AVIATION OCCURRENCE REPORT

CONTROLLED FLIGHT INTO TERRAIN

MCMURRAY AVIATION
PIPER PA-34-200T SENECA C-GPRL
LA LOCHE, SASKATCHEWAN 8 NM W
30 OCTOBER 1997

REPORT NUMBER A97C0215

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

The Piper PA-34-200T Seneca departed Fort McMurray, Alberta, on a 62 nautical mile (nm) charter flight to La Loche, Saskatchewan, with a crew of one pilot and five passengers on board. The aircraft departed at 1750 mountain standard time (MST), and was expected back in Fort McMurray at 1930. The pilot had filed a flight plan, and when the aircraft did not return, the Fort McMurray Flight Service Station operator (FSS) initiated a radio search to determine its whereabouts. The radio search was unsuccessful, and the FSS contacted McMurray Aviation, the operator. An airborne search party organized by the operator departed from Fort McMurray with several company pilots on board. The search party retraced the route from Fort McMurray to La Loche, but could not find the accident aircraft. Another search was organized using personnel and several fixed wing and rotary wing aircraft from Canadian Forces Base Cold Lake, Alberta, and the wreckage was located on the afternoon of the following day (see Appendix A). The pilot and one of the passengers died at the time of the accident. One passenger succumbed to her injuries the following morning, before help arrived. The three surviving passengers were taken by military aircraft to La Loche and then to Fort McMurray, with serious injuries. The aircraft was destroyed by impact forces and a post-crash fire.

Ce rapport est également disponible en français.

Other Factual Information

[1] All times are MST (coordinated universal time minus seven hours) unless otherwise noted.

The flight was arranged by telephone several hours before the flight departed. The passengers were reported to be anxious to complete the trip to La Loche that day, in order to facilitate an appointment the following day. They arrived at the company hangar, which was its base of operations at the Fort McMurray airport, about one hour before departure. The pilot of the accident flight was away from the company base on a charter flight with a Cessna 206 aircraft at the time the passengers arrived.

When he returned, the pilot called to the FSS to check the weather at Fort McMurray and Buffalo Narrows, and filed a visual flight rules (VFR) flight plan. The passengers' baggage had already been loaded into the aircraft by company staff before the pilot arrived at the airport. The pilot consulted another company pilot who had returned from a flight to La Loche at 1500. The occurrence pilot was reportedly advised that the cloud ceiling was about 500 feet above ground level (agl) at La Loche and as low as 200 feet agl in some areas along the west shore of Lac La Loche. He then refuelled the aircraft, loaded the passengers and departed. On his last contact with Fort McMurray FSS, the pilot made a routine radio call advising that he had departed the control zone to the east. A surviving passenger reported that the aircraft was flying below the cloud at a low altitude shortly before the crash.

The wreckage was found at an elevation of about 1,540 feet. The aircraft had struck the tops of poplar trees at an elevation of about 1,600 feet in a shallow descent, with a right bank angle of 10 to 15 degrees. The direct course from Fort McMurray to La Loche is 100 degrees magnetic. The aircraft was on course, with the landing gear and flaps retracted, when it struck the trees. The aircraft's heading at the time of impact was about 105 degrees. After initial impact with the trees, the aircraft bank angle increased, and an impact with larger trees detached the wings and the tail. The aircraft came to rest in an inverted position, toward the end of a crash path 320 feet long. The time of the crash was about 1817. Several post crash fires consumed much of the cockpit, the fuselage, and the wings. An examination of the wreckage indicated that both engines were developing power at the time of impact. The aircraft structure and systems were examined to the degree possible, and no evidence of a pre-crash malfunction was found. No evidence of frost or ice on critical aircraft surfaces was found. The aircraft's Narco ELT-10 emergency locator transmitter was destroyed in the crash and did not activate.

The relevant records from the Fort McMurray ISSR secondary radar receiver were reviewed. The radar is designed to record signals from aircraft transponders, and is not able to detect primary radar targets. No information pertaining to the accident flight was received by the radar.

