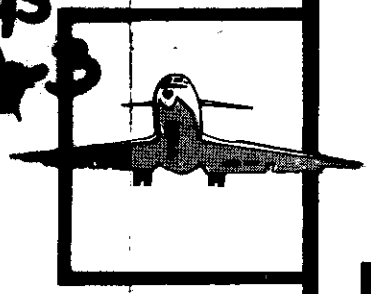

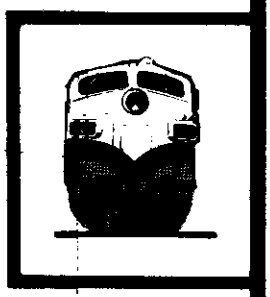

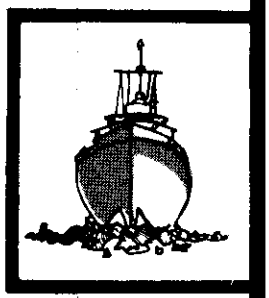

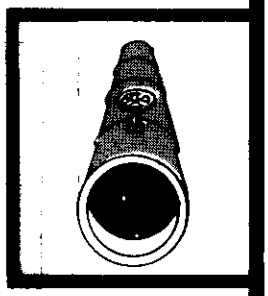

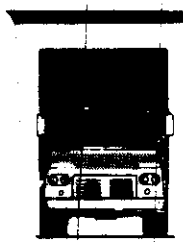

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SPECIAL STUDY

AIR TAXI SAFETY IN ALASKA

NTSB-AAS-80-3

UNITED STATES GOVERNMENT

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16. Abstract

This report details the results of a National Transportation Safety Board study of air taxi accidents which occurred in Alaska from 1974 through 1978. Accident data from the Safety Board's automated aviation accident data system for that period were analyzed by means of frequency distributions. Safety Board staff also visited Alaska and met with officials of the Federal Aviation Administration, the National Weather Service, the Alaska Department of Transportation and Public Facilities, the Alaska Air Carriers Association, and 17 air taxi operators. The data revealed that the nonfatal air taxi accident rate (per 100,000 flying hours) in Alaska is almost five times higher, and the fatal rate more than double, the air taxi accident rate in the rest of the United States.

The Safety Board study concluded that there are three major factors responsible for the high air taxi accident rate in Alaska: (1) the "bush syndrome," (2) inadequate airfield facilities and inadequate communications of airfield conditions, and (3) inadequate weather observations, inadequate communications of the weather information, and insufficient navigation aids.

Five recommendations for corrective action were made to the State of Alaska, four to the Federal Aviation Administration, and one to the Alaska Air Carriers Association.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

SPECIAL STUDY

Adopted: September 16, 1980

AIR TAXI SAFETY IN ALASKA

INTRODUCTION

Alaska has many unique characteristics. Probably Alaska's most striking characteristics are its vast size and small population. Alaska covers 586,412 square miles, making it the largest State. On the other hand, it has the smallest population of any State with only slightly over 400,000 inhabitants. Outside of population centers, roads connecting all but a few cities are rare, and there are virtually no roads in western Alaska. Almost everything that is required for survival, including food, clothing, medicine, consumer products, and in some cases heating oil, must be supplied by air transportation to many rural communities. Therefore, flying is a necessary way of life. Alaska has more licensed pilots and aircraft per capita than any other State.

The Civil Aeronautics Board has determined that 233 communities in Alaska, including 102 in western Alaska, are entitled to a minimum level of air transportation service. This essential service is supplied primarily by the air taxi industry which includes commuter air carriers and on-demand air taxi operators. Air taxi aircraft in Alaska account for about 10 percent of the total air taxi flying hours in the United States.

Alaska, however, has an air safety problem. From 1974 through 1978, the general aviation 1/ accident rate (based on 100,000 hours flying time) for Alaska was more than double the rate for the rest of the United States. More importantly, about 30 percent of all air taxi accidents in the United States occurred in Alaska, and their rate of occurrence was four times that of the accident rate for air taxis in the rest of the United States.

Numerous factors could be affecting the safety of air taxi operations in Alaska. They include the unique terrain and weather; the extent of and condition of airway and airport facilities (en route and terminal navigation aids, landing strips, airfield lights, and weather reporting stations); the quality of the air taxi operators (experience of their pilots, adequacy of and maintenance level of their aircraft, and attitudes of the operators and pilots toward safety); and the interaction of the Federal and State authorities with the aviation community. The purpose of this special study was to determine the factors which most significantly affect the safety of air taxi operations in Alaska and to formulate recommendations designed to improve that safety record.

1/ The Safety Board classifies general aviation kinds of flying as air taxi, instructional, pleasure, business, and corporate/executive.

Data about air taxi accidents that occurred from 1974 through 1978 were analyzed by means of frequency distributions. The data were obtained from the National Transportation Safety Board's (NTSB) automated aviation accident data system. Staff from the Safety Board's Washington headquarters and Alaska field office observed the conditions under which the air taxi community operates, the community's attitudes and needs, and the community's interaction with Federal and State agencies. The Safety Board staff met with officials of the Federal Aviation Administration, the National Weather Service, the Alaska Department of Transportation and Public Facilities, the Alaska Air Carriers Association, and 17 air taxi operators.

This report explores the background information on the State of Alaska and its air taxi industry necessary for the analysis of the data collected in the study. Analysis of the Safety Board data on air taxi accidents in Alaska and findings of the survey of conditions in Alaska also are presented. Based on this analysis, conclusions regarding the factors affecting aviation safety in Alaska have been drawn, and recommendations which the Safety Board believes will promote safety have been made to appropriate organizations.

ALASKA AND ITS AIR TAXI INDUSTRY

About Alaska

Alaska is indeed a very large State. It is more than twice the size of Texas and is larger than the States of Washington, Oregon, California, Arizona, and Nevada combined. The distance from the southern panhandle of Alaska to the tip of the Aleutian Island chain equals the distance from the east to the west coasts of the contiguous 48 States of the United States.

The State's topography varies enormously. Alaska contains the highest mountain in North America, Mt. McKinley at 20,320 feet. It contains 18 other mountains over 14,000 feet high. There are thousands of rivers, streams, and lakes, vast areas of flat, rambling tundra, massive forests, active volcanoes, and many glaciers. Its more than 33,000 miles of shoreline are dotted with islands, and there is an extensive system of waterways.

Climatic conditions across this vast area vary as much as the topography. Precipitation ranges from a low of 5 to 10 inches annually in the arctic regions to over 200 inches annually in the coastal regions of southeastern Alaska. Temperatures range from almost 100° F in the summer to more than 70° below zero F in the winter in the interior of the State. In most of the State, the waterways and ground surfaces are frozen and covered with snow or ice in the winter. During the spring and early summer, much of the land is water-saturated tundra. Summer days have 24 hours of sunlight in the north and almost 20 hours of sunlight in the southcentral part of the State. Winter days have 24 hours of darkness in the most northern parts of the State and only about 4 hours of daylight in the southern areas. About one-third of the State is above the Arctic Circle.

Weather hazards for aviators include fog, icing, and turbulence. Whiteout, an optical or visual effect during which all depth perception is lost, is another hazard.

Whiteout, which cannot be forecast, is not a weather phenomenon, but it occurs only under certain weather conditions. Whiteout is unique to the polar regions, and thus, among the United States, it is found only in Alaska.

Scattered throughout this enormous State are cities, towns, villages, and settlements ranging in size from Anchorage, Alaska's largest city with a population of over 200,000, to villages with a population of 25 or less. Alaska's population of about 403,000 2/ includes about 70,000 natives—Indians, Aleuts, and Eskimos. Almost one-third of Alaska's population (and almost 70 percent of its native population) lives outside of its handful of major urban centers. The socioeconomic conditions range from the urban atmosphere of Anchorage to an informal lifestyle in much of southeast Alaska to a harsh, subsistence existence in many remote villages in western Alaska and much of the arctic regions of the State.

Alaska has only three major cities: Anchorage; Fairbanks, the second largest city with a population of over 30,000; and Juneau, the State capital, with a population of about 20,000. Other important centers include Ketchikan, south of Juneau in Alaska's panhandle, Bethel in the southwest, and Nome in the northwest. The locations of these cities and other centers serving as regional hubs in the aviation transportation system of Alaska are shown in figure 1.

Aviation in Alaska

Air transportation is essential to Alaska to an extent that is difficult for those in other States to comprehend. The considerable distances between the State's larger population centers, the remoteness of hundreds of small villages, the dearth of highways or even crude roadways, and the freezing of many waterways during much of the year have made air transportation indispensable to Alaska. In fact, traveling by airplane is as ordinary and routine to most Alaskans, especially those in rural Alaska, as traveling by car is to most residents of other States. Adults travel by air to larger cities to shop or to visit friends and relatives. Children are flown to schools, medical clinics, sporting events, or other activities to which children in other States routinely would be transported by automobile or schoolbus.

Freight and mail, especially in the rural areas of Alaska, are moved almost exclusively by air during most of the year, and totally by air when the waterways are frozen. Mail often includes food, medicine, clothing, and other essentials for life. Oil for heating houses is often shipped by air in the winter to supplement the supply transported by barge when the waterways are open. Sometimes the waterways are not open long enough to transport even the basic supplies needed for a small village to survive the winter. The remaining necessities must be transported by air.

Table 1, based on Federal Aviation Administration (FAA) data for 1978, illustrates the extent of general aviation activity in Alaska in relation to that in the rest of the United States. In 1978 there were almost 16 times as many active aircraft, and almost 8 times as many pilots, per 1,000 inhabitants in Alaska as there were in the rest of the United States. Further, the number of general aviation hours flown annually per 1,000 inhabitants in Alaska was nearly 16 times that of the rest of the United States.

2/ 1978 estimate.

