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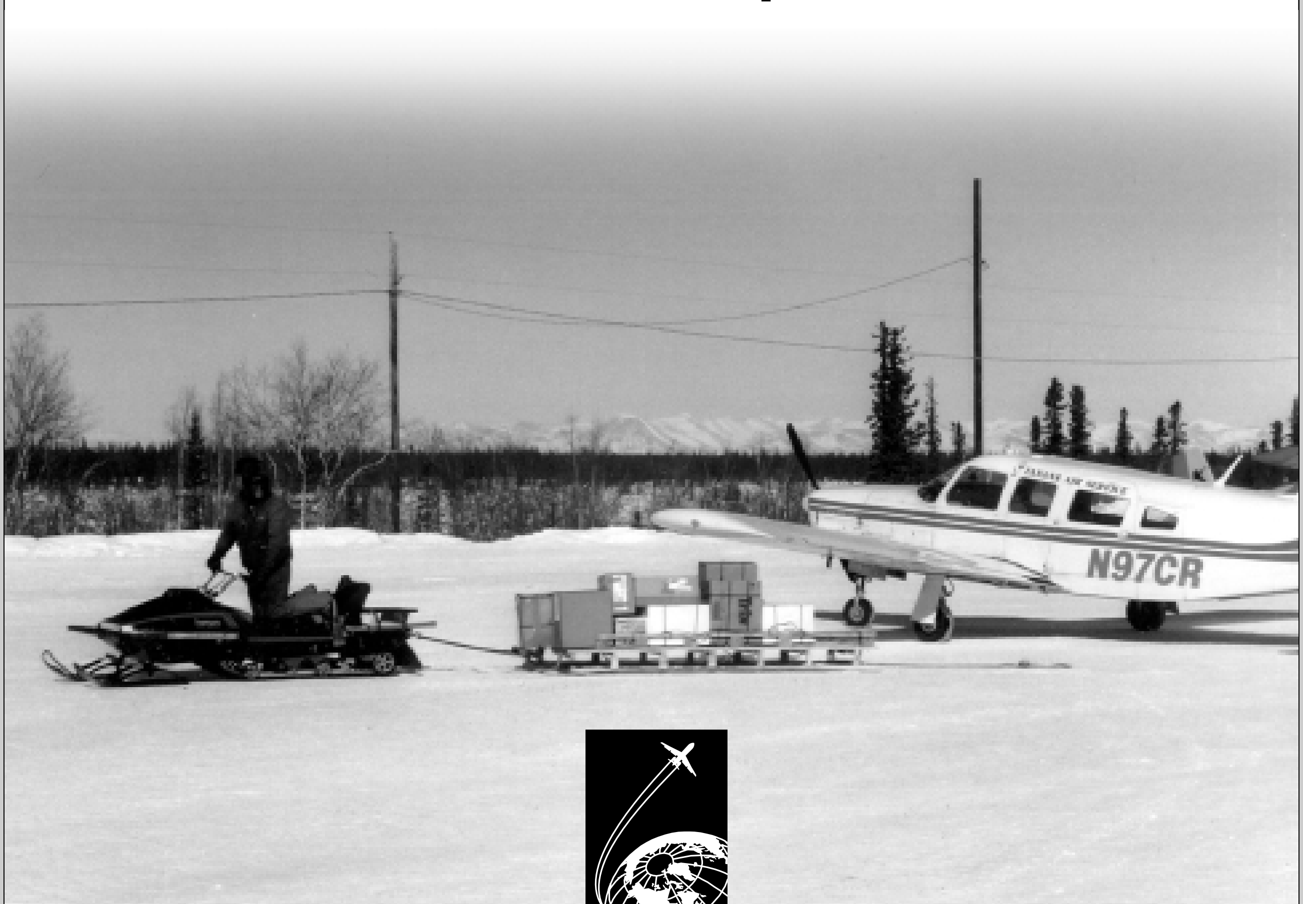
DIGEST

Controlled Flight Into Terrain: A Study of Pilot Perspectives in Alaska

Among U.S. States, Alaska Has Highest Incidence of Accidents in FARs Part 135 Operations



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In This Issue

Cover photo: Most commuter and on-demand flights in Alaska are single-pilot operations conducted in single-engine airplanes. (FSF photo by Christopher Deck)

Flight Safety Foundation is an international membership organization dedicated to the continuous improvement of aviation safety. Nonprofit and independent, the Foundation was launched officially in 1947 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 850 member organizations in more than 150 countries.

Controlled Flight Into Terrain: A Study of Pilot Perspectives in Alaska

Survey results indicate that pilots employed by companies involved in controlled-flight-into-terrain (CFIT) accidents rated their company's safety climate and practices significantly lower than pilots employed by companies that had not been involved in CFIT accidents.

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In 1995, the U.S. National Transportation Safety Board (NTSB) issued the safety study, *Aviation Safety in Alaska*, which highlighted two accident types of major consequence: accidents during takeoff and landing, and accidents related to flying under visual flight rules (VFR) into instrument meteorological conditions (IMC). The report states that accidents related to VFR flight into IMC are less frequent but account for a larger percentage of the fatal accidents, making them the leading safety problem for Alaskan commuter airlines and air taxis (NTSB, 1995).

Seeking to address this critical safety issue, the State of Alaska and the U.S. Federal Aviation Administration (FAA) developed several initiatives to reduce aviation fatal accident rates by 80 percent by the year 2007. As part of the overall effort to reduce the number of fatal aircraft accidents in the State of Alaska, an interagency task force was formed to study pilot perceptions of factors relevant to aviation in Alaska. Efforts were focused on the procedures and behaviors of management and employees of Alaskan passenger or freight companies. For the purpose of this research, the terms *passenger* and *freight company* are reserved for those companies holding U.S. Federal Aviation Regulations (FARs) Part 135, Part 131, Part 125 and Part 121 certificates and operating within the State of Alaska. Major-airline pilots, U.S. Department of Defense pilots and pilots employed by the state or federal government were excluded from the study.

The interagency task force began with an analysis of the NTSB aircraft accident database for the period Jan. 1, 1990, to Dec. 31, 1998. Data regarding probable causes for each Alaskan commercial aviation accident reported by the NTSB between 1990 and 1998 were reviewed. Accident statistics revealed that controlled flight into terrain (CFIT) was a major factor in the fatality rate in aircraft accidents in Alaska during this period. Of 126 fatal accidents that occurred in Alaska between Jan. 1, 1990, and Dec. 31, 1998, 89 accidents (71 percent) involved CFIT. A CFIT accident occurs when an airworthy aircraft, under the control of a pilot, is flown (unintentionally) into terrain, water or obstacles with inadequate awareness on the part of the pilot (crew) of the impending collision (Wiener, 1977). In general use, the acronym *CFIT* refers to a broad spectrum of accidents. These include flights operated under either instrument flight rules (IFR) or VFR, or during transitions from one mode to the other. IFR applies to flights conducted by reference to the aircraft instruments when visibility is reduced. VFR applies to flights in which the pilot navigates by maintaining visual contact with objects on the surface.

Because of the specific challenges facing Alaskan aviation, CFIT accidents are limited in the current study to accidents that occurred when aircraft flown under VFR encountered IMC and subsequently impacted the terrain. VFR flight into IMC occurs under the following circumstances: pilots depart for VFR-only destinations with the intention of maintaining visual separation from terrain or water and continue flying toward their destination after encountering weather conditions that would normally require flight under IFR. Of the 89 fatal CFIT accidents that occurred in Alaska between Jan. 1, 1990, and Dec. 31, 1998, 69 accidents (77.5 percent) involved VFR flight into IMC.

All other accident categories — including but not limited to mechanical difficulties, pilot operational error, wind draft or wind shear, runway conditions, foreign objects and weather and icing conditions at takeoff and landing — accounted for only 29 percent of the fatal accidents between Jan. 1, 1990, and Dec. 31, 1998. Additionally, the majority of serious injuries were associated with CFIT accidents.

The high fatality rate associated with CFIT events emphasizes the importance of addressing this type of accident and examining the associated risk factors. A substantial reduction of CFIT accidents in Alaska would reduce the number of commercial aviation fatalities in that state by up to 70 percent. Understanding the factors resulting in a pilot flying an airworthy aircraft into terrain can assist in the development of appropriate interventions at multiple levels within the aviation industry and could reduce the number of commercial aviation fatalities.

The NTSB aircraft accident database identified Alaskan companies that were involved in accidents in which NTSB investigators determined that VFR flight to IMC was a contributing factor. These companies are referred to in the remainder of this report as *CFIT companies*. Companies without CFIT as an accident causal factor during the same period are referred to as *non-CFIT companies*. To examine potential differences between CFIT companies and non-CFIT companies in Alaska, a method of comparing pilot perceptions of the practices, policies and procedures of their companies and their companies' pilots was developed. Identification of differences between the two types of companies could heighten awareness of the factors involved in CFIT.

Geographic, Environmental, Airport and Air Route Issues

Alaska is a vast state, spanning 365 million acres (148 million hectares) and equal to one-fifth the size of the continental United States. The 49th state is a land of immense geographic diversity, bordered by two oceans and three seas, resulting in more than 33,000 miles (53,097 kilometers) of coastline. In the north, Alaska is treeless with tundra, while the Panhandle is lush with temperate rain forests. Alaska also contains North America's highest peak, Mount McKinley (20,320 feet). The temperature between two locations in Alaska may vary as much as 100 degrees Fahrenheit (38 degrees Celsius). Alaska's large landmass, vast mountain ranges, flat marshy tundra and extensive coastline result in variable climatic zones and weather. Wide areas of poor flight visibility are common. Many VFR destinations have no weather-reporting observers or equipment. Pilots base their pre-departure weather evaluations on area forecasts, with in-flight updates coming from station agents and what can be observed through the windshields of their aircraft. In the winter, southern Alaska has long hours of darkness, and in the far north, night extinguishes day for more than two months. Summer days are long in the northern latitudes. Aviation companies seeking to benefit by the extended daylight may assign pilots to lengthy duty periods.

Although more than half of the Alaskan population lives in one of the state's three major cities — Anchorage, Fairbanks and Juneau (Bureau of the Census, 1992) — much of the remaining population lives in remote villages accessible year-around only by aircraft. Commuter aircraft and on-demand (charter) aircraft serve as the main link between these villages and regional hubs, transporting people, goods and mail. Alaska has approximately 600 published airports and more than 3,000 airstrips (FAA, 1996). These airports and airstrips are served by 331 scheduled commuter or charter passenger and freight companies. Sixty-six public airports are equipped for IFR aircraft arrivals, with the remainder accessible only by flights operated in VMC. A high percentage of flights serving these areas terminate at airports or landing areas with unlighted runways, many with soft gravel or rutted dirt surfaces. Because of length restrictions, numerous airstrips are limited to only those aircraft able to make short approaches and landings. In addition, many aircraft are equipped with floats and land on water surfaces that are visually challenging because of glare and reflection, in addition to being susceptible to both wave fluctuations and wind drafts. Landings under those conditions require special knowledge and skills.

This information presents a picture of Alaska as a unique state with distinctive geographic features and environmental features affecting aviation. From this uniqueness emerges an operational requirement that forces pilots to face many difficult decisions about flying each day.

Human Factors Issues

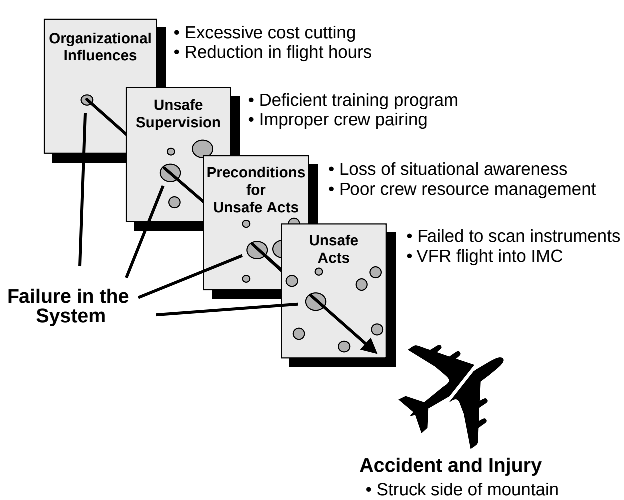
The 1995 NTSB report investigated the following issues: the operational pressures on pilots and commercial operators to provide reliable air service in an operating environment and aviation infrastructure that often are inconsistent with these demands; the adequacy of weather observing and weather reporting; the adequacy of airport inspections and airport-condition reporting; the potential effects on safety of current regulations for pilot flight duty and rest time, applicable to commuter and on-demand operations in Alaska; the adequacy of the current IFR system and enhancements needed to reduce the reliance of Alaska's commuter airline operations and on-demand operations on VFR; and the needs of special aviation operations in Alaska.

On the basis of the preceding considerations, researchers determined that CFIT mishaps in Alaska have multiple levels of causality. The concept of multiple levels of causality is a component of the Human Factors Analysis and Classification System (HFACS), a model developed to analyze and classify human factors associated with aviation accidents (Wiegmann and Shappell, 1998).

The HFACS idea that aircraft accidents typically have multiple levels of causality also is known as the "Swiss cheese" model of accident causation and comes from James Reason's work (Reason, 1990) on causes of human error (Figure 1). In 85 percent of all accidents, human error was involved. Human error involvement in accidents is not unique to aviation; it applies to any industry (Flight Safety Foundation, 1999).

For an accident to occur, failures have to occur at several different levels of responsibility. Responsibility for an accident typically cannot be placed solely on the pilot because, in the best-case scenario, there should be a system in place that would have prevented certain conditions that contributed to the accident. Failures may be attributed to the following: unsafe acts, preconditions for unsafe acts, unsafe supervision and/or organizational influences.

James Reason's "Swiss Cheese" Model of Human Error Causation



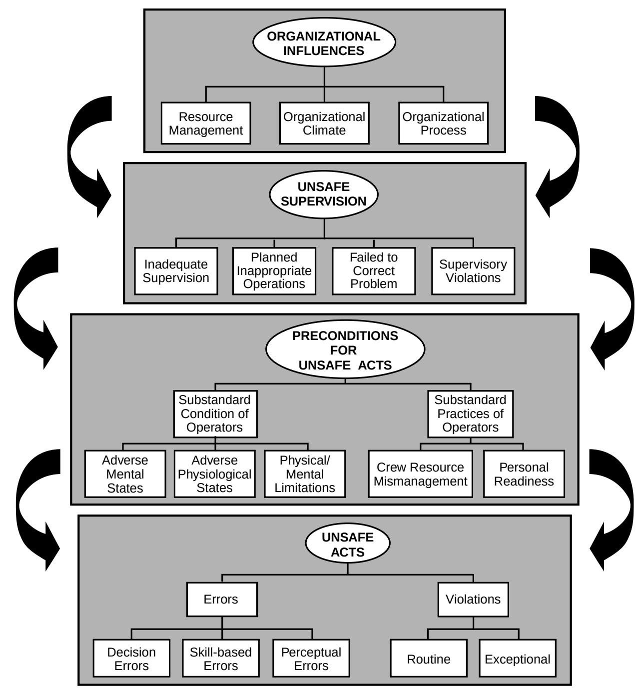
VFR = Visual flight rules
IMC = Instrument meteorological conditions

Source: U.S. Federal Aviation Administration

Figure 1

The HFACS taxonomy defines four levels of causality for accidents, each of which is further subdivided into specific types of failures. Figure 2 shows the four categories of the taxonomy and their representative subcategories (see "Taxonomy of Unsafe Operations [Shappell and Wiegmann, 2000]," page 10).

Human Factors Analysis and Classification System Taxonomy



Source: U.S. Federal Aviation Administration

Figure 2

The first HFACS level is the unsafe act itself. For example, the pilot failed to scan the instruments at a critical time during the flight (skill-based error) or entered instrument conditions unexpectedly (decision error) and lost control of the aircraft. Before those events took place, however, certain preconditions for the unsafe acts had to occur.

The second level in the taxonomy identifies preconditions for unsafe acts, which are events that could have led to the unsafe act. Fatigue (substandard condition of the operator), for example, could have led to the pilot's inadequate scanning of the instruments.

The third level in the taxonomy is unsafe supervision. An example of a failure at this level would be inadequate supervision regarding pilot rest requirements and the adverse physiological consequences and mental consequences that could arise from a lack of sleep.

Underlying unsafe supervision, the fourth HFACS level involves organizational influences. Two examples of failures at this level are a reduction in the training budget (resource management), which would eliminate training regarding pilot rest requirements, and an organizational climate that condones working beyond the recommended normal work schedule. Some studies found that CFIT is related to organizational failure (Khatwa and Roelen, 1998; Maurino, 1993; Weiner, 1977).

Using the HFACS taxonomy, a survey was devised to assess pilot perceptions of flying conditions in Alaska and to evaluate possible differences and similarities between pilots employed by CFIT companies and pilots employed by non-CFIT companies. These differences could then be examined to formulate recommendations to heighten awareness and to reduce CFIT accidents in Alaska.

Method

Questionnaire Development

Development of the majority of survey items was based on the HFACS taxonomy. Survey items were generated to measure the extent to which pilot respondents agreed or disagreed that various problematic conditions existed within their company. The majority of the survey questions were structured to allow respondents to answer on a range from "strongly disagree" to "strongly agree," with the option to answer that the item was "not applicable." Questions that were not conducive to "agree" or "disagree" ratings used rank order responses; in some instances, categories required a single selection (e.g., demographic information). Because of the difficulty in constructing appropriate items for some of the HFACS domains, different numbers of items were generated for each of the four levels. In all, the following categories were created to assess individual HFACS areas:

- Unsafe acts (nine items);
- Preconditions for unsafe acts (20 items);
- Unsafe supervision (six items); and,
- Organizational influences (36 items).

In addition to the items based on the HFACS taxonomy, several items were included for the collection of demographic information. An additional set of items was included to measure pilot perceptions of pilot interactions with FAA personnel and the impact of certain FARs on flying in Alaska. In all, 87 survey items were generated (see "Summary and Results for Non-CFIT-company Pilots and CFIT-company Pilots," page 13).

Pretesting of the Survey Form. The survey was pretested by 30 personnel from several FAA flight standards district offices in Alaska. Pretesting determined the expected time to complete the survey and whether all the items were easily understandable by the general pilot population. Changes, additions and deletions were made to several items in the survey based on information received from the pretests.

Survey Population. Prior to development of the survey, personnel from the FAA Alaskan Region Flight Standards Division assembled a list of flight companies in Alaska. Accident data available from NTSB were used to identify passenger/freight companies involved in one or more CFIT accidents between Jan. 1, 1992, and Sept. 10, 1998. Of the 330 companies identified, 301 were designated as non-CFIT companies and 29 were identified as CFIT companies.

A list of pilots working in Alaska was generated using information on pilot medical certification contained at the FAA's Civil Aeromedical Institute (CAMI [now called the Civil Aerospace Medical Institute]) in Oklahoma City, Oklahoma, U.S. All pilots holding a second-class medical certificate and living in Alaska were identified. The Alaskan Region Flight Standards Division generated a list of pilots working in Alaska but living out of state. These lists were combined, and, when possible, employers were identified using the medical certification database at CAMI. Pilots working for major airlines were eliminated from the study, as were military pilots and government pilots. A total of 3,237 pilots were identified to receive the survey.

When appropriate employer information was available, pilots were identified as employed either by non-CFIT companies or by CFIT companies, and the survey they received was coded as "non-CFIT" or "CFIT." When employer information was not available, the survey was coded as "other." The survey provided respondents the opportunity to identify their employer. Specific employer information was not kept, and surveys did not contain information regarding the personal identification of the pilots. Returned surveys could be identified as belonging to the non-CFIT group or to the CFIT group but could not be traced to a specific pilot — therefore, the anonymity of the respondent was assured. A total of 680 surveys were coded as non-CFIT; 186 were coded as CFIT; and 2,371 were coded as other.

Survey Procedure. One week prior to the distribution of the surveys, an introductory letter was sent to the survey population explaining the need for the survey and the purpose of the survey. The letter gave a broad overview of the types of items contained in the survey and included a request for cooperation, particularly for some of the more sensitive issues covered by the survey. The letter ended with a promise to advise participants of the recommendations developed as a result of the survey analysis. Surveys were mailed the following week. Each survey was accompanied by a cover letter, similar in scope and content to the letter of introduction. Approximately one month following the survey mailing, a follow-up letter was mailed. The follow-up letter encouraged respondents to complete and return their surveys.

Results

Return Rates

Of the 3,237 surveys distributed, a total of 491 were returned, giving an overall response rate of approximately 15 percent. While low, this return rate is similar to, or better than, that obtained for other surveys in the Alaskan region (Driskill, Weissmuller, Quebe, Hand and Hunter, 1997; Joseph, Jahns, Nendick and St. George, 1999; Rakovan, Wiggins, Jensen and Hunter, 1999). Of the 680 non-CFIT surveys, 134 were returned — a return rate of approximately 20 percent. Of the 186 CFIT surveys, 37 were returned —a return rate of approximately 20 percent. Of the 2,371 other surveys, 320 were returned — a return rate of approximately 14 percent.

The last item on the survey requested that respondents identify their employer. If the respondent answered this question and the company was designated as a non-CFIT company or as a CFIT company, the survey was coded as either a non-CFIT survey or as a CFIT survey. One hundred and thirty-four surveys were coded as non-CFIT or as CFIT using this information. Forty-three surveys were eliminated because the respondents indicated that they worked either for the military or for a major airline. The resulting samples included 234 non-CFIT surveys and 71 CFIT surveys. (Surveys coded as “other” were not used for further analysis.)

Given the low response rates and small sample sizes, the reader is cautioned about generalizing the results of this survey to the broader Alaska population. The lower the response rates, the more uncertainty there is about how well the results will generalize to the target population. Thus, the reader is advised to seek confirmation from other sources (e.g., accident reports or articles) before using the results of this survey to guide policy and decision making.

Survey Item Analysis

The survey items were analyzed two ways. First, a descriptive analysis of the item response distributions was conducted for CFIT-company pilots and for non-CFIT-company pilots. Next, the response distributions of CFIT-company pilots and non-CFIT-company pilots were compared statistically using nonparametric Mann-Whitney tests and chi-square tests.

Graphical displays of item response distributions were examined to determine the general shape and frequency of responses. Reported in Appendix B (page 13) are item sample size, mean and standard deviation. An additional statistic — “percentage disagree” and “percentage agree” — was included to assist the reader in interpreting item distributions. The percentages were computed by excluding respondents expressing a “slight” opinion (i.e., the middle two rating options — “slightly agree” or “slightly disagree”) and using only respondents who disagreed (combination of “disagree” and “strongly disagree”) or who agreed (combination of “agree” and “strongly agree”) with an item. By reporting data this way, greater attention was given to respondents with more definite opinions.

It was determined that mean scores would not be the appropriate statistic for comparing responses of CFIT-company pilots and non-CFIT-company pilots. Instead, a statistic was needed to determine whether CFIT-company pilots and non-CFIT-company pilots differed in their overall response for a given item. For all items employing a rating scale, the Mann-Whitney test was chosen because it determines whether one population has larger values than the other, regardless of the shape of the response distribution. Using the Mann-Whitney test, 19 items yielded significant differences.

Several survey items required respondents to respond in a “check-box-like” manner or to rank-order their responses. In these instances, a chi-square test of significance was used to determine whether pilots from non-CFIT companies responded differently, compared with pilots from CFIT companies. The chi-square test analyzes the distribution of responses across the number of response options presented. It uses the sample sizes and the number of response options to determine the probability that a given response will be endorsed. The probability is then compared with the actual percentage of respondents who endorsed a given response option. Using the chi-square test, five items yielded significant differences.

Significant differences in either the Mann-Whitney tests or the chi-square tests were found in the following categories of system failures: Organizational Influences, 11 of 36 questions; Unsafe Supervision, three of six questions; and Preconditions for Unsafe Acts, five of 20 questions. As previously mentioned, all categories were not represented equally. The results appear in Table 1 (page 6) for items tested using the Mann-Whitney statistic and in Table 2 (page 7) for items tested using the chi-square statistic. To aid the reader in interpreting the results, the percentages of disagreement and the percentages of agreement are provided, rather than mean scores, for the applicable items.

In the category Organizational Influences, the responses to item 61 (Table 1) show that pilot perceptions differed concerning the age of their company’s aircraft, with non-CFIT companies having older aircraft (21–25 years old) than CFIT companies (16–20 years old). The perceptions of maintenance provided by a company (item 60, Table 2) also differed, with significantly more non-CFIT-company pilots than CFIT-company pilots agreeing that their company provided sufficient maintenance in the areas of basic flight instruments, navigation instruments and communication equipment.

Table 1
Statistically Significant Items Based on Mann-Whitney Test of Significance

Item	Company[1]	Percent Disagree	Percent Agree
Organizational Influence			
11. In my company, pilot morale is high.	Non-CFIT	24.9	49.8
	CFIT	37.7	31.9
15. My company does all that it can to prevent accidents.	Non-CFIT	14.1	66.5
	CFIT	15.9	50.7
16. My company does not cut corners where safety is concerned.	Non-CFIT	14.1	64.8
	CFIT	14.5	43.5
17. My company considers the safety of its pilots as its top priority.	Non-CFIT	16.8	59.7
	CFIT	17.4	46.4
26. In my company, safety awards are used to promote safe flying.	Non-CFIT	63.6	23.0
	CFIT	79.3	12.1
31. My company provides me with opportunities to make safety recommendations.	Non-CFIT	8.5	73.2
	CFIT	18.8	56.5
61. The average age of the aircraft my company uses is ____ years old (range: 1 year to more than 25 years).[2]	Non-CFIT	21–25 years	
	CFIT	16–20 years	
66. My company's safety practices are: at bottom of industry; below average; average; above average; at top of industry (range: bottom of industry to top of industry; higher score is better).[2]	Non-CFIT	3.67 mean	
	CFIT	3.19 mean	
Unsafe Supervision			
33. Before each flight, my company makes sure that pilots have the right frame of mind for flying.	Non-CFIT	43.4	26.5
	CFIT	53.7	13.4
34. Before each flight, my company makes sure that pilots are physically fit to fly (e.g., free from the adverse effects of fatigue, medications).	Non-CFIT	40.9	33.6
	CFIT	52.2	16.4
68. The first time my company discovered I flew through weather below legal VFR, they would: do nothing; give me a warning, place me on suspension; fire me (range: severity of disciplinary action).[2]	Non-CFIT	1.77 mean	
	CFIT	1.53 mean	
Preconditions for Unsafe Acts			
38. In Alaska, safety would improve if the visibility requirement for special VFR (conducted under FARs Part 135) was increased to 2 miles when operating under a ceiling of less than 1000 feet.	Non-CFIT	51.7	31.7
	CFIT	39.7	47.1
43. In Alaska, during periods of extended daylight, pilot and copilot aircrews fly over 10 hours per day.	Non-CFIT	46.6	34.5
	CFIT	66.2	16.9
44. It is hard for Alaskan passenger and freight pilots to maintain a consistent sleep schedule.	Non-CFIT	31.3	43.6
	CFIT	46.5	26.8
45. In Alaska, during periods of extended daylight, a single-pilot aircrew flies over 8 hours per day.	Non-CFIT	49.0	28.3
	CFIT	65.7	13.4
46. Alaskan passenger and freight pilots understand how the time of day can affect their flying performance.	Non-CFIT	8.8	69.6
	CFIT	7.1	52.9
Demographic Information			
70. I am ____ years old (range: 18 years to over 50 years).[2]	Non-CFIT	46–50 years	
	CFIT	41–45 years	
71. I have flown in Alaska a total of ____ years (range: 1 year to 56 years).[2]	Non-CFIT	18.56 years mean	
	CFIT	15.07 years mean	
74. My total number of commercial rotary hours is ____ (range: 0 hours to 17,000 hours).[2]	Non-CFIT	2,970 hours mean	
	CFIT	1,129 hours mean	

Note: The percentages were computed by excluding respondents expressing a "slight" opinion (the middle two ratings options: "slightly agree" or "slightly disagree") and using only respondents who disagreed (combination of "disagree" and "strongly disagree") or agreed (combination of "agree" and "strongly agree") with an item.

[1]Non-CFIT companies are those identified by U.S. National Transportation Safety Board (NTSB) investigators as not having been involved in a fatal CFIT (controlled-flight-into-terrain) accident between Jan. 1, 1992, and Sept. 10, 1998; CFIT companies are defined as those identified by NTSB investigators as having been involved in one or more fatal CFIT accidents between Jan. 1, 1992, and Sept. 10, 1998. (CFIT occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew.)

[2]"Percent disagree" and "percent agree" responses do not apply to this question.

VFR = Visual flight rules   FARs = U.S. Federal Aviation Regulations

Source: U.S. Federal Aviation Administration

Table 2
Statistically Significant Items Based on Chi-square Test of Significance

Item	Percentage of Non-CFIT Pilots[1]	Percentage of CFIT Pilots[2]
Organizational Influences		
60. My company provides sufficient maintenance on each of the following aircraft components:		
Basic flight instruments	86.3	69.0
Navigation instruments	78.6	64.8
Communication equipment	86.3	66.2
63. (The flight follower or dispatcher) makes the final pre-departure go/no-go decision.	12.4	23.9
67. My company uses (station agents) during pre-departure weather evaluations.	46.2	60.6
Demographic Information		
72. I fly in Alaska during the following months:		
November	85.5	97.2
December	82.9	95.8
January	83.3	95.8
February	84.2	94.4
75. I hold (an airline transport pilot) certificate.	61.5	80.3
(I work for an FARs Part 135 certificate holder.)	59.0	88.7

Note: The percentages were computed by excluding respondents expressing a “slight” opinion (the middle two ratings options: “slightly agree” or “slightly disagree”) and using only respondents who disagreed (combination of “disagree” and “strongly disagree”) or agreed (combination of “agree” and “strongly agree”) with an item.

[1]Pilots employed by “non-CFIT companies,” defined as companies identified by U.S. National Transportation Safety Board (NTSB) investigators as not having been involved in a fatal CFIT (controlled-flight-into-terrain) accident between Jan. 1, 1992, and Sept. 10, 1998. (CFIT occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew.)

[2]Pilots employed by “CFIT companies,” defined as companies identified by NTSB investigators as having been involved in one or more fatal CFIT accidents between Jan. 1, 1992, and Sept. 10, 1998.

FARs = U.S. Federal Aviation Regulations

Source: U.S. Federal Aviation Administration

Table 1 shows differences in pilot perceptions about morale, safety issues and final pre-departure go/no-go decisions. More non-CFIT-company pilots rated their company’s safety climate and practices as safety-oriented than did CFIT-company pilots, with percentages ranging from 44 percent to 67 percent (item 15, item 16 and item 17). Non-CFIT-company pilots also agreed by a greater percentage that their company’s morale is high (item 11). Significantly more CFIT-company pilots indicated that they rely on a flight follower or dispatcher for the final pre-departure go/no-go decisions than did non-CFIT-company pilots (item 63, Table 2).

Differences were found among the perceptions of non-CFIT-company pilots and CFIT-company pilots about safety, safety awards and the use of station agents for weather reporting during pre-departure weather evaluations. Significantly more non-CFIT-company pilots than CFIT-company pilots considered their company’s safety practices to be “above average” or “at top of industry” (item 66, Table 1) and believed that they have more opportunity to make safety recommendations (item 31). The data also indicated that more non-CFIT-company pilots agreed that safety awards are used to promote safe flying (item 26). Significantly fewer non-CFIT-company pilots reported using station agents for weather-reporting services during pre-departure weather evaluations (item 67, Table 2).

In the category Unsafe Supervision, the responses to item 33 and to item 34 (Table 1) indicated that more non-CFIT-company pilots than CFIT-company pilots agreed that their company was cognizant of their frame of mind and physical fitness. The responses to item 68 indicated that more non-CFIT-company pilots agreed that they were likely to encounter repercussions for flying through weather below VFR minimums.

In the category Preconditions for Unsafe Acts, the responses to item 38 indicated that significantly fewer non-CFIT-company pilots agreed that safety would improve if the visibility requirement for special VFR operations (conducted under FARs Part 135) was increased to two miles when operating under a ceiling lower than 1,000 feet.

[Although Part 135 does not specifically address special VFR operations, special VFR operations may be conducted by Part 135 operators in accordance with Part 91.157, which requires operators of aircraft other than helicopters to have flight visibility of at least one statute mile (1.6 kilometers) and to remain clear of clouds. Many Part 135 operators have operations specifications that prohibit special VFR operations. (This information was verified by Gary Childers, operations inspector, FAA Alaskan Flight Standards District Office, and FAA national Free Flight program field coordinator; and by Kathy Perfetti, FAA national resource specialist for Part 135 operations.*)]

Responses to items in the Preconditions for Unsafe Acts category also indicated the following: Pilots flying for non-CFIT companies agreed that they have a better understanding of how the time of day can affect their flying performance (item 46, Table 1). Non-CFIT-company pilots reported flying longer hours for both single-pilot and for pilot-copilot crews (item 43 and item 45). Additionally, non-CFIT-company pilots reported having greater difficulty maintaining a consistent sleep schedule (item 44).

