

AVIATION INVESTIGATION REPORT

A0100165

IN-FLIGHT BREAK-UP

CESSNA 210L CENTURION C-GPMC

LAKE LAVIELLE, ALGONQUIN PARK, ONTARIO

18 JUNE 2001

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.

## Aviation Investigation Report

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### *Summary*

The Cessna 210L aircraft, registration C-GPMC, serial number 21060888, with the pilot and one passenger on board, was on a visual flight rules flight from Wawa, Ontario, to Smiths Falls-Montague (Russ Beach) airport. The flight was receiving flight following from air traffic control (ATC). Approximately two hours after departure and 120 nautical miles from Smiths Falls, the pilot contacted Toronto ATC and requested a descent. ATC cleared the flight to descend at the pilot's discretion. C-GPMC was cruising at approximately 9500 feet above sea level (asl) and 160 knots ground speed when the pilot began the descent. About one minute later, ATC instructed the pilot to switch to an Ottawa frequency for flight following.

The pilot contacted Ottawa ATC during the descent and made several routine transmissions over a period of 45 seconds; however, the last transmission was incomplete. During the descent, the aircraft turned left through approximately 30°, followed by a right turn through approximately 100°. The aircraft's ground speed, as derived from the radar tape, generally increased during the descent, reaching values as high as 203 knots. The aircraft disappeared from radar coverage at approximately 7000 feet asl at the same time as the pilot's last radio transmission to Ottawa ATC was clipped. The aircraft crashed into Lake Lavieille, immediately below the last known radar position. The two occupants were fatally injured. The accident occurred in daylight and visual meteorological conditions at 1615 eastern daylight time.

*Ce rapport est également disponible en français.*

## *Other Factual Information*

The aircraft was manufactured in 1975 and flew 4103 hours before this accident. In January 1995, the aircraft was substantially damaged in an accident resulting from an engine power loss caused by fuel starvation (TSB Report No. A95O0003). The aircraft was repaired in 1997 and purchased by a commercial operator based in the Northwest Territories. The aircraft subsequently flew approximately 1457 hours over a period of four years before it was sold to the occurrence pilot in April 2001.

No significant weather was reported in the vicinity of the flight. A commercial pilot flying in Algonquin Park that afternoon recalled that the weather was generally good, with no convective clouds and no rain shower activity. He was flying between 1000 feet and 2000 feet above ground level (agl), and there was a thin overcast layer at about 4000 feet agl. The following aviation routine weather reports were reported at 1600 eastern daylight time:<sup>1</sup>

CYWA (Petawawa): a few clouds at 5000 feet agl, a broken layer at 10 000 feet agl, a broken layer at 25 000 feet agl, and visibility 15 statute miles (sm). Petawawa is 39 nautical miles (nm) from the accident site, on a bearing of 96° magnetic (M).

CYQA (Muskoka): a few clouds at 5000 feet agl, a few clouds at 8000 feet agl, a broken layer at 15 000 feet agl, an overcast layer at 20 000 feet agl, and visibility 12 sm. Muskoka is 70 nm from the accident site, on a bearing of 232°M.

CYYB (North Bay): a broken cloud layer at 3500 feet agl, an overcast layer at 8000 feet agl, and visibility 15 sm. North Bay is 57 nm from the accident site, on a bearing of 314°M.

The occurrence pilot held a commercial pilot licence and a Category 1 medical and was certified and qualified for the flight in accordance with existing regulations. He was issued his private pilot licence in 1965 and his commercial licence in 1966. He had flown several types of single-engine aircraft and had accumulated more than 1200 hours' total flying time, including approximately 52 hours on the accident aircraft. Based on the autopsy, toxicology tests, and medical records, there was no indication that incapacitation or physiological factors affected the pilot's performance.

The accident occurred on the final leg of a trip that had begun 10 days before. The pilot and his wife departed Ottawa, Ontario, on June 9 and flew more than 22 hours during the next five days before arriving in Calgary, Alberta. Four days later, on June 17, they departed Calgary and flew to Brandon, Manitoba, where they remained overnight. On June 18, they flew from Brandon to Wawa, Ontario, where they refuelled and departed on the final leg of their trip to Smiths Falls-Montague (Russ Beach), a flight of approximately three hours.

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder; however, recordings of air traffic control (ATC) radar data and VHF radio communications between the pilot and ATC were available. Slightly more than two hours after departing Wawa, and approximately 120 nm from Smiths Falls, the pilot requested and was cleared for a descent from 9500 feet above sea level (asl) by Toronto ATC. The sequence of events from this time until the aircraft disappeared from radar was as follows:

1612:24

Toronto ATC cleared C-GPMC to descend at the pilot's discretion.

