can be carried nearly to Bethel, providing there are no delays. Predicted times and velocities of tides may vary, hovever, due to freshets and winds.

The best weather usually occurs in March and April. During the summer, southeast to southwest gales are frequent and last from two to five days. These storms gradually blow themselves out and are generally followed by a few days of good weather. In the early fall, northerly winds are frequent and are usually accompanied by clear skies. After mid-September, strong gales become frequent and prolonged. General climatic conditions in the vicinity of Bethel are stated in Table 1. Of interest to navigation are the number of days with fog conditions and number of days when visibility is less than one-half mile. On average, July and August appear to be the worst months for fog while December and January have the greater number of days of seriously reduced visibility.

Average dates of ice breakup and freezeup in the vicinity of Bethel together with the earliest and latest dates are shown in Table 2. Earliest freezeup occurs by October 8 and latest by November 24 with October 29 the average date. Earliest breakup occurs by April 24 and latest by May 28 with May 15 the average date. Ice thickness approaches a maximum of 1.2 meters (4 feet) in the river.

Facilities Usage. Medium draft ocean-going vessels and shallower draft coastal and riverine barges are brought directly to Bethel for unloading or loading. Table 3 identifies the annual level of vessel activity at the port of Bethel for the period 1973 through 1978. These numbers represent all kinds of vessels, including commercial marine cargo and fishing vessels. The reported high level of activity in 1973, when compared against more recent years, cannot be explained by large increases in cargo tonnage that year. It is suspected that the lower figures in subsequent years are due to a change in reporting requirements and/or the change in operating characteristics at the port after the wharf was built.

TABLE 1

CLIMATIC CONDITIONS IN THE VICINITY OF BETHEL, ALASKA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
AVERAGE TEMPERATURE (F)	5	8	11	25	40	52	55	52	45	30	17	4
LOW TEMPERATURE (F)	-52	-45	-42	-31	-5	28	31	33	18	-5	-27	-44
AVERAGE WIND SPEED (KNOTS)	11	11	11	10	9	9	9	9	9	10	10	10
PREVAILING WIND DIRECTION	NNE	NNE	NNE	NW	NW	NW	SSW	SSW	WNW	NNE	NNE	NNE
FOG (AVERAGE DAYS)	11	8	10	10	9	9	14	19	13	10	10	10
VISIBILITY LESS THAN 1/2 MILE (DAYS)	5	3	3	2	2	2	3	4	3	3	4	5

SOURCE: U.S. Department of Commerce, NOAA, 1981.

TABLE 2

DATES OF ICE BREAKUP AND FREEZEUP IN THE VICINITY OF BETHEL, ALASKA

	AVERAGE	EARLIEST	LATEST
BREAKUP	MAY 15	APR 24	MAY 28
FREEZEUP	OCT 29	OCT 08	NOV 24

SOURCE: U.S. Department of Commerce, NOAA, 1981.

TABLE 3

COMMERCIAL VESSEL ACTIVITY AT BETHEL, ALASKA 1973 - 1978

	INBOUND			OUTBOUND		
YEAR	DRY CARGO	TANKER	TUG OR TOW	DRY CARGO	TANKER	TUG OR TOW
1973	760	19	32	764	18	31
1974	105	45	107	108	48	109
1975	43	58	61	44	57	
1976	156	77	160	157	79	164
1977	76	62	114	76	60	118
1978	64	76	95	70	73	94

SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics

Throughput tonnage for the period 1973-1978 is stated in Table 4. This table shows a 100 percent increase in throughput tonnage during this period. Part of this growth can be explained as increases in building product shipments and shipments in sand, gravel, and crushed rock for construction activities. However, much of the growth in tonnage is due to the rise in demand for petroleum products, a 344 percent increase over the 1973-1978 period. In Table 5, throughput tonnage for 1978 is displayed by origin-destination for each major commodity group. With the exception of petroleum products, most inbound goods originate in Seattle and are shipped either directly to Bethel or are transshipped through Kodiak, depending on the carrier. Most inbound petroleum products are shipped through Unalaska-Dutch Harbor. Approximately 41 percent of throughput tonnage in 1978 either originated in Bethel, or was transshipped from Bethel to other communities, mostly alo. the Bering Sea Coast and in Bristol Bay. Food products exported to foreign countries consists mainly of canned fish products.

Outbound fuel products are mainly heating oil, diesel fuel and gasoline. Of the outbound tonnage, about eight percent moves up river to McGrath and intermediate villages; about 77 percent is sent to villages along the north and south side of the Alaska Peninsula; about two percent is sent to Hooper Bay; and the remaining 13 percent is either exported (two percent), sent to Bering Sea ports farther north (11 percent), or to Seattle (less than one-tenth percent).

TABLE 4

THROUGHPUT TONNAGE AT BETHEL, ALASKA (1973-1978)

YEAR	PETROLEUM PRODUCTS (1)	FOOD PRODUCTS (2)	BUILDING PRODUCTS (3)	SAND, GRAVEL, CRUSHED ROCK (4)	LUMBER AND WOOD PRODUCTS (5)	OTHER (6)	ANNUAL TOTAL
1973	20,579	2,098	826	7,650	1,429	9,278	41,860
1974	14,445	2,349	688	10,220	3,327	9,651	40,680
1975	43,000	1,945	955	-	2,925	5,415	54,240
1976	59,216	2,242	1,743	30,800	3,477	12,934	110,412
1977	46,668	2,201	6,215	24,000	4,536	7,867	91,487
1978	70,811	2,766	2,662	-	4,058	9,522	89,819

Notes:
(1) Includes gasoline, jet fuel, fuel oil, lubricative oil and greases, liquified gases, asphalt building materials and misc. petroleum and coal products.
(2) Includes salt, meat, prepared fish, alcoholic beverages, groceries and misc. foods.
(3) Includes building cement, clay products, nonmetalic mineral products, iron, steel, fabricated metal products and misc. building products
(4) Includes sand, gravel and crushed rock.
(5) Includes lumber, manufactured wood and furniture and fixtures.
(6) Includes all other remaining commodities.

Source: U. S. Army Corps of Engineers, 1980

TABLE 5

1978 COMMODITY TONNAGE AT BETHEL, ALASKA
BY ORIGIN AND DESTINATION

COMMODITY GROUP	COMMODITY ORIGIN	INBOUND TONNAGE	THROUGHPUT TONNAGE	OUTBOUND TONNAGE	COMMODITY DESTINATION
FOOD PRODUCTS	FOREIGN	112	707	595	FOREIGN
	SEATTLE	2059	2059		
LUMBER AND WOOD FURNITURE	FOREIGN	165	165		
	SEATTLE	3856	3856		
			37	37	NOME
CHEMICAL PRODUCTS	SEATTLE	42	42		
PETROLEUM PRODUCTS	SEATTLE	961	961		
	DUTCH HARBOR	40679	40679		
			2006	2006	SOUTH SIDE ALASKA PENINSULA
			798	798	MC GRATH
			570	570	HOOPER BAY
			3456	3456	BERING SEA PORTS
			22044	22044	NORTH SIDE ALASKA PENINSULA
	LOCAL	297	297		
BUILDING PRODUCTS	SEATTLE	2611	2624	13	SEATTLE
			38	38	NOME
TRANSPORT EQUIPMENT	SEATTLE	332	333	1	SEATTLE
			1	1	DILLINGHAM
			5	5	NOME
COMMODITIES AND NECESSITIES	SEATTLE	1755	1771	16	SEATTLE
	BERING SEA PORTS	1	783	782	BERING SEA PORTS
			4	4	SOUTH SIDE ALASKA PENINSULA
			1	1	DILLINGHAM
			2012	2012	MC GRATH
			280	280	HOOPER BAY
	NORTH SIDE ALASKA PENINSULA	6	4290	4284	NORTH SIDE ALASKA PENINSULA
TOTALS		52876	89819	36943	

Source: Corps of Engineers, Unpublished data.

DILLINGHAM

Facilities. The city of Dillingham is located on the north shore of the Nushagak River at the confluence of the Wood River, as shown in Figure 1. Several docks are available at Dillingham: a City owned dock, the Standard Oil (Chevron) Dock, and several private cannery docks.

The City dock serves as the principal cargo receiving and distribution facility for a regional area best defined as the Dillingham Census Area. This area stretches from Togiak on the west to Port Heiden on the south and includes places upriver as far north as Koliganek (see later discussion of this area and map in Chapter III). The dock also provides haul out, loading, unloading, and fresh water services to independant fishermen and local boatowners, and serves as a resupply point for floating fish processors who anchor in the river during the fishing season. The dock itself is a timber pile wharf approximately 43 meters (140 feet) wide with a face of 55 meters (180 feet). Figure 2 shows an aerial photograph of the existing City dock. The dock can handle only one barge at a time and depth alongside the dock bares during low tide as shown in Figure 3. Along the wharfface, a gravel bed for barges to rest on is maintained by the City. Cranes carried on each barge are used to unload and load the container vans. To aid cargo handling on the dock, the City maintains a Taylor forklift with an 36,300 kilogram (80,000 pound) capacity.

Until recently, a limited onshore staging area necessitated storing containers on the dock itself (see Figure 2), which greatly interfered

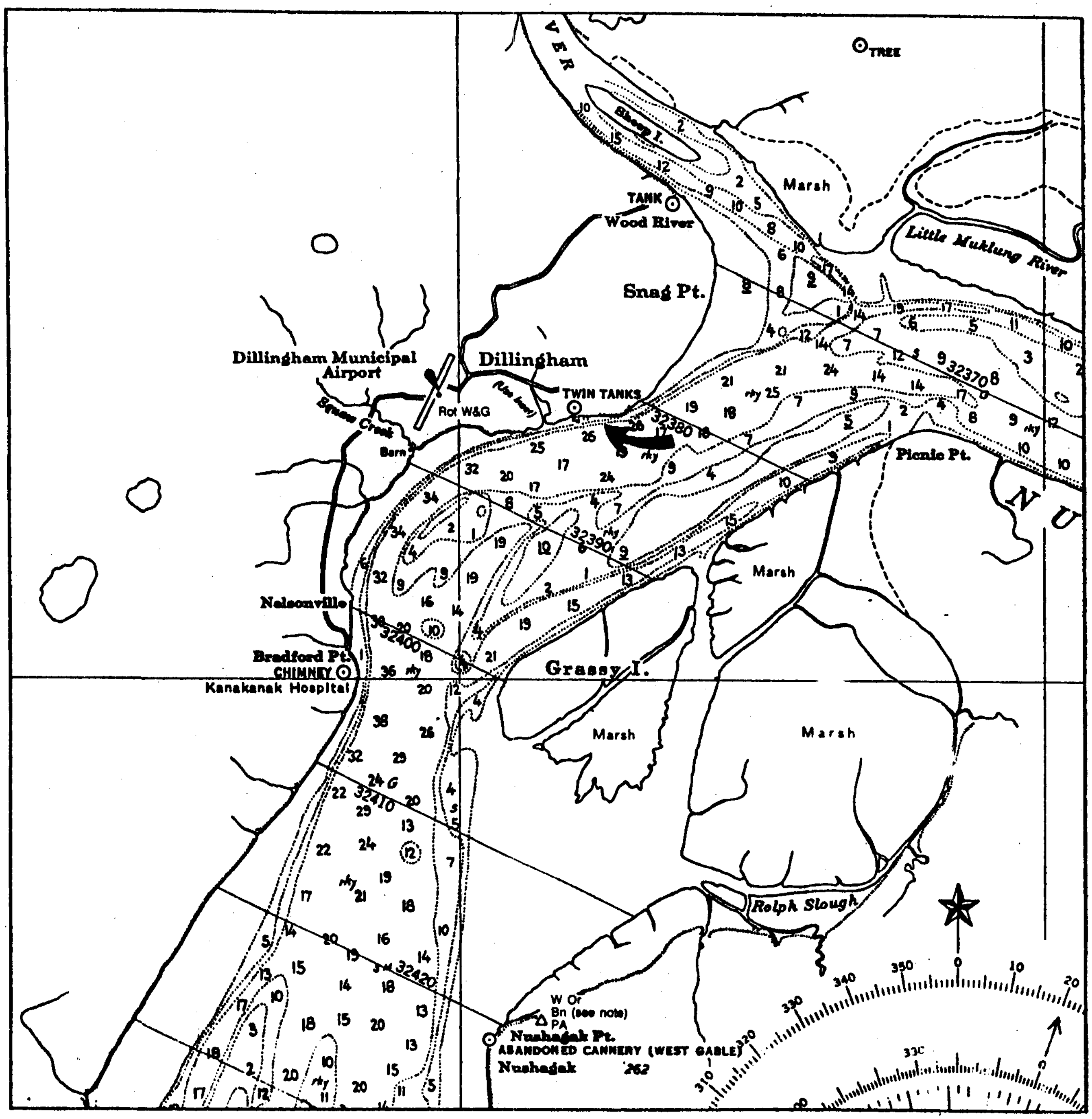

FIGURE 1

LOCATION MAP - PORT FACILITIES, DILLINGHAM, ALASKA

SOURCE: U.S. Department of Commerce, NOAA

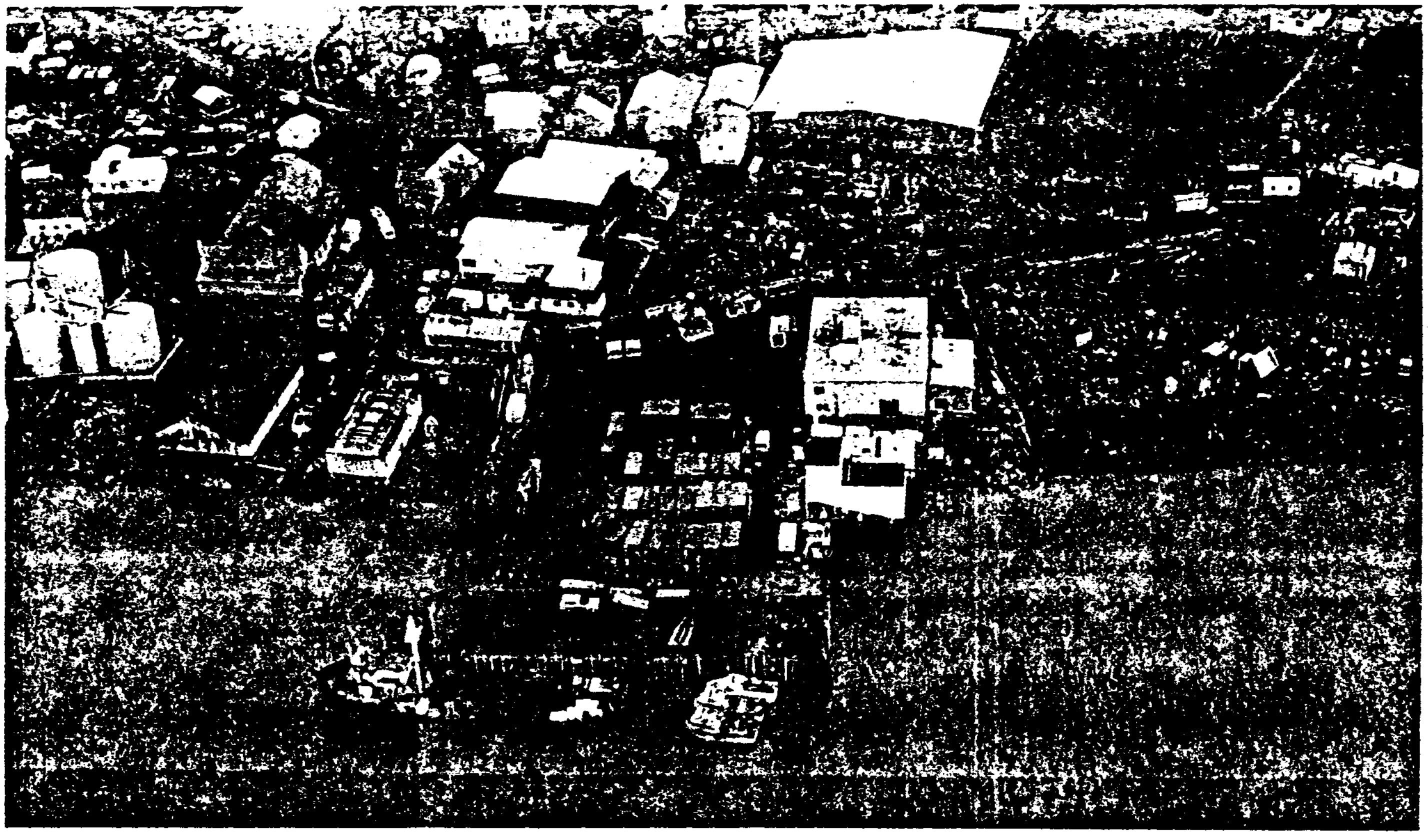

FIGURE 2

AERIAL VIEW - DILLINGHAM CITY DOCK

Source: DMJM Forssen, 1980.

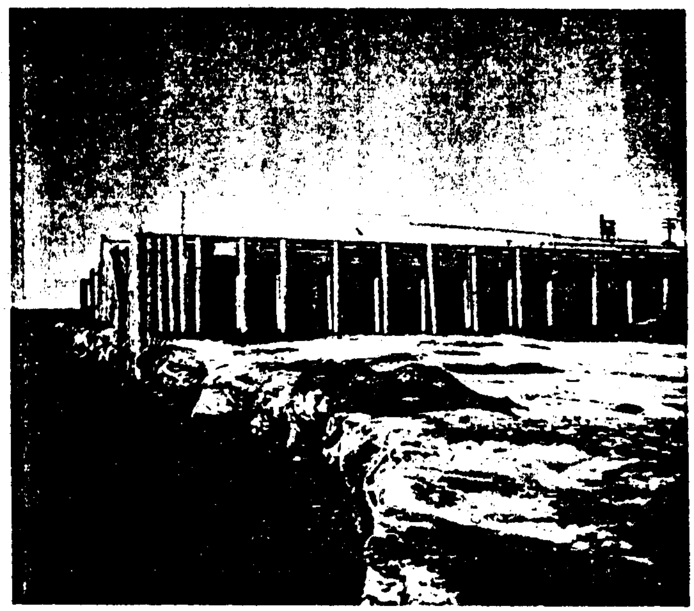

FIGURE 3

DILLINGHAM CITY DOCK AT LOW TIDE

Source: DMJM Forssen, 1980.

with transshipment activities and other port functions. However, as part of the City's ongoing port expansion 8.7 hectares (3.5 acres) of additional staging area were acquired during 1981 and put into operation late that year. This added area is located just to the right (east and upstream) of the existing dock shown in Figure 2. As part of the expansion, the City is also in the process of begining construction of a new dock to be built during 1982. The new dock is located on the river adjacent to the new staging area. It was advertised for bid as a T-shaped facility with a face 122 meters (400 feet) long with the capability to handle two ocean going barges at a time. After some problems with the bids a contractor was selected, however, the bid price for the work exceeded available funds so only half the dock (about 210 feet) can be constructed. The City has asked the 1982 Legislature for an additional $200,000 to complete the project. If appropriated and authorized during 1982, the entire project could be built the same year. Funds for the apron and dock were previously appropriated in 1979 and 1980. (Wood, 1981)

Adjacent to the dock, the City maintains a cold storage warehouse with a capacity estimated by the authors to be about 2,300 cubic meters (80,000 cubic feet). This warehouse serves as temporary storage for fish products awaiting shipment. There are no general warehouses serving marine transportation needs in Dillingham, although a demand for such services exists. Choggiung, Ltd. operates a private warehouse at the small boat harbor, but it is used to store only fishing gear and nets. Depending upon the demands of the fishing industry, portions of the cold storage facility have been used for temporary storage of goods. However, the cold storage facility is typically available only during the late part of the fishing season, if at all. Goods being transshipped to other communities are more likely to be stored in the vans in which they arrived.