Demographic differences also were noted, including: a greater percentage of pilots who fly for CFIT companies do so under Part 135, have an airline transport pilot certificate (item 75, Table 2) and fly during the months of November, December, January and February (item 72). Pilots flying for non-CFIT companies are, on average, older (item 70, Table 1), have more years of experience flying in Alaska (item 71) and have more hours flying commercial rotary-wing aircraft (item 74).

Discussion and Recommendations

The primary purpose of developing the survey was to create an instrument with the potential to differentiate between the perceptions of pilots who flew for CFIT companies and pilots who flew for non-CFIT companies. Based on the profile that emerged from the results, it is clear that this objective was accomplished. The survey distinguished the perceptions of pilots for non-CFIT companies and of pilots for CFIT companies in the following areas: organizational influences, preconditions for unsafe acts and unsafe supervision.

Data analyzed from the study indicate lower CFIT-company pilot agreement in the crucial areas of safety practices and overall safety climate of their company than pilots of non-CFIT companies. In the event that CFIT companies create a more positive safety climate and improve their safety practices, it is likely that they also will reduce their risk of CFIT accidents.

In addition, the data reflect that among non-CFIT-company pilots, the ranking of a company priority for safety practices and overall safety climate ranges from a low of 23 percent to a high of 73 percent. This range indicates room for improvement in safety policies, procedures and practices of non-CFIT companies as well as CFIT companies.

Based on the survey results and considering the findings of the 1995 NTSB report, the following recommendations were developed to reduce the number of CFIT accidents in Alaska:

- Increase pilot awareness of CFIT safety-related issues;
- Improve company safety culture;
- Improve pilot training in the environment in which they commonly fly;
- Improve weather briefings; and,
- Eliminate pressure to complete a flight.

An assessment to determine the efficacy of the suggested interventions is essential to ascertain changes in pilot perceptions in the four HFACS categories, with an emphasis on exploring changes in safety practices and safety climate.

The results of this survey research should not be viewed in isolation of other related research on this topic. In this case, a number of studies have examined the issue of why CFIT accidents happen and what can be done to prevent them. A recent study conducted by an FAA Joint Safety Analysis Team (JSAT) reviewed the CFIT records of U.S. general aviation during the past five years (FAA, 1999). Many of this survey's findings support the recommendations that emerged from the JSAT, adding further evidence for the validity of the survey and its value as an organizational assessment tool.♦

[FSF editorial note: To ensure wider distribution in the interest of aviation safety, this report has been adapted from the U.S. Federal Aviation Administration Office of Aviation Medicine's *Controlled Flight Into Terrain: A Study of Pilot Perspectives in Alaska*, DOT/FAA/AM-00/28, August 2000. Some editorial changes were made by FSF staff for clarity and for style. Larry L. Bailey, Linda M. Peterson, Kevin W. Williams and Richard C. Thompson are researchers at the FAA Civil Aerospace Medical Institute.]

Notes

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Appendix A
Taxonomy of Unsafe Operations (Shappell and Wiegmann, 2000)

Organizational Influences

Resource Management

Human — refers to the management of operators, staff and maintenance personnel. Issues that directly influence safety include selection (including background checks), training and staffing/manning.

Monetary — refers to the management of nonhuman resources, primarily monetary resources. Issues such as excessive cost-cutting, a lack of funding for proper and safe equipment and resources have adverse effects on operator performance and safety.

Equipment/facility — refers to issues related to equipment design, including the purchasing of unsuitable equipment, inadequate design of work spaces and failures to correct known design flaws. Management should ensure that human factors engineering principles are known and utilized, and that specifications for equipment and work-space design are identified and met.

Organizational Climate

Structure — refers to the formal component of the organization. The "form and shape" of an organization are reflected in the chain-of-command, delegation of authority and responsibility, communication channels and formal accountability for actions. Organizations with maladaptive structures (i.e., do not optimally match to their operational environment or are unwilling to change) will be more prone to accidents and "will ultimately cease to exit."

Policies — refers to a course or method of action that guides present and future decisions. Policies may refer to hiring and firing, promotion, retention, raises, sick leave, drugs and alcohol, overtime, accident investigations, use of safety equipment, etc. When these policies are ill-defined, adversarial or conflicting, safety may be reduced.

Culture — refers to unspoken or unofficial rules, values, attitudes, beliefs and customs of an organization. "The way things really get done around here." Other issues related to culture include organizational justice, psychological contracts, organizational citizenship behavior, esprit de corps and union-management relations. All these issues affect attitudes about safety and the value of a safe working environment.

Organizational Process

Operations — refers to the characteristics or conditions of work that have been established by management. These characteristics included operational tempo, time pressures, production quotas, incentive systems, schedules, etc. When set up inappropriately, these working conditions can be detrimental to safety.

Procedures — the official or formal procedures as to how the job is to be done. Examples include performance standards, objectives, documentation, instructions about procedures, etc. All of these, if inadequate, can negatively impact employee supervision, performance and safety.

Oversight — refers to management's monitoring and checking of resources, climate and processes to ensure a safe and productive work environment. Issues here relate to organizational self study, risk management and the establishment and use of safety programs.

Unsafe Supervision

Unforeseen

Unrecognized hazardous operations — can be viewed as a loss of supervisory situational awareness. Though somewhat broad, it includes those instances when unsafe conditions or hazards exist yet go unseen or unrecognized by the untrained or overtasked supervisor. Selected examples include:

- Medical conditions, such as illness or fatigue, that adversely affect performance; and,
- The insidious effects of recent life changes, such as divorce, death of a family member, legal difficulties, financial discord and other personal difficulties.

Inadequate documentation/procedures — typical of most systems, particularly new ones where the "bugs" have yet to be worked out. Accounting for all possible contingencies through technical specifications, instructions, regulations and standard operating procedures is an extremely difficult task, at best. As a result, accidents, incidents and hazards continue to be a common way of identifying deficiencies in existing documentation, often after tragedy has struck.

Known

Inadequate supervision — refers to management of the individual on a personal level. It is expected that individuals will receive adequate training, professional guidance and operational leadership, and that all will be managed appropriately. Unfortunately, supervision may prove inappropriate or improper, or it may not occur at all. Regardless, inadequate supervision is viewed as a function of some action or purposeful inaction by the supervisor.

Planned inappropriate operations — refers to management of the individual as an asset among many others (i.e., a “cog in the wheel”). Occasionally, the operational tempo and/or schedule is planned such that individuals are put at unacceptable risk, crew rest is jeopardized and, ultimately, performance is adversely affected. Such operations, though arguably unavoidable emergency situations, are unacceptable during normal operations.

Failed to correct problem — refers to those instances when deficiencies among individuals, equipment, training or other related safety areas are “known” to the supervisor yet are allowed to continue uncorrected.

Supervisory violations — refers to those instances when existing rules, regulations, instructions or standard operating procedures are not adhered to by supervisors when managing assets. Moreover, that the violation is considered an “intended” act implies a willful disregard for authority. This is quite different from inadvertently or unwittingly violating the rules, considered unrecognized hazardous operations, as described earlier.

Preconditions for Unsafe Acts

Substandard Conditions of Operators

Adverse mental states — refers to those psychological conditions and/or mental conditions that impact negatively on performance. Principal among adverse mental states are the loss of situational awareness, cognitive effects of sleep loss and circadian dysrhythmia, and other psychological diagnoses that affect safety. Also included in this category are personality traits and pernicious attitudes such as overconfidence and complacency, and misplaced motivation.

Adverse physiological states — refers to those medical conditions or physiological conditions that preclude safe operations. Particularly important to some operational settings are conditions such as hypoxia, physical fatigue, illness, intoxication and the myriad of pharmacological abnormalities and medical abnormalities known to affect performance.

Physical/mental limitations — refers to those instances in which necessary visual information or aural information is not available due to limitations inherent within the sensory system. For example, in aviation, this most often includes not seeing other aircraft, power lines and other obstacles because of the size or contrast of the object in the visual field. Also included are those instances when time to process information or to respond exceeds human capacity (i.e., the individual simply could not physically respond or decide quickly enough to avert the accident) and instances when the individual’s inherent aptitude or intelligence is incompatible with the characteristics or requirements of the task.

Substandard Practices of Operators

Interpersonal resource management — was created to account for occurrences of inadequate crew coordination in selected occupational settings. Also included are those instances when individuals directly responsible for the conduct of the operations fail to coordinate and/or supervise operations appropriately. For example, within aviation, this category is reserved for aircrew who function during the flight as aircraft commanders, flight leaders, section leaders, etc. Elements of this category differ from those classified as unsafe supervision, which generally involves individuals in positions of higher authority that are detached from the direct conduct of operations.

Personal readiness — two general issues fall under this category. The first is readiness violations, which refer to disregard for rules, regulations and instructions that govern the individual’s readiness to perform. The violations include such behaviors as violating crew rest requirements and alcohol restrictions. Both may lead to altered behavioral states and lead to the occurrence of unsafe acts. Conversely, aviators sometimes exhibit poor judgment when it comes to readiness, but do not necessarily violate existing instructions or standard operating procedures. For example, running 10 miles (16 kilometers) before piloting an aircraft may impair the physical capabilities and mental capabilities of the individual enough to degrade performance and elicit unsafe acts. However, there may be no rules governing such behavior, other than reasonable judgment.

Unsafe Acts

Errors

Decision errors —represent intentional behavior that proceeds as intended, yet the chosen plan proves inadequate to achieve the desired outcome. *Procedural decision errors* (Orasanu, 1993) or *rule-based mistakes* (Rasmussen, 1986) occur during highly structured tasks (e.g., “if X, then do Y”). For example, for most emergency situations, condition-action rules are available as standard procedures. Procedural decision errors often occur when a situation is not recognized or is misdiagnosed and the wrong procedure is performed. However, not all situations have corresponding procedures. Therefore, many situations require a choice to be made among multiple response options. Under these circumstances, *choice decision errors* (Orasanu, 1993) or *knowledge-based mistakes* (Rasmussen, 1986), may occur, particularly when there is insufficient experience or time to determine which option is best. Finally, a problem sometimes is not well understood and formal procedures and response options are not available. In these situations, the problem is ill-defined and requires the invention of a novel solution; therefore, individuals must resort to slow and effortful reasoning processes, which may result in problem-solving errors.

Skill-based errors — are errors in the execution of a response that has become highly automated. They are actions that unwittingly deviate from planned behavior, and are generally classified as either *attention failures* or *memory failures*. Attention failures may take the form of a breakdown in visual scan, inadvertent operation of a control or a failure to see and avoid other aircraft. Memory failures may appear as omitted checklist items, place losing or forgotten intentions.

Perceptual errors — occur when we misrecognize some object or sensory input — for example, misjudging distance, altitude or airspeed. Other types of perceptual errors include visual illusions or spatial disorientation, where perceptions of the world are not congruent with reality.

Violations

Routine violations — tend to be habitual by nature, constituting part of the individual's behavioral repertoire (e.g., driving consistently 5–10 miles per hour [mph; 8–16 kilometers per hour (kph)] faster than allowed by law). Often, routine violations are perpetuated by a system that tolerates such departures.

Exceptional violations — are isolated departures from authority and are not necessarily indicative of an individual's typical behavior pattern nor condoned by management (e.g., an isolated instance of driving 105 mph [169 kph] in a 55-mph [89-kph] zone is considered an exceptional violation, not because of its extreme nature, but because the violation is neither typical of the individual not condoned by authority).♦

Notes

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Appendix B
Summary of Results for Non-CFIT-company Pilots and CFIT-company Pilots

Guide to Report Content

Results of the Alaskan flight industry survey are summarized in this report. Presented are item-by-item comparisons of responses for non-CFIT-company pilots and CFIT company pilots.

(CFIT [controlled flight into terrain] occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew. For the purposes of this report, *non-CFIT companies* are defined as those identified by U.S. National Transportation Safety Board [NTSB] investigators as not having been involved in a fatal CFIT accident between Jan. 1, 1992, and Sept. 10, 1998; *CFIT companies* are defined as those identified by NTSB investigators as having been involved in one or more fatal CFIT accidents between Jan. 1, 1992, and Sept. 10, 1998.)

Included in the comparisons are item descriptive statistics, response distributions and significant findings. The grouping of the items is based on "Taxonomy of Unsafe Operations (Shappell and Wiegmann, 2000)" (page 10).

Descriptive Statistics

The following descriptive statistics apply to each individual item, independent of any other item:

- *n* = Number of valid responses for each pilot group for an item;
- *Mean* = Average of all valid responses for each pilot group for an item. Means for selected items also are presented in graphs;
- *SD* = Standard deviation — a measure of dispersion, or spread, of scores around the mean for each pilot group;
- *Percent Disagree* and *Percent Agree* = Percentages computed by excluding respondents expressing a "slight" opinion (i.e., the middle two rating options: "slightly agree" and "slightly disagree").

Response Distributions

Where appropriate, response distributions are presented in bar graphs to the right of each item. Distributions are based on the percentage of responses within each response category for each pilot group. Distributions may not sum to 100 due to rounding.

Response distributions for multi-response items are reported as percentages in tables. For these items, percentages will not sum to 100 because respondents were asked to mark all that apply.

Significant Findings

All items were tested for significant differences between non-CFIT-company pilots and CFIT-company pilots. Chi-square tests were used for multi-response items or nominal-level data. Mann-Whitney tests were used for all other items. The statistical tests were conducted on each item independently of all other items.

The abbreviation *sig.* indicates items for which significant difference was found between non-CFIT-company pilots and CFIT-company pilots. *CS* indicates that the significant difference was found in chi-square tests; *MW* indicates that the significant difference was found in Mann-Whitney tests.♦

Additional material follows on pages 14–41.

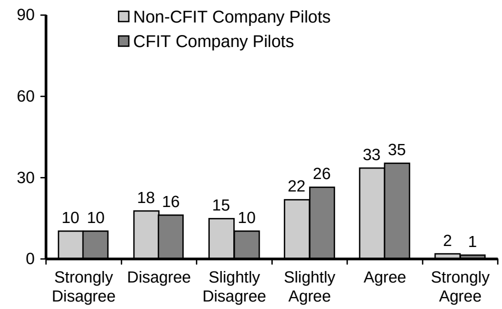
I. Alaskan Pilot and U.S. Federal Aviation Administration (FAA) Official Interaction

1. In Alaska, FAA inspectors adequately explain the rationale behind the decisions they make.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	215	3.56	1.42	27.9	35.3
CFIT Company Pilots	68	3.65	1.41	26.5	36.8

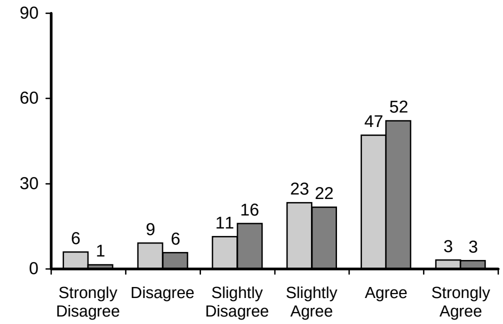
Response Distribution (percent)



2. When interacting with FAA inspectors, Alaskan passenger and freight pilots are allowed to express their point of view.

Descriptive Statistics

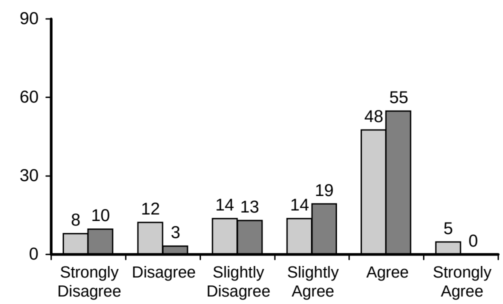
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	219	4.06	1.27	15.1	50.2
CFIT Company Pilots	69	4.26	1.05	7.2	55.1



3. FAA inspectors use the same evaluation standard for Alaskan passenger and freight pilots.

Descriptive Statistics

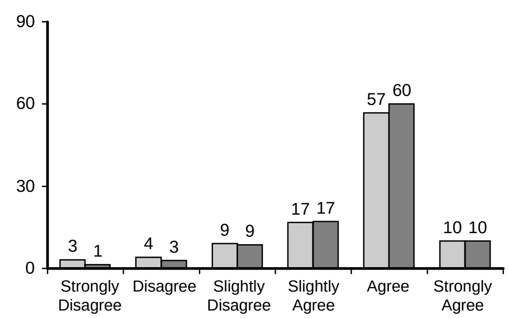
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	189	3.95	1.42	20.1	52.4
CFIT Company Pilots	62	4.06	1.30	12.9	54.8



4. FAA inspectors are courteous when interacting with Alaskan passenger and freight pilots.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	220	4.50	1.12	7.3	66.8
CFIT Company Pilots	70	4.61	0.98	4.3	70.0

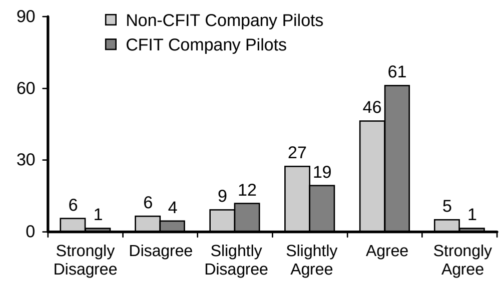


5. Overall, the FAA inspectors treat Alaskan passenger and freight pilots fairly.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	216	4.18	1.22	12.0	51.4
CFIT Company Pilots	67	4.39	0.98	6.0	62.7

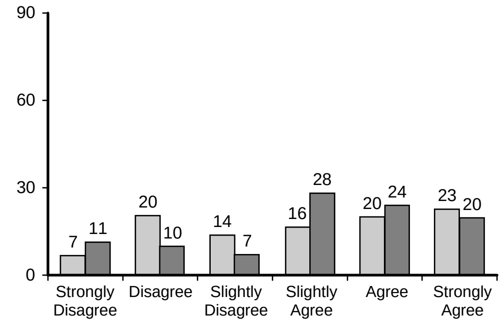
Response Distribution (percent)



6. If Alaskan passenger and freight pilots followed all aspects of the U.S. Federal Aviation Regulations (FARs), they would not be able to get their job done.

Descriptive Statistics

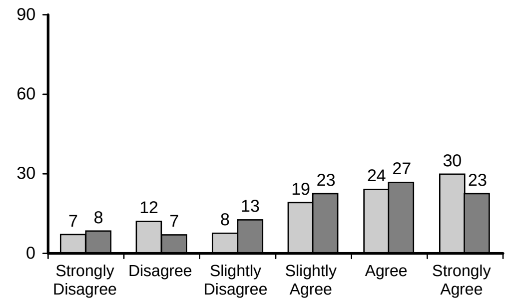
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	225	3.91	1.63	27.1	42.7
CFIT Company Pilots	71	4.03	1.59	21.1	43.7



7. Additional exemptions are needed in the FARs so that the rules conform to the reality of Alaskan flight operations.

Descriptive Statistics

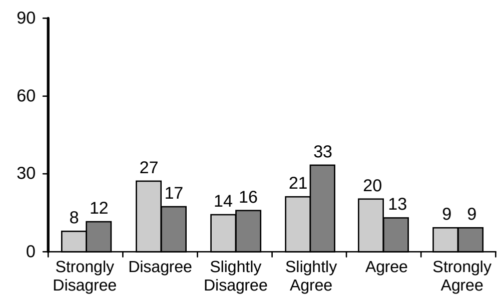
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	224	4.31	1.60	19.2	54.0
CFIT Company Pilots	71	4.20	1.53	15.5	49.3



8. The FARs interfere with the profitability of Alaskan passenger and freight operations.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	217	3.47	1.49	35.0	29.5
CFIT Company Pilots	69	3.45	1.45	29.0	21.7



II. Organizational Influences

A. Resource Management

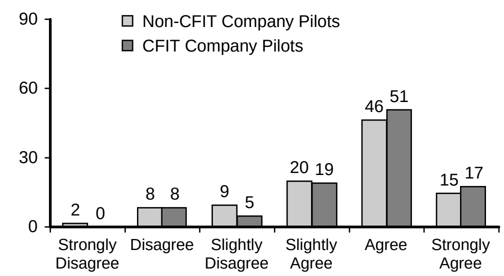
Human

21. Passenger and freight pilots can find work flying in Alaska even if they have prior aviation accidents on their record.

Descriptive Statistics

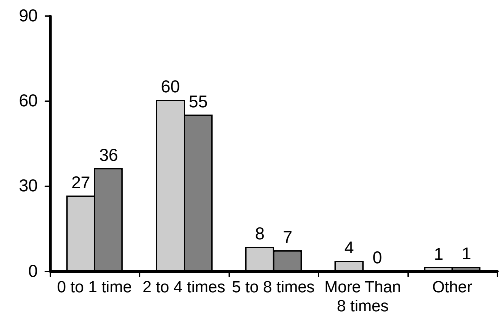
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	192	4.45	1.19	9.9	60.9
CFIT Company Pilots	63	4.65	1.08	7.9	68.3

Response Distribution (percent)



59. In the last two years, I have received training on weather and weather avoidance approximately:

	n
Non-CFIT Company Pilots	226
CFIT Company Pilots	69



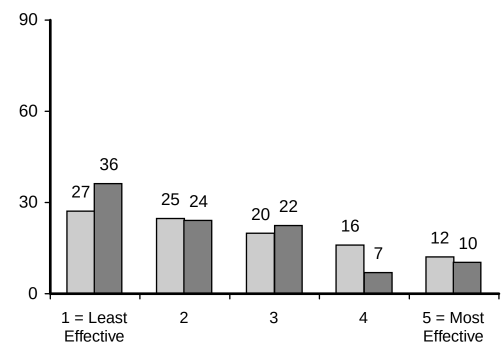
79. Rank the following methods according to how effective each is in obtaining qualified pilots for your company.

a. Conducting pre-employment background checks.

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	206	2.61	1.36
CFIT Company Pilots	58	2.31	1.31

Note: Response options were reversed to maintain a consistent direction for scoring.



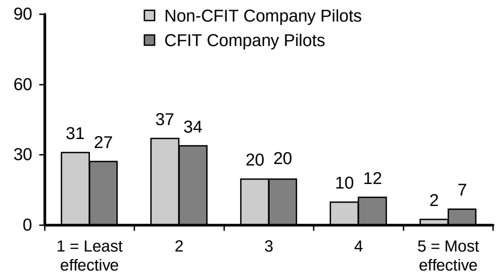
b. Reviewing pilot's past accident records.

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	203	2.16	1.05
CFIT Company Pilots	59	2.37	1.20

Note: Response options were reversed to maintain a consistent direction for scoring.

Response Distribution (percent)

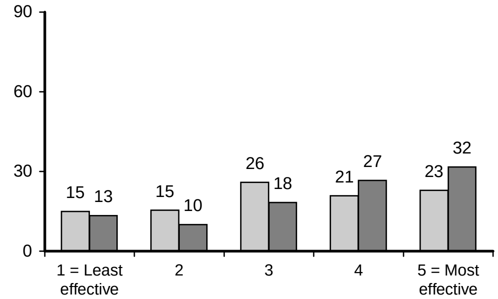


c. Conducting check rides.

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	201	3.21	1.36
CFIT Company Pilots	60	3.53	1.38

Note: Response options were reversed to maintain a consistent direction for scoring.

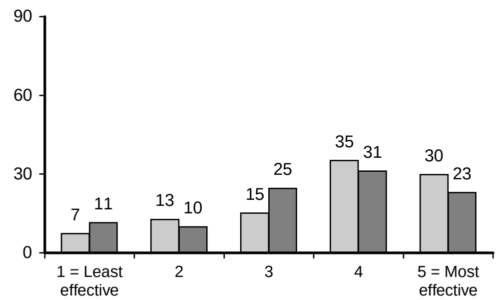


d. Conducting face-to-face interviews.

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	205	3.67	1.23
CFIT Company Pilots	61	3.44	1.27

Note: Response options were reversed to maintain a consistent direction for scoring.

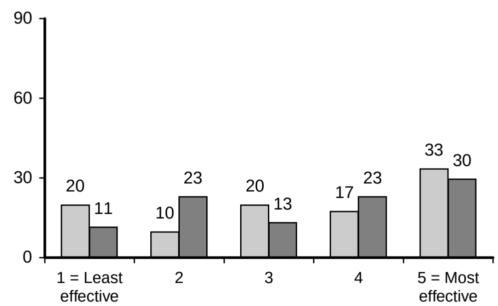


e. Getting recommendations from other pilots.

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	207	3.35	1.51
CFIT Company Pilots	61	3.36	1.41

Note: Response options were reversed to maintain a consistent direction for scoring.



Money

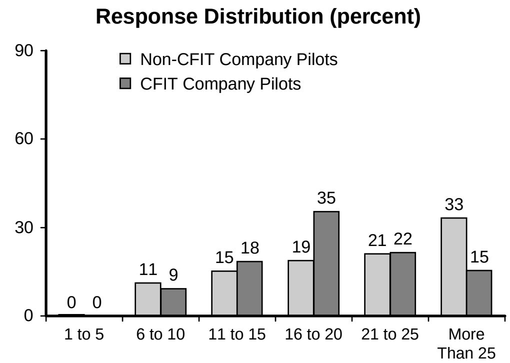
60. My company provides sufficient maintenance on each of the following aircraft components *(choose all that apply)*:

	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent	sig.
a. Engine	92.3	91.5	
b. Basic flight instruments	86.3	69.0	CS
c. Navigation instruments	78.6	64.8	CS
d. Communication equipment	86.3	66.2	CS
e. Flight controls	91.0	91.5	
f. Airframe	91.0	87.3	

Equipment

61. The average age of the aircraft my company uses is ______ years old.

	n	sig.
Non-CFIT Company Pilots	223	MW
CFIT Company Pilots	65	



62. What kind of navigational equipment do you use when flying by visual flight rules (VFR) through low visibility *(choose all that apply)*?

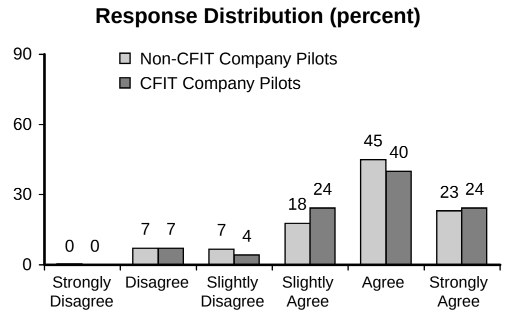
	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent
a. Global positioning system unit	70.9	78.9
b. Head-up display	3.0	1.4
c. Ground-proximity warning system	17.1	15.5
d. Autopilot	12.0	16.9
e. Other	32.9	33.8

B. Organizational Climate

22. In Alaska, if one passenger or freight company does not fly because of weather, there is a chance that the company next door will go ahead and fly.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	225	4.69	1.14	7.6	68.0
CFIT Company Pilots	70	4.70	1.11	7.1	64.3

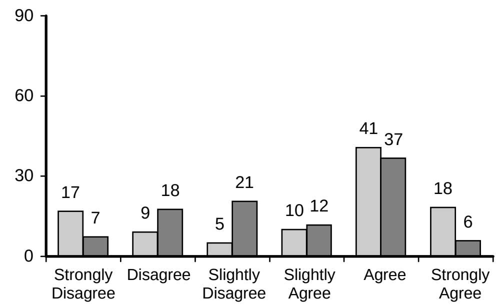


Structure

9. I am satisfied with the way my company deals with pilot complaints.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	219	4.03	1.76	26.0	58.9
CFIT Company Pilots	68	3.71	1.46	25.0	42.6



63. Who makes the final pre-departure go/no-go decision *(choose all that apply)*?

	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent	sig.
a Director of operations or chief pilot	27.4	26.8	
b. Flight follower or dispatcher	12.4	23.9	CS
c. Pilot	91.0	97.2	
d. Other	4.3	2.8	

80. Rank the following according to who has the greatest responsibility for pre-departure weather evaluations.

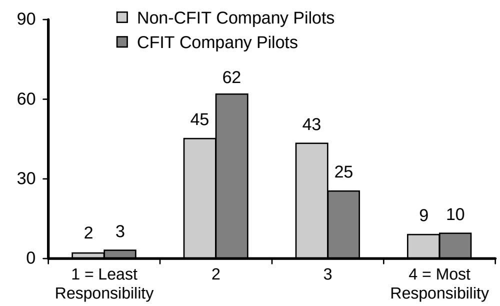
Response Distribution (percent)

a. Company management (i.e., director of operations or chief pilot)

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	210	2.59	0.69
CFIT Company Pilots	63	2.41	0.71

Note: Response options were reversed to maintain a consistent direction for scoring.

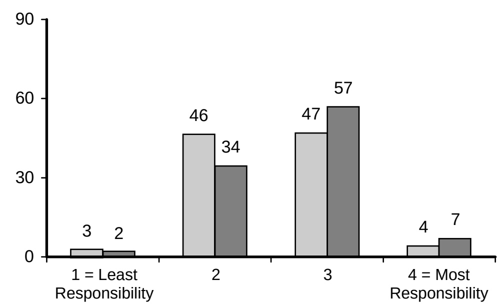


b. Flight follower or dispatcher

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	196	2.53	0.62
CFIT Company Pilots	58	2.69	0.63

Note: Response options were reversed to maintain a consistent direction for scoring.

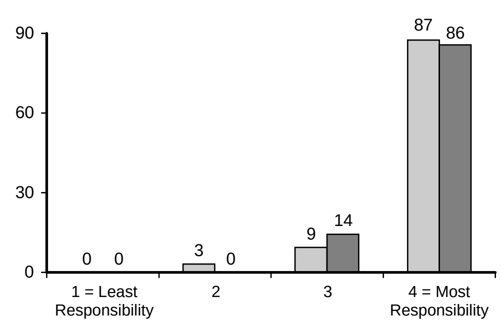


c. Pilot

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	223	3.84	0.44
CFIT Company Pilots	70	3.86	0.35

Note: Response options were reversed to maintain a consistent direction for scoring.

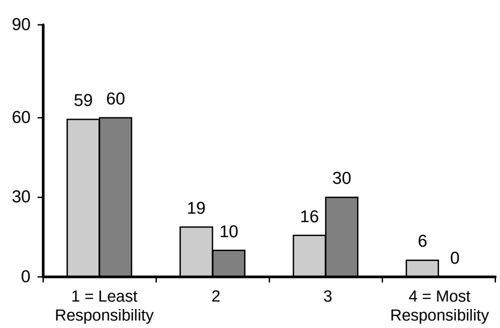


d. Other

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	32	1.69	0.97
CFIT Company Pilots	10	1.70	0.95

Note: Response options were reversed to maintain a consistent direction for scoring.



