Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A00C0060

LOSS OF CONTROL – COLLISION WITH TERRAIN

CESSNA 180J C-GRPR

SMOOTHSTONE LAKE, SASKATCHEWAN 10 nm SE

17 MARCH 2000

Canada

Aviation Investigation Report

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Summary

A ski-equipped Cessna 180J, C-GRPR, with the pilot and one passenger on board, departed from the frozen surface of Delaronde Lake, Saskatchewan, at 1500 central standard time on a visual flight rules flight to a cabin at Swan Lake. As the aircraft was approaching the midpoint of the 80 nautical mile flight, the cloud ceilings lowered and snow began to fall, which reduced forward visibility. An area of heavier snow was noted further along the route of flight, and the pilot was in the process of deciding whether to make a precautionary landing on a nearby road to await improved weather conditions, or to return to his base at Delaronde Lake. As the aircraft was rolling out of a left turn at about 500 feet above ground level, it yawed to the right. Airframe buffeting was noted, and the pilot had difficulty maintaining pitch control. Despite the application of elevator pitch input and full engine power, the aircraft descended and crashed in a wooded area. The pilot called the La Ronge flight service station by satellite telephone, and a search was commenced. The two occupants were airlifted from the site and taken to hospital with serious injuries. The aircraft was destroyed by impact forces. There was no fire. The accident occurred during daylight at latitude 54˚20' north, longitude 104˚30' west.

Ce rapport est également disponible en français.

Other Factual Information

The nearest Environment Canada weather reporting station is located at La Ronge, about 60 nautical miles (nm) northeast of the accident site. The 1500[1] weather report for La Ronge was as follows: wind 270 degrees at 13 knots, visibility 15 miles, scattered cloud at 1500 feet and overcast ceiling at 3000 feet, temperature 2 degrees Celsius, dewpoint minus 3 degrees Celsius, and altimeter setting 29.41 inches. The terminal forecast for the La Ronge area predicted overcast cloud at 2000 feet and visibility 3 miles in light snow showers. The area forecast predicted ceilings of 3000 to 4000 feet with visibilities 3 to 6 miles in light snow and frequent embedded altocumulus castellanus cloud (ACC) giving visibilities 1 to 3 miles in light snow with frequent snow ceilings of 1000 to 2000 feet. Moderate turbulence was forecast in the vicinity of ACC.[2] The surface winds were reported to be from the southwest, and the aircraft encountered moderate low-level turbulence before and during the final descent.

The pilot held a private pilot licence valid for single-engine, land, and sea aeroplanes. His category-3 medical certificate was valid until 01 March 2001, with the conditions that glasses must be worn and a headband or cable frame must be available. Information provided indicated that those conditions were met at the time of the accident.

The aircraft had been modified in 1994 with the installation of a kit that modified the tail and increased the allowable gross weight to 3190 pounds. A reconstruction of the aircraft's load indicated that the aircraft's gross weight and centre of gravity were within approved limits.

The crash path was about 330 feet long. As the aircraft descended, it struck and severed trees up to 10 inches in diameter. The aircraft came to rest upright, facing the direction from which it had come. The right wing was severed by impact with the trees. Examination of the aircraft revealed no pre-impact structural defects. The engine oil and air filters were clear, and no pre-existing engine anomalies were noted. The propeller was intact and exhibited indications of significant engine power at impact. The flight controls were examined, and no pre-impact defects were found. The pilot's control column was broken off, in overload failure, flush with the instrument panel. The elevator push-pull tube was severed at the forward elevator bell crank, also in overload failure, in a manner consistent with impact forces.

The airframe was examined for indications of airframe icing. Some airframe parts that had been exposed to the forward airflow, including part of the right wing, had been surrounded by snow from the time of the accident to the time at which the wreckage was examined. The snow was considered to be an indication that temperatures at the surface of those airframe parts had remained below freezing levels. No indication of in-flight airframe icing was found on any part of the aircraft.

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[1] All times are central standard time (Coordinated Universal Time [UTC] minus six hours) unless otherwise stated.

[2] ACC clouds are often associated with precipitation and convective turbulence of various intensities. Such clouds are middle-level convective clouds and may have extensive vertical development. They are a sign of instability aloft and may precede the development of thunderstorms.

The aircraft's landing gear configuration was converted from floats to skis on 01 December 1999, and the aircraft had operated for 67 hours since that time (see Appendix A). The Federal Fluidyne C3200 wheel-skis that were installed were inspected before installation, and no defects were found. The skis were equipped with hydraulically operated attachment links that allow the skis to be retracted for wheel operations or extended for ski operations. Most of the take-offs and landings made since the skis were installed were made from lake surfaces near the pilot's home and at several other camp locations. The landing strip near the pilot's home had been mechanically smoothed, but the other locations were unprepared. During these operations, the skis occasionally encountered small snow drifts and irregular snow surfaces. The pilot usually stored the aircraft in a hangar adjacent to the landing strip between flights. His practice was to retract the skis to taxi the aircraft on land and into the hangar. He would extend the skis again for operation on the lake landing strip. The skis were normally retracted in flight for aerodynamic efficiency; however, the skis were left in the extended position during the accident flight.

