

AVIATION OCCURRENCE REPORT

IN-FLIGHT BREAKUP

CESSNA A185F C-GCTI
SEPT-ÎLES, QUEBEC 21 nm N
17 FEBRUARY 1997

REPORT NUMBER A97Q0032

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

The ski-equipped Cessna A185F, serial No. 18502495, registration C-GCTI, took off at 1045 eastern daylight time (EDT) from Sept-Îles Airport, Quebec, on a visual flight to Wabush, Newfoundland. Shortly after reaching its cruise altitude of 4,500 feet above sea level (asl), at an indicated airspeed of approximately 145 mph, the aircraft pitched down sharply. The pilot immediately reduced power and pulled back on the elevator to stabilize the aircraft. The aircraft stabilized for about two seconds, then broke up.

The aircraft was flying over a wooded area with an average elevation of 1,000 feet asl and was found 14 nautical miles north of Sept-Îles Airport, broken up into several pieces. The pilot and the aircraft owner were seated in front and sustained fatal injuries at ground impact. Two passengers, seated in the rear, survived the fall of about 3,500 feet.

Ce rapport est également disponible en français.

Other Factual Information

The pilot had held a commercial pilot licence since 1991 and had over 2,900 flying hours. At the time of the occurrence, he was the chief pilot for an air carrier located in the region. There was no evidence that psychological or physiological factors affected the pilot's performance. Toxicology testing revealed nothing unusual.

Weather conditions at Sept-Îles were favourable for the flight as planned. The weather report issued at 1100 indicated a few clouds at 1,500 feet and visibility of 30 statute miles. The temperature was minus 22 degrees Celsius and the winds were from 270 degrees magnetic at seven knots. No pilots reported turbulence or high winds at altitude in the Sept-Îles area.

The aircraft was purchased from the manufacturer in April 1975 by the former operator. In December 1975, Airglas LW3600-180A skis were installed on the aircraft. In subsequent winters, the operator did not reinstall the Airglas skis because he had purchased another model of skis. When the current owner purchased the aircraft in November 1996, it had about 1,680 flying hours since new. The aircraft was purchased in float-equipped configuration, and the wheels and Airglas skis were included in the transaction.

In December 1996, an aircraft maintenance engineer (AME) removed the floats and installed the wheels. Approximately three hours were flown, and no vibrations or other irregularities that would have indicated a potential problem were observed on the aircraft. On 13 February 1997, the owner had the Airglas skis installed by the same AME. The AME observed nothing unusual during the installation. No research was done regarding the airworthiness directives (ADs) applicable to this type of aircraft; however, the entries in the technical log-books and the amendment to the weight and balance report were made in accordance with existing regulations.

Section 605.84 of the *Canadian Air Regulations* (CARs) provides the following extract:

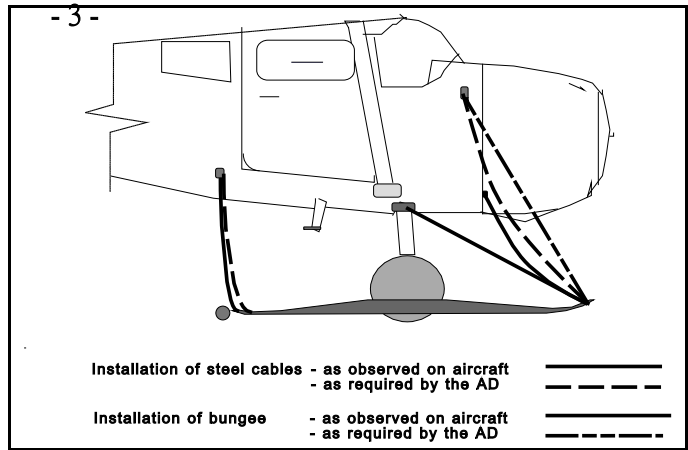
No person shall conduct a take-off, or permit a take-off to be conducted in an aircraft that is in the legal custody and control of the person, unless the aircraft is maintained in accordance with

b) the requirements of any airworthiness directives issued by the Minister pursuant to section 593.02; and . . .

Subpart 71 of Part V of the CARs provides that responsibility for complying with ADs rests with the aircraft owner. If the owner wants the AME to do research as a separate maintenance task, he must so indicate in a document specifying the agreements. Responsibility is thereby delegated.

On the morning of 17 February, the pilot and one passenger made a familiarization and test flight in preparation for the flight to Wabush planned for later that morning. They flew two circuits at Sept-Îles Airport. On returning from that flight, both were satisfied with the aircraft's performance. Shortly after the arrival of the aircraft owner and another passenger, the aircraft took off for Wabush.

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



The rear passengers reported that, while in flight at cruise altitude, they suddenly noticed that their legs were hanging in the air and they were descending in a turn. The fuselage had separated between the front and rear seats, and the engine had broken away. They tried to unfasten their seat-belts, but centrifugal force prevented them from doing so. The forward fuselage struck the snow-covered surface upside-down, penetrated through five to six feet of unpacked snow, and struck the ground. The pilot and front passenger, who were still attached to their seats in the forward fuselage, perished at impact. The rear of the fuselage, with the other two passengers, struck the ground on the left side. The passenger seated on the right was not injured, and he made a fire to protect his companion from the cold and to keep them both alive. Although the left passenger could not move around, he was able to call for help on his cellular phone one hour after the occurrence. About three hours later, they were rescued and transported to hospital for the usual examinations.