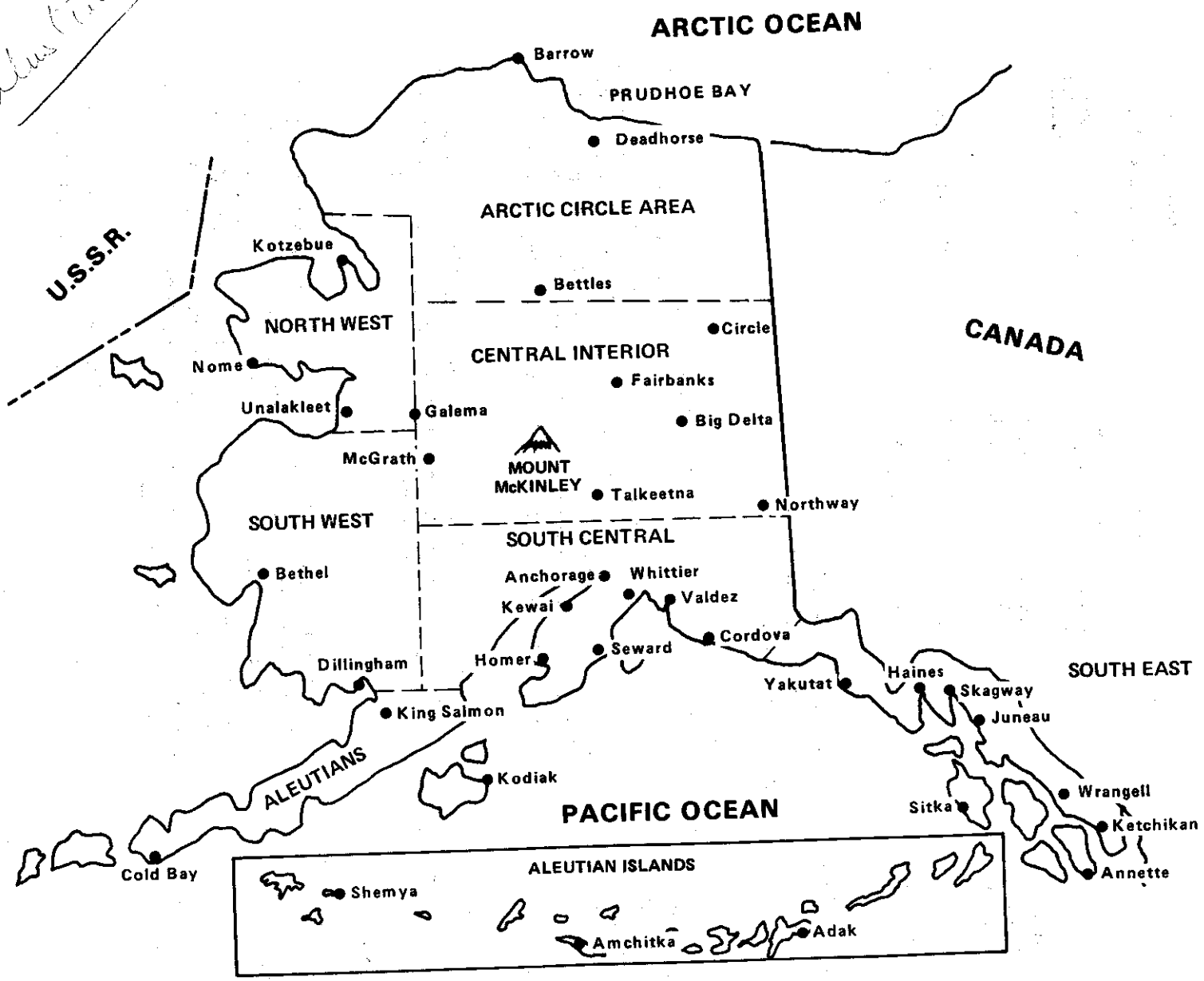

Figure 1.--Geographic areas of Alaska.

Table 1.--U.S. General Aviation Activity, 1978.

	Alaska		United States (excluding Alaska)	
	Total	per 1,000 1/	Total	per 1,000 2/
Active aircraft	6,616	16.4		
Pilot certificates	10,914	27.0		
General aviation hours flown 3/	1,137,000	2,820.0	38,272,000	180.00
Air taxi hours flown	485,000	1,200.0	4,013,000	17.00

1/ Estimated 1978 population: 403,000.
2/ Estimated 1978 population: 217,662,000.
3/ Including air taxi hours flown.

The 233 Alaskan communities which are entitled to a minimum level of air transportation service according to a January 1980 Civil Aeronautics Board (CAB) decision are served primarily by Alaska's air taxi industry. In 1978, air taxi flying accounted for almost 43 percent of all general aviation flying hours in Alaska compared with about 10 percent in the rest of the United States. Further, in 1978, the number of hours flown by air taxi operators in Alaska per 1,000 inhabitants was 1,200. This was more than 70 times the rate of 17 hours per 1,000 inhabitants for the rest of the United States.

As of July 1980, there were 218 air taxi operators in Alaska 3/ operating 1,496 aircraft. Sixty-nine of these operators have authority to fly multiengine aircraft. Thirty-five of the 218 air taxi operators are commuter air carriers.

Airports

In 1978, Alaska had 756 airport facilities on record according to the FAA. 4/A comparison of the airport facilities in Alaska and in the rest of the United States by type of facility is shown in table 2. A high percentage of Alaskan facilities are seaplane bases because early in Alaska's aviation history there were few airfields and most general aviation flying was done in seaplanes. Even today in some parts of Alaska, such as the southeast panhandle area, most general aviation flying, including air taxi flying, is done in seaplanes.

Most airports in Alaska are publicly owned or located on publically owned land, while most airports in the other States are privately owned. (See table 3.) 5/

3/ Certificated Air Taxi List, July 1980, Alaska Region, Flight Standards Division, FAA.
4/ FAA Statistical Handbook of Aviation, Calendar Year 1978.
5/ FAA Statistical Handbook of Aviation, Calendar Year 1978.

Figure 1.--Geographic areas of Alaska.

Table 2.--Comparisons of U.S. Airport Facilities

	Alaska		United States (excluding Alaska)	
	Facilities	Percentage	Facilities	Percentage
Airports	520	68.8	11,452	83.2
Heliports	42	5.5	1,933	14.0
STOLports	---	---	46	0.3
Seaplane bases	194	25.7	338	2.5
Total	756	100.0	13,769	100.0

Table 3.--Ownership of U.S. Airport Facilities

	Alaska		United States (excluding Alaska)	
	Facilities	Percentage	Facilities	Percentage
Public Ownership	537	71.0	4,183	30.4
Private Ownership	219	29.0	9,586	69.6
Total	756	100.0	13,769	100.0

Most of the 756 airport facilities of record are not often used, and little or nothing is known about them. The Department of Transportation and Public Facilities (DOT/PF) of the State of Alaska estimates that the State is responsible for about 320 airport facilities and that it actively maintains about 260 of these facilities. 6/ According to the July 1979 FAA Alaska Region Ten Year Plan for fiscal years 1981 through 1990, the current airport system in Alaska consists of 277 existing and projected facilities. Thirty-eight are major air carrier and general aviation airport facilities, and 239 are existing and projected airport facilities in rural communities with less traffic. Some 230 of these 277 locations are on the CAB's list of essential service determination. One of the 38 major facilities is a seaplane base, and 52 of the 239 lesser facilities are seaplane bases. Another 13 of the 277 total facilities are future facilities, including one major facility. Thus, of the 277 total facilities, 211 are existing, landbased airports.

Of these 211 landbased airports, 125 have a runway length of 3,000 feet or less, 41 have a runway length of 3,001 to 4,999 feet, 42 have a runway length of 5,000 to 10,000 feet, and 3 have a runway length of over 10,000 feet. 7/ Of the 211 runways, 38 have a paved surface, 132 have a gravel or partial gravel surface, 39 have a dirt or turf surface, and 2 have other surfaces.

6/ These figures were given by the DOT/PF Director of Central Division Planning and Research. However, other DOT/PF personnel cited different statistics. One DOT/PF employee indicated that the State owned about 250 airports and maintained 229 of them.

7/ Data from the July 1979 FAA Alaska Region Ten Year Plan.

Navigation Aids

The Alaska Region of the FAA lists about 90 FAA-owned and -operated, en route navigation aids (navaids) in Alaska including 54 NDBs 8/ (including 3 NDB/DMEs 9/), 7 VORs 10/ (including 4 VOR/DMEs), and 26 VORTACs. 11/ In addition, there are 70 to 75 non-FAA-owned navaids of various types. The FAA owns and operates over 2,000 en route navaids in the rest of the United States; half of the navaids are VORs or VORTACs and slightly less than half are NDBs. There are about 1,000 additional en route navaids in the other States not owned and operated by the FAA. The 54 NDBs and 33 VOR/VORTACs in Alaska are spread over an area of about 586,000 square miles. In comparison, the more than 2,000 NDB and VOR/VORTAC facilities in the other States are spread over 3.7 million square miles.

Terminal navaids in Alaska include 28 ILSs 12/ and LOCs 13/ compared with over 700 in the rest of the United States. Most of the 36 existing, landbased, major airports in Alaska are serviced by some type of en route and terminal navaids. However, only 22 of the 175 landbased airports serving Alaska's rural communities have any navaids. These include 18 airports with NDBs (including two privately owned), 3 airports with VORs, and 1 airport with an NDB/DME.

While it is not feasible to compare in detail the entire system of navaids in Alaska with the system in the rest of the United States, it is possible to compare a geographical subarea for each. For example, Bethel, Alaska, and Des Moines, Iowa, have similar weather characteristics and topography. Both have weather with better than 1,000-foot ceilings and 3-mile visibility approximately 85 percent of the year, and both have relatively flat terrain. The number of air taxi operations per year at Bethel is more than 50,000 14/ but only 12,816 at Des Moines. 15/ Within a 100-nmi radius, the Bethel area has only 1 VORTAC and 2 NDBs while the Des Moines area has 12 VORTACs and 33 NDBs. The Bethel area has approximately 600 nm of airways and Des Moines has over 1,300 nmi. The Bethel area has only 3 airports with any terminal navaids for instrument approaches while Des Moines has 45.

8/ Nondirectional radio beacon--a low- or medium-frequency radio beacon that transmits nondirectional signals with which a pilot of aircraft equipped with a receiver can determine his bearing and "home in" on the station.
9/ Distance measuring equipment--a device that indicates how far the aircraft is from the ground station.
10/ Very high frequency omnidirectional range--a line-of-sight electronic navigational guidance aid considered superior to the NDB.
11/ VOR with tactical area navigational capability--a combined aircraft and ground base electrical system which provides a visual presentation of azimuth and distance for the pilot.
12/ Instrument landing system--an electronic system which provides the pilot with an approach path for exact alignment and descent of the aircraft.
13/ Localizer facility--provides course guidance during descent; can be used separately or in combination with an ILS.
14/ Estimated by the Alaska Region of the FAA.
15/ FAA Air Traffic Activity, 1978.

In addition to the system of navaids discussed, there is another system of NDBs which was installed in western Alaska by Wien Air Alaska, one of the two major Alaskan air carriers. This en route system, which is still in place, was deactivated in 1978 when Wien stopped flying in the area and subcontracted its service to air taxi operators. The Wien system included a total of 13 NDBs located at rural village airfields in western Alaska, from Platinum in southwest Alaska (about 125 miles south of Bethel) to Kobuk, 600 miles north (about 100 miles east of Kotzebue). Two of the NDBs were located on St. Lawrence Island (at Gambel and Savoonga) about 175 miles west of Nome. The current condition of the equipment in this system is not known.