Even with the new apron, the land area devoted to marine transportation services offers no opportunity for construction of an adjacent warehouse. The authors estimate the existing demand for marine transportation warehousing at about 1,115 to 1,394 square meters (12,000 to 15,000 square feet). To meet existing demands additional land must be acquired. In purchasing the new apron area, the City had to acquire a portion of the elementary school grounds bordering the dock area and part of the school itself was scheduled to become warehouse space. However, the School Board changed its mind about releasing the school and has proposed a major rehabilitation to convert it to an intermediate school. If a warehouse is to be built, it should be located adjacent to the dock apron to avoid added labor and equipment handling charges. The additional charges and the lack of land near the dock are cited as reasons why a warehouse has not been constructed before now.

Just west of the City dock, Standard Oil Company maintains a fuel dock and tank farm. This dock serves as the distribution facility for bulk petroleum products going to Dillingham and other smaller communities in the region. Depth alongside the dock and on the dock face bares during low tide. The fuel dock is approachable only at high tide.

Immediately west of the Standard Oil facility is a cannery complex. Generally, depths alongside the cannery dock also bare at low tide, although one portion of dock has 0.6 meters (two feet) of water at low tide. The cannery wharf is 54 meters (178 feet) long and of timber pile construction. A 100 ton capacity marine railway, which is owned by the cannery, is located between the cannery and the Standard Oil facility.

Other port facilities include a 13.1 hectare (5.3 acre) small boat harbor west of the city, which provides half-tide access and all-tide moorage for approximately 100 fishing vessels and services for 100 privately owned boats used for transportation to other river settlements. During the fishing season this harbor becomes a central point for transferring freshly caught salmon to trucks fo movement to the airport. A dredged channel leads from Nushagak Bay to the harbor. The harbor is designed to retain a minimum of about 1.5 meters (5 feet) of water behind a rock sill. The entrance channel and basin are subject to rapid shoaling due to sediment from Nushagak Bay. Maintenance dredging is accomplished annually by the Corps of Engineers using the suction dredge "Dillingham". The Corps is currently studying possible expansion of the small boat harbor.

Navigation. The marine approach to Dillingham is through Nushagak Bay and the Nushagak River, a distance of about 69 kilometers (43 miles). The controlling depth of the Bay and River is about 3 meters (10 feet) to Dillingham. Small vessels of about .76 meters (two and one-half feet) draft can continue up the Nushagak River to Nuachuak, 161 kilometers (100 miles) above the mouth. Vessels drawing 3.7 meters (12 feet) moor at the various wharves only on higher tides; vessels drawing up to 7 meters (23 feet) can reach Dillingham on high tides, but must anchor just below Snag Point and goods must be lightered to the various docks. Most vessels that call at the port are served directly at the docks.

Good anchorage can be found south of Ekuk Bluff, in 9 to 11 meters (30 to 35 feet) of water where a mud bottom provides good holding ground and the current is not strong. During the fishing season when the canneries are operating, mooring buoys placed in a line parallel to the beach, are maintained for tally barges in the area south of Ekuk Bluff and east of the main channel. Above Ekuk good anchorage can be found wherever depths permit. This part of the Bay is very choppy in h vy weather, but the sea is not heavy enough to endanger vessels. Vessels rem ining long are anchored in line to interfer as little as possible with the fishing nets.

The channels and bars of Nushagak Bay and River are subject to constant change because of action of currents and to a smaller extent by actions of the sea. The currents in Nashagak Bay have considerable strength with velocity of about four knots observed in both the flood and ebb tides. A current of over five knots may be experienced at times. From Clarks Point to the upper canneries, numerous mud flats and sand bars are exposed at low water in central and western parts of the river. Nearly all navigation in this section is done in a rising or high tide, particularly large vessels. Traffic generally starts up river in a half-flood tide. The diurnal range of tides at Clarks Point is 5.9

meters (19.5 Feet).

The best weather usually occurs in early summer. During late summer, the duration of gales and showers increase. Generally, the weather is considered better than farther west. General climatic conditions in the immediate vicinity of Dillingham are not available in the U.S. Coast Pilot, however, data from the Bristol Bay area generally and for the vicinity of King Salmon are available as shown in Table 6. Of interest to navigation are the number of days with fog conditions and number of days with fog conditions and number of days when visibility is less than one-half mile. On average, June, July, and August appears to be the worst months for fog, while July and August have the greater number of days with seriously reduced visibility.

Average dates of ice breakup and freezeup in the vicinity of Dill, jham (Nushagak Bay) are shown in Table 7 together with the earliest and latest dates. Earliest freezeup occurs by October 16 and latest by December 22 with November 7 the average date. Earliest breakup occurs by April 25 and latest by May 27 with May 5 the average date.

Facilities Usage. As discussed earlier Dillingham functions as a transportation hub for villages and canneries located along the Nushagak Bay and River and other communities in the Dillingham Census area. Marine service to the canneries differs slightly from service to the City and outlyin areas. Most canneries are served directly by private contract carriers and indirectly by common carriers through Dillingham. goods to the outlying villages.

TABLE 6

CLIMATIC CONDITIONS IN THE VICINITY OF KING SALMON, ALASKA AND BRISTOL BAY AREA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	---	---	---	---	---	---	---	---	---	---	---	---
KING SALMON												
TEMPERATURE (F) HIGH	53	51	56	65	75	88	83	84	74	67	50	48
MEAN	13.4	16.6	20.4	31.5	42.6	50.7	54.5	53.8	47.3	33.6	22.1	11.7
LOW	-39	-40	-35	-19	-4	29	30	31	16	-11	-25	-38
AVERAGE WIND SPEED (KNOTS)	9.7	10.2	9.9	9.2	9.4	8.7	7.7	8.7	8.7	9.2	9.5	9.1
PREVAILING WIND DIRECTION	N	N	N	N	E	SSW	SSW	SSW	N	N	N	N
MEAN NUMBER OF DAYS WITH FOG	9	7	9	8	9	12	17	20	12	10	11	11
VISIBILITY LESS THAN 1/2 MILE (DAYS)	2.6	2.0	2.6	1.7	2.4	3.8	4.8	4.2	2.0	2.1	3.3	3.5
BRISTOL BAY AREA												
PERCENT FREQUENCY WHEN WINDS EQUAL OR EXCEED 34 KNOTS				3.1	1.9	*	*	1.8	3.7			
PERCENT FREQUENCY WHEN WAVE HEIGHT EQUALS OR EXCEEDS TEN FEET				4.9	6.8	1.8	5.6	4.9	10.0			
PERCENT FREQUENCY WHEN SKY IS OVERCAST OR OBSCURED				55.0	57.6	60.3	70.6	77.9	49.8			
PREVAILING WIND DIRECTION				NW	NW	W	W	SW	NW			

*0.0 - 0.5 %

Source: U.S. Coast Pilot, Vol. 9, Pacific & Arctic Coasts Alaska, Cape Spencer to Beaufort Sea, Tenth Edition, 1981. U.S. Department of Commerce, NOAA, National Ocean Surv[illegible] Corrected through Nov. 1980.

TABLE 7

DATES OF ICE BREAKUP AND FREEZEUP IN THE VICINITY OF DILLINGHAM, ALASKA (NUSHAGAK BAY)

	Average	Earliest	Latest
Breakup	May 9	Apr 25	May 27
Freezeup	Nov 7	Oct 16	Dec 22

SOURCE: U.S. Department of Commerce, NOAA, 1981.

Fuel oil for the Nushagak Bay and Nushagak River canneries is generally brought in by tanker barge early in the fishing season and transferred to cannery barges at the anchorage off Clarks Point. Fuel for the City and outlying villages is delivered by tanker directly to the Standard Oil dock. From this dock fuel scows deliver the petroleum products to outlying villages. Dry cargo barges deliver these products to the City dock and, after repacking or storage, riverine barges deliver these products to the outlying villages. Public carrier cargo shipments to the canneries are delivered to the City dock and transshipped to the canneries by cannery vessels or by a local lighterage company.

Vessel traffic at the port over the period 1972-1978 is shown in Table 8. Commercial cargo and tanker vessels as well as fishing vessels are included in the numbers. The data from 1972 through 1975 is thought to represent a mix of commercial cargo and lighterage barges that operated until the pier was extended to deeper water in 1975. The large number of cargo vessels in 1974 are not due to any particular peak in fishing activity and are otherwise unexplained. After 1975, the data shows commercial cargo barges only and does not illustrate the continuing lighterage services provided to other communities.

Throughput tonnage for Dillingham over the period 1973-1978 is presented in Table 9. Annual levels of throughput tonnage have increased significantly during this period: almost seven fold. The greatest changes occured in 1975 and 1978 when tonnages jumped four fold and two fold, respectively. Part of the jump in tonnage in 1978 was due to a large increase in fishery products. Overall, the increase is also due

TABLE 8

COMMERCIAL VESSEL ACTIVITY AT
DILLINGHAM, ALASKA
1972 - 1978

	INBOUND			OUTBOUND		
YEAR	DRY CARGO	TANKER	TUG OR TOW	DRY CARGO	TANKER	TUG OR TOW
1972	94	6	11	93	4	11
1973	83	2	16	82	2	16
1974	141	1	18	140	1	
1975	95	7	20	95	7	20
1976	4	7	15	4	6	15
1977	18	-	23	17	-	24
1978	23	-	27	23	-	27

SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics

TABLE 9

THROUGHPUT TONNAGE AT DILLINGHAM, ALASKA (1973-1978)

YEAR	PETROLEUM PRODUCTS (1)	FOOD PRODUCTS (2)	BUILDING PRODUCTS (3)	LUMBER AND WOOD PRODUCTS (4)	FISH AND SHELLFISH (5)	ALL OTHER COMMODITY GROUPS (6)	ANNUAL TOTAL
1973	387	2452	588	157	1345	1319	6248
1974	365	1046	99	777	2367	837	5491
1975	10848	4550	323	693	2275	2052	20741
1976	11098	10057	1581	433	2992	2214	28375
1977	9506	8484	764	2462	0	3017	24233
1978	13467	1188	1217	2288	18152	6719	43031

Notes:
(1) Includes gasoline, jet fuel, fuel oil, lubricative oil and greases, liquified gases, asphalt building materials and misc. petroleum and coal products.
(2) Includes salt, meat, alcoholic beverages, groceries and mics. foods.
(3) Includes building cement, clay products, nonmetalic mineral products, iron, steel, fabricated metal products and misc. building products.
(4) Includes lumber, manufactured wood and furniture and fixtures.
(5) Includes fresh fish and shellfish.
(6) Includes all other remaining commodities.

Source: U. S. Army Corps of Engineers, Waterborne Commerce Statistics, Part 4.

to changes in petroleum products demands both for fishing purposes and other needs in this growing community.

A breakdown of throughput tonnage for 1978 by commodity origin and destination is presented in Table 10. Virtually all inbound goods originate in Seattle. Petroleum products are transshipped to Dillingham through Unalaska-Dutch Harbor, while most dry cargo products are shipped directly or transhipped through Kodiak. Approximately 55 percent of inbound cargoes are petroleum products and 99 percent of outbound cargoes are fish products. Inbound tonnage constitutes about 57 percent of throughput tonnage and outbound constitutes the remaining 43 percent.

MARINE CARRIERS

Marine freight carriers serving the study area can be divided into three general catagories: (1) interstate, (2) intrastate coastal shipping, and (3) lightering transportation. Table 11 identifies the carriers that serve the Bethel and Dillingham regions. With the exception of the North Star III, which is federally owned and operated, the carriers are regulated by either the Federal Maritime Commission (FMC), Interstate Commerce Commission (ICC), or both.

Common and Contract Carriers

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

TABLE 10

1978 COMMODITY TONNAGE AT DILLINGHAM, ALASKA
BY ORIGIN AND DESTINATION

COMMODITY GROUP	COMMODITY ORIGIN	INBOUND TONNAGE	THROUGHPUT TONNAGE	OUTBOUND TONNAGE	COMMODITY DESTINATION
FOOD PRODUCTS	SEATTLE	228	1248	1020	SEATTLE
	KODIAK	960	18092	17132	KODIAK
TEXTILE PRODUCTS	SEATTLE	2	2		
LUMBER AND WOOD FURNITURE	SEATTLE	1493	1493		
	KODIAK	795	795		
CHEMICAL PRODUCTS	SEATTLE	23	25	2	SEATTLE
	KODIAK	80	80		
PETROLEUM PRODUCTS	SEATTLE	57	57		
	DUTCH HARBOR	13410	13410		
BUILDING PRODUCTS	SEATTLE	832	865	33	SEATTLE
	KODIAK	227	227		
	SEWARD	125	125		
TRANSPORT EQUIPMENT	SEATTLE	481	548	67	SEATTLE
	BETHEL	1	1		
COMMODITIES AND NECESSITIES	SEATTLE	361	362	1	SEATTLE
	KODIAK	5503	5675	172	KODIAK
	BETHEL	1	1		
	CORDOVA	25	25		
TOTALS		24604	43031	18427	

Source: U. S. Corps of Engineers, Unpublished data.

TABLE 11

MARINE CARRIERS SERVING THE
BETHEL AND DILLINGHAM REGIONS

CARRIER	TYPE OF SERVICE	REGULATING AGENCY(1)
U. S. Government, Bureau of Indian Affairs	North Star III, General Cargo Ship	None
Alaska Cargo Lines, Inc.	Oceangoing Tug and Barge	FMC
Alaska Puget United Transportation Companies(2)	Oceangoing Tug and Barge "COOL BARGE"	FMC
Foss Alaska Line, Inc.	Oceangoing Tug and Barge	FMC
Moody's Sea Lighterage	Lighterage	ICC & FMC
Pacific Alaska Line - West(2)	Oceangoing Tug and Barge	FMC
Sorenson's Barge Service	Coastal and Inland River Tug and Barge	ICC & FMC
Standard Oil	Tanker	FMC
United Transportion	Coastal and Inland River Tug and Barge	ICC & FMC

Notes: 1. Abbreviation used:

ICC - Interstate Commerce Commission
FMC - Federal Maritime Commision

2. Subsidiary of Crowley Maritime Corporation.

Source: L. Berger & Associates, WAATS,1979.

carriers.

Scheduled Common Carriers. Typical examples of this type marine service in the Bethel and Dillingham areas are Alaska Cargo Lines, Foss Alaska Lines, Pacific Alaska Lines, and Northland services. Each of these carriers publishes scheduled routes and sailing dates and provides seasonal (summer only) service from Seattle to western Alaska The following provides a brief description of the western Alaska activities of each marine carrier who provide scheduled seasonal freight service between Seattle and the ports of Bethel and Dillingham.

Alaska Cargo Lines is a common carrier tug and barge service primarily hauling north-bound freight from Seattle to eight western Alaska communities including Dillingham and Bethel. Alaska Cargo Lines operates during only the ice-free season, typically from Api l to October and schedules four to five sailings during that time. Most freight carried by this line is containerized, however, a covered barge is available for transportation of vehicles. Although this carrier calls at other smaller Alaskan ports on inducement (i.e. sufficient tonnage to make the call profitable) cargo bound for smaller communities is transshipped through hub ports and delivered by local carriers, whose operations are discussed later.

Foss Alaska Lines (FAL) is a common carrier tug and barge operation providing service links from Seattle to Alaskan ports. FAL provides weekly scheduled common carrier service to southeast Alaska and regularly scheduled service to Dutch Harbor and other Aleutian chain ports, as well as Kodiak. During the summer months from May to August the FAL service extends to western Alaska, including the communities of Bethel and Dillingham. FAL transports both containers and less-than-container load (breakbulk) shipments. Northbound cargoes range from lumber and construction materials to books and pharmaceuticals, while south bound cargo consist of canned salmon and other seafood picked up for shipment to the Pacific northwest.

Northland Services operates as a common carrier tug and barge based out of Seattle. This company carries cargo to and from Alaska between April and September primarily serving Naknek, Dillingham, and Bethel. Northland Services also calls on intermediate ports where freight volume is large enough. Six to seven sailings from Seattle are scheduled each year.

Pacific Alaska Line-West (PAL-West) is a subsidiary of Crowley-Maritime Corporation providing common carrier scheduled tug and barge service from Seattle to western Alaska including Bethel and Dillingham. Twelve communities are served directly and others are served through lightering companies.

Contract Carriers. Contract or charter carriers are used by major shippers, such as petroleum companies or canneries, to move specialized or 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 development of oil and gas on Alaska's North Slope. During this period Arctic Marine Freighters shipped 594,000 tons to the North Slope. Two of the common carriers operating scheduled services also offer contract services to western Alaskan shippers: FAL and PAL-West.

Alaska Puget-United Transportation Company (APUTCO) is a contract operator of the "COOL BARGE" which makes delivery of dry cargo, reefer, and bulk petroleum to Department of Defense and other federal coastal installations in western Alaska. A list of the locations and agencies served by the COOL BARGE is identified in Table 12. At Bethel, COOL BARGE serves the Alaska Army National Guard, Bureau of Indian Affairs, Public Health Service and National Weather Service. At Dillingham, the COOL BARGE serves the Public Health Service.

Standard Oil operates a tanker named ALASKA STANDARD, which hauls bulk fuel to Bethel, Dillingham and other communities in the Aleutian Islands, Alaska Peninsula and Kodiak areas. For communities farther north fuel deliveries are handled by Puget Sound Tug and Barge Company a contract operator to Chevron, USA, Inc.

Other contract marine carriers providing services on a regional basis include Sorenson's Barge Service and Moody's Sea Lighterage, who provide local charter service from Dillingham and Ekuk, respectively, in the Bristol Bay area, and United Transportation, Incorporated, who operates out of Bethel and provides both coastal and inland river tug barge services. Communities served by United Transportation from Bethel are shown in Table 13. Much of the equipment used by the contract carriers is shallow draft due to limited water depths along the coast and in most

TABLE 12

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 - Alaska
NPS	National Park Service
NWS	National Weather Service
PHS	Public Health Service
USCG	U.S. Coast Guard

Source: L. Berger & Associates,WAATS, 1979

TABLE 13

POINTS SERVED FROM BETHEL BY
UNITED TRANSPORTATION, INC.

Scammon Bay	Eek
Hooper Bay	Quinhagak
Chevak	Goodnews Bay
Newtok	Platinum
Toksook Bay	Mekoryuk [Nunivak Is.]
Tununak	Napakiak
Nightmute	Napaskiak
Chefornak	Oscarville
Kipnuk	Kwethluk
Kwigillingok	Kasigluk
Tuntutuliak	Cape Newenham
Atmautluak	Akiak
Akiachak	McGrath

Source: L. Berger & Associates, 1979

of the river channels. The size of barges used by these carriers run from 18.3 by 6.1 meters (60 by 20 feet) with a capacity of about 100 tons of cargo to larger linehaul barges 44.2 by 22.9 meters (145 by 75 feet) with a capacity of 1,000 tons or more. Draft on the barges can be varied from 3 to 7 feet by the density of loading for the specific water depths encountered. A number of barges in use are designed for liquid cargo with a flat deck for top loading of dry cargo. [L. Berger & Associates, WAATS, 1979]

For those remote villages not served by common commercial carriers, the Bureau of Indian Affairs (BIA) operates the ship North Star III. The BIA resupply program is a non-profit, self sustaining operation serving approximately 60 villages annually. Two voyages are made each year. Generally, the first voyage serves people living in the Aleutian Islands to Cape Prince of Wales, and the second voyage serves coastal communities living north of Wales. Although Bethel and Dillingham do not receive shipments from the North Star III, several villages in their service areas do. These villages include Goodnews Bay, Mekoryuk, Platinum, Tununak, Nightmute, Scammon Bay, Hooper Bay, Chevak, Newtok, Toksook Bay, and Togiak.

