AVIATION INVESTIGATION REPORT
A02O0287

LOSS OF CONTROL AND COLLISION WITH TERRAIN

ORILLIA AVIATION LIMITED

CESSNA 172P C-GNRJ

LAKE ST. JOHN, ORILLIA, ONTARIO

07 SEPTEMBER 2002

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Summary

At 1130 eastern daylight time, C-GNRJ, a float-equipped Cessna 172P aircraft, serial number 17275283, with an instructor and student on board, departed from Lake St. John near Orillia, Ontario. The purpose of the flight was to allow the student to practise take-offs, landings, and simulated engine failures on departure. During the climb following the second takeoff, the instructor simulated an engine failure by pulling the throttle back to idle. The student executed a 180-degree turn as part of a simulated forced approach back to Lake St. John. During this simulated forced approach the aircraft stalled, pitched nose down and crashed into the swampy area along the shore line. The aircraft came to rest in an inverted position with its nose embedded in the swamp. Fishermen on the lake were able to rescue both occupants from the partially-submerged aircraft. Neither the instructor nor the student was wearing a shoulder harness, and both received serious injuries.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft was manufactured in 1981 and had accumulated 9826 flight hours before the accident. It was equipped with Canadian Aircraft Products (CAP) floats, model number 67-2000, and was used both as a rental aircraft and for flight instruction. Records indicate that the aircraft was equipped and certified in accordance with existing regulations. There were no known defects before the flight, and the aircraft's weight and centre of gravity were within approved limits.

The closest meteorological reporting office was at the Muskoka Airport, approximately 16 miles north of Lake St. John. At 1200 eastern daylight time[1], the weather recorded at the Muskoka, Ontario, airport was as follows: broken cloud ceiling at 25 000 feet above ground level, visibility 12 statute miles, temperature 26°C, dew point 13°C, wind variable 110° to 190° magnetic at 8 knots, and altimeter setting 30.24. The meteorological conditions were similar at Lake St. John.

Lake St. John is approximately 3.4 kilometres long and 2 kilometres wide and is oriented in a north/south direction (see Appendix A). Orillia Aviation Limited's float plane base is located on a bay on the south-eastern side of the lake. At the south end of the lake, where the occurrence took place, there is approximately 300 to 500 metres of swampy shoreline extending south to a tree line. The tree line marks the beginning of a forested area, with trees 20 to 30 feet tall.

The instructor pilot held a valid Canadian commercial pilot aeroplane licence and a Class 4 instructor rating. The instructor was licenced to fly gliders, and all single-pilot, non-high performance, single- and multi-engine land and sea aeroplanes. The instructor had accumulated 571 flight hours in powered aircraft, 150 of which were on float-equipped aircraft. The instructor pilot occupied the right seat during the occurrence flight.

The student pilot held a valid Canadian student pilot aeroplane permit and was taking *ab initio* pilot training on float-equipped aircraft. The student had been taking flying lessons since June 2001 and had accumulated 30.5 flight hours, of which 19.5 were on float-equipped aircraft. The student also had undocumented experience at the controls of a friend's float-equipped Cessna 206. The instructor and student had completed two training flights in the week preceding the accident. Circuits and emergencies were the primary focus of these trips. The accident flight was scheduled to allow for further enhancement of these skills and to determine if the student was ready to fly solo.

The student completed the aircraft pre-flight safety inspection before the instructor met her at the aircraft. The instructor conducted an informal pre-flight briefing with the student at the dock and in the aircraft as it was taxiing before the first takeoff. This was common practice at the flight school, and there was no time set aside between bookings for pre- and post-flight briefings. It was assumed by both the instructor and the student that this lesson would be a continuation of the previous day's lesson which had encompassed take-offs and landings combined with simulated engine failures. However, all previous simulated engine failures had been introduced at an altitude of at least 1000 feet above ground level.
In this instance the simulated engine failure was introduced during climb out, and the student was not prepared. Directly ahead of the aircraft, the terrain was forested, and the aircraft altitude was not considered sufficient to

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

turn right and land on an adjacent lake, so the student turned back to land on Lake St. John.

As the student completed the turn back toward Lake St. John, control of the aircraft was either transferred to the instructor, or the instructor took control. During or subsequent to the transfer of control, the aircraft stalled and descended into the swamp. At no time during the simulated engine failure scenario did either the student or the instructor apply engine power to abort the simulated forced approach.