The skis were examined at the TSB Engineering Branch Laboratory. The left ski surface had sustained little damage. However, the mechanical link by which it is attached to the main landing gear was found to be twisted and broken. The break occurred at a repair that had been made to the link, in which the broken link had been welded and augmented with additional material. The date of the repair was not determined. The ski manufacturer has indicated that there is no approved method of making repairs to the ski link. In an analysis of the repair, it was determined that the strength of the repaired link was about 74 per cent of its original strength. However, the residual strength of the left link was considered sufficient to withstand aerodynamic loads in flight, and it was considered likely that the link separated on impact with the trees.

The right main ski surface had been bent up aft of the mechanical link. The damage was attributed to impact forces. The right mechanical ski link was found to be broken. A pre-existing crack was found at the break in the right link, which was found to have reduced the residual strength of the link to about 31 per cent of its original strength. Despite this reduction in strength, the right link's residual strength was also considered sufficient to withstand aerodynamic loads in flight. It was considered most likely that the link separated on impact with the trees.

The attitude of the skis in flight is maintained by rigging, with cable/bungee rigging lines. Wire rope limit cables are installed to prevent over-extension or failure of the rigging lines. Correct rigging of the lines and limit cables is required to maintain the skis in the proper attitude in flight; the skis do not trail naturally. If a ski is allowed to tilt up or down beyond specified limits in flight, air flow can be disrupted. In extreme situations, the resulting drag may overwhelm the aircraft's ability to maintain level flight. Rigging specifications are prescribed by the ski manufacturer and are established individually on each aircraft installation. The forward bungee cords, which comprise part of the rigging lines, were tested. It was found that the bungees were at least five years old, although their exact age was not determined. Elongation testing was done to determine whether the bungees met the requirements of MIL-C-5651. This standard specifies the resistance to stretching that the bungees should display at various elongation values. The tests indicated that the bungees in use on both of the aircraft's skis provided approximately one-half of the resistance to stretching specified in MIL-C-5651. The rigging lines on the skis maintain rigging trim of the skis, within the limits established by the limit cables. Damage to the

aircraft precluded a determination as to whether the length of the rigging lines or the limit cables met the installation specifications, or whether the condition of the bungees allowed vibration or oscillation of the skis. However, the aircraft had operated without difficulty during the winter seasons since the initial installation of the skis in January 1996, without a change in the rigging of the cables. A TSB accident investigation report (A97Q0032) of a ski-equipped Cessna 185F found that non-compliance with an airworthiness directive (CF-80-18), and possibly an incorrectly torqued bolt, allowed an in-flight failure of the right ski and gear leg. An article entitled "In-flight Breakup Owing to Ski Attachment", discussing ski installation and maintenance issues, was later published in issue 3/98 of Transport Canada's publication *Aviation Maintainer*.

Analysis

The length of the crash path and the nature of the damage to the aircraft, the propeller, and the trees indicate that the aircraft had significant forward momentum at impact, and the engine was producing a considerable amount of power. It is most likely that the aircraft struck the trees in forward flight above the stall speed with the engine producing power.

Air turbulence was forecast for the route of flight in the area of ACC cloud, and it was noted by the aircraft occupants during the time of the aircraft's uncontrolled descent. The turbulence and the heavier snow observed along the route of flight both indicated the presence of ACC cloud in the vicinity of the accident site. Various degrees of convective turbulence may be associated with ACC cloud, and it is possible that the accident aircraft encountered turbulence of sufficient strength to result in the aircraft's descent.

Airframe parts that had been exposed to forward airflow were considered to have been preserved at below-freezing temperatures after the accident, and no airframe ice was noted. Therefore, it is unlikely that airframe icing had accreted on the aircraft at the time of the accident.

The weld repair made to the left ski link was not approved. However, the residual strength of the link was such that it is unlikely the link failed in flight. The fatigue cracking found in the right ski link had also weakened that link; however, it was also considered unlikely the right link failed in flight.

The forward bungee cords comprising part of the ski rigging lines for both skis were found to provide significantly less than the required resistance to stretching. The damage to the aircraft precluded testing to determine the effect of the substandard bungees on the rigging of the skis. It was not determined whether the condition of the bungees had allowed ski oscillation or vibration. However, if oscillation or vibration had occurred, it could have contributed to the aircraft's descent, in combination with weather-related turbulence.

The following TSB Engineering Branch Laboratory Report was completed:

LP 046/00 — *Ski Analysis*.

This report is available upon request from the Transportation Safety Board of Canada.

Findings as to Causes and Contributing Factors

1. The accident aircraft may have encountered air turbulence of sufficient strength to result in the aircraft's descent.

2. The forward rigging bungees for both skis had less than the required stretching resistance and may have allowed oscillation or vibration of either or both skis.

Findings as to Risk

1. The right main ski attachment link failed on impact at a pre-existing fatigue crack.

2. The left main ski attachment link failed on impact at the site of an unapproved repair.

Other Findings

1. It is unlikely that airframe icing had accreted on the aircraft at the time of the accident.

2. The aircraft's gross weight and centre of gravity were within approved limits.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 21 March 2001.

Appendix A - Aircraft Diagram