



# Aviation Investigation Final Report

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<b>Location:</b>	Skagway, Alaska	<b>Accident Number:</b>	ANC16FA023
<b>Date &amp; Time:</b>	May 6, 2016, 19:00 Local	<b>Registration:</b>	N94TH
<b>Aircraft:</b>	Airbus AS350	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	VFR encounter with IMC	<b>Injuries:</b>	1 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Other work use		

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## Analysis

The non-instrument-rated commercial pilot was making a visual flight rules internal-cargo company flight in the helicopter. He was returning to base in the helicopter after dropping off 1 employee and 12 dogs at a remote dog camp situated on a glacier surrounded by mountainous terrain. The pilot had previously completed 5 of the day's 7 planned roundtrip flights from the base to the dog camp. According to the dog camp manager, the weather was deteriorating with snow and wind increasing when the pilot departed on the accident flight. The dog camp manager's observations and radar data indicated that the pilot attempted to depart via the normal route to the south but turned around. He likely encountered low visibility conditions and then attempted several departures by routes to the north of the dog camp. About 8 minutes after departure, the helicopter impacted snow-covered mountainous terrain about 2 miles northeast of the dog camp.

Postaccident examination of the helicopter revealed no evidence of preimpact mechanical anomalies that would have precluded normal operation. Given the deteriorating weather conditions when the pilot departed, it is likely that the pilot continued visual flight into an area of instrument meteorological conditions, which resulted in the pilot experiencing a loss of visual reference and subsequent controlled flight into terrain.

During the impact sequence, the two cargo straps used to secure two wooden dog boxes to the rear cabin floor failed, and the dog boxes shifted forward, striking the back of the pilot's fiberglass seat. It could not be determined if the forward movement of the dog boxes during the accident sequence contributed to the injuries sustained by the pilot.

Immediately before departing from the dog camp on the accident flight, the pilot told the dog camp manager that, due to the degrading weather conditions, he would not be coming back for the last scheduled trip of the day, and the dog camp manager told the pilot that he agreed with him. However, the pilot then told the dog camp manager, "but don't give up on me yet," a statement consistent with self-induced pressure to complete the day's series of flights.

On one of the day's previous flights, the pilot reported to the base manager, who was exercising operational control at the time of the accident, that he had encountered icing conditions while in flight. The base manager told the pilot "to do what he thought was best." However, flight operations in icing conditions are prohibited by the helicopter's rotorcraft flight manual and the operator's operations manual, and the pilot's statement should have prompted the base manager to suspend the flights. If flight operations had been cancelled for the day when the pilot reported the icing conditions, the subsequent flights, including the accident flight, would not have occurred. The base manager's failure to appropriately exercise operational control and terminate the flights may have been due to the difference in experience between the base manager, who had been operating these flights for 8 years, and the pilot, who had been operating these flights for 25 years.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's decision to continue visual flight into an area of instrument meteorological conditions, which resulted in the pilot experiencing a loss of visual reference and subsequent controlled flight into terrain. Contributing to the accident were the pilot's self-induced pressure to complete the flight and the operator's failure to maintain operational control over the flight.

### Findings

<b>Personnel issues</b>	Decision making/judgment - Pilot
<b>Personnel issues</b>	Situational awareness - Pilot
<b>Personnel issues</b>	Monitoring environment - Pilot
<b>Personnel issues</b>	Aircraft control - Pilot
<b>Aircraft</b>	Altitude - Not attained/maintained
<b>Environmental issues</b>	Below VFR minima - Decision related to condition
<b>Personnel issues</b>	Motivation/respond to pressure - Pilot
<b>Organizational issues</b>	Oversight of operation - Operator

## Factual Information

### History of Flight

<b>Enroute</b>	VFR encounter with IMC (Defining event)
<b>Enroute</b>	Loss of visual reference
<b>Enroute</b>	Controlled flight into terr/obj (CFIT)

On May 6, 2016, about 1900 Alaska daylight time, an Airbus (formerly Eurocopter) AS 350 B2 helicopter, N94TH, collided with snow-covered mountainous terrain about 4 miles southeast of Skagway, Alaska, after departing from a remote landing site on the Denver Glacier. The commercial pilot received fatal injuries, and the helicopter sustained substantial damage. The helicopter was registered to and operated by TEMSCO Helicopters, Inc., Ketchikan, Alaska, under the provisions of Title 14 *Code of Federal Regulations (CFR)* Part 91 as a visual flight rules (VFR) internal-cargo company flight. Instrument meteorological conditions were reported on the Denver Glacier at the time of the accident, and company flight following procedures were in effect. The flight originated from a heliport at the operator's headquarters in Skagway about 1840, landed at the remote site for several minutes, and departed for the return flight about 1852.

