
		NTSB ID: DCA02MA003		Aircraft Registration Number: N9530F	
		Occurrence Date: 10/10/2001		Most Critical Injury: Fatal	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place Dillingham		State AK	Zip Code	Local Time 0926	Time Zone ADT
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility: 1			
Aircraft Information Summary					
Aircraft Manufacturer Cessna			Model/Series 208		Type of Aircraft Airplane
Revenue Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:					
HISTORY OF FLIGHT					
<p>On October 10, 2001, about 0926 Alaska daylight time (all times in this brief are Alaska daylight time based on a 24-hour clock), Peninsula Airways, Inc. (PenAir) flight 350, a Cessna CE-208 Caravan, N9530F, crashed shortly after takeoff from the Dillingham Airport (DLG), Dillingham, Alaska. The pilot and nine passengers were killed, and the airplane was destroyed. (One passenger was evacuated to Anchorage, Alaska, but died the next day.) There was no fire. The impact site was located about 0.7 nautical miles (nm) northeast of the departure end of runway 01 at DLG. The accident occurred during daylight hours, and visual meteorological conditions prevailed at the time of the accident. The flight was operated by PenAir as a visual flight rules flight in accordance with Title 14 Code of Federal Regulations (CFR) Part 135 of the Federal Aviation Regulations (FAR). Flight 350 was bound from DLG to King Salmon, Alaska.</p>					
<p>The pilot of the accident airplane arrived for duty at DLG about 0800 the morning of the accident. The flight coordinator informed the pilot that he would fly N9530F to King Salmon, Alaska, with nine passengers.</p>					
<p>The airplane had been parked outside on the ramp overnight, and flight 350 was to be its first flight of the day. DLG had experienced light rain and mist for most of the day before the accident. This precipitation turned to light snow and mist about 2016 and continued until about midnight as the first major winter weather of the season passed through the Dillingham area. Temperatures dropped steadily to about -4 degrees C (24 degrees F).</p>					
<p>Several pilots whose airplanes were also parked outside overnight were interviewed about the snow accumulation on their airplanes the morning of the accident. A PenAir check airman who was scheduled to fly a Cherokee to King Salmon, Alaska, with the overflow passengers from PenAir flight 350 described the contamination on his airplane as "like epoxy" and said that he observed that the snow/ice on his airplane and on the accident airplane were the same. Another PenAir pilot reported that his airplane had 1/8-inch-thick icy patches covered by about 1/4 inch of snow. Another pilot on the field stated that his airplane was covered with 1/4 to 1/2 inch of clear ice with snow/frost on top.</p>					
<p>Between about 0830 and 0840, a pilot from another operator on the field observed the accident pilot conducting a preflight check of the accident airplane. The accident airplane had not yet been deiced.</p>					
<p>The PenAir ramp supervisor reported that, sometime before 0900, the accident pilot asked him to fuel the accident airplane with 60 gallons of Jet A fuel (30 gallons in each wing tank). The ramp supervisor told the pilot that his airplane would need deicing. The pilot did not acknowledge this comment. While returning to the flight office, the pilot met the PenAir check airman and asked</p>					
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what the deicing procedures were in Dillingham. The check airman told Safety Board investigators that he did not think the pilot's question was unusual because the pilot had not deiced at Dillingham previously. He told the pilot that the deicing procedures were the same as for a Cherokee and that the pilot should make sure that his airplane was thoroughly deiced that morning.

The PenAir ramp employee who fueled the accident airplane said that he had trouble removing the accident airplane's left fuel cap due to what he described as "1/4 inch of frost with maybe ice underneath." He reported that he had to use a tool to remove the fuel cap.

After the fueling was complete, the ramp supervisor sprayed deicing fluid on the accident airplane.

The PenAir ramp employee who had fueled the airplane drove the forklift with the deicing equipment attached. The supervisor described the accident airplane as having 1/8 inch of frost that covered the entire airplane. He said that he did not physically touch the surfaces of the wing after the deicing process because he believed that the upper surface of the wing was clear of ice. The ramp employee driving the forklift said that he could not see the accident airplane's wing after deicing but that "a lot of glycol" had been applied. The pilot was not present during the deicing.