Carrier Rates

Marine shipping rates, as established by any one carrier, reflect the characteristics of demand in a given community or region. Among some of these characteristics are total tonnage, length of haul, kinds of commodities, characteristics of the handling catagory, relationship between inbound and outbound tonnage, and the degree of competition. Rates are also affected by transshipment costs, which may include storage or warehousing requirements, as well as packing or repacking of breakbulk items. These additional charges are added by the transshipment carrier. Comprehensive rate data from each carrier operating in the Bethel and Dillingham region is not readily available on a carrier-by-carrier basis. Table 14 illustrates linehaul rates for a selected number of goods between Seattle and Dillingham. This data was provided by Foss Alaska Lines, Inc. These rates are representative of shipment costs in a competitive market. The rates shown are for the less than minimum weight loads. Generally, loads exceeding the minimum weight can be shipped at a reduced rate as illustrated for the commodity catagory "machinery" in Table 14. The actual rates charged a shipper will vary from those illustrated due to wharfing costs, special handling, and other similar items not reflected in the standard rate.

In addition to the handling, packing, shipping and other transportation charges levied by the major transportation companies, users of the dock facilities at both Bethel and Dillingham pay for other special services each city provides. The tariff structure at Bethel provides an example. Users of the Bethel Terminal must pay a Bethel-Terminal Tariff, which consists of time-based and weight-based charges for dockage, wharfage, handling of freight, storage, labor, and equipment services. Under terms of the agreement with the City, United Transportation receives half the terminal tariff revenues as payment for operating the port while the City retains the remainder. Dockage

TABLE 14

SELECTED COMMODITY RATES BETWEEN
SEATTLE, WASHINGTON AND DILLINGHAM, ALASKA

COMMODITY	RATE (Per 100 lbs.)	MINIMUM WEIGHT (lbs.)
Household appliances	$27.55	10,000
Batteries, tires	10.46	10,000
Bricks or blocks	6.65	34,000
Beams, joists and other structural building materials	15.52 (1)	24,000
Empty metal cans (for canning fish)	6.58	30,000
Cement, gravel, drilling mud	7.62	36,000
Canned fish (southbound only)	6.48 (2)	20,000
Furniture (set up)	47.33	7,000
Groceries	9.23	22,000
Insulating material	54.74	3,500 (3)
Household goods / Personal effects	18.94	no minimum (4)
Liquor:		
Wines and alcohol	14.59	20,000
Ale, beer, and stout	10.46	2[illegible]00
Machinery:		
General machinery and parts	9.85	24,000
Single units over 40,000 lbs	6.38	40,000
Oil, Petroleum, Petroleum products	7.44	32,000 (5)
Paint	8.88	24,000
Motor vehicles:		
Northbound	17.74 (6)	10,000
Southbound	13.79	no minimum

Notes:
(1) 25 percent higher if beams are curved
(2) Includes delivery for unloading in Seattle, but does not include marine cargo insurance for owner of shipment
(3) Subject to a minimum weight of not less than 3 lbs. per cubic foot
(4) Except that full container loads of 10,000 lbs are shipped at a rate of $16.17 per 100 lbs.
(5) Approximately 114.4 bbl. at a volume of 7.15 bbl./2000 lbs
(6) Minimum charge per vehicle $770. Rate drops to $15.83, if 6 or more units are shipped together

Source: Foss Alaska Line, Inc. Freight Tariff No. 49, effective April 4, 1980 charges are based on the overall length of the vessel and duration of time that the vessel is docked. The unit time for this charge is one day, with the minimum charge being twelve hours or a half-day. Associated wharfage and handling charges are specified by commodity with the rate based on the rate of the shipment. Exceptions to this charge include bulk fuel, which utilizes a per gallon rate and loose gravel which is based on a per cubic yard rate. Storage charges are based on a rate per day per weight or volume unit by commodity. Labor charges are based on a rate per man-hour, and depend upon whether or not labor services are provided during normal working hours. After normal working hours labor rates are substantially increased. Equipment charges depend on the type of equipment (crane or lift truck) and length of time equipment is used. Equipment rates are quoted in equipment hours. (L. Berger & Assoc. WAATS, 1979)

The lack of adequate marine facilities in several communities in both regions, also imposes added tariffs on transportation consumers who are served through or in spite of 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 local facility limitations. For example, when warehouse space is not located where dock based cargo handling equipment normally operates (i.e. adjacent to the dock), such as at Bethel, a shipping container must be loaded on a truck, transported to the nearest warehouse, offloaded and unpacked. The trucking process is repeated when the container is moved back to the dock. The cost of labor and equipment operations in this process adds to normal shipping costs.

Communities that cannot generate sufficient tonnage demands to warrant a stop by linehaul carriers are also penalized by additional charges for the transshipment of commodities through hub ports. The fact that tariff rates are inversely based on demand also penalizes smaller communities whose demands tend to be lower. Typically, communities with small demands tend to also be those with inadequate facilities, thus, compounding the effects of the marine tariff structure.

There are few, if any, alternatives for people whose marine transportation costs are too high. Airfreight is not an optional alternative since rates are considerably higher than those illustrated in Table 14. Air mail is an alternative for some commoaities and a growing one, since the service is heavily subsidized in A ska. 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 Associates, 1979).

Regulatory Agencies

The regulation of marine shipping and maintenance of navigable waters is a function performed by agencies of the Federal government, specifically the U.S. Army Corps of Engineers (COE) and the U.S. Coast Guard. The activities of these agencies in the Bethel and Dillingham regions are important because their activities can be expected to influence the direction of some existing trends.

The Corps of Engineers handles the permit process for channel and harbor improvements and has the responsibility for maintenance of navigable waters. The COE's responsibilities also extend to flood control, water supply, hydroelectric power, recreation, and water conservation. The COE, with the participation of local and state agencies, funds the construction of breakwaters and channel improvements, such as their proposal to eliminate erosion at the waterfront in Bethel. Communities with a problem can seek help from COE directly, however, Congress must initially authorize COE to conduct the necessary investigation and studies, and afterward must authorize the recommended project and appropriate the needed funds. Due to the small size of many communities, and the remoteness of the area, relatively few people benefit directly or indirectly by projects needed to solve local problems. Despite multiple-use aspects of many projects, not all of the projects meet acceptable cost-benefit criteria and, thus, are unlikely to be authorized or funded. Nonetheless, with the potential for large-scale development of the bottomfish industry and continued pressure to upgrade delivery systems in both the Bethel and Dillingham regions, many more people may benefit from proposed projects. Consequently, the likelyhood of project approval and funding in the future may be increased.

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 areas. Because a considerable amount of the Coast Guard's responsibilities lie in the Bering Sea and the Aleutian Island areas, the Coast Guard has considered establishing a base at Unalaska-Dutch Harbor with a maximum possible force to include an air station with up to three helicopters and a sea based operation consisting of two 115 meter (378 foot) high endurance cutters, one vessel in the 61 to 69 meter (200-225 foot) range, one 56 meter (184 foot) buoy tender and a dry storage area for buoys. 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 enforcement of marine safety and environmental protection (U.S. Coast Guard, 1980). If adequate funds are avai ble, relocation of the Coast Guard facilities to the Bering Sea area will improve marine search and rescue capabilities, but beyond the upgrading, improvement or addition of navigational aides, it is unlikely that the increased Coast Guard presence in the Bering Sea will significantly effect the level of marine transportaion services to either the Bethel or Dillingham region.

Air Mode

The air mode of transportation is the principal means of passenger travel in western Alaska. The emphasis in this section of the baseline is on defining the character of air travel in the Bethel and Dillingham regions and on the roles of Bethel and Dillingham as regional centers for air travel. Of particular interest to subsequent study efforts are those air routes and facilities most likely to be affected by potential OCS personnel and air freight movements. Because OCS aviation activities tend to be oriented toward Anchorage and Seattle, as well as other lower 48 cities, the baseline discussion includes certain aspects of operations at Anchorage International Airport. Regulatory and other aviation issues together with the implications of changing technology on current trends are also discussed.

Commercial aviation services are available in Bethel, Dillingham, and their respective surrounding areas year-round. Both scheduled and contract services are offered. The scheduled aviation services offered to southwestern Alaska and the Bristol Bay area can best be described as hub and spoke, as illustrated in Figure 4. In southwest Alaska, Bethel, St. Mary's, and Aniak serve as hub airports and in the Bristol Bay area, Dillingham and King Salmon serve as hub airports. Linehaul services are available between each hub and Anchorage. From these hubs, feeder services radiate to the smaller villages. Jet and turboprop aircraft are employed in providing linehaul services and smaller, propeller driven aircraft are used to provide feeder services.

AIR TERMINALS

This description of existing air terminal conditions includes the Bethel and Dillingham airports, as well as the Anchorage International Airport because of its role as an interregional and interstate hub. Five

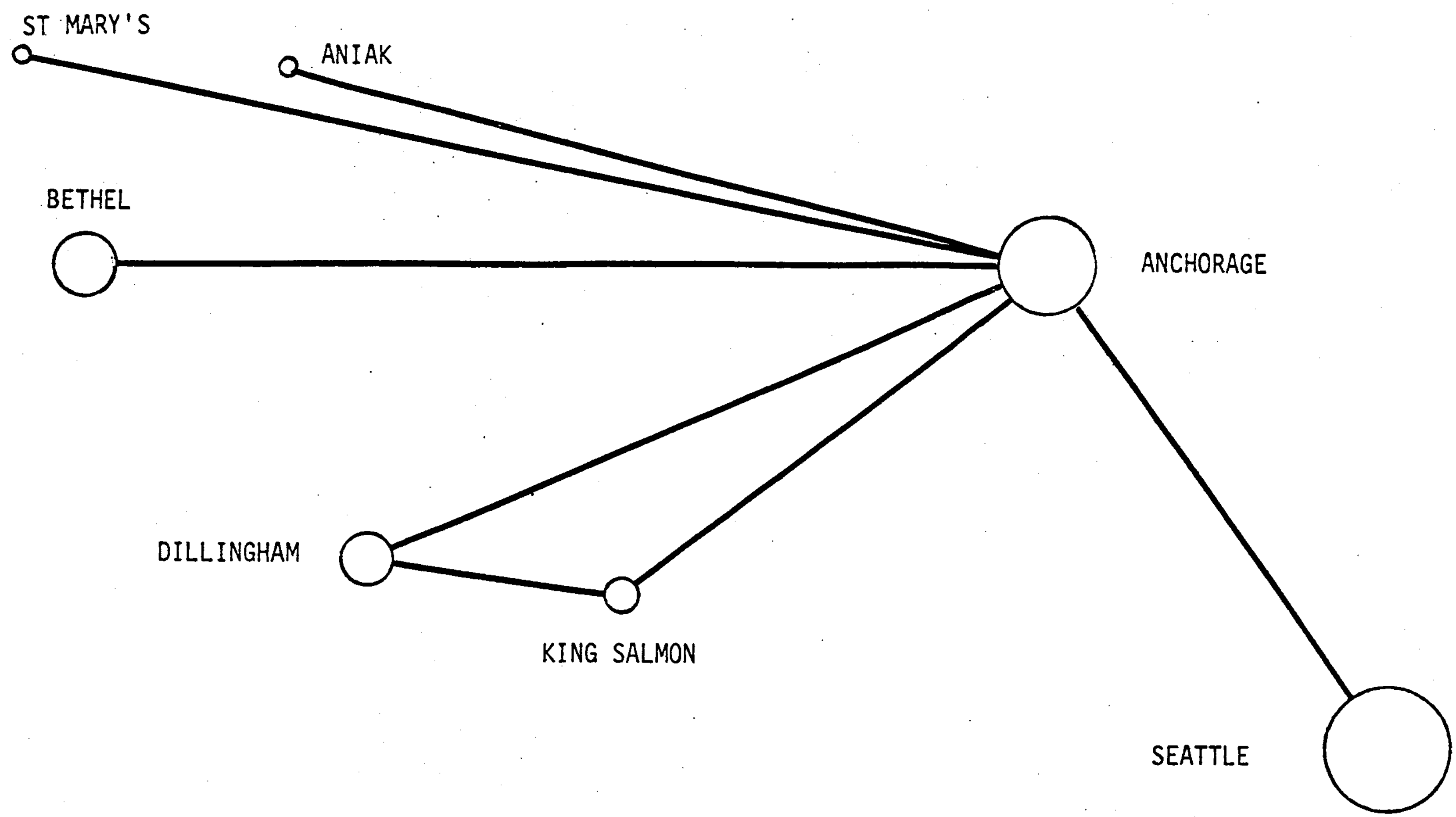

FIGURE 4

LINEHAUL AIR ROUTE STRUCTURE IN THE BETHEL AND DILLINGHAM AREAS

Source: ERE Systems, Ltd.

catagories of data are examined: (1) ground facilities utilized by aircraft 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, maintenance, and weather reporting; (4) passenger and freight handling facilities and their utilization; and (5) airport operations levels.

The State of Alaska has established for Alaska three major catagories of airports: (1) International Airports, which provide the interface between combinations of international, interstate, and intrastate service; (2) Trunk Airports, which serve to distribute goods and passengers to outerlying secondary airports; and (3) Secondary Airports, which may lie as far away as 241 to 323 kilometers (150 to 200 miles) from trunk airports. All airports not meeting the first two criteria automatically fall into the secondary airport catagory. The designation assigned an airport represents the highest use of the airport. Both Bethel and Dillingham are considered trunk airports, while Anchorage is considered an international airport.

Federal Aviation Regulations (FAR Part 139) require that all land based airports must have an operating certificate if it serves air carrier airlines who hold a certificate of public convenience and necessity issued by the Civil Aeronautics Board (CAB). Federal regulations provide for two types of airport certificates: (1) airports serviced by scheduled air carriers using aircraft with a maximum takeoff weight larger than 5,670 kilograms (12,500 pounds) must have an airport operating certificate (AOC). Airports serving air carriers conducting only unscheduled operations or operations with smaller aircraft are eligible for a limited airport operating certificate (LOC). The airports at both Bethel and Dillingham, as well as Anchorage, are required to meet the criteria for an AOC since CAB certificated air carriers serve these communities.

Bethel

The airport at Bethel is located 6.5 kilometers (4 miles) west of the city. The airport layout plan is shown in Figure 5 and information about runway characteristics, lighting, navigational aids, and ground facilities are summarzed in Table 15. The airport was constructed during 1957 and 1958 and is owned and operated by the State of Alaska. Landing facilities at the airport consist of two intersecting asphalt surfaced runways: runway 18-36 is an air carrier runway 1,950 meters (6,399 feet) long by 46 meters (150 feet) wide; runway 11-29, is a general utility runway 564 meters (1,850 feet) long and 23 meters (75 feet) wide. The air carrier runway was extended to its present length in 1973 and was at that time strengthened to accomodate Boeing 727 type aircraft. Terminal facilities include a small passenger terminal, a flight service station, and minor maintenance facilities. A new air traffic control tower is expected to be completed during the fall of 1981. Fuel storage tanks are located in the City, but fuel can be purchased at the airport. There are no helicopter facilities on the airport.

FIGURE 5

AIRPORT LAYOUT PLAN - BETHEL

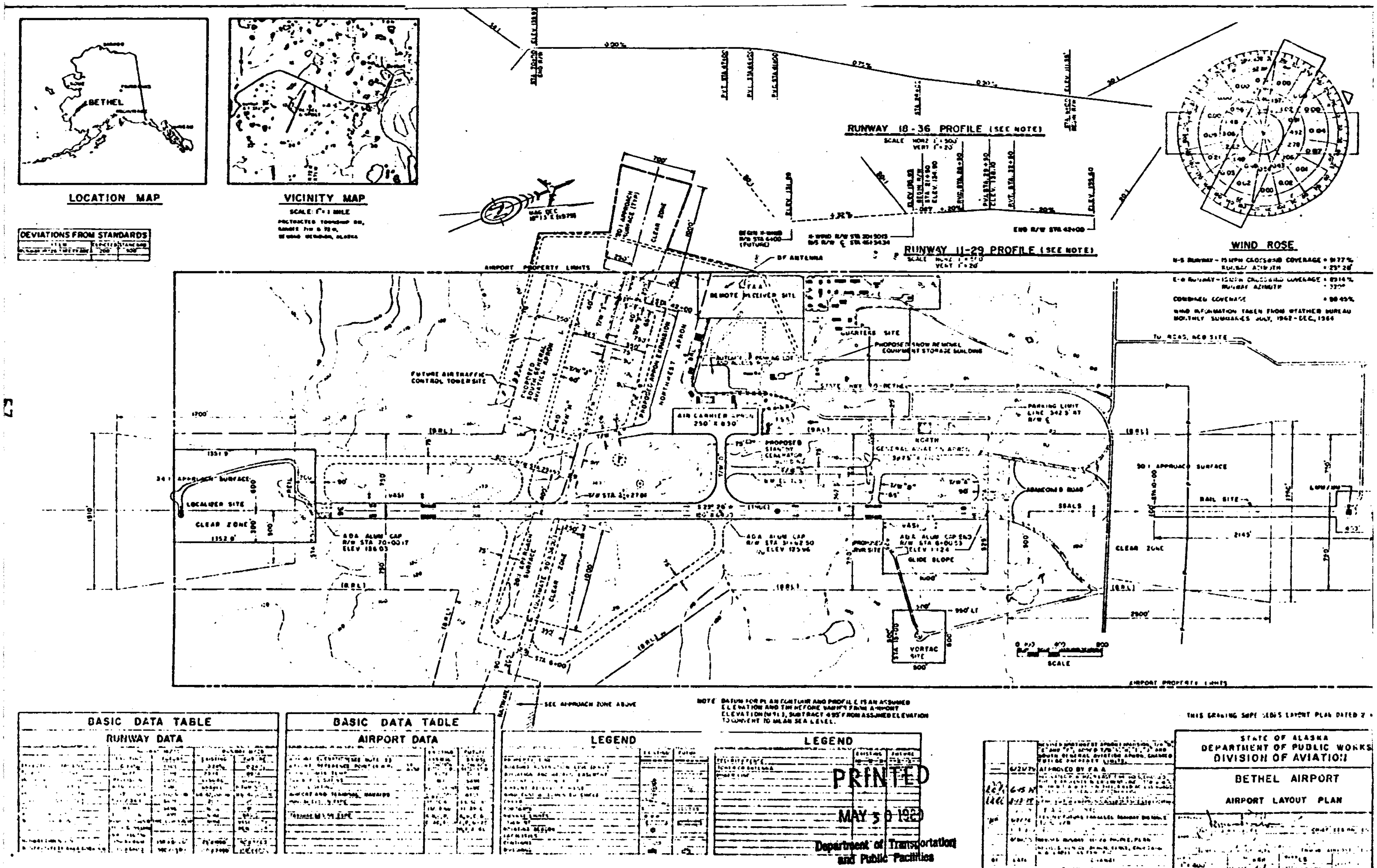

TABLE 15

AIRPORT CHARACTERISTICS AT BETHEL, ALASKA

GENERAL INFORMATION

Owner:	State of Alaska
Airport Role:	Air Carrier
Ground Facilities Include:	Flight Service Station; Passenger terminal building and several small hangers; Some maintenance facilities, but limited; Aircraft and cargo storage available, but limited; Fuel is available; No heliport.