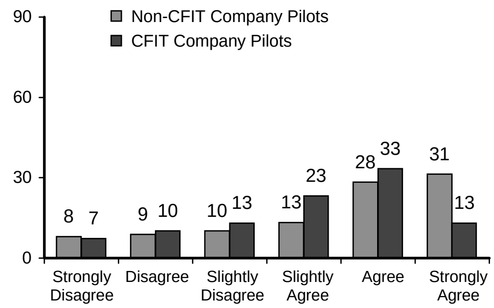
Policies

17. My company considers the safety of its pilots as its top priority.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	226	4.39	1.60	16.8	59.7	MW
CFIT Company Pilots	69	4.04	1.44	17.4	46.4	

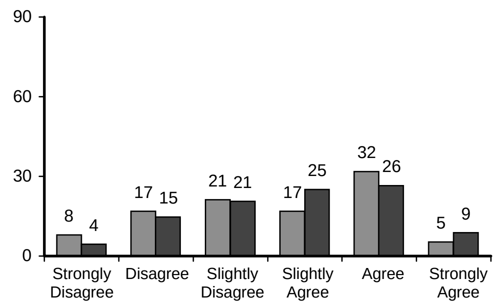
Response Distribution (percent)



23. In Alaska, passenger and freight companies rarely question a pilot's decision to turn around due to weather.

Descriptive Statistics

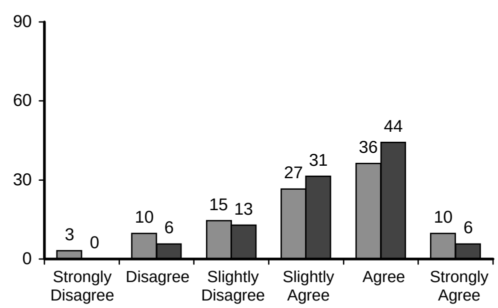
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	226	3.64	1.42	24.8	37.2
CFIT Company Pilots	68	3.81	1.34	19.1	35.3



24. Passenger and freight pilots in Alaska are encouraged to turn around when the weather deteriorates en route.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	226	4.12	1.25	12.8	46.0
CFIT Company Pilots	70	4.31	0.97	5.7	50.0

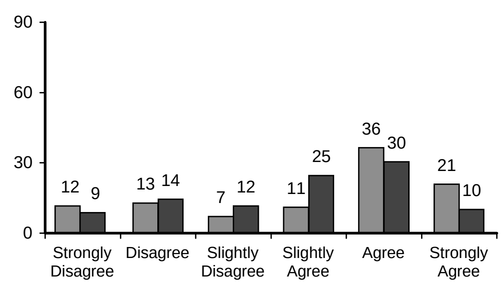


Culture

10. My company stays in touch with pilot concerns and problems.

Descriptive Statistics

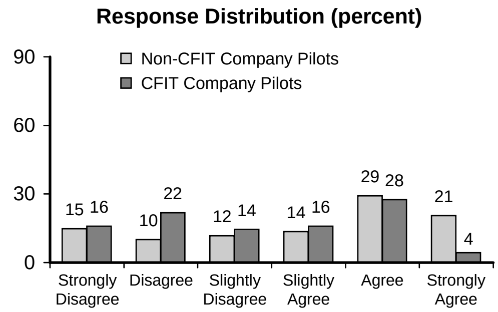
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	225	4.11	1.68	24.4	57.3
CFIT Company Pilots	69	3.84	1.48	23.2	40.6



11. In my company, pilot morale is high.

Descriptive Statistics

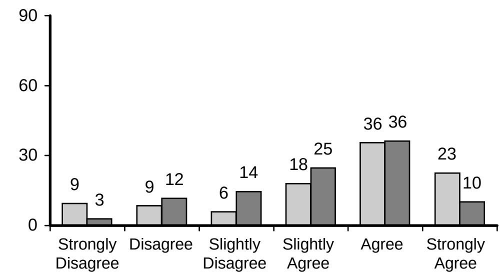
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	229	3.94	1.73	24.9	49.8	MW
CFIT Company Pilots	69	3.30	1.57	37.7	31.9	



12. My company appreciates the good work that I do.

Descriptive Statistics

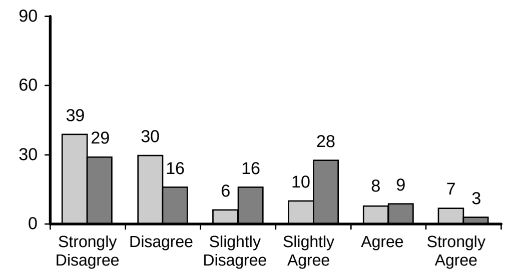
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	222	4.29	1.56	18.0	58.1
CFIT Company Pilots	69	4.10	1.29	14.5	46.4



13. In my company, getting the job done has higher priority than safety.

Descriptive Statistics

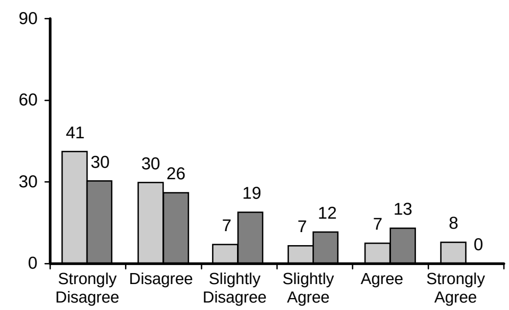
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	229	2.40	1.60	68.6	15.3
CFIT Company Pilots	69	2.80	1.48	44.9	11.6



14. My company is more concerned about making money than being safe.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	228	2.33	1.61	71.1	15.4
CFIT Company Pilots	69	2.51	1.38	56.5	13.0

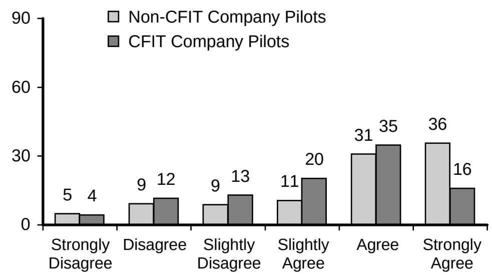


15. My company does all that it can to prevent accidents.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	227	4.60	1.51	14.1	66.5	MW
CFIT Company Pilots	69	4.17	1.40	15.9	50.7	

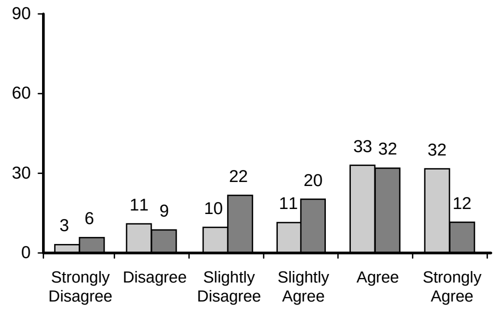
Response Distribution (percent)



16. My company does not cut corners where safety is concerned.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	227	4.56	1.45	14.1	64.8	MW
CFIT Company Pilots	69	3.99	1.38	14.5	43.5	



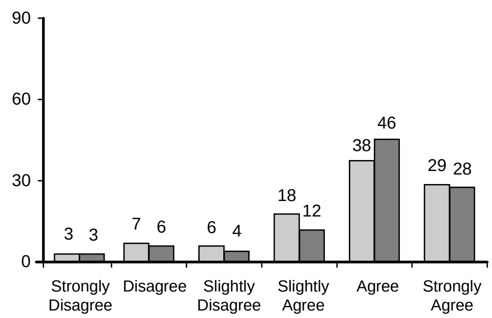
C. Organizational Process

Operations

25. Passenger and freight companies in Alaska operate on small profit margins.

Descriptive Statistics

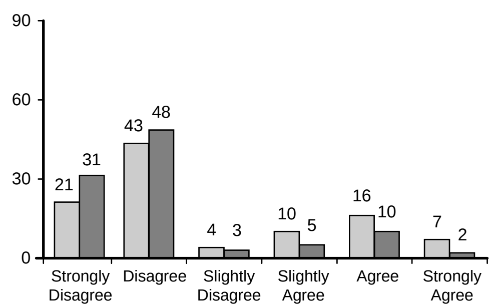
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	210	4.65	1.32	10.5	66.2
CFIT Company Pilots	67	4.78	1.25	9.0	74.6



26. In my company, safety awards are used to promote safe flying.

Descriptive Statistics

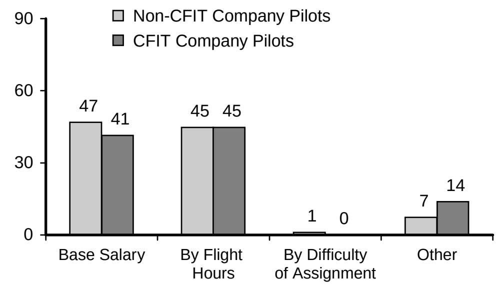
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	165	2.78	1.60	63.6	23.0	MW
CFIT Company Pilots	58	2.21	1.32	79.3	12.1	



64. Indicate the method used to determine your pay.

	n
Non-CFIT Company Pilots	192
CFIT Company Pilots	58

Response Distribution (percent)



65. The majority of my flights are flown over the following terrain *(choose all that apply)*:

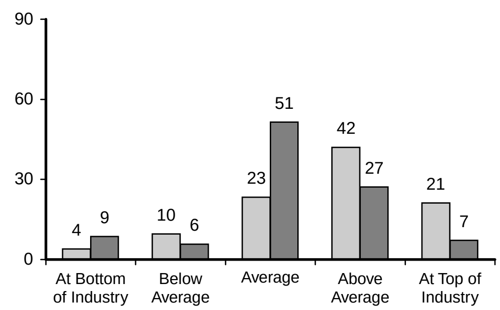
	Non-CFIT Company Pilots (n = 234) **Percent**	**CFIT Company Pilots** (n = 71) **Percent**
a Flat terrain	63.7	62.0
b. Open water	47.0	40.8
c. Channels, islands and peninsulas	39.7	43.7
d. Hills	38.9	42.3
e. Hills and mountains	68.4	71.8
f. Mountains and mountain passes	59.8	52.1
g. Other	8.1	5.6

66. My company's safety practices are (select one):

Descriptive Statistics

	n	**Mean**	**SD**	**sig.**
Non-CFIT Company Pilots	231	3.67	1.04	MW
CFIT Company Pilots	70	3.19	0.97	

Note: Response options were reversed to maintain a consistent direction for scoring.

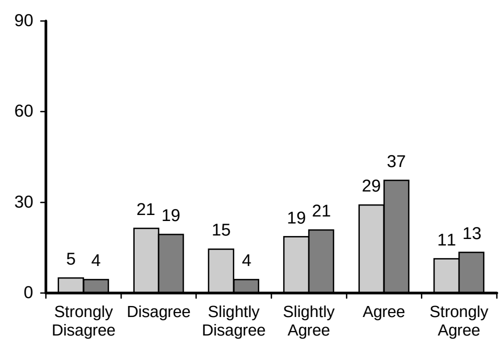


Procedures

27. Alaskan passenger and freight companies formally teach unwritten "rules of thumb" for flying in areas of low ceiling and reduced visibility.

Descriptive Statistics

	n	**Mean**	**SD**	**Percent Disagree**	**Percent Agree**
Non-CFIT Company Pilots	220	3.80	1.47	26.4	40.5
CFIT Company Pilots	67	4.07	1.47	23.9	50.7

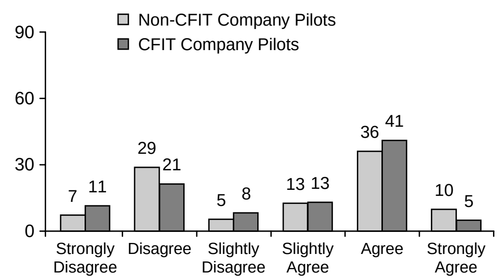


28. Pilot training on how to operate in low-visibility conditions is provided by my company.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	222	3.71	1.59	36.0	45.9
CFIT Company Pilots	61	3.66	1.58	32.8	45.9

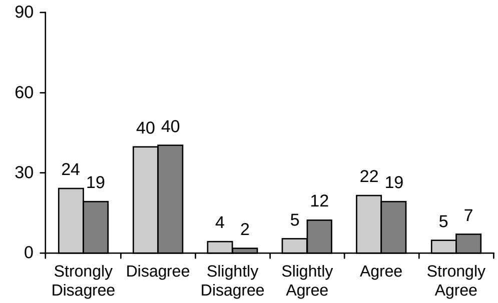
Response Distribution (percent)



29. My company launches weather reporting observation flights to supplement pre-departure weather services.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	186	2.75	1.63	64.0	26.3
CFIT Company Pilots	57	2.93	1.66	59.6	26.3

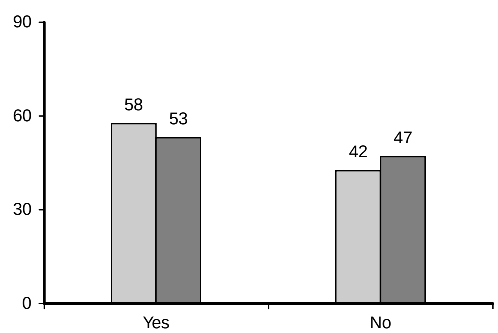


67. My company uses each of the following weather-reporting services during pre-departure weather evaluations (*choose all that apply*):

	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent	sig.
a National Weather Service	67.5	67.6	
b. Flight service station	81.2	87.3	
c. Automated flight service station	59.4	60.6	
d. Station agents	46.2	60.6	CS
e. Pilot observations	75.2	74.6	
f. Other	13.7	14.1	

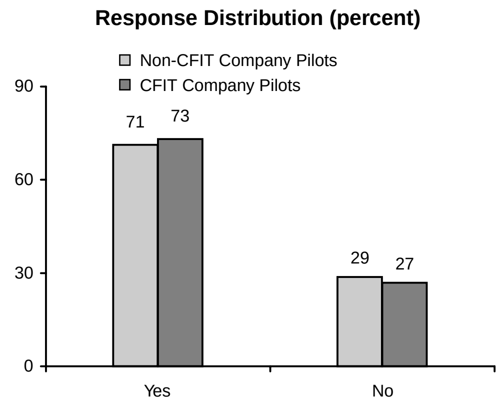
83. My company's training program contains an inadvertent instrument meteorological conditions (IMC) recovery procedure.

	n
Non-CFIT Company Pilots	219
CFIT Company Pilots	66



84. My company requires “re-dispatch” or “re-contact” with the company when pilots reroute due to weather.

	n
Non-CFIT Company Pilots	223
CFIT Company Pilots	67

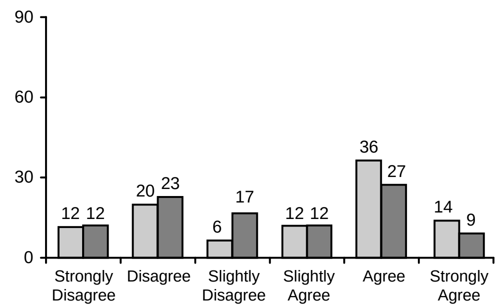


Oversight

30. My company conducts formal pilot safety meetings.

Descriptive Statistics

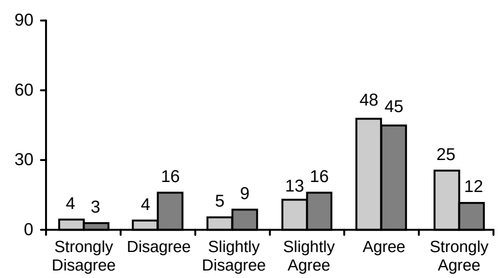
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	217	3.83	1.67	31.3	50.2
CFIT Company Pilots	66	3.47	1.60	34.8	36.4



31. My company provides me with opportunities to make safety recommendations.

Descriptive Statistics

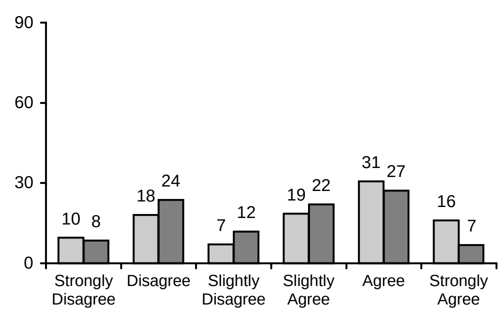
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	224	4.72	1.27	8.5	73.2	MW
CFIT Company Pilots	69	4.19	1.37	18.8	56.5	



32. My company’s safety meetings focus on hard-hitting safety issues that pilots face each day.

Descriptive Statistics

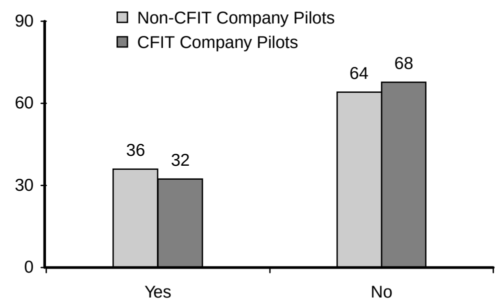
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	199	3.91	1.61	27.6	46.7
CFIT Company Pilots	59	3.56	1.49	32.2	33.9



85. My company's safety program includes something like a safety risk reporting form.

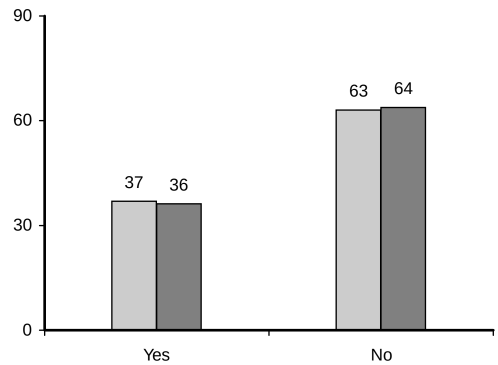
	n
Non-CFIT Company Pilots	217
CFIT Company Pilots	68

Response Distribution (percent)



86. My company's safety program includes something like a risk management or internal audit process.

	n
Non-CFIT Company Pilots	214
CFIT Company Pilots	69



III. Unsafe Supervision

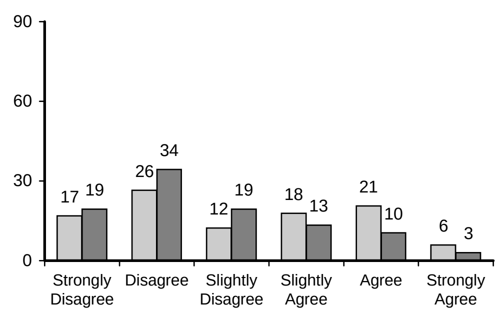
A Unforeseen

Unrecognized Hazardous Operations

33. Before each flight, my company makes sure that pilots have the right frame of mind for flying.

Descriptive Statistics

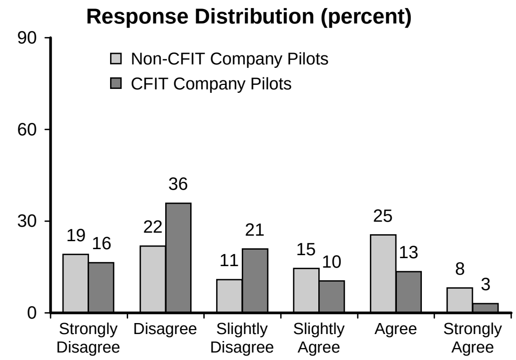
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	219	3.16	1.57	43.4	26.5	MW
CFIT Company Pilots	67	2.70	1.37	53.7	13.4	



34. Before each flight, my company makes sure that pilots are physically fit to fly (e.g., free from the adverse effects of fatigue, medications).

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	220	3.30	1.67	40.9	33.6	MW
CFIT Company Pilots	67	2.78	1.38	52.2	16.4	

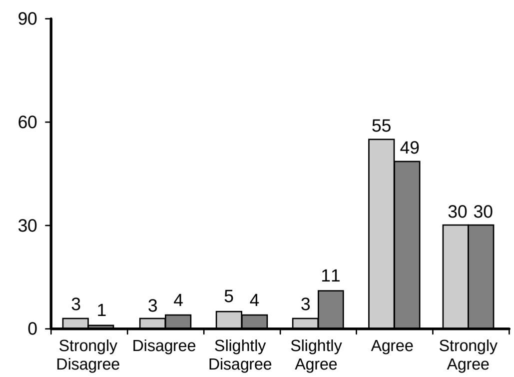


Inadequate Documentation Procedures

35. My company's standard operating procedures manual is up to date.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	220	4.95	1.15	5.9	85.5
CFIT Company Pilots	70	4.91	1.10	5.7	78.6



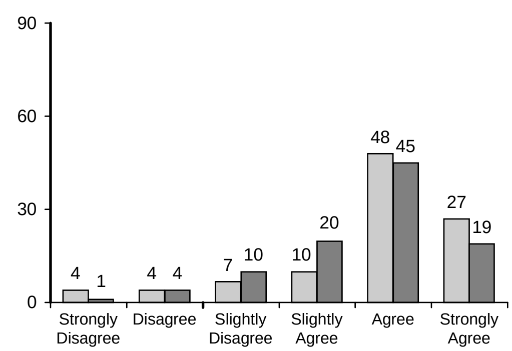
B. Known

Inadequate Supervision

36. My company ensures that pilots obtain sufficient training on new equipment.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	223	4.75	1.25	8.1	74.9
CFIT Company Pilots	69	4.59	1.13	5.8	63.8

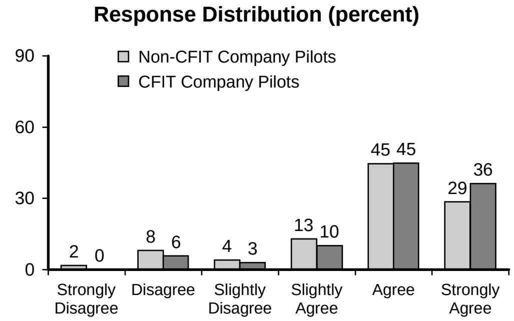


Planned Inappropriate Operations

37. In Alaska, passenger and freight assignments require flying in marginal visual meteorological conditions (VMC).

Descriptive Statistics

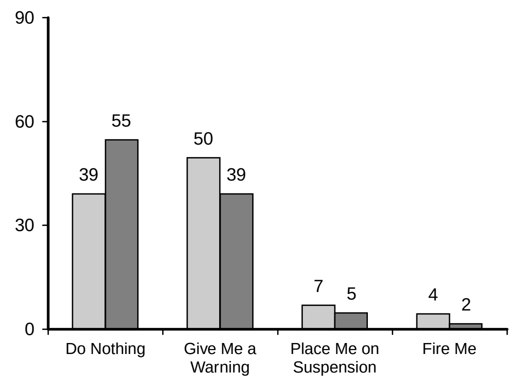
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	224	4.76	1.24	9.8	73.2
CFIT Company Pilots	69	5.03	1.06	5.8	81.2



Failed to Correct Problem

68. The first time my company discovered I flew through weather below legal VFR, they would *(select one)*:

	n	sig.
Non-CFIT Company Pilots	202	MW
CFIT Company Pilots	64	

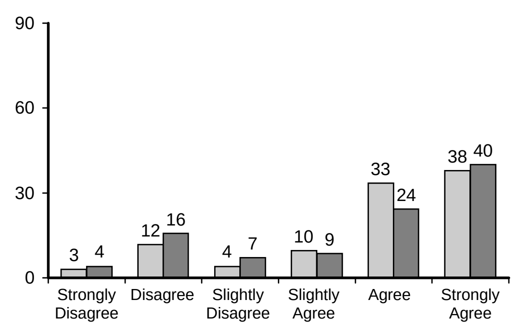


IV. Preconditions for Unsafe Acts

18. As a pilot, I am concerned about having an accident while flying.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	230	4.72	1.46	14.8	71.3
CFIT Company Pilots	70	4.53	1.64	20.0	64.3

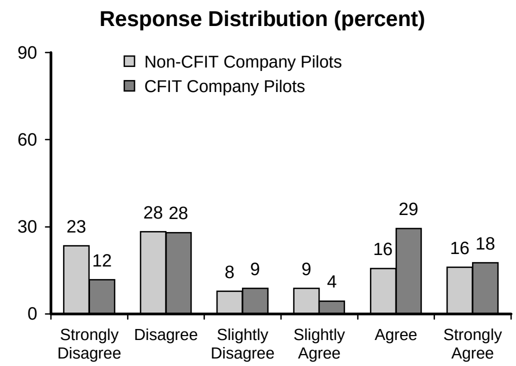


A. Substandard Conditions

38. In Alaska, safety would improve if the visibility requirement for special VFR (conducted under FARs Part 135) was increased to 2 miles when operating under a ceiling of less than 1,000 feet.

Descriptive Statistics

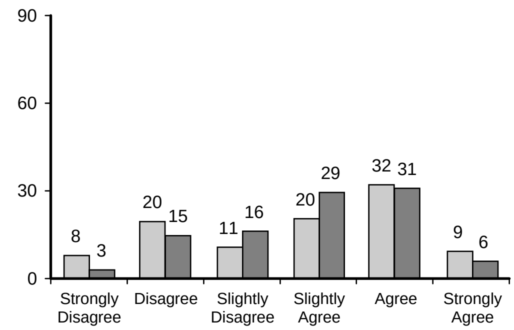
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	205	3.13	1.84	51.7	31.7	MW
CFIT Company Pilots	68	3.65	1.79	39.7	47.1	



39. In Alaska, passenger and freight pilots would feel comfortable flying VFR in low visibility over flat terrain or water.

Descriptive Statistics

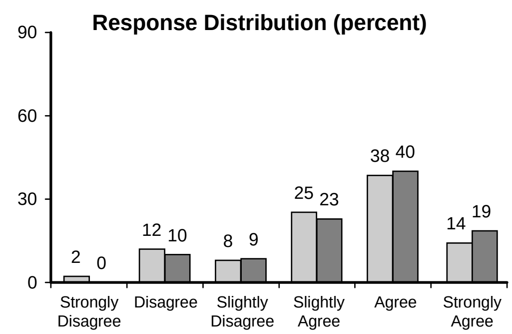
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	215	3.77	1.50	27.4	41.4
CFIT Company Pilots	68	3.88	1.25	17.6	36.8



40. Alaskan passenger and freight pilots talk about having to “push” the weather during their flights.

Descriptive Statistics

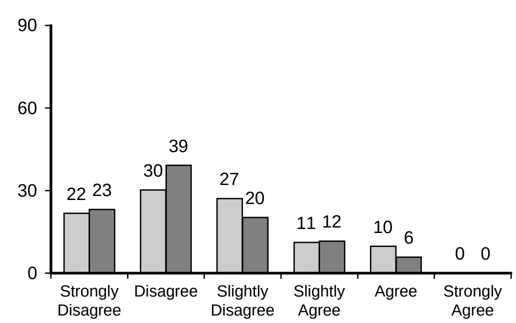
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	226	4.28	1.28	14.2	52.7
CFIT Company Pilots	70	4.49	1.19	10.0	58.6



41. In Alaska, one seldom sees passenger and freight pilots “push” the weather at community airports.

Descriptive Statistics

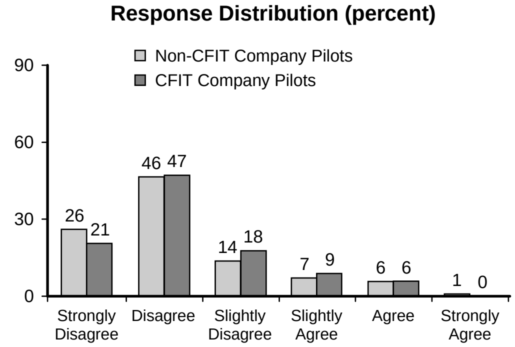
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	225	2.57	1.22	52.0	9.8
CFIT Company Pilots	69	2.38	1.14	62.3	5.8



42. Passenger and freight pilots in Alaska would feel comfortable flying VFR in low visibility over hills and mountains.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	226	2.23	1.14	72.6	6.6
CFIT Company Pilots	68	2.32	1.09	67.6	5.9

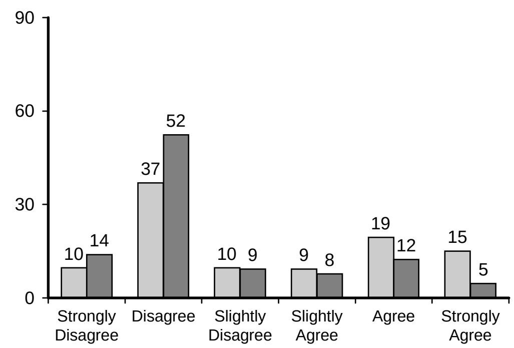


Adverse Mental States

43. In Alaska, during periods of extended daylight, pilot and copilot aircrews fly over 10 hours per day.

Descriptive Statistics

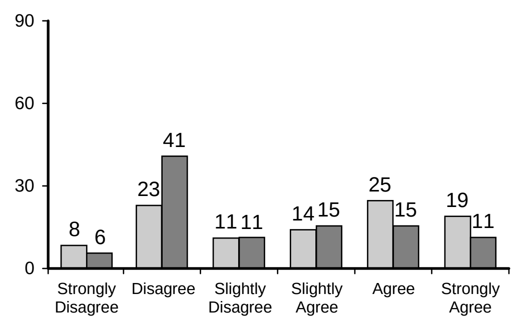
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	206	3.37	1.69	46.6	34.5	MW
CFIT Company Pilots	65	2.66	1.41	66.2	16.9	



44. It is hard for Alaskan passenger and freight pilots to maintain a consistent sleep schedule.

Descriptive Statistics

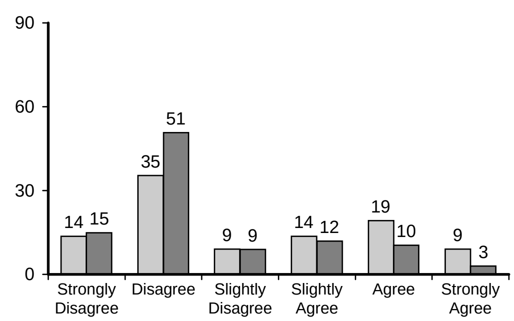
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	227	3.81	1.66	31.3	43.6	MW
CFIT Company Pilots	71	3.28	1.54	46.5	26.8	



45. In Alaska, during periods of extended daylight, a single-pilot aircrew flies over 8 hours per day.

Descriptive Statistics

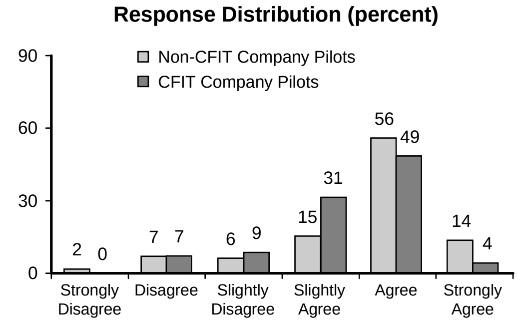
	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	198	3.17	1.61	49.0	28.3	MW
CFIT Company Pilots	67	2.61	1.34	65.7	13.4	



46. Alaskan passenger and freight pilots understand how the time of day can affect their flying performance.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree	sig.
Non-CFIT Company Pilots	227	4.58	1.13	8.8	69.6	MW
CFIT Company Pilots	70	4.34	0.96	7.1	52.9	

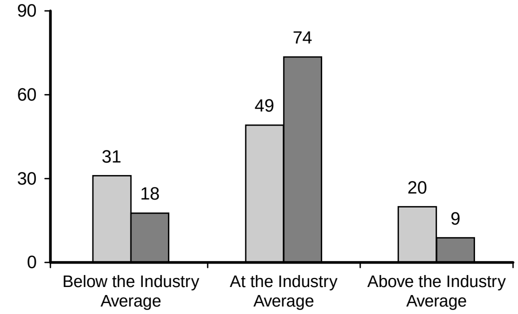


69. Compared to other Alaskan pilots with similar flying experience, the salary that I receive is:

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	226	1.89	0.71
CFIT Company Pilots	68	1.91	0.51

Note: Response options were reversed to maintain a consistent direction for scoring.

