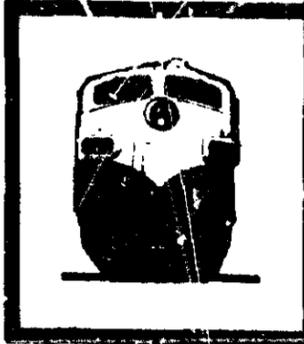


PB82-910416



NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594



AIRCRAFT ACCIDENT REPORT



**GIFFORD AVIATION, INC.,
deHAVILLAND DHC-6, N103AQ
HOOPER BAY, ALASKA
MAY 16, 1982**



NTSB-AAR-82-16



UNITED STATES GOVERNMENT

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CONTENTS

SYNOPSIS	1
INVESTIGATION.	2
History of the Flight.	2
Injuries to Persons.	3
Personnel Information.	4
Airplane Information	4
Aerodrome Information.	5
Wreckage and Impact Information.	5
Medical Information.	6
Tests and Research	6
Additional Information	6
Pilot Responsibilities	6
Weight and Balance Calculations.	7
Airplane Operations with Extreme Aft Center of Gravity	8
FAA Surveillance	8
ANALYSIS	10
PROBABLE CAUSE	14

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Adopted: November 18, 1982

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deHAVILLAND DHC-6, N103AQ
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SYNOPSIS

About 1015 Alaska daylight time, on May 16, 1982, Gifford Aviation Inc., DHC-6 (Twin Otter), operated as Weir Air Alaska Flight 517, crashed while attempting to land at Hooper Bay, Alaska. The airplane crashed 1,320 feet short of the threshold of runway 13 during an approach in visual meteorological conditions.

The airplane was substantially damaged when it crashed onto hard-packed snow and ice about 100 feet from the edge of the Bering Sea. There was no fire. The two pilots and six passengers sustained serious injuries in the accident.

The National Transportation Safety Board determines that the probable cause of this accident was the flightcrew's failure to compute and properly interpret the airplane's weight and balance and their operation of the airplane with the center of gravity substantially aft of its authorized limit which resulted in loss of control of the airplane during a landing attempt.

INVESTIGATION

History of the Flight

On May 16, 1982, Weir Air Alaska Flight 517, a deHavilland DHC-6, N103AQ, was a regularly scheduled passenger/cargo commuter flight from Bethel, Alaska, to Hooper Bay, Alaska, with en route stops at Chevak and Scammon Bay. Gifford Aviation, Inc., was operating the flight under contract to Weir Air Alaska. The flight was subject to the requirements of 14 CFR 135.

The pilots asserted that the severity of the injuries they sustained prevented them from recalling the events of the accident; however, the six passengers clearly recalled a number of observations regarding these events.

Flight 517 departed Bethel at 0833 A.d.t., ^{1/} with three passengers, and 1,633 lbs of mail and cargo aboard. The flight arrived at Chevak at 0919, where two passengers disembarked and five passengers boarded. Nine hundred and fifty pounds of mail and cargo were unloaded and 646 lbs of mail and 256 lbs of baggage were placed in the aft baggage compartment. The loading was conducted by the pilots themselves. The station agent at Chevak said that one of the pilots placed the tail stand under the empennage during the loading, but he did not notice if the crew had difficulty removing the stand before departure. The tail stand is routinely used during loading to prevent the airplane from settling onto its tail, especially when the cockpit is not occupied.

The airplane departed Chevak at 0936. Weir flights had not landed at Scammon Bay for the previous few days because the runway was extremely soft and muddy from melting snow. Before departure from Chevak, the crew asked two male passengers to sit in the most aft cabin seats. The crew told the passengers that the runway at Scammon Bay was muddy and they wanted to move weight to the rear "to lighten the nose." One of the passengers described the landing approach to Scammon Bay as a shallow descent with high engine power.