RUNWAY CHARACTERISTICS

Heading(s)	18-36	11-29
Design type	Air Carrier	General Utility
Length in Meters (ft)	1950 (6399)	564 (1850)
Width in Meters (ft)	46 (150)	23 (73)
Surface Type	Asphalt	Asphalt
Lighting	REIL (36) VASI-4 (18/36) SSAL-R (18)	
Navigational Aids	LOC (18) GS (18) MM (18) NBD (18)	

OTHER NAVIGATION AIDS

VORTAC
DF
LMM
RCAG
FSS
DMEL

Legend

DF - Direction Finder
DME - Distance Measuring Equipment
DMEL- DME Co-located with Localizer
FSS - Flight Service Station
GS - Glide Slope
LOM - Outer Compass Locator Co-located with Outer Marker (OM)
LMM - Middle Compass Locator Co-located with Middle Marker (MM)
MM - Middle Marker
NDB - Nondirectional Beacon
OM - Outer Marker
RCAG - Remote Center Air-Ground Facility
REIL - Runway End Identification Lights
SFO - Single Frequency Outlet
SSALS-R - Short Approach Lighting System
VASI - Visual Approach Slope Indicator
VORTAC - Combined very high frequency omnirange (VOR) and tactical navigation (TACAN)

Sources: U.S. DOT, FAA, Ten Year Plan, 1981; and Alaska Department of Transportation and Public Facilities

Scheduled service to Bethel is provided by three commercial air carriers: Wien Air Alaska, Sea Airmotive (Seair), and Alaska Aeronautical Industries (AAI). Wein currently provides twice daily jet service between Anchorage and Bethel using Boeing 737-200C aircraft. Seair currently provides once daily service between Anchorage and Bethel from Monday through Friday with a Convair CV-580 aircraft. AAI, incorporates the former Great Northern Airlines, which was purchased by AAI in 1980. AAI currently provides a cargo-only service once a week from Anchorage.

Several air taxi operators are based in Bethel and provide services to outlying smaller communities: Bush Air, Inc.; Delaire Charter Service; Executive Charter Service; Samuelson Flying Service; West-Air-Inc.; Chugiak Aviation; and Christiansen Air Service. Sea Airmotive also has an air taxi permit to operate from Bethel. Both Sea Airmotive and Bush Air provide an extensive scheduled air carrier feeder service between Bethel and other villages in the surrounding region. Bush Air operates this service as a subcontractor to Wien. Details about these and other air taxi operators and subcontract services in the Bethel region are presented later as part of the discussion on air transportation operators.

In 1978, annual aircraft operations at the Bethel airport reached about 187,000 landings and takeoffs. The breakdown of these operations by principal aircraft user groups is:

USER GROUP	OPERATIONS	PERCENT
Air Carriers	12,000	6.4
Air Taxi	50,000	26.7
General Aviation	75,000	40.2
Training (touch and go)	50,000	26.7
TOTALS	187,000	100.0

Additional details about air carrier traffic; as well as information on enplaned passenger levels and mail and freight tonnage, for the period 1974-1980 is presented in Table 16. The information pertaining to scheduled departures and enplaned passengers encompass both linehaul and feeder routes such as those operated by Bush Air for ι in. Enplaned passenger levels have remained relatively steady over the ›eriod 1974-1979, followed by a marked increase in 1980 and continuation in 1981, if the remainder of 1981 is similar to the first quarter. During the 1974-1979 period, scheduled departures and all-service departures almost doubled. Most of these changes can be attributed to increased demands for feeder service flights. However, despite the apparent improvement in the frequency of feeder services the number of scheduled departures completed fell and so did the overall level of service. The Bethel Comprehensive Plan (Darbyshire & Assoc. 1980) estimated that over 50 percent of true passenger demands utilized unscheduled air taxi and unrecorded private flights to get to their destinations. As a result air taxi operations have increased substantially over the past several years. These air taxi demands are expected to continue to increase as

TABLE 16

TRAFFIC DATA FOR BETHEL AIRPORT

YEAR	Enplaned Passengers	Freight (Revenue tons)	Mail (Revenue tons)	Airline[1]	Scheduled Service	Non Scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	28,384	1765.54	1762.43	WE	4147	65	4212	2765	2515	90.95
1975	30,545	1600.77	1947.67	WE	5357	19	5376	3004	2576	85.75
1976	31,868	1564.01	2280.31	WE	5699	4	5703	3574	3337	93.36
1977	31,793	1967.31	2499.56	WE	7136	-	7136	3999	2357	58.93
1978	27,722	1475.77	2034.92	WE	5766	1	5767	4433	2154	48.59
1979	27,954	1648.64	2972.73	WE	7081	3	7084	4471	3842	85.93
1980[2]	40,478	2744.10	3275.78	WE			10,343	5635	5070	89.97
1981[3]	9,604	365.42	481.69	WE			1,620	879	879	100.00
	3,847	123.00	244.00	SA			786	606	595	98.18

Notes: (1) WE - Wien Air Alaska, SA - Sea Airmotive

(2) Data taken from each airlines' 1980 quarterly reports to the Civil Aeronautics Board.

(3) Data taken from each airlines first quarter [illegible] report to the Civil Aeronautics Board.

Sources: CAB Airport Activity Statistics, 1973-1979.
Wein Air Alaska Quarterly CAB Reports 1st Quarter 1980 - 1st Quarter 1981.
Sea Airmotive Quarterly CAB Report 1st Quarter 1981.

Bethel grows and is better equipped to satisfy shopping and business trip demands now requiring a trip to Anchorage.

The FAA has forecast an increase of 83 percent in air carrier operations and over 500 percent in air taxi operations by 1990. Through FY 1990, FAA has recommended expansion of the passenger terminal, new paving on both runways and general improvements to the airfield including clear zones, access road, fencing and utility improvements.

Based on the runway configuration at the Bethel airport, the theoretical runway capacity under visual flight rules (VFR) conditions is estimated to be somewhere between 55 and 85 operations per hour depending on wind conditions and the landing-takeoff pattern (Horonjeff, 1975). If the airport operates only during VFR or daylight instrument flight rules (IFR) conditions averaging 12 hours per day, daily capacity ranges from 660 operations to 1,020 operations and annual capacity ranges from 240,900 operations to 372,300 operations. Additional hours of operation would increase these capacities, as would an increase in the number of small fixed wing aircraft in the overall mix of aircraft using the field. Increased frequency of IFR conditions, on the other hand, would reduce capacity.

Dillingham

The Dillingham airport is located about 1.6 kilometers (one mile) west of the City. Figure 6 shows the airport layout plan and Table 17 provides information about ground facilities, runway characteristics,

FIGURE G

AIRPORT LAYOUT PLAN - DILLINGHAM

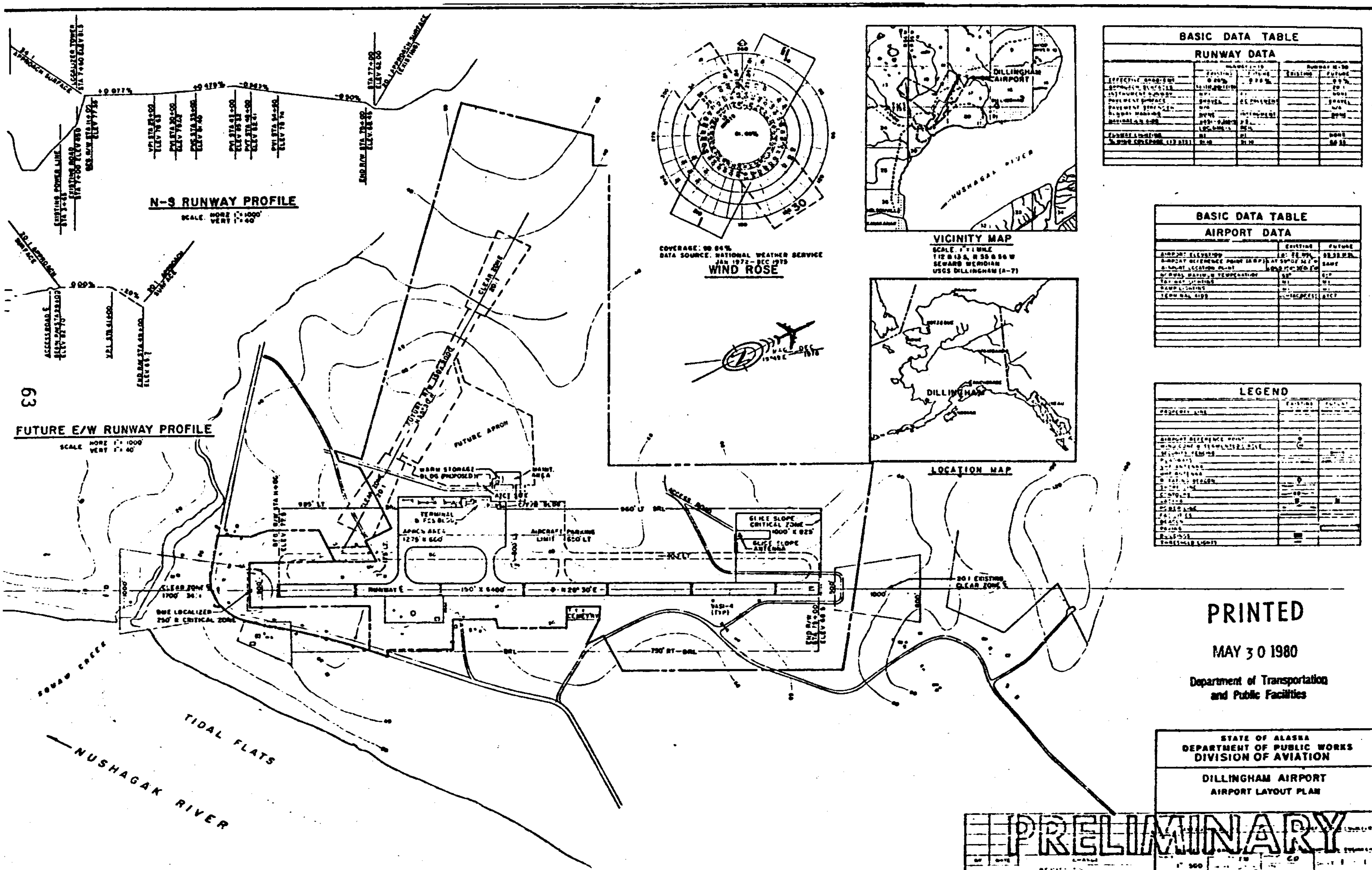

TABLE 17

AIRPORT CHARACTERISTICS AT DILLINGHAM, ALASKA

GENERAL INFORMATION

Owner:	State of Alaska
Airport Role:	Air Carrier
Ground Facilities Include:	Flight Service Station; Passenger terminal building and several small hangers; Some maintenance facilities, but limited; Aircraft and cargo storage available, but limited; Fuel is available; No heliport

RUNWAY CHARACTERISTICS

Heading	1-19
Design Type	Air Carrier
Length in Meters (ft)	1950 (6400)
Width in Meters (ft)	46 (150)
Surface Type	Gravel(Being paved in Fall 1981)
Lighting	VASI-4 (1/19)
Navigational Aids	LOC (19) DME (19)

OTHER NAVIGATION AIDS

VORTAC
FSS
DF

Legend

DF - Direction Finder
DME - Distance Measuring Equipment
FSS - Flight Service Station
VASI - Visual Approach Slope Indicator
VORTAC - Combined very high frequency omnirange (VOR) and tactical navigation (TACAN)

Source: FAA, Ten Year Plan, 1979 and Alaska Department of Transportation and Public Facilities.

and lighting and navigation aids. The airport is owned by the State of Alaska and operated by the Department of Transportation and Public Facilities. Until recently the single runway (1-19) was a gravel surfaced runway 1,950 meters (6,400 feet) long and 46 meters (150 feet) wide. The runway, taxiways, and several aprons were paved in the fall of 1981 (Seattle Journal of Commerce, 1981b). Terminal facilities include a small passenger terminal, flight service station, and minor maintenance facilities. Fuel is available at the airport. There are no helicopter facilities, although helicopters operate from the airport.

Scheduled service to Dillingham is provided by two commercial air carriers: Wein Air Alaska, and Kodiak Western Airlines. Wein currently provides a daily Boeing 737-200C jet flight between Anchorage and Dillingham. The flight from Anchorage is direct to Dillingham, b the return flight makes an intermediate stop at King Salmon. On four days a week Wien adds a second flight which makes an intermediate stop at King Salmon on the way to Dillingham, but returns directly to Anchorage. During the fishing season, Wien adds flights to handle increased passenger demands and cargo demands for moving fresh fish. Kodiak Western Airlines operates scheduled service to communities between Togiak and Kodiak including the Alaska Peninsula, but does not serve Anchorage. Most aircraft used by Kodiak Western are small fixed wing aircraft under 300 horsepower.

Several air taxi operators are based in Dillingham and provide services to outlying villages: Armstrong Air Service; Southwest Airways, Inc.; and Yute Air Alaska. Some additional details about these and other air taxi operators in the Bristol Bay region are presented as part of the discussion of air transportation operators.

Annual aircraft operations at the Dillingham airport reached 69,000 landings and takeoffs in 1978. A breakdown of these operations by principal aircraft user group is:

USER GROUP	OPERATIONS	PERCENT
Air Carriers	6,000	8.7
Air Taxi	12,000	17.4
General Aviation	47,000	68.1
Training (touch and go)	4,000	5.8
TOTALS	69,000	100.0

Air carrier enplaned passenger levels and mail and freight tonnage at Dillingham for the period 1974-1980 is presented in Table 18. Between 1974 and 1978 passenger enplanements were steady, but in 1979 and 1980 enplanements jumped about 50 percent. Part of this increase can be attributed to the shortened fishing seasons which increase the travel requirements of transient workers between seasons and forces such movements to occur over shorter time spans. Part of this jump is also due to improved economic conditions in the area. Freight and mail tonnages have both remained relatively constant throughout the 1974-1979 period. However, freight tonnage appears to drop off in 1980 and during the first quarter of 1981, although spring and summer are busier periods. Throughout the 1974-1979 period, Kodiak Western has had a high number of non-scheduled fights, averaging about 15 percent of all services. Part of the reason for this is a relatively high demand for

TABLE 18

TRAFFIC DATA FOR DILLINGHAM AIRPORT

YEAR	Enplaned Passengers	Freight (Revenue tons)	Mail (Revenue tons)	Airline[1]	Scheduled Service	Non Scheduled Service	All Services	Departures Scheduled	Scheduled Departures Completed	Percent of Departures Scheduled
1974	11,044	551.49	574.94	Total	3967	785	4282	3074	2861	93.07
				KD	3497	781	4278	2708	2520	93.05
				WE	470	4	4	366	341	93.16
1975	12,402	562.67	598.94	Total	3679	535	4214	3002	2713	90.37
				KD	3036	534	3570	2405	2167	90.10
				WE	643	1	644	597	546	91.45
1976	12,355	821.18	619.68	Total	3029	584	3613	2829	2485	87.84
				KD	2595	584	3179	2429	2110	86.86
				WE	434	-	434	400	375	93.75
1977	12,835	933.40	564.35	Total	3097	485	3582	2774	2454	88.46
				KD	2618	485	3103	2279	2057	90.25
				WE	479	-	479	495	397	80.20
1978	12,548	832.39	78.95	Total	2589	168	2757	2819	1976	70.09
				KD	2054	168	2222	2336	1518	64.98
				WE	535	-	535	483	458	94.82
1979	19,232	775.78	532.07	Total	2528	343	2871	1943	1911	98.35
				KD	1994	342	2336	1551	1533	98.83
				WE	534	1	535	392	378	96.42
1980[2]	17,986	593.77	534.94	Total			2427	1898	1847	97.31
	1,640	101.84	428.24	KD			1828	1389	1358	97.77
	16,346	491.93	106.70	WE			599	509	489	96.07
1981[3]	3,044	52.78	46.33	Total			645	183	382	208.74[4]
	479	16.05	29.02	KD			541	124	323	260.48
	2,565	36.73	17.31	WE			104	59	59	100.00

Notes:
(1) KD - Kodiak Western Airlines, WE - Wein Air Alaska.
(2) Data taken from each airlines 1980 quarterly repo--s to the Civil Aeronautics Board.
(3) Data taken from each airlines first quarter 198- ..ort to the Civil Aeronauticics Board.
(4) Apparent discrepancy in this information is unexp,ained in available CAB documents. Most likely the data will be ammended in subsequent quarterly reports.

Sources: CAB Airport Activity Statistics, 1973-1979.
Wein Air Alaska Quarterly CAB reports 1st Quarter 1980 - 1st Quarter 1981.
Kodiak Western Quarterly CAB reports 1st Quarter 1980 - 1st Quarter 1981.

services, a schedule affected by weather delays and associated flight cancellations, plus some lack of capacity in available equipment.

Through 1990, the FAA is forecasting a 16 percent increase in air carrier operations and a 75 percent increase in air taxi operations. FAA has also recommended several improvements for the airport including: runway end identification lights for runway 1; an aircraft traffic control tower; expansion of the passenger terminal; and improvements to clear zones, fencing, and other similar items.

Based on the single runway configuration at Dillingham, the theoretical runway capacity under VFR conditions is estimated to be between 45 and 60 operations per hour (Horonjeff, 1975). Based on an average 12 hour operating period, daily capacity is expected to be between 540 and 720 operations and annual capacity to be between 197,100 and 2[illegible]2,800 operations. Weather, crosswinds, actual daylight conditions and other factors would serve to reduce these theoretical values, however.

<u>Anchorage International Airport</u>

Anchorage International Airport serves an important role in both the State of Alaska and national airport systems because it functions as an interregional, interstate, and international airport. In 1976, this airport handled 236,000 operations (landing and take-offs), which is 77 percent of the capacity estimated in the 1971 Airport 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 persons. Certificated 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 1977 and 1978 passenger enplanements continued to grow as shown in Table 19. By 1978, passenger enplanements exceeded one million persons as did the number of passengers passing through Anchorage. By 1996, the Alaska Department of Transportation & Public Facilities (ADOT/PF) is forecasting 3.6 million enplanements and 3.2 million through passengers.

The International Airport also serves an important role in moving freight to, from, and within Alaska. In 1976, throughput tonnage at the airport amounted to 107,800 metric tons (118,800 tons), which was 11.1 percent of the Port of Anchorage's throughput for general cargo in that year. As shown in Table 19, cargo tonnage increased in 1977, then declined slightly in 1978, but not below 1976 levels. By 1996, the ADOT/PF is forecasting cargo tonnage to reach 1.1 billion pounds (550 thousand tons). Transiting cargo is forecast to reach 6.2 billion pounds (3.1 million tons) in 1996.