Alaska Icefield Expeditions, Inc., contracted with TEMSCO to provide helicopter support for the movement of personnel, dogs, and cargo. The purpose of the flight was to transport dog camp company personnel (mushers) and dogs (Alaskan Huskies) from the operator's headquarters in Skagway to a remote dog camp on the Denver Glacier in the Tongass National Forest, about 5 miles southeast of Skagway. TEMSCO and Alaska Icefield Expeditions conducted heli-mushing operations for the Alaska tourism industry using a helicopter glacier landing permit issued by the US Forest Service.

The pilot was scheduled for seven continuous roundtrip flights (without shutting down the helicopter) to the dog camp on the day of the accident. All flights scheduled for the day of the accident fell under the operational control of the base manager, who was located at TEMSCO's headquarters in Skagway. The pilot was ready to begin flight operations at 0800, but low ceilings prevented flight operations. The pilot attended company orientation training at 0900, and, at 1300, he provided helicopter loading training for new TEMSCO employees. At 1530, the pilot completed the training and evaluated the weather for flight operations. The pilot determined that the wind conditions were unsuitable at the time but were forecasted to improve later in the afternoon.

The dog camp manager, who was located at the dog camp on the Denver Glacier, was responsible for managing operations of the dog camp. He reported that, on the day of the accident, from about 0600 to 1200, the weather in the dog camp was cloudy, snowing, and foggy, and the visibility was "a few hundred yards." At 1200, the clouds broke, the snow stopped, and visibility was such that he could see through Paradise Valley across the Taiya Inlet. He reported that flight operations were cancelled because of the wind; the wind on the glacier was between 10 and 15 mph. About 1630, TEMSCO informed the dog camp manager, that flight operations would begin to deliver mushers and dogs to the camp.

At 1645, the wind speed had dropped significantly at the base, and the pilot decided it was safe to

launch. The pilot completed two roundtrips, each with 1 musher and 10 dogs on board the helicopter. The dog camp manager stated that it was snowing as these flights arrived. At 1738, the pilot called inbound from the Denver Glacier to the base, and the base manager asked the pilot about the weather conditions. The pilot reported to the base manger that there was turbulence around the toe of the glacier and that he was keeping his airspeed down for a smoother ride. Based on the pilot's report, the base manager decided to cancel a scheduled external load flight that he had planned to fly and load the cargo internally in another helicopter.

At 1747, the helicopter departed from the base for the third trip, again with 1 musher and 10 dogs onboard. En route to the glacier, the pilot reported to the base manager that he "experienced a little bit of inflight icing" at 3,000 ft mean sea level (msl). The base manager asked the pilot what kind of precipitation he was experiencing, and the pilot reported "wet snow." The base manager told the pilot "to do what he thought was best." The pilot responded that he would evaluate the icing conditions as he flew on the subsequent flights. The fourth and fifth roundtrips were completed uneventfully; the fourth carried 1 musher and 10 dogs, and the fifth carried 1 musher and 11 dogs.

At 1840, the helicopter departed for the sixth trip with 1 musher and 12 dogs onboard. As the helicopter passed through Paradise Valley, the passenger reported that the valley itself was "wide open" with a rainbow present, but he and the pilot could see that the clouds were "moving in" as the helicopter approached the Denver Glacier. The passenger reported that the clouds were "thick," and he could not see up the glacier toward the dog camp. The passenger further reported that the western mountain wall near the glacier was visible at the time, so the pilot elected to follow the wall into the dog camp "very slowly." He stated that the helicopter was "very low" with regard to the bluff and was closer to the wall than he had ever been on previous flights up to the dog camp. The dog camp manager reported that just before the sixth flight arrived, the wind speed was up to 20 to 30 mph, and it was snowing. The clouds had moved in and covered the bluff; visibility was about a 1/4 mile looking toward Paradise Valley. The helicopter landed at the dog camp, and the musher and 12 dogs were unloaded.

Before the pilot left, he signaled for the dog camp manager and told him that he was "not coming back in this weather." The dog camp manager verbally agreed. The dog camp manager told the pilot to be safe, and the pilot said to the dog camp manager, "but don't give up on me yet." The pilot then departed from the dog camp at 1852 and headed toward Paradise Valley.

According to the dog camp manager, the helicopter traveled about 1/8 mile toward Paradise Valley, turned around, and then turned north. The dog camp manager reported that the visibility looking north from the dog camp appeared to be about 1/4 mile. He noticed that the snow rate had picked up "considerably," and the wind speed was still between 20 and 30 mph.

A review of Harris OpsVue track data was conducted during the timeframe of 1815 to 1915. The OpsVue data indicated the accident helicopter was making multiple 360° turns before turning to the north and east and continuing to make turns. As the helicopter was tracking toward the east, the altitude was trending up in a slow climb before descending near the accident site.