Airfield Lighting

Most of the 36 existing, landbased, major airports in Alaska are lighted. Of the 45 airports in Alaska with runways of 5,000 feet or more in length, 40 have some form of lighting. Twelve of the 24 airports with runways of 4,000 to 5,000 feet in length have some form of lighting. The remaining 154 landbased airports have no lighting.

Weather Reporting

To service the weather information needs of the aviation community, there were a total of 122 weather observation stations in Alaska as of January 1980. 16/ These included 42 contracts with persons in rural communities to observe and report the weather regularly using government-furnished equipment. These National Weather Service (NWS) trained and certificated observers are paid on the basis of the number of observations they make. Also included were 19 supplemental aviation weather reporting stations (SAWRS), 18 FAA and 18 NWS manned weather stations. In addition, there were 25 other various reporting facilities including 18 automated weather observation stations.

The NWS in Alaska also airs an early evening television show. This daily program gives aviation weather forecasts for the next day. The show can be seen throughout Alaska. Furthermore, the FAA is experimenting with weather observations using remote television cameras. A camera is located on the airport at Unalakleet and another camera is located in the waterway narrows at Valdez. The Unalakleet information is transmitted to a television screen at the Nome FAA flight service station (FSS), and the information at the Valdez narrows is transmitted to the Cordova FSS and the Valdez tower.

FACTORS AFFECTING SAFETY

Safety is important in any transportation system, but because of the extreme dependence of Alaska on its air taxi industry, a high level of safety is particularly important. Alaskans should be provided an air taxi system which is as safe as that enjoyed by their fellow citizens in other parts of the United States. The Safety Board expressed its concern for the level of safety of the commuter air carrier segment of the air taxi industry in the United States at its January 1980 hearing on

16/ These data were obtained from the National Weather Service, Anchorage, Alaska.

the safety of the commuter segment of the air taxi industry, and in its July 1980 special study report on commuter airline safety nationwide. 17/ Statistics derived from the files of the Safety Board's automated aviation accident data system clearly indicate that the Alaskan air taxi system is not as safe as the air taxi system of the rest of the United States.

The annual trend of total and fatal air taxi accidents in Alaska for the 10-year period 1969-1978 18/ is presented in figure 2. The annual number of total accidents and fatal accidents varied considerably over the period with an increasing trend since 1972. During the most recent 5-year period for which data is available, 1974-1978, there were 311 air taxi accidents in Alaska, of which 266 were nonfatal and 45 were fatal. During the same period, there were 753 air taxi accidents, 562 nonfatal and 191 fatal, in the rest of the United States.

The rate of occurrence of nonfatal air taxi accidents in Alaska per 100,000 hours of air taxi flying between 1974 and 1978 was almost five times, and the fatal accident rate more than double, that of the rest of the United States. (See table 4.) Thus, air taxi operators in Alaska are experiencing accidents (per 100,000 hours of flying) considerably more often than their counterparts in the rest of the United States.

To identify the factors that contribute to the high rate of occurrence of air taxi accidents in Alaska, statistical data and actual accident cases from Safety Board aviation accident investigations were analyzed. Safety Board staff members interviewed a number of owners, pilots, and mechanics in Alaska who were asked for their views on why the air taxi accident rates in Alaska were so much higher than in the rest of the United States and on what is needed to improve safety. The Safety Board staff members also flew on several air taxi flights into remote village airstrips in rural southwest Alaska. The Alaska Air Carriers Association was also asked for its views.

FAA personnel in the FAA's Alaska Region headquarters, controllers and supervisors at the Anchorage Air Route Traffic Control Center, personnel at the Anchorage TRACON and tower, and Principal Operations and Maintenance Inspectors at the Anchorage General Aviation District Office (GADO) discussed air taxi safety with the Safety Board staff. The Bethel FSS and Nome FSS were also visited. NWS personnel in Anchorage provided data on the existing weather information system and on the future plans for the system. The Alaska DOT/PF staff and Mr. Walt Parker of Parker Associates of Anchorage, consultants to the House Committee on Finance of the Alaska State Legislature, discussed the State involvement in aviation transportation.

The Safety Board's aircraft accident data were analyzed extensively in an effort to identify any consistent problem areas. The types of accidents, the phases of operation during which the accidents occurred, the Safety Board-determined probable causes and contributing factors, the types of aircraft involved, the location, terrain, and weather of the accident sites, and the experience level of the pilots were all examined.

17/ "Special Study--Commuter Airline Safety," July 22, 1980 (NTSB-AAS-80-1).
18/ The latest year for which complete accident and exposure data were available at the time of this study was 1978.

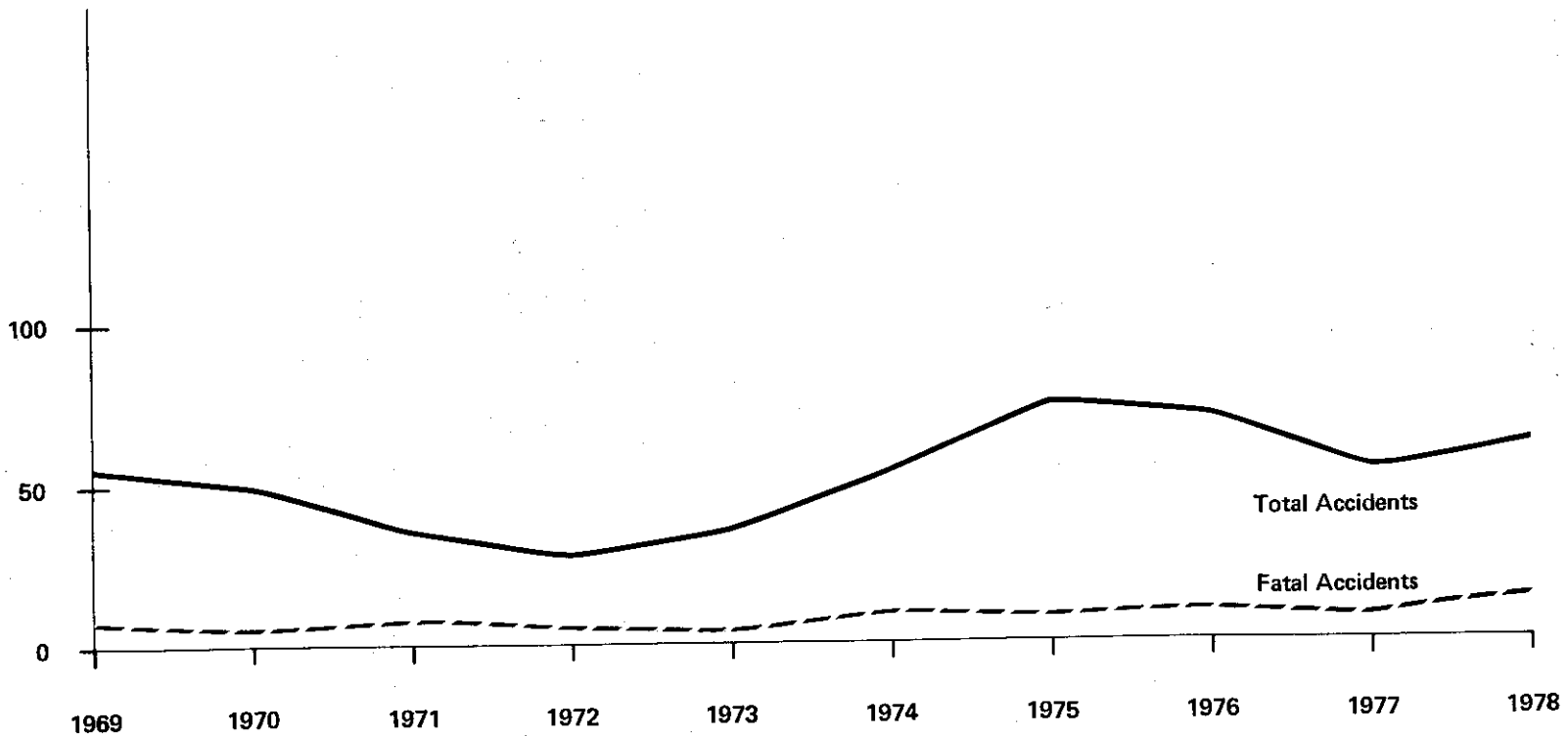

Figure 2.--Total and fatal Alaskan air taxi accidents, 1969-1978.

Table 4.--Comparison of air taxi accident rates for 1974-1978.

	Alaska		United States (excluding Alaska)	
	Total	Per 100,000 hours 1/	Total	Per 100,000 hours 1/
Nonfatal general aviation accidents	1,083	23.54	18,041	10.74
Fatal general aviation accidents	168	3.65	3,594	2.14
Nonfatal air taxi accidents	266	15.20	562	3.29
Fatal air taxi accidents	45	2.57	191	1.11

1/ Flight hours, obtained from the FAA, were (in 100,000 hours):

	Alaska	United States (excluding Alaska)
General aviation	46.0	1,679.6
Air taxi	17.5	170.9

Hours were not available for Alaska for 1977 and had to be estimated from the data for 1974-1976 and 1978. All data are subject to some error. The estimate of air taxi hours in Alaska for 1978 is subject to the largest standard error--12.8 percent. Overall, the errors are believed to be considerably less for the 5-year totals. More importantly, the small magnitude of the errors is believed to have a minimal effect on the comparisons shown above.

Table 5 presents data about the types of air taxi accidents which occurred in Alaska from 1974 through 1978 and the phase of operation during which they occurred. Similar data for air taxi accidents in the rest of the United States are presented in table 6. The data show that air taxi accidents in Alaska involve a slightly larger percentage of landing types of accidents, particularly noseover and rollover accidents, than air taxi accidents in the rest of the United States. Alaska has a larger percentage of collisions with obstacles, collisions with ground or water, and stalls, but has fewer engine failures or malfunctions.