About 0850, the PenAir check airman flying the Cherokee to King Salmon was on the ramp and watched as the accident airplane was deiced. He stated that he saw the accident airplane deiced one time and that the process was completed in about 20 minutes. The same crew and equipment that deiced the accident airplane deiced his airplane.


No witnesses were found who could verify whether, after the fueling and deicing of the accident airplane was complete, the accident captain climbed a ladder or used any other means to check that the fuel caps were replaced properly or that the upper wing surfaces were clear of ice, snow, or frost. A PenAir customer service manager did state that he saw glycol on the accident pilot's coat prior to the accident airplane's departure. In addition, the PenAir check airman reported that, when he looked at the accident airplane from the ground and again from the wing of his own airplane, the accident airplane appeared to be free of snow.

About 0920, as he taxied the Cherokee out to the runway, the check airman observed the accident airplane's takeoff roll. He said that the accident airplane used the normal amount of runway. After aligning the Cherokee with the centerline of runway 01, the check airman looked up and saw the accident airplane make the standard 45-degree right turn to depart the local airport traffic pattern. The check airman reported that everything appeared normal about the accident airplane at that time. A pilot doing a preflight check on his airplane on the north end of the field said that he glanced up and saw the accident airplane during takeoff, about 50 feet above the Bravo intersection.

A private pilot who was talking on the telephone in his office less than 1 mile from the accident site watched as the accident airplane took off. This witness said that the airplane was traveling from left to right and was moving slightly away from him. The airplane appeared to be straight and level and at an altitude of less than 1000 feet above ground level. The sound of the engine was normal and gradually dissipated as the airplane traveled across his field of view. This witness stated further that the flight appeared to be normal until the airplane abruptly pitched up, rolled more than 90 degrees to the left, and yawed to the left, "back towards the airport," when he was able to see the entire top of the airplane. The witness reported that the nose of the airplane then dropped until the nose pointed directly down as the airplane rolled to the right. The airplane did not spin. The airplane finally disappeared behind a small hill in a nose-down attitude. The witness immediately hung up the telephone, dialed 911, and left for the accident site. When he arrived, fire and rescue personnel were already on scene.

PILOT INFORMATION

The pilot, age 41, held a commercial pilot certificate with an airplane single-engine and

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multi-engine land, and instrument rating; he also held an airframe and powerplant mechanic certificate. His most recent second-class medical certificate was issued on February 9, 2001, with the limitation, "The holder shall wear corrective lenses."

PenAir hired the accident pilot on October 16, 2000, and he had accrued 869 hours of total flight experience since that time. PenAir records also indicate that, at the time of the accident, the pilot's total flight experience consisted of about 3,100 hours. In the 90 days, 30 days, and 24 hours prior to the accident, PenAir records show that the pilot had accrued a total of 271, 86, and 4.4 hours, respectively.

PenAir records show further that the pilot had accrued a total of about 74 hours in the Cessna CE-208 Caravan, the same airplane make and model as the accident airplane. Records also show that the pilot's initial flight training in the CE-208 occurred on June 4, 2001, that his last CE-208 FAR 135.293 competency check and FAR 135.299 line check prior to the accident also occurred on June 4, 2001, and that his initial operating experience in the CE-208 occurred on August 11, 2001. PenAir's records indicate that the accident pilot was also qualified in the Piper PA-32.

AIRPLANE INFORMATION

The accident airplane, a Cessna Caravan CE-208, N9530F, S/N 20800088, was manufactured in 1986. The airplane had accumulated 10,080 hours since it was manufactured. The most recent inspection was accomplished on October 5, 2001, 12.4 hours before the accident.

