

**AVIATION OCCURRENCE REPORT**

**UNCONTROLLED DESCENT/COLLISION WITH TERRAIN**

**AERO COMMANDER 700 N9920S  
CASTLEGAR, BRITISH COLUMBIA 15 nm SE  
28 NOVEMBER 1995**

**REPORT NUMBER A95W0210**

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**

At about 1826 mountain standard time (MST)<sup>1</sup>, the aircraft, with the pilot and four passengers on board, departed the Calgary International Airport, Alberta, on a night instrument flight rules (IFR) flight to Hillsboro, Oregon, USA. At about 1946 the aircraft disappeared from the Vancouver Area Control Centre (ACC) radar screen in the vicinity of Castlegar, British Columbia. The Victoria Rescue Coordination Centre (RCC) was notified, and search aircraft were dispatched. Despite bi-national search cooperation and radar fixes of the aircraft's last known position (LKP), a seven-day search failed to locate the missing aircraft. An emergency locator transmitter (ELT) signal was not received.

On 14 June 1996, the wreckage was located at latitude 49°14'48"N, longitude 117°03'20"W, at an elevation of approximately 6,700 feet above sea level (asl). The aircraft was destroyed by impact forces and a post-crash fire. The pilot and four passengers were fatally injured.

*Ce rapport est également disponible en français.*

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<sup>1</sup> All times are MST (Coordinated Universal Time minus seven hours) unless otherwise noted.

### Other Factual Information

The purpose of the flight was to return company personnel to Hillsboro in their corporate aircraft after attending a business meeting in Calgary. The pilot received a weather briefing from Edmonton Flight Service Station (FSS) and filed an IFR flight plan with Springbank FSS. On filing the flight plan, he requested 15,000 feet asl direct to Battleground, Washington, then direct to Hillsboro, the destination. He reported that the estimated time en route (ETE) would be 3 hours and 15 minutes and that he had 4 hours and 30 minutes of fuel on board.

The Castlegar weather during the time of the incident was partially obscured with an overcast ceiling estimated at 1,500 feet above ground level (agl), and 1½ statute miles (sm) visibility in light rain and fog. A warm front in the vicinity was forecast to cause 500- to 1,500-foot ceilings with visibility reduced to one-half sm in a mix of rain and snow. The area forecast called for a probability of severe clear icing in freezing drizzle and occasional moderate turbulence below 14,000 feet asl for the route of flight. A pilot report (PIREP) from an aircraft at flight level 200 (FL200), over the LKP indicated he was experiencing light rime icing in clear air. He also reported turbulence and solid cloud layers above and below his position. The forecast freezing level was 4,000 feet agl. During the pilot's weather briefing with Edmonton FSS, the probability of encountering severe clear icing during flight was not mentioned. It could not be determined if the pilot obtained weather information from the Total Aviation Briefing System (TABS) available at his hangar facility. Approximately 35 minutes after the aircraft was towed out of the hangar in Calgary, the pilot asked to have it de-iced before departure. Snow was accumulating on the wings during the brief time outdoors, and the outside air temperature was minus 14 degrees Celsius.