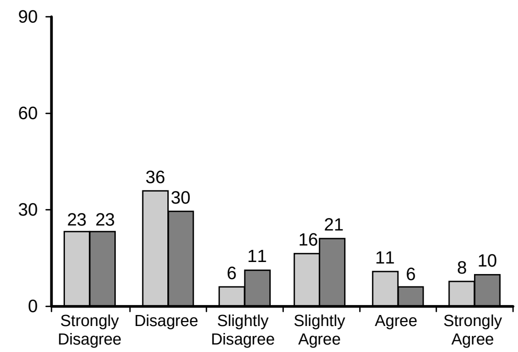


Adverse Psychological States

19. Over time, being an Alaskan pilot will adversely affect my health.

Descriptive Statistics

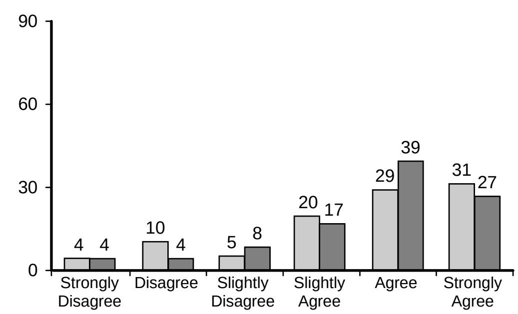
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	231	2.80	1.60	58.9	18.6
CFIT Company Pilots	71	2.87	1.59	52.1	15.5



20. As an Alaskan pilot, the job that I perform requires flying in hazardous conditions.

Descriptive Statistics

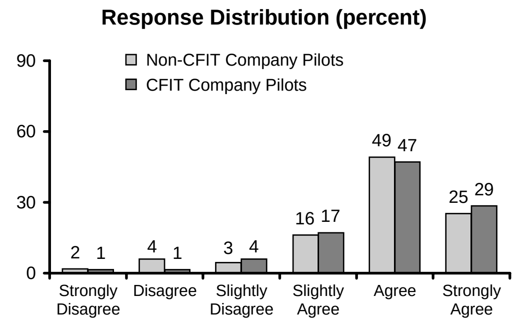
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	230	4.53	1.46	14.8	60.4
CFIT Company Pilots	71	4.63	1.31	8.5	66.2



47. Alaskan passenger and freight pilots have to fly sometimes when they are tired.

Descriptive Statistics

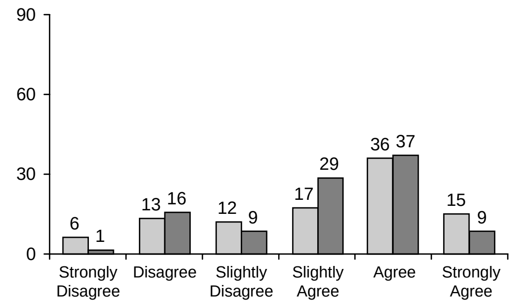
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	230	4.82	1.09	6.1	74.3
CFIT Company Pilots	70	4.93	1.00	2.9	75.7



48. Alaskan passenger and freight pilots have to fly even when ill.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	225	4.09	1.48	19.6	51.1
CFIT Company Pilots	70	4.10	1.25	17.1	45.7

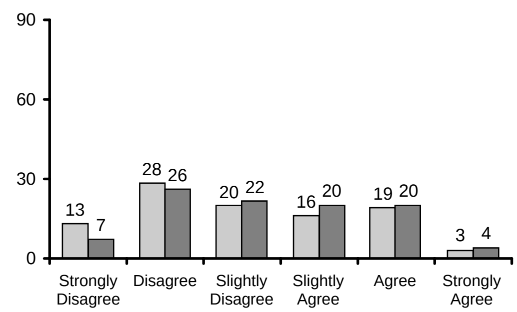


Physical/Mental Limitations

49. Boredom is a problem for Alaskan passenger and freight pilots.

Descriptive Statistics

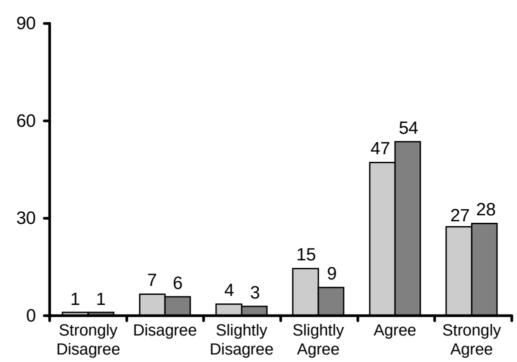
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	229	3.10	1.43	41.5	22.7
CFIT Company Pilots	69	3.33	1.37	33.3	24.6



50. Unless Alaskan passenger and freight pilots stay on top of the situation, they can soon become overwhelmed with sudden changes in flying conditions.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	227	4.82	1.13	7.5	74.4
CFIT Company Pilots	69	4.90	1.11	7.2	81.2



B. Substandard Practices of Operators

Interpersonal Resource Mismanagement

81. Rank the following factors based on the amount of pressure created by each to fly in reduced visibility.

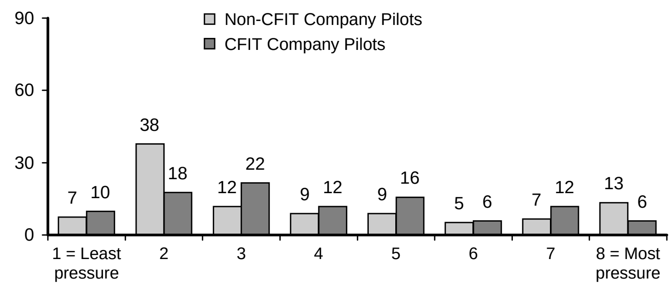
a. Delivering the U.S. mail

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	135	3.83	2.31
CFIT Company Pilots	51	4.00	2.07

Note: Response options were reversed to maintain a consistent direction for scoring.

Response Distribution (percent)

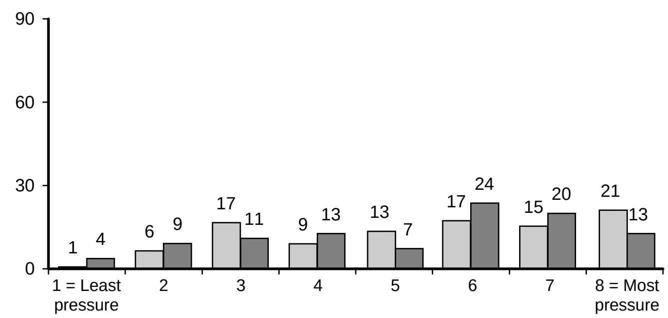


b. Company management

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	156	5.47	1.98
CFIT Company Pilots	55	5.25	2.04

Note: Response options were reversed to maintain a consistent direction for scoring.

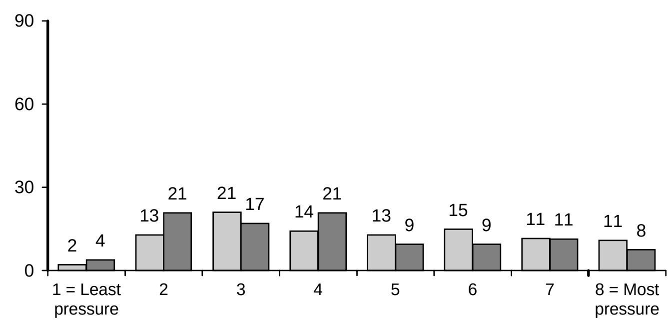


c. Making money for myself

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	148	4.68	1.99
CFIT Company Pilots	53	4.23	2.02

Note: Response options were reversed to maintain a consistent direction for scoring.



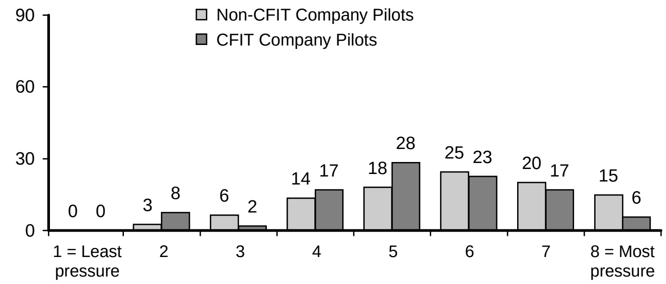
Response Distribution (percent)

d. Tight schedule

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	155	5.75	1.57
CFIT Company Pilots	53	5.30	1.51

Note: Response options were reversed to maintain a consistent direction for scoring.

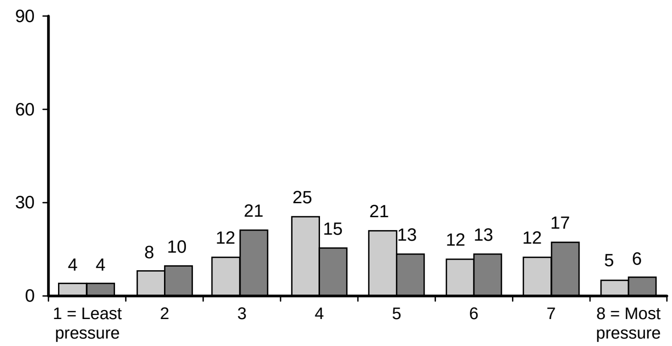


e. Peer pressure

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	153	4.63	1.75
CFIT Company Pilots	52	4.63	1.94

Note: Response options were reversed to maintain a consistent direction for scoring.

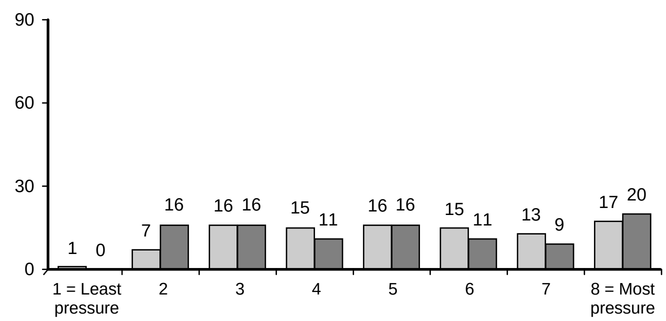


f. Pride in my ability

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	156	5.21	1.93
CFIT Company Pilots	55	4.96	2.14

Note: Response options were reversed to maintain a consistent direction for scoring.

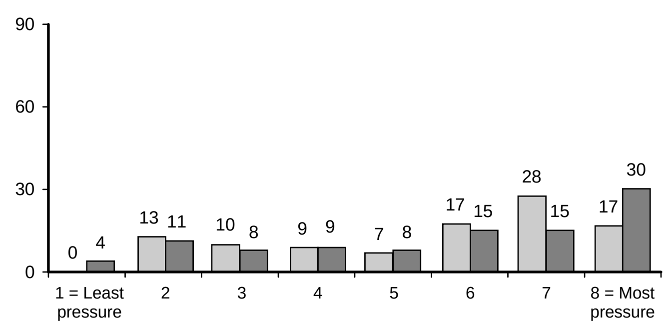


g. Passengers

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	149	5.56	2.03
CFIT Company Pilots	53	5.62	2.28

Note: Response options were reversed to maintain a consistent direction for scoring.

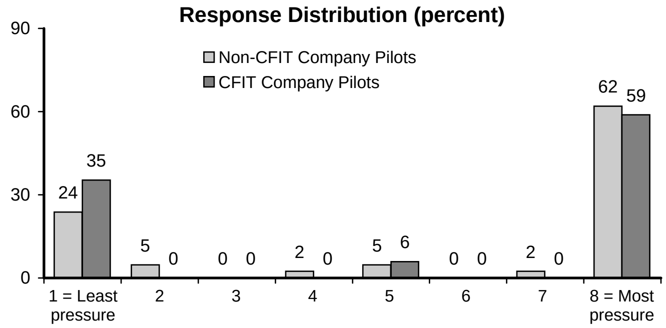


h. Other reasons for flying in reduced visibility

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	42	5.79	3.09
CFIT Company Pilots	17	5.35	3.39

Note: Response options were reversed to maintain a consistent direction for scoring.



Personal Readiness

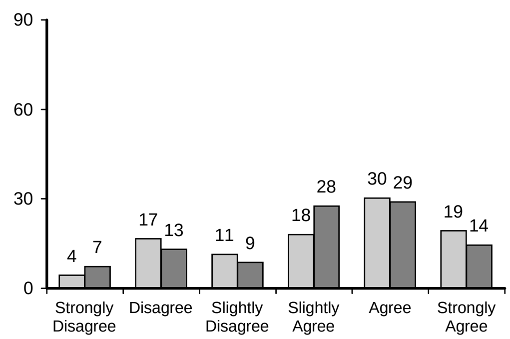
Please indicate the certificate holders you work for:

	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent	sig.
Part 135	59.0	88.7	CS
Part 133	9.8	4.2	
Part 125	3.4	0.0	
Part 121	26.9	16.9	

51. In Alaska, it is possible to eliminate all accidents caused by passenger and freight pilots flying into terrain in poor weather.

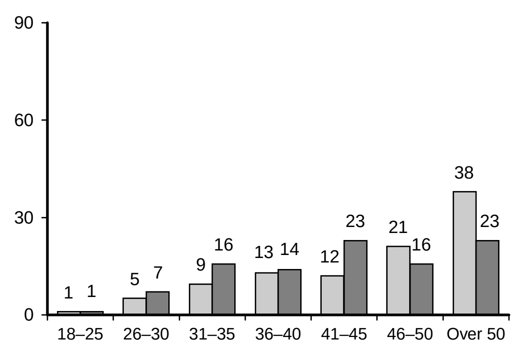
Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	228	4.11	1.50	21.1	49.6
CFIT Company Pilots	69	4.01	1.47	20.3	43.5



70. I am ______ years old.

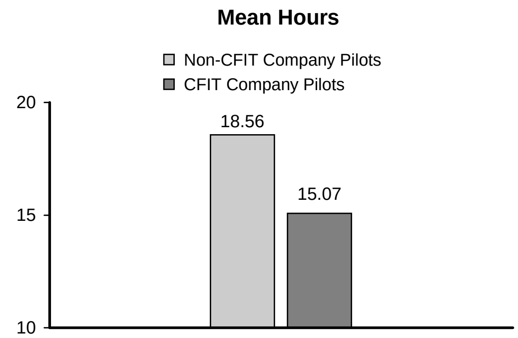
	n	sig.
Non-CFIT Company Pilots	232	MW
CFIT Company Pilots	70	



71. I've flown in Alaska a total of ______ years (*round to the nearest year*).

Descriptive Statistics

	n	Mean	SD	sig.
Non-CFIT Company Pilots	233	18.56	10.38	MW
CFIT Company Pilots	70	15.07	10.47	



72. I fly in Alaska during the following months (*choose all that apply*):

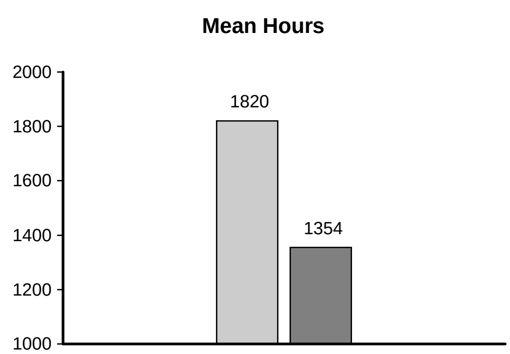
	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent	sig.
a January	83.3	95.8	CS
b. February	84.2	95.8	CS
c. March	87.6	94.4	
d. April	91.9	95.8	
e. May	95.3	98.6	
f. June	95.3	97.2	
g. July	94.0	97.2	
h. August	93.2	97.2	
i. September	97.9	98.6	
j October	92.3	97.2	
k. November	85.5	97.2	CS
l December	82.9	95.8	CS

73. My total number of non-commercial flight hours in Alaska is:

a. Non-commercial fixed-wing aircraft hours

Descriptive Statistics

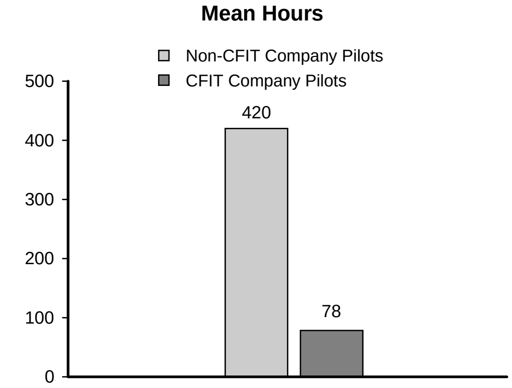
	n	Mean	SD
Non-CFIT Company Pilots	211	1820	5782
CFIT Company Pilots	65	1354	3842



b. Non-commercial rotary-wing aircraft hours

Descriptive Statistics

	n	Mean	SD
Non-CFIT Company Pilots	79	420	1336
CFIT Company Pilots	27	78	187

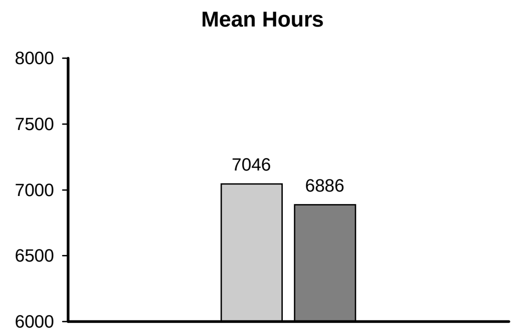


74. My total number of commercial flight hours in Alaska is:

a. Commercial fixed-wing aircraft hours

Descriptive Statistics

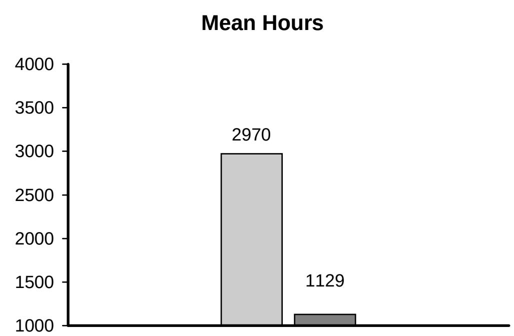
	n	Mean	SD
Non-CFIT Company Pilots	214	7046	6646
CFIT Company Pilots	68	6886	6550



b. Commercial rotary-wing aircraft hours

Descriptive Statistics

	n	Mean	SD	sig.
Non-CFIT Company Pilots	80	2970	4195	MW
CFIT Company Pilots	28	112	2611	

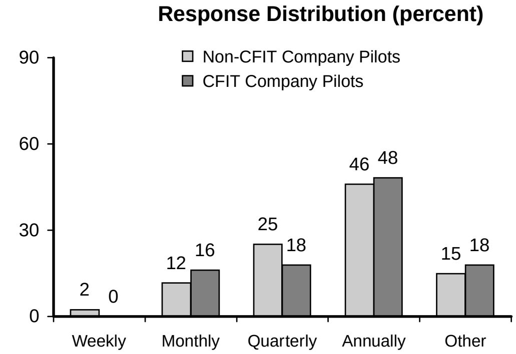


75. I hold the following airman's certificates and ratings (*choose all that apply*):

	Non-CFIT Company Pilots (n = 234) Percent	CFIT Company Pilots (n = 71) Percent	sig.
a Commercial	64.53	57.75	
b. Airline transport pilot	61.54	80.28	CS

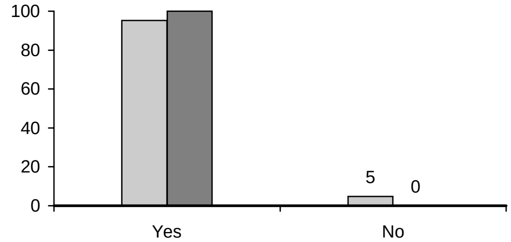
76. I attend pilot safety meetings of some kind:

	n
Non-CFIT Company Pilots	215
CFIT Company Pilots	56



82. My permanent residence is in Alaska.

	n
Non-CFIT Company Pilots	232
CFIT Company Pilots	71



V. Unsafe Acts

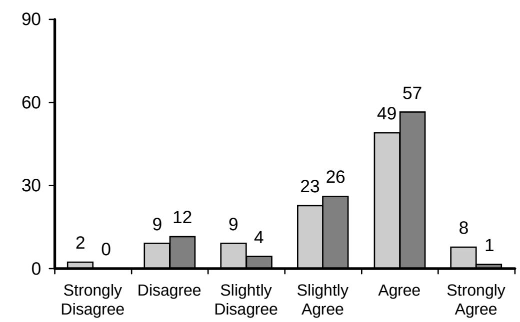
A. Errors

Decision Error

52. It is safe for Alaskan passenger and freight pilots to fly under low-lying narrow bands of clouds, provided that the visibility is clear beneath the clouds and it looks clear beyond the cloudy area.

Descriptive Statistics

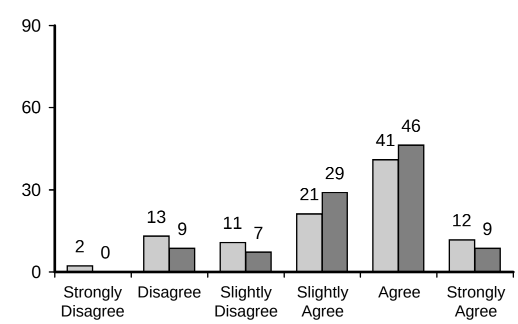
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	220	4.30	1.17	11.4	56.8
CFIT Company Pilots	69	4.32	1.02	11.6	58.0



53. Passenger and freight pilots in Alaska are more likely to “push” the weather when aircraft are equipped with modern navigation equipment.

Descriptive Statistics

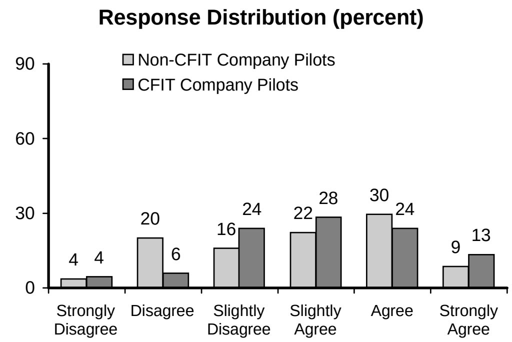
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	222	4.21	1.29	15.3	52.7
CFIT Company Pilots	69	4.39	1.05	8.7	55.1



54. In Alaska, "rules of thumb" learned from more experienced passenger and freight pilots are required in order to fly through areas of low clouds and reduced visibility.

Descriptive Statistics

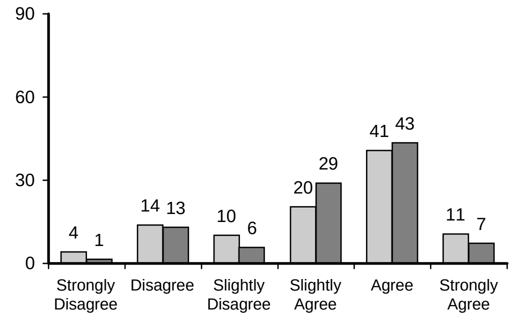
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	220	3.80	1.38	23.6	38.2
CFIT Company Pilots	67	4.01	1.30	10.4	37.3



55. Flying under VFR in low-visibility conditions over hills and mountains is a common experience for Alaskan passenger and freight pilots.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	216	4.12	1.36	18.1	51.4
CFIT Company Pilots	69	4.22	1.19	14.5	50.7



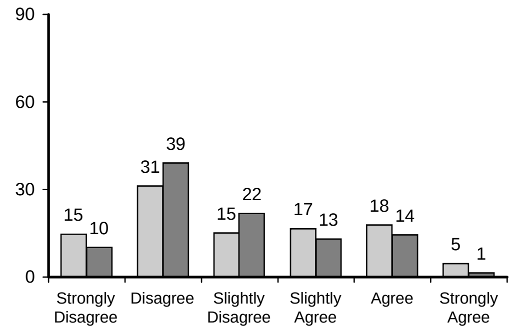
B. Violations

Routine

56. For Alaskan passenger and freight operations, it is considered safe to fly VFR in visibility below 1 mile on routes over which the pilot has flown many times before.

Descriptive Statistics

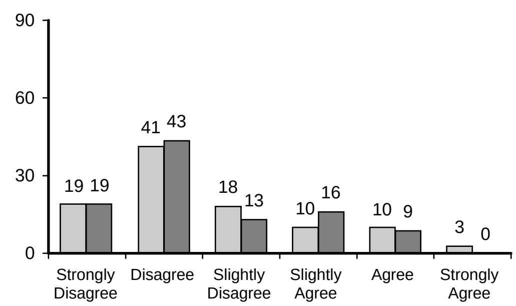
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	218	3.06	1.48	45.9	22.5
CFIT Company Pilots	69	2.87	1.28	49.3	15.9



57. In Alaska, it is safe for passenger and freight pilots to fly VFR en route when visibility is less than 1 mile, provided that pilots know the destination weather is good.

Descriptive Statistics

	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	221	2.59	1.31	59.7	12.2
CFIT Company Pilots	69	2.52	1.22	62.3	8.7

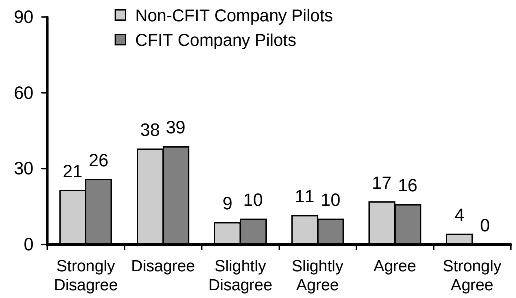


58. It is OK for Alaskan passenger and freight pilots to fly in weather below 500-foot ceilings and 1-mile visibility as long as the pilot feels it can be done safety.

Descriptive Statistics

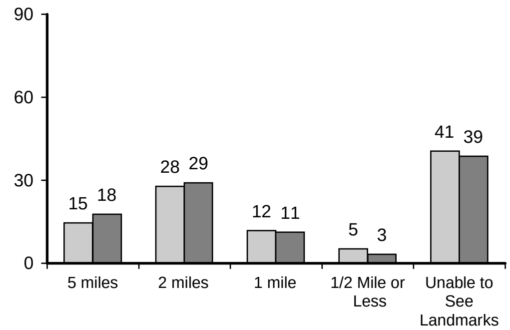
	n	Mean	SD	Percent Disagree	Percent Agree
Non-CFIT Company Pilots	220	2.77	1.53	59.1	20.9
CFIT Company Pilots	70	2.51	1.39	64.3	15.7

Response Distribution (percent)



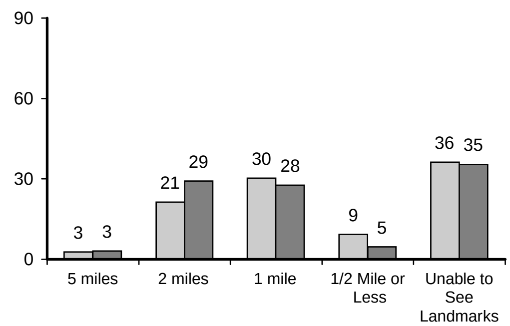
77. When flying VFR over mountains, I would turn around when the visibility is reduced to:

	n
Non-CFIT Company Pilots	212
CFIT Company Pilots	62



78. When flying VFR over flat terrain, I would turn around when the visibility is reduced to:

	n
Non-CFIT Company Pilots	215
CFIT Company Pilots	65



Among U.S. States, Alaska Has Highest Incidence of Accidents in FARs Part 135 Operations

Since the early 1980s, about 30 percent of accidents involving U.S. Federal Aviation Regulations Part 135 operations in the 50 U.S. states have occurred in Alaska. Results from an informal survey of Alaskan pilots indicate that external pressures to fly in marginal conditions and inadequate training are among the factors affecting safety.

—

Colleen Mondor

A disproportionately high number of U.S. aircraft accidents occur in the state of Alaska. This is particularly true of accidents involving U.S. Federal Aviation Regulations Part 135 commuter operations and on-demand operations.[1]

U.S. National Transportation Safety Board (NTSB) data (Table 1, page 44) show that, of 2,230 Part 135 accidents that occurred in the United States in 1982 through 2000, 645 accidents (29 percent) occurred in Alaska.[2]

These findings are similar to the following findings of studies conducted by NTSB in 1980 and in 1995:

- In the 1980 study, NTSB found that, of 1,064 accidents that occurred during air taxi operations (the term used at that time for on-demand operations) in the United States in 1974 through 1978, 311 accidents (29 percent) occurred in Alaska.[3]

- In the 1995 study, NTSB found that, of 1,032 commuter accidents and air taxi accidents that occurred in the United States in 1986 through 1994, 300 accidents (29 percent) occurred in Alaska.[4]

The aviation environment in Alaska differs from the aviation environment in other U.S. states. Most Part 135 certificate holders in Alaska conduct both commuter operations and on-demand operations. Most Part 135 flights are single-pilot operations conducted in single-engine airplanes under visual flight rules (VFR).

There are relatively few navigational aids, weather-reporting facilities and improved airports in Alaska, which is the largest of the 50 U.S. states, encompassing 570,464 square miles (1.5 million square kilometers) of land mass. Alaska has, for example, 41 very-high-frequency omnidirectional radios (VORs) — or one VOR per 13,913 square miles (36,034 square kilometers); in comparison, Washington, which is the closest U.S. state and, with 66,581 square miles (172,445 square kilometers) of land mass, is about one-eighth the size of Alaska, has 20 VORs — or one VOR per 3,329 square miles (8,622 square kilometers).

Alaska's climate and topography are unique. Temperatures vary from about –40 degrees Fahrenheit (F; –40 degrees Celsius [C]) in winter to over 100 degrees F (38 degrees C) in summer. In winter, there are long periods of darkness. The terrain typically is rugged, with two large mountain ranges — the Alaska Range in the south (which includes the tallest mountain in North America: 20,320-foot Mount McKinley) and the Brooks Range in the north — and 15 smaller mountain ranges.

In addition to coping with the demands of the environment, Alaskan pilots must respond to the state's extreme dependence upon air transportation. There is one intercity highway open

Table 1
Accidents During U.S. Federal Aviation Regulations Part 135 Operations in the United States and in the State of Alaska, 1982–2000

	United States			Alaska[1]		
Year	Commuter[2]	On-demand[3]	Total	Commuter (Percentage of U.S. Commuter)	On-demand (Percentage of U.S. On-demand)	Total (Percentage of U.S. Total)
1982	26	132	158	6 (23%)	31 (24%)	37 (23%)
1983	16	142	158	3 (19%)	26 (18%)	29 (18%)
1984	22	146	168	4 (18%)	23 (16%)	27 (16%)
1985	18	157	175	3 (17%)	45 (29%)	48 (27%)
1986	14	118	132	2 (14%)	17 (14%)	19 (14%)
1987	33	96	129	9 (27%)	15 (16%)	24 (19%)
1988	18	102	120	4 (22%)	36 (35%)	40 (33%)
1989	19	110	129	7 (37%)	32 (29%)	39 (30%)
1990	15	107	122	5 (33%)	34 (32%)	39 (32%)
1991	23	88	111	10 (43%)	25 (28%)	35 (32%)
1992	23	76	99	12 (52%)	25 (33%)	37 (37%)
1993	16	69	85	6 (38%)	26 (38%)	32 (38%)
1994	10	85	95	2 (20%)	32 (38%)	34 (36%)
1995	12	75	87	7 (58%)	22 (29%)	29 (33%)
1996	11	90	101	4 (36%)	29 (32%)	33 (33%)
1997	16	82	98	11 (69%)	27 (33%)	38 (39%)
1998	8	77	85	8 (100%)	31 (40%)	39 (46%)
1999	13	73	86	12 (93%)	26 (36%)	38 (44%)
2000	12	80	92	10 (83%)	18 (23%)	28 (30%)
Total	**325**	**1,905**	**2,230**	**125 (39%)**	**520 (27%)**	**645 (29%)**

[1]Alaska is one of 50 states in the United States.

[2]The U.S. Federal Aviation Administration (FAA) defines *commuter operation* as any scheduled operation consisting of "at least five round trips per week on at least one route between two or more points according to the published flight schedules." Before March 20, 1997, commuter operations were conducted under U.S. Federal Aviation Regulations Part 135 in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) or less. Beginning March 20, 1997, commuter operations under Part 135 have been conducted in non-turbojet airplanes with fewer than 10 passenger seats and in rotorcraft; scheduled service in turbojet airplanes and in other airplanes with 10 or more passenger seats have been conducted under Part 121.

[3]FAA defines *on-demand operation* as: a public-charter flight conducted in an aircraft with 30 or fewer passenger seats and a maximum payload capacity of 7,500 pounds or less; a scheduled passenger-carrying operation consisting of "less than five round trips per week on at least one route between two or more points according to the published flight schedules" conducted in a non-turbojet airplane with fewer than 10 passenger seats and a maximum payload capacity of 7,500 pounds or less, or in a rotorcraft; or an all-cargo operations conducted in an airplane with a maximum payload capacity of 7,500 pounds or less, or in a rotorcraft.

Source: Colleen Mondor, from U.S. National Transportation Safety Board data and U.S. Federal Aviation Administration

year-round; the highway runs from Fairbanks, which is in the center of the state, south to Anchorage and to a few smaller cities in the southern part of the state. There is one rail line, between Anchorage and Fairbanks. Some coastal communities are served by marine vessels, but the main link between populated areas across the state is provided by aircraft.

Because of the limited surface-transportation alternatives, aviation operators are required to perform a unique role that includes the transportation of items as diverse as sled dogs, mail and high school athletic teams.

A review of NTSB reports on Part 135 accidents in 1983 through 1999 indicates that pilot error is a leading accident cause (see "Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999," page 51).

Few Survey Respondents Accept 'Bush Pilot' Label

In 1999, an informal survey was conducted of 100 Alaskan Part 135 pilots — about one-tenth of pilots with current Part 135 check rides — to obtain their perspectives on factors affecting safety. The pilots were based at 16 different cites, towns and villages. Forty-seven pilots had fewer than 5,000 flight hours; 27 pilots had between 5,000 flight hours and 10,000 flight hours; and 26 pilots had more than 10,000 flight hours.

Four survey questions were based on findings from the NTSB studies about possible factors influencing the disproportionately high number of Part 135 accidents in Alaska.

The first question was designed to gauge the pilots' perception of the term "bush pilot" and whether they identified themselves as bush pilots. The 1980 NTSB report said that a contributing factor in Part 135 accidents was the *bush pilot syndrome*, which involves casual acceptance by pilots of the unique hazards of flying in Alaska or the willingness to take unwarranted risks to complete a flight.

Bush pilot syndrome dates from the 1920s and 1930s, when Alaskan pilots endured enormous physical hardships while accomplishing their jobs. Taking extraordinary chances to complete a flight was common, and many accidents occurred. In the 1930s, for example, more than one-third of the airplanes operating in Alaska were destroyed in accidents.[5] The pilots of this era attained heroic status and, as described by one newspaper at the time, were considered "the highest type of men — brave enough to face any condition in order to alleviate, through the agency of the transportation business, suffering or starvation."[6] These were the men who set the standard for Part 135 operations in Alaska (see "'Bush Pilot Syndrome' Stems From Challenges and Hardships Faced by Alaska's Aviation Pioneers," page 46).