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<sup>1</sup>

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

1612:43 C-GPMC began a descent.

1612:57 C-GPMC, descending through 8900 feet asl, began a left turn; speed was 190 knots ground speed (G/S) (calculated to be 154 knots indicated airspeed [KIAS]).

1613:07 – 1614:24 C-GPMC's speed varied from 199 to 203 knots G/S (160 to 165 KIAS) and ground track varied from 98°M to 103°M.

1613:33 Toronto ATC cleared C-GPMC to contact Ottawa ATC.

1614:16 C-GPMC contacted Ottawa ATC and stated that he was descending through 8800 feet asl for 5500 feet asl. (The radar transponder data indicated that the aircraft was descending through 7800 feet asl.)

1614:29 C-GPMC, descending through 7600 feet asl, began a right turn.

1614:29 – 1614:48 C-GPMC's average rate of descent was 1800 feet per minute.

1614:48 C-GPMC was descending through 6900 feet asl, speed 202 knots G/S (175 KIAS), and turning right through 160°M.

1614:58 The last transponder data was received from C-GPMC at 7100 feet asl. The transponder subsequently stopped transmitting. Subsequent radar data was unreliable.

1615:03 C-GPMC's last radio transmission to Ottawa ATC was clipped.

Radar data and VHF communications ceased at the same time, approximately 1615.

The consistency of the altitude, heading, and ground speed data available from the radar indicated that the pilot was most likely using the autopilot during the en route portion of the flight. After the pilot began the descent and the left turn, the track and the vertical speed were linear and agreed with the autopilot settings found on examination of the instruments. Therefore, the descent and the left turn were most likely performed with the autopilot engaged. The autopilot course deviation indicator pointer was set to 130°, and the heading bug was set to 104°. Before the turn, the track to Smiths Falls was 131° and the radar data showed the aircraft tracking 131°M. The autopilot track selector was found in the heading position, and the heading bug was in agreement with the track flown after the left turn. At 1614:29, the aircraft started a right turn, indicating that the autopilot was disconnected, because this was not consistent with the autopilot settings. The maximum operating speed for the autopilot was 165 KIAS. The aircraft was approximately 57 nm from the North Bay radar when it disappeared from radar coverage. Under normal circumstances, an aircraft with a functioning transponder would be in radar coverage down to an altitude of about 2500 feet asl.

At approximately 1615, while the aircraft was in a descending, right-hand turn, the left wing failed in overload. It separated from the aircraft in six major pieces, at least one of which struck the vertical stabilizer, causing the entire empennage to separate from the fuselage. The power converters for the VHF communication and navigation radios were contained in the left wing root. When the left wing separated, power to these radios ceased, ending VHF communication and navigational information. After the separation, the aircraft lost

horizontal speed and fell vertically, with the left side facing the ground and the right wing trailing upwards. The aircraft subsequently crashed near the shore of Lake Lavieille, in the immediate vicinity of the last observed radar position.

Lake Lavieille is a large, remote lake in the interior of Algonquin Provincial Park. The forest surrounding the lake is very dense. The main wreckage was found approximately 15 feet from shore in 3 feet of water. The remaining portions of the aircraft and personal effects were found scattered up to 1000 feet away, both in the water and on the land. (See wreckage diagram in Appendix A.) The aircraft landed on the left side of the fuselage, severely deforming the fuselage along its entire length; however, the right side of the fuselage was relatively undamaged. The flaps and the landing gear were found in the retracted position.

The empennage separated just forward of the vertical stabilizer and was found in the water southeast of the main wreckage. All of the associated control cables and electrical wiring failed in overload. The horizontal stabilizers and the elevators separated from the empennage and were found in the water and on the land. The leading edges of the vertical and horizontal stabilizers showed signs of paint transfer and severe impact damage.

The right wing was still attached to the fuselage and was fractured chordwise at the aileron cutout. All control cables and electrical wiring to the right wing were intact.

The left wing failed along the spar, but the wing attachments to the carry-thru-spar, top and bottom, were still intact. Approximately 18 inches of the forward inboard section of the left wing remained with the fuselage and was attached by the aileron cable, which had wrapped around the propeller mounting flange. The remaining five sections of the left wing were found up to 1000 feet southeast of the main wreckage, in the water and on the land. All five sections showed varying degrees of impact deformation and paint transfer. The left aileron separated from the wing and was found in three pieces. The left flap failed mid-span but was still attached to the relevant wing structures. The inboard seven feet of the spar failed completely. The upper and lower spar caps were bent and twisted upward, and the spar web showed signs of buckling, consistent with the upward bending of the spar caps and a positive  $g$  overload. The cables and electrical wiring to the left wing failed in overload.