About 1900, the TEMSCO base manager noted that he had not heard any communication on the radio for a few minutes, so he asked about the status of the accident helicopter and noticed on the flight tracking computer that the helicopter's position was northwest of the dog camp at an elevation of about

6,200 ft msl, about 2,000 ft above the dog camp's elevation. He made several radio calls to the pilot, and no responses were received. After repeated radio calls with no response from the pilot, the base manager decided to launch in a helicopter with an observer on onboard. The company emergency response plan was activated. At 1914, the base manager departed to the last known coordinates of the missing helicopter. The base manager reported that he was unable to fly over the dog camp via Paradise Valley at 1924 due to low ceilings, blowing snow, and turbulence.

At 1942, the base manager reported that he was maneuvering near the North Denver Icefall area, and he was unable to climb higher than 4,000 ft msl due to low ceilings, blowing snow, and "mechanical" turbulence. By 1948, the base manager reported "improving" ceilings and being able to maneuver around 5,000 ft msl. At 2009, the base manager and observer visually confirmed the wreckage of the accident helicopter lying on its left side with the tailboom separated in steep, mountainous terrain near a frozen glacial lake, about 2 miles northeast of the dog camp.

After the base manger confirmed the location of the wreckage, he asked if the dog camp personnel could travel to the wreckage site. The dog camp manager and several other workers rode two snow machines toward the wreckage; they noted the wind speed was between 30 and 40 mph and visibility was between zero and "a few hundred feet" in blowing snow. As they proceeded toward the wreckage, the wind speed increased to between 50 and 70 mph. The dog camp personnel were unable to proceed any farther due to the steep terrain and the possibility of avalanches.

The base manager attempted multiple times to land at the accident site but was unable to land due to high wind and flat light conditions. About 2200, a US Coast Guard helicopter attempted to access the accident site but was unsuccessful due to the wind conditions. After dumping fuel, the Coast Guard helicopter was able to access the accident site, and an aviation survival technician (helicopter rescue swimmer) confirmed one fatality in the wreckage.

## Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	66, Male
<b>Airplane Rating(s):</b>	Single-engine sea	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	February 27, 2016
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	March 19, 2016
<b>Flight Time:</b>	(Estimated) 7190 hours (Total, all aircraft), 5700 hours (Total, this make and model), 6690 hours (Pilot In Command, all aircraft), 5 hours (Last 90 days, all aircraft), 3 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

The pilot, age 66, held a commercial pilot certificate with a rotorcraft-helicopter rating and held private pilot privileges for airplane single-engine land. The pilot did not have and was not required to have a helicopter instrument rating. His most recent second-class medical certificate was issued on February 27, 2016, with the limitation that he must wear corrective lenses.

According to the operator, the pilot's total aeronautical experience was about 7,190 hours of which about 5,700 hours were in the accident helicopter make and model. In the 90 and 30 days before the accident, the pilot flew 5 and 3 flight hours, respectively. This was his 25th season with TEMSCO.

The operator's pilot training records showed no deficiencies and indicated that the pilot had completed all required training, including a competency check ride on March 19, 2016.

The Skagway base manager, age 30, held a commercial pilot certificate with a rotorcraft-helicopter and instrument helicopter rating. His total aeronautical experience was about 3,445 hours, and this was his eighth season with TEMSCO. All of his eight seasons were in Skagway.

### Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Airbus	<b>Registration:</b>	N94TH
<b>Model/Series:</b>	AS350 B2	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>	1991	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	2548
<b>Landing Gear Type:</b>	Emergency float; High skid	<b>Seats:</b>	6
<b>Date/Type of Last Inspection:</b>	December 17, 2015 Annual	<b>Certified Max Gross Wt.:</b>	4961 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Turbo shaft
<b>Airframe Total Time:</b>	10190.5 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Safran (formerly Turbomeca)
<b>ELT:</b>	C126 installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	Arriel 1D1
<b>Registered Owner:</b>	TEMSCO HELICOPTERS, INC.	<b>Rated Power:</b>	760 Horsepower
<b>Operator:</b>	TEMSCO HELICOPTERS, INC.	<b>Operating Certificate(s) Held:</b>	Rotorcraft external load (133), On-demand air taxi (135), Commercial air tour (136)

The 1991-model-year helicopter was equipped with a Safran (formerly Turbomeca) Arriel 1D1 turboshaft engine. According to the operator's records, at the time of the accident, the helicopter had accumulated 10,190.5 flight hours, and the engine had accumulated 4,281.6 hours. The most recent inspection of the airframe and engine was completed on December 17, 2015. An examination of the helicopter's maintenance records revealed no evidence of uncorrected mechanical discrepancies with the airframe and engine.

The helicopter was originally manufactured as an AS 350 B and was converted to an AS 350 BA in 1992 and then to an AS 350 B2 in 2003. The helicopter was configured to be flown from the right front seat, which was a non-energy attenuating, fiberglass seat. The left front seat that was installed in the helicopter was a single-place, non-energy attenuating, fiberglass seat.