TABLE 19

ANCHORAGE INTERNATIONAL AIRPORT TRAFFIC DATA FOR 1977-78

	Passengers Inbound (in thousands)		Passengers Outbound (in thousands)		Passengers in Transit (in thousands)		Total Passengers (in thousands)	
	1977	1978	1977	1978	1977	1978	1977	1978
International	31.8	30.5	32.0	28.9	880.4	988.7	944.2	1,048.1
Domestic	572.3	579.7	590.3	597.2	86.0	76.8	1,248.6	1,253.7
Intrastate	340.7	372.1	343.2	375.7	1.5	0.2	685.4	748.0
Total	944.8	982.3	965.5	1,001.8	967.9	1,065.7	2,878.2	3,049.8

	Cargo Inbound (tons)		Cargo Outbound (tons)		Total Cargo (tons)	
	1977	1978	1977	1978	1977	1978
International	492.1	484.7	1,272.2	2,116.4	1,764.3	2,601.1
Domestic	32,807.7	30,474.4	12,263.9	10,302.9	45,071.6	40,777.3
Intrastate	16,158.7	21,227.1	69,202.9	65,413.5	85,361.6	86,530.6
Total	49,458.5	52,076.2	82,739.0	77,832.8	132,197.5	129,909.0

Source: Alaska Journal of Commerce & Pacific Rim Reporter , August 11, 1980.

Facility Issues

In both the Bethel and Dillingham regions, as in many other areas of the state, airport facilities of some kind or another exist in virtually every community and in many places in between. Most of these facilities are grass or gravel strips, some are lakes or rivers and can only be used by float equipped aircraft. Very few communities have a paved runway as at Bethel. Generally, the physical condition of runways and other airport facilities in the Bethel and Dillingham regions are poor. Potholes, standing water, and unevenness (beyond the nature of the surfacing materials) are typical physical problems. Some areas lack air navigation control coverage. Each of these conditions, singly or in combination, contribute to the relative low levels of service experienced by the outlying villages. As explained later in the section on air carriers, their actions contribute equally to the low levels of service. However, regarding the physical problems, the age or condition of some facilities are such that a major maintenance effort is required to bring them to acceptable standards. Due to the remoteness of these communities, such major maintenance efforts are difficult and costly to perform. The lack of gravel resources in many areas contributes significantly to this situation. Because maintenance is expensive and because weather and soil conditions (e.g. permafrost) are so hard on structures, standards for new construction are set higher than normal, thus increasing the initial construction costs. This, in turn, means that fewer new projects can be constructed and relatively few airports receive necessary maintenance when needed.

The Alaska Department of Transportaion and Public Facilities (ADOT/PF) has responsibility for construction, maintenance, and operation of airport facilites. The Federal Aviation Administration (FAA) has responsibility for aircraft navigation and safety. These two agencies work together to prepare specific airport development plans and regional aviation system plans that explain how all the airports in a particular region fit together to create a cohesive system. They are well aware of the physical limitations of the system and have either developed necessary improvement plans or in the process of doing so.

AIR TRANSPORTATION OPERATORS

The State of Alaska requires all persons to obtain a Certificate of Public Convenience and Necessity from the Alaska Transportation Commission prior to operating aircraft in intrastate air commerce between points in the state. Air carriers may apply for and be granted authority under one of the following classes of operating rights: scheduled air carrier; air taxi operator; and, contract carrier. The discussion that follows, attempts to identify the relevant scheduled air carriers, air taxi operators, and contract air carriers operating in the Bethel and Dillingham regions. For purposes of this discussion, each region is defined as the area within a 150 mile radius of either hub community.

Scheduled Air Carriers

A scheduled air carrier holds its services out to the public generally and operates aircraft between paired points from which the primary source of revenue collected is based upon individual passenger fares or per pound cargo rates. Unless otherwise restricted by its certificate, a scheduled air carrier may perform charter trips and special services provided the transportation performed originates at or is destined to a point the carrier is authorized to serve.

There are several scheduled air carriers serving the Bethel and Dillingham regions as identified on Table 20. Also identified are communities within the region served by each carrier. These scheduled air carriers include Alaska Aeronautical Industries based in Anchorage; Kodiak Western Airlines, based in Kodiak; Munz Northern Airlines, based in Nome; Sea Airmotive, based in Anchorage; Western Yukon Air, based in St. Mary's; and, Wein Air Alaska, based in Anchorage. Wein Air Alaska holds operating rights to serve the greatest number of communities in this combined regional area. However, virtually all of the communities Wein has the right to serve are, in fact, served by other airlines through a subcontract agreement. These subcontractors are identified in the footnotes of Table 20, and are discussed further under contract operators below.

Air Taxi Operators

An air taxi operator holds its services out to the public generally and conducts its business from a specified base of operations primarily through the charter of its aircraft. Such operators are restricted to

TABLE 20

SCHEDULED AIR CARRIERS SERVING THE BETHEL AND DILLINGHAM REGIONS (1)

CARRIER	PERMIT NUMBER	REGIONAL COMMUNITIES SERVED		
Alaska Aeronautical Industries (Great Northern Airlines, Inc.)	G-0234 (2,3) G-0230		Bethel	
Kodiak-Western Airlines, Inc.	G-0002 (3)	Aleknagik	Ekwok	Pilot Point
		Clarks Point	Igiugig	South Naknek
		Dillingham	King Salmon	Togiak
		Egegik	Levelock	Ugaghik
Munz Northern Airlines, Inc.	G-0227 (3)	Alakanuk	Grayling	Pilot Station
		Anvik	Holy Cross	Russian Mission
		Bethel	Hooper Bay	Scammon Bay
		Cape Romanzof	Kotlik	Shageluk
		Chevak	Marshall	Sheldon Point
		Emmonak	Mountain Village	St. Mary's
Sea Airmotive, Inc.	G-6576 (3)	Akiackak	Goodnews Bay	Newtok
		Akiak	Hooper Bay	Nunapitchuk
		Akolmiut	Kasigluk	Platinum
		Aniak	Kipnuk	Quinhagak
		Bethel	Kongiganak	Scammon Bay
		Cape Newenham	Kwethluk	Shageluk
		Cape Romanzof	Kwigillingok	St. Mary's
		Chefornak	Mekoryuk	Toksook Bay
		Chevak	Napakiak	Tuluksuk
		Eek	Napaskiak	Tuntutuliak
				Tununak
Western Yukon Air	G-1979 (3,4)	Bethel	Marshall	Pilot Station
		Emmonak	Mountain Village	Russian Mission
		Kotlik		St. Mary'
Wien Air Alaska, Inc.	G-0003 (3)	Akiachak (5,7)	Hooper Bay (5)	Nunapitchuk (5)
		Akiak (5,7)	Iliamna (7,8)	Nyak (7)
		Alakanuk (5,10)	Kalskag (7)	Paimuit (7)
		Aniak (5,7,9)	King Salmon (7)	Pilot Station (5)
		Anvik (7)	Kipnuk (5)	Platinum (5,7)
		Atmautluak (5)	Kongiganac (5)	Red Devil (7,9)
		Bethel (7)	Kotlik (5,6,10)	Russian Mission (5,7)
		Cape Romanzof	Kwethluk (5,7)	Scammon Bay (5,6)
		Chefornak (5)	Kwigillingok (5)	Shageluk (7)
		Chevak (5)	Kwiguk	Sheldon Point (6)
		Crooked Creek (7,9)	Kwinhagak (7)	Sleetmute (7,9)
		Dillingham (5,7)	Marshall (5,7)	St. Mary's (5,6)
		Eek (5)	Mekoryuk (5)	Stony River (7,9)
		Emmonak (5,10)	Mountain Village (5)	Toksook Bay (5)
		Flat (7)	Napakiak (5)	Tuluksak (5,7)
		Goodnews Bay (5,7)	Napamute (7,9)	Tuntatuliak (5)
		Hamilton	Napaskiak (5)	Tununak (5)
		Holy Cross (7)	Newtok (5)	

NOTES:
(1) Each Region is defined as the area within a 150 mile radius .
(2) Great Northern Airlines was purchased by Alaska International Air, which holds its operating authority.
(3) May provide charter service on most of its routes between these communities.
(4) Limited to fixed wing aircraft under 12,500 pounds.
(5) Served by Bush Air, Inc. (Permit Number S-1373) as subcontractor to Wien (Subcontract Number 25165).
(6) Served by Delta Air Service, Inc. Emmonak (Permit Number S-4667) as a subcontractor to Wien (Subcontract Number 19695).
(7) Pursuant to an agreement with Wien, Hub Air Service, Inc., McGrath, (Permit Number S-0065) may serve these communities and others not listed.
(8) Served by Iliamna Air Taxi, Inc, Iliamna, (Permit Number S-2167) as a subcontractor to Wien (Subcontract Number 24075).
(9) Pursuant to an agreement with Wien, Vanderpool Flying Service, Red Devil (Permit Number S-0179) may serve these communities only.
(10) Pursuant to an agreement with Wien; Unalakleet Air Taxi, Unalakleet, (Permit Number S-0101) may serve these communities and others not listed.

Source: Alaska Journal of Commerce & Pacific Rim Reporter, February 16, 1981.

the utilization of aircraft having a certificated gross take-off weight of 5,670 kilograms (12,500 pounds), or less, unless otherwise authorized by their certificate.

The air taxi operators serving the Bethel and Dillingham regions are identified in Table 21 and Table 22, respectively. Each table is organized to show those air taxi operators located within the region and those located outside the region, but with authority to serve the region. Within each of these two general catagories, operators are identified by the location of their principal base of operations as stated in their operating certificate. Additional information on these tables includes the permit number, and general stipulations applicable to the air taxi operator. In the Bethel region, 15 communities are identified as being a base of operations for air taxi operators and there are fifteen air taxi operators located throughout the region. Three operators are located outside the region. Eight air taxi operators are located in Bethel.

In the Dillingham region, eight communities are identified as authorized bases of operation. Thirteen operators located within the region and one operator outside the region provides service to this area. Three air taxi operators are based in Dillingham.

Contract Carrier

A contract carrier is a private for-hire carrier and does not hold its service out to the public generally. This type of carrier operates

TABLE 21

AIR TAXI OPERATORS SERVING BETHEL AND SURROUNDING REGION(1)

LOCATION	AIR TAXI OPERATOR	PERMIT NUMBER	GENERAL STIPULATIONS(2)	AUTHORIZED BASES OF OPERATION
OPERATORS LOCATED WITHIN BETHEL REGION				
Aniak	Aniak Flying Service	E-0866	A,B,C	Aniak
	Vanderpool Air Taxi	E-0194	A,B,C	Aniak
Bethel	Bush Air, Inc.	E-1373	A,B,C	Bethel
	Delaire Charter Service	E-0228	A,B,C	Bethel, Kipnuk
	Executive Charter Service	E-4475	A,B,C	Bethel
	Samuelson Flying Service	E-0093	A,B,C	Bethel
	West-Air-Inc.	E-0221	A,B,C	Bethel
Emmonak	Delta Air Service Inc.	E-4667	A,B,C	Emmonak
Grayling	Grayling Air Service	E-2674	A,B,C,	Grayling
Hooper Bay	Sanda Fe Air Service	E-2473	A,B,C	Hooper Bay
Quinhagak	Tri Cities Air Service	E-4580	A,B,C	Quinhagak, Eek, Goodnews Bay
Red Devil	Vanderpool Flying Service	E-0179	A,B,C	Georgetown
Sleetmute	Nixe's Flying Service	E-2179	A,B,C	Sleetmute
St. Mary's	Andreafski Air and or	E-2179	A,B,C	Mountain Village,
	Mountain Air	E-7869	A,B,C	St. Mary's
	Western Yukon Air	E-0672	A,B,C	St. Mary's/Pitkas Pt., Pilot Station
OPERATORS LOCATED OUTSIDE BETHEL REGION				
Chugiak	Chugiak Aviation	E-7869	A,B(3)	Bethel, Birchwood, St. Mary's
Anchorage	Christiansen Air Service	E-0258	A,B,C	Bethel
	Sea Airmotive, Inc.	E-0023	A,B(4)	Anchorage, Bethel, Deadhorse

Notes: (1) Region is defined as the area within a 150 mile radius from Bethel.
(2) General stipulations applicable as noted above: A. Holder shall at all times provide safe, adequate and continuous service; B. Holder shall utilize aircraft having a gross certificated takeoff weight not greater than 12,500 pounds; C. Holder shall utilize fixed wing aircraft only.
(3) Authorized to operate both fixed wing and rotary wing aircraft from Bethel.
(4) All rotary wing from Bethel shall be to points within 250 miles of Bethel.

Source: Alaska Journal of Commerce & Pacific Rim Reporter, February 15, 1981.

TABLE 22

AIR TAXI OPERATORS SERVING DILLINGHAM AND SURROUNDING REGION(1)

LOCATION	AIR TAXI OPERATOR	PERMIT NUMBER	GENERAL STIPULATIONS(2)	AUTHORIZED BASES OF OPERATION
OPERATORS LOCATED WITHIN DILLINGHAM REGION				
Dillingham	Armstrong Air Service	E-0028	A,B,C	Dillingham
	Southwest Airways, Inc.	E-6676	A,B,C	Dillingham
	Yute Air Alaska, Inc.	E-0058	A,B,C	Dillingham
Iliamna	Iliamna Air Taxi, Inc.	E-2167	A,B,C	Illiamna
	Iliaska Lodge	E-8277	A,B,C(3)	Iliaska Lodge
	Rainbow King Lodge	E-1579	A,B,C(4)	Illiamna
	Talarik Creek Air Taxi	E-0666	A,B,C	Illiamna, Nondalton
King Salmon	Air Martel, Inc.	E-0116	A,B,C(5)	King Salmon
Naknek	King Flying Service	E-0232	A,B,C	Naknek, King Salmon
	Lake Clark Lodge, Inc.	E-0129	A,B,C(6)	Nak[illegible]
	Roy Smith Flying Service, Inc.	E-0108	A,B,C	Sout[illegible]aknek, Naknek
Pilot Point	Griechen Air Taxi	E-2267	A,B,C	Pilot Point, N[illegible]ek
	Peninsula Airways	E-0088	A,B,C(7)	Pilot Point, Ki[illegible] Salmon, Naknek, Cold Bay
OPERATORS LOCATED OUTSIDE DILLINGHAM REGION				
Homer	Homer Air and/or Heiden-Chignik Air Service	E-0059	A,B,C(8)	Port Heiden, Homer, Brown Bear Lodge

Notes: (1) Region is defined as the area within a 150 mile radius from Dillingham.
(2) General stipulations applicable as noted above: A. Holder shall at all times provide safe, adequate and continuous service; B. Holder shall utilize aircraft having a gross certificated takeoff weight not greater than 12,500 pounds; C. Holder shall utilize fixed wing aircraft only.
(3) Limited to Lodge patrons, April 15 - November 15, water only landing and takeoff.
(4) Limited to Lodge patrons.
(5) Only May 15 - October 15.
(6) Under indefinite suspension.
(7) Contract operator for Reeve Aleutian Airways.
(8) Transportation from Port Heiden and Brown Bear Lodge limited to 100 mile radius of Port Heiden.

Source: Alaska Journal of Commerce & Pacific Rim Reporter, February 16, 1981.

under one or more contracts of a continuing nature for a limited number of persons, or performs specialized services for specified individuals or concerns. Contract carriers include those air taxi and air carrier airlines authorized to perform charter services, as well as those airlines working under a major contract or agreement with a larger airline for scheduled services.

Air carriers providing contract services in the Bethel and Dillingham regions were identified earlier in Table 20. Each of the scheduled air carriers identified in Table 20 have the authority to provide charter service to, from, or between communities identified in their operating rights. Of particular interest are the contract carriers that provide an extension of Wein Air Alaska's services in the Bethel and Dillingham regions. Each of these subcontractors are also air taxi operators within their respective regions. The specific subcontractors are identified in the footnotes of Table 20 and the communities each serves in the Bethel and Dillingham areas are identified in the body of the Table. Several of these subcontractors have authority to provide services to other nearby communities, but these communities fell outside the 150-mile radius criteria and are not listed.

Air Carrier Issues

A 1979 study of air service to rural Alaska, which focused on much of western Alaska including Bethel and Dillingham concluded that the present system is "at best inadequate and at worst dangerous" and that rural Alaskans are being short changed as compared to their urban neighbors in the quality of transportation services offered by private enterprise and by government (Parker Associates, 1979). The report went on to state that:

- The situation is not the fault of any one sector responsible for air service delivery, rather it is due to being ill prepared to deal with the explosion of passengers, mail, and freight generated in rural Alaska.

- Several local air carriers are as much the victims of the system as are the customers they serve. Even with high fares and rates many cannot afford the type of aircraft and ground support facilities required to do a good job.

- Because Wien operates in a larger area and under generally more difficult conditions it has been the major target for complaints.

  - The evidence is overwhelming that Wien's move to direct its resources toward high-profit passenger routes between urban centers has wreaked havoc with freight and parcel post deliveries bound for rural areas. Service to Bethel and Dillingham, among other regional centers, are specifically cited.

  - Even more serious than the inability of Wein to handle the freight and parcel post load to the regional centers has been the intermittent breakdown of the system subsequent to the carrier's decision to subcontact to small local operators all routes from the regional centers to the villages. Before retreating from the rural areas Wien had a well-balanced fleet of aircraft to serve rural Alaska villages, including twin and single-engine Otters with Skyvans to carry outsize loads and peak cargo loads. Currently (1979), however, not one Wien subcontractor operates a twin-Otter and only one has a single-Otter.

- In addition to subcontracting to ill-equipped operators, deteriorating service can also be traced to the ailure of all concerned with aviation in rural Alaska to supply t most essential tools required for good service. These essential tools range from navigational aids, radios, and electronics equipment, to maintenance facilities and services, all of which contribute to more efficient utilization of existing aircraft.

- The installation of improvements lacks overall planning or coordination. The effectiveness of past actions, both policy related and funding related, are not being monitored or audited. No performance standards have been established to guide actions.

EQUIPMENT OPERATIONS AND RATES

Traffic data by type of aircraft utilized for scheduled air carrier activities at Bethel and Dillingham is shown in Table 23. For linehaul routes Wien relies on the Boeing 737-200C jet aircraft, which has a gross takeoff weight of 52,617 kilograms (116,000 pounds). Wein uses this aircraft on the routes between Anchorage and Bethel or Dillingham, as well as in its service to Aniak and St. Mary's north of Bethel. Wien's subcontractor in Bethel, Bush Air, relies on smaller Cessna aircraft as its main equipment. Similarly, Kodiak Western in Dillingham relies on a variety of fixed wing aircraft, typically under 300 horsepower. Kodiak Western also uses the larger Grummen G21A on several routes. Virtually all of the aircraft used for linehaul and feeder service are configured to carry both passengers and cargo. Table 23 notes the typical passenger seating capacity of the various aircraft types.

