Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A03P0199

COLLISION WITH TERRAIN

PACIFIC PROFESSIONAL VISUAL FLIGHT TRAINING LTD.

CESSNA 172 C-GDPD

APPROXIMATELY 24 NM NNW OF

HARRISON HOT SPRINGS, BRITISH COLUMBIA

18 JULY 2003

Canada

Aviation Investigation Report

Collision with Terrain

Pacific Professional Visual Flight Training Ltd.
Cessna 172M C-GDPD
Approximately 24 nm NNW of
Harrison Hot Springs, British Columbia
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Report Number A03P0199

Summary

The Cessna 172M (registration C-GDPD, serial number 17262636) departed Boundary Bay Airport, British Columbia at 1848 Pacific daylight time. There was a flight instructor, a student pilot, and an observer on board to conduct mountain flying training in the areas around Stave Lake and Harrison Lake. About one hour later, during a practice forced approach conducted west of Harrison Lake, the aircraft struck the ground and was destroyed. There was no fire. The two front seat occupants were seriously injured, and the rear seat occupant received minor injuries. An emergency locator transmitter signal was reported about three hours after the accident, and the aircraft was located about 24 nautical miles north-northwest of Harrison Hot Springs, British Columbia. All three occupants were evacuated from the site by helicopter.

Other Factual Information

The student pilot, who was in the left front seat, held a valid Canadian private pilot licence and had accumulated 78 hours at the time of the accident. The instructor pilot, who was employed by Pacific Professional Visual Flight Training Ltd., held a valid Canadian commercial pilot licence endorsed with a Class 2 instructor rating and was in the right front seat. He had accumulated over 6000 hours, the majority as a flight instructor in Cessna 150 and 172 series aircraft. Both pilots were appropriately certified for the type of flight being conducted. A review of records revealed that the instructor's flight and duty times were in accordance with existing regulations. The rear seat occupant, who was training to become a flight instructor, was invited on the flight to observe the mountain flying instruction.

The student pilot carried out the pre-flight inspection of C-GDPD and calculated the aircraft's weight and balance. He also gathered the weather information and filed a visual flight rules (VFR) flight plan indicating that they would depart Boundary Bay Airport, British Columbia[1] at 1800 Pacific daylight time,[2] proceed northeast into the mountains, and return to Boundary Bay Airport at 2100. Nine imperial gallons of fuel were added to bring the total fuel on board to 38 imperial gallons, sufficient for the three-hour flight plus adequate reserve, and a ground briefing was conducted. The aircraft departed Boundary Bay Airport at 1848 and flew northeast along the flight-plan route into the mountains.

Two practice precautionary approaches were carried out at an abandoned airstrip at the north end of Stave Lake, and some minimum-radius (confined-area) turns were conducted in the same area. The aircraft continued on the flight-plan route and entered the Tretheway Creek valley, nine nautical miles (nm) south-southwest of Harrison Lake. While flying down the Tretheway Creek valley toward Harrison Lake, the instructor reduced the throttle to idle and suggested that the student perform a practice forced approach. The student conducted a 180-degree turn and established the aircraft on a descent toward a meadow-like area that they had overflown when they entered the Tretheway Creek valley. The aircraft descended until it was abeam of the selected landing site at a height significantly below 500 feet above ground level (agl); the exact height to which the aircraft descended was not determined. At that time, the instructor took control of the aircraft to conduct an overshoot. The instructor increased the throttle to full power, selected carburetor heat off, and fully retracted the flaps. Despite normal engine and flight control response, the aircraft continued to approach the rising terrain, and the instructor initiated an evasive left turn. During the turn, the aircraft struck the hillside, approximately 24 nm north-northwest of Harrison Hot Springs. Air traffic control radar and flight path calculations show that the accident occurred at about 1948.