The airplane was equipped with a Pratt & Whitney Canada (PW&C) PT6A-114 turbopropeller engine and a three-bladed Hartzell Propeller, model number HC-B3MN-3, with M10083K composite blades. The engine had accumulated 10,984 hours.

The airplane's weight and balance were within the normal operating range. A review of the airplane and engine logbooks revealed no discrepancies and no deferred items for the accident flight.

METEOROLOGICAL INFORMATION

At 0851, the on-field Federal Aviation Administration (FAA) flight service station reported the DLG weather as follows: wind, from 260 degrees at 5 knots; visibility, 10 statute miles with a few clouds at 2,000 feet; temperature, -4 degrees C (24.8 degrees F); dew point temperature, -10 degrees C; and altimeter, 29.40 inches of Hg.

AIRPORT INFORMATION

Dillingham airport is an uncontrolled airport with a part-time FAA Flight Service Station located on the field. The airport has one grooved asphalt runway, 01/19, which is 6,404 feet long. No radar services are available locally.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest in a level attitude approximately 0.7 nm northeast of the departure end of runway 01 at approximately N59°03.15' latitude and W158°28.41' longitude. The entire debris field stretched along a magnetic heading of 059 degrees for approximately 163 feet and was approximately 118 feet wide. Based on tree strikes and initial impact marks in the soft tundra, the flight path angle was estimated to be equal to or greater than 40 degrees down.

The entire airplane structure was found within the impact area. There was no fire, but the crash site did have a strong smell of jet fuel. The fuselage came to rest approximately 121 feet from the initial impact crater with the nose of the airplane pointing almost perpendicular to the wreckage path. The fuselage exhibited significant vertical compression with little longitudinal

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compression. The empennage structure was separated from the fuselage but remained connected by pushrods and cables.

Both wings sustained significant leading edge impact damage near the wing root. The right wing had separated from the fuselage and was found upside down and slightly ahead of the fuselage. The left wing remained attached to the fuselage, but the front spar web was fractured outboard of the wing root.

All flight control surfaces (ailerons, spoilers, elevators, and trim tabs) were found attached to their respective hinge attach points except for the outboard half of the left elevator, which was found in the wreckage field. Control system continuity was verified in the rudder and elevator control systems. The elevator trim actuator was measured to be at 0-degree deflection. The rudder gust lock handle was found in the unlocked position. The left aileron control cables were continuous. The right aileron control cables were found separated at the wing root and exhibited a "broom straw" appearance.

The flap selector handle was found positioned against the 10-degree stop. The flap indicator was positioned at approximately 2 degrees but was free to move. The left flap surface was attached to the left wing in the retracted position. The right flap surface was attached to the right wing in an extended position. The flap jackscrew and transmission assembly (part of the flap gearbox) and the flap actuator tube assembly were attached to the right wing. The wing flap actuator jackscrew was intact and was attached to the fuselage mount, but the fuselage mount was ripped from the fuselage. Measurements indicated by the position of the gearbox were considered unreliable because the gearbox was separated from the transmission assembly and was free to rotate around the jackscrew. The entire flap mechanical control system linkage was inspected, and no preexisting failures were noted that would indicate an asymmetric flap existed at impact.

Examination of the cockpit area revealed that both the pilot's and copilot's control yokes were broken free of their respective attaching mounts and were fractured at nearly the same length, indicating approximately full airplane nose-up elevator. The pilot's seat was found locked and positioned in the sixth hole forward of the aft stop pin.

The left pitot/static tube was broken from its structural wing attach point but remained connected by electrical wires. No damage was observed to the stall detector, and the tab (vane) was unrestricted and free to move. The right pitot/static tube remained intact, and the tubing was free of any obstruction.

The left and right fuel tank selector knobs were found in the OFF position. The left fuel tank shutoff valve handles in the left wing tanks were both in the OPEN position against the mechanical stops. The right fuel tank aft shutoff valve handle was found in the OPEN position, and the right fuel tank forward shutoff valve handle was found between the OPEN and CLOSED positions. Examination of right and left wing integral fuel tanks revealed a significant amount of fuel.