When asked to define "bush pilot," the survey respondents gave the following answers:

- A pilot who operates "off airport," primarily on gravel bars, glaciers and fields, rather than on designated and maintained landing areas (63 pilots [63 percent]);

- A pilot who flew in Alaska during the pioneering period of the 1920s, 1930s and 1940s (19 percent);

- A pilot who operates in rural areas accessible only by aircraft (11 percent); and,

- A general aviation pilot who operates primitive aircraft, disobeys regulations and is involved frequently in accidents (5 percent).

Two pilots (2 percent) provided no definition of bush pilot.

Only 11 pilots said that they would identify themselves as bush pilots.

Demands of Passengers Affect Pilots' Decisions

The NTSB reports said that bush pilot syndrome affects not only pilots, but passengers and aircraft operators as well.

"Taking chances is considered a part of flying in Alaska by many Alaskans — not just the pilots, but also the passengers," the 1995 NTSB report said. "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."

The second survey question was designed to gauge pilots' perceptions of passenger influence on flight safety. When asked whether passengers can exert pressure on pilots to "take a look" — to attempt a flight in adverse conditions — the respondents gave the following answers:

- Seventy-three pilots said that passenger pressure can affect their decision making and could have a negative impact on flight safety;

- Thirteen pilots said that they cannot be influenced by passenger pressure;

- Nine pilots said that passenger pressure exists but can be ignored easily; and,

- Five pilots said that passengers tend to be more conservative than pilots and actually have pressured them to turn back or to take greater care.

Passenger pressure was cited in an NTSB report on an accident that occurred in Wainwright, Alaska, on April 10, 1997.[7] The report said that the passengers were scheduled to depart from Barrow in the morning, but the flight was postponed because of low ceilings. The pilot obtained weather information from Barrow Flight Service Station (FSS) 11 times that day. During one weather briefing, he said, "As soon as I call the passengers back [to the airport] the darned stuff [weather] comes down." At 1920, Barrow FSS told the pilot that the overcast ceiling was at 500 feet and that visibility was seven miles (11 kilometers). The flight departed from Barrow 30 minutes later under a special VFR clearance. Wainwright had IMC with cloud tops at 1,000 feet. After two attempts to land, the pilot radioed his company's

Sled dogs were depended on decades ago to supply remote Alaskan outposts. Aviation has become the primary mode of supply in the state, and sled dogs are often transported in airplanes. (FSF photo by Christopher Deck) ground agent in Wainwright that he was returning to Barrow. The aircraft, a Cessna 208B, struck terrain four miles (six kilometers) from the village. The pilot and all four passengers were killed. Company personnel told investigators that passengers "had waited all day to go and were anxious to leave Barrow." NTSB said that the probable causes of the accident were "the pilot's intentional VFR flight into [IMC] and his failure to maintain altitude/clearance from terrain."

Overconfidence Prevents Some Pilots From Refusing Flights

The 1995 NTSB report said that the attitude of company management about safety can affect pilot judgment and decision making.

When asked if companies exert pressure on pilots to fly overweight aircraft or to fly in marginal conditions, the survey respondents gave the following answers:

- Eighty-two pilots said that they had been pressured by their companies or had direct knowledge of other pilots who had been pressured by their companies to fly;
- Eight pilots said that their companies did not pressure pilots to fly;
- Seven pilots said that a pilot's job is to accept only those flights that he or she is capable of conducting safely and that no pilot can be pressured into conducting a flight; and,
- Three pilots said that company pressure existed in the past but no longer existed.

The 82 pilots who said that they, or other pilots they knew, had been pressured by their companies to fly were asked why pilots succumb to company pressure to fly. Their answers were as follows:

Continued on page 48

'Bush Pilot Syndrome' Stems From Challenges and Hardships Faced by Alaska's Aviation Pioneers

Bush pilot syndrome, which involves casual acceptance by pilots of the unique hazards of flying in Alaska or the willingness to take unwarranted risks to complete a flight, was identified by the U.S. National Transportation Safety Board as a factor in the high accident rate among U.S. Federal Aviation Regulations Part 135 operators in Alaska.[1]

The pioneer pilots, who endured tremendous physical hardships and often took extraordinary risks to complete their jobs, played a large role in the creation of the bush pilot syndrome. In particular, Russel Merrill, Carl "Ben" Eielson, Harold Gillam, Noel Wien, Ralph Wien and Don Sheldon exemplify the characteristics that commonly define a bush pilot.

Russel Merrill[2]

Russel Merrill learned to fly in 1918 in the U.S. Navy. He completed his training too late to serve in World War I, but he accumulated almost 400 flight hours before he was discharged. He returned to college, earned a degree and settled in Portland, Oregon. The appeal of flying remained, however, and when he saw a sales advertisement for a Curtiss flying boat (amphibious aircraft), he immediately called the seller, Roy Davis.

After meeting the former naval aviator, Davis asked Merrill if he would help him start an aviation business in Alaska. Six weeks later, in May 1925, the Merrill family moved to Ketchikan. Aircraft were rare in southeast Alaska, and the Roy J. Davis Airplane Co. quickly found business hauling freight and passengers throughout the region. The airplane had frequent mechanical problems, however, and the rough seas and rugged terrain taxed the flying boat's capabilities.

In 1926, the partnership between Davis and Merrill ended amicably, and Merrill accepted an offer from Anchorage Air Transport (AAT) to become the new company's chief pilot. He quickly began establishing routes to southwestern coastal villages where trappers were eager to bring their furs to market in Anchorage. He discovered a pass at 3,000 feet in the Alaska Range that shaved an entire day off the flight. Three years later, Merrill Pass appeared as an official landmark on government maps.

In 1929, Eielson's new Alaskan Airways made a cash offer for AAT that the shareholders quickly accepted. Merrill found himself busy as the only pilot flying out of Anchorage. On Sept. 16, 1929, he arose at 0300 and conducted two round-trip flights between Anchorage and Sleetmute. He departed from Anchorage late that day, carrying mail and an air compressor, for a third flight but never arrived in Sleetmute. For weeks, pilots searched in vain. A piece of torn fabric from the airplane's tail was found on the beach at Tyonek, a village on the west side of Cook Inlet. The search for Merrill was still in progress when news of another missing pilot — Eielson — reached Anchorage.

Carl "Ben" Eielson[3,4,5]

Like Merrill, Ben Eielson completed his military flight training just as World War I ended. In 1922, he moved to Fairbanks, ostensibly to teach school but with the desire to fly. He persuaded city leaders to purchase an airplane and obtained a 10-month government contract to deliver mail twice a month between Fairbanks and McGrath.

On his first mail flight in February 1924, Eielson shaved 14 days off the usual ground-delivery time by completing his route in only four hours. During the next eight months, however, 40 percent of his landings resulted in accidents. The government rescinded the contract and returned the mail route to dogsleds.

In 1927, Eielson and navigator George "Hubert" Wilkins conducted several staging flights to Barrow, on the north coast, delivering supplies for long-range trips over the North Pole. In April 1928, the two men departed from Barrow in a Lockheed Vega to fly across the ice cap. After more than five hours of flying, the engine malfunctioned. After two landings and makeshift repairs, they turned back to Barrow. The engine failed, and Eielson landed the airplane on the ice cap. Eielson and Wilkins endured five days of blizzard conditions and then began to walk toward the mainland. Eight days later, they arrived at Beechy Point, 180 miles (290 kilometers) east of Barrow.

Eleven months later, they succeeded in flying across the top of the world. In just over 20 hours, they flew from Barrow to Spitsbergen, Norway, via the northern end of Greenland. The flight was an unparalleled achievement in Arctic air navigation and made the two men famous. In 1929, Eielson received the Distinguished Flying Cross from U.S. President Herbert Hoover for his Arctic flight and for a subsequent journey over Antarctica.

Capitalizing on his success, Eielson persuaded investors to finance the merger of several pioneer Alaskan flight services into one company, Alaskan Airways. He was named vice president and general manager. The new company was awarded a contract from Swenson Fur Trading to remove 15 passengers and 12,000 pounds (5,443 kilograms) of fur from the icebound ship Nanuk off the coast of Siberia. The contract, worth US$50,000, was the largest awarded to date in the territory.[6]

Eielson and another pilot, Frank Dorbandt, conducted two successful flights to the trapped ship before a storm grounded their aircraft in the village of Teller (near Nome). As daylight hours decreased with each passing day, the pilots became increasingly impatient. Without a weather report from the ship, the pilots took off at 1045 Nov. 9, 1929, each with a mechanic aboard his airplane. Dorbandt later returned to Teller, explaining that he had encountered dense fog on the Siberian coast. Eielson and his mechanic, Earl Borland, were never seen alive again. The wreckage of their airplane was found 11 weeks later in Siberia.

Harold Gillam[7,8]

Harold Gillam was a novice, unlicensed pilot when he participated in the search for Eielson and Borland in 1929. Gillam's airplane was the first to reach the Nanuk, a feat accomplished by flying blind through fog in an open cockpit with no radio and no knowledge of the weather ahead.

Gillam later started his own company and flew from Cordova to mountain mining camps with short runways that usually were shrouded in fog and buffeted by high winds. He earned the nickname "thrill 'em, chill 'em, spill 'em, but no kill 'em Gillam." In the first six months of operation, he was involved in six accidents.

In 1934, Gillam moved to Fairbanks, where his reputation for all-weather flying had preceded him. For three years, he delivered mail from Fairbanks to Bethel and to 26 villages between; he never missed a trip. He was known to fly so low under cloud cover that his wings would skim the treetops and to taxi 10 miles (16 kilometers) or more on frozen rivers to reach his destination.

In 1941, Gillam was hired as chief pilot for a contracting company that was building airports in Alaska. On Jan. 5, 1943, he departed from Seattle on a routine flight to Fairbanks with five passengers. Other northbound flights were canceled that day because of a storm approaching the Alaskan coast. Four hours out of Seattle, the flight encountered dense fog, and Gillam began flying by reference to his instruments. He picked up a radio range station at a new U.S. Army field on Annette Island and attempted to navigate by what he thought was the southeast course. He apparently did not realize that his airways map was obsolete; the courses had been changed, and Gillam was on the northeast course of the radio range. As later recounted by one of his five passengers, the aircraft was at 5,000 feet with ice building on its wings when the left engine failed. The airplane began to descend rapidly. For the first time that day, Gillam used his radio; he told Ketchikan Radio that he was in trouble. He did not have time, however, to radio a position report before the airplane broke out of the clouds at 2,500 feet and struck the side of a mountain.

Gillam and his passengers survived the accident. Gillam, who had been injured in the accident, set out in search of high ground where he could determine their position. One passenger died from blood loss a few days after the accident. One month after the accident, the four surviving passengers accidentally were discovered by the U.S. Coast Guard. Gillam's frozen body was found one mile away.

Noel Wien and Ralph Wien[9,10]

In contrast to Gillam's bold style, Noel Wien was considered much more conservative. Wien learned to fly in his native Minnesota in 1921 and barnstormed across the Midwest. In 1924, he found irresistible an offer to earn $300 a month flying for a fledgling airline based in Fairbanks. Soon after arriving in Alaska, he completed the first nonstop flight from Anchorage to Fairbanks. In the following years, Wien distinguished himself as a pilot for several charter operations.

By 1928, Wien and his three brothers were operating their own company, Wien Alaska Airways, providing weekly air service between Fairbanks and Nome. One day, Noel Wien was away on a flight to Barrow, and the company's airmail contract rested on the shoulders of his brother, Ralph, who had 10 flight hours and had flown the route twice as a passenger.

Ralph was ill when he departed from Fairbanks and was so exhausted when he arrived in Nome that he was unable to speak. Ralph continued the route the next day, delivering mail around the Seward Peninsula. On his return trip home, he encountered dense fog and lost ground contact for long periods of time; but his safe arrival in Fairbanks fulfilled the contract.

Ralph was killed in October 1930 when the experimental aircraft he was flying struck terrain during takeoff from Kotzebue.

After Ralph died, Noel formed a new company, Wien Airways of Alaska. Flight service was expanded steadily to the interior and northern regions of the state, and the airline prospered. Noel Wien died of natural causes in 1977.

Don Sheldon[11]

Among postwar Alaskan bush pilots, Don Sheldon is legendary. Typically a cautious pilot, who filtered his fuel through a chamois even when the fuel was supplied by systems that were state-of-the art at the time, he is best known for rescue flights, including many flights to Mount McKinley.

Born in Wyoming, Sheldon moved to Alaska at age 17 and worked as a dairyman, miner and surveyor. By 1942, he had saved enough money to take flying lessons and earn a private pilot license. Intent on becoming a fighter pilot, he joined the Army Air Corps, which trained him, instead, as a B-17 tail gunner. After flying 26 combat missions in Europe, Sheldon returned to the United States, where he delivered airplanes for Piper Aircraft and earned an airframe-and-powerplant mechanic's license.

Sheldon returned to Alaska in 1948 and began a flight service in Talkeetna that soon became much in demand. Sheldon often flew from before sunrise to after sunset. In 1950, his float-equipped airplane stalled during takeoff from a small lake. Uninjured in the accident, Sheldon rescued his seriously injured passenger from the icy water and then walked 14 hours to find help.

Five years later, he landed a floatplane several times on a narrow, turbulent and fast-moving river to rescue eight surveyors who had been thrown from their boat and were clinging to the canyon wall. With a wing perilously close to the rocks, Sheldon used engine power and control inputs to position the airplane where the surveyors, two by two, could step off the wall onto a float. He then taxied the airplane tail-first in the "white water" until reaching calmer water from which the airplane could take off.

This was just one of Sheldon's many rescue flights that over the years would be woven into the tapestry of Alaskan bush flying. Sheldon was involved in six serious — but nonfatal — accidents in a flying career that spanned more than a million miles. In 1975, he died of cancer at age 53.♦

– Colleen Mondor

Notes

1. U.S. National Transportation Safety Board. *Special Study: Air Taxi Safety in Alaska*. NTSB-AAS-80-3. September 1980.
2. MacLean, Robert Merrill; Rossiter, Sean. *Flying Cold: The Adventures of Russel Merrill, Pioneer Alaskan Aviator*. Fairbanks, Alaska, United States: Epicenter Press, 1994.
3. Potter, Jean. *The Flying North*. San Francisco, California, United States: Comstock Editions, 1945.
4. Ruotsala, James. "Great Pilot in the Great Land." *Alaska Flying*, August 1987: 21+.
5. "Alaskan Airways Will Bring Furs From North Cape." *Anchorage Daily Times*, 25 October 1929: A1.
6. The United States purchased the Alaskan Territory from Russia in 1867; the territory became the 49th U.S. state in 1959.
7. Potter.
8. Gebo, Robert. "The Gillam Plane Was Missing." *The Alaska Sportsman*, July 1943: 16–23.
9. Harkey, Ira. *Pioneer Bush Pilot: The Story of Noel Wien*. New York, New York, United States: Bantam Books, 1991.
10. Kennedy, Kay. *The Wien Brothers Story*. Alaska, United States: Wien Air Alaska, 1967.
11. *The Bush Pilots*. Alexandria, Virginia, United States: Time-Life Books, 1983.

- Twenty-one percent said that "ego" (i.e., overconfidence in personal ability) or a need to be considered "macho" (i.e., virile and domineering) prevented pilots from refusing flights;
- Seventeen percent said that pilots want to assist their company or supervisor and believe that all flights are necessary and important, and must be accomplished if possible;
- Eighteen percent could not articulate why pilots can be pressured into flying;
- Fifteen percent said that financial concerns (e.g., loss of payment for flying, loss of continued employment) cause pilots to accept flights against their better judgment;
- Five percent said that competition among pilots causes concern that a flight refused by one pilot will be flown successfully by another pilot; and,
- Three percent said that doing what the company wants is easier than putting up a fight.

Pilots Cite Pressure on Their Companies to Deliver Mail

The 1995 NTSB report said that many Part 135 operators in Alaska depend on revenues derived from transporting mail and that specific U.S. Postal Service (USPS) policies might result in pressure on operators to fly in marginal conditions.

For example, USPS requires operators to notify a postal representative whenever a mail-carrying flight does not depart within 15 minutes of the scheduled departure time. The postal representative then may require the operator to transfer the mail to another operator, return the mail to a USPS facility or hold the mail for a later flight.

Alaskan Part 135 pilots often have direct contact with postal employees. In many rural areas, pilots pick up the mail from a USPS facility and respond to postal employees' inquiries about flight status.

When asked if USPS policies exert pressure on operators to dispatch flights in marginal conditions, the survey respondents gave the following answers:

- Fifty-five percent said that they had direct knowledge that USPS policies exert pressure on operators;
- Forty-two percent said that USPS policies do not exert pressure on operators;
- One respondent said that pilots should not concern themselves with USPS policies; and,
- One respondent said that his company always delivered the mail and, thus, did not need to be pressured by USPS.

Training Cited as Key To Safety Improvement

Based on the 1980 study and the 1995 study, NTSB made several recommendations to improve the safety of Part 135 operations in Alaska. The recommendations included improved maintenance of landing facilities, improved weather observation and dissemination of weather information, use of the global positioning system (GPS) for en route navigation and for nonprecision instrument approaches, and pilot decision-making training and judgment training based on typical company flight operations and on Alaska's aviation environment.

When asked what should be done to reduce the number of pilot-error accidents in Alaskan Part 135 operations, the survey respondents gave the following answers:

- Twenty-one pilots said that improved initial training and improved recurrent training are required. Specific recommendations included more flight training and better decision-making training related to the Alaskan aviation environment;
- Twelve pilots said that the attitude in Alaska about flying must change. Although no specific recommendations were made, several respondents said that pilots should be free of outside influences (e.g., passengers or company) on their decision making and should base their decisions on factors that could affect flight safety, such as route and weather;
- Eleven respondents said that pilots must prevent accidents by not making mistakes;
- Ten respondents said that the experience level of pilots must be increased by the implementation of higher minimum requirements and higher wages;
- Eight pilots said that the maximum duty period prescribed in Part 135 should be reduced below 14 hours, or companies should be prevented from scheduling pilots to work several 14–hour days in succession;
- Eight pilots said that weather reporting should be improved. Specific recommendations included the installation of more automated weather observing systems (AWOS) and more manned flight service stations;
- Six pilots said that operators must be forced to consider safety equally as important as economic performance. Specific recommendations included imposing fines on operators for pilot-error accidents and increasing U.S. Federal Aviation Administration (FAA) enforcement;
- Five pilots said that better navigational aids (e.g., increased use of GPS) and improved runways are required;
- Five pilots said that FAA should increase VFR weather minimums;
- Three pilots said that more research should be conducted on the causes of pilot error;
- Two pilots said that increased operation with two-pilot crews would improve safety;
- One pilot recommended formation of a pilots' union; and,
- One pilot provided no recommendations.

Capstone Program Demonstrates Safety-improvement Technologies

Responding to NTSB's recommendations for safety improvements in Alaska and to industry recommendations for improvement of the U.S. National Airspace System, FAA in 1999 began tests in southeastern Alaska of the Capstone Program, which includes installation of ground equipment and aircraft equipment to support a system of weather observation, data link communication, traffic surveillance and flight information service.[8]

FAA said that it will install the airborne equipment aboard as many as 200 commercial aircraft and government aircraft operated in Alaska. As of Sept. 5, 2001, installation of the following equipment was completed in 123 aircraft:[9]

- GPS receivers approved for nonprecision instrument approaches and including a moving-map display capable of showing the aircraft's position relative to airports, runways, ground-based navigational aids and special-use airspace;
- Multi-function displays capable of showing terrain, flight-plan information and weather information; and,
- Automatic dependent surveillance-broadcast (ADS-B) transceivers that can transmit the aircraft's position, course, airspeed, altitude and intended flight path, and receive weather information and data from other Capstone-equipped aircraft being operated on the ground or in the air.

The program also involves the installation of AWOS equipment and the commissioning of GPS stand-alone nonprecision instrument approaches at 10 airports. As of Sept. 6, 2001, AWOS installations were completed at five airports and GPS approaches were commissioned at nine airports.

Aviation Accidents Top List of Occupational Fatalities

Over a 30-year career, professional pilots in Alaska are nearly five times more likely to be killed while flying than professional pilots in other U.S. states, said a report by the U.S. National Institute for Occupational Safety and Health (NIOSH) Alaska Field Station.[10] The report said that aviation accidents are the leading cause of occupational fatalities in Alaska and that pilots in Alaska have approximately 100 times the mortality rate of all U.S. workers.

While the Capstone Program brings possible technological solutions to some of Alaska's aviation-safety problems, the results of the pilot survey indicate that nontechnical solutions also would improve the safety of Part 135 operations conducted in the state.

The most common response among the survey respondents to the question of reducing pilot-error accidents was that better training, particularly for new hires, is needed. Among specific recommendations were that newly hired pilots should have additional flight time in the aircraft prior to taking their check rides and that they should accumulate more flight experience in the environment before being assigned to fly solo. Training should be more "Alaska-specific" and should cover the situations that pilots are most likely to encounter.

The respondents said that enhanced navigational aids and an increase in weather-reporting facilities in areas such as mountain passes and coastal areas could reduce the accident rates.

The NTSB reports and the informal pilot survey indicate that Part 135 pilots in Alaska experience pressure from passengers and company personnel to fly in marginal conditions or with heavier-than-legal loads. The external pressure is exacerbated by the willingness of some pilots to take unwarranted risks — the bush pilot syndrome that is apparent in many accident reports. Several respondents said that the key to improving the safety of Part 135 operations in Alaska is to change the attitude about flying that exists among many company managers, pilots and passengers in the state.♦

Notes

1. U.S. Federal Aviation Regulations (FARs) Part 135 is titled *Operating Requirements: Commuter and On-demand Operations and Rules Governing Persons On Board Such Aircraft*. The U.S. Federal Aviation Administration (FAA) defines *commuter operation* as any scheduled operation consisting of "at least five round trips per week on at least one route between two or more points according to the published flight schedules." Before March 20, 1997, commuter operations were conducted under Part 135 in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) or less. Beginning March 20, 1997, commuter operations under Part 135 have been conducted in non-turbojet airplanes with fewer than 10 passenger seats and in rotorcraft; scheduled service in turbojet airplanes and in other airplanes with 10 or more passenger seats have been conducted under Part 121, *Operating Requirements: Domestic Flag and Supplemental Operations*. FAA defines *on-demand operation* as: a public-charter flight conducted in an aircraft with 30 or fewer passenger seats and a maximum payload capacity of 7,500 pounds or less; a scheduled passenger-carrying operation consisting of "less than five round trips per week on at least one route between two or more points according to the published flight schedules" conducted in a non-turbojet airplane with fewer than 10 passenger seats and a maximum payload capacity of 7,500 pounds or less, or in a rotorcraft; or an all-cargo operation conducted in an airplane with a maximum payload capacity of 7,500 pounds or less, or in a rotorcraft.

2. U.S. National Transportation Safety Board (NTSB). *Aviation Accident Statistics*. Aug. 28, 2001. www.ntsb.gov/aviation/stats.htm
3. NTSB. *Special Study: Air Taxi Safety in Alaska*. NTSB-AAS-80-3. September 1980.
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About the Author

Colleen Mondor is a licensed pilot and holds a bachelor's degree in aviation management from Florida Institute of Technology and a bachelor's degree in history and a master's degree in northern studies from the University of Alaska Fairbanks. She specializes in the study of commercial aircraft accidents in Alaska involving pilot error. She has worked for two commuter airlines in Alaska and serves as a consultant for air carriers seeking certification to conduct operations under U.S. Federal Aviation Regulations Part 135 and Part 121. She presented a paper on Alaska's aviation accident history at the 11th Annual Symposium on Maritime Archaeology and History of Hawaii and the Pacific in 1999. She is writing a book on pilot-error accidents among Part 135 operators in Alaska.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 11, 1983	Dutch Harbor	Aerospatiale AS 350D	destroyed	1 serious, 3 minor
The pilot and passengers heard a loud boom soon after takeoff. Rotor speed decreased, and the pilot began an autorotation. He observed that the engine was not driving the rotor system and shut down the engine. During the landing on a mountain slope, the helicopter rolled over. An inspection of the engine revealed that the no. 3 bearing had failed and that the oil jet for that bearing was clogged.				
Aug. 19, 1983	Atmautluak	Cessna T207A	substantial	1 serious, 4 none
The pilot's seat slid back during takeoff, and he lost control of the airplane. The pilot said that the seat latch had broken. The report said that no broken seat-latch parts were found.				
Aug. 20, 1983	Iliamna	De Havilland DHC-2	destroyed	2 serious, 3 minor
During a caribou-spotting flight, the airplane encountered a downdraft and struck terrain. The passengers said that the airplane was about 300 feet above ground level (AGL) when it began to descend.				
Sept. 21, 1983	Valdez	Cessna 185	substantial	2 fatal
The pilot attempted to land on a lake but rejected the landing because of low ceilings and limited visibility. When he later returned to the lake, the ceiling had improved but there were layers of cloud and fog. Witnesses said that the airplane was in a descending left turn when the left float struck the water. The airplane bounced, pitched down and struck the water. The report said that the occupants survived the impact but "disappeared in the fog" before rescue vehicles arrived; they were presumed to have drowned.				
Dec. 23, 1983	Anchorage	Piper PA-31-350	destroyed	3 serious, 3 minor, 6 none
Visibility was about 0.1 mile (0.2 kilometer), but runway visual range was improving when the pilot was cleared to taxi and to hold for takeoff on Runway 6L. The crew of a McDonnell Douglas DC-10 was cleared to taxi to Runway 32 but taxied the airplane to an intersection of Runway 24R. Tower personnel were unable to observe the aircraft. The DC-10 crew was cleared to take off on Runway 32; the crew began the takeoff from the intersection with 2,400 feet (732 meters) of Runway 24R remaining. The DC-10 struck the PA-31. The accident report said that the DC-10 crew did not use the compass to confirm the airplane's heading and that "there was a lack of legible taxiway [signs] and runway signs."				
June 26, 1984	Ekuk	Piper PA-32-300	substantial	1 serious, 3 minor, 4 none
The airplane collided with a water pipe at about six feet AGL during takeoff. Witnesses said that the pilot did not use all the available runway and that the airplane drifted from the runway centerline after a premature liftoff.				
July 11, 1984	Ketchikan	Cessna A185F	destroyed	1 serious, 3 minor, 3 none
The pilot selected an empty fuel tank, causing fuel starvation soon after takeoff. The airplane flipped over during the forced landing.				
July 21, 1984	Ouzinkie	Grumman G-21A	destroyed	4 fatal
The pilot departed from Kodiak with a special visual flight rules (special VFR) clearance and then circled over a bay while waiting for the weather to clear. The accident pilot told another pilot that the weather appeared to be improving and that he was going to "take a look." The airplane struck the water northwest of the bay. Witnesses said that instrument meteorological conditions (IMC) prevailed in the area. The airplane was not equipped for instrument flight, and the pilot was not current on instruments. Another pilot said that the accident pilot had voiced concern that his cargo of frozen meat was thawing while he was circling.				
July 25, 1984	Anchorage	Cessna 401	unknown	5 fatal
The pilot's first preflight weather briefing included a forecast of visual meteorological conditions (VMC) with occasional marginal conditions along the flight route. Thirty minutes later, he received another briefing that included a report of IMC at the destination, which was Cantwell. The pilot departed from Anchorage 30 minutes later on a company VFR flight plan. There was no further radio communication with the pilot. The airplane did not arrive in Cantwell, and an extensive search revealed no trace of the airplane or the occupants.				
Sept. 16, 1984	Point Hope	Cessna P210N	substantial	3 serious, 1 minor, 1 none
The pilot-controlled runway lights were not illuminated when the airplane struck terrain during a night takeoff. "The pilot stated [that] he had consumed a couple of alcoholic beverages earlier in the evening and, although approached by several people to fly, he refused and passed out," the report said. "He did not remember the takeoff [or] the crash."				
Jan. 10, 1985	Kenai	Bell 206BIII	destroyed	1 fatal, 2 serious, 1 minor
The pilot, who received training for offshore operations the previous day, was flying the helicopter to an offshore oil platform. The pilot said that visibility was poor above 500 feet, so he flew below 500 feet. The helicopter struck the water and rolled over 1.5 miles (2.4 kilometers) from shore. The life raft, which was secured to the helicopter's chin bubble, was lost when the bubble separated during impact.				
Jan. 16, 1985	Port Alsworth	Cessna 207	substantial	1 fatal
The report said that the pilot continued a flight into known adverse weather conditions and that the airplane struck a mountain.				

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Feb. 4, 1985	Soldotna	Beech 65-A80	destroyed	9 fatal

During arrival, the crew radioed the company weather observer, who advised that the wind was calm, the ceiling was at 600–800 feet and visibility was 8–10 miles (13–16 kilometers). The crew conducted an NDB (nondirectional beacon) approach and a missed approach, and requested clearance for another instrument approach. The crew said that the aircraft had accumulated a heavy load of ice. The report said that the crew could have diverted to Kenai, which had an ILS (instrument landing system) approach, but elected to make a VOR (very-high-frequency omnidirectional radio) approach to Soldotna. While being vectored for the approach by air traffic control (ATC), the crew received another report from the weather observer, who said that the weather was below minimums and recommended that the crew divert to another airport. The crew did not acknowledge the weather observer's message. The airplane struck trees on high terrain 1.5 miles from the airport. The report said that recurring problems had been encountered with the airplane's anti-ice system.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Feb. 7, 1985	Koyuk	Cessna 207A	minor	1 fatal, 1 none

The airplane was landed about 630 feet (192 meters) from the runway threshold, where it struck and killed a snowmobile driver. According to the report, the pilot said that he landed short purposely "to take advantage of a runway upslope" and because there was snow-removal equipment at the departure end of the runway.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
March 12, 1985	Barter Island	De Havilland DHC-6-300	substantial	2 serious, 2 minor

The airplane was in a steep nose-down attitude when it struck terrain during a missed approach at a temporary winter landing strip. Marginal weather conditions prevailed, and icing conditions had been reported.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 20, 1985	Kodiak	Cessna U206G	destroyed	2 serious

Soon after takeoff for a fish-spotting flight, the airplane stalled during a steep 180-degree turn at low altitude and spun into the water.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 16, 1985	Golovin	Cessna C207A	substantial	2 fatal, 3 serious

The pilot attempted to fly over a mountain saddle. As he turned the airplane toward the mountain and began a climb, weather conditions rapidly deteriorated to zero ceiling, zero visibility and severe turbulence. The airplane struck the 1,707-foot mountain at the 1,590-foot level.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
June 15, 1985	Eek	Cessna 207	substantial	1 serious, 2 minor, 5 none

The pilot said that during the takeoff roll, he moved the flap-control lever up and down to effect a liftoff. The airplane overran the runway, struck an embankment and flipped over into a lake. Examination of the wreckage showed that the flaps were retracted and that the throttle friction control was unscrewed from its shaft.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 18, 1985	Tutna Lake	De Havilland DHC-2	destroyed	4 fatal

The airplane struck a mountain at 2,200 feet about three miles (five kilometers) from a remote lake that was the destination.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 20, 1985	Gulkana	Gates Learjet 24D	destroyed	3 fatal

The crew was conducting a VOR approach at night when the airplane struck trees and terrain about 7.4 miles (13.7 kilometers) from the VOR. The wreckage was found on the 330-degree radial of the VOR. The inbound course for the approach was 135 degrees (i.e., the 315-degree radial of the VOR).