The pilot held a commercial pilot licence, and a medical certificate valid to 01 April 1998. He had suffered a disabling hand injury in February 1997, but he resumed active flying duties after successfully completing a re-certification flight test in June 1997. The pilot held a Class 3 instructor rating and an instrument rating valid to 01 August 1999. His total flight time was 2,154 hours, 175 of which were on multi-engine aircraft, and 25.5 hours on multi-engine aircraft at night. He successfully completed a pilot proficiency check flight with C-GPRL, the only Piper PA-34-200 in the operator's fleet, in July 1997, and had accumulated 109 hours on type. He had completed five VFR flights at night with C-GPRL in the Fort McMurray area and several instrument flight rules (IFR) flights, within the previous 30 days. The pilot was one of the more experienced company pilots. He had reportedly completed a pilot decision making (PDM) course, and was described as

proficient and safety-conscious.

Toxicology testing was conducted at the Royal Canadian Mounted Police forensic laboratory in Regina, Saskatchewan. Test results indicated the presence of 20 milligrams of ethyl alcohol in 100 millilitres of blood in the sample which was submitted. Alcohol can be produced in the blood when the body is subjected to severe trauma, as was the case, and putrefaction has the time, nutrients, and temperature to develop. The sample tested was taken from the cranium which was subjected to sufficient heat to sustain bacterial action, and the sample was not taken until 3 November, four days after the crash. A study reported in the Journal of Forensic Sciences concluded that "Specimens from 1989 and 1990 showed postmortem ethanol ranging on concentration from our cutoff of 0.01% (10 mg/dL) to 0.18% (180 mg/dL)." and, "The concentration of ethanol in postmortem blood, in the absence of additional information, cannot be used with any degree of certainty to verify the ingestion of ethanol." Thus the finding of 20 milligrams of alcohol in the pilot's blood sample is inconclusive as to the blood-alcohol content of the pilot prior to the accident.

The observed weather at Fort McMurray at 1800 was as follows: winds 120 degrees at 8 knots, visibility 10 statute miles, a ragged overcast cloud ceiling at 1,000 feet above ground level (agl), and temperature minus 2 degrees Celsius. The terminal area forecast for Fort McMurray, valid from 1600 to 0400 was: winds 120 degrees at 8 knots, visibility greater than 6 statute miles, and an overcast ceiling at 1,000 feet agl, with a temporary fluctuation of the visibility down to 4 statute miles and a temporary fluctuation of the ceiling down to 500 feet agl, from 1600 to 2200. The area forecast included the possibility of light to moderate icing in cloud.

The observed weather at 1700 at Buffalo Narrows, 53 nm south-east of the accident site, was as follows: winds 120 degrees at 10 knots, visibility 15 statute miles, an overcast ceiling at 700 feet agl, and temperature minus 3 degrees Celsius.

La Loche is not served by an official weather reporting agency. The weather in the La Loche area was observed by several pilots. Their reports indicate that at the time of the accident, La Loche was experiencing overcast cloud ceilings of about 500 feet agl and that ceilings were lower over the higher ground west of La Loche, in the direction of Fort McMurray. A small amount of virga and freezing precipitation was noted in the area just west of La Loche.

The airport at Fort McMurray is located at an elevation of 1,211 feet, and is served by several instrument approaches. The lowest descent altitude for these approaches is 200 feet agl. The airport at La Loche is located at an elevation of approximately 1,500 feet, and is served by a company non-directional beacon (NDB) approach. The minimum descent altitude for the approach is 600 feet agl. The accident aircraft was equipped with instrumentation to carry out the approaches at Fort McMurray and La Loche, and en route navigation

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[2] Canfield, D.V., PhD, Kupiec, T., M.Ed, and Huffiene, E., M.S, "Postmortem Alcohol Production in Fatal Aircraft Accidents," *Journal of Forensic Sciences*, JFSCA, Vol. 38, No. 4, July, 1993, pp. 914 - 917.

between the two points.

The aircraft was equipped with six forward-facing seats. The two cockpit seats were equipped with lap belts and shoulder harnesses, and the cabin seats were equipped with lap belts only. The damage sustained by the cockpit area during the crash sequence and the post crash fire made the accident unsurvivable for its two occupants.

A post-crash calculation of the aircraft's weight and balance after the accident indicated that the gross takeoff weight on departure from Fort McMurray was about 4,500 pounds and that the zero fuel weight was about 4,050 pounds. The centre of gravity was within the allowable limits. The maximum allowable gross weight for the PA-34-200T is 4,570 pounds and the maximum zero fuel weight is 4,000 pounds. The maximum zero fuel weight is a structural specification and is not dictated by handling or performance considerations.