Flight 517 landed at Scammon Bay at 0950, where 278 lbs of mail was removed from the nose compartment, which was then empty, and 191 lbs of cargo was removed from the cabin. No other payload changes were made at Scammon Bay. The station agent at Scammon Bay said that one of the pilots called to him from the cockpit to find the tail stand from the baggage compartment and place it under the airplane before anyone got off the airplane. The agent could not find the tail stand so one of the pilots exited the airplane, found the stand, and placed it under the aft fuselage. The agent did not recall if the crew had difficulty removing the stand before departure. The crew left one engine running during the loading and unloading.

^{1/} All times contained herein are Alaska daylight time based on the 24-hour clock.

The flight departed Scammon Bay at 0958. The passengers said the pilot raised the nose of the airplane off the runway early in the take-off roll and when the airplane became airborne, the pilot flew it quite low over the runway for a while before beginning the climb. Otherwise, the takeoff at Scammon Bay was uneventful and the en route phase to Hooper Bay was routine. The passengers recalled no turbulence or precipitation en route, and the flight was always clear of clouds.

The passengers and witnesses on the ground at Hooper Bay stated that the airplane descended in a southwesterly direction over the airport and then made a right descending turn to final approach for runway 13. The passengers said that the airplane appeared to be higher on this approach than other approaches they had flown on the Twin Otter. They said that as the pilot aligned the airplane with runway 13 on final approach, the nose suddenly pitched up and then the airplane dropped rapidly. They recalled that, when the nose pitched up, the captain yelled at the copilot. The consensus of their recollection about the captain's words was "I said more power ***, more power." They said that before the nose pitched up the captain had his right hand on two levers (propeller controls) on the overhead panel and he moved a "square" handle (flap lever), while the copilot had his left hand on two other levers on the overhead panel (power levers). The passengers recalled that both pilots were "frantically" moving the overhead levers after the nose pitched up. None of the passengers recalled hearing the stall warning horn.

The airplane crashed slightly right (south) of the extended runway centerline onto level hard-packed snow and ice. It struck the ground in a slight right wing low and slight nosedown attitude about 1,320 feet from the approach end of runway 13. The airplane slid forward about 50 feet before it came to a stop; the fuselage was oriented about 130° magnetic. There was no fire.

Local residents who witnessed the accident proceeded to the site in snowmobiles and assisted the injured.

The accident occurred during the hours of daylight about 1015 at 61° 32' north latitude, 166° 9' west longitude. Weather was clear at Hooper Bay at the time of the accident with winds of about 20 knots from the east.

Injuries to Persons

<u>Injuries</u>	<u>Crew</u>	<u>Passengers</u>	<u>Other</u>	<u>Total</u>
Fatal	0	0	0	0
Serious	2	6	0	8
Minor/None	0	0	0	0

Personnel Information

The captain held an Airline Transport Pilot (ATP) rating, issued November 13, 1979, and a first-class medical certificate, issued January 26, 1982. He had logged 4,550 hours total flight time, 1,100 hours of which were in the DHC-6 airplane. He had logged 750 hours as pilot-in-command in the DHC-6 airplane. He was hired by Gifford Aviation on April 23, 1981, and was assigned copilot duties on the DHC-6 airplane until August 12, 1981, when he was assigned as captain.

The copilot held an ATP rating issued April 11, 1982, and a second-class medical certificate issued June 29, 1981. He had logged about 1,850 hours total flying time of which about 300 hours were in the DHC-6 airplane. He was hired by Gifford Aviation on June 29, 1981, and was assigned copilot duties on the DHC-6 airplane on August 29, 1981.

A review of company records revealed that the pilots had received the ground and flight training required for 14 CFR 135 operations. Their ground training included instruction in the computation of weight and balance for the DHC-6 using the deHavilland Twin Otter weight and balance handbook, and the FAA approved company operations specifications pertaining to weight and balance procedures.

The pilots had been on duty 2 hours the day of the accident and had received 14.5 hours rest time before reporting for duty.

Airplane Information

DeHavilland Aircraft, Ltd., DHC-6-200 Twin Otter, N103AQ, serial No. 182, was owned by Kodiak Aviation, an Indiana General Partnership, located in Fort Wayne, Indiana. The airplane was leased to, and operated by, Gifford Aviation, Inc., of Anchorage, Alaska. The airplane was based at Bethel, Alaska, along with two other Twin Otters, as part of Gifford Aviation's contract service to fly Weir Air Alaska's routes to surrounding native villages.