The helicopter was not equipped with a radar altimeter, nor was it required to be at the time of the accident. The helicopter was equipped with a Federal Aviation Administration (FAA) Capstone Project avionics package. The skid system of the helicopter included snow/tundra boards mounted on the aft ends of both skid tubes along with an emergency floatation system on both skid tubes.

TEMSCO configured the helicopter cabin to facilitate the transportation of internal cargo. The rear seat assembly was folded up against the cabin wall, and two wood, dog transportation boxes were placed behind the front seats. A tarp, blanket, and wood shoring were placed between the lower box and the cabin floor. The dog boxes were stacked vertically and secured using two cargo straps attached to a total of four seat belt attachment rings installed on the floor of the cabin. Both cargo straps were secured to the rear seat belt attachment points in front of the aft cabin wall, routed over the top of the stacked boxes, and secured to the pilot and front passenger seat belt attachment points. With the configuration of the two cargo straps, forward restraint was present; however, no lateral restraint was present. Neither dog box had a placarded weight value on the outside of it.

The make and model of the cargo straps, as well as the maximum load rating of the straps, could not be determined. The two cargo straps had abrasions at various locations along with unknown stains throughout the length of the straps.

The Airbus AS 350 B2 rotorcraft flight manual (RFM) discusses required placards in the limitations section and states that a loading instruction placard is to be mounted on the side face of the control pedestal. On the accident helicopter, the placard was found mounted on the rear of the control pedestal. This placard listed the "distributed loads maximum" for the rear cabin floor as 682 pounds.

The combined weight of the two wood dog boxes was 190.5 pounds; the wood boards used for shoring on the cabin floor weighed 9.5 pounds; and the blanket, tarp, and two cargo straps weighed 5 pounds. The total weight of 205 pounds was not included on the cargo manifest documents for the day's flights or the helicopter's weight and balance record.

On each of the first four flights from Skagway to the dog camp, the total dog weight entered on the cargo manifest form was 500 pounds (10 dogs on board). On the fifth flight, the dog weight entered was 550 pounds (11 dogs on board). On the sixth flight, the dog weight entered was 600 pounds (12 dogs on board). For all six flights from Skagway to the dog camp, the weight of the dog boxes and related items (205 pounds) combined with the dog weight resulted in the structural limitation of 682 pounds being exceeded.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Instrument (IMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	PAGY,20 ft msl	<b>Distance from Accident Site:</b>	4 Nautical Miles
<b>Observation Time:</b>	02:53 Local	<b>Direction from Accident Site:</b>	271°
<b>Lowest Cloud Condition:</b>	Few / 8000 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	19 knots / 28 knots	<b>Turbulence Type Forecast/Actual:</b>	/ None
<b>Wind Direction:</b>	210°	<b>Turbulence Severity Forecast/Actual:</b>	/ N/A
<b>Altimeter Setting:</b>	29.79 inches Hg	<b>Temperature/Dew Point:</b>	12°C / 3°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	SKAGWAY, AK	<b>Type of Flight Plan Filed:</b>	Company VFR
<b>Destination:</b>	SKAGWAY, AK	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>		<b>Type of Airspace:</b>	Class G

The closest official weather observation station to the accident site was located at the Skagway Airport, Skagway, about 4 miles northwest of the accident site. At 1853, the reported weather conditions were wind 210° at 19 knots gusting to 28 knots, visibility 10 statute miles, few clouds at 8,000 ft, temperature 53°F, dew point 37°F, and altimeter setting 29.81 inches of mercury.

Refer to the Meteorology Group Chairman's Factual Report in the public docket for further weather information.

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Fatal	<b>Latitude, Longitude:</b>	59.450279,-135.205551(est)

On May 8, 2016, the NTSB investigator-in-charge (IIC), along with an additional NTSB investigator, an aviation safety inspector (ASI) from the FAA's Juneau Flight Standards District Office (FSDO), and a representative from TEMSCO traveled to the accident scene via helicopter.

All the major components of the helicopter were found at the main wreckage site. The accident site was in an area of steep, mountainous terrain covered with deep snow, at an elevation of about 4,200 ft mean sea level, near a frozen glacial lake. The impact point of the helicopter was on about a 090° heading (magnetic). Scattered downslope from the helicopter were small portions of wreckage debris, broken



Plexiglass, and personal effects.

The helicopter fuselage was lying on its left side with the nose oriented to the south. The Artex ME406 emergency locator transmitter (ELT) antenna wire had separated during the accident sequence.

The cockpit was severely damaged with extensive deformation. The canopy was segmented and separated with all canopy glass windscreens and overhead transparencies shattered or missing.

The cockpit levers and switches appeared to be configured for normal flight except for the guarded HYD TEST (in position), BATT/EPU (off position), and HORN switch (out position) on the center console, which had sustained impact damage.