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 14, 1985	Togiak	Piper PA-32-300	substantial	2 serious

Adverse weather conditions prevailed when the airplane struck a mountain. Marginal weather conditions had been forecast, and the pilot had received a pilot report (PIREP) that VFR flight was not recommended.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 26, 1985	Merrill Pass	De Havilland DHC-2	destroyed	3 fatal

The airplane struck terrain at 3,600 feet in a mountain pass. The pilot had received a weather briefing forecasting the pass to be closed because of deteriorating weather. In his last radio transmission, the pilot had reported weather in the pass as marginal, with two miles (three kilometers) visibility, snow and occasional moderate turbulence.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Oct. 22, 1985	Juneau	Gates Learjet 24D	destroyed	4 fatal

The airplane struck a mountain during descent for a nonprecision instrument approach. Both navigation receivers were tuned to the localizer frequency, but the crew inadvertently left the DME (distance measuring equipment) switch in the "hold" mode, which retained a previously tuned VOR frequency. The report said that the crew conducted the initial descent prematurely.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Nov. 1, 1985	Bethel	Cessna 208	destroyed	2 fatal, 2 serious

The engine lost power on takeoff because the fuel selectors were in the "OFF" position. The pilot was trying to restart the engine when the airplane stalled and struck terrain. The passengers said that the pilot had not used a checklist.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Nov. 16, 1985	Quinhagak	Piper PA-32-300	destroyed	4 fatal, 1 serious, 2 minor

The airplane struck frozen tundra during a VFR flight at night in IMC. The report said that the pilot had not received a preflight weather briefing and was not certified to carry passengers for hire at night.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Dec. 15, 1985	Napaskiak	Cessna 207	substantial	4 serious

The pilot encountered deteriorating weather at his destination and diverted to Napaskiak, which had freezing drizzle, rain and fog. The pilot was attempting to line up with the runway for landing when the windshield became covered with ice. He increased power to go around, and the airplane struck terrain.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Feb. 11, 1986	Nome	Cessna 207	destroyed	3 fatal

The report said that the pilot "waited for a break in the weather" to depart from Nome with a special VFR clearance. Marginal weather conditions prevailed, with freezing drizzle and icing in clouds. The wreckage was located at 650 feet on the side of a mountain. The report said that the airplane was in a descending turn when it struck terrain. Witnesses at the accident site observed ice 0.13–0.75 inch (0.32–1.91 centimeters) thick on the wings and airframe.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
June 16, 1986	St. Mary's	Cessna 207A	destroyed	1 fatal

The pilot was flying his airplane in formation with another airplane at low altitude when both pilots observed power lines. The other pilot pulled up and cleared the power lines. The accident pilot turned steeply, and the airplane stalled and struck terrain.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 14, 1987	Kenai	Cessna 207A	destroyed	1 fatal, 4 serious, 2 minor

During flight, the pilot encountered snow showers and descended to 500 feet. He said that, without warning, he encountered a snow squall and whiteout conditions while flying over a ridge. He was attempting to conduct a 180-degree turn when the aircraft struck snow-covered terrain.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 1, 1987	Anchorage	Cessna 402	substantial	2 fatal

The airplane was on the last leg of a flight when it struck terrain in a wooded area during a VFR approach. The copilot, who had deplaned before the pilot began the last leg of the flight, said that he had not observed the pilot use the airplane's auxiliary fuel tanks at any time during the earlier flights. The airplane's main fuel tanks have a usable capacity of 100 gallons (379 liters); the report said that the engines would have consumed slightly more than 100 gallons of fuel at the time of the accident. The report said that ample fuel remained in the auxiliary tanks.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 7, 1987	Nightmute	Piper PA-31-350	destroyed	1 fatal

The airplane struck a hill at an elevation of 350 feet during a cargo flight in an area where the ceiling was below 500 feet and visibility was less than one mile (1.6 kilometers). The report said that several other FARs Part 135 operators had cancelled their flights.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 8, 1987	Crooked Creek	Cessna 207	destroyed	1 fatal

After the station manager reported that weather conditions were zero-zero at the destination, the pilot said that he would continue the flight to Red Devil. The report said that some debris was found along the shore of a river, but the airplane and the pilot were not found.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 12, 1987	Ketchikan	Cessna 185E	substantial	2 fatal, 3 none

A helicopter was inbound from the southeast to land at Ketchikan Heliport when the accident airplane departed to the southeast from Ketchikan International Airport. The weather was 500 feet scattered, 1,100 feet broken, visibility five miles (eight kilometers) with light rain and fog. Both pilots received traffic advisories from Ketchikan Flight Service Station (FSS). The aircraft collided about one mile southeast of Ketchikan. The helicopter struck water; the airplane was "crash-landed" at the airport.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Nov. 23, 1987	Homer	Beech 1900C	destroyed	18 fatal, 3 serious

The report said that there were indications that the crew lost control of the airplane when they extended the flaps on approach. The airplane struck terrain short of the runway. The investigation revealed that the aircraft was loaded with approximately 600 pounds (272 kilograms) more cargo than the first officer had requested; the center of gravity (CG) was 8–11 inches (20–28 centimeters) aft of the aft limit; and up to 0.38 inch (0.96 centimeter) of ice had accumulated on the airplane's leading edges.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Dec. 10, 1987	Ambler	Cessna 207A	substantial	1 fatal

The airplane struck a mountain at an elevation of about 2,100 feet, 15 miles (24 kilometers) off the intended route during a night flight in marginal VFR weather conditions. Another pilot in the area about two hours after the accident reported whiteout conditions with snow and ice crystals, and visibility less than 0.5 mile (0.8 kilometer). The accident pilot recently was hired by the operator and had accumulated 23 flight hours in the area.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Dec. 23, 1987	Kenai	Piper PA-31-350	destroyed	6 fatal, 2 serious, 2 minor

The pilot reported engine problems soon after liftoff. While circling to land, the airplane struck terrain. The right engine had an extensive cylinder-head crack, a partially disconnected intake pipe and was capable of producing 55 percent of rated power. The left engine had seven severely worn camshaft lobes.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 30, 1988	Cold Bay	Piper PA-32-300	substantial	1 serious

The pilot was conducting a cargo flight at night over unfamiliar terrain when the airplane struck rising terrain. Another pilot said that there were localized areas of fog and snow reducing visibility to less than 0.5 mile.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 18, 1988	Skwentna	Piper PA-32-260	destroyed	3 fatal

The airplane was on a VFR flight when it struck a mountain at the 8,600-foot level. Witnesses said that weather conditions were poor and visibility was less than 0.5 mile.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 24, 1988	Dillingham	Aerospatiale AS 350D	destroyed	4 fatal

The helicopter was on a cargo flight when it collided at 400 feet AGL with a Cessna 206 about 0.5 mile south of the Dillingham airport. The pilot of the airplane was practicing takeoffs and landings at the airport. Both the airplane pilot and the helicopter pilot were communicating with Dillingham FSS and had received traffic advisories.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 23, 1988	Kongiganak	Cessna 207A	substantial	1 serious, 3 minor, 2 none

The airplane was landed two-thirds of the way down the runway, struck a rut and flipped over. The report said that a U.S. Federal Aviation Administration (FAA) publication states that the runway is unusable after heavy rain and should be inspected prior to use.

July 30, 1988	Liscome Bay	Cessna 185	destroyed	3 fatal

The pilot lost control of the airplane during an approach in a narrow, tree-lined area. Poor visibility in heavy rain existed at the time of the accident. The pilot had no instrument flight experience.

Aug. 17, 1988	Mount Torbet	Cessna 402B	substantial	2 fatal

The airplane was on a VFR cargo flight when it struck the mountain at the 10,570-foot level. The report said that the pilot-in-command was found in the right cockpit seat with a non-aviation book in his lap; a company mechanic was in the left cockpit seat with an aeronautical chart open in his lap. The mechanic held a commercial pilot license but no instrument rating. IMC prevailed at the accident site.

Aug. 18, 1988	Sitka	De Havilland DHC-2	destroyed	1 fatal

The pilot flew the airplane into a valley with the intent of flying through a mountain pass with an elevation of 2,745 feet. When the pilot observed clouds in the pass, he began a 180-degree right turn. The airplane stalled and struck a slope.

Sept. 5, 1988	Sitka	Britten-Norman BN-2A	destroyed	1 fatal, 5 serious, 2 minor, 2 none

The pilot encountered low ceilings, rain and fog while attempting to fly through a narrow mountain pass. He reversed course and then flew into a small canyon that terminated in a small glacier-covered bowl surrounded by steep walls. The report said that while conducting a turn to reverse course, the pilot realized that he did not have sufficient area in which to complete the turn and crash-landed the airplane on the glacier.

Sept. 30, 1988	Homer	Cessna 206	substantial	1 serious, 1 minor

The engine failed after takeoff because the fuel was contaminated by water, and the airplane struck terrain. The company's chief pilot said that the accident pilot did not check the fuel prior to the flight.

Dec. 14, 1988	Kasaan	De Havilland DHC-2	destroyed	1 fatal, 2 serious

The pilot landed long in a bowl-shaped cove and attempted to go around. He began a steep turn at low altitude to avoid striking buildings and rising terrain. The airplane entered a steep descent and struck a wooden walkway near a seaplane dock.

Jan. 15, 1989	Ketchikan	De Havilland DHC-3	destroyed	2 fatal

The crew departed on a company VFR flight plan and flew at a low altitude over the water. The crew then encountered a snow squall and attempted a steep turn to reverse course. The airplane struck the water and sank. Search-and-rescue efforts were suspended after four days.

Feb. 9, 1989	Fairbanks	Cessna U206G	destroyed	1 fatal

The engine failed during a cargo flight, and the airplane struck trees. The report said that a rear torsion-vibration damper had separated from the crankshaft boss, resulting in massive internal engine damage.

April 19, 1989	Pelican	De Havilland DHC-2	destroyed	2 fatal

The aircraft struck a rock wall at an elevation of 1,950 feet, about 12 miles (19 kilometers) east of Pelican. Another pilot who planned to fly the same route— Juneau to Pelican — diverted because of poor weather conditions in the area.

May 23, 1989	Green Island	Cessna 180	substantial	1 serious, 2 minor

The airplane flipped over during a water landing. The pilot said that the airplane might have encountered a boat's wake that he had not observed. A witness said that the airplane appeared to enter a slight left turn during the flare and the left float contacted the water.

June 15, 1989	Puntilla Lake	Aerospatiale AS 350B	destroyed	1 fatal

While returning to base, the helicopter struck a 3,900-foot ridge at the 3,500-foot level. An overcast at 3,000–3,500 feet, and light to occasionally heavy rain were reported in the area. The pilot had an instrument rating for airplanes but not for helicopters.

July 13, 1989	Kodiak	De Havilland DHC-2	substantial	2 serious, 4 minor

The airplane was on a VFR flight when it struck terrain at the 1,800-foot level of a mountain pass. At the time, the pass was reported closed because of IMC.

July 30, 1989	Haines	Piper PA-32-301	destroyed	2 fatal, 3 serious

While on a VFR flight, the pilot encountered obscuring weather conditions and reversed course. He then encountered a low ceiling, rain and fog, and descended to fly under the ceiling. He lost visual flight references about 150 feet above an inlet and began to climb in IMC. The airplane struck a steep, wooded hillside.

Aug. 7, 1989	Nome	Cessna 402	destroyed	1 fatal

During arrival, the pilot was advised by Nome FSS that the weather at Nome was below VFR minimums. The pilot requested a special VFR clearance and was advised to remain in VFR conditions and to stand by. When the FSS specialist later tried to issue the clearance, there was no reply from the pilot. A search was initiated, and the wreckage was found four days later 18 miles (29 kilometers) west of Nome. The airplane had struck rising terrain at 450 feet in level flight. At the time, Nome had a 400-foot overcast and two miles visibility with rain and fog.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 11, 1989	Tanana	Cessna 207A	substantial	1 serious, 1 minor

The airplane was being flown on a company VFR flight plan when it struck a mountain at the 2,936-foot level. The ceiling was 500 feet obscured, and visibility was two miles with fog.

Oct. 5, 1989	Hoonah	Piper PA-32-300	substantial	1 serious, 5 minor

The pilot said that during landing, the airplane bounced and then touched down. He reduced power, and a gust raised the right wing. The pilot tried to lower the right wing but was unable to maintain control. The airplane veered off the runway and struck an embankment.

Dec. 22, 1989	Beluga	Piper PA-31	destroyed	1 fatal

The airplane was on an IFR flight from Kenai to Beluga, which had an uncontrolled airport with no navaids. The report said that pilots typically filed IFR flight plans for the route, flew for 34.5 miles (63.9 kilometers), then determined whether a visual approach could be conducted at Beluga. The accident pilot was cleared by ATC to fly direct to Beluga at 2,000 feet. ATC radar showed that the airplane descended to 600 feet about five miles south of Beluga, flew over the airport and struck trees about eight miles northwest.

Feb. 17, 1990	Cold Bay	Piper PA-31-350	destroyed	1 fatal

The flight's scheduled departure from King Cove was delayed because of weather. A witness said that weather conditions were good when the flight departed. The airplane struck terrain near the top of a ridge at the 1,250-foot level about eight miles west of Cold Bay. Cold Bay weather reports indicated that there were snow showers in the area.

March 16, 1990	Almautlak	Piper PA-32-301	destroyed	1 fatal

The airplane struck terrain soon after the pilot received an IFR clearance from ATC to fly to the final approach fix for the ILS/DME approach at Bethel.

May 4, 1990	Glennallen	Piper PA-18	substantial	1 serious, 1 minor

The pilot was maneuvering the airplane at low altitude when the left wing struck the ground.

June 9, 1990	Bethel	Piper PA-32	substantial	1 fatal

The pilot declared an emergency after takeoff. Witnesses observed the airplane in a right, descending turn toward the airport. The airplane struck terrain 0.3 mile (0.4 kilometer) from the runway. The report said that the fuel selector was positioned either to "OFF" or to the left tip tank.

June 25, 1990	Aialak Bay	Cessna 207A	destroyed	5 fatal

The pilot was conducting a sightseeing flight. The report said that the pass normally taken during the flight was obscured by clouds, with bases at 1,200 feet. The wreckage of the airplane was found at the 2,700-foot level of a mountain.

July 14, 1990	Farewell	Bell 206L-1	substantial	5 serious

The pilot was conducting an approach to a remote mountaintop landing site when, at about 100 feet AGL and at 40 miles per hour (mph), the engine failed, causing a hard landing. The report said that the first-stage turbine wheel had failed because of thermal fatigue and that the first-stage turbine wheel and the second-stage turbine wheel had signs of overtemperature operation.

Aug. 5, 1990	Tetlin	Cessna 207	substantial	2 serious, 3 minor

The pilot said that the airplane bounced slightly upon touchdown. After the second touchdown, the airplane veered off the left side of the runway and flipped over.

Aug. 12, 1990	Wrangell	Cessna A185F	destroyed	1 fatal, 1 serious

Prior to the coastline-mapping flight, the pilot and passenger agreed that the flight would be conducted at 400 feet AGL and at 75 mph. During the flight, the passenger asked the pilot to turn around. The passenger said that when the pilot began to turn left, he felt light turbulence and the airplane began to descend. The pilot applied full power, but the airplane continued in a descending left turn until it struck water near the shoreline.

Sept. 3, 1990	Kaltag	Piper PA-31-325	destroyed	3 fatal, 6 serious, 1 minor

The airplane was being flown about 500 feet over a river and beneath a low overcast when the right engine began to lose power. The airplane descended, and the fuselage and left propeller struck the water. The pilot then attempted to turn around. During the turn, the right engine failed and the airplane struck trees beside the river. The report said, "No reason was found for either engine to lose power before water or tree contact."

Oct. 4, 1990	Kennsington	Hughes 500D	substantial	1 serious, 2 none

The pilot was unable to find level terrain on which to land the helicopter and pick up his passengers. The report said that he "nosed the helicopter into the side of the mountain and maintained the aft portion of the skids at a hover." The passengers boarded the helicopter and fastened their restraints. When the pilot increased power to take off, the helicopter began settling aft. The pilot continued to increase power, and the helicopter rolled over onto its left side.

Dec. 21, 1990	False Pass	Cessna 208	destroyed	1 fatal

The airplane struck terrain during a 15-minute flight from Cold Bay to False Pass. Cold Bay had a 4,500-foot overcast, light rain and fog, and was forecast to have frequent ceilings below 1,000 feet. False Pass had no weather-reporting facilities. The wreckage of the airplane was found between two mountains. Estimated weather conditions at False Pass were 400 feet overcast, 2–3 miles visibility with rain and fog, and winds from 25 knots to 30 knots. The captain of a nearby fishing boat estimated that the velocity of winds down the mountain was 60 mph or more.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 18, 1991	Two Moon Bay	De Havilland DHC-2	substantial	2 serious, 2 minor
The pilot said that when he began a right turn, the airplane stalled and struck the side of a mountain.				
Jan. 28, 1991	Nome	De Havilland DHC-3	substantial	2 serious, 4 minor, 5 none
The engine lost power during climb, and the pilot conducted an emergency landing on an ice pack. The report said that six piston-link rods were broken where they were attached to the engine's master rod.				
March 3, 1991	Finger Lake	De Havilland DHC-2	none	1 serious, 5 minor
After landing on a snow-covered lake, the pilot lost directional control. The airplane veered off the left side of the landing area, struck two parked aircraft and injured a bystander.				
March 29, 1991	Homer	Cessna 206	destroyed	4 fatal
After taking off from a location about 15 miles northeast of Homer, the pilot was told by a Homer tower controller that VFR conditions prevailed at the airport but that there were snow showers and restricted visibilities north and east of the airport. The pilot decided to make a straight-in approach to Runway 21 and discussed his position with the pilot of another aircraft on approach to Runway 3. Soon thereafter, an ELT (emergency locator transmitter) signal was detected. The wreckage of the airplane was found in a tidal basin.				
Aug. 10, 1991	Angoon	Cessna 185F	destroyed	1 serious
The pilot said that he was conducting a steep descending turn from base leg to final approach at low altitude when the flaps retracted and the engine seemed to sputter. The airplane landed hard in shallow water, struck rocks and flipped over.				
Aug. 14, 1991	Gustavus	Piper PA-32	destroyed	6 fatal
After departing from Gustavus, the pilot filed a VFR flight plan. There were no further radio transmissions from the pilot. Fog, clouds and darkness hampered the search. The wreckage was found the next day at the 4,000-foot level of steep rising terrain in a box canyon. Other pilots reported that, at the time of the accident, the ceiling was broken to overcast at about 4,000 feet and the mountaintops were obscured.				
Aug. 20, 1991	Ketchikan	Pilatus Britten-Norman BN-2A-26	destroyed	4 fatal
The airplane was 30 miles (48 kilometers) from Ketchikan when the pilot told the company dispatcher that he was returning to Wrangell because of the weather. The report said that Ketchikan had low ceilings, multiple cloud layers and reduced visibilities with light rain. The airplane was in near-level flight when it struck trees and rising terrain at 800 feet.				
Sept. 23, 1991	Koliganek	Cessna A185F	substantial	1 serious, 2 none
The pilot said that after the airplane lifted off from a lake, a changing wind condition caused it to settle back onto the water. With insufficient room to stop on the lake, the pilot jerked the airplane back into the air, trying to clear the shoreline. The airplane settled to the ground and flipped over.				
Dec. 13, 1991	Ninilchik	Piper PA-31T3	destroyed	1 fatal
The airplane was being flown at 10,000 feet in IMC. ATC radar showed that the airplane entered a right turn and began to descend rapidly. The pilot did not respond to radio calls from ATC. The report said that all major components of the airplane were present at the accident site, but impact damage precluded a check of flight-control continuity, and the accident site was inaccessible to equipment required to recover the engines.				
July 13, 1992	Bethel	Shorts SC-7	destroyed	1 fatal
On takeoff, the airplane rolled 200–300 feet (61–92 meters) before becoming airborne in a nose-high attitude. The airplane banked right, then left and descended to the ground in a nose-high attitude. The report said that the airplane was 325 pounds (147 kilograms) over maximum gross weight. The cargo was eight 55-gallon (208-liter) drums of fuel, which had been placed on their sides and secured with one cargo strap fore and aft, and with one cargo strap diagonally. The strength rating of each tie-down ring was 1,600 pounds (726 kilograms); the cargo weighed 2,863 pounds (1,299 kilograms). Three cargo hooks were found attached to tie-down rings; one hook and one ring were not found. Post-impact fire destroyed the straps, and the barrels were strewn about the cabin.				
Aug. 6, 1992	Funter Pass	Cessna 207	substantial	2 serious
The pilot said that while flying through the pass in VFR conditions, "a cloud of undetermined size suddenly and inexplicably appeared in front of me." He turned to exit the cloud, and the airplane struck the mountain.				
Sept. 11, 1992	Eagle	McDonnell Douglas 369D	destroyed	3 fatal
Soon after takeoff, the pilot radioed that he was returning to the airport because of inadequate VFR conditions. The helicopter last was observed circling the runway. The wreckage was found seven hours later, 450 feet (137 meters) from the runway. The report said that one main-rotor blade had separated; metallurgical examination revealed fatigue progression in the fractured blade-root fittings. Maintenance personnel said that they were not aware of an airworthiness directive (91-17-04) that required removal and inspection of the main-rotor blades at 100-hour intervals.				
Nov. 6, 1992	Montague Island	Cessna 207	destroyed	2 fatal
The accident airplane and another company airplane were landed on a beach to pick up hunters for a return flight to Seward. Occupants of the other airplane said that the accident airplane took off five minutes before them and "disappeared into the weather and was never seen again." The weather was described as ceilings at 400–600 feet and visibility of one mile in fog. The wreckage was found six miles (11 kilometers) from the takeoff point at an elevation of 1,000 feet in mountainous terrain.				

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Nov. 8, 1992	Kiana	Cessna 402C	destroyed	3 fatal
The airplane was on a VFR flight when it struck a mountain. Rescue personnel said that the mountaintops in the area were obscured by snow, fog and clouds. The terrain was covered with snow.				
Nov. 11, 1992	Ekwok	Cessna 207	substantial	2 serious, 2 minor, 1 none
The pilot aborted her first VFR approach and lost control of the airplane during the second approach. The pilot said that the engine produced only partial power when she attempted to reject the second approach. A passenger said that during the second approach, he tapped the pilot on the shoulder, told her that the runway was on the right side of the airplane and pointed to the runway; the pilot then conducted a very steep right turn, and the airplane stalled and descended to the ground. The pilot said that VFR conditions existed; her passengers said that the windshield and wings were accumulating ice, and ground witnesses said that visibility was less than one mile.				
Feb. 20, 1993	Bradley Lake	Cessna 206	destroyed	4 serious, 1 none
The pilot decided not to polish smooth or to remove frost from the airfoil surfaces during preflight because he believed that the frost was not heavy enough or coarse enough to affect the takeoff. Halfway down the 2,000-foot (610-meter) runway, he rotated for takeoff, but the airplane did not lift off. During the second takeoff attempt, the airplane lifted off but settled back onto the runway. The pilot reduced engine power to reject the takeoff but then decided to continue the takeoff because he believed that he could not stop the airplane on the 500 feet (153 meters) of runway remaining. The airplane overran the runway at 85 knots and struck a perimeter fence and rock-covered terrain.				
April 3, 1993	Nome	Cessna 207	destroyed	2 fatal
Before takeoff, the pilot received PIREPs of fog and low visibility on the route of flight. During taxi, the pilot was told that VFR flight was not recommended to the east. The airplane was in a steep left-wing-down attitude when it struck snow-covered terrain about four miles (six kilometers) east of the runway.				
May 17, 1993	Malina Bay	Fairchild FH-1100	substantial	2 serious, 2 minor
The helicopter was substantially damaged during an emergency landing after the engine lost power during climb. The engine drive-shaft coupling had failed. Investigators found no documentation indicating that the drive shaft had been maintained in accordance with applicable service letters and service bulletins.				
June 29, 1993	Gambell	Piper PA-31-350	none	1 serious, 7 none
After deplaning, a passenger walked into the rotating propeller of another airplane. The report said that during medical treatment, the passenger said that she had attempted to commit suicide.				
July 20, 1993	Denali National Park	Cessna A185F	destroyed	4 serious, 1 minor
The pilot landed the airplane at the 6,500-foot level of Ruth Glacier for a 20-minute tourist stop. The company's senior pilot, who also had landed an airplane on the glacier, observed that a fuel-tank cap on the accident airplane was not in place. The pilots found that one fuel tank was empty. The report said that the pilots decided that the accident pilot should take off, check the fuel-quantity indications in level flight and return to the glacier if he had any doubt about the fuel supply. The engine lost power about three minutes after takeoff, and the airplane struck terrain. The right tank was empty; 2–5 gallons (8–19 liters) of fuel were found in the left tank.				
Sept. 11, 1993	Cooper Landing	Cessna 180	substantial	3 serious, 1 minor
When the pilot repositioned the throttle lever to reduce power during departure, power decreased below the desired level. The pilot advanced the throttle lever, but the engine did not respond. He returned to the airstrip and attempted to land but was unable to reduce power; the airplane overshot the runway. The pilot was turning to reverse course when power decreased and the airplane descended into trees. The report said that the throttle arm had not been safetied to the carburetor stop, as required by an airworthiness directive, and had separated from the carburetor.				
Oct. 16, 1993	Kenai	Cessna 207	destroyed	1 fatal
The pilot was following power lines from Kenai to Homer on a dark, moonless night when the airplane struck rising terrain about 600 feet (183 meters) from the power lines.				
June 22, 1994	Juneau	De Havilland DHC-3	substantial	7 fatal, 4 serious
Five float-equipped airplanes departed in sequence from a lodge. The pilot of the lead airplane radioed to the other pilots to cross the river. The pilot of the accident airplane said that he encountered deteriorating weather and began a descent, intending to conduct a precautionary landing. He then began to level the airplane, expecting conditions to improve, and the airplane struck the water.				
July 8, 1994	Kenai	Cessna T207	substantial	1 serious
The airplane overran the runway after the engine crankshaft failed on takeoff. The engine had accumulated 86 hours since overhaul.				
July 11, 1994	Portage Creek	Piper PA-32-301	substantial	3 fatal, 2 serious
The airplane lifted off 260 feet (79 meters) from the end of a 1,920-foot (587-meter) runway that had a wet, soft surface. The airplane then entered a descending left turn and struck terrain. The report said that the airplane was 411 pounds (63 kilograms) over its maximum gross weight and that the CG was 2.8 inches (7.1 centimeters) aft of the aft CG limit.				

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 18, 1994	McCarthy	Piper PA-31-310	substantial	5 serious, 3 minor
The pilot said that engine indications were normal but the airplane was slow to accelerate for takeoff. He said that he did not consider rejecting the takeoff. The airplane struck terrain soon after liftoff. The report said that the parking brake had not been released before takeoff.				
July 29, 1994	Kenai	Bell 206	substantial	2 serious, 3 none
The pilot attempted to land the helicopter at gross weight or near gross weight on a mountaintop at 11,070 feet. The helicopter entered an uncontrolled descent and struck terrain. The report said that the helicopter's maximum operating altitude was 9,000 feet.				
Aug. 7, 1994	Kodiak	De Havilland DHC-2	destroyed	6 fatal, 1 serious
The airplane was on a VFR sightseeing flight when it entered IMC and struck terrain. Witnesses said that the ceiling was at about 50 feet and visibility was about 0.3 mile.				
Aug. 11, 1994	Port Alsworth	De Havilland DHC-2	destroyed	3 fatal
The pilot was turning left to reverse course in a valley when the airplane struck terrain. Witnesses said that visibility was unlimited and the sky was clear.				
Aug. 14, 1994	Kenai	Piper PA-32-260	destroyed	3 fatal, 1 serious
The airplane was in cruise flight when the no. 3 cylinder and the no. 3 piston separated, and a fire began in the engine compartment. The report said that the airplane was crash-landed on terrain near a body of water. Inspection of the engine revealed fatigue cracks in the case under the no. 3 cylinder.				
Nov. 20, 1994	Juneau	Bell 206	none	1 fatal
After landing, the pilot locked the controls, exited the helicopter and began refueling it while the engine and rotors were turning at flight idle. A company employee, after speaking with the pilot, attempted to walk under the tail boom and was struck by the tail rotor. The report said that the victim had worked around helicopters and had received company training about the hazards of rotor blades.				
Dec. 3, 1994	Kenai	Cessna 206	substantial	1 fatal
VMC prevailed at Kenai and at the destination, but lower conditions existed en route when the pilot departed from Kenai on a cargo flight. ATC radar tracked a primary target that disappeared a few miles from the shoreline of an inlet. No wreckage was recovered.				
Dec. 10, 1994	Elim	Cessna 402C	destroyed	5 fatal
The airplane was on a night flight when it struck a mountain at the 2,725-foot level. Rescue personnel said that the accident site had an indefinite ceiling and poor visibility with heavy, blowing snow. The accident site was on a direct course from the departure point, Nome, to the destination, Koyuk. The report said that the pilot had borrowed a hand-held GPS (global positioning system) receiver from another company pilot.				
Dec. 12, 1994	Takotna	Cessna 185	destroyed	1 serious, 1 minor, 1 none
The pilot conducted a takeoff in flat light conditions from a 1,717-foot (524-meter) runway that was covered with 4–5 inches (10–13 centimeters) of snow and surrounded by snow banks. The airplane lifted off halfway down the runway, settled, struck a two-foot (0.6-meter) snow bank at the end of the runway, descended toward lower terrain and struck trees.				
Feb. 25, 1995	Kotzebue	Cessna 207A	destroyed	1 fatal
The airplane entered a box canyon after the pilot radioed to another company pilot that he was "looking for wolves." The airplane wreckage later was located on the side of the canyon about 100 feet (31 meters) below the top. The report said that the pilot had no prior experience in mountain flying.				
March 10, 1995	Ketchikan	Cessna 207A	destroyed	3 serious
The pilot obtained a weather briefing prior to departure that included AIRMETs (airman's meteorological information) about mountain obscuration, IFR conditions and icing conditions. A company pilot who had departed before the accident pilot departed returned because of low ceilings. The accident pilot, who had filed a VFR flight plan, attempted to maneuver around mountainous terrain after encountering low ceilings. The airplane struck trees.				
June 30, 1995	Kodiak	Piper PA-32-301	destroyed	4 fatal
The pilot attempted to fly VFR through a mountain pass in rapidly changing weather conditions. He was maneuvering to reverse course when the airplane struck terrain near the bottom of the pass. Witnesses said that the cloud bases were lower than the accident site.				
July 7, 1995	Haines	Piper PA-32R-300	destroyed	6 fatal
During a sightseeing flight, the pilot circled at about 700 feet AGL to observe a moose. He then descended and circled to observe a bear and the bear's cubs. Another pilot observed the airplane climbing in a nose-high attitude toward steep terrain. The airplane struck trees at about 500 feet AGL.				
Aug. 26, 1995	Deadhorse	Piper PA-18-150	substantial	2 fatal
Two trips were required to fly two hunters from a small landing area to a larger landing area. The pilot completed one trip and returned to the small landing area to pick up the other hunter. The airplane did not arrive at the larger landing area. The wreckage was located at the 5,000-foot level of a steep slope in a box canyon.				