Examination of the PT6A-114 turbopropeller engine revealed that the compressor section had ingested tundra and that all compressor and turbine blades exhibited blade tip rub of varying degrees. All three propeller blades were found at the wreckage site and were fractured in about the same lengthwise location, just outboard of the blade butt.

MEDICAL AND PATHOLOGICAL INFORMATION

A postmortem examination of the pilot was conducted under the authority of the Alaska State Medical Examiner, Anchorage, Alaska, on October 12, 2001. The cause of death for the pilot was reported to be multiple blunt force injuries.

A toxicological test performed by the FAA's Civil Aeromedical Institute was negative for ethanol

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and drugs.

TESTS AND RESEARCH

The engine, engine controls, and propeller were sent to the PW&C facility in Montreal, Quebec, Canada, where they were disassembled and examined. No preexisting defects or anomalies were found that would have prevented normal engine or propeller operation. All internal damage was consistent with that of an engine that was operating at impact. Spinner damage showed that the propeller's blade angle was in the normal operating range at the time of the impact.

The accident airplane was equipped with a TrendCheck Engine Monitor, which was removed from the accident engine. Its data were downloaded at the manufacturer's facility in Norwood, Massachusetts. No anomalous events were recorded that would indicate engine stoppage prior to impact. Parameters recorded for the accident flight included an engine run duration of 509 seconds and a maximum pressure altitude of 1021 feet (651 feet mean sea level).

The Cessna CE-208 Caravan is equipped with a warning system that activates if one or both tank selector knobs are placed in the OFF position and/or if the fuel level in the reservoir tank or wing tanks becomes low. The system includes annunciator lights in the cockpit annunciator panel (CAP) and redundant warning horns. The CAP, various cockpit gauges, and stall heat and pitot/static heat switches were examined at the Safety Board's Materials Laboratory. None of the CAP bulb filaments showed any evidence of hot filament stretching, and none of the cockpit gauge faceplates displayed any needle contact marks. Internal examination of both heat switches confirmed that they were in the OFF position at impact.

An airplane performance study was conducted using data obtained during the investigation, including data from the engine monitor. However, because no radar data was available, the study was inconclusive. The report is contained in the Airplane Performance Study Report, which is included in the public docket.

Fuel samples from both wings and the fueling truck were sent to CT&E Environmental Services, Inc., Anchorage, Alaska, for testing. No anomalies were noted in any of the fuel samples. The deicing fluid was determined to be 70.8 percent water.

ADDITIONAL INFORMATION


PenAir Deicing/Anti-icing Equipment and Procedures

PenAir uses a portable 300-gallon deicing unit with an operator bucket attached. Electrical power is used to keep the deicing fluid heated to an operational temperature within the unit. Before each use, the outside air temperature, freeze point of the fluid, and fluid temperature are documented. When airplane deicing is required, one ground employee picks up the deicing unit with a forklift and positions it at the airplane for the deicing process. Another ground employee stands in the bucket atop the unit and sprays the airplane with deicing fluid.

According to the PenAir ramp supervisor, the company receives large plastic containers with 100 percent freeze point depressant fluid. (It was reported that the fluid was Union Carbide type 1 fluid and was 92 percent ethylene glycol, 7.5 percent water, and 0.5 percent processing additives.)

He reported that they drain half the mixture into another plastic container and then fill both containers with water to create a 50 percent fluid mixture (50 percent glycol and 50 percent water). PenAir's FAA-approved deicing/anti-icing program requires the deicing mixture to be 50 percent glycol, which has a freeze point of about -28 degrees C.

The supervisor stated that the deice machine had been operationally ready since October 1, 2001, and contained 300 gallons of heated 50 percent water/glycol mixture. On the morning of the

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accident, the outside air temperature, freeze point of the fluid, and fluid temperature were recorded as 32 degrees F, 0 degrees F, and 140 degrees F, respectively. A sample of the deice fluid was also sent to CT&E Environmental Services, Inc., for testing. The deicing fluid was determined to be 70.8 percent water. According to FAA advisory material, the freeze point of a 70 percent glycol/water mixture is approximately 5 degrees F (accepted industry practice is for the freeze point of deice fluid to be at least 18 degrees F below the outside air temperature).