The two front seat occupants were seriously injured. The rear seat occupant received minor injuries and was able to locate the first aid kit and assist the injured pilots. The survival kit and some of the occupants' personal effects, such as spare clothing, were ejected from the aircraft during the accident and could not be located due to the darkness and ground cover. All occupants were wearing lap belts, and both front seat occupants were wearing shoulder

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1 All locations are in British Columbia.

2 All times are Pacific daylight time (Coordinated Universal Time minus seven hours).

harnesses. The occupants moved the emergency locator transmitter (ELT) function switch from the AUTO position to the ON position shortly after the accident, and a signal was reported to the rescue coordination centre at 2230, approximately three hours after the accident. A night search was conducted and C-GDPD was located by a search aircraft at 0230 the following morning. Search and rescue located the accident site more readily because the aircraft had not deviated from its flight-planned route and because the occupants of the crashed aircraft directed a camera flash at the search aircraft.

The mountain peaks in the vicinity of the accident site vary in height between 6400 feet and 7400 feet above sea level (asl), and there was some snow at higher elevations, particularly on the north-facing slopes. The wreckage was located at approximately 2100 feet asl on a northwest-facing slope at the juncture of two U-shaped glacial valleys: Tretheway Creek valley and a slightly narrower, unnamed valley. The wreckage was situated about 1000 feet south and 300 feet above Tretheway Creek. The mountainside in the immediate area of the accident site was covered with low, light-green vegetation typically found in sub-alpine avalanche chutes; the predominant vegetation elsewhere in the area was dark, coniferous forest.

