

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A04C0098



LOSS OF CONTROL AND COLLISION WITH TERRAIN

PICKEREL ARM CAMPS

de HAVILLAND DHC-2 MARK I BEAVER C-GQHT

FAWCETT LAKE, ONTARIO

18 MAY 2004

Canada

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

Pickerel Arm Camps is located about 22 km south of Sioux Lookout, Ontario. It operates a main campsite at its water base and several remote fishing lodges. The company operates two float-equipped de Havilland DHC-2 Beaver aircraft to fly guests and supplies to their remote sites. Seven guests of the company arrived at the water base on 18 May 2004, the day before their scheduled four-day fishing trip at Fawcett Lake, one of the remote lodges. Because the remote lodge was available, a decision was made to fly in that afternoon. The group was divided in two, and a group of three guests and all the supplies for the seven guests were to go in the first aircraft. The second group of four, with their personal baggage, was to follow in the company's other Beaver.

The occurrence aircraft, a de Havilland DHC-2 Beaver (C-GQHT, serial number 682) with one pilot and three camp guests on board, departed the company water base at approximately 1700 eastern daylight time on a day visual flight rules flight to Fawcett Lake. At approximately 1930, the pilot and the other four guests arrived in the second aircraft to discover that the first group had not arrived. The guests later found the accident aircraft overturned in the lake. Ontario Provincial Police divers recovered the bodies of the pilot and the three passengers. The aircraft sustained substantial damage. There was no fire.

Other Factual Information

The company employed two pilots, one of whom was designated the chief pilot. Transport Canada conducted an audit of the company in June 2003. Some deficiencies were noted; however, the corrective actions taken by the company with regard to the audit findings were considered satisfactory by Transport Canada, and the audit was closed.

The occurrence pilot did not record the fuel, cargo or passenger weights in the operational flight plan and load record. Post-occurrence calculations, based on estimated weights, indicated that the aircraft was likely within the weight and centre of gravity (C of G) limitations, as indicated in the aircraft flight manual, both at take-off and on arrival at Fawcett Lake. However, the aircraft was close to its maximum gross weight, and the C of G was close to the aft limit.

When the second aircraft arrived at Fawcett Lake, the first group of guests was not at the lodge. The second group disembarked, and the second pilot flew in the local area but could not locate or contact the first aircraft. Because of fuel considerations, the second pilot then flew back to Pickerel Arm Camps, and by radio relay with another flight, notified at 2003¹ the Winnipeg flight information centre (FIC) of the overdue aircraft. A communications search initiated by the FIC was not successful. During this time, the second group, which had no means of communication, went onto the lake to fish. They noticed an object floating on the lake near the place where they had landed, approximately one-half kilometre from the lodge dock toward the centre of the lake. Closer inspection revealed the partially submerged float of an overturned aircraft. Despite the temperature of the lake and the dangerous condition of the aircraft, a guest entered the water in an attempt to determine whether there were survivors inside the wreckage.

The company notified Search and Rescue (SAR) at 2116, and a SAR Hercules from Winnipeg, Manitoba, was on scene at Fawcett Lake at 2335 to conduct an emergency locator transmitter (ELT) search; no ELT signals were received. At 0036, the SAR crew observed a flashing SOS and confirmed with the company that a fishing party had been left at the lodge with adequate accommodation and supplies. At 0544 the following morning, the SAR crew dropped radios to the lodge guests and observed two boats on the lake near a submerged, overturned aircraft. A planned jump by SAR technicians with the objective of a snorkel dive was cancelled by the Rescue Coordination Centre because of the unlikelihood of survivors in the wreckage. A shoreline search was conducted instead. The SAR aircraft left the scene at 0630, after a company aircraft landed at the lodge.

The Ontario Provincial Police (OPP) was notified and dispatched officers to Fawcett Lake. The OPP secured the site and conducted a search of the local shoreline for survivors. The following day, OPP divers recovered the bodies of the pilot and the three passengers. All victims had sustained fatal injuries at impact and were found with their seat belts fastened. The force of the impact detached the pilot's seat, along with a section of the cockpit floor structure, and the legs of the rear cabin bench seat were broken. There was no indication that the cargo in the aft compartment had been secured.

¹ All times are eastern daylight time (Coordinated Universal Time minus four hours).