Regarding the establishment of rates, it should be noted that each scheduled air carrier and air taxi operator files individual rates with the Alaska Transportation Commission. The charge for transportation typically varies from carrier to carrier, and depends upon the circumstances of the service. Most air taxi operators and some scheduled air carriers publish charter rates for light aircraft on an hourly basis for a round trip from the point they are based. As an alternative, some air carriers publish charter rates on a per mile basis. Under this system charges are computed from mileage flown at a flat rate per mile for each type aircraft between main points. Charter rates might also identify individual passenger fares between specified

TABLE 23

1979 TRAFFIC DATA BY TYPE OF AIRCRAFT, BY CARRIER, BY AIRPORT FOR BETHEL AND DILLINGHAM

Airport	Carrier	Type of Aircraft	Manufacturer	Scheduled Service	Non-Scheduled Service	All Service	Average Passenger Seating
Bethel	Wein Air Alaska	U-Type-PIS-1	Cessna	3038	-	3038	5
		U-Type-PIS-2	Cessna	1881	-	1881	5
		B-737-200C	Boeing	846	1	847	112
		FH-227	Fairchild	1	-	1	30
		All Types		5766	1	5767	
Dillingham	Kodiak Western	DHC-2	DeHavilland	4	1	5	5
		DHC-3 OTTER	DeHavilland	4	1	5	8
		FWUNDR 300HP	(1)	1831	116	1947	4
		C-402/402A	Cessna	26	2	28	7
		G21A	Grummon	187	48	235	9
		PA-23-250	Piper	1	-	1	5
		G-44/44A	Grummon	1	-	1	4
		All Types		2054	168	2222	
	Wien Air	F-27 Series	Fairchild	10	-	10	26
		B-737-200C	Boeing	485	-	485	112
		FH-227	Fairchild	40	-	40	30
		All Types		535	-	535	

Notes: (1) Fixed Wing under 300 horsepower and not otherwise identified.

Source: CAB, Airport Activity Statistics.

points subject to a minimum charge for three or four passengers for each trip. Contract carriers, on the other hand, try to sell a specified portion of their capability to perform air commerce to a vendee or select clientele who guarantee substantial payment for the capabilities so reserved, whether or not such services are actually utilized.

One-way coach fare linehaul rates for Wein between Bethel or Dillingham and Anchorage are shown in Table 24. Additional rates are charged for the use of feeder services to outlying villages. For example, in 1979, the one-way fare from Dillingham to Clark's Point or Aleknagik (each about 15 miles away) was $13.20, about $0.88 per mile; while the one-way fare from Bethel to Hooper Bay or Scammon Bay (respectively, 160 and 150 miles away) was $44.96 or about $0.28 to $0.30 per mile.

TECHNOLOGY

The rate data presented in the previous section and on Table 24 is intended to illustrate the effect of technology on level of service as distance increases. Generally as distance increases, unit distance cost declines. Jumbo jet aircraft such as the Boeing 747 or DC 10, with large passenger capacity and efficiency at high altitudes, provide fast and economical services for long distances. For, example, Northwest Orient's one-way coach fare to Chicago from Anchorage represents a cost of about $0.05/km ($0.08/mile) compared to Wien Air Alaska fares of about $0.20/km ($0.32/mile) between Anchorage and Bethel. Aircraft used by commuter airlines and air taxi operators are unable to compete economically at medium or long distances when adequate demands exist to

TABLE 24

CHARACTERISTICS OF SCHEDULED SERVICE

Link	Anchorage-Bethel	Anchorage-Dillingham
Carrier	Wein	Wein
Kilometers	640.52	531.08
Miles	398	330
One-Way Coach Fare ($)	126.00	110.00
Cost		
¢/km	.1967	.2071
¢/mile	.3166	.3333
Time Elapsed		
Hours	one	one
Minutes	16	8
Average Speed (mph)	314	291

Source: Wien Air Alaska for fare data.

support larger aircraft. The reverse is true for the larger aircraft in that it is difficult for them to compete on routes with many communities and relatively small demand.

According to the WAATS study (L. Berger & Assoc., 1979), major breakthrough 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 small but steady improvement in aircraft operating characteristics and economy.

Ultimately, the financial resources of the airlines may dictate their ability to take advantage of available technology. This is particularly true with respect to the subcontractor airlines providing feeder services who do not have large financial backing and rely on the parent organization for some of their business. It seems more likely that increased applications of existing technologies through improvements in ground-to-ground and ground-to-air communications, as well as, improvements in air navigation and weather reporting, which are several of the goals of the FAA, are likely to have a greater impact on increased aircraft utilization, economy, and reliability of service in western Alaska than will new aircraft technology.

III. BASE CASE FORECAST - DILLINGHAM

This chapter forecasts demands and potential impacts for transportation facilities in Dillingham, supposing that the proposed North Aleutian Shelf lease sale is not held. This base case forecast builds from the Dillingham baseline data provided in Chapter II. One inherent assumption in this study is that changes in demands for transportation services come about as a result of changes in economic activities. Consequently, the chapter begins with a brief narrative of the future economy and population of Dillingham and the region it serves. Following this narrative are sections presenting the transportation demands and requirements forecast for both the marine and air modes. Specific issues and potential impacts are included in the discussion of each mode.

Economy and Population

The methodology used to develop the base case economic and population forecast revolves about the assumption that the economy of Dillingham and the economic region it serves is influenced by exogenous and endogenous events and special projects, as well as by the expenditure patterns of state and federal government, all of which affect basic employment. The methodology also assumes that basic employment affects secondary or supporting services employment and that both basic and secondary employment affect population.

Although the general area of interest in this discussion is the economic region served through Dillingham's marine and aviation port facilities, this region must be recognized as part of the larger Bristol Bay region. This larger Bristol Bay region as shown in Figure 7, includes the Bristol Bay Borough and Dillingham census areas. In the Bristol Bay Borough, marine transportation demands are channeled through Naknek and air transportation demands are channeled through King Salmon. For most of the Dillingham Census Area, including Port Heiden and Togiak, marine transportation demands are channeled through Dillingham, as are air transportation demands for the northern and western portion of the census area. Forecasts of economic growth by the University of Alaska, Institute of Social and Economic Research (ISER - see U of AK, ISER, 1981) were prepared for only the larger Bristol Bay region without distinguishing differences in the smaller sub areas. Forecasts of economic growth by Alaska Consultants, Inc. (ACI, 1981) were prepared for only Dillingham and its immediate surrounding area. Consequently, in order to properly assess transportation demands for the Dillingham facilities, it was necessary to interpolate between these two forecasts and independently develop a forecast for the Dillingham Census Area. In the following paragraphs relevant information from both the ISER and ACI forecasts is presented first followed by the forecast for the Dillingham Census Area.

A significant number of special construction projects and major development events are anticipated statewide over the 20-year forecast period. These projects and events include: four OCS lease sales

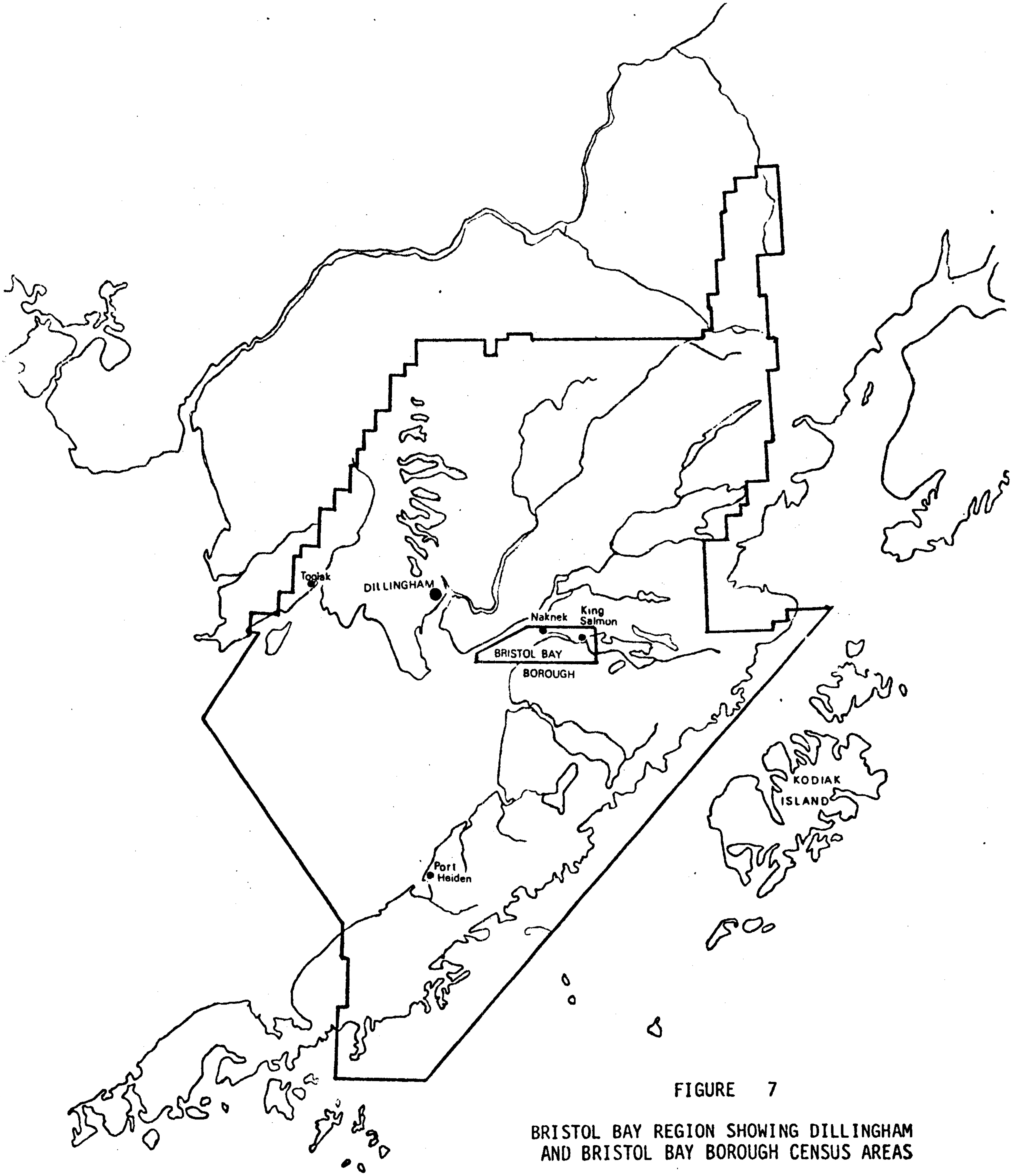

FIGURE 7

BRISTOL BAY REGION SHOWING DILLINGHAM AND BRISTOL BAY BOROUGH CENSUS AREAS (numbers 60, 71, 57, and 70); construction of the Alaska Natural Gas Transmission System; continued development of North Slope petroleum resources, including the Kuparuk and Prudhoe Bay fields, as well as the National Petroleum Reserve; coal development at Beluga-Chuitna; construction of Susitna Dam; and other major projects. However, none of these major activities are located in the Dillingham region, or in areas of the state that would impact on Dillingham. Consequently, these activiies are not expected to directly affect basic employment in the Bristol Bay area. For similar reasons, activities in the agriculture; forestry/lumber, pulp and paper; and non-fisheries manufacturing sectors are not expected to affect the Bristol Bay area. (U of AK, ISER, 1981)

One exogenous activity that will affect growth in the Bristol Bay area and, therefore, the Dillingham region, is fisheries, which include both the harvesting and processing functions. Most of the major expansion of fisheries is expected to take place in the Aleutian Islands due to growth of the groundfish industry, where it is assumed (by ISER) that by 2000 up to 50 percent of the foreign fishing effort within the 200-mile limit is replaced by U.S. fishermen. Spillover effects of this growth are expected to increase exogenous employment in the Bristol Bay area by about eight percent per year between now and 1985 and about four percent per year thereafter. These employment growth figures include construction employment for new port and fish processing facilities. (U of AK, ISER, 1981)

Federal civilian employment is another exogenously driven economic activity in the Bristol Bay area. This sector is forecast to increase a half percent per year throughout the forecast period, thereby following traditional low levels of growth. Federal military employment is expected to remain unchanged. Growth in state government and capital project expenditures, however, largely depends upon state fiscal policy, which can have a far-reaching effect on the different 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 state 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, effecting the growth of employment, income, prices, and migration into the state and region. 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 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. (U of AK, ISER, 1981)

Economic growth within the Dillingham region is expected to focus on continued expansion of the traditional salmon fisheries and emerging herring fishery. Although this growth should be distributed among all fishing communities in the region, some concentration related to the herring fishery can be expected at Togiak, and some additional concentration related to the various salmon fisheries can be expected at Dillingham. Continued recreational development of the Wood-Tikchik State Park should create some additional employment opportunities in the region, but many of these are likely to be concentrated in Dillingham also. Aside from occasional spurts of growth generated by capital construction expenditures, growth in other sectors of the regional economy can be expected to concentrate in Dillingham.

In Dillingham itself, fishing and fish processing should remain the community's major economic activity, while regional services, tourism and recreation, and activities of the regional and local Native corporations are expected to be the major contributors to growth in basic employment. The community's contract construction, government, and services sectors are projected to increase basic employment at a 4 percent annual rate between 1980 and 2000; while transportation, communications and public utilities, trade, and the finance, insurance and real estate sectors are projected to increase basic employment at a 5 percent annual rate during the same period. Secondary employment estimates for Dillingham were developed as a ratio of basic employment: 1:0.6 between 1980 and 1985; 1:0.65 between 1985 and 1995; and 1:0.7 after 1995. (Alaska Consultants, Inc., 1981)

The affect of these trends on future employment levels in Dillingham are shown on the left side of Table 25 expressed as "equivalent annual full-time employment." This term is a way of expressing total annual man-months of employment as a monthly average. This ap, roach smooths seasonal variations. However, since these seasonal variatio are important to air transportation demands, they are discussed as part of that forecast. As show in Table 25, in 1980 basic employment numbered 519, secondary employment 309, and total employment 828 equivalent annual full-time jobs. By 1990, basic employment is expected to grow 28 percent to 665 jobs, secondary employment is expected to grow 40 percent to 432 jobs, and total employment increases 32 percent to 1,097 jobs. By 2000, basic employment grows 72 percent over 1980 levels to 891 jobs, secondary employment grows 102 percent to 624 jobs, and total employment increases 83 percent to 1,515 jobs.

Population growth in Dillingham supporting these various job opportunities is also shown in Table 25. These population forecasts were developed on the basis of ratios between population and

TABLE 25

DILLINGHAM AND DILLINGHAM CENSUS AREA POPULATION FORECAST
NORTH ALEUTIAN SHELF SALE 75 BASE CASE
1980 - 2000

	City of Dillingham(1)					Dillingham Census Area Without Dillingham		Dillingham Census Area(4)	
	Employment(2)								
Year	Basic	Secondary	Total	Population	Community Growth Factors(3)	Population	Growth Factors	Population	Regional Growth Factors
1980	519	309	828	1,563	1.00	3,053	1.00	4,616	1.00
1981	532	323	855	1,635	1.05	3,089	1.01	4,724	1.02
1982	545	337	882	1,707	1.09	3,119	1.02	4,826	1.05
1983	557	351	908	1,780	1.14	3,148	1.03	4,928	1.07
1984	570	365	935	1,852	1.18	3,171	1.04	5,023	1.09
1985	583	379	962	1,954	1.23	3,159	1.03	5,113	1.11
1986	599	390	989	2,000	1.28	3,245	1.06	5,245	1.14
1987	616	400	1,016	2,076	1.33	3,298	1.08	5,374	1.16
1988	632	411	1,043	2,152	1.38	3,348	1.10	5,500	1.19
1989	649	421	1,070	2,228	1.43	3,394	1.11	5,622	1.22
1990	665	432	1,097	2,304	1.47	3,437	1.13	5,741	1.24
1991	685	453	1,138	2,416	1.55	3,530	1.16	5,946	1.29
1992	705	474	1,179	2,527	1.62	3,617	1.18	6,144	1.33
1993	725	494	1,219	2,639	1.69	3,700	1.21	6,339	1.37
1994	745	515	1,260	2,750	1.76	3,777	1.24	6,527	1.41
1995	765	536	1,301	2,862	1.83	3,852	1.26	6,714	1.45
1996	790	554	1,344	2,986	1.91	3,937	1.29	6,923	1.50
1997	815	571	1,387	3,111	1.99	4,019	1.32	7,130	1.54
1998	841	589	1,429	3,235	2.07	4,096	1.34	7,331	1.59
1999	866	606	1,472	3,360	2.15	4,169	1.37	7,529	1.63
2000	891	624	1,515	3,484	2.23	4,236	1.39	7,720	1.67

NOTES:
1. Source of this information is ACI, 1981.
2. Employment numbers shown are "equivalent annual full-time employment." See text for explanation.
3. Growth factors are derived by dividing each subsequent years population by the 1980 population.
4. Dillingham Census Area projections are developed from the Dillingham population forecast assuming the City [illegible] increasing percentage of the regional total. The City population is forecast to increase from 34 to 45 percent of the regional population.

SOURCES: Alaska Consultants, Inc., 1981; ERE Systems, Ltd.

employment. Based on the assumption that a higher proportion of persons in fishing and fish processing become permanent community residents, meaning the replacement of single transients by persons with families, and assuming expected expansion of the City's regional service function, the existing population-employment ratio was assumed to increase. Specifically, the current ratio of 1.9 persons per job was assumed to increase to 2.0 by 1985, to 2.1 by 1990, to 2.2 by 1995, and to 2.3 by the year 2000. The net result is that the population more than doubles during the forecast period from 1,563 persons in 1980 to 2,304 persons in 1990 and 3,484 persons in 2000.

Due to its role as a regional center, Dillingham is expected to grow faster than the remainder of the Dillingham Census Are In 1970, Dillingham's population constituted about 26.2 percent of the ensus area. By 1980, this figure increased to 33.8 percent; an annual average gain of about 0.76 percent per year. For purposes of estimating the future census area population in order to obtain the population in the area outside Dillingham; it was assumed that this annual rate of change would continue at about 0.76 percent through 1985 and then decline to about 0.50 percent for the remainder of the forecast period. This assumption leads to the Dillingham Census Area forecast on the right hand side of Table 25. Population of the Census-Area-without-Dillingham was derived by subtracting the City's forecast from the Census Area forecast.

Water Mode

The discussion in this section seeks to translate the population and economic growth forecast presented in the previous section into an assessment of future marine transportation demands and vessel requirements. A discussion of the positive and negative impacts of these expected changes on the marine transportation facilities available in Dillingham is also included. The discussion is organized to present first the demand and requirements forecast followed by the impacts assessment.