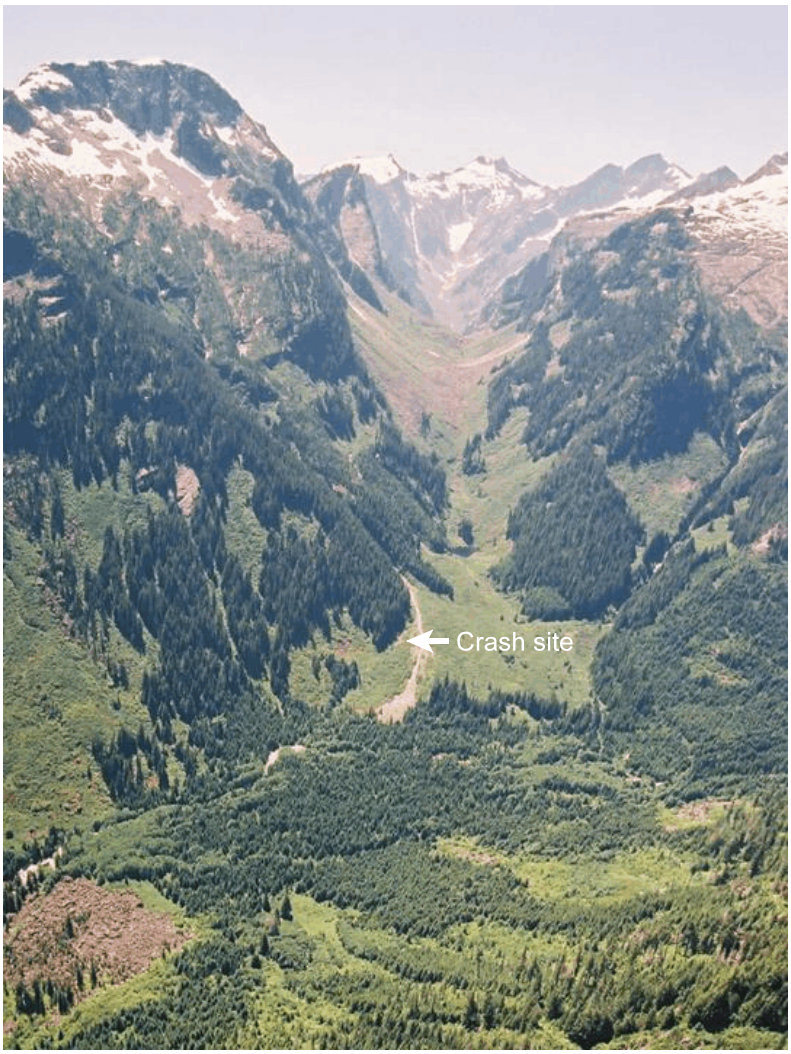

Photo 1. Aerial photograph of crash site, facing southwest

During impact, the left wing, engine, firewall, and nose landing gear detached from the fuselage and the battery was ejected from the aircraft. Pieces of the left wingtip and navigation light were found embedded in the ground 130 feet west of the main wreckage and at approximately the same elevation. A series of impact marks and aircraft parts extended horizontally across the hillside between the wingtip pieces and the main wreckage. A section of propeller blade tip found near the beginning of the wreckage trail exhibited leading-edge damage, chordwise scratching, and torsional damage indicative of applied power. The propeller fractured 20 inches inboard from the tip; the cause was overload. The ELT remained attached to the aft fuselage wall via its mount, but the antenna

connection and the function switch at the forward end of the ELT were damaged when the fuselage was crushed. Although a substantial amount of avgas and engine oil was spilled at the accident site, there was no fire.

The weather recorded at 2000 (12 minutes after the accident) at Abbotsford Airport, 190 feet asl and 35 nm south of the accident site, was as follows: a few clouds at 23 000 feet asl, visibility 30 statute miles, temperature 25.3°C, wind 3 knots at 240° true, and altimeter 30.11. Using the standard lapse rate of 2°C per 1000 feet of elevation, the outside air temperature at the accident site (2050 feet) would have been about 21°C. Official sunset was at 2100.

Weight and balance calculations done during the investigation indicated that at take-off, the aircraft weighed approximately 2260 pounds, 40 pounds below its maximum gross weight of 2300 pounds, and was within its centre of gravity (C of G) limitations. At the time of the accident, the aircraft C of G was within allowable limits.

The Cessna model 172M Pilots Operating Handbook (POH) indicates that the best rate of climb for this aircraft at gross weight, flying at 2000 feet asl, with an outside air temperature of 20°C is 535 feet per minute. The POH also states that, for the best angle of climb, the aircraft should be configured with the flaps retracted, throttle full in, carburetor heat off, and 64 knots indicated airspeed. These best rate-of-climb and best angle-of-climb figures are predicated on the assumption that the aircraft is flying in wings-level flight. In-flight manoeuvring, such as an aggressive turn, will sharply degrade the aircraft's climb performance.

Records show that the aircraft was serviced and maintained in accordance with existing directives. The maintenance log books contained no uncorrected deficiencies.

During the last segment of the flight path, just prior to the 180-degree turn, the aircraft was in sunlight, flying toward the setting sun. The accident site was in a large shadow region and had been for several hours prior to the accident. Although the pilots did not report downdrafts or katabatic wind (the local downward motion of cool air) during the flight, the cooling of air in shadowed areas, and the cooling of air above snow-covered surfaces are known causes of downdrafts in mountainous areas.

Pacific Professional Visual Flight Training Ltd. has verbal guidelines for all instructors who instruct in the mountains, and the Chief Flying Instructor (CFI) offers advice to these instructors on a one-on-one basis. Guidelines can vary from pilot to pilot, based on the CFI's assessment of the instructor. The company states that their minimum safe altitude in mountainous regions is at least 1000 feet above the valley floor. Furthermore, their minimum safe altitude on low level flights in canyons is at least 2000 feet when downdrafts are expected. As well, the CFI also suggests to the instructors that simulated forced approaches in the mountains be initiated only when safe and conducted so as to lose 200 to 300 feet of altitude before terminating the exercise. The company deems this loss of altitude sufficient for the instructor to assess the reaction of the student pilot in that simulated emergency.