The aft cabin was bent and buckled inward along the upper roof area. Both cargo straps used to secure the dog boxes were found separated. The top dog box was lodged in the forward cockpit area against the rear of the pilot's seat. The pilot's seat sustained multiple fractures to the rear and base of the seat, and the seat was separated from the floor.

The bottom of the fuselage exhibited severe deformation with a large section of the skin missing just below the fuel cell.

The left skid remained relatively intact and was buried in snow. The right skid tube separated from the two crosstubes.

The tailboom separated from the fuselage just aft of the fuselage. Both tail rotor blades exhibited damage consistent with multiple terrain strikes under power.

The yellow main rotor blade remained attached to the Starflex assembly and was lying downhill from the fuselage. The red and blue main rotor blades, including part of the Starflex assembly, were partially buried beneath the snow and underneath the fuselage. All main rotor blade portions visible above the snow exhibited damage consistent with sudden stoppage associated with multiple terrain strikes while under power.

The main rotor system, transmission, and engine areas displayed damage consistent with rolling over while under power after the initial impact with terrain. The left side of the main rotor system, transmission, and engine were lying against the snow-covered terrain. No evidence of preimpact mechanical anomalies with the airframe and engine were found during the onsite examination.

The wreckage was recovered from the accident site and transported to a secure hangar at the Juneau International Airport, Juneau, Alaska. On June 9, 2016, a wreckage examination and layout were done under the direction of the NTSB IIC. Also present were an ASI from the FAA Juneau FSDO, an air safety investigator from Airbus, an air safety investigator from Safran, and three representatives from TEMSCO. During the examination, no preimpact mechanical malfunctions or failures with the airframe and engine were noted.

## **Flight recorders**

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The helicopter was not equipped and was not required to be equipped with a cockpit voice recorder, flight data recorder, or image recorder. A Latitude Technologies S200-001 flight tracker, a Garmin GDL 90 datalink transceiver, and an AKV ETM 1000 engine and rotor system monitoring device were recovered from the wreckage. These electronic devices were not designed for crash resistance or survivability.

The Latitude Technologies Corporation S200-001 flight tracker, which was used by TEMSCO for flight tracking purposes, was transported to the manufacturer's facility in Victoria, British Columbia, Canada, for an examination of the unit and subsequent data download. According to the manufacturer, the unit had the original firmware installed from when the unit was released in February 2009 with no subsequent firmware updates. The manufacturer additionally reported that this build of firmware had a previously unknown "bug" resulting in the data being captured in the background log being identical to the data that were transmitted while the helicopter was in flight with no additional GPS data in between the transmitted logs being captured. At the time of the accident, the operator had the "ping rate" set to every 120 seconds.

The Garmin GDL 90 and the AK ETM 1000 devices were submitted to the NTSB Vehicle Recorder Laboratory in Washington, DC, for examination and download. No track or navigation data was stored on the Garmin GDL 90. Various engine and main rotor system parameters were recorded for the accident flight on the AK ETM 1000.

Refer to the Recorder Specialist's Factual Report in the public docket for further information regarding the Garmin GDL 90 and an AKV ETM 1000 devices.

## **Medical and Pathological Information**

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The Alaska State Medical Examiner, Anchorage, Alaska, conducted an autopsy of the pilot. The cause of death for the pilot was attributed to multiple blunt force injuries.

The FAA's Bioaeronautical Research Sciences Laboratory, Oklahoma City, Oklahoma, performed toxicology tests on specimens from the pilot that were negative for carbon monoxide, ethanol, and drugs. Cyanide tests were not performed.

## **Survival Aspects**

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The pilot was seated in the front right seat and was wearing a 4-point restraint system at the time of the accident. The pilot did not wear and was not required to wear a flight helmet.

## Tests and Research

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The caution-warning light panel from the helicopter was submitted to the NTSB Materials Laboratory for examination. The panel was x-rayed to determine the filament status of the light bulbs within the panel. The examination determined that none of the filaments exhibited hot filament stretching.

## Organizational and Management Information

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### *TEMSCO Operations*

The TEMSCO Operations Manual discusses icing conditions and states:

*Helicopter flights during icing conditions are prohibited. TEMSCO shall not fly into known icing conditions. If icing conditions are encountered, the Pilot-in-Command will deviate from course to avoid and navigate around any encountered icing conditions.*

The Airbus AS 350 B2 Rotorcraft Flight Manual lists "flight in freezing rain or icing conditions (visible moisture and temperatures likely to produce ice)" as a prohibited maneuver in the limitations section.