At the time of the accident, PenAir's deicing/anti-icing program stated the following in part:

A pretakeoff check is a check of the "representative aircraft" to make sure other critical surfaces are free of frost, ice and snow. This check must be conducted within five minutes prior to beginning the takeoff. It must be accomplished from outside the aircraft unless an alternate procedure is used.

PenAir's alternate procedure was defined as follows:

When deicing/anti-icing fluid has been applied, the flight crew will make a visual check of the inboard leading edge of both wings prior to taking the active runway for departure. The visual check will verify that contaminants have not built up on the aircraft during the holdover period.

PenAir's deicing/anti-icing program did not require pilots or ramp personnel to physically check their airplanes' critical surfaces after deicing. The pilot's preflight walk around in the PenAir C-208 Company Flight Manual states in part, "Warning: It is essential in cold weather to remove even small accumulations of frost, ice or snow from the wing and control surfaces." PenAir personnel stated that after deicing, operational procedures called for the pilot to visually check the airplane. PenAir did have ladders available at DLG so that pilots could check the upper surfaces of their airplanes if they thought such a check was necessary.

While on scene, Safety Board investigators inspected another PenAir CE-208B and found that, due to the airplane's high-wing configuration, a pilot would have to stand about 10 to 15 feet behind the airplane in order to see most of the upper surface of the wing.

Technical and Advisory Information

Safety Board staff questioned the FAA's Chief Scientific and Technical Advisor for Flight Environmental Icing about airplane deicing. He stated that the heat of the glycol/water fluid de-bonds the frozen contamination from the aircraft surface and the force of the fluid jet drives/flushes the de-bonded frozen contamination from the surface. The glycol in the fluid acts as a freeze point depressant and keeps the fluid mixture from refreezing.

The advisor also stated that clear ice, a form of glaze ice, is difficult to see and has a high adhesion strength. He also stated that the density of glaze ice inhibits penetration by deicing fluids, making it difficult to remove.

Icing Advisory Material

Title 14 CFR 135.227 prohibits airplanes from taking off when snow, ice, or frost is adhering to the airplanes' wings, propellers, or control surfaces. FAA Advisory Circular (AC) 20-117, Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing (3/29/88), states that testing has shown that ice formations on various aircraft components can have significant and sometimes devastating effects on airplane flight characteristics. The AC further states that surface roughness on the afterbody of a wing can have an effect approximately equal to the effect of similar surface roughness on the leading edges of some airfoils. One of these effects can be to decrease the stall angle of attack, possibly before activation of stall warning

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devices.

The Society of Automotive Engineers report ARP4737, Rev. E, "Aircraft Deicing/Anti-icing Methods," addresses several precautions concerning clear ice, including the following:

Clear ice can form on aircraft surfaces below a layer of snow or slush. It is, therefore, important that surfaces are closely examined following each deicing operation, in order to ensure that all deposits have been removed.

Clear ice formation is extremely difficult to detect. Therefore, when [clear icing] conditions prevail, or when there is otherwise any doubt that clear ice may have formed, a close examination shall be made prior to departure, in order to ensure that all frozen deposits have been removed.