The accident instructor used written sheets as an aide-memoire when conducting mountain-flying checkout flights, and they were found in the cockpit wreckage after the accident. The instructor had personally compiled these sheets while employed by a different flying school. These sheets included pertinent notes concerning precautionary approaches, minimum-radius

(confined-area) turns, forced approaches, terrain rising more quickly than the aircraft's ability to climb, and visual perception in varying light conditions. Under the subject heading of "Valley Rising Steeper Than A/C Performance" the instructor's notes caution that, *following an engine failure, the aircraft should be glided down the valley to lower terrain*. On the accident flight, the instructor briefed and demonstrated many of the items on the mountain flying checkout sheets, including confined-area turns and precautionary approaches, but did not brief on or demonstrate in-flight practice forced approaches.

The student's previous forced-approach training had been conducted with other Pacific Professional Visual Flight Training Ltd. instructors and had been conducted over non-mountainous terrain. During that training, the student maintained the aircraft in a descent until the instructor called for an overshoot; this typically occurred when the aircraft reached about 500 feet agl.

Analysis

The aircraft was within weight and balance limits, and there was sufficient fuel on board for the flight. No mechanical malfunction was reported or found that would have resulted in engine power loss or a loss of flight control. The damage to the propeller indicates that the engine was likely developing significant power at impact. Damage to the aircraft and the length and direction of the debris trail indicate that the aircraft was in controlled flight until impact; it does not appear that the aircraft stalled before striking the ground. The absence of a post-crash fire is likely due in part to the aircraft battery being ejected from the aircraft during the breakup sequence, thus preventing an electrical spark from igniting the fuel.

During forced-approach training over non-mountainous terrain with other Pacific Professional Visual Flight Training Ltd. instructors, the student would continue the aircraft's descent until the instructor called for an overshoot. As no briefing was given regarding the forced-approach technique to be used on the accident flight, the student conducted that forced approach in the same manner. While waiting for the instructor to call for an overshoot, the student continued the aircraft's descent to a height above ground much lower than the 500 feet agl overshoot height used during his previous forced-approach training. The exact height to which the aircraft descended before the overshoot was initiated was not determined. It is possible that the visual cues normally used to determine height above terrain were degraded because the accident site was in shadow and, unlike the surrounding areas, was not forested.

Although the instructor's mountain flying checkout sheets indicated that following an engine failure, the aircraft should be glided down the valley toward lower terrain, the instructor did not prevent the student from gliding the aircraft up the valley toward rising terrain after the throttle was retarded to simulate an engine failure.

The aircraft was configured for best angle of climb for the overshoot, and no mechanical problems were reported; however, the aircraft was unable to out-climb the terrain. The aircraft's climb performance was negatively affected by the high weight of the aircraft, the altitude, and the outside air temperature. Climb performance would have been degraded further by the

aggressive left turn after the instructor took control. It is possible that downdrafts, caused by the cooling of air in shadowed areas and by snow on the ground at higher elevations in the mountains, negatively affected the aircraft's climb performance.

The following TSB Engineering Laboratory report was completed:

LP 131/03 - Terrain Shadow Analysis

Findings as to Causes and Contributing Factors

1. The instructor did not brief the student on forced-approach procedures and allowed the student to continue the forced approach to a height from which the aircraft could not avoid rising terrain.

2. The aircraft was near gross weight which, combined with the effects of altitude, outside air temperature, and aggressive manoeuvring, degraded the aircraft's ability to out-climb the terrain.

Other Findings

1. Shadows and lack of visual cues, such as trees, in the area of the forced approach may have adversely affected the pilots' ability to estimate the aircraft's height above ground.

2. The risk of a fuel-fed post-crash fire was significant; ejection of the aircraft's battery eliminated one potential ignition source.

Safety Action Taken

As a result of this accident, Pacific Professional Visual Flight Training Ltd. has made the following changes:

1) Aircraft will no longer be dispatched into the mountains in the evening,

2) Safe flying limits for mountainous terrain have been established.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 22 December 2004.

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