After the aircraft was examined at the accident site, it was recovered and transported to the Ontario Regional Wreckage Examination Facility in Richmond Hill. The wings were subsequently transported to the TSB Engineering Laboratory for a more detailed examination.

The detailed examination of the wings revealed no signs of flutter or pre-existing structural weakness, such as fatigue, corrosion, or loss of rigidity. The right wing skin showed signs of positive  $g$  deformation. The right wing main spar web was found to be buckled at a location similar to that of the left wing, and the buckles were oriented in a direction corresponding to upwards deflection of the wing. The left wing was examined at all the locations reported to have been repaired after the earlier accident. There was no indication that any improper repair technique or material had been used. There was also no sign of any pre-existing damage at any of these repair locations.

Examination of the engine, a Continental model IO-520-FCL (17), serial number 291359R, indicated that it was likely serviceable and capable of producing power. Inspection of the propeller, a Hartzell model PHC-J3YF-1RF, serial number FP768A, revealed no pre-impact deficiencies that would have prevented it from operating normally.

## *Analysis*

ATC radar data and VHF radio communications between the pilot and ATC were available; however, radar data and VHF communications ceased at the same time, at 1615, indicating that a catastrophic event likely occurred at that time. Because there was no flight data recorder or cockpit voice recorder, other data (such as precise airspeed,  $g$  load, autopilot status, and position of the flight controls and control column) could not be determined.

The absence of any identified evidence of flutter or pre-existing structural weakness, such as fatigue, corrosion, loss of rigidity, improper repair, or incorrect material, suggests that the left wing was subjected to an overstress condition that exceeded the design strength. An in-flight event capable of loading the left wing beyond its design strength would likely also cause permanent deformation elsewhere on the aircraft. However, the severe structural damage caused to the aircraft during the break-up and the ground impact obscured the more subtle indications of overstress. The positive  $g$  deformation of the right wing skin and spar might have been the result of an in-flight overstress but could also have occurred during the ground impact.

Possible causes of an overstress condition include aircraft manoeuvres, gust loads, or a combination of the two. The direction of the deformation in both wings indicates that the aircraft was subjected to a severe positive  $g$  load factor. The fact that the left wing failed before the right may be due to the two wings not being precisely of the same strength or may indicate that there was an asymmetric component to the manoeuvre or gust.

The pilot began a descent approximately 120 nm from Smiths Falls. During the descent, the airspeed increased significantly and the aircraft turned approximately  $30^\circ$  left, maintained direction for approximately one minute, and then began a right turn. No VHF transmission indicated any reason for the descent or the turns. Routine radio communications between the pilot and ATC indicated that the flight was proceeding normally until radio and radar contact was lost. Radio communications from the pilot, including the final clipped transmission, gave no indication of a significant  $g$  load; however, the airspeed was approximately 175 KIAS, well into the yellow cautionary range of 165 to 195 KIAS, and the autopilot speed limit might have been exceeded. The speed was well in excess of the manoeuvre speed, or speed at which a damaging load factor can be attained without stalling the aircraft. A combination of high speed, pilot-induced  $g$  load, and gust-induced  $g$  load could have been present. For a given magnitude of gust, the resulting incremental load factor on the aircraft becomes greater with increased airspeed. Travelling at a higher airspeed increases the probability that the aircraft will encounter a structurally damaging gust.

The following TSB Engineering Laboratory reports were completed:

LP 054/2001—Instrument Examination  
LP 055/2001—Radar and Audio Analysis  
LP 059/2001—Structural Examination

These reports are available upon request from the Transportation Safety Board of Canada.

### *Findings as to Causes and Contributing Factors*

1. The left wing failed in overload and separated from the aircraft, rendering the aircraft uncontrollable. Portions of the left wing struck the empennage, causing the empennage to also separate in flight.