A significantly larger percentage of air taxi accidents occur during the takeoff phase of operation in Alaska than in the rest of the United States. Table 5 also shows that takeoff and landing types of accidents and accidents involving collisions with obstacles occurring during the takeoff and landing phases of operation accounted for 46 percent of all air taxi accidents in Alaska. Table 6 shows that the same type of accidents occurring during the takeoff and landing

Table 5.--Total Air Taxi Accidents in Alaska, 1974-1978

Accident Type	Phase of Operation						Total Aircraft	Total Accident	Percentage of Total Aircraft
	Static	Taxi	Takeoff	Inflight	Landing	Other			
Takeoff and Landing									
Ground/Water Loop/Swerve	-	1	8	-	15	-	24	24	7.72
Dragged Wing Tip Pod or Float									
Wheels-Up Landing	-	-	1	-	-	-	1	1	0.32
Wheels-Down Landing in Water	-	-	-	-	4	-	4	4	1.29
Gear Collapsed	-	2	1	-	6	-	9	9	2.89
Gear Retracted	1	-	1	-	5	-	7	7	2.25
Hard Landing	-	-	-	-	10	-	10	10	3.22
Nose-Over/Down	-	2	5	-	12	-	19	19	6.11
Roll-Over	1	-	1	1	6	-	9	9	2.89
Overshoot	-	-	-	-	7	-	7	7	2.25
Undershoot	-	-	-	-	9		9	9	2.89
Total	2	5	17	1	74	-	99	99	31.83
Collision with Obstacles	-	6	33	5	19	-	63	63	20.26
Engine Failure or Malfunction	-	-	16	26	4	-	46	46	14.79
Propeller or Rotor Failure	-	-	2	5	3	-	10	10	3.22
Collision with Ground/Water	-	-	7	29	10	2	48	48	15.43
Stall	-	-	19	4	3	-	26	26	8.36
Collision with Aircraft	-	-	-	2	1	-	3	3	0.96
Fire or Explosion	-	-	-	-	-	-	-	-	-
Airframe Failure	-	-	-	1	-	-	1	1	0.33
Other	3	2	5	-	3	2	15	15	4.82
Total	5	13	99	73	117	4	311	311	100.00
Percentage of Accidents	1.6	4.2	31.8	23.5	37.6	1.3			

Percentage of Accidents 1.6 4.2 31.8 23.5 37.6 1.3

Table 6.--Total Air Taxi Accidents in U.S. (excluding Alaska), 1974-1978

Accident Type	Phase of Operation						Total Aircraft	Total Accident	Percentage of Total Aircraft
	Static	Taxi	Takeoff	Inflight	Landing	Other			
Takeoff and Landing									
Ground/Water Loop/Swerve	-	10	16	-	34	-	60	60	7.93
Dragged Wing Tip Pod or Float Wheels-Up Landing	-	-	-	-	26	-	26	26	3.43
Wheels-Down Landing in Water	-	-	-	-	-	-	-	-	-
Gear Collapsed	-	8	2	-	16		26	26	3.43
Gear Retracted	1	4	5	-	14		24	24	3.17
Hard Landing	-	-	-	-	25	-	25	25	3.30
Nose-Over/Down	1	4	-	-	5	-	10	10	1.32
Roll-Over	-	1	3	1	3	-	8	8	1.06
Overshoot	-	-	-	-	25	-	25	25	3.30
Undershoot	-	-	-	-	17	-	17	17	2.25
Total	2	27	26	1	165	-	221	221	29.19
Collision with Obstacles	-	33	26	27	41	-	127	127	16.78
Engine Failure or Malfunction	-	-	35	97	26	-	158	158	20.87
Propeller or Rotor Failure	2	-	7	16	3	-	28	28	3.70
Collision with Ground/Water	-	-	15	53	26	-	94	94	12.42
Stall	-	-	14	4	12	-	30	30	3.96
Collision With Aircraft	4	10	3	5	2	-	24	20 1/	3.17
Fire or Explosion	-	4	-	17	3	-	24	24	3.17
Airframe Failure	-	-	5	10	2	-	17	17	2.25
Other	4	3	3	10	5	9	34	34	4.49
Total	12	77	134	240	285	9	757	753	100.00
Percentage of Accidents	1.6	10.2	17.7	31.7	37.6	1.2			

1/ The difference in totals is due to four collisions between eight occupied aircraft.

phases of operation account for only 34 percent of the air taxi accidents occurring in the rest of the United States. Thus, it appears that accidents involving takeoff and landing are more of a problem in Alaska.

The distribution of air taxi accidents on a monthly basis as a percentage of the total for Alaska and for the rest of the United States are shown in figure 3. These data show that the percentage of air taxi accidents that occur during the summer months in Alaska is larger than that in the rest of the United States. Also, the percentage of accidents that occur during the winter months is lower in Alaska than that in the rest of the United States. One reason for this may be drawn from figure 4, which presents the 5-year (1974-1978) cumulative monthly distribution of accidents for Alaska and for the rest of the United States. Figure 4 also presents the distribution of Alaskan air taxi accidents involving amphibious aircraft and aircraft equipped with hulls or floats (seabased aircraft). These data show that the number of air taxi accidents in Alaska peaks during the summer months of June through September as does the number of such accidents involving seabased aircraft. This peak of accidents involving seabased aircraft obviously reflects the significantly increased use of such aircraft in Alaska during these months. The monthly accident distribution for the rest of the United States, while varying significantly from month to month, does not exhibit the marked seasonal fluctuation of the Alaskan accident distribution.

A comparison of the percentages of accidents involving a given type of landing gear-equipped aircraft in Alaska with those of the rest of the United States is shown in table 7. The data show a much larger percentage of air taxi accidents in Alaska involve aircraft equipped for water landing and ski-equipped aircraft. The data further show that a larger percentage of air taxi accidents in Alaska involve aircraft with tailwheels (combined fixed and retractable gear). These facts indicate the extent of the waterbased and rough-field operations in Alaska.

Table 7.--Comparison of Accidents by Landing-gear Type

Landing Gear Type	Alaska (percentage)	United States (excluding Alaska) (percentage)
Hull/Float	19.29	4.22
Amphibious	3.22	3.03
Ski	6.43	1.06
Skid	15.11	10.82
Tricycle Gear Retractable	13.83	46.83
Tricycle Gear Fixed	17.68	17.41
Tail Wheel Retractable	2.57	14.38
Tail Wheel Fixed	21.22	1.72
Other/Unknown	0.64	0.53

Also, about 20 percent of the accidents in Alaska involve rotary-wing aircraft (helicopters) compared with about 15 percent in the rest of the United States. This fact reflects the higher use of rotary-wing aircraft by air taxi

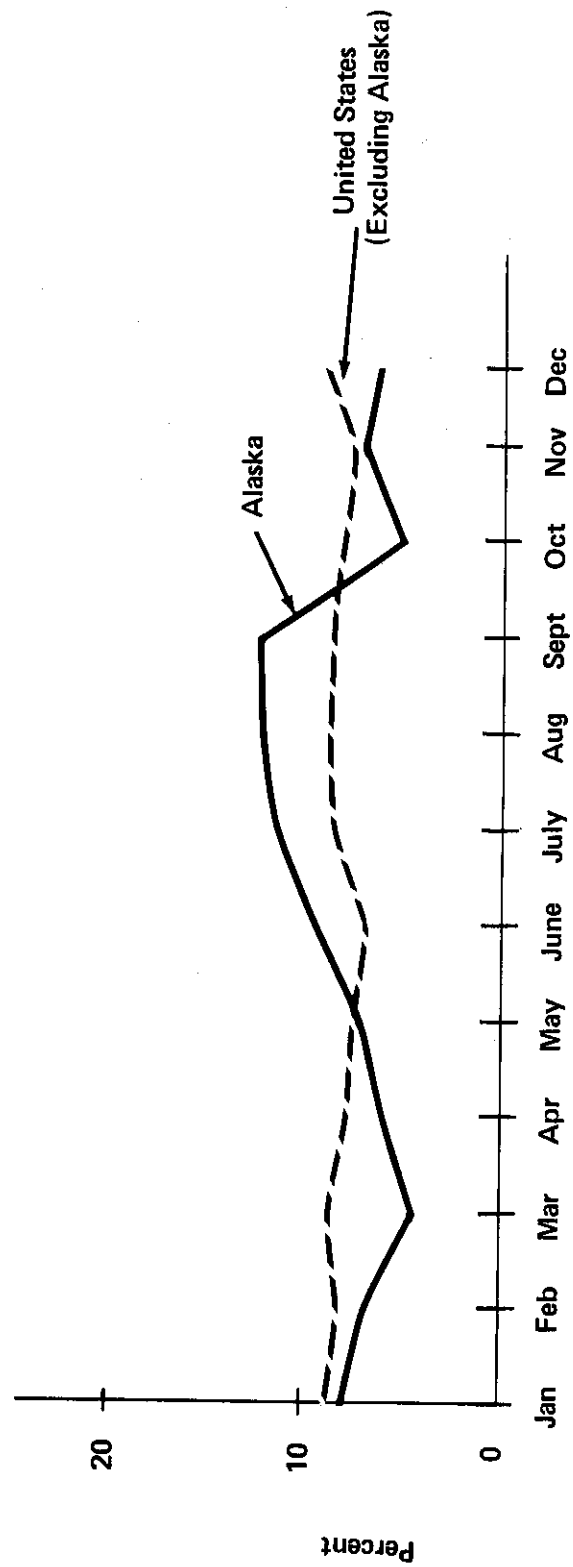

Figure 3.—Percentage of annual accidents occurring monthly. Data from 1974-1978 for Alaska and the U.S. (excluding Alaska).