There is insufficient guidance provided in either the Transport Canada (TC) *Flight Instructor Guide*, the TC *Flight Training Manual*, 4th Edition (Revised), or the *Cessna 172 Pilot Operating Handbook* for a pilot to determine the minimum altitude required to safely execute a 180-degree turn following an engine failure after take-off. The TC *Flight Training Manual* (p. 128) states the following:

> Numerous fatal accidents have resulted from attempting to turn back and land on the runway or aerodrome following an engine failure after take-off. As altitude is at a premium, the tendency is to try to hold the nose of the aircraft up during the turn without consideration for the airspeed and load factor. These actions may induce an abrupt spin entry. Experience and careful consideration of the following factors are essential to making a safe decision to execute a return to the aerodrome: 1) altitude 2) the glide ratio of the aircraft 3) the length of the runway 4) wind strength/ground speed 5) experience of the pilot and 6) pilot currency on type.

The *Cessna 172 Pilot Operating Handbook* (Section 3, Engine Failures) states the following:

> In most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute a 180-degree gliding turn to the runway.

Although these documents recognize the inherent dangers associated with a 180-degree turn following an engine failure, they do not address the process by which a pilot or a student can determine the minimum safe altitude for an engine-out turn back. TC civil aviation document TP 13748E, *An Evaluation of Stall/Spin Accidents in Canada 1999*, discusses the need for clear and concise information regarding the altitude required before an engine-out 180-degree turn is initiated. TP 13748E states in part:

> Turn Back After Takeoff
>
> Several stalls occurred when the pilot decided to turn back to the runway when the engine failed. Typically, guidance on this topic recommends that the pilot land straight ahead unless the aircraft has enough altitude to make the turn back to the runway. This constitutes a “fuzzy rule”. That is, the rule requires interpretation, but the rule provides little or no guidance in making that interpretation. How much altitude is enough? Is it always the same? What variables may affect the requirement? The pilot is better off not having to consider these questions. Lives would be saved if the guidance required no thought or assessment. If an engine failure after takeoff results in an accident, the pilot is at least eight times more likely to be killed or seriously injured turning back than landing straight ahead. The easiest decisions to make are those which are prescriptive. As soon as the situation is known to exist, the

procedure to follow is defined. Engine failure after take off should be such a decision.

Analysis

The aircraft was serviceable, and the meteorological conditions were favourable for flight training; however, the lack of communication between the instructor and student was problematic. The informal pre-flight briefing did not prepare the student for an engine failure shortly after take-off and, contrary to the recommendations in the *Flight Training Manual,* did not provide full consideration of the factors essential to making a successful turn back. The *Flight Training Manual* does not address forming a hard rule for the predetermined safe turn-back altitude recommended in TP13748E. If such a hard rule had been formulated prior to the simulated engine failure, the student would not have to analyse the factors after the simulated engine failure to determine if turning back was a feasible option.

The exact altitude of the aircraft when the engine failure was simulated could not be ascertained; however, the student pilot was able to complete the 180-degree turn which put the aircraft in a downwind approach to the lake. At this point the aircraft was both low enough and slow enough that a successful forced landing was not assured, and it was necessary for the instructor to take control of the aircraft. Due to the lack of pre-flight planning for this exercise, the instructor was not prepared for the dangerous situation which had quickly developed and, as a consequence, tried to salvage the forced landing rather than apply power to execute an effective abort procedure.

The student sustained serious head injuries during the crash. It is highly probable that the injuries would not have been so severe had the available shoulder harness been worn. The instructor suffered loss of memory as a result of head trauma during the occurrence. It is likely that this injury would have been less severe had the shoulder harness been worn.

Findings as to Cause and Contributing Factors

1. The instructor allowed a dangerous situation to develop and continue until the aircraft stalled at an altitude from which recovery was not possible.

2. Neither pilot wore the available shoulder harness, which likely contributed to their degree of injury.

Findings as to Risk

1. Although the Transport Canada *Flight Training Manual*, 4th Edition (Revised), recognizes the inherent dangers associated with a 180-degree turn following an engine failure, it does not provide sufficient guidance for a student or an instructor to determine the minimum safe altitude for a 180-degree turn back to the take-off area in the event of an engine failure or simulated engine failure after take-off.

2. The training flight was conducted without a detailed formal pre-flight briefing. Therefore, the student was not fully aware of the expected actions following a simulated engine failure at low altitude, increasing the risk that errors could be made.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 29 January 2004.

Visit the Transportation Safety Board of Canada web site (www.tsb.gc.ca) for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A - Lake St. John and Aircraft Track