A review of the airplane and engine maintenance records revealed that all required maintenance and checks had been performed. Only one deferred item, dated March 31, 1982, was noted a low pneumatic pressure light was illuminated. The airplane had accumulated about 15,270 hours at the time of the accident. It was equipped with two Pratt and Whitney PT6A-20 turboprop engines.

The certificated maximum takeoff weight for N103AQ was 11,579 lbs and its forward and aft center of gravity (c.g.) limits were 20 percent mean aerodynamic chord (MAC) and 36 percent MAC, respectively. The rear baggage compartment was restricted to a maximum of 500 lbs total, ^{2/} which included a 150-lb maximum on the shelf at the back of the compartment. A placard specifying the 500-lb limitation was installed on

^{2/} According to deHavilland personnel, the 500-lb limit was both a structural and weight and balance restriction.

the wall of the cargo compartment. There was an 80-lb survival kit located on the shelf in the aft cargo compartment. It was included in the airplane's basic operating weight.

The cabin was equipped with 16 passenger seats. Four forward-facing seats were positioned along the left cabin wall. A forward-facing double unit was located directly across the aisle from each of these units. A side-facing single unit seat was behind these double units and across from the cabin entry door. At the aft end of the cabin, mounted on the bulkhead was three forward-facing single units.

Aerodrome Information

The runway at Hooper Bay is 3,600 feet long and 100 feet wide oriented 130°/310° magnetic. The surface is stabilized sand and asphalt. At the time of the accident, the northwest end of the runway was unusable because of snow drifts and piled snow on the surface. The unusable area extended for about 1,500 feet from the approach end of runway 13, leaving about 2,100 feet available for takeoff and landing.

Wreckage and Impact Information

The wreckage was confined to an area about 68 feet long and 45 feet wide. The airplane came to rest about 100 feet from the edge of the Bering Sea on hard-packed snow and ice which covered the beach. The fuselage was aligned with the runway centerline, but slightly to the south, about 1,320 feet from the approach end of runway 13 and slightly below the runway elevation. The airplane slid about 50 feet before coming to rest.

The entire left wing was displaced forward and down with a torn section of fuselage sidewall attached. The left engine was attached to the wing, except for the propeller and forward nose case which were separated from the engine assembly. The engine was found against the side of the captain's entry door. There was a propeller slash mark in the fuselage structure just behind the captain's seat.

The entire right wing was separated from the fuselage and was displaced aft and downward along the side of the fuselage. The right wingtip was crushed and broken upward and the wing was broken chordwise about midspan and was bent slightly upward. The right engine was attached to the wing and its propeller was in place.

The fuselage was broken in the midsection area with the forward and aft sections bent downward. The entire bottom part of the fuselage was compressed upward with the greatest compression along the right side.

The vertical stabilizer and rudder were intact. The horizontal stabilizer was intact although the left stabilizer was bent downward. The horizontal stabilizer deicing boots were intact and properly attached. There were a few flecks of mud splashed on the horizontal stabilizer leading edges. The upper and lower surfaces were clean.

All cargo and cabin doors were intact and attached to the fuselage except the aft portion of the cabin entry door which was lying beside the fuselage.

All flight control surfaces were intact and attached to the appropriate structure. The rudder and elevator cables were intact and attached to their respective fittings. The aileron cables were intact except for a tension overload failure at the right wing root and a propeller cut behind the captain's seat. The flap push-pull rods in the left wing were intact. The flap push-pull rods in the right wing were broken by overload. The flap push-pull rods were broken by overload in the cabin overhead. Measurements of the flap hydraulic actuator piston rod extension and the flap-elevator interconnect jackscrew threads corresponded to a flap extension of about 20°. The flap position selector lever and the flap indicator were found at the 10° position.

The left rear passenger seat seatbelt was found broken. The fabric was extensively worn and frayed where it passed through the left seat frame fitting. Also, seatbelt fabric of the unoccupied sidelining seat was extremely frayed and worn.