The aircraft was recovered from the lake over the next two days under the observation of the Transportation Safety Board of Canada (TSB), and investigators conducted an initial inspection to the extent possible on the shoreline near the lodge. The airframe structure, engine and floats incurred extensive damage. The right wing had broken off at the attachment fittings and was not found initially because of poor visibility in the lake. The condition of the fittings and the aileron push-pull tube indicated that the right wing had swept rearwards and upwards as it broke off. The left wing was still attached and had swept forward. One blade of the two-blade propeller was bent rearwards, from the mid-point to the tip of the blade, to an angle of approximately 45 degrees. Neither blade showed any marks from contact with other parts of the aircraft, and there were no apparent propeller strike marks on the floats. The right elevator torque tube attachment was broken. There was significant dishing of the right fuselage into the cabin, aft of the wing root. The fuel selector was selected to the centre tank, and the primer was down but not locked. The throw-over control yoke was on the pilot's side. There was no indication of fire. Subsequently, the wreckage was flown to a storage site for further examination.

Sonar was later used to find the right wing in the silt on the lake bottom. The right wing was found about 7 m from where the main wreckage had been found, and was recovered for examination. The damage to the wing was consistent with water impact damage while it was still attached to the fuselage, and there was no indication of pre-existing fatigue cracking (TSB Engineering Branch report LP 070/2004).

The occurrence aircraft was manufactured in 1953 and was equipped with EDO 58-4580 floats. The aircraft was not equipped with a stall warning system, nor was one required by regulation. Measurements of aircraft damage determined the impact angles to be approximately 37 degrees nose-down and 57 degrees right-wing-down. The flaps, hydraulically actuated by a hand-operated pump in the cockpit, had a cockpit flap indicator marked: CRUISE, TAKE-OFF, CLIMB, LAND, and FULL. The flaps were determined to have been in the FULL position at impact.

All breaks in the flight control system were determined to be in overload, indicating continuity of controls at the time the right wing was torn from the fuselage. The elevator trim was determined to be in full nose-down trim, consistent with the estimated aft C of G. Both the aileron and rudder trims were in mid-range.

The forward fuel tank was found with an outwards rupture in the direction of impact. The centre and rear tanks displayed no signs of rupture. During the engine tear-down, the engine-driven fuel pump shaft was found broken. There were no other anomalies found. In addition to the engine-driven fuel pump, the aircraft was equipped with a hand-operated "wobble" pump and a fuel pressure warning light.

It was reported that the ELT (Narco ELT 10, serial number 19093) was installed and functionally tested during the most recent aircraft inspection. During an aircraft inspection, it was determined that the external portion of the airframe ELT antenna had been broken off. A new antenna cable was ordered, but had not arrived when the aircraft was returned to service. The duration of the unserviceability was within the 30-day period allowed by Canadian Aviation Regulation 605.39. An internal examination of the ELT revealed that the inertia switch had activated at impact. Extensive corrosion at the battery connection and on various locations of the ELT circuit board indicated that battery power was supplied to the ELT when it was submerged

and flooded. After recovery to the maintenance facility, the battery connector was found disconnected from the circuit board terminals. This disconnection is believed to have occurred as a result of corrosion of the terminal clips and impact during wreckage recovery.

The cockpit instruments, fuel pressure warning light, engine-driven fuel pump, and right wing attachment fittings were examined at the TSB Engineering Branch. The following information was obtained from the cockpit instruments: engine oil temperature 77°C; oil pressure 70 to 80 psi; altimeter baroscale setting 30.08 inches; manifold pressure 27 to 29 inches; and turn and bank five pointer widths to the right. The drive shaft for the engine-driven fuel pump failed in torsion and the fracture surfaces showed smearing, indicating that the engine continued driving the pump after the shaft failed.

Internal inspection indicated that the pump rotor had come into contact with the rotor housing and likely jammed at impact. The aircraft fuel wobble pump was removed and functioned normally when tested. The right wing forward spar failed outboard of the attachment bolt, the rear spar failed at the attachment bolt, and the lower lift strut bolt pulled through and bent the airframe lift strut attachment fitting; all three failures were overload in nature.

The company pilot who flew into Fawcett Lake about 1 hour 15 minutes after the occurrence aircraft reported that the weather was clear with winds from the south at 10 knots. The surface of the lake was described as having a light ripple and not considered smooth enough to create a glassy-water effect. There was still ice in the southern portion of the lake, but a substantial portion of the lake was clear of ice. The lodge was located in the ice-free area of the lake. The weather at 1800 at Pickle Lake, Ontario, approximately 60 nautical miles east, was representative of the area weather at the time of the accident and was reported as follows: visibility 15 statute miles, mainly clear, temperature 17°C, dew point -5°C, wind 290°T at 6 knots.