The TEMSCO Operations Manual discusses operational control and states:

*Operational control with respect to a flight, means the exercise of authority over initiating, conducting, or terminating a flight. The Director of Operations and the pilot in command are jointly responsible for the initiation, continuation, diversion, and termination of a flight. The Director of Operations may delegate functions to other trained personnel, but retains responsibility for initiation, continuation, diversion, and termination. The final authority over conducting or terminating a flight rests with the pilot in command. The following persons have "operational control" with respect to flight in descending order: director of operations, chief pilot, pilot in command, second in command, director of maintenance, base managers, base lead pilot, and trained flight followers.*

The FAA's Order 8900.1, Flight Standards Information Management System, identifies one of several failure modes of operational control and states:

*Loss of operational control within the air carrier – hands-off management results in inadequate controls over its own operations. Management of operations should never be inattentive, distracted, or careless. Hands-off management is not a legitimate excuse for failing to maintain operational control.*

FAA Operations Specification A008 Operational Control states that non-management personnel exercising operational control shall be specified in the general operations manual (names, titles, duties, responsibilities, and authorities). A review of the TEMSCO Operations Manual showed that, for the operational control chain of command, the base lead pilot positions were listed "as assigned" with no names listed, and the trained flight follower positions had no names listed.

A formal flight risk assessment was not conducted by the pilot for the accident flight, nor was it required by the operator at the time of the accident. The TEMSCO Safety Management Systems Manual states that flight risk assessments are to be conducted for emergency medical services and tour operations.

The TEMSCO Operations Manual discusses company VFR weather minimums and states that, for the local operating area (within a 30-nautical-mile radius from the base of operations), a 500 ft ceiling or greater and 1 statute mile visibility or greater is required. The manual states that the lowest of the ceiling or visibility shall be the limiting factor for dispatch.

A review of the TEMSCO Operations Manual found no operational procedures listed for flight operations in deteriorating VFR weather conditions (such as reduced visibility and ceilings), inadvertent instrument meteorological conditions (IIMC) avoidance procedures, or IIMC recovery procedures.

#### *TEMSCO Internal Cargo Operations*

The TEMSCO Operations Manual discusses internal cargo carried in passenger compartments and states:

*Will be secured by means approved by the FAA. Will be carried in accordance with each of the following: Will be properly secured by a safety belt or other tie down having enough strength to eliminate the possibility of shifting under normally anticipated flight and ground conditions. Will be packaged or covered to avoid possible injury to passengers. It will not impose any load on seats or on the floor structure that exceeds the load limitations for those requirements. It will not be located in a position that restricts the access to or use of any required emergency or regular exit, or the use of the aisle between the crew and the passenger compartment. It will not be carried directly above seated passengers.*

This document further discusses the limitations of carriage of cargo in the passenger compartments and states:

*Each bay or bin will be able to withstand the load factor as applicable to passenger seats of the aircraft. The maximum weight of cargo that each bin or bay is approved to carry will not be exceeded. Each bay will be loaded to insure proper weight distribution when using cargo load schedule. The load will not impose any load on the floor or other structure of the aircraft that exceeds the limitations of that structure. The maximum concentrated load for each compartment will not be exceeded. The bin or netting for loose cargo will be attached to the seat tracks or to the floor structure of the aircraft and its attachment must withstand the load factors applicable to the passenger seats. The cargo will not restrict access to or use of any required exit or aisle in the passenger compartment. It will be the responsibility of the Pilot-In-Command to check and ensure that all cargo and passenger doors are properly secured prior to any flight.*

The operator reported that before the accident, the company conducted internal cargo load training for contract, charter, and utility pilots at company headquarters in Ketchikan, which was hands-on training that was both mission-specific and aircraft-specific with no training syllabus or published curriculum at the time. The training was not conducted with the tour pilots.

After the accident, the operator developed internal cargo loading guidelines for all company Airbus AS 350 pilots. This document covers cargo strap standards (what type to use), the various helicopter floor weight limitations, and the various limitations of the mooring rings. The document also highlights the importance of not exceeding any limitations of seat-belt-based mooring rings when a ring is used to restrain cargo and the seat is occupied.

### *Tour Operators Program of Safety*

At the time of the accident, the operator was a member of the Tour Operators Program of Safety (TOPS). The most recent TOPS compliance audit on the operator before the accident took place from August 8 through August 10, 2015. All the audit areas (management, safety, flight operations, pilots, flight coordination, heliport, maintenance, maintenance personnel, and ground support personnel) along with base visits and flight observations were classified as "meets TOPS standards."

