

AVIATION INVESTIGATION REPORT

A00W0079

IN-FLIGHT ICING / LOSS OF CONTROL

ACCENT AVIATION
CESSNA 310I C-GWWO
CALGARY, ALBERTA
12 APRIL 2000

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Summary

A Cessna 310I, C-GWWO, serial number 310I0161, departed Manning for Calgary, Alberta, on an instrument flight rules flight plan, with Lethbridge as the alternate airport. The aircraft started to pick up light rime icing during the initial descent into the Calgary area. During radar vectors for an instrument landing system (ILS) approach onto runway 34 in Calgary, the aircraft entered an area of moderate icing. The approach was unsuccessful, and the pilot was vectored for another ILS approach to the same runway. During the second approach, the aircraft descended into a rail yard 4.5 statute miles short of the runway, at 1910 mountain daylight time. The aircraft collided with a structure on the roof of a diesel locomotive maintenance building and came to rest in an inverted position. The pilot and two passengers evacuated the aircraft unassisted. The pilot sustained serious injuries and the passengers, minor injuries.

Ce rapport est également disponible en français.

Other Factual Information

The pilot was certified and qualified for the flight in accordance with existing regulations. He had a total of 2200 hours, with 615 hours on Cessna 310's at the time of the accident.

The pilot was on radar vectors for an approach to runway 34 at Calgary. At 1848,¹ he advised the arrival controller that he was experiencing moderate icing and requested a lower altitude. The accumulations were described as one to two inches thick, covering the leading edges of both wings and tip tanks. Ice was observed shedding from the propellers and the wings as the aircraft flew in and out of cloud. The pilot was vectored to final and transferred to tower control at 1855. He was unable to use the automatic direction finder (ADF) for the approach, and could not identify the Yankee non-directional beacon (NDB). The pilot was able to identify the ILS frequency. Apparently, the glide path indicator did not move from the upper portion of the instrument, but the course indicator for the localizer did work. The aircraft did not descend on the glide path. At 1857, the aircraft was one mile on final, three quarters of a mile west of the localizer, at 5000 feet above sea level (asl) when the tower controller instructed the pilot to go around. The pilot was now operating the aircraft at full power to maintain flight.

During vectors for the second approach, the pilot commented to air traffic control (ATC) that he was having trouble maintaining altitude. The pilot was able to identify and use the Yankee NDB for this approach. During this second approach, the aircraft intercepted the localizer at 1906. Two minutes later the pilot contacted the tower controller. The arrival controller told the tower controller (via land line) that the Cessna was having a hard time maintaining the localizer and altitude. At no time did the pilot declare an emergency.

The aircraft's airspeed, derived from the radar tapes, averaged 85 knots on the second approach. The aircraft's landing gear was down and the flaps were up. The stall speed of the Cessna 310I at 5100 pounds, gear up, flaps up, power to idle, and with no ice contamination is 71 knots. Shortly after the descent was initiated for the glide path, the right engine surged, with a resultant loss of power. The right engine's propeller appeared to be turning more slowly than the left engine's propeller. The pilot had difficulty controlling the aircraft laterally at this time. Eyewitnesses described the aircraft rocking from side to side as it came out of cloud, just before striking the building.

The last communication with the tower was at 1910. The radar tapes indicate an average descent rate of 2400 feet per minute during the last 35 seconds of the flight. The aircraft's left wing hit a structure on top of the diesel locomotive repair shop. The right wing struck a sand-filled pipe from a sand tower collocated with the repair shop. The rear of the aircraft struck the edge of the building. The aircraft came to rest inverted, approximately 10 metres from the building.

A cold front was bisecting Alberta east and west through the Edmonton area at 1200. The front was forecast to move southwards at 15 knots. South of the front, cloud bases were to be 8000 to 14 000 feet asl, lowering in the vicinity of the front to 400 to 1000 feet above ground level (agl). Light rain and snow showers were forecast near the front. Moderate icing was forecast for the region of flight between 5000 and 14 000 feet asl. A pilot report from a Dash 8 at 1517, at 16 000 feet asl and 30 nautical miles (nm) northwest of Calgary, indicated

¹ All times are mountain daylight time (Coordinated Universal Time [UTC] minus six hours).

moderate rime icing. The pilot of a Cessna Cardinal at 1445, flying at 5500 feet asl, 37 nm northwest of Calgary, reported light turbulence and occasional light freezing rain. Weather at the Cessna 310I's estimated time of arrival in Calgary was forecast to be visibility greater than 6 statute miles (sm) and broken clouds at 3000 feet agl. The lower cloud ceilings and reduced visibility were not forecast to occur until two hours after the estimated time of arrival. At 1600 Red Deer, 60 nm north of Calgary, was experiencing visibility of 2 sm in light snow showers with overcast clouds at 700 feet agl. The Edmonton Flight Service Station briefed the pilot on the weather, upper winds, and Notices to Airmen at 1615.

The actual weather at the Calgary International Airport at 1900 was wind 030 degrees at 21 knots gusting to 26 knots, ceiling 500 feet broken, 2500 feet overcast, temperature 1 degree Celsius, and dew point minus 1 degree Celsius. A special observation taken at 1914, four minutes after the accident, was wind 020 degrees at 17 knots gusting to 25 knots, visibility 10 sm, and overcast clouds at 400 feet agl.

There was no indication of any airframe failure or system malfunction prior to or during the flight. All control surfaces were accounted for, and all damage to the aircraft was attributable to the severe impact forces. Both engines were examined to the degree possible, and no indication of malfunction was found. The aircraft was not certified for flight into known icing conditions.