FORECAST OF MARINE TRANSPORTATION DEMANDS AND REQUIREMENTS

The marine tonnage forecast for Dillingham was developed from information presented in Tables 9 and 10, in Chapter II, and Tab[illegible] 25. Three components of marine tonnage demands are considered: inbound; outbound; and throughput, the latter of which is the sum of the first two. These components are further subdivided based on logistical considerations and type of product. Marine tonnage arriving at Dillingham may be redistributed in several different ways. Most of the tonnage is destined for the local population, either directly or indirectly through local shops and stores. A much smaller portion of the inbound tonnage is destined for local shops or stores for subsequent resale to residents of outlying communities, in which case either air or water transportation may be utilized in delivering the commodities. Another portion of inbound tonnage is transshipped directly to residents and stores in coastal and riverine communities or canneries served by regional lighteraging services. Based on these various redistributive demands, inbound tonnage can be defined by the following equation, which is applicable to each major product category:

$$TI = \sum_{0}^{i} TI(i) = \sum_{0}^{i} TCL(i) + TITW(i) + TSTW(i) + TSTA(i)$$

Where:
- i is the variable notation used to identify each product categogy (i.e., fish and shellfish, petroleum, etc.)
- TI is Tonnage Inbound
- TCL is Tonnage Consumed Locally
- TITW is Tonnage Immediately Transshipped via Water
- TSTW is Tonnage Stored locally and Transshipped eventually by Water
- TSTA is Tonnage Stored locally and Transshipped eventually by Air

As a practical matter, tonnage eventually transshipped by air s not separately identified and is assumed to be included in tonnage consumed locally. Also, it is not practical to distinguish between tonnage stored locally and eventually transshipped by water and tonnage immediately transshipped by water, although such a distinction is important in determining the adequacy of available redistribution facilities. For purposes of this study, all tonnage transshipped by water is assumed to be redistributed at the port soon after arrival. These assumptions simplify the above equation to:

$$TI = \sum_{0}^{i} TI(i) = \sum_{0}^{i} TCL(i) + TTW(i)$$

Where:
- i is the variable notation used to identify each product categogy

TI is Tonnage Inbound
TCL is Tonnage Consumed Locally
TTW is Tonnage Transshipped by Water

Outbound tonnage demands consist of the water related transshipped tonnage components discussed above and tonnage that is generated locally and shipped elsewhere. Fish and shellfish products are, for all practical purposes, the only outbound tonnage locally generated. Contaminated petroleum products and construction machinery, as well as some other items also contribute to outbound tonnage, but these are small and occasional amounts that can be ignored in the forecast. Consequently, outbound tonnage can be defined by the following equation:

$$TO = \sum_{0}^{i} TO(i) = \sum_{0}^{i} TGL(i) + TITW(i) + TSTW(i)$$

or simplified:

$$TO = \sum_{0}^{i} TO(i) = \sum_{0}^{i} TGL(i) + TTW(i)$$

Where: i is the variable notation used to identify each product category
TO is Tonnage Outbound
TGL is Tonnage Generated Locally
TITW is Tonnage Immediately Transshipped via Water
TSTW is Tonnage Stored locally and Transshipped eventually by Water
TTW is Tonnage Transshipped by Water

Only three product categories are considered in the analysis: bulk petroleum products, dry cargo products except fish and shellfish, and fish and shellfish products. The analysis begins with outbound tonnage demands and proceeds to local consumption demands, inbound tonnage demands, and finally throughput tonnage demands. Results of the analysis are shown in Table 26 and are discussed in the following paragraphs.

The analysis of outbound tonnage at Dillingham considered all three product categories individually. Petroleum products and dry cargo products other than fish and shellfish are lightered from Dillingham to coastal and riverine communities accessable by boat. These communities include Togiak, Port Heiden, and Koligenek and all coastal and riverine communities between them and Dillingham. Fish and shellfish products may be lightered in the opposite direction. Availa[illegible]e Corps of Engineers' data for Dillingham does not identify products or t[illegible]ages moved by lighters in the Dillingham region.

From data available for other similar western Alaska communities (Nome and Unalaska) it was determined both petroleum and dry cargo categories each varied from three to six percent of total throughput tonnage. For purposes of this study, it was assumed lightered petroleum products were six percent of throughput tonnage and lightered dry cargo products were five percent of throughput tonnage. Because the historic data is based primarily on inbound tonnage, these assumed percentages of throughput tonnage were converted to percentages of inbound tonnage using the inbound-outbound-throughput relationships in Table 10. In Table 10, inbound tonnage is just over 57 percent of throughput tonnage and the above assumptions for outbound petroleum and dry cargo products change

TABLE 26

DILLINGHAM MARINE TRANSPORTATION DEMANDS
NORTH ALEUTIAN SHELF SALE 75 BASE CASE
1980 - 2000

	Outbound Tonnage Demands				Local Consumption Demands			Inbound Tonnage Demands			Throughput Tonnage Demands		
Year	Petroleum Products 1/	Dry Cargo 2/	Fish and Shellfish 3/	Total	Petroleum Products 4/	Dry Cargo 5/	Total	Petroleum Products 6/	Dry Cargo 7/	Total	Petroleum Products 8/	Dry Cargo 9/	Total
1980	1400	800	15200	17400	12600	8400	21000	14000	9200	23200	15400	25200	40600
1981	1500	800	15800	18100	13300	9200	22500	14800	10000	24800	16300	26600	42900
1982	1600	900	16400	18900	14000	9800	23800	15600	10700	26300	17200	28000	45200
1983	1700	900	17000	19600	14700	10500	25200	16400	11400	27800	18100	29300	47400
1984	1800	1000	17500	20300	15400	11200	26600	17200	12200	29400	19000	30700	49700
1985	1800	1100	18000	20900	16300	11800	28100	18100	12900	31000	19900	32000	51900
1986	1900	1100	18400	21400	17000	12500	29500	18900	13600	32500	20800	33100	53900
1987	2000	1200	18900	22100	17700	13200	30900	19700	14400	34100	21700	34500	56200
1988	2100	1300	19300	22700	18400	13800	32200	20500	15100	35600	22600	35700	58300
1989	2200	1300	19700	23200	19100	14500	33600	21300	15800	37100	23500	36800	60300
1990	2300	1400	20000	23700	19800	15100	34900	22100	16500	38600	24400	37900	62300
1991	2400	1500	20400	24300	20600	15800	36400	23000	17300	40300	25400	39200	64600
1992	2400	1500	20700	24600	21400	16500	37900	23800	18000	41800	26200	40200	66400
1993	2500	1600	21000	25100	22100	17100	39200	24600	18700	43300	27100	41300	68400
1994	2600	1700	21300	25600	22800	17800	40600	25400	19500	44900	28000	42500	70500
1995	2700	1700	21600	26000	23500	18500	42000	26200	20200	46400	28900	43500	72400
1996	2800	1800	21900	26500	24200	19100	43300	27000	20900	47900	29800	44600	74400
1997	2900	1800	22200	26900	25000	19800	44800	27900	21600	49500	30800	45600	76400
1998	3000	1900	22400	27300	25700	20500	46200	28700	22400	51100	31700	46700	78400
1999	3000	2000	22700	27700	26500	21100	47600	29500	23100	52600	32500	47800	80300
2000	3100	2000	22900	28000	27200	21800	49000	30300	23800	54100	33400	48700	82100

NOTES:
1. Derived as 10.49 percent of inbound petroleum tonnage.
2. Derived as 8.74 percent of inbound dry cargo tonnage.
3. Derived from:
   Outbound Fish and Shellfish Tonnage = - 2632.9 + 7456.3[Log (X)]
   Where X is number of years since 1969 (for 1970, X = 1).
4. Derived as the difference between inbound ar. outbound petroleum product tonnages.
5. Derived as the difference between inbound and outbound dry cargo tonnages.
6. Derived from:
   Inbound Petroleum Products Tonnage = 5041.02 + 816.47(X)
   Where X is number of years since 1969 .or 1970, X = 1).
7. Derived from:
   Inbound Dry Cargo Tonnage = 1284.64 + 728.65(X)
   Where X is number of years since 1969 (for 1970, X = 1).
8. Derived by adding inbound and outbound petroleum product tonnages.
9. Derived by adding outbound dry cargo and fish and shellfish tonnages to inbound dry cargo tonnage.

SOURCE: FRE Systems, Ltd.

to 10.49 percent and 8.74 percent of inbound tonnage, respectively. The outbound tonnage forecast for these two products, as shown in Table 26, were then derived directly from the inbound tonnage forecast discussed later in this subsection.

The marine tonnage demand forecast for outbound shipments of fish and shellfish products depends to a large extent on the volume of fish processed in the region and shipped through Dillingham. Currently, both the salmon and herring fisheries generate fish product tonnage demands with the salmon fishery predominant by far. In the future, both fisheries are expected to grow with salmon continuing to be the dominant tonnage generator. The volume of locally processed salmon depends, in part, on several important factors including: the capacity of existing shorebased and floating processing plants; the balance between market demands for processed versus fresh fish; the volume of fish allowed to be caught each year; and the time reqired to catch the allowable limit. Market trends within the salmon industry seem to indicate a consumer preference for a fresh or frozen product rather than a canned product. Yet, demand for both type products has remained strong and is expected to continue. In years of low catch volume, however, it is more difficult to maintain a balance between fresh and canned products and in years of high catch volume more fresh fish are made available. Since fresh salmon remain marketable for only three or four days depending on how they are handled, fresh fish are moved out of the Dillingham region by air transportation. When local processing plants are operating at or near capacity, fresh fish are also moved by air to other processing plants in Alaska and Washington. Once the salmon are processed, however, it is cost effective to use water transportation because processed fish are less susceptible to spoilage.

In recent years fish stocks have begun to rise to near-record levels. With the 200-mile limit restricting foreign participation and hatcheries improving fish return rates, it might be concluded that salmon product tonnages could continue to grow following a straight line equation. Yet, if a straight line equation of the type Y = a + b(x) were regressed against historic fish and shellfish tonnage data shown in Table 9, the coefficient of determination r^2 would be 0.41 indicating a rather poor fit. It seems more logical to assume that a biological catch limit is likely to be reached in the future; thereby limiting continued expansion of catch size. Similarly, it seems unlikely that significant additional processing capacity will be provided in the Dillingham area, since plants in this and other nearby areas are underutilized most of the year. For this reason and others, flying salmon to plants in other less remote areas makes more sense economically. Collectively, these trends and other factors indicate continued growth in water transported fish tonnage, but at a continuously declining rate year to year.

The expected growth curve for fish and shellfish tonnage can be represented by an equation of the form:

$$Y = a + b[\text{Log }(X)]$$

Where: Y is marine fish and shellfish tonnage
a and b are constants

X represents the year.

When this equation is regressed against historic fish and shellfish product demands for Dillingham, as shown in Table 9, the resulting coefficient of determination r^2 equals only 0.20 indicating a very poor fit. To compensate for the fact that historic data does not reflect expected future trends, it was assumed that fish tonnage demands for 1990 would be maintained at the historical annual average rate of 35 percent of throughput tonnage and for 2000 would decline to 30 percent of throughput tonnage. Throughput tonnage for 1990 and 2000 was estimated using a straight line projection of historic throughput tonnage (Table 9). The resulting estimate of fish produc' tonnages were then included with the historic data and the above growth curve again regressed against this new information. The result was the fol.owing equation:

$$Y = -2632.9 + 7456.3[\text{Log}(X)]$$

Where: Y is marine fish and shellfish tonnage as shown in Table 26
X is the number of years since 1969 (for 1970, X = 1)

Total outbound tonnage demands represent the sum of outbound petroleum products, dry cargo, and fish and shellfish products. By 2000, total outbound demands increase 61 percent from an estimated 1980 level of 17,400 tons to a 2000 level of 28,000 tons. Over the same period, tonnage demands among the individual components increase as follows:

petroleum products, 121 percent; dry cargo products, 150 percent; and fish and shellfish products, 51 percent.

Local consumption demands were based on the difference between forecast outbound and inbound tonnage demands. Locally consumed petroleum product tonnage increases 116 percent over the twenty-year period and dry cargo product tonnage increases 160 percent. These compare favorably with the expected 123 percent increase in local population over the forecast period.

Inbound tonnage demands were forecast independently of other components based on historic data (see Table 9). Data for 1973 and 1974 were assumed to be non-representative and were excluded. The resulting data produced the following straight line equation with coefficient of determination r^2 equal to 0.84:

$$IPP = 5041.02 + 816.47(X)$$

Where: IPP is Inbound Petroleum Products tonnage demands
X is the number of years since 1969 (for 1970, X = 1)

Similarly, for inbound dry cargo tonnage, a straight line equation was regressed against historic data (without exclusions) producing the following equation with a coefficient of determination r^2 of 0.41:

$$IDC = 1284.64 + 728.65(X)$$

Where: IDC is Inbound Dry Cargo tonnage demands
X is the number of years since 1969 (for 1970, X = 1)

The effects of these equations on inbound tonnage can be seen in Table 26. Petroleum product tonnage increases 116 percent from an estimated level of 14,000 tons in 1980 to 30,300 tons in 2000. Dry cargo product tonnage increases 159 percent from an estimated level of 9,200 tons in 1980 to 23,800 tons in 2000.

Throughput tonnage combines inbound and outbound tonnage estimates, as shown in Table 26. Throughput tonnage demands for petroleum products in 2000 increase 117 percent over estimated 1980 demands. Throughput tonnage demands for dry cargo products, which include fish and shellfish products, are estimated to increase only 93 percent between 1980 and 2000. Total throughput tonnage over the same period doubles, increasing 102 percent.

Using the tonnage demand information in Table 26, an estimate of future commercial vessel activity at Dillingham was prepared. This estimate, shown in Table 27, looks at the number of inbound vessels but can also be interpreted as vessel round trips. Both commercial tanker and general cargo barges are forecast, together with tug or tow operations. Although petroleum products are assumed to be delivered via tanker barges with an average capacity of 7,000 tons (50,050 bbl.), the average load delivered at Dillingham represents only a small part of that capacity since other communities are served as well. From historic data, it was determined that the average petroleum product load delivered at Dillingham ranged between 1,500 tons and 1,900 tons, with a median value of about 1,700 tons. It was also determined that the average size load has been increasing over time with the average change each year ranging between 50 tons and 100 tons. It was assumed that the average annual increase in the average load would be 70 tons. Similar trends exist in the use of general cargo barges: the average load ranges between 500 tons and 600 tons with an annual increase ranging between zero and 60 tons per year. For analysis purposes it was assumed the average annual increase was 30 tons.

Applying the above assumptions to the inbound tonnage forecast in Table 26 produces the tanker barge and general cargo vessel activity forecast in Table 27. Over the 20-year forecast period, the number of tanker barges visits grows from 8 to 10, a 25 percent increase in trip making, while the average load size grows from 1,700 tons to 3,100 tons, an 82 percent increase. Over the same period the number of general cargo vessel visits grows from 15 to 20, a 33 percent increase, while average load size grows from 600 tons to 1,200 tons, a 100 percent increase. The implications of these expected changes on Dillingham's port facilities is discussed in the next subsection.

With respect to expected tug or tow operations at Dillingham, historic data suggests a relationship ranging from 1.17 to 1.36 one-way tug trips per barge visit. The trend is toward a declining ratio with lower values being more recent. To simplify calculations it was assumed this value remained steady at 1.2 one-way tug trips per inbound barge visit. Application of this ratio to the inbound tanker barge and general cargo forecast in Table 27 produces the tug or tow activity forecast in the right hand column of the table. One-way tug operations are expected to increase from a level of 28 trips in 1980 to 36 trips in 2000, a 29

TABLE 27

DILLINGHAM COMMERCIAL VESSEL ACTIVITY FORECAST[1/]
NORTH ALEUTIAN SHELF SALE 75 BASE CASE
1980 - 2000

Year	Tanker Barges[2/]	General Cargo[3/]	Tug or Tow[4/]
1980	8	15	28
1981	8	16	29
1982	8	16	30
1983	9	17	30
1984	9	17	31
1985	9	17	31
1986	9	17	32
1987	9	18	32
1988	9	18	32
1989	9	18	33
1990	9	18	[illegible]
1991	9	19	33
1992	9	19	34
1993	9	19	34
1994	9	19	34
1995	10	19	35
1996	10	19	35
1997	10	19	35
1998	10	20	35
1999	10	20	35
2000	10	20	36

NOTES:
1. Forecast does not include lighterage barges.
2. Average load size per barge changes 70 ST per year from a 1980 level of 1,700 ST per barge.
3. Average load size per barge changes 30 ST per year from a 1980 level of 600 ST per barge.
4. Based on the relationship of 1.2 tugs per barge.

SOURCE: ERE Systems, Ltd.

percent increase.

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.

There is a general concern in the Bristol Bay 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 servic two elements of the community itself are important: tonnage demand and available marine facilities. The latter element encompasses docks, warehouses, and equipment serving both. The kinds of facilities available in each community vary considerably in size, age, and ownership. Few communities have public docks or storage facilities adequate for their intended purpose. Inadequate public facilities are difficult to maintain and, due to the remoteness of this area, such 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.

Where facilities are inadequate or missing, the cost of providing transportation services increases. There may be several reasons for increased costs: the service requires special equipment (such as lighters); because the operation becomes more labor-intensive; or the service causes delays of the larger more expensive line haul vessels. 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 due to minimum size load standards. Communities that are larger because of seasonal fishing activities have higher inbound demands and produce fish products for outbound shipment, such as at Dillingham. 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 operating 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, packing, and repacking at transshipment points, 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 federally subsidized service and an infrequent one.

As a way of offsetting poor marine freight service 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 area 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 accomodations 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 2.4 x 2.4 x 6.1 meter (8 x 8 x 20 foot) modules is proposed for this system. The north side vessel would carry 25 passengers and 40 container equivalents up to an 800 ton payload. The south side vessel would carry 50 passengers and 85 container equivalents up to a 1,700 ton payload. The system could require extensive improvements to existing berthing facilities in all but Anchorage, Kodiak, Port Lions, Naknek and Unalaska-Dutch Harbor. At Dillingham the ferry would use the planned new City 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 entire system at this time, however, they have begun regular service over part of the southern route. 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, but it may be a long time before the full benefits come to Dillingham, if at all.

Expected growth in the region and in Dillingham should not create significant adverse impacts on the regional marine transportation system, although many of the region's marine transportation facilities need improvement. State and local efforts at maintaining or improving the regional distribution centers, such as Dillingham, are vitally important if the marine transportation system is to continue to function at an acceptable level of service. The recent addition to the staging area and planned construction of a new dock at Dillingham should provide most of the necessary facilities to meet expected regional growth through 2000. The enlarged staging area will provide badly needed storage space for containers and should increase space available on the older dock. The new dock, if built to its originally proposed size, will be able to unload two ocean barges at a time, with additional equipment and a second crew. This ability should greatly improve turnaround times on these barges. The design also provides the capability to unload an ocean barge and load a river barge simultaneously, thus improving the efficiency of transhipment activities. With the addition of a crane at the new dock whole containers can be placed on the lighters reducing the need to break up bulk load shipments. This feature also allows transhipment repacking activities to be accomplished on the apron away from the dock area since vans instead of the lighters themeselves are being packed.

One continuing problem, however, will be lack of covered space to aid repacking of the vans. As discussed in Chapter II, no marine warehouses currently exist in Dillingham although current demand could be as high as 1,394 square meters (15,000 square feet). Since outbound dry cargo tonnage demands are expected to increase 250 percent by 2000, the demand for warehouse space could reach 2,787 to 3,484 square meters (30,000 to 37,500 square feet). Although, other factors mitigate this demand. For example, as loads to outlying communities increase, the likelyhood of full van loads being packed in Seattle instead of being repacked in Dillingham also increases. On the other hand, some factors support a greater demand level. For example, with more cargo arriving on each barge, late season cargo could create a significant demand for over-winter storage space.

These planned improvements will not affect the bulk petroleum facility owned and operated by Chevron Oil. Since this facility operates on a demand basis and draws fuel supplies principally from Unalaska/Dutch Harbor, forecast fuel demands are not expected to create a serious storage or resupply problem. Problems are more likely to arise if fuel supplies cannot be redistributed quickly enough during the short shipping season. Since the volume of products to be moved is small and most communities served are nearby, the redistribution of petroleum products should also not be a problem.