## **Additional Information**

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### *Carriage of Internal Cargo in Airbus AS 350 Series Helicopters*

The NTSB IIC submitted multiple inquiries during the investigation to the FAA Office of Accident Investigation and Prevention, Washington, DC, regarding the carriage of internal cargo in the Airbus AS 350 series. On March 28, 2017, the FAA responded, in part:

*The FAA does not require original equipment manufacturers (OEMs) to publish information regarding cargo loading. The certification assumption is that the helicopter will be used to carry people, unless indicated otherwise by the applicant. In the case of the AS350, Airbus did not indicate that anything other than passengers will be carried.*

In its March 28, 2017, response, the FAA also stated:

*Any "approved" cargo installation will be explained in the rotorcraft flight manual (RFM) limitation or supplement section – (what tie-downs are used, what straps are used, etc.); loading instructions (what areas in the cabin get loaded first, second, etc.); and procedures (walk around procedures will mention to verify cargo secured). Operators do not have certification approval to install cargo in the cabin unless it is mentioned in the RFM or [RFM supplement] RFMS (part of the [type certificate] TC or an STC) – installation instructions are provided in the flight manual. It is possible that there may be some operators that have been using existing tie-downs/seat rails to tie down cargo in the cabin, and incorrectly assuming that this is a "certified" installation when in fact it is not. ... The RFM or RFM supplement will be clear as to what is approved regarding internal cargo (if it does not mention how and where to install cargo, then it's not certified).*

In a response on August 25, 2017, the FAA stated, "our position is the same as in the other queries from the NTSB regarding cabin cargo – operators should not be securing cargo in areas unless doing so has been FAA approved (basic design, design change, field approval, etc.)." In a letter dated August 29, 2017, the FAA stated, in part:

*Also, while a definition for a cargo/baggage compartment in rotorcraft does not exist, the FAA has interpreted this as a compartment (enclosed area) that is separated from the cabin (passenger area). ... Additionally, the FAA is not aware of any documentation that would prohibit Part 27 rotorcraft from carrying cargo in the cabin, even if a certification does not exist for that helicopter.*

The NTSB submitted a follow-up question to the FAA asking: From a regulatory aspect: If an aircraft is not certified for a particular task, does it mean that the task is prohibited? The specific example that is being investigated is the carriage of cargo in the main cabin of helicopters certified under Part 27. Most rotorcraft operating manuals don't address the carriage of cargo. Most Part 27 helicopters do not have certification for the carriage of cargo. Does that mean the carriage of cargo in these helicopters is prohibited?

On January 25, 2018, the FAA responded, stating, in part:

*The FAA's Aircraft Certification Service (AIR) certifies designs that are compliant with the applicable airworthiness standards. AIR does not approve operations (i.e. particular tasks); operational approvals are issued by the FAA's Flight Standards Service (AFS). When AIR certifies a design for a certain operation, the certification only ensures the design meets the design requirements set forth by the FAA. Approved cabin cargo designs include pertinent safety information such as maximum weight of the cargo, location of the cargo in the cabin, and how the cargo is secured to the airframe. ... As previously stated by FAA, if an FAA-approved cabin cargo configuration has been published for a specific aircraft, the flight manual for that aircraft is where the information will be found.*

As previously stated, review of the Airbus AS 350 B2 RFM found that it discusses required placards in the limitations section and states that a loading instruction placard is to be mounted on the side face of the control pedestal. No other information regarding the carriage of cargo in the cabin was found in the RFM.

Regarding internal cargo, the Airbus AS 350 Systems and Descriptions Manual states, "further to removing the front [left seat] and folding back the rear benches, the cabin floor can be used to transport cargo. The eleven mooring points are embedded into the floor and are also used to attach the seatbelts." The manual also lists the "limit permissible force on a mooring ring" as 620 dekanewtons or 1393.7 pound-force.

On April 21, 2017, Airbus stated in an email to the NTSB IIC that "it is the responsibility of the operator to define an adapted cargo, freight, or baggage securement that is in respect to the limitations permissible force on the floor stowing mooring rings." On June 26, 2018, the Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile reported to the NTSB IIC that Airbus has developed a "cargo installation in cabin" procedure for the Airbus AS 350 series, which is currently in the certification process.

### *Helicopter Internal Cargo Securement*

The US Army's Training Circular 3-04.4, Fundamentals of Flight, discusses the securement of internal cargo in helicopters and states:

*Aircraft are subjected to G-forces resulting from air turbulence, acceleration, rough or crash landings, and aerial maneuvers. Since the cargo is moving at the same rate of speed as the aircraft, forward movement is the strongest force likely to act on cargo if the aircraft is suddenly slowed or stopped. Other forces which tend to shift cargo aft, laterally, or vertically will be less severe. Restraining or tie-down devices prevent cargo movement that could result in injury to occupants, damage to the aircraft or cargo, or cause the aircraft center of gravity to move out of limits. The amount of restraint required to keep cargo from moving in any direction is called restraint criteria and is expressed in Gs. The maximum force exerted by an item of cargo is equal to its normal weight times the number of Gs specified in restraint criteria. Restraint criteria are normally different for each type of aircraft and provided in the operator's manual. To prevent cargo movement, the amount of restraint applied should equal or exceed the amount of restraint required. Restraint is referred to by the direction in which it keeps cargo from moving. For example, forward restraint keeps cargo from moving forward and aft restraint keeps cargo from moving aft.*

A search revealed no regulatory guidance or best practices available from the FAA regarding the care, inspection, and maintenance of cargo straps used for internal cargo operations with helicopters.