Medical Information

Three of the occupants sustained compression fractures of their spinal columns. These three occupants, one of whom was the copilot, were seated in widely separated locations throughout the airplane. The captain sustained four fractured ribs on his right side. Two other occupants sustained fractures of facial bones. Most of the remaining serious injuries consisted of fractured extremities. There were four occupants who sustained a total of seven fractured extremities, five of which were sustained on the occupants' right side. The passenger occupying the left rear passenger seat sustained a fractured left leg. All of the occupants, with the possible exception of one person, suffered loss of consciousness as a result of the impact.

Three months after the accident, the captain and copilot still complained of total memory loss regarding the events of the day of the accident.

Tests and Research

The two stall warning system detectors which were installed on the leading edge of the left wing were removed and tested. Both detectors functioned normally. The stall warning horn assembly was damaged during the accident and could not be tested.

Additional Information

Pilot Responsibilities

The Gifford Aviation, Inc., Operations Manual specifies that the pilot-in-command is responsible for computing and verifying the airplane's

weight and balance. The pilot-in-command is also responsible for overseeing and verifying the accuracy of the loading of the airplane at each station and for completing the load manifest before each departure.

Weight and Balance Calculations

The Gifford Aviation, Inc., FAA-approved Operations Manual contains procedures for computing the weight and balance of the airplane. The procedures allow the use of "average" weights for pilots, passengers, and checked baggage. The average weight of 160 lbs may be used for adult passengers in the summer (May 1 through October 31). An average of 80 lbs may be used for a child between the ages of 2 and 12. These "average" weights include minor items normally carried by a passenger, such as handbags and briefcases. An average weight of 170 lbs and 25 lbs of baggage is used for each crewmember. For each piece of checked baggage, an average of not less than 23.5 lbs may be used in lieu of actual weighing, and for each passenger boarding the airplane an average of not less than 5 lbs for additional unchecked baggage is used. The Operations Manual procedures specify that "actual" weights will be used when a passenger's weight obviously does not conform with the "average" passenger weight.

There was no evidence that the crew of Flight 517 weighed the passengers or their baggage. The "Bush Station Daily Flight Report" carried by the crew of Flight 517 contained entries for mail, cargo, passengers, and fuel weights. The record contained an entry of 11,566 lbs gross weight for takeoff from Bethel and a 29.0 percent MAC c.g. The record contained an entry of 11,044 lbs gross weight for departure from Chevak and 10,613 lbs gross weight for departure from Scammon Bay. There were no entries for c.g. on the daily record for departure from Chevak or from Scammon Bay. The Safety Board calculated the gross weights to be 11,418 lbs upon departure from Chevak and 10,824 lbs upon departure from Scammon Bay using the fuel figures entered on the daily log by the pilots.

The Safety Board calculated the weight and balance for N103AQ at the time of the accident using both average and actual weights. Using average weights, the airplane weighed 10,859 lbs, and using actual weights, it weighed 10,856 lbs, assuming 1,210 lbs of fuel aboard; ^{3/} and 10,646 lbs, assuming 1,000 lbs of fuel aboard.

The distribution of the load at the time of the accident was as follows:

- Fuel - 490 lbs, forward tank, 720 lbs aft tank
- Mail - 646 lbs, aft cargo compartment
- Baggage - 256 lbs, aft cargo compartment
- Cargo - 203 lbs, cabin floor across from entry door
- Passengers - one male adult, row 1
 - one male, one female, and one child, row 3
 - two males, last row

^{3/} Fuel readings taken from gauges after the accident were 490 lbs forward tank and 720 lbs aft tank. The pilots entered a weight of 1,175 lbs for departure from Scammon Bay and a 1,000 lbs estimated for departure from Hooper Bay.

Using these distributions and average weights, the c.g. was 48.1 percent MAC at the time of the accident. Using the same distributions and actual weights, the c.g. was 47.8 percent MAC at the time of the accident. Additionally, the c.g. was calculated to have been about 40.1 percent upon departure from Chevak.