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Dec. 10, 1995	Nanwalek	Piper PA-32-300	substantial	1 serious, 3 minor, 2 none

The pilot observed that the wind favored a landing on Runway 19. During the approach, the wind shifted; the pilot conducted a go-around and circled to land on Runway 01. He said that while crossing trees and a bluff on left base for Runway 01, “the airplane fell out of the sky.” He applied full power and raised the nose to a level attitude. The airplane, struck the end of the runway and slid 100 feet (31 meters) before stopping.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 17, 1996	Kotzebue	Cessna 207	destroyed	1 serious

The pilot departed from Kotzebue with a special VFR clearance. Visibility was 2–3 miles in snow, fog and flat light conditions. Witnesses said that the airplane climbed about 500 feet, banked right about 90 degrees and descended to the ground in a wing-low and nose-low attitude. No signs of any mechanical malfunction were found.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 17, 1996	Whittier	Cessna 206G	destroyed	2 serious

On the day of the accident, the pilot made several VFR flights through a glacier-covered mountain pass. As he approached the pass on the last flight, the visibility decreased in light rain and haze. The pilot was turning away from the pass when the airplane entered whiteout conditions. The pilot extended flaps and began a 40-degree-banked turn to reverse course. About two seconds later, the airplane struck terrain on the side of the pass.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 24, 1996	Point Hope	Piper PA-31-350	substantial	2 serious, 2 minor, 2 none

A station agent loaded the nose baggage compartment and closed the compartment door. The pilot visually checked the compartment door while standing on the wing next to the cockpit door. During takeoff, the compartment door opened, and baggage and boxes exited the compartment and struck the left propeller. The pilot conducted an emergency landing on sea ice.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 19, 1996	Elfin Cove	De Havilland DHC-2	destroyed	1 fatal

The airplane was being flown through a mountain pass when it struck steeply rising terrain at the 1,250-foot level. A helicopter crew that flew near the accident site two hours later said that the area was obscured by low clouds.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 26, 1996	Dillingham	Grumman G-21A	none	1 serious, 2 none

The pilot was conducting a 180-degree taxi turn on a gravel beach when the airplane’s tail struck a person. The pilot said that he saw several people on the beach, but not the person who was struck.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 3, 1996	Tuntutuliak	Piper PA-32-300	none	1 serious, 2 none

The pilot was conducting a left turn while taxiing the airplane on the ramp when the right wing struck a cargo handler. The pilot said that he was looking to the left during the turn and did not see the cargo handler until after the impact.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 11, 1996	Dutch Harbor	Grumman G-21G	destroyed	2 fatal

The report said that the airplane was presumed to have been involved in a fatal accident during a VFR flight from Anderson Bay to Dutch Harbor. The search for the airplane was hampered by low clouds and fog, and was suspended four days after the flight was reported overdue.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 30, 1996	Port Alsworth	Cessna 180	substantial	1 serious, 1 minor, 1 none

After landing the airplane to pick up passengers at a field site, the pilot drained fuel from the left tank to store for future use. The operator said that storing fuel at field sites was normal practice and that company pilots routinely positioned the fuel-selector valve to the right fuel tank. The airplane was about five minutes from the destination when the engine lost power because of fuel starvation. The airplane flipped over during the forced landing. Investigators found 7.3 gallons (27.6 liters) of usable fuel in the right tank and 3.1 gallons (11.7 liters) of usable fuel in the left tank.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 1, 1996	Haines	Piper PA-32	substantial	4 serious, 2 minor

The passengers said that the pilot was flying the airplane 100–500 feet above a glacier and that the sky was overcast. The pilot observed a fog bank ahead and attempted to reverse course. During the turn, the airplane descended and struck the glacier.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 13, 1996	Cantwell	Bell 206B	destroyed	1 serious, 1 minor, 1 none

Weather conditions along the intended route of flight through a mountain pass included low ceilings, snow and fog. The area forecast included an AIRMET for marginal VFR conditions and temporary IFR conditions. The pilot made several telephone calls to an FSS and to his company office to obtain weather information. He decided to fly through a different mountain pass. During the flight, the pilot encountered whiteout conditions and began a turn to reverse course. The pilot became disoriented, and the helicopter struck snow-covered terrain at an elevation of about 5,300 feet.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 23, 1996	Anchorage	Cessna 206G	destroyed	3 fatal, 2 serious

Witnesses said that soon after the float-equipped airplane lifted off from a seaplane base, the flaps were retracted and the airplane pitched to a climb attitude. The airplane then stopped climbing, began to settle, struck a utility pole and descended onto a road. Investigators found that the brass throttle arm was worn and had disconnected from the throttle linkage.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Oct. 13, 1996	Ketchikan	De Havilland DHC-2	destroyed	3 fatal

The area forecast included an AIRMET for marginal VFR conditions and mountain obscuration by clouds and precipitation. The airplane struck a steep ridge at an elevation of 2,850 feet during a VFR flight to a remote destination.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Nov. 26, 1996	Bethel	Cessna 208B	destroyed	1 fatal

Soon after taking off for a cargo flight, the pilot received a radio transmission from the company dispatcher. The pilot told the dispatcher to "stand by." ATC personnel observed the airplane in a left turn toward the airport at about 200 feet AGL. The bank angle increased and the nose dropped suddenly. The airplane struck the ground in a nose-low and left-wing-low attitude. The report said that the engine was developing power and that one of the three composite propeller blades had rotated 0.53 inch (1.35 centimeters) in its blade clamp.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Nov. 30, 1996	Marshall	Cessna 185	destroyed	2 fatal

The pilot was conducting a moose-survey flight when the airplane struck terrain in a steep nose-down attitude.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Dec. 12, 1996	Ketchikan	De Havilland DHC-2	destroyed	1 fatal, 1 minor

The passenger said that during initial climb over open water, the pilot said "here comes a gust" and increased power. The airplane descended and struck the water.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 17, 1997	Tununak	Cessna 207A	substantial	1 serious

The pilot was following a coastline during a cargo flight to a remote village. As he approached the destination, weather conditions began to deteriorate with lowering clouds, drizzle and fog. The report said that the pilot was considering which direction to turn to avoid the clouds when the airplane entered the clouds and struck rising terrain.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 29, 1997	Sparrevohn	De Havilland DHC-4A	destroyed	1 fatal, 1 serious

The airplane was being flown at night on an IFR cargo flight at 12,000 feet over remote, mountainous terrain. The report said that about two hours after takeoff, the no. 2 (right) engine and propeller began to overspeed. The captain feathered the propeller and shut down the no. 2 engine, declared an emergency and flew toward an alternate airport 120 miles (222 kilometers) away. He could not maintain altitude (the airplane's single-engine service ceiling was about 8,700 feet) and increased power from the no. 1 (left) engine, which "produced banging [noises] and coughing noises." The captain decided to conduct an emergency landing at a nearby military airfield, which was in mountainous terrain and had a one-way, daylight-only approach. The airplane encountered severe turbulence on final approach, and the captain attempted to climb out. The airplane struck snow-covered terrain two miles from the field. Investigators found no hydraulic fluid in the control system for the propeller on the no. 2 engine.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 10, 1997	Wainwright	Cessna 208B	destroyed	5 fatal

The pilot called an FSS 11 times on the day of the accident to obtain weather briefings. Conditions were below VFR minimums but later improved, and the pilot departed from Barrow with a special VFR clearance. The report said that he conducted "two approaches that were consistent with the two GPS approaches that were available" at the destination, where IMC prevailed. The pilot then radioed that he could not see the airport and was returning to Barrow. Soon thereafter, the airplane struck sea ice in a right bank and at a 60 degree nose-down attitude. The report said that the airplane was over its maximum gross weight and that small pieces of clear ice, about 0.25 inch (6.4 millimeters) thick, were found on the tail surfaces.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
June 27, 1997	Nome	Cessna 207A	destroyed	2 fatal

The pilot requested a special VFR clearance to enter a Class D surface area and then flew the airplane outside the area for 26 minutes while awaiting the clearance. During this time, reported weather conditions at the airport included a 300-foot overcast and one mile visibility. Four minutes after the pilot received clearance to enter the Class D surface area for a landing, the airplane struck a 260-foot (79-meter) radio antenna tower that was painted orange and white, and equipped with obstruction lights. One minute after the accident, airport weather conditions were reported as 200 feet overcast and 0.6 mile (one kilometer) visibility.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 3, 1997	Skagway	Piper PA-32	destroyed	4 fatal, 1 minor, 1 none

Returning from a sightseeing flight, the airplane was about 1,200 feet above water and 1.5 miles from the airport when the left-magneto impulse coupling failed and the engine lost power. The pilot ditched the airplane 100 feet (31 meters) from cliffs. None of the passengers exited the airplane with a life vest. Water temperature was 39 degrees Fahrenheit (4 degrees Celsius). The pilot threw out one life vest before exiting the airplane. One passenger, with the help of her husband, donned and inflated the vest. The passenger with the life vest and the pilot were picked up by the crew of a rescue helicopter 10 minutes after the airplane was ditched. Two passengers drowned; two passengers were not found. The surviving passenger did not recall receiving a briefing about the location or use of life vests.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 5, 1997	Skwetna	De Havilland DHC-2	substantial	4 fatal, 1 serious

About 45 minutes after departure, while the airplane was cruising about 1,700 feet above rugged terrain and a river, the engine began to lose power. During approach for an emergency landing on a small lake, the airplane stalled and struck terrain in a steep nose-down attitude. Investigation revealed that an engine exhaust-valve pushrod had failed.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 20, 1997	Dillingham	Bell 206B	destroyed	1 fatal, 1 serious, 2 minor

The helicopter departed from a mountaintop landing site in near zero visibility with clouds, rain and strong winds. The report said that the pilot attempted to hover down the mountain until clear of the clouds. A rear-seat passenger held the pilot's door open as the pilot leaned out, with his shoulder harness unfastened, to observe the terrain. The front-seat passenger unfastened his shoulder harness so that he could wipe condensation off the inside of the windshield. The helicopter was airborne about five minutes before striking a ridge. The pilot was killed; the front-seat passenger received serious injuries. None of the survivors observed the terrain prior to impact. The report said that the mountaintop landing site was equipped with a survival shelter, heater and sleeping bags.

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 24, 1997	Bethel	Piper PA-32-300	substantial	1 serious, 1 none
The engine began to lose power soon after takeoff. The pilot conducted an emergency landing one mile from the airport. An FAA inspector found the fuel selector positioned to the left wing-tip fuel tank, which contained no fuel.				
Sept. 1, 1997	McGrath	Cessna U206E	substantial	1 serious, 1 minor, 1 none
The airplane was landed hard and bounced. During the subsequent touchdown, the nose wheel separated and the airplane flipped over. The rear-seat passenger received serious neck injuries when he was struck by unsecured cargo.				
Sept. 26, 1997	Twin Hills	Cessna 207A	destroyed	1 fatal
After the pilot radioed that he was 13 minutes from the destination, the airplane struck an 890-foot ridge at about the 700-foot level. Other pilots reported that the pass was not obscured by clouds. Toxicological tests detected several over-the-counter medications for cold symptoms and asthma symptoms. The report said that among the possible side effects of the medications were distraction and sensory disturbance.				
Oct. 23, 1997	Juneau	Piper PA-32-300	destroyed	2 fatal
The airplane struck rising terrain at 2,600 feet while being flown through a mountain pass. The report said that the flight had been delayed several hours because of low ceilings and that the pilot was in a hurry to return because of plans for the evening. Other pilots who flew in the area around the time the accident occurred said that they did not believe the pass was open. The ceiling was broken with overcast layers above 1,000 feet.				
Nov. 8, 1997	Barrow	Cessna 208B	destroyed	8 fatal
Witnesses said that there was heavy frost on aircraft at the airport. The pilot was not observed deicing the airplane, and he was described as being in a hurry to depart on time. The pilot told a lineman to refuel the left-wing tank only, which resulted in the left-wing tank containing 450–991 pounds (204–450 kilograms) more fuel than the right-wing tank. After takeoff, the pilot conducted a left turn. The airplane was observed climbing past the end of the runway and descending vertically into water. The aileron-trim indicator was found in the full right-wing-down position.				
Feb. 6, 1998	Homer	Cessna 207	destroyed	1 fatal
After takeoff, the airplane climbed about 200 feet and, instead of turning right on course, turned left toward the runway. The angle of bank increased to about 45 degrees; the airplane entered a nose-down attitude and struck snow-covered terrain about 600 feet (183 meters) from the runway. The report said that an engine cylinder head was fractured.				
May 14, 1998	Nome	Cessna 208	substantial	1 serious, 6 minor, 3 none
The terminal forecast for the destination airport was for visibility greater than six miles and scattered clouds at 2,500 feet. During the flight, the obscured ceiling began to lower and visibility decreased to 3–4 miles. The pilot said that he descended to 1,000 feet and began to follow a road. An updated weather advisory for the destination reported one mile visibility, light snow and mist, and a ceiling of 1,000 feet broken. The pilot requested a special VFR clearance. During a turn at about 850 feet, the airplane entered whiteout conditions and struck snow-covered terrain.				
May 30, 1998	Juneau	Aerospatiale AS 350-B2	substantial	2 fatal, 1 serious, 5 none
The helicopter collided with an airplane in uncontrolled airspace. The helicopter was landed without further incident; the airplane was destroyed, and the two occupants were killed, when it struck water. The helicopter pilot had made periodic position reports on the common traffic advisory frequency (CTAF) for the area; the airplane's radios were not tuned to the frequency.				
Aug. 5, 1998	Ketchikan	Cessna A185F	destroyed	1 fatal, 2 serious
The pilot said that before refueling the airplane, he placed the fuel-selector valve in the "LEFT" position to prevent fuel from cross-feeding between the wing tanks. He asked line personnel to fill the right tank. Before takeoff, the fuel gauges indicated that the right tank was full and that the left tank contained 5–10 gallons (19–38 liters) of fuel. After about 45 minutes of flight, the engine failed. The pilot conducted emergency procedures, including placing the fuel-selector valve in the "BOTH" position, but the engine did not restart. The airplane struck trees and marshy terrain.				
Sept. 9, 1998	Port Alsworth	De Havilland DHC-2	substantial	5 fatal
The pilot was following two company airplanes through a mountain pass. The occupants of the other airplanes said that there was 5–7 miles (8–11 kilometers) visibility, 700-foot ceilings, clouds on the mountainsides and misty rain. A flight through the pass requires several turns. The pilot had not flown previously through the pass in marginal VFR conditions. After the first two pilots exited the pass, they lost radio contact with the accident pilot. The wreckage of the airplane was found in an intersecting canyon two miles from the pass.				
Sept. 17, 1998	Kotzebue	Cessna 207	destroyed	1 fatal
The pilot was conducting a cargo flight to a remote coastal village. When the airplane did not arrive at the destination, a search was begun. The wreckage was found in a mountainous area. An AIRMET for mountain obscuration by clouds and precipitation was in effect for the planned route of flight. A pilot who flew a similar route said that there was very low visibility with rain, fog and varied layers of cloud cover.				
Dec. 17, 1998	Manokotak	Cessna 207A	substantial	1 serious, 1 minor
The pilot said that after departing on a VFR night flight, he encountered severe turbulence and entered a snow squall where visibility dropped below one mile. A strong surface wind blew the airplane off course. The pilot was correcting his course when the airplane struck a snow-covered hill. The passenger said that no ground features were visible until he observed snow-covered terrain about three feet (0.9 meter) below the airplane.				

Appendix

Accidents Involving Fatalities/Serious Injuries During U.S. Federal Aviation Regulations Part 135 Operations in Alaska, United States, 1983–1999 *(continued)*

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Feb. 11, 1999	St. Mary's	Beech 1900C	substantial	1 serious

The airplane struck terrain 3.2 nautical miles (5.9 kilometers) from the runway threshold during a localizer approach at 2345 local time. The pilot said that he was on final approach, descending to the minimum descent altitude (MDA), and then "woke up in the snow." Weather conditions included a 200-foot overcast, 1.5 miles visibility in snow and winds at 12 knots, gusting to 32 knots. The MDA for the approach was 560 feet (263 feet above touchdown zone elevation). The pilot had returned from the previous night's flight at 0725 and had three rest periods — of four hours, two hours and five hours 15 minutes — each of which was interrupted by contact with the company. The pilot conducted the flight without a first officer. The report said that company policy was to dispatch a first officer at the request of a captain but to reduce the captain's pay by an amount equal to one-half of the first officer's pay. The airplane was not equipped with an autopilot.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 14, 1999	Kotzebue	Cessna 207A	destroyed	1 fatal

During the first flight after an annual maintenance inspection, the airplane was flown to a village 37 miles (60 kilometers) away. When the airplane returned about 35 minutes later, IMC prevailed and special VFR procedures were in use. After the pilot declared an emergency on the CTAF, no further radio transmissions were heard. The wreckage was found on a frozen, snow-covered lagoon. The airplane had struck the terrain in a nose-down attitude. The report said that the engine-driven vacuum pump's internal support post, on which the internal block rotated, was fractured; the fracture resulted from fatigue and overstress. The airplane was equipped with a standby vacuum system. The report also said that a screwdriver with a shattered handle was found in the left wing, but no flight-control-cable impingement was observed.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
April 27, 1999	Juneau	Cessna 185	substantial	1 serious, 1 minor

The airplane was at about 300 feet AGL on short-final approach when the engine failed. The pilot landed the amphibious airplane with the wheels extended; the airplane flipped over in soft mud. The report said that the engine-driven fuel pump was inoperative.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
June 9, 1999	Juneau	Eurocopter AS 350BA	destroyed	7 fatal

The helicopter departed for an air tour over glaciers in mountainous terrain. About 10 minutes after the pilot transmitted a routine radio message, the wreckage of the helicopter was observed by another company pilot on a nearly level snow-covered glacier. Pilots in the area reported flat light conditions.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
June 11, 1999	Tanana	Piper PA-31-350	destroyed	1 fatal

After departing from a rural airport, the airplane was observed flying about 200 feet over a river. The pilot radioed that he was having a problem with the airplane and might have to ditch. He then said that the airplane was "clipping trees" and that he was attempting to return to the airport. The airplane struck trees on a gravel bar and then struck the river 1.5 miles from the airport. The report said that the propeller on the left engine appeared to have been feathered.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 3, 1999	Bettles	Piper PA-32R-300	destroyed	1 fatal

After receiving a weather briefing, the pilot departed on a scheduled VFR mail flight over mountainous terrain. When the pilot opened his flight plan, the FSS specialist told him that an AIRMET was in effect for mountain obscuration and icing. The airplane struck a 4,720-foot mountain at the 4,500-foot level.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Sept. 10, 1999	Juneau	Eurocopter AS 350B-2	destroyed	1 serious, 5 minor

While returning from a sightseeing flight over an ice field, the helicopter was flown into a localized snow shower. The pilot slowed the helicopter and attempted to use a mountain range for visual reference. He said that flat light conditions contributed to his inability to recognize landmarks on the ice surface. The helicopter struck the snow-covered ice field, slid about 150 feet (46 meters) and flipped over.

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Dec. 7, 1999	Bethel	Cessna 207	destroyed	6 fatal

When the airplane did not return from a flight to a remote coastal village, an aerial search was begun. The wreckage was found on flat, featureless, snow-covered terrain. Another pilot, who had departed about one minute after the accident pilot, said that he had changed course after observing a "wall of weather" in the area where the accident occurred.

Source: Colleen Mondor, from reports by the U.S. National Transportation Safety Board

Accident Rates Decrease Among U.S. Air Carriers in 2000

Preliminary data from the U.S. National Transportation Safety Board show that scheduled air carriers operating under U.S. Federal Aviation Regulations Part 121 were involved in 49 accidents in 2000, compared with 48 accidents in 1999.

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FSF Editorial Staff

Preliminary data compiled by the U.S. National Transportation Safety Board (NTSB) show that U.S. Federal Aviation Regulations Part 121 scheduled air carriers were involved in 49 accidents, including three fatal accidents, in 2000, compared with 48 accidents, including two fatal accidents, in 1999 (Table 1, page 64).

The 2000 accidents resulted in 92 fatalities, compared with 12 fatalities in 1999.

U.S. Federal Aviation Administration (FAA) data show that activity increased. FAA said that Part 121 air carriers conducted 11.2 million departures in 2000, compared with 10.7 million departures in 1999, and accumulated 17.2 million flight hours, compared with 16.6 million flight hours the previous year.

The accident rate for Part 121 scheduled air carriers was 0.285 per 100,000 flight hours (and 0.440 accidents per 100,000 departures) in 2000, compared with 0.290 accidents per 100,000 flight hours (and 0.449 accidents per 100,000 departures) in 1999. The fatal accident rate was 0.017 fatal accidents per 100,000 flight hours (and 0.027 fatal accidents per 100,000 departures) in 2000, compared with 0.012 fatal accidents per 100,000 flight hours (and 0.019 fatal accidents per 100,000 departures) in 1999.

The 2000 fatalities included the 88 people killed in an Alaska Airlines McDonnell Douglas MD-83, which struck the Pacific Ocean off Point Mugu, California, after a structural failure on Jan. 31; the three crewmembers killed in an Emery Worldwide Airlines Douglas DC-8 cargo plane, which struck terrain and an auto-salvage yard in Rancho Cordova, California, on Feb. 16; and a flight attendant killed during the emergency evacuation of an American Airlines Airbus A300 in Miami, Florida, on Nov. 20 (Table 2, page 64).

The 92 fatalities included 83 air carrier passengers (Table 3, page 65). Nine passengers received serious injuries in accidents in 2000. Table 4 (page 66) shows the number of passenger fatalities on all Part 121 U.S. airline flights from 1982 through 2000.

Part 121 nonscheduled air carriers were involved in five accidents in 2000, compared with four accidents in 1999; none of the accidents was a fatal accident (Table 5, page 67). The 2000 accident rate was 0.575 accidents per 100,000 flight hours (and 1.131 accidents per 100,000 departures), compared with 0.481 accidents per 100,000 flight hours (and 0.979 accidents per 100,000 departures) in 1999.♦

Table 1
Accidents Involving U.S. Air Carriers Operating Under U.S. Federal Aviation Regulations Part 121, Scheduled Service, 1982–2000[1]

	Accidents		Fatalities				Accidents per 100,000 Flight Hours		Accidents per 100,000 Departures	
Year	All	Fatal	Total	Aboard	Flight Hours[2]	Departures[2]	All	Fatal	All	Fatal
1982[3]	16	4	234	222	6,697,770	5,162,346	0.224	0.045	0.291	0.058
1983	22	4	15	14	6,914,969	5,235,262	0.318	0.058	0.420	0.076
1984	13	1	4	4	7,736,037	5,666,076	0.168	0.013	0.229	0.018
1985	17	4	197	196	8,265,332	6,068,893	0.206	0.048	0.280	0.066
1986[3]	21	2	5	4	9,495,158	6,928,103	0.211	0.011	0.289	0.014
1987[3]	32	4	231	229	10,115,407	7,293,025	0.306	0.030	0.425	0.041
1988[3]	29	3	285	274	10,521,052	7,347,575	0.266	0.019	0.381	0.027
1989	24	8	131	130	10,597,922	7,267,341	0.226	0.075	0.330	0.110
1990	22	6	39	12	11,524,726	7,795,761	0.191	0.052	0.282	0.077
1991	25	4	62	49	11,139,166	7,503,873	0.224	0.036	0.333	0.053
1992	16	4	33	31	11,732,026	7,515,373	0.136	0.034	0.213	0.053
1993	22	1	1	0	11,981,347	7,721,870	0.184	0.008	0.285	0.013
1994[3]	19	4	239	237	12,292,356	7,824,802	0.146	0.033	0.230	0.051
1995	34	2	166	160	12,776,679	8,105,570	0.266	0.016	0.419	0.025
1996	32	3	342	342	12,971,676	7,851,298	0.247	0.023	0.408	0.038
1997	44	3	3	2	15,061,662	9,920,569	0.292	0.020	0.444	0.030
1998	43	1	1	0	15,929,308	10,540,481	0.270	0.006	0.408	0.009
1999	48	2	12	11	16,550,145	10,684,222	0.290	0.012	0.449	0.019
2000[4]	49	3	92	92	17,170,000	11,145,000	0.285	0.017	0.440	0.027

[1]Beginning March 20, 1997, aircraft with 10 or more passenger seats have conducted scheduled passenger operations under U.S. Federal Aviation Regulations (FARs) Part 121. Before that date, commuter operations in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) were conducted under FARs Part 135.

[2]Flight hours and departures are compiled by the U.S. Federal Aviation Administration.

[3]An occurrence of suicide or sabotage is included among accidents and fatalities but is excluded from calculations of accident rates.

[4]Data for 2000 are preliminary.

Source: U.S. National Transportation Safety Board

Table 2
Fatal Accidents Involving U.S. Air Carriers Operating Under U.S. Federal Aviation Regulations Part 121, Scheduled Service,[1] 2000[2]

					Fatalities				
Date	Location	Operator	Service	Aircraft	Passengers	Crew	Other	Total	Number Aboard
Jan. 31, 2000	Point Mugu, California	Alaska Airlines	Passenger	MD-83	83	5	–	88	88
Structural failure resulting in aircraft striking ocean									
Feb. 16, 2000	Rancho Cordova, California	Emery Worldwide Airlines	Cargo	DC-8-71F	–	3	–	3	3
Struck terrain and auto salvage yard after takeoff									
Nov. 20, 2000	Miami, Florida	American Airlines	Passenger	A300B4	–	1	–	1	130
Flight attendant fatally injured during emergency evacuation									

[1]There were no accidents in 2000 involving Part 121 nonscheduled service.

[2]Beginning March 20, 1997, aircraft with 10 or more passenger seats have conducted scheduled passenger operations under U.S. Federal Aviation Regulations (FARs) Part 121. Before that date, commuter operations in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) were conducted under FARs Part 135.

Source: U.S. National Transportation Safety Board

Table 3
Fatalities and Serious Injuries Among Passengers on U.S. Air Carriers Operating Under U.S. Federal Aviation Regulations Part 121, Scheduled Service and Nonscheduled Service, 1982–2000[1]

Year	Passenger Fatalities	Passenger Serious Injuries	Total Passenger Enplanements (millions)	Million Passenger Enplanements per Passenger Fatality
1982	210	17	299	1.4
1983	8	8	325	40.6
1984	1	6	352	352.0
1985	486	20	390	0.8
1986	4	23	427	106.8
1987	213	39	458	2.2
1988	255	44	466	1.8
1989	259	55	468	1.8
1990	8	23	483	60.4
1991	40	19	468	11.7
1992	25	14	494	19.8
1993	0	7	505	No Fatalities
1994	228	15	545	2.4
1995	152	15	561	3.7
1996	319	19	592	1.9
1997	2	18	641	320.5
1998	0	11	631	No Fatalities
1999	10	37	646	64.6
2000[2]	83	9	665	8.0

[1]Beginning March 20, 1997, aircraft with 10 or more passenger seats have conducted scheduled passenger operations under U.S. Federal Aviation Regulations (FARs) Part 121. Before that date, commuter operations in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) were conducted under FARs Part 135.

[2]Data for 2000 are preliminary.

Source: U.S. National Transportation Safety Board

Table 4
Accidents Involving Passenger Fatalities On U. S. Air Carriers Operating Under U.S. Federal Aviation Regulations Part 121, 1982–2000[1]

				Passengers	
Date	Location	Operator	Aircraft Type	Fatal	Survivors
Jan. 13, 1982	Washington, D.C.	Air Florida	Boeing 737-222	70	4
Jan. 23, 1982	Boston, Massachusetts	World Airways	McDonnell Douglas DC-10-30	2	198
July 9, 1982	New Orleans, Louisiana	Pan American World Airways	Boeing 727-235	137	0
Nov. 8, 1982	Honolulu, Hawaii	Pan American World Airways	Boeing 747-100	1	274
Jan. 9, 1983	Brainerd, Minnesota	Republic Airlines	Convair 580-11-A	1	29
Oct. 11, 1983	Pinckneyville, Illinois	Air Illinois	Hawker Siddeley HS-748-2A	7	0
Jan. 1, 1985	La Paz, Bolivia	Eastern Air Lines	Boeing 727-225	21	0
Jan. 21, 1985	Reno, Nevada	Galaxy Airlines	Lockheed 188C	64	1
Aug. 2, 1985	Dallas-Fort Worth, Texas	Delta Airlines	Lockheed L-1011-385-1	126	26
Sept. 6, 1985	Milwaukee, Wisconsin	Midwest Express Airlines	Douglas DC-9-14	27	0
Dec. 12, 1985	Gander, Newfoundland, Canada	Arrow Airways	Douglas DC-8-63	248	0
Feb. 4, 1986	Near Athens, Greece	Trans World Airlines	Boeing 727-231	4	110
Feb. 14, 1987	Durango, Mexico	Ports of Call	Boeing 707-323B	1	125
Aug. 16, 1987	Romulus, Michigan	Northwest Airlines	McDonnell Douglas DC-9-82	148	1
Nov. 15, 1987	Denver, Colorado	Continental Airlines	McDonnell Douglas DC-9-14	25	52
Dec. 7, 1987	San Luis Obispo, California	Pacific Southwest Airlines	British Aerospace BAE-146-200	38	0
Aug. 31, 1988	Dallas-Fort Worth, Texas	Delta Airlines	Boeing 727-232	12	89
Dec. 21, 1988	Lockerbie, Scotland	Pan American World Airways	Boeing 747-121	243	0
Feb. 8, 1989	Santamaria, Azores	Independent Air	Boeing 707	137	0
Feb. 24, 1989	Honolulu, Hawaii	United Airlines	Boeing 747-122	9	328
July 19, 1989	Sioux City, Iowa	United Airlines	McDonnell Douglas DC-10-10	110	175
Sept. 20, 1989	Flushing, New York	USAir	Boeing 737-400	2	55
Dec. 27, 1989	Miami, Florida	Eastern Air Lines	Boeing 727-225B	1	46
Oct. 3, 1990	Cape Canaveral, Florida	Eastern Air Lines	McDonnell Douglas DC-9-31	1	90
Dec. 3, 1990	Romulus, Michigan	Northwest Airlines	McDonnell Douglas DC-9-14	7	33
Feb. 1, 1991	Los Angeles, California	USAir	Boeing 737-300	20	63
March 3, 1991	Colorado Springs, Colorado	United Airlines	Boeing 737-291	20	0
March 22, 1992	Flushing, New York	USAir	Fokker 28-4000	25	22
July 2, 1994	Charlotte, North Carolina	USAir	Douglas DC-9-30	37	20
Sept. 8, 1994	Aliquippa, Pennsylvania	USAir	Boeing B-737-300	127	0
Oct. 31, 1994	Roselawn, Indiana	American Eagle	ATR-72-212	64	0
Dec. 20, 1995	Cali, Colombia	American Airlines	Boeing B-757	152	4
May 11, 1996	Miami, Florida	ValuJet Airlines	McDonnell Douglas DC-9	105	0
July 7, 1996	Pensacola, Florida	Delta Airlines	McDonnell Douglas MD-88	2	140
July 17, 1996	Moriches, New York	Trans World Airlines	Boeing 747	212	0
Aug. 2, 1997	Lima, Peru	Continental Airlines	Boeing 757-200	1	141
Dec. 28, 1997	Pacific Ocean	United Airlines	Boeing 747	1	373
June 1, 1999	Little Rock, Arkansas	American Airlines	McDonnell Douglas MD-80	10	129
Jan. 31, 2000	Point Mugu, California	Alaska Airlines	McDonnell Douglas MD-83	83	0

[1]Beginning March 20, 1997, aircraft with 10 or more passenger seats have conducted scheduled passenger operations under U.S. Federal Aviation Regulations (FARs) Part 121. Before that date, commuter operations in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) were conducted under FARs Part 135.

Source: U.S. National Transportation Safety Board

Table 5
Accidents Involving U.S. Air Carriers Operating Under U.S. Federal Aviation Regulations Part 121, Nonscheduled Service, 1982–2000[1]

	Accidents		Fatalities				Accidents per 100,000 Flight Hours		Accidents per 100,000 Departures	
Year	All	Fatal	Total	Aboard	Flight Hours[2]	Departures[2]	All	Fatal	All	Fatal
1982	2	1	1	1	342,555	188,787	0.584	0.292	1.059	0.530
1983	1	0	0	0	383,830	209,112	0.261	–	0.478	–
1984	3	0	0	0	429,087	232,776	0.699	–	1.289	–
1985	4	3	329	329	444,562	237,866	0.900	0.675	1.682	1.261
1986	3	1	3	3	480,946	273,924	0.624	0.208	1.095	0.365
1987	2	1	1	1	529,785	308,348	0.378	0.189	0.649	0.324
1988	1	0	0	0	619,496	368,486	0.161	–	0.271	–
1989	4	3	147	146	676,621	378,153	0.591	0.443	1.058	0.793
1990	2	0	0	0	625,390	296,545	0.320	–	0.674	–
1991	1	0	0	0	641,444	311,002	0.156	–	0.322	–
1992	2	0	0	0	627,689	365,334	0.319	–	0.547	–
1993	1	0	0	0	724,859	351,303	0.138	–	0.285	–
1994	4	0	0	0	831,959	413,504	0.481	–	0.967	–
1995	2	1	2	2	728,578	351,895	0.275	0.137	0.568	0.284
1996	5	2	38	8	774,436	377,512	0.646	0.258	1.324	0.530
1997	5	1	5	4	776,447	393,257	0.644	0.129	1.271	0.254
1998	7	0	0	0	892,333	444,864	0.784	–	1.574	–
1999	4	0	0	0	831,854	408,617	0.481	–	0.979	–
2000[3]	5	0	0	0	870,000	442,000	0.575	–	1.131	–

[1]Beginning March 20, 1997, aircraft with 10 or more passenger seats have conducted scheduled passenger operations under U.S. Federal Aviation Regulations (FARs) Part 121. Before that date, commuter operations in aircraft with 30 or fewer passenger seats and with a maximum payload capacity of 7,500 pounds (3,402 kilograms) were conducted under FARs Part 135.

[2]Flight hours and departures are compiled by the U.S. Federal Aviation Administration.

[3]Data for 2000 are preliminary.

Source: U.S. National Transportation Safety Board

Publications Received at FSF Jerry Lederer Aviation Safety Library

Revised Recommendations Issued for Aircraft Deicing, Anti-icing

The guidelines, prepared by the Association of European Airlines, discuss methods of removing ice from large transport airplanes and preventing ice buildup while the airplanes are on the ground.

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FSF Library Staff

Reports

Recommendations for Deicing/Anti-Icing of Aircraft on the Ground. Association of European Airlines (AEA). 15th Edition. September 2001. 33 pp. Available from AEA.*

This document was drafted by the AEA Deicing/Anti-icing Working Group and was approved by the AEA Technical and Operations Committee to replace the 14th edition. The main changes in the revised document are:

- Revisions to make this a stand-alone document;
- Introduction of infrared deicing technologies;
- Introduction of air blower/forced air technology;
- Introduction of post deicing/anti-icing check;
- Updated weather definitions;
- Revision of Type II and Type IV holdover timetables in concert with the Society of Automotive Engineers (SAE), according to the most recent fluid-testing protocol and removal of out-of-date fluid data; and,
- Revision of fluid-checking procedures.