### *Self-Induced Pressure*

The FAA's Helicopter Flying Handbook, FAA-H-8083-21, discusses effective aeronautical decision-making and, with regard to operational pitfalls, states, in part:

*There are numerous classic behavioral traps that can ensnare the unwary pilot. Pilots, particularly those with considerable experience, try to complete a flight as planned, please passengers, and meet schedules. This basic drive to achieve can have an adverse effect on safety and can impose an unrealistic assessment of piloting skills under stressful conditions. These tendencies ultimately may bring about practices that are dangerous and sometimes illegal and may lead to a mishap. Pilots develop awareness and learn to avoid many of these operational pitfalls through effective single-pilot resource management training.*

### *Aviation Safety in Alaska*

The NTSB's safety study, Aviation Safety in Alaska SS-95/03, discusses aviation safety issues with weather and risk taking in Alaska and states, in part:

*Flying weather in Alaska can be quite variable depending on the climate zone and time of year. Although all parts of Alaska experience periods of instrument meteorological conditions (IMC), such conditions are frequent in the Aleutian Islands, Alaska Peninsula, southeast Alaska, and the Arctic Coast during the summer and early fall. Weather conditions can change rapidly in Alaska, and the vast distances between some reporting points will often conceal significant local variations in the weather. VFR flight into IMC usually involves poor pilot decision making, whether in initiating the flight or continuing it into adverse weather.*

### *Training Device and Simulator Usage*

The operator was asked by the NTSB IIC if any aviation training devices (ATD), flight training devices (FTD), or full flight simulators (FFS) for training Airbus AS 350 pilots in Alaska in areas such as flight operations in flat light conditions, flight operations in degraded visual meteorological conditions, and IIMC recovery were utilized. The operator reported that they use the actual helicopter and real-world training scenarios when training their pilots for operations in flat light conditions and degraded visual meteorological conditions. The operator has their pilots use instrument hood devices to train for IIMC avoidance and recovery. Additionally, the operator uses the actual helicopter and an FAA Capstone Project training device to assist in training terrain avoidance. The operator further reported that they are in the process of acquiring a level 5 FFS for the Airbus AS 350.

The NTSB has published Safety Alert SA-031, "Safety Through Helicopters Simulators." This document discusses the benefits of utilizing helicopter simulators and states in part:

*Through simulator training, operators can provide pilots a valuable tool to ensure proficiency in emergency procedures, including autorotations, use of night vision goggles, recognition of degraded visual conditions, and recovery from unusual attitudes. Consistent, standardized simulator training will help prepare pilots for the unexpected and will decrease the risk of an accident. Simulators can be a helpful tool for operators to provide pilot training on degraded visual conditions, safe decision-making skills, and IIMC encounters. By practicing potential emergencies, pilots will be better equipped to handle emergency situations.*

## **Preventing Similar Accidents**

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### Reduced Visual References Require Vigilance (SA-020)

#### **The Problem**

About two-thirds of general aviation accidents that occur in reduced visibility weather conditions are fatal. The accidents can involve pilot spatial disorientation or controlled flight into terrain. Even in visual weather conditions, flights at night over areas with limited ground lighting (which provides few visual ground references) can be challenging.

#### **What can you do?**

- Obtain an official preflight weather briefing, and use all appropriate sources of weather information to make timely in-flight decisions. Other weather sources and in-cockpit weather equipment can supplement official information.
- Refuse to allow external pressures, such as the desire to save time or money or the fear of disappointing passengers, to influence you to attempt or continue a flight in conditions in which you are not comfortable.



- Be honest with yourself about your skill limitations. Plan ahead with cancellation or diversion alternatives. Brief passengers about the alternatives before the flight.
- Seek training to ensure that you are proficient and fully understand the features and limitations of the equipment in your aircraft, particularly how to use all features of the avionics, autopilot systems, and weather information resources.
- Don't allow a situation to become dangerous before deciding to act. Be honest with air traffic controllers about your situation, and explain it to them if you need help.
- Remember that, when flying at night, even visual weather conditions can be challenging. Remote areas with limited ground lighting provide limited visual references cues for pilots, which can be disorienting or render rising terrain visually imperceptible. When planning a night VFR flight, use topographic references to familiarize yourself with surrounding terrain. Consider following instrument procedures if you are instrument rated or avoiding areas with limited ground lighting (such as remote or mountainous areas) if you are not.
- Manage distractions: Many accidents result when a pilot is distracted momentarily from the primary task of flying.

See <https://www.nts.gov/Advocacy/safety-alerts/Documents/SA-020.pdf> for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

## Administrative Information

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**Original Publish Date:** October 1, 2018

**Last Revision Date:**

**Investigation Class:** [Class](#)

**Note:** The NTSB traveled to the scene of this accident.

**Investigation Docket:** <https://data.nts.gov/Docket?ProjectID=93116>

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).