Airplane Operations with Extreme Aft Center of Gravity

DeHavilland Aircraft Company had never flight tested the DHC-6 with a c.g. more than 5 to 6 percent aft of its rearmost limit. Therefore, deHavilland flight personnel could not provide quantitative data, nor could they state precisely the characteristics of the stability and controllability problems that a pilot might encounter with the c.g. more than 10 percent beyond its aft limit. However, they stated that longitudinal stability would be severely affected with such an extreme aft c.g., and that any actions affecting the pitch would generate an abnormal pitch control response under these conditions. Additionally, power reductions and flap extension both would induce a noseup pitching moment, and the pitching moments associated with those actions would require much greater pitch control deflections with an extreme aft c.g. than would be required under normal conditions. With a c.g. beyond the aft limit, the airplane reaction to noseup pitching moments induced by power reduction and flap extension would be significant as compared to reactions associated with normal c.g. conditions, and pitch control deflections would also have to be significant to control the abnormal pitching moments.

During discussions with Gifford Aviation, Inc. Twin Otter pilots, several stated that "...as long as you can get the tail stand out from under the aft fuselage, the airplane would fly." The Vice President of Gifford also related that he understood that the Twin Otter c.g. was not a problem if the pilot could remove the tail stand. The Vice President was not a pilot.

FAA Surveillance

Gifford Aviation had been operating Weir Air Alaska bush routes out of Bethel for about 9 months before the accident. No base inspection of the Bethel operation had been performed during that period by either the principal operations inspector or the maintenance inspector from the Anchorage General Aviation District Office (GADO). The last base inspection of Gifford's Anchorage base was performed in November 1981. The principal operations inspector assigned to oversee Gifford Aviation was also responsible for the surveillance of 30 on-demand air taxi operators and 3 additional commuter air taxi operators. The principal maintenance inspector assigned to oversee Gifford Aviation was also responsible for 27 on-demand (nonscheduled) air taxi and 2 additional commuter air taxi operators.

During the Safety Board's investigation of this accident, its investigators observed numerous Gifford Aviation Twin Otter operations out of Bethel. Baggage, cargo, and mail were observed to be loaded in most cases by untrained station agents without any supervision from the

flightcrew. The pilots were provided with manifests containing total weights and passenger counts; however, they were not aware of actual locations or specific weights of items in the aft or forward cargo compartments.

Additionally, the Board's investigators examined two of Gifford Aviation's operating Twin Otters and found seatbelts frayed and worn beyond serviceable limits.

No reports of violations of operational or airworthiness requirements had been issued by the Anchorage GADO for the Gifford Aviation operation at Bethel during its 9-month history of servicing Wein's routes from Bethel. As a matter of fact, no notices of violations had been issued to Gifford Aviation in the previous 2 years.

ANALYSIS

The pilots were properly trained, qualified, and certificated to conduct the flight. There was no evidence of medical problems which would have affected the pilots' ability to conduct the flight. They had received the required rest. The position of the pilots' hands during the approach, as described by the passengers, indicates that the copilot was flying the airplane during the approach to Hooper Bay.

There were no meteorological conditions which could have contributed to the cause of the accident.

There were no airplane structures, systems, or powerplant malfunctions which contributed to the cause of the accident. The airplane was properly certificated and was being maintained in accordance with applicable regulations with the exception of the passenger seatbelts. The worn and frayed seatbelt for the left rear-seat passenger failed and probably contributed to the severity of his injuries. The condition of the belt indicated that the worn and frayed condition had existed for several months, indicating poor maintenance and inadequate FAA surveillance.

The investigation indicated clearly that the airplane's longitudinal stability (balance condition) was the primary event involved in this accident. The airplane's c.g. was considerably beyond its aft limit at the time of the accident. The airplane was about 4 percent aft of its c.g. limit during the landing at Scammon Bay because the pilots intentionally made the airplane "tail heavy" by loading most of the mail and cargo from Chevak in the aft baggage compartment and by asking two large adults to change their seats to the rear-most cabin seats. Moreover, they burned more fuel out of the forward fuel tank than the rear tank. They did this to "lighten the nose" for the landing and takeoff at Scammon Bay because of the muddy runway. However, the critical factor was the removal of 278 lbs of mail from the nose baggage compartment at Scammon Bay with no other shift of payload. The c.g. change associated with the removal of the 278 lbs in the nose equates to the addition of about 500 lbs in the aft baggage compartment. Therefore, with the c.g. already beyond its aft limit, the removal of 278 lbs from the nose compartment without a compensating load transfer from behind the c.g. resulted in an extremely aft c.g. condition.