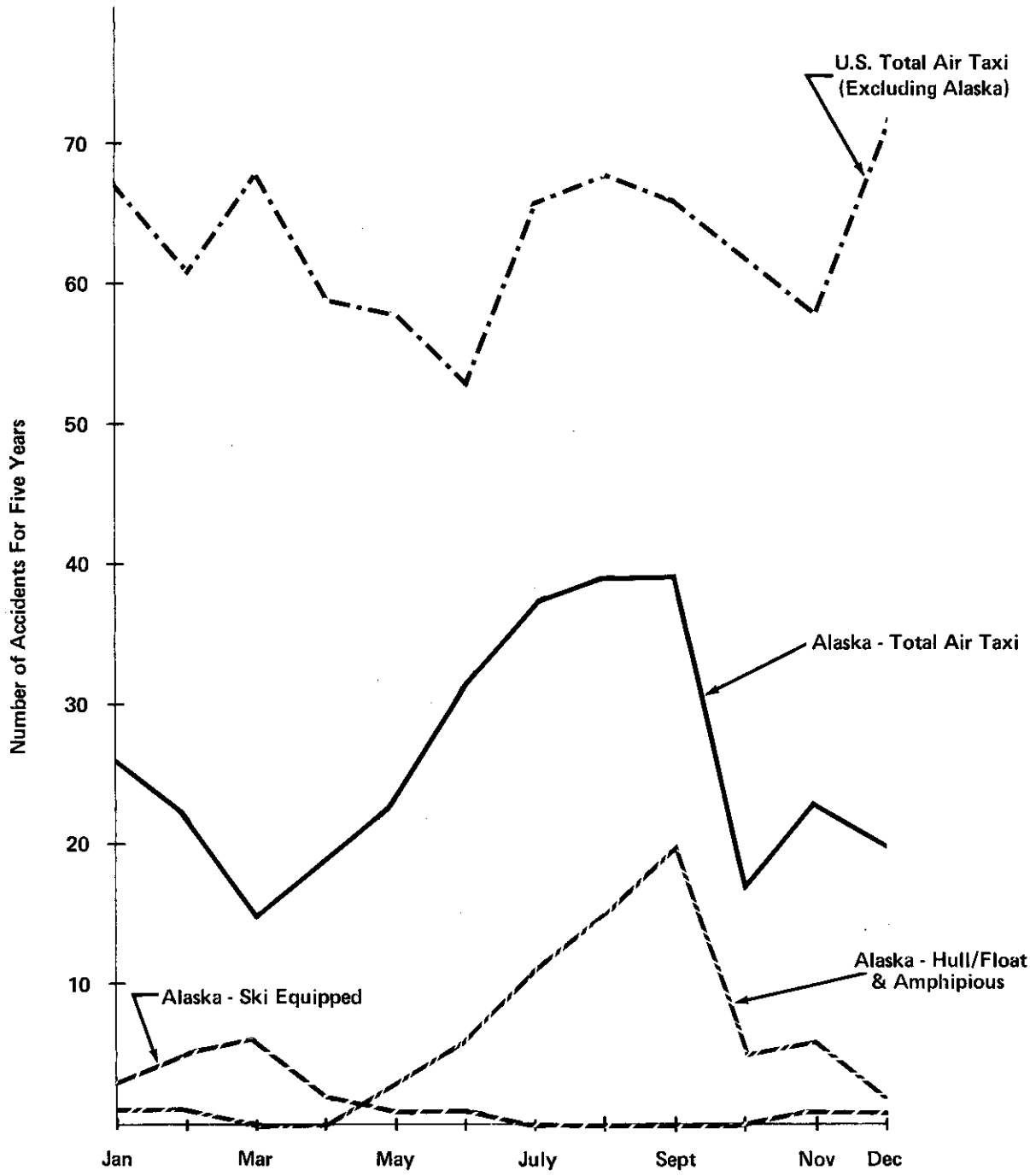

Figure 4.--Air taxi accidents for 1974-1978 on monthly basis. Comparison of Alaska with U.S. (excluding Alaska).

operators in Alaska 19/ due, in part, to the less developed conventional airport system.

In carrying out its Congressional mandate to determine the probable causes of all aircraft accidents that occur on United States territory, the Safety Board has established 13 broad categories of cause/factors. 20/ The broad categories have been subdivided further into numerous detailed cause/factors. For example, the broad category of cause/factor could be cited as the "pilot," and the detailed cause/factor could be that the "pilot continued VFR [visual flight rules] flight into adverse weather." Furthermore, a single accident could have more than one cause/factor assigned to it. In some cases, where the aircraft is never located or insufficient facts are available, the Safety Board is unable to determine a probable cause.

Of the 266 nonfatal air taxi accidents in Alaska from 1974 to 1978, the cause of 1 was undetermined because the aircraft was not located. Of the 45 fatal Alaskan air taxi accidents, the aircraft involved in 1 accident was never found, and 3 accident investigations developed insufficient data, for a total of 4 accidents in which the probable cause was not determined. Of the 562 nonfatal air taxi accidents in the rest of the United States, the probable cause could not be determined for 31 accidents, and of the 191 fatal air taxi accidents, 5 resulted in an undetermined probable cause.

A comparison of the broad categories of cause/factors assigned by the Safety Board to air taxi accidents in Alaska and to air taxi accidents in the rest of the United States is presented in table 8. While this comparison does not unequivocably identify the factors contributing to the higher accident rates in Alaska, there are several differences in the distribution of causal assignments that provide direction in the search for these factors.

Table 8 shows that the pilot is cited as a cause/factor in a larger percentage of all air taxi accidents in Alaska than in accidents in the rest of the United States. The assignment of "personnel" as a broad cause/factor is less in Alaskan accidents. Airports/airways/facilities are cited in a slightly larger percentage of all air taxi accidents in Alaska. Terrain is cited as a cause or related factor substantially more often in Alaska than it is in the rest of the United States. Mechanical causes such as powerplant, landing gear, and systems are cited considerably less often in Alaska. Weather is the assigned factor in the same percentage in both.

19/ Over 25 percent of the air taxi fleet in Alaska are rotary-wing aircraft; about 12 percent of the air taxi fleet in the rest of the United States is rotary-wing aircraft.

20/ The 13 broad categories of cause/factors are: pilot, personnel, airframe, landing gear, powerplant, systems, instruments/equipment and accessories, rotorcraft, airport/airways/facilities, weather, terrain, miscellaneous, and undetermined.

Table 8.—Comparison of Air Taxi Accidents
By Broad Cause/Factor Categories

	Alaska		United States (excluding Alaska)	
	Accidents	Percentage[1/]	Accidents	Percentage[2/]
Pilot	263	85.1	518	70.4
Personnel	39	12.6	156	21.2
Mechanical[3/]	57	18.4	228	31.0
Rotorcraft	10	3.2	20	2.72
Airport/Airways/Facilities	44	14.2	88	12.0
Weather	92	29.8	219	29.8
Terrain	101	32.7	155	21.1
Miscellaneous	5	1.62	36	4.9
Undetermined	5	1.62	36	4.9

1/ Based on 309 air taxi accidents, some of which had more than one cause/factor assigned, for which probable cause was determined.
2/ Based on 736 air taxi accidents, some of which had more than one cause/factor assigned, for which probable cause was determined.
3/ "Mechanical" is not a Safety Board broad category of cause/factors. It is a consolidation, used here only for convenience, of the Safety Board broad categories of airframe, landing gear, powerplant, systems, and instruments/equipment and accessories.

A review of the geographical distribution of the air taxi accidents within Alaska shows that accidents occur fairly uniformly throughout the State, but with an apparent bias toward those areas which are known to have more air taxi operations. The percentages of air taxi accidents that occurred in Alaska from 1974 to 1978 by geographical areas within the State (see figure 1) were:

Area	Percentage
Southwest	25
Northwest	11
Arctic Circle	19
Central Interior	7
Southcentral	16
Southeast	14
Aleutians and Kodiak Islands	8

The southwest area, where Bethel is the most important transportation hub, has the highest percentage of accidents. This area has a substantial amount of air taxi activity. The combined areas of western Alaska have over one-third of all air taxi accidents within the State. This area also has very few navaids and many poorly maintained runways.

The area above the Arctic Circle also has a significant portion of the accidents. It too has substantial air taxi activity and few navaids. The southeast, in which the air taxi flying involves significant float operations, also has a substantial portion of the State's accidents. This area has over 160 inches of rainfall each year, and the air taxis operate almost solely under visual flight rules. The southcentral area, with Anchorage at its center, is the most congested area and involves a mixture of landbased and seabased operations.

Although the perspectives of the air taxi operators and pilots and Federal and State government agency personnel interviewed during this study varied widely and their emphasis on particular aspects of problems affecting safety was slightly different, a review of the opinions expressed, coupled with an analysis of the accident data, revealed three recurring problem areas. They are: (1) pilot/operator/passenger attitude ("bush syndrome"), (2) inadequate airfield facilities/communications, and (3) inadequate weather information/communications/navaids.

Pilot/Operator/Passenger Attitude--"Bush Syndrome"

One comparison that particularly stands out, especially in light of the opinions gathered in Alaska, is the larger percentage (86 percent to 72 percent) of all air taxi accidents in Alaska in which the pilot was cited as a cause/factor. Further examination of the pilot involvement in these accidents was prompted by both the large percentage of accidents in which the pilot was assigned as a cause/factor, and by the fact that it was cited more often in Alaska.

A review of the total hours of flight time, flight time flown in the accident type of aircraft, and certificates and ratings held revealed that the majority of the pilots involved in air taxi accidents in Alaska were experienced pilots. Almost all pilots involved in these accidents had more than 1,000 hours of total flight time and approximately 80 percent of those pilots had more than 2,000 hours of total flight time. Approximately 80 percent of those pilots for whom the number of hours flown in the accident type of aircraft could be determined had more than 100 hours in type. About 20 percent had airline transport pilot certificates in addition to their commercial certificates, and almost 80 percent of the pilots had instrument ratings.

Although these pilots generally had considerable flight experience, it is not known how much of their experience was gained in Alaska. Unfortunately, these data are difficult to obtain and generally are not collected. Obviously, if the flight experience of these pilots was not obtained in Alaska where many unique flying problems exist, then the "effective" level of their experience would not be as high as it appears to be.

While these statistics illustrate the extensive involvement of the pilot in the accidents, they do not identify specific problem areas. However, statements from operators, pilots, and regulatory personnel in the Alaskan aviation community suggest that the "bush pilot syndrome" may be an integral factor not only in the high pilot involvement but also in the high accident rate in Alaska.

Descriptions of the "bush pilot syndrome" range from a pilot's casual acceptance of the unique hazards of flying in Alaska to a pilot's willingness to take

unwarranted risks to complete a flight. In Alaska, it is not uncommon for pilots to fly in extremely poor weather or to attempt to land on runways that are in bad condition or off the airport on snow-covered strips or frozen lakes marginally suited for landing. Stories abound about pilots who have been involved in numerous accidents and have survived. These pilots have become near legends and are spoken of almost reverently by some young pilots, especially those who have arrived only recently in Alaska. Taking chances is considered a part of flying in Alaska by many Alaskans--not just the pilots, but also the passengers. Passengers affected by the "bush syndrome" demand to fly even in hazardous weather conditions, and if one pilot or operator will not fly, the passengers will go to another operator; occasionally they find one who will fly in hazardous weather conditions.

The "bush syndrome" goes beyond the realm of poor judgment compounded by pressures and into the area of unreasonable risk-taking. Although the "bush syndrome" apparently exists, it cannot be unequivocably demonstrated by statistical data. However, it is clear that most operators, pilots, and others associated with Alaskan aviation believe that it does exist. The review of accident cases further supports the contention. The following case history helps to illustrate the "bush syndrome" attitude.