The aircraft was maintained for the operator by a contract maintenance organization. Most of the day to day maintenance work was performed by an aircraft engineer employed by the operator at its Fort McMurray base. His work was then approved and signed out by the contract maintenance organization. The operator was in the process of seeking approval to form its own approved maintenance organization.

The aircraft's journey log book was destroyed in the post-crash fire. Examination of the available technical records indicated that the aircraft was equipped and maintained in accordance with existing regulations for VFR flight. At the time of the accident, the aircraft had accrued a total flight time of about 2,653 hours. Its last inspection was completed on 08 September 1997 at 2,603.6 hours.

The aircraft was not equipped with propeller or airframe de-ice or anti-ice devices. Such devices are required by regulation for an aircraft operating in known icing conditions. The aircraft was equipped with an autopilot, but the autopilot was unserviceable at the time of the accident flight. A functioning autopilot is not required by regulation for VFR flight, but it is required by regulation for a commercial, passenger-carrying operation of an aircraft by a single pilot under IFR. Aircraft which are flown under IFR require an altimeter calibration every two years. The aircraft's altimeter had last been calibrated in May 1995.

In VFR flight, pilots are required to use visual reference to the ground to manoeuver and navigate their aircraft. The Canadian Air Regulations (CARs) section 602.115 provides that night VFR flight requires a visibility of three miles; no minimum altitude is specified. However, CARs section 703.27 requires that an operator of an air transport service flying at night maintain an

obstacle clearance height of 1,000 feet agl. Commercial night VFR flight must be conducted on a route; CARs standard 723.34 provides a formula for the establishment of a route for night VFR flight.

Air operators are required to maintain a record of company routes. The accident aircraft was reportedly not equipped with a route manual, nor was a route manual found at the operator's base after the accident. The other pilots employed by the operator were interviewed after the accident. They were not familiar with the obstacle clearance requirement found in the CARs, nor with the requirements of a route for night VFR flight.

The operator's Flight Operations Manual (FOM) is dated 01 January 1997 and was approved by Transport Canada on 06 June 1997. Section 3.5 of the FOM summarizes the CARs requirements for day VFR flight. Sections 3.6.2, 3.6.3, and 3.6.4 outline the requirements for IFR flight. Section 3.6.1 of the FOM is entitled "Routes in Uncontrolled Airspace", and provides the following:

> Pilots may fly under IFR or Night VFR using routes in uncontrolled airspace that are not yet contained in the record of company routes provided that all requirements of Standard 723.31 have been met.

Standard 723.31 sets out certain requirements for no-alternate IFR flight, and does not refer to night VFR. The pilot was reportedly familiar with the FOM and had referred to it frequently during his preparation for an examination required for an airline transport pilot licence. He successfully completed the examination several weeks before the accident. The company operations exam completed by the pilot on 29 June 1996, does not refer to the requirement for an obstacle clearance height for night VFR.

The time of official sunset at the accident site was 1641. The amount of sky illumination available at 1800, shortly after the time of takeoff from Fort McMurray, was 11.5 millilux. At the time of the accident, it was 1.12 millilux. The amount of sky illumination is affected by any cloud layer between an observer and the sky. The amount of visual reference available to a pilot is further affected by the reflectivity level of the surface of the earth. Snow has a high reflectivity level and trees have a low reflectivity level. On departure, the lights of the town of Fort McMurray would have provided illumination to assist the pilot with ground reference. La Loche is a much smaller centre than Fort McMurray and provided little ground lighting visible at low altitude from the area of the accident. There is little or no ground lighting in the area between Fort McMurray and La Loche.

Company pilots were routinely in direct contact with customers. They were reportedly subject to frequent pressure from customers to operate their aircraft in adverse weather conditions, at excessive gross weights, and from inadequate runways. Company pilots were reportedly not always successful in resisting these pressures, and they sometimes changed their procedures before dealing with customers because they anticipated these customer requests. It was not established whether or not the pilot was subject to pressure from the customers before or during the accident flight.

Analysis

Examination of the wreckage did not reveal any pre-crash malfunctions of the aircraft's structure, systems, or engines. The shallow angle of the aircraft's impact with terrain, and the speed of the aircraft at impact, are consistent with controlled flight into terrain.

A calculation of the aircraft's weight and balance indicates that its gross weight was within allowable limits. Although the zero fuel weight was slightly over the maximum allowed, this would not have degraded the aircraft's handling or performance characteristics.