The occurrence pilot was hired by the company one week prior to the accident and had flown a satisfactory check flight with the company's chief pilot. In the week with the company, the pilot had flown 16.8 hours, his total flying for the year-to-date. On the day of the accident, the pilot flew 1.6 hours prior to the accident flight. The pilot held a commercial pilot licence, valid for all single-pilot, non-high-performance, single- and multi-engine land and sea aeroplanes. The pilot had flown for nine years, primarily with float operators in the summertime. He had a total of 1688 flight hours, 344 of which were on the Beaver.

The autopsy of the pilot did not reveal any pre-existing conditions that could have affected his performance. Toxicology testing did not detect the presence of alcohol or drugs and established that the blood saturation of carbon monoxide was within the normal range.

The DHC-2 Beaver aircraft flight manual contains the following information about the use of full flap. Section 1.12.3 states that "FULL FLAP is only required for emergency landing in very restricted areas." Section 2.14.1 states that "Minimum run landings may be necessary under extraordinary circumstances. Pilots familiar with the aircraft and experienced in short landing technique may perform minimum run landings by using full flap and reducing the airspeed on the final approach to 65-68 mph and maintaining that speed to the point of flare-out."

The short landing technique, as described in the aircraft flight manual, requiring the use of full flap, increases aerodynamic drag significantly and places the aircraft in a steep, nose-down attitude. The aircraft buffets from the interaction of the flaps and airflow. Reportedly, the pilot had received no training in short landing technique in previous employment flying the Beaver, nor was there any record of such training or experience. The pilot had flown only one training flight at Pickerel Arm Camps, and that training did not include short landing technique.

Analysis

The most likely scenario, based on the damage to the aircraft and the bank and impact angles, is that the aircraft experienced an aerodynamic stall on final approach.

The size of the open-water area and the weather conditions at Fawcett Lake would not have required the pilot to use a full-flap configuration, which is specified for use only in an emergency landing in a restricted area. However, the pilot selected FULL flap during the approach; the reason for the selection could not be determined. While the pilot was familiar with the aircraft type, training in this type of approach had not been conducted recently, nor was there any information found to show prior experience.

During an approach with full flap, a steeper-than-normal nose-down attitude is required to maintain the required airspeed and, combined with engine power, the approach path. Any shallowing of the approach angle would bring the aircraft closer to the attitude that was normally seen by the pilot during the final stages of an approach without full flap. However, because of the drag at the full flap setting, there would be a more rapid reduction in airspeed than on a normal approach, unless significant engine power was added.

The full nose-down position of the elevator trim, consistent with the aft C of G, indicates that the pilot may have been holding the elevator in position with forward pressure on the control yoke to maintain the desired approach path and airspeed. Any distraction could result in the pilot relaxing the pressure on the control yoke and would result in a shallowing of the approach angle. The heavy weight of the aircraft would increase the stall speed. The pilot, without training in approach and landing with full flap, may not have been aware of the nose-down pitch attitude necessary to maintain the approach airspeed and the requirement to maintain this pitch attitude until immediately prior to initiating the landing flare. The additional buffet from the full flaps may also have masked some of the aerodynamic stall characteristics. These factors may have contributed to the pilot not recognizing the impending aerodynamic stall. When the stall developed fully, the wing dropped violently at an altitude that was insufficient for the pilot to recover the aircraft.

The ELT likely generated a signal; however, the signal would not have been transmitted because of the broken airframe antenna. The remaining antenna cable would provide a weak signal that would be attenuated further when the aircraft overturned and submerged. As well, the aircraft's immersion quickly rendered the ELT unserviceable.

The following TSB Engineering Branch reports were completed:

LP 072/2004 – Instrument Analysis
LP 097/2004 – Logbook Recover
LP 106/2004 – Fuel Pump Examination
LP 070/2004 – Examination of Wing Attachment Fittings

These reports are available upon request from the TSB.

Findings as to Causes and Contributing Factors

1. The pilot flew a high-drag approach configuration for which his proficiency was not established.
2. The pilot most likely allowed the airspeed to decrease to the point that the aircraft stalled on approach at an altitude at which recovery was unlikely.
3. The impact was non-survivable because of the high impact forces.

Findings as to Risk

1. The emergency locator transmitter (ELT) airframe antenna was broken off above the fuselage; however, the flight was within the 30-day period allowed by regulation for flight with an unserviceable ELT.
2. The pilot did not secure the cargo prior to flight, which allowed the cargo to shift forward on impact.
3. The weight and centre of gravity (C of G) were not indicated in the operational flight plan and load record, and the aircraft's weight and C of G could only be estimated.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 14 March 2005.

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