In November 1978, two persons asked to be flown from McGrath to Tatalina. They asked one air taxi operator who refused because it was a "pitch dark night" and the dirt strip at Tatalina was not lighted. A pilot for another operator agreed to take the flight even though he did not have the operator's permission. Immediately after takeoff, the aircraft, a Piper PA-32, entered a steep right bank and descended into trees approximately 1 mile from the McGrath airport.

The accident pilot had already been involved in three other accidents, and on the day of the accident he had argued with another pilot about not getting his share of the flying. On this flight, he violated Federal Aviation Regulations (FARs) because he did not have an air transport rating or an instrument rating required to fly 14 CFR 135 flights at night. This case illustrates the "bush passenger" attitude of wanting to fly under any conditions and the "bush pilot" attitude of total disregard for rules and safe operating practice.

Although the pilot is cited in a higher percentage of air taxi accidents in Alaska, that statistic does not tell the entire story and may even be misleading. The Safety Board determinations of detailed cause/factors in air taxi accidents in Alaska were compared with the determinations for accidents in the rest of the United States. This comparison indicated that when the pilot was cited as the broad cause/factor, several detailed cause/factors pointing to two general problem areas frequently appeared. These problem areas are: (1) inadequate airfield facilities and inadequate communications of airfield conditions, and (2) inadequate weather observations, inadequate communications of the weather information, and insufficient navaids.

Airfield Facilities and Communications

Observations from participants in the Alaskan air taxi system indicate that inadequate airfield facilities and communications are a significant factor in the air taxi accidents in Alaska. A close look at the detailed cause/factor of "pilot selection of unsuitable terrain" reveals that although this detailed cause/factor

may be the result of poor pilot judgment, it is, in part, a manifestation of the problems of inadequate airfield facilities and communications in Alaska.

Selection of unsuitable terrain was cited as a cause/factor in over 13 percent of all air taxi accidents in Alaska in which the pilot was cited as the broad cause/factor, but in less than 4 percent of such accidents in the rest of the United States. Further review reveals that pilot selection of unsuitable terrain is almost always associated with nonfatal accidents and almost never associated with a forced landing due to an engine failure or malfunction. Of the 43 Alaskan air taxi accidents in which unsuitable terrain was cited, 42 were nonfatal accidents. Only one accident involved an engine failure or malfunction. It is apparent that those accidents in which the pilot was cited for selection of unsuitable terrain involved an intentional effort by the pilot to either take off or land.

There was virtual unanimity of opinion among operators and pilots that runway conditions present a problem in much of rural Alaska. Inadequate runway length and width, inferior runway surface construction, poor surface condition, and a lack of lighting often make takeoffs and landings difficult, if not dangerous. This problem of runway conditions was cited time after time not only by operators and pilots but also by FAA personnel and even by State DOT/PF staff personnel.

Many runways are either too narrow or too short, or both, and cannot handle safely the aircraft needed to adequately serve the villages near the airport/strip. The State has established a minimum length of 3,000 feet and a minimum width of 100 feet. Unfortunately, the geography and topography of many villages physically preclude the construction of a runway of minimum size.

Gravel is considered to be the best surface composition for use in rural Alaska because of the weather and terrain, but gravel is expensive and difficult to obtain. Therefore, almost half of the rural runways have little or no gravel covering the dirt surface. Thus, the surfaces often become a quagmire of mud during rain or during the spring breakup, when the tundra thaws and the ice melts. Many of these dirt strips have ruts and potholes.

The problem most consistently cited by operators, pilots, and the FAA, however, is that of inadequate maintenance of the runway surfaces. Removal of snow and grading of the dirt surfaces after rain are often inadequately performed and occasionally not done at all. If snow is not plowed completely from an already short and/or narrow runway, it leaves a runway of even more marginal dimensions, often with patches of snow, soft snow, or ice still remaining on the surface.

It is under these conditions that the Alaskan air taxi pilot functions. The pilot must decide whether to attempt a takeoff or landing or lose a revenue-producing flight. If the trip is not completed satisfactorily, the operator will not receive revenue. There are many pressures on the pilot to attempt a landing, including those from passengers on board or waiting at the destination airport; those from the local villagers awaiting food, mail, or medicine; or those from the operator. Decisions have to be made, and pressure can affect the pilot's judgment, sometimes distorting his assessment of the runway conditions. Analysis of the accidents in which the pilot was cited for selection of unsuitable terrain shows that the condition of the airfield may be more significant in these runway-related accidents than poor pilot judgment or attitude.

Many of these accidents resulted from taking off or landing on runways that were either snow- or ice-covered because they were inadequately cleared. The following case history helps to illustrate this point. The pilot, a certified flight instructor with over 2,200 hours of total flight time and over 45 hours in the type aircraft, a Cessna 185, successfully landed his aircraft at 1340. During landing the pilot noticed that the runway was covered by 6 to 7 inches of loosely packed snow. The pilot requested that the runway be plowed and a caterpillar tractor made two passes on the runway and packed down approximately 2,000 feet of its length. At 1545, during the attempted takeoff, the aircraft was unable to obtain liftoff speed because too much snow still covered the runway and the aircraft ran off the runway into a snow bank.

Many of the accidents involve intentional off-airport takeoffs and landings, often on frozen waterways or on snow/ice strips, because of inadequate runways or poor runway conditions. The following case history illustrates this point. In December 1978, a wheel-equipped Cessna U-206 was dispatched on an air taxi flight from Bethel to Sheldon's Point with a cargo of supplies needed by the village. The pilot had approximately 1,000 hours of total flight time and over 100 hours in the Cessna U-206. Upon reaching his destination, the pilot landed on the frozen lake adjacent to Sheldon's Point because the runway/landing area was not maintained. The landing was uneventful even though the lake was covered by 6 inches of snow. During the takeoff from the snow-covered and frozen lake, the aircraft struck a snowdrift after an unsuccessful attempt to obtain flying speed. While skis may have been better suited for this terrain, wheels were better suited for the home base of Bethel.

Adequate maintenance of airfields is a difficult problem for Alaska. According to the State DOT/PF officials, sufficient funds are not available for full-time State employees to maintain rural airports. Therefore, the State generally contracts with a local villager to operate the State-supplied equipment and maintain the runways. Sometimes the work is not performed adequately. The runway-related air taxi accidents already discussed show the magnitude of this problem.

Another example of an accident during an intentional off-airport landing, where the Safety Board cited pilot selection of unsuitable terrain, involved a ski-equipped Cessna 180 aircraft. The pilot, with over 1,500 hours total flight time and over 1,500 hours in type, successfully landed at a ski strip near Kwigillingok. During the attempted takeoff about 1 hour later, the aircraft never obtained sufficient speed because of the wet, sticky snow. Similar accidents have involved float-equipped aircraft landing on shallow waterways and then running into sandbars or submerged debris. In one accident, a float-equipped Cessna 185 flown by a pilot with over 18,000 hours in type struck a submerged log during landing.

A greater percentage of nonfatal air taxi accidents in Alaska than in the rest of the United States involved collisions with obstacles on takeoff or landing. In fact, almost 19 percent of the nonfatal accidents in Alaska are of this type compared with less than 10 percent in the rest of the United States. It also should be noted that pilot selection of unsuitable terrain is often cited in these accidents. These statistics support the contention that many of these accidents occur because operators use float- and ski-equipped aircraft, in part, to compensate for the lack of adequately maintained runways.

Operators and pilots also stated that the lack of airfield lights at most rural airports contributes to the high accident rate. Since much of Alaska is shrouded in darkness, or near darkness, for several months of the year, operations at unlighted airfields are hazardous and often illegal. The installation of lights is a problem, but the maintenance of lighting at airports is even more of a problem. Lights are sometimes accidently plowed out during snow removal or occasionally shot out by local villagers engaging in target practice.

Information on runway conditions is occasionally inaccurate, often untimely for operator and pilot needs, and sometimes not available at all. Villagers who are in desperate need of supplies or who must make a trip out of the village will sometimes optimistically report conditions to be better than they really are. This problem is further compounded by an inadequate communications system. The following two accident cases highlight this information reporting/communications problem.

The first accident, which occurred in January 1978, involved a wheel-equipped Cessna 180 flown by a pilot with over 5,000 hours total time and over 350 hours in that type aircraft. In preparation for the flight to Kipnuk, the pilot learned that there was a 20-knot crosswind at Kipnuk and there was poor braking action on the runway. The air taxi operator called Kipnuk and was informed by villagers that the lake surface was satisfactory for landing. Upon arriving at Kipnuk the pilot flew over the lake at 250 feet, and again at 50 feet, to check the surface. The pilot did not observe any shadows or definitions of snow berms (a protruding shelf or ledge of snow) because of overcast skies. However, upon landing, the aircraft struck a snow berm and flipped over. The information communicated to the pilot concerning the landing area's condition was incorrect.

The second accident also occurred in January 1978. This accident involved a Piper PA-31 Navajo that was flown by a pilot with over 500 hours of multiengine flight time and 50 hours in the PA-31. The pilot was unable to learn the condition of a runway. The aircraft touched down on its destination airstrip within 100 feet of the threshold. However, the 2,800-foot runway was very icy and the pilot was unable to stop the aircraft. It finally went off the end and struck a large frozen outcropping while the pilot was attempting to go around. Once again, inadequate communication of information to the pilot was a factor in an accident.

Weather Observation/Communications/Navaids

Certain detailed cause/factors related to accidents in adverse weather conditions and whiteout were assigned in a greater percentage of air taxi accidents in Alaska than in the rest of the United States. (See table 9.)

Based on the 309 total air taxi accidents in Alaska and the 736 such accidents in the rest of the United States for which the Safety Board determined probable causes, these weather- and whiteout-related detailed cause/factors were assigned more than twice as often (24.3 vs. 10.1 percent) in air taxi accidents in Alaska. These cause/factors could be a manifestation of poor pilot judgment or the "bush pilot syndrome" discussed previously. However, these detailed cause/factors might also reflect, in part, inadequacies in weather observations, communications, and the navaid system.

Table 9.—Comparison of Accidents by Detailed Cause/Factors Related to Certain Adverse Weather Conditions and Whiteout

	Alaska	United States (excluding Alaska)
Whiteout	19	0
Continued VFR into adverse weather	33	47
Initiated flight into adverse weather	9	12
Spatial disorientation	9	11
Became lost or disoriented	5	4
	75	74

There is general agreement that the current system of en route and terminal navigational aids serving the major hubs of Anchorage, Fairbanks, and Juneau and the regional hubs such as Bethel, Nome, Kotzebue, McGrath, and Ketchikan is satisfactory. However, partly because of the scarcity of navaids, flights between the regional hubs and the outlying villages operate almost completely on VFR flight plans and thus are severely limited by weather. Weather in many areas of Alaska is poor much of the time and often causes delays resulting in frustration on the part of operators, pilots, and passengers. Typical of this weather is constant rain, fog, or low clouds often found in southeast Alaska, Kodiak Island, and the Aleutian Peninsula or island chain; fog, low clouds, snow, or whiteouts in rural western Alaska; and the snow and whiteout conditions of the arctic region.