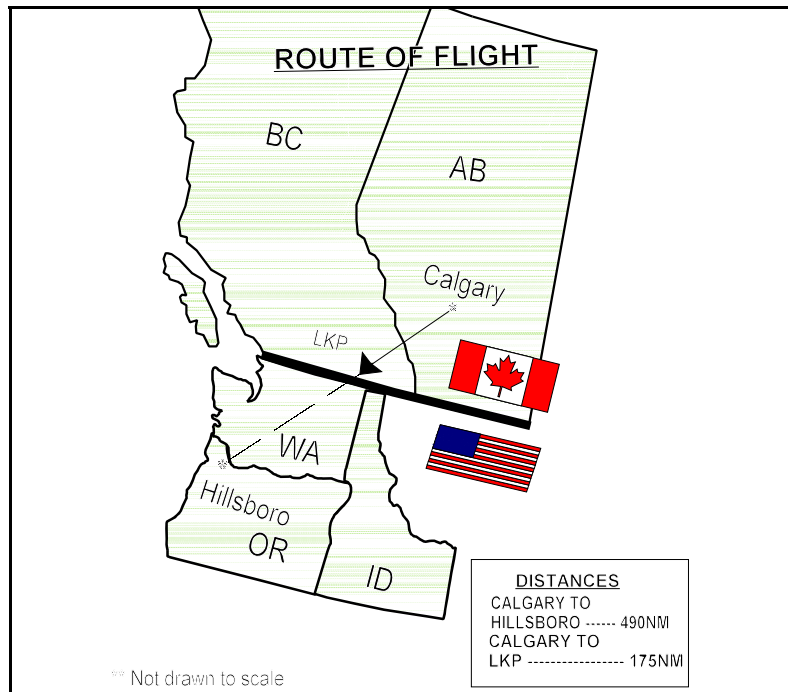


Figure 1

At 1735 the aircraft was refuelled to maximum capacity, with the addition of 520 litres of Avgas. Moments later the pilot and passengers boarded the aircraft and it was de-iced with a type 1 fluid. At about 1750, the pilot requested taxi clearance from Calgary ground control, and the aircraft departed the service facility hangar. Runway 16 was the active departure runway, and the pilot requested the full length (12,675 feet) for take-off. At about 1812 the pilot began the take off roll; however, before reaching rotation speed, he rejected the take-off. He then advised the tower that the right engine (Lycoming TIO-540) was not developing full rpm and requested another run-up on taxiway Alpha. Approximately 10 minutes later he informed ground control that the problem had been corrected. N9920S was re-cleared to taxi for runway 16, and the pilot taxied the aircraft the full length of the runway for departure. Shortly after becoming airborne, N9920S was further cleared en route to 16,000 feet by Calgary Terminal Control.

Radar data indicate that the aircraft climbed initially at about 870 fpm, and by 15,000 feet asl the rate of climb was about 340 fpm. The TSB Engineering Branch analyzed the magnetic tape of the communication between the pilot of N9920S and Calgary Terminal. The spectral analysis indicates that at 1828, as the aircraft was climbing through 4,400 feet asl, both engines were operating at a propeller speed of approximately 2400 rpm. During the en route segment of flight the aircraft's airspeed, altitude, and track remained relatively constant. At 1903 Edmonton ACC terminated radar service with N9920S and instructed the pilot to contact Vancouver ACC on 133.6 megahertz (MHz). The last transmission received from N9920S was at about 1937, when the pilot reported to Vancouver ACC that he was level at 16,000 feet. The controller noted that the pilot's voice sounded normal. Radar data indicate that, from 1941 to 1945, the ground speed of the aircraft decreased from its cruise speed of about 140 knots to 90 knots. At about 1946 the aircraft disappeared from Vancouver ACC radar screen, over the Selkirk mountain range, near Castlegar, during the hours of darkness. The aircraft's LKP was latitude 49°15'11"N and longitude 117°03'18"W. The highest terrain elevation near the LKP is about 8,000 feet asl. The sparsely populated mountainous terrain is heavily forested, and was under a thick mantle of snow.

Vancouver ACC radar tapes revealed that N9920S lost about 50 knots of ground speed and about 300 feet of altitude during the final seconds of radar contact. Seattle ACC, which had also been tracking the aircraft, reported that, at about 1946, N9920S descended from 16,300 feet to 11,800 feet asl in about 35 seconds, and did not reappear on radar. The rate of descent was calculated to be about 7,700 fpm.

The aircraft's LKP, as reported by Vancouver ACC and by Seattle ACC, were within two nm of each other. No distress call was heard by ACC, FSS, or any other station including an aircraft that was overhead at the time of the occurrence; nor were there any known eye-witnesses to the accident.

The aircraft was equipped with a fixed ACK E-01 ELT; however, a signal was not received at the time of the occurrence nor during the seven-day search period.

Canadian search resources consisted of five Canadian military aircraft and two to six civilian (CASARA) aircraft. American participation consisted of an Oregon Air National Guard C-130, United States Air Force aircraft, and United States Army UH-1 helicopters at various times. The Search and Rescue (SAR) Operations Report indicates that a grand total of 306.9 search hours were conducted before the search was officially reduced on 05 December 1995.

The aircraft type is a pressurized, low-wing, twin-engine, retractable gear airplane equipped with two reciprocating TIO-540 (turbo-charged) Lycoming engines, with a single-engine service ceiling of 10,600 feet, and a twin-engine service ceiling of 27,400 feet. The occurrence aircraft was equipped with all the instruments and radios necessary for IFR operation at night and was certified in accordance with existing regulations. It also had de-icing equipment and was approved for flight in known icing conditions in accordance with Federal Aviation Regulations (FAR) 25, Appendix C. The conditions defined by FAR, Part 25, Appendix C, are finite and do not take into account unlimited operation in icing conditions or operation in freezing rain. The aircraft was also equipped with an altitude reporting (Mode "C") transponder, which functioned continuously on code 7313 from take-off to the LKP.

Witnesses who observed the aircraft being boarded prior to departure reported that the weight of each of the five male occupants was greater than the standard winter weight of 188 pounds per person. In addition, the occupants were each equipped with overnight baggage; however, none was dressed in winter survival clothing and footwear. The on-board aircraft emergency winter survival equipment consisted of an axe, flares, candy bars, solar blankets, a two-way transceiver, and a first-aid kit. Estimated weight calculations indicate that the take-off weight may have exceeded the aircraft's allowable limits.