The Safety Board did not determine how the crew was able to remove the aft fuselage tail stand with the c.g. so far aft. The weight should have made the removal extremely difficult or could have caused the airplane to settle onto its tail. However, since one engine was running, a sufficiently large nosedown pitching moment apparently was generated by propeller thrust, compensating for the extreme aft c.g. condition.

The flightcrew of Flight 517 supervised the loading and unloading at Chevak and Scammon Bay. In fact, they actually loaded the cargo and baggage into the aft compartment at Chevak and shifted some Scammon Bay and Hooper Bay cargo to the cabin. Similarly, they removed the mail from the nose compartment at Scammon Bay. The pilots actually handled all of the mail and cargo, including the 256 lbs of checked baggage and 646 lbs of mail loaded at Chevak, and they had the weight sheets in their possession. Additionally, they made notations on the daily record of the various individual weights involved, although their total gross weight figures varied somewhat from the actual gross weight upon departure from Chevak and Scammon Bay. Consequently, the Safety Board concludes that the pilots of Flight 517 were aware of the weight and the location of all the payload aboard the airplane and accepted the imbalanced condition. Their failure to compute accurate total weights and their failure to calculate the airplane's c.g. before departure from Scammon Bay prevented them from being aware of the extent of the imbalanced condition. They probably were aware that the airplane was beyond its c.g. limit, but they were not aware how far aft the c.g. actually was or they most likely would have compensated by shifting the load before takeoff. Therefore, the Safety Board concludes that the flightcrew's failure to compute the airplane's c.g. was the primary reason for this accident.

It is apparent, based on the facts of the accident, that the flightcrew lost control of the airplane shortly after starting the final approach to Hooper Bay. The airplane pitched noseup, stalled, and crashed almost vertically onto the snow and ice. The short ground slide (about 50 feet) forward and the extreme downward crushing of the fuselage and wings indicated conclusively that the airplane was stalled or was in poststall recovery at impact.

The pilots lost control of the airplane when they reduced power and extended flaps in preparation for landing. The fact that the captain shouted, "I said more power," indicates that he apparently was aware of the critical longitudinal instability of the airplane and that he probably had previously advised the copilot not to reduce power during the approach. When the nose began to pitch up, the captain ordered the copilot to add power to overcome the pitchup tendency associated with extension of the flaps. The copilot was operating the power levers and the captain was operating the propeller controls and the flap lever. The captain apparently extended flaps to 20° when the airplane was aligned with the final approach and the copilot probably reduced power because the airplane was slightly high. The noseup pitching moments associated with these actions (flap extension and power reduction) were significant and were not counteracted by the pilots in time to prevent a significant increase in pitch attitude. The control forces required to counter the pitching moments were probably considerably greater than the crew had ever encountered or expected because of the extreme aft c.g. conditions. It could not be determined if the noseup pitching moment exceeded the amount of elevator authority available to counter the moment since the danger of this configuration precluded gathering actual flight test

data. Moreover, the deviation may have gone uncorrected for a sufficient period of time for the stall to occur before the crew could react and recover. The passengers' description of the pitchup and stall indicates that the onset was sufficiently rapid that it probably caught the flightcrew by surprise. Nevertheless, the reason for the excessive and uncontrolled pitchup and stall was the extreme aft c.g. which exaggerated the normal pitching moments of the airplane. The stall occurred too close to the ground for the flightcrew to effect recovery.

The crew should have been aware of the extreme aft c.g. condition based on elevator control positioning requirements on departure from Scammon Bay. The airplane would have been noticeably "tail heavy" and longitudinal stability would have been sensitive during the flight. However, the takeoff and en route phase were carried out successfully because of the nosedown pitching moment associated with high power settings and a flaps-retracted configuration.