During the interviews in Alaska, the lack of navaids and inadequate weather reporting and inadequate communications of the weather information were repeatedly cited by operators and pilots flying in the more rural areas as being significant factors in weather-related accidents. The pilots in western Alaska stated that the installation of navaids would greatly enhance their ability to cope with the unanticipated low ceiling and poor visibility often encountered during whiteouts or when weather suddenly deteriorates. Also, navaids would reduce the number of accidents that occur when attempting, in marginal weather conditions, to fly into villages that are in desperate need of air service.

VFR flight in adverse weather is not uncommon in Alaska. Many operators stated that they did not want their VFR flights flown in adverse or even marginal weather, but, at times, the pressures of operating in rural areas did result in such operations. The risk of losing unrecoverable business often results in pressure on the operator or pilot to fly when good judgment dictates otherwise. Occasionally, poor decisions are made and unwarranted risks are taken. The accident involving the flight on a "pitch black night" into an unlighted dirt strip by a noninstrument-rated pilot after another operator had refused to make the flight is a glaring example of the pressures which many operators claim they have to face.

Another point made by many operators was that the lack of FAA inspectors permanently on site at the regional hub airports--FAA inspectors are permanently stationed only in Anchorage, Fairbanks, and Juneau--does little to discourage these unwarranted and often illegal flights. There is no one of authority available to discourage or stop those operators or pilots with a "bush mentality" from flying when others choose not to do so.

The interviews revealed that relations between the FAA General Aviation District Office and the air taxi operators and pilots involve considerable mutual distrust. The FAA appears to believe that the most serious safety problem is operator and pilot attitude, and the operators and pilots seem to feel that the FAA, rather than working with them to solve their problems, is "violation" oriented. Evidence of friction in this relationship was found in most areas of the State, but it was more pronounced in rural areas.

Although State and Federal officials placed greater emphasis on operator and pilot attitude and less on the physical infrastructure, they did agree that improvements in weather reporting and additional navaids were needed.

Another problem which the operators and pilots face is inadequate reporting of weather conditions. The problem is twofold and involves both inadequate official weather observations and inadequate communication of the observations. Many operators believe that the official weather reporting system set up by the NWS, using certified weather observers, has deteriorated over the years. Almost all agreed that some improvements are necessary and that a system based only on actual human observation of weather would be satisfactory. Remote automated weather observation stations were considered by the operators as being inadequate to satisfy the needs of air taxi pilots for timely observation of actual local conditions.

Communications of the weather observations are often poor. In villages where weather observations are taken by an NWS-certified observer, usually the only method to communicate this information from the village to the NWS and the flight service station (FSS) is by telephone. A significant problem can develop because there is generally only one telephone in the smaller villages and another villager may be using the telephone or it may not be functioning. Therefore, the weather observer in some cases is delayed or prevented from relaying the current weather to the NWS or the FSS.

To alleviate the communication problem and the lack of a certified weather observer in a particular village, many operators have set up their own weather observation and communications networks. These operators supply a high frequency (HF) radio with frequencies used in ground-to-ground communications to a villager who is paid to supply weather information to the operator. This villager not only provides unofficial weather reports to the operator but also supplies information on runway conditions. Operators have a HF radio at their home base and even have installed some in their aircraft. However, even this private system is not perfect. Communication equipment often malfunctions or the villager responsible for observing and communicating the weather is not available. Sometimes weather conditions and runway conditions are reported as being significantly better than they are.

The NWS and FSS facilities do not have HF radios with the same frequencies used in the operator network, so information from this operator network often does not get into the official FAA/NWS system. Further, the weather observers usually are not trained or certified by the NWS. Thus, the flights based on these weather data are often in violation of Federal Aviation Regulations. This system has been tolerated because of the lack of an alternative system.

According to the NWS, while the official NWS system needs to be improved, its observer network has not really deteriorated. The NWS argues that demands of the system have increased and its resources have not been increased accordingly. In support of its contention that the system has not deteriorated, the NWS pointed out that in January 1970, there were only 16 weather observation stations under NWS contract (contract stations) and 18 supplemental aviation weather reporting stations (SAWRS) in Alaska. By February 1980, there were 42 contract stations and 19 SAWRS. Further, in October 1974, there were only 1,500 contract weather observations per week in Alaska, and by February 1980, the number of observations per week had reached 3,427.

Following is a brief summary of an accident which occurred in Alaska in January 1978. It is typical of many air taxi accidents in Alaska involving adverse weather or whiteout conditions. A Britten-Norman BN-2A Islander on a nonscheduled air taxi/cargo flight departed Bethel on a VFR flight plan for Tanunak. Before departure the pilot received a weather briefing for the local area. No official weather reporting facility exists for Tanunak or Toksook Bay, and no weather information on these areas was available to the pilot at the time of departure because attempts to contact the destination village by radio failed. Bethel weather was 1,500 feet overcast, visibility 7 miles in light snow, and wind 220° at 17 knots. The station agent at Bethel received weather information on Tanunak about 20 minutes after the Islander departed. Tanunak weather was reported as 1,000-foot ceiling and overcast with 10- to 15-mile visibility. Two other aircraft departed Bethel for the same general destination area about the same time as the Islander, one probably slightly before and the other about 5 minutes after the Islander. A third aircraft departed Bethel for the same area about 2 hours later. The pilot of the first aircraft stated that Bethel weather was good at departure and that en route weather was generally good with ceiling and visibility variable, occasionally down to 500 feet and 1 mile, respectively, but that he maintained visual contact with the ground. The pilots of the second and third aircraft both reported that the weather en route deteriorated rapidly. The pilot of the second aircraft stated that VFR flight eventually became impossible and he landed his aircraft on a frozen lake and waited 30 minutes until weather conditions improved. The pilot of the third aircraft (2 hours later) encountered ceilings of 500 feet with visibility of less than 1 mile and whiteout conditions. He aborted his flight and returned to Bethel. The Islander aircraft wreckage was found several hours later that day in the area where the second flight landed to wait out the storm and near the area where the third flight was aborted.

The pilot of the Islander had a commercial pilot certificate, with single- and multiengine land and sea ratings and was instrument rated. He had a total of 1,783 flight hours—179 hours in the Islander, and 7 hours in the last 24 hours.

This accident illustrates a number of problems facing Alaskan air taxis, especially those operating in rural western Alaska. The attempt to contact the destination village for a report on weather conditions failed. Existing conditions provided no indication or forewarning of potential weather problems. Weather conditions en route deteriorated rapidly and severely; no navaids were available. These conditions, which are typical of rural Alaska, are certainly conducive to an accident.

CURRENT EFFORTS TO IMPROVE SAFETY

In the July 1979 update of its Ten Year Plan for Alaska, the Alaska Region office of the FAA recommended major improvements to the aviation infrastructure, including the navaid system, weather observation and reporting system, and the airport system. Most operators interviewed for this study believed the recommended improvements in navaids to be adequate for their needs but they were concerned about the long lead time in the implementation of the improvements to the system. In its Ten Year Plan, the FAA has proposed the installation of 10 TVORs (terminal-area VORs) and 17 NDBs. Funding has been committed for four TVORs and seven NDBs. The TVORs are attractive because approaches to several neighboring villages often can be made from one well-located TVOR. Obviously, the installation of the funded and the planned TVORs would be of significant benefit to the air taxi system.

Some air taxi operators have applied to the FAA for an exemption which will allow them to use the radar on board their aircraft to assist in making instrument approaches at lower minimums. During the interviews, the operators serving western Alaska repeatedly stated that they need navaids now and suggested that the existing beacon system that was installed and operated by Wien Air Alaska be reactivated immediately.

In June 1980, the State Legislature of Alaska enacted Chapter 50, containing the Fiscal Year 1981 Budget. Chapter 50, SLA 1980 contained appropriations of $51,357,600 for further development of the State aviation system. Amounts appropriated by development category are:

Airport lighting	$ 4,719,000
Navigational aids	2,775,000
Rural airport runway improvement	35,247,000
Southwest air transportation and facilities 21/	6,137,600
Airport weather reporting equipment	300,000
Airport terminal and storage buildings	1,950,000
Air-to-ground radios	199,000
Emergency medical supplies	30,000
	$ 51,357,600

This appropriation package is unprecedented for this or any other State. In comparison, Federal Airport Development Aid Program (ADAP) funding for general aviation in Alaska was less than $4 million for FY 1979.

21/ Includes runway improvement, runway lighting, navaids, weather reporting, airport terminal and storage buildings, air-to-ground radios, and emergency medical supplies for 22 villages in the southwestern part of the State.

Funding allocations for aviation in rural Alaska in Chapter 50, SLA 1980 were based on recommendations provided to the 1980 State legislature by Parker Associates of Anchorage, aviation transportation consultants to the State. These recommendations were the result of a 1979 study of the problems of air service to rural Alaska. 22/

Chapter 50, SLA 1980 incorporated a number of conditions on the use of the appropriated funds. For example, runways constructed with the funds must meet, where possible, the minimum State standard for runways of 3,000 feet in length by 100 feet in width. Another requirement is that runway lighting must have a power source that complies with a State DOT/PF design document. 23/ Perimeter lighting and marking systems must also meet certain requirements.

Among other conditions specified by Chapter 50, SLA 1980 there is a requirement under the appropriations for navaids that "Beacon installation plans shall be implemented immediately for those villages where Wien Air Alaska has agreed to turn over its existing frequencies and licenses to the State." Implementation of this requirement would be an immediate response to some of the needs and desires of the air taxi operators serving rural Alaska. Further, Chapter 50, SLA 1980 appropriates money for the installation of considerably more navaids than are proposed overall in the FAA Alaska Region's Ten Year Plan. Similarly, Chapter 50, SLA 1980 appropriates funds for establishing significantly more weather reporting stations than the NWS projected in the near future.

Chapter 50, SLA 1980 apparently appropriates sufficient funds to make a significant improvement in the airport and airway facilities serving Alaska's air taxi industry. In combination with the FAA Ten Year Plan, the improvements could have a substantial impact on the safety of Alaska's aviation system, depending on the application of the State funds and the implementation of the FAA Ten Year Plan.