The aircraft had been fuelled two days before departure with 500 pounds of fuel, giving the aircraft an estimated 780 pounds of fuel when it left Calgary. The pilot did not refuel the aircraft in Manning and departed with approximately 485 pounds of fuel. Flight planning indicated that a minimum of 310 pounds were required to fly to Calgary and 564 pounds were required to comply with the fuel requirements for instrument flight rules (IFR) flight to Calgary, with Lethbridge as an alternate. The gas combustion heater in the Cessna 310I uses fuel from the right main tank at approximately three pounds per hour. The heater had been in use for most of the four and one-half hour return trip.

It was reported that the aircraft auxiliary fuel gauges read empty en route to Calgary and that the main tank (tip tank) fuel gauges were reading close to empty towards the end of the flight. While examining the accident scene, there were no obvious gasoline odours or stains. The right auxiliary tank was the only fuel tank that had not ruptured during the crash sequence, and it contained a small quantity of fuel. There was no post-crash fire, although there was some indication of arcing on the left wing structure from the torn battery leads.

The right propeller detached during impact. Both blades showed scarring and a slight bend span-wise. The spinner was dented and showed little indication of rotational damage. The left propeller was attached to the engine and showed signs of scarring and significant twisting at the blade tips. The propeller and spinner damage is indicative of the right engine turning but not producing power and the left engine producing power at impact.

All occupied passenger seats broke free from the aircraft. The passengers were secured in their seats by lap belts that were attached to the seats, not the airframe. The passenger seat rails were attached to the airframe, but carpet and foam underlay were between the rails and the cabin floor structure. The original aircraft interior carpeting had been replaced on 30 June 1997, and the carpet had not been cut out around the passenger seat rail attachment points. The carpet and underlay installed after manufacture did not meet the requirements outlined by the *Cessna 310 Maintenance Manual*. The seat rails were installed on top of the carpet instead of the carpet being cut away. This incorrect installation did not allow the seat rail to mate directly with the cabin floor structure.

The pilot's seat was equipped with a lap belt and adjustable shoulder harness affixed to the aircraft structure. When snugly fastened, the shoulder strap did not allow the pilot full freedom of movement in the cockpit. The pilot flew with the shoulder strap loosened to allow for better movement to reach controls and to see out all of the windows. The pilot sustained serious head injuries to the right side of the face.

NAV CANADA completed a flight check on the ILS for runway 34 on 13 April 2000 and found the system to be within design tolerances. No other aircraft on the day of the accident had reported the ILS system malfunctioning.

Analysis

The weather briefing given to the pilot prior to departure indicated that icing conditions would be present during the flight. The pilot departed although the aircraft was not certified for flight into known icing conditions. When the pilot first encountered in-flight icing 60 nm northwest of Calgary, he based his decision to continue on the low catch rate of the ice. The absence of icing reports being broadcast on radio by other pilots and ATC supported his decision. Having experienced flights into icing conditions previously in his career and in similar conditions, the pilot decided to continue.

When the accumulations reached moderate proportions, the pilot requested a lower altitude to leave the icing area and to enter warmer air to reduce the accumulations on the airframe. The last surface temperature reading the pilot had access to was four degrees Celsius at 1800. By the time the accident occurred, the temperature had dropped to one degree Celsius. The airframe ice was seen departing from the aircraft at times, but it was accumulating faster than it was shedding.

The first approach was unsuccessful because of a lack of situational awareness. Without an operating ADF, the pilot was unaware of the aircraft's exact position relative to the airport. A build-up of ice on the ADF antennas is the most likely reason that the ADF was not operating properly. During the second approach, the ADF functioned properly, probably because some ice had shed from the antennas.

The prolonged exposure to the icing conditions increased the amount of ice on the aircraft, decreasing its lifting capability. The situation was aggravated by the fuel exhaustion that started to occur on the right engine. With the loss of power on the right engine and the ice accumulation on the airframe, the pilot could not control the aircraft's rate of descent.

The low amount of fuel, in combination with the lateral movement of the aircraft, most likely caused the right main fuel tank port to become exposed to air, causing the power loss on the right engine. The higher-than-normal power setting used while in the icing conditions, the extra flying time required for the second approach, and the use of the cabin heater for the duration of the round-trip flight contributed to the lower quantity of fuel in the main tanks, particularly in the right main tank.

The elasticity of the carpet and underlay contributed to the detachment of the passenger seats from the airframe. When the seats became detached from the cabin floor, the passengers were no longer secured and were exposed to a high risk of injuries.

The pilot remained in position because his seatbelts were attached to the airframe and not the seat. The pilot's facial injuries resulted from a loose shoulder strap, which allowed his head to hit the glare shield.

Findings as to Causes and Contributing Factors

- A. The aircraft did not have enough fuel on departure from Manning to meet the requirements for IFR flight.
- B. The aircraft was not certified for flight into known icing conditions.
- C. The pilot continued flight into forecast icing conditions.
- D. The weather in Calgary had deteriorated faster than forecast.
- E. The aircraft was unable to maintain altitude because of ice on the wings.
- F. The right engine lost power because of fuel exhaustion.
- G. The pilot's shoulder harness was not tightly fastened across the torso.

Finding as to Risk

- 1. Carpeting and underlay between the passenger seat rails and the aircraft cabin floor contributed to the passenger seats detaching from the cabin floor.

Other Finding

- 1. The pilot did not declare an emergency at any time during the arrival into Calgary.

Safety Action

An article for the Transport Canada *Maintainer* is being written to address the techniques used in the upholstering of this aircraft. This periodical is sent to all aircraft maintenance engineers in Canada.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 28 November 2000.