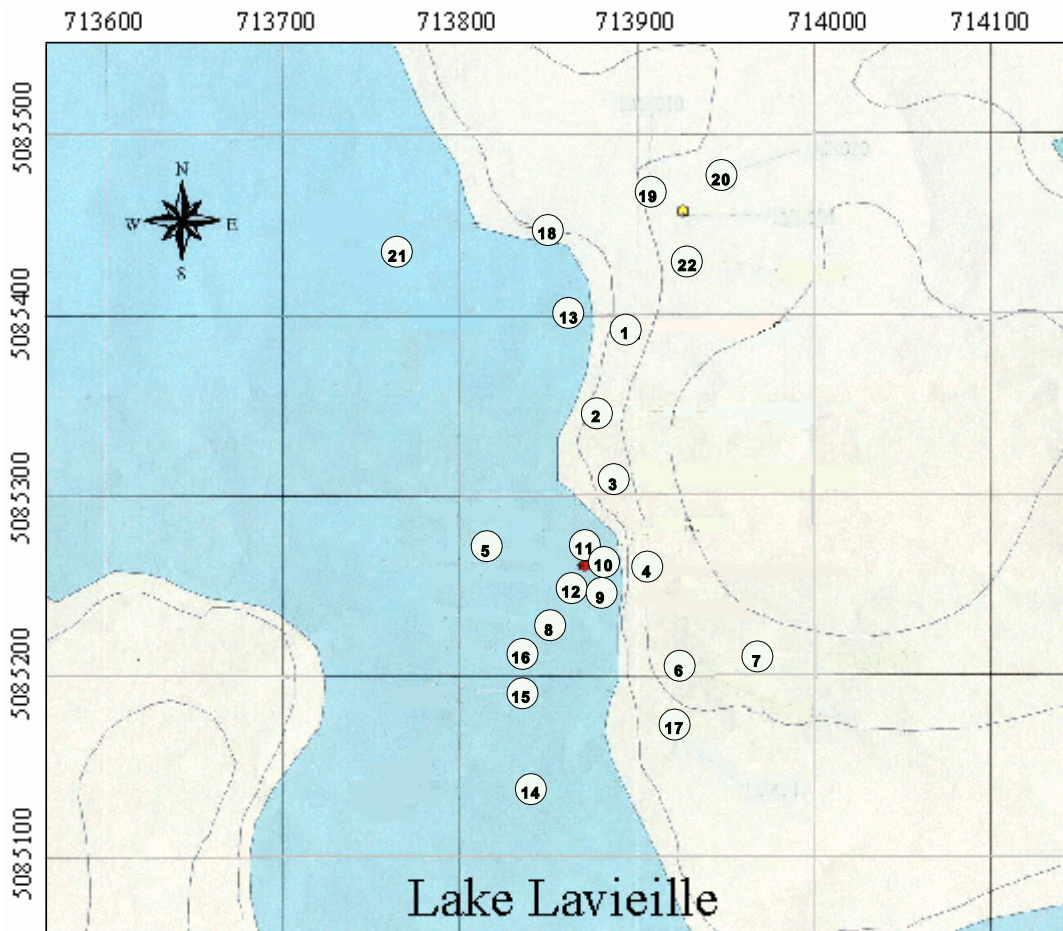
### *Other Findings*

1. There were no indications of flutter or pre-existing structural weakness of the aircraft structure from fatigue, corrosion, loss of rigidity, improper repair, or incorrect material.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 03 July 2002.*

## Appendix A—Wreckage Diagram

### C-GPMC GPS LANDMARK INDEX



- |    |   |    |  |
|----|---|----|--|
| 1  | Portion of left aileron on land           | 12 | Main wreckage inverted in water, right wing attached   |
| 1  | Left elevator on land                     | 13 | Paint chips in water                                   |
| 2  | Right elevator end cap and weight on land | 14 | Flight control rod in water                            |
| 3  | Left wing outboard section on land        | 15 | Inboard section of wing in water                       |
| 4  | Left wing end cap near shore              | 16 | Inboard section of wing on land                        |
| 5  | Portion of left aileron on land           | 17 | Window from pilot's door on land                       |
| 6  | Horizontal stabilizer on land             | 18 | Jacket in trees near ground                            |
| 7  | Flight control in water                   | 19 | Small debris in forest                                 |
| 8  | Horizontal stabilizer in water near shore | 20 | Clothing 30 to 40 feet up in tree in the forest canopy |
| 9  | Vertical stabilizer and rudder in water   | 21 | Large tree approximately 50 to 60 feet high            |
| 10 | Section of wing in water                  |    |  |
| 11 | Unknown piece in water                    |    |  |

Notes: Small pieces of aluminum, plastic, plexiglass, and fibreglass were found throughout the entire forested debris field as defined by the landmarks. Although large pieces of wing, stabilizers, and flight controls were found in the water, very little small debris was found in the water, except at the main wreckage site.



The area around 21 and 22 was littered with small debris, that is, small pieces of aluminum, plastic, plexiglass, fibreglass, pieces of map, a magazine, and two sponge mitts that were used as intake plugs.