Another area of potential conflict could be crowding in the river approach and departure routes and in the vicinity of the dock. In addition to the tugs, barges, and lighters, floating processors are anchored in the river and numerous fishing boats are moving in the river. The City currently uses floats to identify the maneuvering and approach areas in the vicinity of the dock. Fishing boats already crowd three and sometimes four deep at the existing dock awaiting services. Crowding at the dock should be relieved somewhat with construction of the new dock, particularly during periods when only one barge or no barge is at the new facility. In the river, however, the pace is frantic at the height of the fishing season. As allowable catch limits rise, the number of processors and fishing boats may rise as well. In combination with increased commercial vessel activity, the probability for a collision is increased and so to the rates for marine insurance. In this study, however, no attempt has been made to identify the change in collision probability for forecast economic changes, since considerable additional information about the number of boats, their sizes, and routes would be needed.

AIR MODE

As the primary people mover, air transportation is expected to play an increasingly important role in future development of the Dillingham 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 meet the demands of forecast population changes and the adequacy of available facilities and equipment to meet expected demands. Several determinants of demand are forecast and evaluated including: emplaned passengers, air freight, air mail, and airport operations.

FORECAST OF AIR TRANSPORTATION DEMANDS AND REQUIREMENTS

This forecast of regional air transportation demands and requirements at Dillingham is built upon the regional and community level population and economic growth forecasts presented earlier in this chapter. The following material is organized to present, first, general assumptions about the overall system and system operational characteristics and, second, the detailed forecast for Dillingham.

The existing regional aviation system serves passenger and air freight movements within the region, as well as between the region and Anchorage. The air route structures already established by the air carriers and air taxi operators were assumed not to change. The linehaul linkage to Anchorage is considered the most significant with respect to any poential OCS activities. Dillingham is expected to continue and grow as the regional transfer point. The linehaul air carriers are assumed to continue to base their aircraft in Anchorage; local air carriers and air taxi operators are expected to continue to base their aircraft in the region.

The kinds of equipment used by air carriers and air taxi operators is expected to change little over the forecast period. Operators are expected to emphasize increased utilization of equipment as an initial means for improving capacity. Linehaul air carriers operating between Dillingham and Anchorage are expected to continue using B-737 aircraft configured for combined passenger and freight operations. Seating capacity in this configuration is assumed to be 126, but with an operational load factor of 80 percent only 101 seats are assumed to be utilized. Since linehaul air carriers serving Dillingham also serve King Salmon on the same route, the entire seating capacity of an aircraft is not available to Dillingham bound or boarding passengers. From historic data it was estimated that on an annual average basis, seating available to Dillingham boarding passengers ranged from 22 percent to 41 percent of available seating with an average of about 31 percent. The average rate of 31 percent was assumed as the load factor in determining seats available to Dillingham bound or boarding passengers.

Local air carrier routes are expected to continue to be served by aircraft with less than 10 seats. Presently, almost 90 percent of operations are performed by aircraft with only four seats or less and the average number of seats available per aircraft is estimated at 4.58. The average number of emplaned passengers per local air carrier aircraft at Dillingham is less than one (0.8972), so that current passenger load factors are about 20 percent. This ratio is not expected to change significantly over the forecast period. However, the average size aircraft is expected to increase somewhat as operators replace older equipment, but any potential gains in seating capacity are expected to be mostly offset by increases in freight demands.

Generally, the growth in emplaned passengers and freight is assumed to increase proportionally with expected economic and population growth. This relationship is expressed through the Dillingham community growth factors identified earlier in Table 25. These growth factors were used to forecast passenger emplanements through 2000 as shown in Table 28. Based on this relationship, passenger emplanements at Dillingham in 2000 are expected to more than double 1980 levels, increasing 123 percent.

Peak period passenger travel demands coincide with the fishing season and generally occur during a four to six week period spanning July and August. Since the fishing season is short, demands are concentrated in a small time period and peak more sharply. Normally, 15 percent of annual emplanements might be expected during this peak period. However, because of the sharp peaking characteristic, it is assumed that up to 20 percent of annual emplaned passenger demands occur during this period. During the peak week within this peak period, emplanements could range from 25 to 30 percent of total peak period emplanements with an assumed likely average of 27.5 percent. From these assumptions, peak week emplanements constitute about 5.5 percent (0.20 x 0.275) of annual emplanements. This relationship was used to develop the peak week forecast in Table 28. Since these values are proportional to annual emplanements they exhibit similar changes over time.

Expected changes in air freight and air mail tonnage demands are also shown in Table 28. Based on the historic data in Table 18, air freight demands have averaged about 720 tons with a standard deviation of about 21 percent plus or minus; while air mail demands have averaged about 500 tons with a standard deviation of about 38 percent plus or minus. Using these averages to represent 1980 demand levels, air freight and air mail tonnage was forecast using FAA's Alaska-wide assumptions for growth in these demands: five percent per annum on air freight and three percent per annum on air mail (U.S.DOT, FAA, 1981). Based on these assumptions air freight tonnage demands are expected to increase 163 percent between 1980 and 2000, while air mail tonnage demands increase 178 percent over the same period.

An estimate of future aircraft operations at Dillingham is also provided in Table 28. Operations were estimated for air carrier, air taxi, and general aviation activities, total annual operations, and peak day

TABLE 28

DILLINGHAM AIR TRANSPORTATION DEMANDS
NORTH ALEUTIAN SHELF SALE 75 BASE CASE
1980 - 2000

Year	Passenger Enplanements: Total Annual(1)	Passenger Enplanements: Peak Month Average Week(2)	Annual Air Freight Tonnage Demands(3)	Annual Air Mail Tonnage Demands(4)	Estimated Aircraft Operations: Air Carrier: Line Haul(5)	Air Carrier: Local(6)	Air Taxi(7)	General Aviation: Fish Related(8)	General Aviation: Other(9)	Total Annual(10)	Peak Day(11)
1980	18000	990	720	500	1020	4000	10040	1250	46390	62700	340
1981	18800	1030	756	515	1060	4140	10790	1280	48530	65800	360
1982	19600	1070	793	530	1080	4300	11560	1300	50660	68900	370
1983	20400	1120	832	545	1120	4460	12410	1330	53080	72400	390
1984	21300	1170	873	561	1140	4660	13340	1370	55790	76300	410
1985	22500	1230	916	577	1200	4900	14480	1420	59300	81300	440
1986	23000	1260	961	594	1200	5000	15190	1420	60890	83700	450
1987	23900	1310	1009	611	1240	5200	16260	1450	64050	88200	480
1988	24700	1350	1059	629	1260	5360	17210	1470	66600	91900	500
1989	25600	1400	1111	647	1300	5560	18350	1490	69900	96600	520
1990	26500	1450	1166	666	1320	5740	19410	1510	72820	100800	550
1991	27800	1520	1224	685	1360	6020	20840	1550	77130	106900	580
1992	29100	1600	1285	705	1420	6300	22380	1580	81820	113500	620
1993	30300	1660	1349	726	1460	6560	23850	1610	86220	119700	650
1994	31600	1730	1416	747	1500	6820	25370	1630	90680	126000	690
1995	32900	1800	1486	769	1540	7100	27000	1660	95600	132900	720
1996	34300	1880	1560	792	1600	7400	28800	1680	101120	140600	770
1997	35800	1960	1638	815	1640	7720	30650	1700	106790	148500	810
1998	37200	2040	1719	839	1680	8020	32490	1720	112490	156400	850
1999	38600	2120	1804	864	1720	8320	34380	1720	118360	164500	900
2000	40100	2200	1894	889	1780	8640	36470	1730	124980	173600	950

NOTES:
1. Based on community growth factors for Dillingham as set out in Table 25.
2. Peak month is assumed to be 20 percent of annual emplaned passengers. The average week is assumed to be 27.5 percent of peak month emplanements.
3. Assumes five percent increase per annum based on FAA assumptions for State as a whole (USDOT, FAA, 1981).
4. Assumes three percent increase per annum based on FAA assumptions for State as a whole (USDOT, FAA, 1981).
5. Derived from:

$$\text{Line Haul Air Carrier Operations} = \frac{\text{Annual Enplanements} \times 0.9 \times 2}{101\,[\,0.31 + 0.0045\,(t)\,]}$$

where: annual emplanements are as defined above; the factor 0.9 assumes 90 percent of annual air carrier emplanements are on line haul air carrier aircraft (typically a B-737); the factor 2 assumes arrivals equal departures; the factor 101 represents available seating on a B-737 at 80 percent load; the factor 0.31 represents the percentage of seats available at Dillingham; and the factor 0.0045 (t) represents additional seats available at Dillingham over time t years from 1980.

6. Derived from:

$$\text{Local Air Carrier Operations} = \frac{\text{Annual Enplanements} \times 0.1 \times 2}{0.8972 + 0.1\,\text{Ln}\,(t)}$$

where: annual emplanements are as defined above; the factor 0.1 assumes 10 percent of annual air carrier emplanements are on local air carrier aircraft; the factor 2 assumes arrivals equal departures; the factor 0.8972 represents available seating on the typical smaller aircraft used by local air carriers; the factor 0.1 Ln(t) represents additional seating available over time t years from 1979.

7. Derived from:

Air Taxi Operations = Air Carrier Operations x [illegible] x 0.075(t)

where: air carrier operations include both line haul and local opera.ions; the factor 2 assumes air taxi operations are initially twice as high as air carrier operations; the factor 0.075(t) assumes air taxi operations grow faster than air carrier operations by 7.5 percent per year t from 1980.

8. Fish related operations are assumed to initially be two percent of total annual operations, but this percentage is assumed to decrease by the factor 0.0005(t), where t is the number of years since 1980.
9. Includes all other general aviation operations and training flights and is derived as the difference between total annual operations and all other previously defined operations.
10. Derived from air carrier forecast assuming air carrier operat[illegible] [illegible]e initially 8 percent of total operations, but that air carrier operations decline as a percentage of tot[illegible] operations by the factor 0.001(t) per year t from 1980.
11. Peak daily operations are assumed to be twice annual daily average operations.

SOURCE: ERE Systems, Ltd.

operations. The air carrier operations forecast for both linehaul and locally oriented air carriers was based on forecast passenger emplanements and the previously discussed assumptions about aircraft seating capacity and seating availability. Ninety percent of passenger emplanements were assumed to use linehaul air carrier aircraft and ten percent were assumed to use local air carrier aircraft. The respective emplanements were converted to departures by dividing by the different representative aircraft capacities. These departures were then doubled to obtain both landings and departures assuming they are equal. The equations and component factors used in developing these air carrier forecasts are identified and described in Notes 5 and 6 of Table 28. From these equations linehaul air carrier operations increase 29 percent by 1990 and 75 percent by 2000, while local air carrier activities increase 44 percent by 1990 and 116 percent by 2000. When linehaul and local operations are combined, air carrier operations increase 41 percent by 1990 and 108 percent by 2000.

The air taxi operations forecast was developed through assumptions about the relationship of these activities to air carrier operations based on historic data. Air taxi operations are presently at a level approximately twice as high as air carrier operations. In the future, air taxi operations are expected to grow at a faster rate than air carrier operations. A 7.5 percent per year faster rate was assumed. These assumptions lead to the equation in Note 7, Table 28. Applying this equation produces a 93 percent increase in air taxi operations by 1990 and almost a four-fold increase (263 percent) by 2000, a growth rate that seems quite high. However, when compared to FAA's 1990 forecast of a 75 percent increase (discused in Chapter II), the difference is only two years growth.

In forecasting general aviation activity, an attempt was made to separately account for fishing related aviation activities which FAA records as transient general aviation. Fishing related aviation activities are significant because of the sharp peaking characteristics they exhibit and the kinds of aircraft employed. At the height of the fishing season up to 50 aircraft may be on the ground loading fish or waiting to load. These aircraft include an assortment of DC-3's, DC-4's, DC-6's, C-46's, Convair 440's, Electra 188's, Lockhead C-130 Hercules, and B-737's with cargo payloads ranging from 6,000 to 45,000 pounds. Additional smaller aircraft are used for spotting fish. As discussed earlier, consumer demands for fresh fish and continued high yield harvests are expected to place increasing reliance on air transportation to move fresh fish to world markets and to processing plants in other areas of the state. Although the fish harvest and, therefore, fishing related flight requirements vary year to year, it was assumed that such flights constitute about 2 percent of annual operations in 1980 and that this percentage is likely to decline each year as other aviation activities grow. The decline each year was assumed to be 0.05 percent, which over 20 years reduces the fishing related operations to one percent of annual operations. Actual operations over the forecast period increase, however: 21 percent by 1990 and 38 percent by 2000.

Other general aviation activities, including training operations, were derived as the difference between total annual operations and all previously defined operations. No attempt was made to separately look at changes to other transient aircraft operations or to based aircraft or training activities.

Total annual operations were derived from the air carrier forecast assuming air carrier operations are initially eight percent of total operations. This percentage was assumed to decline one-tenth of one percent per year because other operations in the total mix of activities are growing faster than air carrier operations. Due to these assumptions, total annual operations are seen increasing 61 percent by 1990 and 177 percent by 2000. Peak day operations were also forecast assuming such operations to be twice annual daily average operations. Because of this relationship peak daily operations exhibit the same growth rates over time.

AIR TRANSPORTATION IMPACTS AND ISSUES

As discussed in the previous subsection, forecast economic and population changes are expected to significantly increase demands on the air transportation system operating through Dillingham. It is also clear that the expected growth in demands are not equally distributed among various sectors of the aviation industry just as many of the existing problems are not equally distributed. What is important to note, however, is that some key growth areas coincide with key problem areas and such situations are likely to exacerbate existing problems.

Both governmental agencies and the airlines in Alaska share responsibility for current problems and their solution. The following discussion seeks to identify specific issues and possible impacts, agency / airline responsibilities, and current actions working toward reducing future impacts.

Of key interest to this study are segments of the aviation system likely to be impacted at some point by OCS activities . Because of its inland location, Dillingham is unlikely to play a major role as a marine service base. If Dillingham plays any role in OCS development at all, it is likely to be one of the following: 1) the City could be an enroute stopover for OCS employees flying a commercial air carrier route between a coastal location near the lease sale area and Anchorage or 2), the City may become a transfer point, where OCS employees change from a chartered aircraft plying a route between Dillingham and a coastal location near the lease sale area to a line haul air carrier plying a route between Dillingham and Anchorage.

Based on these potential roles in future OCS development, segments of the existing regional air transportation system of interest to this study are: the line haul air carrier system linking OCS areas to Dillingham and through there to Anchorage; and local air carrier and air taxi systems linking Dillingham to OCS activity areas. Other sectors of the aviation system are affected only indirectly, if at all, and are disregarded for purposes of this analysis.

Generally, line haul air carriers serving Dillingham provide a high level of service in that they operate larger and faster aircraft, typically jets, and are a part of a larger interregional or interstate air transportation system. Because of these characteristics, line haul air carriers serve only regional centers or major cities and require high passenger volume routes to offset high operating costs. At the same time, they can provide certain amenities on one route and not on another by spreading costs over many routes and they have greater access to capital resources when it comes to major improvements to operating equipment. In short, they are generally in a very good position to handle increasing line haul air carrier passenger demands.

In the Dillingham region, air taxi operators and local air carriers who operate like an air taxi with a schedule, offer quite a contrast to line haul air carriers. These operators are regionally oriented and erve much smaller communities where air transportation is the only transportation. They typically operate small four or six place aircraft with no frills in order to maintain relatively low operating costs. Landing facilities in most communities are inadequate and poorly maintained; these facilities lack weather reporting systems and are restricted to visual flight rules for lack of lighting. The airlines are too small to maintain extensive communications systems and their access to capital markets is restricted. Additional travel demands would be great for business, but in many cases they don't have the financial ability to expand operations and take advantage of the situation, and/or they are restricted by the physical limitations of facilities in the communities or along the routes they serve.

Local, state and federal agencies can normally do little to directly influence the financial ability of an air taxi operator to take advantage of a growth situation. They can and do, however, have the ability to directly influence the physical conditions within which the operators function. The FAA, who is responsible for air navigation and safety, lacks full navigational coverage in parts of western Alaska. While this situation is likely to be remedied over the next several years, the navigation and lighting problems at small community airports will not. Like most public agencies, FAA is financially constrained and projects throughout the State and Nation are subject to competing priorities. One FAA project that may ultimately help operators serving small communities is an automated weather reporting system. The FAA currently plans to begin testing such systems in Alaska in 1982 (Alaska Journal of Commerce and Pacific Rim Reporter, 1981b). If successful, implementation of these systems in smaller communities should improve aircraft scheduling and utilization, as well as safety. Other navigation improvements for selected airports in the Dillingham region are identified in FAA's most recent "Ten-Year Plan For Alaska" (USDOT, FAA, 1980).

Yet, improved navigation aids alone cannot overcome limitations of the ground facilities. The Alaska Department of Transportation and Public Facilities (ADOT/PF) has reponsibility for construction, maintenance, and operation of public airport facilities in the state. Runways, aprons, and other physical plant items deteriorate due to weather, soil conditions, and use by aircraft, among other factors. The remoteness of most small communities contributes significantly to the problem of maintaining these facilities in top condition. Because of the remoteness, both construction and maintenance are expensive. To offset the maintenance problems created by the location of these facilities, standards for new construction are set higher than normal. This, in turn, means fewer new projects are built and fewer airports receive necessary maintenance when needed.

At Dillingham, as at all other airport locations, the FAA and ADOT/PF work together to resolve inportant problems. For the period through 1990, FAA has identified several improvements for the Dillingham airport including: medium intensity approach lights; runway end identification lights for runway 1; an aircraft control tower; expansion of the passenger terminal; and improvements to clear zones, fencing, and other items (USDOT, FAA, 1981). ADOT/PF in its airport layout plan (see Figure 6) has also identified several potential improvements: future construction of a 2,500 foot gravel crosswind runway, primarily designed for general aviation activities; reservation of 6.2 hectares (2.5 acres) for future construction of another air carrier passenger terminal; plus improvements to several aprons. As reported in Chapter II, runway 1-19, related taxiways, and the existing air carrier apron recently have been paved. Without specifying when, Wein Airlines has apparently indicated to ADOT/PF that it has sufficient space for expected passenger growth, but expects to add terminal space for handling cargo. Wein is also planning to increase its jet fuel storage capacity from 3,000 gallons to 15,000 gallons (Wood, 1981). If these planned improvements occur over the next ten to fifteen years, it appears unlikely that the expected growth in aviation demands at Dillingham will cause any seriously adverse impacts.

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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 accomodations 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 ommercial maritime service:

- 7.79 cubic meters (275 cubic feet), measuring 2.36 x 1.96 x 1.96 meters (7'-9" x 6'-5" x 6'-5").

- 25.49 cubic meters (900 cubic feet), measuring 5.18 x 2.44 x 2.44 meters (17'-0" x 8'-0" x 8'-0").

- 56.64 cubic meters (2,000 cubic feet), measuring 10.67 x 2.44 x 2.44 meters (35'-0" x 8'-0" x 8'-0").

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 used 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, or bulkhead, or in European 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 a 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 in this report, 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 passengers or 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 by freighters, the terminal is commonly referred to as a Freight or Cargo terminal, but may also be a 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 loading and 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 wharves 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 Services: Roll on Roll off service. Ships providing this service have side or end doors to permit vehicles to be driven on or ff. Typically, in cargo applications, trailers are loaded by 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 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.

I-Head 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 an L-shaped pier depending upon whether the tressel connection is at the center or at the end.

Wharf or Quay: A dock which parallels the shore.

Williwaw: A sudden violent wind.