The pilot was certified and qualified for the flight, whether flown VFR or IFR, and his flying record indicates that he had recent experience in night VFR operations.

Because the aircraft was not equipped for flight into icing conditions and the area forecast included icing in cloud, the aircraft was not approved for flight into cloud during the accident flight. The aircraft's autopilot was unserviceable and the altimeter required calibration. For these reasons, the aircraft was not approved for flight under IFR, and, in the prevailing weather, was, therefore, not approved for flight into cloud. Although the pilot was qualified to complete the flight under IFR, the aircraft was not equipped for IFR flight under the prevailing conditions.

At the time of departure, the cloud ceiling met the requirements for night VFR flight in the Fort McMurray area. As the flight progressed toward La Loche, the cloud ceiling decreased below the minimum required for commercial air operations. Flight below the cloud left the pilot with reduced terrain clearance and increased the requirement for effective manoeuvring to avoid collision with terrain.

The lighting conditions on departure were likely sufficient to allow the pilot to maintain a visual reference to the ground. As the flight progressed, however, the available lighting and ground reference progressively decreased. The overcast sky, the decreasing sky illumination, and the dark colour of the forested area along the route and in the area of the accident yielded little light with which the pilot could manoeuver and navigate with reference to the ground. At the low altitude which the pilot flew to maintain clearance from cloud, the lights of La Loche probably provided him with little assistance.

It was not determined whether the pilot would have conducted the flight under IFR had the accident aircraft been appropriately equipped. However, if the aircraft had been so equipped, the pilot would have had the option to commence the flight under IFR, or to revert to IFR en route, when weather and lighting conditions made VFR flight impracticable.

Although the operator's FOM has detailed information on day VFR flight standards, the section on night VFR contains little guidance on night VFR, and the standard it refers to is misleading.

The pilot, who was familiar with the FOM, may have been misled by the lack of information in Section 3.6.1. The requirement for the minimum obstacle clearance height is not contained in the company operations exam. The level of pilot awareness of the requirement within the company indicates that the pilots were not receiving the information from other sources.

It was not established whether the pilot was subject to pressures from the customers of the accident flight to fly in adverse weather. However, customer and self-induced pressures were encountered frequently by company pilots in their dealings with other customers. As well, the occurrence aircraft was already loaded with the passengers' baggage prior to the pilot's return from his previous flight, and a company pilot had recently successfully completed a flight from La Loche. It is not known to what extent the pilot's decision to depart was influenced by one or more of these factors.

The following Engineering Branch report was completed:

LP 166/97 - Instruments Examination

Findings

1. The pilot was certified and qualified for the accident flight, whether it was flown VFR or IFR.

2. The available information indicates that the pilot's performance was not affected by incapacitation.

3. The aircraft records indicated that the aircraft was maintained in accordance with existing regulations.

4. The aircraft's gross weight and centre of gravity were within allowable limits at the time of the occurrence.

5. Examination of the aircraft's structure, systems, and engines did not reveal any pre-crash malfunctions.

6. The aircraft emergency locator transmitter was destroyed in the crash and did not activate.

7. The aircraft was not equipped for flight into cloud at the time of the accident.

8. The minimum en route altitude allowed by the CARs for the accident flight was 1,000 feet agl.

9. The weather at departure from Fort McMurray was within allowable limits for night VFR flight; however, as the flight progressed toward La Loche, the cloud ceiling decreased below allowable limits for a commercial air operator.

10. The available lighting and ground reference available en route and at the time of the accident decreased markedly from that prevailing on departure.

11. The pilot continued flight into weather and lighting conditions which did not enable him to avoid collision with terrain.

12. The operator's FOM contains little guidance to pilots on the subject of night VFR operations.

13. Company pilots were subject to customer and self-induced pressures from time to time to complete flights in adverse conditions.

Causes and Contributing Factors

The pilot continued flight into adverse weather and lighting conditions which did not enable him to avoid collision with terrain. Contributing factors to this occurrence were the aircraft's unserviceability for single pilot IFR flight and the lack of guidance to company pilots as to weather limits for night VFR flight.

Safety Action

After the accident, the operator arranged with Transport Canada to obtain, and distribute to company pilots, training information related to night flying and reduced visibility hazards.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 10 September 1998.

Appendix A - Area of the Flight