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Landing Facility/Approach Information					
Airport Name DILLINGHAM	Airport ID: DLG	Airport Elevation 86 Ft. MSL	Runway Used 01	Runway Length 6404	Runway Width 150
Runway Surface Type: Asphalt					
Runway Surface Condition: Unknown					
Approach/Arrival Flown: NONE					
VFR Approach/Landing: None					
Aircraft Information					
Aircraft Manufacturer Cessna		Model/Series 208		Serial Number 20800088	
Airworthiness Certificate(s): Normal					
Landing Gear Type: Retractable - Tricycle					
Amateur Built Acft? No		Number of Seats:		Certified Max Gross Wt. 8000 LBS	
				Number of Engines: 1	
Engine Type: Turbo Prop		Engine Manufacturer: Pratt & Whitney Canada		Model/Series: PT6A-114	
				Rated Power: 600 HP	
- Aircraft Inspection Information					
Type of Last Inspection Continuous Airworthiness		Date of Last Inspection 10/2001		Time Since Last Inspection 12.4 Hours	
				Airframe Total Time 10080.3 Hours	
- Emergency Locator Transmitter (ELT) Information					
ELT Installed?/Type Yes /		ELT Operated? No		ELT Aided in Locating Accident Site? No	
Owner/Operator Information					
Registered Aircraft Owner Avion Capital Corp.		Street Address 4451 Aircraft Dr. Suite 201			
		City Anchorage		State AK	Zip Code 99502
Operator of Aircraft PENINSULA AIRWAYS INC		Street Address 1808 Bellevue Loop			
		City Anchorage		State AK	Zip Code 99515
Operator Does Business As: Pen Air			Operator Designator Code: PNSR		
- Type of U.S. Certificate(s) Held:					
Air Carrier Operating Certificate(s): Cargo; Commuter Air Carrier; Flag Carrier/Domestic; Supplemental; On-demand Air Taxi					
Operating Certificate:			Operator Certificate:		
Regulation Flight Conducted Under: Part 135: Air Taxi & Commuter					
Type of Flight Operation Conducted: Scheduled; Domestic; Passenger Only					

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First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 41
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Sex: M	Seat Occupied: Left	Occupational Pilot? Civilian Pilot	Certificate Number: On File
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Certificate(s): Commercial

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Current Biennial Flight Review? 06/2001

Medical Cert.: Class 2	Medical Cert. Status: Valid Medical--w/ waivers/lim.	Date of Last Medical Exam: 02/2001
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- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air
						Actual	Simulated			
Total Time	3100	74								
Pilot In Command(PIC)	2800									
Instructor										
Instruction Received										
Last 90 Days	271									
Last 30 Days	86									
Last 24 Hours	4									

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? Yes	Second Pilot? No
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Flight Plan/Itinerary

Type of Flight Plan Filed: Company VFR

Departure Point Same as Accident/Incident Location	State	Airport Identifier	Departure Time 0925	Time Zone AST
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Destination King Salmon	State AK	Airport Identifier AKN	
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Type of Clearance: VFR

Type of Airspace: Class E

Weather Information

Source of Wx Information:


Company

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Weather Information					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
DLG	0851	ADT	86 Ft. MSL	2 NM	190 Deg. Mag.
Sky/Lowest Cloud Condition: Few			2000 Ft. AGL	Condition of Light: Day	
Lowest Ceiling: None		Ft. AGL	Visibility: 10	SM	Altimeter: 29.40 "Hg
Temperature: -4 °C	Dew Point: -10 °C	Weather Conditions at Accident Site: Visual Conditions			
Wind Direction: 250	Wind Speed: 5	Wind Gusts:			
Visibility (RVR): Ft.	Visibility (RVV): SM				
Precip and/or Obscuration:					

Accident Information		
Aircraft Damage: Destroyed	Aircraft Fire: None	Aircraft Explosion: None

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot	1				1
Second Pilot					
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants					
Other Crew					
Passengers	9				9
- TOTAL ABOARD -	10				10
Other Ground					
- GRAND TOTAL -	10				10

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Administrative Information

Investigator-In-Charge (IIC)

Joseph M. Sedor

Additional Persons Participating in This Accident/Incident Investigation:

Federal Aviation Administration
Washington, DC

Peninsula Airways, Inc.
Anchorage, AK

Cessna Aircraft Company
Wichita, KS

Transportation Safety Board of Canada
Quebec, CANADA,

Pratt & Whitney Canada
Quebec, CANADA,