The pilot held an airline transport pilot licence (ATPL) and was considered to be a proficient instrument pilot. His flying experience consisted of about 3,000 flying hours, including 100 hours on type. Prior to the occurrence flight, the pilot spoke with the chief pilot; no problems were noted during the conversation. The normal procedure for such a flight was to fly IFR with the global positioning system (GPS) coupled to the auto-pilot.

On 14 June 1996, the aircraft wreckage was discovered by a company search aircraft, and the accident site was located about one nm south of the LKP. The RCMP were notified and members attended the crash site. The aircraft registration marks (N9920S) and personal identification bearing the pilot's name

confirmed the wreckage to be that of the missing Aero Commander 700.

TSB investigators conducted a field investigation on 25 June 1996. Examination of the wreckage trail revealed the aircraft struck the ground in a steep nose-down attitude, indicative of an uncontrolled descent. The final impact point was exhibited by the right and left wings complete with the respective engines, propellers, and landing gear. A post-crash fire had consumed the cabin section; however, parts of the empennage were unburned. The pilot seat, co-pilot seat, cabin contents, and pieces of plexiglass were scattered about 80 feet south, down a 28-degree mountain slope, beyond the final impact point. Prominent ground scars depicted where the nose section, engines, and propellers struck the ground. The major components of the airframe and control surfaces were accounted for, and all observed damage was attributable to the severe impact forces and a post-crash fire. The flaps and landing gear were in the retracted position. Propeller blade damage and twist was similar for both propellers, and was consistent with minimal power being produced at the time of impact. The ELT was damaged by fire and impact forces and did not activate. Because of the almost complete destruction of the aircraft by the impact forces and post-crash fire, it could not be determined whether any pre-impact structural failure or system malfunction contributed to the accident; however, none was identified. The engines, propellers, and flap actuator were transported to the TSB regional wreckage examination facility. The propellers (Hartzell Propeller Model HC-E3YR-2ATF) were dismantled for examination, and it was determined that they were likely operating with minimal power at the time of impact. The engines (Lycoming TIO-540) were examined by TSB and Textron Lycoming personnel. There were no abnormalities found to indicate a pre-impact malfunction, or evidence that the engines were incapable of producing full power.

The aircraft wreckage and occupants were located approximately six and one-half months after the accident, and the state of the human remains precluded the possibility of obtaining meaningful autopsy and toxicological data.

### **Analysis**

There were no witnesses to the accident, no evidence found of any airframe failure or systems malfunction during flight, and no evidence available to indicate whether incapacitation or physiological factors could have affected the pilot's performance. Concurrent with this, it could not be determined why the aircraft departed cruise flight, began a rapid descent, and struck the mountain side. Wreckage distribution and impact signatures indicate that the aircraft was in a steep nose-down attitude at impact. It is possible that, prior to the rapid descent, the aircraft's performance was affected by one or more factors such as airframe or engine icing, mechanical malfunction, or heavy weight. The ACC radar data, however, reveals that the aircraft's airspeed, altitude, and track remained relatively

constant during the en route segment of flight. During the final moments of flight, from about 1941 to 1945, the aircraft's ground speed decreased from about 140 knots to 90 knots. If airframe icing was a factor in the occurrence, then it is probable that the accumulation occurred during the final five minutes of flight. If the pilot experienced engine difficulties during the flight, it would also have been during the last five minutes of flight. Examination of the engines, however, reveals that they were capable of producing power at the time of impact. The evidence gathered strongly suggests that a catastrophic event resulted in the precipitous uncontrolled descent of the aircraft from which the pilot did not recover.

The following Engineering Branch report was completed:

LP 193/95 - ATC and Radar Data Analysis

### **Findings**

1. The pilot was licensed and qualified for the night IFR flight, and the aircraft was certified in accordance with existing regulations.
2. Based on estimated weights, the take-off weight of the aircraft may have exceeded the allowable limit.
3. The area forecast predicted a probability of severe clear icing in freezing drizzle for the route of intended flight. During the pilot's weather briefing, this information was not mentioned.
4. The pilot aborted the initial take-off from Calgary because the right engine was not developing full rpm.
5. There was no evidence found that the engines were incapable of producing full power. Based on the propeller examination, it is likely that the engines were operating with minimal power at the time of the impact.
6. The aircraft struck the ground in a steep nose-down attitude, with the flaps and the landing gear in the retracted positions.
7. The state of the human remains precluded the possibility of obtaining meaningful autopsy and toxicological data.
8. The spectral analysis indicates that at 1828, both engines were operating at a propeller speed of approximately 2400 rpm.

### **Causes and Contributing Factors**

It could not be determined why the aircraft departed cruise flight and began a rapid descent from which the pilot did not recover. It was determined, however, that the pilot attempted

flight through an area where the probability of severe clear icing, in freezing drizzle, was predicted by the area forecast.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, Benoît Bouchard, and members Maurice Harquail and W.A. Tadros, authorized the release of this report on 25 October 1996.*