Recommendations apply to standard procedures for large transport airplanes. References are provided to specific International Organization for Standardization publications and SAE publications about fluid types and vehicles.

Aviation Accidents and Incidents Associated With the Use of Ophthalmic Devices By Civilian Pilots. Nakagawara, V.B.; Montgomery, R.W.; Wood, K.J. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine.

DOT/FAA/AM-01/14. July 2001. 13 pp. Table, appendix. Available through NTIS.**

About 54 percent of civilian pilots rely on ophthalmic lenses to correct defective vision and to maintain a valid airman medical certificate, the report says. Use or misuse of ophthalmic devices (i.e., eyeglasses, sunglasses, contact lenses) by pilots could create or could contribute to operational problems in an aviation environment. In preparing this report, the authors searched aviation accident and incident databases maintained by FAA, the U.S. National Transportation Safety Board and the National Aeronautics and Space Administration Aviation Safety Reporting System.[1] The authors identified the types of ophthalmic correction in use and whether the devices were identified as contributing factors to accidents or incidents. The researchers limited the study to pilots-in-command of air transport aircraft and general aviation aircraft.

The report includes a tabulated listing of records found in the three databases and a summary table of aviation accidents and incidents associated with ophthalmic devices listed in probable cause categories. The leading probable cause category for incidents was "new or inappropriate refractive correction resulting in impaired visual performance." The leading probable cause for accidents was "eyeglasses lost or broken during flight resulting in impaired visual performance."

To assist aviation medical examiners, pilots and eye care specialists, the report includes recommendations for the fitting, use and care of ophthalmic devices; their corrective quality; and the wearer's adaptation problems.

Index of International Publications in Aerospace Medicine. Antuñano, M.J.; Wade, K. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine. DOT/FAA/AM-01/15. August 2001. 45 pp. Available through NTIS.**

The authors have compiled a comprehensive listing of international aerospace publications in clinical medicine, operational medicine, physiology, environmental medicine/physiology, diving medicine/physiology, human factors, and other related topics. The primary focus is on books that offer comprehensive coverage of a specific topic. Articles from periodicals, technical reports and government documents are included. This bibliographic guide includes resources of current value and historical value from many countries.

Books

Professional Pilot. Lowery, John. 2nd edition. Ames, Iowa, U.S.: Iowa State University Press, 2001. Figures, photographs, appendixes. 332 pp.

The outline for this book is based on patterns established by historical accident data from the U.S. National Transportation Safety Board that show that about 20 percent of accidents occur during departure, 42 percent occur during approach and landing, and 34 percent occur during the en route phase of flight. Within the context of recurring accidents by phase of flight, the book discusses aerodynamic principles and events involved in each phase of flight. The book includes flying techniques, guidelines and facts gathered from a variety of reference sources. Personal tips and insight from the author's 50 years of professional pilot experience are shared with readers.

The Turbine Pilot's Flight Manual. Brown, Gregory N.; Holt, Mark J. 2nd edition. Ames, Iowa, U.S.: Iowa State University Press, 2001. Figures, appendixes, compact disc. 261 pp.

This book summarizes the information a pilot is expected to know when advancing to a high-performance turbine aircraft. The manual is written for pilots of piston-powered aircraft who are preparing for turbine-airplane ground school, military pilots transitioning to non-military operations and pilots who want to review turbine aircraft operations. Designed for quick reference or comprehensive reading, the organization of the manual is similar to that of a pilot's operating handbook or information manual. Complex topics, such as aircraft systems, are explained with illustrations and animations on compact disc.

Air Disasters. Stewart, Stanley. Reprint. Surrey, England: Ian Allan Publishing, 2001. Photographs, charts, maps, bibliography. 240 pp.

The book discusses in detail some of the most significant aviation disasters in history. They are: Airship "R101 Disaster," 1930; "Comet Crashes," 1953–54; "Munich Air Disaster," 1958; "Trident Tragedy," 1972; "Paris DC-10 Crash'" 1974; "BEA/Inex-Adria Mid-air Collision," 1976; "Tenerife Disaster," 1977; "Chicago DC-10 Crash," 1979; "Mount Erebus Crash," 1979; "Korean 747 Shoot-down," 1983; and two "747 Disasters," 1985. The author describes historical events surrounding each accident, the people involved and their personal stories, investigation findings and improvements to aviation safety resulting from each accident.

Regulatory Materials

Advisory Material for the Establishment of the Certification Basis of Changed Aeronautical Products. Federal Aviation Administration (FAA) Advisory Circular (AC) 21.101-1. Aug. 3, 2001. 30 pp. Figures, appendixes. Available through GPO.***

The AC offers guidance for establishing a certification basis for changed U.S. Federal Aviation Regulations Part 25 aeronautical products, including identifying conditions under which application for a new type certificate is necessary. Appendix 1, "Classification of Changes," discusses how to determine whether a change is substantial, significant or not significant, as defined in the AC. Appendix 2, "Procedure for Evaluating Impracticality of Applying Latest Regulations to a Changed Product," includes guidance for determining the practicality of applying a regulation to a changed product. Appendix 3, "Use of Service Experience in Establishing the Certification Basis for a Changed Product," suggests methods of using service experience to support a finding that involves compliance or noncompliance with a new regulation.

FAA Certificated Aviation Maintenance Technician Schools Directory. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 147/2GG. Sept. 5, 2001. 8 pp. Appendix. Available through GPO.***

The directory lists certificated aviation maintenance technician schools in the United States and includes notations indicating whether the schools possess FAA ratings for airframe only, powerplant only or airframe and powerplant.

Specification for L-884, Power and Control Unit for Land and Hold Short Lighting Systems. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5345-7E. Aug. 2, 2001. 8 pp. Table, appendix. Available through GPO.***

This AC contains recommended specifications for airport lighting circuits using L-824 underground electrical cable. Compliance with specifications is mandatory for airport projects receiving money from FAA-administered U.S. government funds, such as the Airport Improvement Program or the Passenger Facility Charge Program. One principle change is that type A cables with rubber insulation have been deleted from the AC. Additional changes are addressed in an accompanying table of cable requirements: cable types, voltage ratings, insulation and jacket materials, shielding, high-voltage tests and discharge-resistance tests.

Note

1. The U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) is a confidential incident-reporting system. The ASRS Program Overview said, "Pilots, air traffic controllers, flight attendants, mechanics, ground personnel and others involved in aviation operations submit reports to the ASRS when they are involved in, or observe, an incident or situation in which aviation safety was compromised. … ASRS de-identifies reports before entering them into the incident database. All personal and organizational names are removed. Dates, times, and related information, which could be used to infer an identify, are either generalized or eliminated."

   ASRS acknowledges that its data have certain limitations. ASRS *Directline* (December 1998) said, "Reporters to ASRS may introduce biases that result from a greater tendency to report serious events than minor ones; from organizational and geographic influences; and from many other factors. All of these potential influences reduce the confidence that can be attached to statistical findings based on ASRS data. However, the proportions of consistently reported incidents to ASRS, such as altitude deviations, have been remarkably stable over many years. Therefore, users of ASRS may presume that incident reports drawn from a time interval of several or more years will reflect patterns that are broadly representative of the total universe of aviation-safety incidents of that type."♦

Sources

* Association of European Airlines
Avenue Louise 350
B–1050 Brussels, Belgium
Internet: http://www.aea.be

** National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161 U.S.
Internet: http://www.ntis.org

*** Superintendent of Documents
U.S. Government Printing Office (GPO)
Washington, DC 20402 U.S.
Internet: http://www.access.gpo.gov

Accident/Incident Briefs

Speed-brake Selection During Descent Causes Uncommanded Roll

Maintenance-scheduling recommendations were issued after a post-incident inspection revealed that cables had been misrouted during a repair session in which maintenance personnel worked more than 24 hours with minimal breaks.

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FSF Editorial Staff

The following information provides an awareness of problems through which such occurrences may be prevented in the future. Accident/incident briefs are based on preliminary information from government agencies, aviation organizations, press information and other sources. This information may not be entirely accurate.

Air Carrier

Corrosion Blamed for Malfunction in Speed Brake

Boeing 737. No damage. No injuries.

The airplane was being flown on a domestic flight in Australia. When the flight crew selected the speed brake during descent to the destination airport, the airplane rolled slightly to the right.

The flight crew disengaged the autopilot, again selected the speed brake, and the airplane again rolled slightly to the right. The speed brake was stowed, the flight continued, and the pilots conducted a normal landing.

An inspection revealed that the left-wing no. 3 flight-spoiler "up" cable had failed at a pulley in the left wheel well. The incident report said that the failure was a result of corrosion. After the inspection, all other left-wing spoiler cables were replaced because of minor corrosion.

The operator said that in 1997, after an earlier failure of a spoiler cable because of corrosion, inspections of all B-737 spoiler cables had been required on a regular basis. After cable replacement, however, the inspection requirements were terminated.

After this incident, the inspection requirements and replacement requirements were revised to provide for ongoing inspections and cable replacement at every fourth heavy-maintenance check.

About two weeks after the incident, maintenance personnel observed that the left-wing spoiler cables had been misrouted.

The report said, "The operator's investigation revealed that the maintenance engineers involved in the original rectification had traveled [about 500 miles (805 kilometers)] that day and had worked a period in excess of 24 hours with minimal breaks. Excessive hours worked and fatigue of the maintenance engineers [were] considered to have contributed to the misrouting of the cables and the failure to detect the misrouting during a duplicate inspection of the spoiler control system."

As a result of that incident, the Australian Civil Aviation Safety Authority (CASA) proposed regulations to require that maintenance personnel have at least 10 hours of "complete rest, away from the workplace, in any day" and at least one 24-hour period of "complete rest, away from the workplace, in any period of seven days." Another proposed regulation says that "a maintenance worker must not continue for so long a period that the worker's capacity to carry out the work becomes significantly impaired."

Landing Gear Fails; Pieces of Broken Part Found on Ramp

Boeing 717-200. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the approach to landing at an airport in the United States. When the flight crew attempted to extend the landing gear, they observed that the nose landing gear did not extend. They declared an emergency and conducted an emergency landing. The airplane was stopped on its main landing gear and its nose, and an emergency evacuation was conducted.

An investigation revealed that the left side of the spray-deflector-assembly casting on the nose landing gear was broken.

"The left-hand support assembly … was found with cast metal retained under two of the assembly's castellated nuts," the report said. "This retained metal was similar in color to the cast metal that was found on the broken spray-deflector assembly."

The left support assembly and the vaned sideplate were intact, and the vaned sideplate was in contact with the left side of the nose-landing-gear wheel well. When the sideplate and its support assembly were removed, the nose landing gear extended and locked into position.

A Boeing flight operations bulletin issued a month before the accident said, "Several [McDonnell Douglas] MD-80/[Boeing] 717 operators have reported incidents of nose-landing-gear spray-deflector damage occurring when taxiing or operating over rigid military arresting gear."

The accident airplane's previous takeoff had been from a runway with arresting gear about 200 feet (61 meters) beyond the departure threshold in the overrun area. The report did not say whether the same runway was used when the airplane was landed at that airport.

Ground personnel found cast metal debris on the ramp where the accident airplane had been parked. The metal was similar in color to the broken spray deflector assembly.

Flight Attendants Upset by Clear Air Turbulence

Airbus A319-100. No damage. Two minor injuries.

The airplane was being flown through clear, smooth air on descent to an airport in Canada when clear air turbulence was encountered. Two flight attendants were thrown to the ceiling and floor of the galley. The flight crew requested priority handling from air traffic control for the remainder of the flight. The injured flight attendants were examined by paramedics after landing and continued their duties on the return flight.

When the incident occurred, the flight crew had been using radar to avoid buildups of cumulus clouds. The clear air turbulence was encountered while the airplane was flown "well clear of the top of a buildup embedded in the cirrus," the incident report said.

Air Taxi
Commuter

Bird Strikes Prompt Engine Shutdown During Landing

Fairchild SA227-AC Metro III. Minor damage. No injuries.

Instrument meteorological conditions prevailed as the airplane was flown on an instrument approach to an airport in New Zealand. The airplane was flown out of clouds at about 1,500 feet, and at 300 feet, the flight crew observed a flock of sea gulls near the runway threshold.

The first officer, who was the pilot flying, told the captain that he would fly over the sea gulls and land farther from the threshold than usual. As the first officer was about to land the airplane, some of the birds flew in front of the airplane. The flight crew heard several thumps just before touchdown.

The left engine failed during the ground roll, and the flight crew conducted the engine-shutdown checklist. While they taxied the airplane to the terminal, the right engine failed. The airplane was stopped, passengers deplaned, and the airplane was towed to the terminal.

The report said that the left engine failed because of bird-strike damage and that the right engine failed, "probably as a result of the crew selecting the fuel shutoff for the right … engine by mistake."

Separate Electric Problems Blamed for Smoke, Equipment Malfunctions

Fokker 50. No damage. No injuries.

The airplane was being flown on a night flight from Denmark to Sweden when the flight crew smelled a burning odor, "as if an electrical component had been burnt," and they "thought that they could detect a faint mist of smoke," the incident report said.

The flight crew told air traffic control that they believed the airplane had an electrical problem and requested clearance to begin a descent and to fly direct to the destination airport. They did not don oxygen masks because they believed that the odor had subsided. During the approach, the circuit breaker for the distance-measuring equipment opened, there were warnings that the deicing system for the left engine and the autopilot trim were not functioning, the intercom system between the cabin and the flight deck failed, and the pilots heard static in their headphones.

The pilots were given radar vectors to the base leg of the approach, and landed the airplane visually. The crew did not inform the passengers of any problem.

An investigation revealed two independent electrical-system malfunctions: "One was in the [direct-current] system and was probably the malfunction that caused disturbances in the instruments," the report said. "The other one was in the [alternating-current] system and was probably the one that caused [the] smell and smoke on [the] flight deck."

The report said that, although the pilots believed the burning odor and smoke were subsiding, they should have donned oxygen masks.

"As the source of the smell and the smoke was unknown, and could very well have been associated with the technical malfunctions that also appeared, the situation was to be considered as very serious with respect to flight safety," the report said. "Considering the fact that the pilots were not able to determine how the problem was going to develop … they should have … utilized the possibility of declaring an emergency."

Fatigue Cracking Cited in Engine Failure

Piper PA-31-350 Chieftain. Minor damage. No injuries.

The airplane was being flown on a domestic flight in Australia, and the captain was about to begin a descent to the destination airport when he felt vibration and observed that the left engine was running roughly. About 30 seconds later, as the captain was attempting to determine the cause of the problem, he observed a decrease in the left engine's oil pressure and power.

The left engine failed, and the captain secured the engine and feathered the propeller. He told air traffic control that he planned to continue the flight to the destination airport, briefed the passengers and landed the airplane.

An investigation revealed that the no. 2-cylinder connecting-rod bolt had failed and that the connecting rod had punctured the left-engine crankcase in two locations. The failure resulted from fatigue cracking of the connecting-rod big-end bearing housing.

"The fatigue cracking had initiated and developed [because of] abnormal loads arising from the loss of the bearing-shell material from within the connecting-rod big-end housing," the report said. "The connecting-rod bolt failure then occurred due to bending overload, which resulted from the fatigue cracking and separation of the opposite side of the big-end bearing housing."

Corporate Business

Engine Failure Prompts Attempted Landing in Residential Neighborhood

Beech C90 King Air. Substantial damage. One serious injury.

Visual meteorological conditions prevailed for the afternoon flight to an airport in the United States. The pilot, who had filed an instrument flight rules flight plan, was flying the airplane on a visual approach. When the airplane was on final approach, a controller in the airport traffic control tower observed that the airplane was in "level flight, descending out of sight behind hangars," the report said.

"The controller asked the pilot if he was experiencing a problem," the report said. "The controller did not receive a reply. The airplane descended into a residential area, where it struck power lines, a tree, a natural gas meter, two private residences and a fence."

The pilot said that while he was flying the airplane on the base leg of the approach, the right engine surged. The pilot turned on the boost pumps and retracted the landing gear. The right engine then lost power. As the airspeed decreased almost to minimum controllable airspeed, the pilot attempted to conduct an emergency landing in the residential area."

Airplane Strikes Terrain During Missed Approach

Piper PA-32R-301 Saratoga SP. Destroyed. One fatality.

Instrument meteorological conditions prevailed during the instrument landing system (ILS) approach to an airport in the United States.

The accident report said that a review of air traffic control radar data showed that "a target" appeared to be established on the ILS localizer. About 0.5 nautical mile (0.9 kilometer) from the approach end of the runway, the target "initiated a climb, then began a left-hand turn toward the east," the report said. "The target then began a series of climbing and descending left and right-hand turns for several minutes, before the target disappeared off radar."

The pilot of the accident airplane had received clearance to land, but several minutes after issuing the clearance, the tower controller asked the pilot if he was going around. The pilot said, "That's affirmative." The tower controller twice told the pilot to turn left to a heading of 090 degrees and to climb to and maintain 2,000 feet, but the pilot did not respond. When the tower controller asked the pilot his intentions, he replied that he was turning the airplane to a heading of 090 degrees, "but 090 is to the right." The pilot did not respond to the tower controller's subsequent instructions to "fly heading 090 [degrees], climb and maintain 2,000 [feet]," and when the tower controller told the pilot to contact departure control, the pilot said, "(unintelligible) control, we're gone."

The pilot did not contact departure control and did not answer the tower controller's repeated calls. Then he radioed the tower controller. She answered, but there were no further radio transmissions from the pilot, and the airplane disappeared from radar. Soon afterward, the controllers heard the signal of an emergency locator transmitter.

Wreckage was found in a nearby wooded area. The pilot was killed.

Other General Aviation

B-747 Jet Blast Overturns Smaller Airplane

Cessna 150J. Substantial damage. No injuries.

An instructor and a student pilot were taxiing the airplane behind a Boeing 747 at an airport in South Africa. After the B-747 was stopped in a parking area, the instructor and student pilot increased power to continue taxiing.

The flight crew of the B-747 applied power to adjust the aircraft's position, and the jet blast overturned the smaller airplane.

Engine Stops During Aerobatic Maneuver

De Havilland DH82A Tiger Moth. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the flight in England, which included a demonstration of aerobatics, and the surface wind was from 120 degrees at eight knots to 10 knots. During a barrel roll, while the airplane was inverted, the engine stopped. The instructor continued the roll until the airplane's wings were level.

Because the airplane was at 1,500 feet — too low for the instructor to dive the airplane to attempt to restart the engine — he transmitted a "mayday" emergency radio call and began an approach to land the airplane on a southerly heading on a large green field.

On final approach, the instructor observed standing crops about one meter (3.3 feet) tall. As the main landing gear descended into the crops, the airplane was flipped onto its back.

The instructor said that the engine had stopped because he had allowed the airplane to develop a nose-high attitude while inverted.

Moose Hunters' Airplane Strikes Terrain After Takeoff

Cessna 207A. Substantial damage. One serious injury.

The airplane, modified for short takeoffs and landings, was being flown from an airstrip in Canada, carrying the pilot, two hunters, several quarters of moose meat and two sets of moose horns. After takeoff, the pilot was unable to maintain a positive rate of climb, and the airplane struck trees and the ground.

The 1,800-foot (549-meter) sand-and-gravel airstrip is 3,000 feet above sea level, the takeoff was being conducted uphill and the airplane was being flown at gross weight or near gross weight. Surface winds were calm.

Rotorcraft

Helicopter Strikes Power Lines During Approach to Field

Bell 206L-1 Long Ranger II. Substantial damage. One serious injury.

Visual meteorological conditions and 12-knot to 15-knot northwest winds, with gusts that may have been as strong as 25 knots to 30 knots, prevailed when the pilot prepared to land the helicopter in a field in a village in Sweden.

He planned to fly an approach over two power lines east of the intended landing site and then to land into the wind.

The report said, "As the visibility was good and he felt completely certain that he saw all the cables clearly, he initiated an approximately 30-degree steep descent toward the landing site … . He estimated that the safety distance to the nearest electrical cable would be a minimum of five meters.

"His impression was that the descent, despite the gusty wind, [was] completely normal until, to his surprise, he suddenly felt the helicopter snag a cable."

The helicopter struck the ground about 20 meters (66 feet) from the power lines.

Pilot Pulls Collective Lever Instead of Parking-brake Handle

Sikorsky S-76A. Minor damage. No injuries.

The helicopter was parked at an airport in England when the captain decided that the first officer should turn the helicopter 90 degrees to the left to allow for easier passenger boarding.

The first officer conducted the maneuver, stopped the helicopter and reached over the center console to apply the T-shaped parking brake. He mistakenly pulled the commander's collective lever, and the helicopter lifted into the air. The first officer lowered his collective lever, and the helicopter landed heavily and tail-first.

The report said that the handle of the parking brake is on the right side of the center console, next to the right collective lever and is not visible from "the normal seating position of the occupant in the left seat."

After the accident, the company changed operating procedures to require the right-seat occupant to operate the parking handle. The company also developed a checklist for ground repositioning.

Switch Flaw Blamed for Contradictory Information On Approach

Aerospatiale AS 332L Super Puma. No damage. No injuries.

Instrument meteorological conditions prevailed for the early afternoon approach to an airport in Australia. The pilot said that he was using the global positioning system (GPS) to track to the initial approach fix for a very-high-frequency omnidirectional radio/distance-measuring equipment (VOR/DME) approach and that after receiving clearance for the approach from air traffic control, he selected his navigation source control switch from "A NAV" (the selection for GPS navigation) to "NAV 2" and "VOR 2."

The accident report said, "Immediately, the navigation 'EMERG MODE' light on the pilot's bearing pointer's control panel illuminated."

As required by the emergency checklist, the pilot selected "ADF (automatic direction finder) 1," "VOR 2" and "NAV 2."

After the helicopter was flown past the initial approach fix and was established on the final approach, the pilot and the copilot observed that contradictory information was being provided by the navigation displays. The helicopter then descended into visual meteorological conditions, and the instrument approach was discontinued.

Maintenance personnel could not reproduce the problem on the ground, but they said that illumination of an "EMERG MODE" light typically indicates one of the following problems:

- A fault in the navigation signal received by the aircraft;
- A fault in the navigation switching power supply; or,
- An internal fault in the navigation switching system.

In this occurrence, maintenance personnel believed that the problem was a sticking relay — an internal fault — in the navigation switching system.♦

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Swiss Pool for Aviation Insurance

Swiss Professional Pilots' Association (SPPA)

Swiss Reinsurance Company–Swiss Re New Markets

Swissair

Syria

Syrianair

Taiwan

Air Force Academy, School of Aviation Safety and Management

Aviation Safety Council

China Airlines

EVA Airways Corp.

Far Eastern Air Transport Corp.

Flight Safety Foundation–Taiwan

Institute of Transportation, MOTC

Mandarin Airlines

Taiwan Civil Aeronautics Administration

TransAsia Airways

Tanzania

Air Tanzania Corp.

Thailand

Bangkok Airways

Thai Airways International

Tonga

Royal Tongan Airlines

Tunisia

Tunisair

Turkey

Turkish Airlines

Turkmenistan

Turkmenistan Airlines

Uganda

Alliance Air–Uganda

Ukraine

Aerosweet Airlines

Air Ukraine

Independent Carrier Aircompany (ICAR)

Ukraine International Airlines

United Arab Emirates

Amiri Flight–Abu Dhabi

Emirates

United Kingdom

Air 2000

The Air League–United Kingdom

Airtours International

Association of Licensed Aircraft Engineers

AvSoft

BAE SYSTEMS

BAE SYSTEMS (Operations) Limited

Britannia Airways

British Airways

British European

British Midland Airways

British Regional Air Lines Group

Cranfield University

European Regions Airline Association

FayAir (Jersey)

GB Airways

Gill Airways

Guild, Air Pilots and Air Navigators

Inspectorate of Flight Safety Royal Air Force –U.K.

International Federation of Air Line Pilots' Associations (IFALPA)

International Federation of Airworthiness (IFA)

JMC Airlines

KLM uk

Lloyd's Aviation Underwriters' Association

Maersk Air Ltd.

Marsh Ltd.

Michael Overall

Capt. Keith Pickett

TWP Ltd.

U.K. Civil Aviation Authority

Virgin Atlantic Airways

United States of America

3M Aviation

Abbott Laboratories

AC Nielsen Corp.

ACE USA

ACM Aviation

Aerospace Concepts Inc.

AFLAC Incorporated

AIG Aviation

Air Line Pilots Association, International (ALPA)

Air Resources Helicopters

Air Routing International

Air Transport Association of America

Air Transport International

Air Wisconsin Airlines Corp.

Airbus North America

Airbus Service Co.–Training Center

Airline Professional Association, Teamsters Local 1224

AirFlite

AirNet Systems

AirTran Airways

Alaska Airlines

Alberto-Culver USA

Alcoa

Alertness Solutions

Allied Pilots Association

Aloha Airlines

Alticor

Amerada Hess Corp.

America West Airlines

American Airlines

American Association of Airport Executives

American Electric Power Aviation

American Express Co.

American Jet International

American Trans Air

AMR Eagle

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Anheuser-Busch Cos.

Aon Corp.

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Asset Management Company
Atlantic Coast Airlines
Atlantic Southeast Airlines
Atlas Air
AT&T
Scott A. Ault
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Aventis Pharmaceuticals
Aviation Personnel International
Avionica
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BANK ONE CORPORATION
Ball Corp.
Bank of America
Bank of Stockton
Barnes & Noble Bookstores
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Baxter Healthcare Corp.
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Bell Helicopter Textron
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Business Express Airlines
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Cessna Aircraft Company
Chevron Corp.
Cigna Corp.
Cingular Wireless
Citigroup Corporate Aviation
City of Atlanta Department of Aviation
The Coca-Cola Co.
Colleen Corp.
College of Aeronautics
Collins & Aikman
Comair
ConAgra Foods
Continental Airlines
Corporate Angel Network
Corporate Flight International
CJ Systems Aviation Group
Cox Enterprises Inc.
Crown Cork & Seal Co.
Crown Equipment Corp.
Cummins Engine Co.
Currey Aviation Services
DaimlerChrysler Aviation
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Deere & Co.
Delta Air Lines
Dominion Resources
The Dow Chemical Co.
Dow Corning Corp.
Capt. Thomas A. Duke
DuPont
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Eastman Kodak Co.
Eaton Corp.
EG&G Technical Services
eJets.com
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Embry-Riddle Aeronautical University–Arizona
Embry-Riddle Aeronautical University–Florida
Emerson Electric Co.
ENRON Corp.
Entergy Services
Era Aviation
EVASWorldwide
Evergreen International Airlines
Executive Jet Aviation
Express One International
ExxonMobil Corp.
Fairchild Dornier
FedEx Express
FedEx Pilots Association
First Union Flight Operations–Hawkaire
FHC Flight Services
FL Aviation
Flight Dynamics
Flight Services Group
FlightSafety International
FlightSafetyBoeing Training International
Florida Power & Light Co.
Flowers Industries
Flying Lion
Ford Motor Co.
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Frontier Airline Pilots Association
Frontier Airlines
Fuqua Flight
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Gateway
Gaylord Entertainment Co.
GE Aircraft Engines
General Electric Co.
General Mills
General Motors Corp.
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Georgia-Pacific Corp.
Global Aerospace
Global Crossing Aviation
Orin Godsey
GTC Management Services
Gulfstream Aerospace
H. Beau Altman Corp.
Halliburton Co.
Jerry B. Hannifin
Harley-Davidson Motor Co.

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Hewlett-Packard Aviation
Yvonne Hill
Hillenbrand Industries Inc.
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Honeywell
Hop-A-Jet
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Hubbell Flight Department
IBM Flight Operations
IHS Aviation Information
IMS Health
Independent Pilots Association
Interlaken Capital Aviation Services
International Paper
International Society of Air Safety Investigators (ISASI)
JCPenney Co.
Jeld-Wen Inc.
Jeppesen Inc.
Jet Aviation Business Jets
JetBlue Airways Corp.
Johnson & Johnson
Johnson Controls
Dr. Daniel Johnson
Margaret A. Johnson
KaiserAir
Kellogg Co.
Kenton County Airport Board
KeyCorp Aviation Co.
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Liberty Mutual Group
The Limited
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Lucent Technologies
Management Air Service Co.
Marathon Oil Co.
Masco Corp. Flight Department
MBNA America Bank
MC Aviation Corp.
McDonald's Corp.
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The Mead Corp.
MedAire
Merck & Co.
Midwest Express Airlines
C.O. Miller
Milliken & Co.
Mission Safety International
MITRE Center for Advanced Aviation System Development
Thomas Monforte
Monsanto Aircraft Operations
Motorola
Luis Moyano
National Aeronautic Association of the USA
National Air Traffic Controllers Association (NATCA)
National Air Transportation Association
National Association of Flight Instructors
National Business Aviation Association (NBAA)
National Center for Atmospheric Research
Nationwide Insurance Enterprise
Northwest Airlines
Omniflight Helicopters
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Ellen Overton
Owens Corning
Owens-Illinois General
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Parker Drilling Co.
Parker Hannifin Corp.
Penn-Tex Aerospace
Penske Jet
PepsiCo
Petersen Aviation
Petroleum Helicopters Inc.
Pfizer
Pharmacia Corporation
Philip Morris
Phillips Aviation Alaska
Pilkington North America
Pilot Corp.
Pizza Hut Aviation
PPG Industries
Pratt & Whitney
Principal Financial Group
Printpack Inc.
Procter & Gamble
Professional Aviation Maintenance Association (PAMA)
Raytheon Aircraft Co.
Raytheon Co.
Regional Airline Association
Richardson Aviation
Richmor Aviation
Harry L. Riggs Jr.
RJ Reynolds Tobacco Co.
Capt. David Robertson
Russell D. Robison
Rockwell Automation
Rockwell Collins
Rocky Mountain Helicopters
Rolls-Royce
Rolls-Royce North America
Rosemore Aviation Inc.
Safe Flight Instrument Corp.
SBC Communications Inc.
Ronald Schleede
Schering-Plough Corp.
Rusty Scioscia
Sears, Roebuck & Co.
Shamrock Aviation
John Sheehan
Shell Oil Company
Signature Flight Support
Silver Ventures
SimuFlite Training International
Skyjet.com
Society of Automotive Engineers (SAE)
Sony Aviation
Southern California Safety Institute–Kirtland
Southern Methodist University
Southern Securities Ltd.

Flight Safety Foundation Members *(continued)*

Southwest Airlines
Southwest Airlines Pilots Association
SPIDELA
Spirent Systems
Sprint Corp.
Steelcase North America
Summa Peto
SunTrust Banks
Sunoco Inc.
Sunworld International Airlines
Taco Bell Corp.
TAG Aviation USA, Inc.
Tampa Airlines
Target Corporation
TeamLease
Teledyne Controls
Tennessee Valley Authority
Texas Instruments
Tillson Aircraft Management
Time Warner
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Trans World Airlines
TransMeridian Airlines
Tricon-KFC Aviation
TRW Flight Services
Tudor Investment Corp.
Tulsa Propulsion Engines
United Airlines
The United Co.
United States Aviation Underwriters
United Technologies Corp.
Universal Weather & Aviation
University Aviation Association
University of North Dakota
University of Southern California
UnumProvident Aviation Department
UPS Airlines
U.S. Air Force Headquarters–SE
US Airways
U.S. Coast Guard–Washington, D.C.
U.S. Department of the Navy
U.S. Federal Aviation Administration (FAA)
U.S. National Aeronautics and Space Administration (NASA)
U.S. National Transportation Safety Board (NTSB)
U.S. Naval Research Laboratory–Monterey
U.S. Naval Safety Center
USAA
USAirports Air Charters
USDA Forest Service
USX Corp.
The VanAllen Group
Veridian Flight Research Group
Verizon
VIAD Corp.
Victory Aviation
Vivendi-Universal Studios
Walter Kidde Aerospace
Charles Waterman
WCF Aircraft Corp.
Whirlpool Corp.
Willis Global Aviation
World Airways
World Class Charters
W.W. Grainger Inc.
Wyvern Aviation Consulting
Xerox Corp.
Terry Yaddaw
Zeno Air

Uruguay

PLUNA Líneas Aéreas Uruguayas

Uzbekistan

Uzbekistan Airways

Vanuatu

Air Vanuatu

Venezuela

Avensa

West Indies

BWIA West Indies Airways

Western Samoa

Polynesian Airlines

Yemen

Yemenia, Yemen Airways

Yugoslavia

Montenegro Airlines
Yugoslav Airlines (JAT)

Zambia

Aero Zambia
Zambian Airways

Zimbabwe

Affretair
Air Zimbabwe
Zimbabwe Express Airlines

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