An improvement in safety would require the development of a program for application of the funds based on a well-designed plan coordinated with the FAA, the NWS, and the users of the system. Further, implementation of even the best-designed program will produce the maximum safety benefits only if the managers, regulators, and users of the system do so with the proper attitude toward safety. The improved system must be maintained adequately by the State and the FAA, and the air taxi operators and pilots who use the system must improve their adherence to sound safety practices. Finally, the regulators of the system, primarily the FAA, must work together with the managers and users to enforce safe operation within the system.

Presently, the NWS and the FAA are working together in the area of weather observations. The NWS is recruiting and training 50 additional observers and the FAA is supplying the funds for equipment. This is an excellent example of an interagency cooperative effort that will help to alleviate the problem of inadequate weather observations. The Safety Board believes this type of effort should continue.

22/ "Air Service to Rural Alaska, A Study in Inadequacy," Parker Associates, October 20, 1979.
23/ "Feasibility Report and Design Guide for Remote Airport Lighting Systems," Alaska DOT/PF.

Although the experimental remote TV cameras for weather observation at Unalakleet and Valdez have not been completely successful, the concept merits further work. The FAA and the NWS are presently exploring the possibility of using "meteor burst" technology to relay weather observations to a central receiving antenna. It would then be automatically transmitted within seconds to all FAA and NWS teletype machines in Alaska and would eliminate many of the problems with current methods of disseminating weather observations. The exploration of these two new technologies is clearly worthwhile and should yield valuable results.

As one of its contributions to improving air safety in Alaska, the Alaska Air Carriers Association (AACA) has an ongoing safety program aimed at management, operations, and maintenance. Inspection teams are sent to various air taxi operators to point out areas where improvements are warranted. The AACA also holds a safety seminar at its annual conference.

SAFETY CONCERNS YET TO BE RESOLVED

Discussions with State DOT/PF personnel, with Federal officials, and with Mr. Walt Parker of Parker Associates suggested that the State of Alaska does not yet have in place an organization which is adequate to implement the apparent intent of the State legislature for application of the fiscal year 1981 funds appropriated for improvements in the aviation transportation system. The State DOT/PF has divided the planning and programming of its transportation system into three regions, which are responsible for all modes of transportation. While it appears that there are efforts to coordinate and work together, to the extent possible, in planning for the use of the funds and for developing a comprehensive program, there appears to be a lack of overall control of the process. No comprehensive program for an aviation system in Alaska was available from the DOT/PF when the Safety Board staff met with DOT/PF staff officials in Alaska. It is not clear that a complete, up-to-date inventory of airports in Alaska exists. Further, effective coordination between the DOT/PF and the State legislature in developing the appropriations bill seemed to be missing.

Recently, the FAA held hearings in several areas of rural Alaska to learn the needs of the users of the aviation system. Much of the information has been incorporated in FAA planning policy in Alaska, including the most recent update of the Ten Year Plan. While a dialogue exists between the FAA and the State DOT/PF, the degree of coordination among the State and Federal agencies (particularly the FAA and the NWS) does not appear to be sufficient to develop and implement an adequate aviation infrastructure.

An action plan for implementation of Chapter 50, SLA 1980 is being developed by the State DOT/PF. However, the time and resources available make it unlikely that this action plan will be an adequate substitute for the development of a comprehensive plan for the Alaskan aviation system. A central organization with complete and exclusive authority and responsibility for the aviation portion of transportation is needed in the Alaska DOT/PF. Coordination between the DOT/PF and the State legislature, the FAA, the NWS, and the user community is necessary to develop such a comprehensive program.

Inadequate maintenance of existing airfield facilities continues to be a problem. The State must determine how to improve the quality and reliability of its current runway maintenance. In addition, the State, in cooperation with the FAA, must develop and implement an effective maintenance program for newly installed navaids, weather reporting facilities, and communications facilities. Failure to do so could lead to a further degradation in safety rather than providing anticipated improvements in safety, because pilots and operators will come to depend on the newly installed facilities, and inadequte maintenance could result in accident-producing system errors.

Another problem which must be resolved is that of the attitude toward safety of some participants in the system. Elimination of the "bush syndrome" exhibited by pilots, operators, and passengers must accompany the improvements in airway and airfield facilities. This is perhaps the most important facet in terms of its potential contribution to safety, and is probably the most difficult area in which to achieve success. Further, the Safety Board recognizes that the "bush syndrome" is, in part, a manifestation of the deficiencies in the aviation system infrastructure (such as inadequate runways and insufficient aids to navigation and weather observation stations) and that the correction of these deficiencies would likely result in the elimination of a part of the "bush syndrome" problem.

Operators and pilots, especially those young pilots who are relatively new to Alaska, should be reminded continually of the hazards of flying in Alaska. They should also be reminded that the results of not respecting those hazards are accidents and violations of the Federal Aviation Regulations. The FAA must relate to the operators and pilots in an atmosphere of trust and respect. Operators must view the FAA not only as enforcers of the regulations but also as being helpful to them in accomplishing their mission of providing safe air service for Alaskans. Friction and antagonism between the FAA and the operators and pilots is often found in Alaska. This does not create an environment conducive to safety.

The permanent relocation of FAA principal operations and maintenance inspectors from the Anchorage, Fairbanks, and Juneau offices of the FAA to the regional hubs such as Bethel, Nome, McGrath, Ketchikan, and Kotzebue undoubtedly would be effective in reducing some of the unwarranted flying in adverse weather conditions and would relieve some of the pressure on the majority of operators who would prefer not to operate under such conditions. It may be difficult to find FAA inspectors who are willing to live in the conditions found in the rural areas. However, it is not an impossible task; FAA flight service station personnel are assigned to these areas now.

Federal and State officials must also develop programs to impress upon the village inhabitants, especially the youth, the importance of the air taxi service to them and the relevance of operating that service safely. They must be helped to understand the significance of the pressures that are often put on operators and pilots and the dangers associated with these pressures. They also must be helped to clearly understand the need to respect the airport facilities provided for them, including runway lights and communications equipment. This task will not be easy, but the Safety Board believes it to be absolutely necessary.

The NWS must reevaluate the usefulness of the automated weather observation stations for aviation purposes in Alaska. Operators and pilots believe this system to be inadequate and often misleading. It is apparent that the current

state-of-the-art of these systems is not sufficient to warrant the replacement of human observers.

CONCLUSIONS

1. The State of Alaska is heavily dependent on its air taxi industry to transport food, medicine, mail, and many other necessities of life to rural villages.

2. The nonfatal air taxi accident rate in Alaska is almost five times higher than the nonfatal air taxi accident rate in the rest of the United States, and the fatal air taxi accident rate in Alaska is more than double the fatal air taxi accident rate in the rest of the United States.

3. Air taxi flying in Alaska is unique because of a number of factors, such as, whiteouts, very rapid changes in weather, a scarcity of navaids that cause most air taxi operations to be made under visual flight rules (VFR), and the large number of off-airport takeoffs and landings in float-equipped and ski-equipped aircraft.

4. The three major factors which probably contribute most to the high air taxi accident rate in Alaska are: (1) the "bush syndrome," (2) inadequate airfield facilities and inadequate communications of airfield conditions, and (3) inadequate weather observations, inadequate communications of the weather information, and insufficient navigation aids.

5. The "bush syndrome" is an attitude on the part of air taxi operators, pilots, and passengers in Alaska that ranges from a casual acceptance of risks to a willingness to take unwarranted risks.

6. The State owns and operates most of the active airports in Alaska, and many of its runways are inadequately maintained.

7. The collection and dissemination of weather information and current runway condition information is hampered by a shortage of trained personnel and by an inadequate communications system in rural Alaska.

8. The State of Alaska has recently appropriated through Chapter 50, SLA 1980 substantial funds for the improvement of the State aviation system, including capital outlays for improvements of runways and for the installation of navaids, weather reporting equipment, and communications equipment.

9. A comprehensive State aviation system plan adequate to implement the intent of Chapter 50, SLA 1980 does not appear to exist. Further, centralized control over and authority for developing such a comprehensive aviation plan does not appear to exist within the State DOT/PF.

10. The relationship between the State's air taxi operators and the FAA appears to be strained. Furthermore, because of a lack of permanent FAA inspectors at the rural hubs, there is insufficient opportunity for the FAA to provide guidance to the air taxi operators.

√11. Cooperation among the State of Alaska, the FAA, the NWS, and the air taxi operators must be increased if the State is to develop and implement an adequate aviation ~~system plan.~~ weather reporting system.

RECOMMENDATIONS

Based on the results of this study, the National Transportation Safety Board recommended:

-- to the State of Alaska:

Coordinate with the Federal Aviation Administration and the National Weather Service to facilitate the rapid implementation of the air transportation projects contained in Chapter 50, SLA 1980. (Class I, Urgent Action) (A-80-96)

Improve the level of maintenance of the runway facilities at the rural villages within the State airport system. (Class II, Priority Action) (A-80-97)

Centralize authority and responsibility for planning, operating, and maintaining the State's aviation facilities. (Class II, Priority Action) (A-80-98)

Develop, in cooperation with the Federal Aviation Administration and the system users, a comprehensive aviation system plan and a program for the implementation of the plan. (Class II, Priority Action) (A-80-99)

Establish, in cooperation with the Federal Aviation Administration and the air taxi operators, a program to impress upon the public, particularly those living in rural villages, the importance of respecting and properly maintaining airfield facilities. (Class II, Priority Action) (A-80-100)

-- to the Federal Aviation Administration:

Evaluate, in cooperation with the State of Alaska and the National Weather Service, the feasibility of equipping its flight service stations and the NWS-certified weather observers in rural villages with high-frequency transceivers that have the appropriate frequencies to facilitate the ground-to-ground communication of weather and runway conditions. (Class II, Priority Action) (A-80-101)

Locate and maintain permanently a Principal Operations Inspector and a Principal Maintenance Inspector at Nome, Bethel, Ketchikan, and at as many other regional hubs as possible. (Class II, Priority Action) (A-80-102)

Continue to develop, in cooperation with the National Weather Service, the concept of "meteor burst" technology for transmission of weather observations from rural villages to regional aviation hubs in Alaska. (Class II, Priority Action) (A-80-103)

Continue to develop and improve, in cooperation with the National Weather Service, the technology of the television weather observation system in Alaska. (Class II, Priority Action) (A-80-104)

-- to the Alaska Air Carriers Association:

Extend its safety program to reiterate the hazards of air taxi operations in Alaska and to overcome, in particular, the "bush pilot syndrome." (Class II, Priority Action) (A-80-105)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, and FRANCIS H. McADAMS, Member, did not participate.

September 16, 1980