The Safety Board has identified nonadherence to regulations and operating procedures as causal in numerous commuter airline and air taxi accidents in the past. Such behavior by pilots is generally reflected by similar casual attitudes of company management and ultimately by the lack of adequate oversight and surveillance by the appropriate FAA office. This situation is unusually prevalent in Alaska because of its unique air transportation requirements and environmental conditions. In a Special Study ^{4/} of Alaska air taxi operations, the Safety Board identified the "bush pilot syndrome," the casual acceptance of risks and a willingness to take risks, as a prevalent attitude among many pilots and operators in Alaska. Based on the results of the Special Study, the Safety Board recommended that the Alaska Air Carriers Association, "Extend its safety program to reiterate the hazards of air taxi operations in Alaska and to overcome, in particular, the 'bush pilot syndrome.'" (A-80-105) The Alaska Air Carriers Association responded, in part, that they were launching the Alaska Aviation Safety Foundation for the key purpose of promoting a safe air transportation environment. Lack of funding apparently has precluded the implementation of the efforts envisioned by the Alaska Air Carriers Association.

As a result of the foregoing Special Study, the Safety Board also recommended that "...the FAA locate and maintain permanently a principal operations inspector and a principal maintenance inspector at Nome, Bethel, Ketchikan...." (A-80-102) To support its recommendation, the Safety Board cited the limited ability of the FAA to provide guidance to outlying air taxi operators because of the lack of inspectors at hubs such as Bethel. In this case, the principal inspectors had not visited or inspected the Bethel base for Gifford's operation in its 9 months of operation.

The Safety Board believes that the circumstances of this accident and information gathered during its investigation reinforce the validity of its earlier recommendations and urges prompt action to accomplish them.

^{4/} Special Study "Air Taxi Safety in Alaska," NTSB-AAS-80-3, issued September 16, 1980.

The accident was survivable because the occupiable area of the airplane was not compromised to the extent that fatal injuries occurred, the impact forces (predominantly downward, forward, and to the right) were within human tolerances, and the occupants' restraint systems held the occupants, with the exception of the captain and the passenger who occupied the left rearmost seat. The captain's seatbelt failed because the structure surrounding the left seatbelt fitting was destroyed by impact. The passenger's seatbelt failed because it had been worn and frayed such that its design strength was degraded significantly. Since the pilots were trapped and some passengers were incapacitated by their injuries, if fire had occurred, there probably would have been fatalities.

The degree, type, and location of some of the injuries sustained by the passenger whose seatbelt broke are not consistent with the injury pattern of the other passengers. Therefore, the Safety Board believes that the seatbelt failure contributed to this passenger's injuries. Further, worn and frayed seatbelts were observed on other airplanes operated by Gifford Aviation, Inc. The worn and frayed condition of these seatbelts appeared to have existed for several months which indicates both poor maintenance practices by the operator and poor or nonexistent FAA surveillance of occupant safety and safety equipment.

This is the second commuter accident in recent months in which there were problems pertaining to occupant safety and safety equipment. The Safety Board's investigation of the Pilgrim Airlines deHavilland DHC-6 crash which occurred near Providence, Rhode Island, on February 21, 1982, (NTSB-AAR-82-7) revealed a need to emphasize to the FAA inspectors the provisions of 14 CFR Part 135 regarding occupant safety and safety equipment.

As a result of the Pilgrim Airlines investigation, the Safety Board issued the following recommendation:

Review the training of and the surveillance procedures followed by Federal Aviation Administration inspectors and modify them if necessary to provide increased emphasis on the provisions of 14 CFR Part 135 with regard to occupant safety and safety equipment. (Class II, Priority Action)(A-82-73)

The Safety Board believes that the Hooper Bay accident reinforces the need for prompt and effective action on this recommendation.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the flightcrew's failure to compute and properly interpret the airplane's weight and balance and their operation of the airplane with the center of gravity substantially aft of its authorized limit which resulted in loss of control of the airplane during a landing attempt.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G.H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

November 18, 1982