With the exception of the right landing gear, which was found on 20 May 1997, all major components of the aircraft were found in the first few days of the investigation. The aircraft was shipped to the TSB Engineering Branch for detailed analysis. The distribution of the parts on the ground and the lack of any evidence of forward speed indicate that the aircraft broke up in flight. The wreckage distribution diagram is at Appendix A.

Examination of the aircraft showed the right wing had red and black transfer marks from the right ski. The marks on the wing extended from the leading edge to the main spar, and there were also marks on the wing strut. Aft of the wing spar, there were tears caused by instantaneous overload. The wing attachment was still fastened to the carry-through structure. The carry-through structure failed in overload. The left wing also failed in overload, and it carried with it the rest of the carry-through structure. The fuselage separated aft of the seats. Red marks were found on the vertical stabilizer and left elevator.

There were transfer marks of white paint on the right ski. The metal plate screwed to the ski tip and used to attach the bungee and steel cable was torn off. The bungee failed near the fitting at the ski tip. The steel cable presented a typical form of failure in overload.

The four engine mount brackets failed in instantaneous overload. One of the blades had two indentations near the tip. The first indentation, close to the blade tip, was deep and of a diameter consistent with that of the cable attached to the ski tip. The second indentation was consistent with the metal plate normally screwed to the ski tip. As a simulation, the engine was temporarily replaced in its normal position. This simulation established that the cable attached to the right ski tip was severed by the propeller.

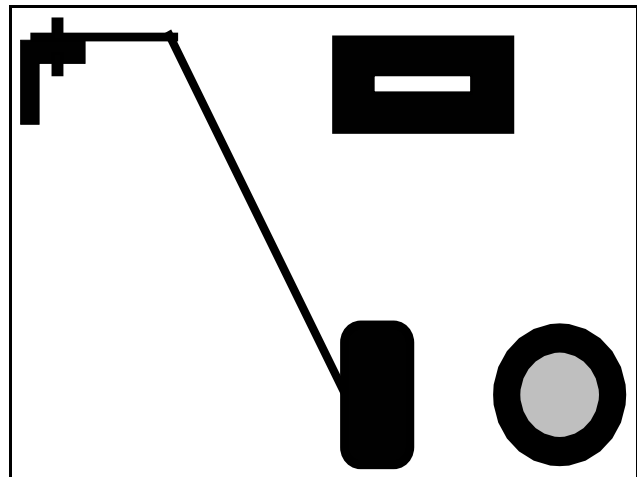
On 21 September 1979, the manufacturer of Airglas skis issued a mandatory Service Bulletin (SB) LW3600-3. The purpose of the modifications outlined in the SB was to prevent the skis from rotating downward, which causes severe unbalancing of the aircraft and makes it hard to control. The bungees were to be replaced with a type that was more suitable for low temperatures. The bungee and forward steel cable attachment points were to be relocated near the windshield, and the aft steel cable attachments were to be relocated on the skis. As well, with the skis installed, the aircraft speed was to be limited to 160 KIAS, and a speed limit placard was to be installed on the instrument panel. On 12 May 1980, the Federal Aviation Authority (FAA) issued AD 80-10-01, directing owners to install a placard to limit speed to 160 KIAS with the skis installed, and to comply

with Airglas Service Bulletin LW3600-3 within 50 hours time in service after the effective date of the AD, and thereafter any time that the skis are installed. On 21 July 1980, Transport Canada issued AD 80-18 which required that, before the next flight and, after that, whenever the skis are installed, Airglas SB LW3600-3 be complied with and that a placard be installed limiting speed to 145 KIAS when the skis are installed. That AD had not been completed on the accident aircraft.

The aircraft technical log-book contained a sheet of notes mentioning Cessna AD 80-10-01 with the description "ski, rotating tip down", and the notation "n/a to equipment installed". This note was written by the former operator's AME and was a reminder for him.

Figure 2 is a schematic of the installation of a landing gear leg on the Cessna 185. When the leg is not on the

ground, the bolt is under tension, and at other times it serves as a locator to hold the assembly in position. On the right side of the aircraft, the upper part of the landing gear leg support bracket was torn away and the outboard lower part showed evidence of compression. The cabin floor area above the ski attachment angle was punctured by the tip of the landing gear leg. There is a hole to insert bolt AN-7 in the attachment angle. The interior surface of this bolt hole shows clear thread imprints on the inboard side. The number of threads matches that observed when the nut is engaged up to the fibre locking portion. The lower part of the attachment angle showed hexagonal imprints consistent with the shape of the nut. These nut and thread imprints were not observed on the left landing gear attachment angle.



Analysis

The pilot was qualified for the flight and the weather was favourable for the flight as planned.

At cruise altitude, as the aircraft speed increased, the angle of attack decreased and the right ski rotated downward. It is possible that this situation was aggravated because the nut (AN-7) was not tight enough, and the right ski was hanging lower than the left ski. The sudden increase in resistance when the ski rotated downward would have caused the aircraft to pitch down. The bungee stretched, probably resisted for a few seconds allowing the pilot to attempt to correct the attitude, then failed. (See Appendix B - In-Flight Breakup Sequence).

When the bungee failed, it allowed the ski to continue rotating. The bolts holding the metal plate on the ski tip failed in tension, allowing the steel cable to recoil and strike the propeller. The propeller plane of rotation was modified, and this produced excessive tension on the engine mount brackets, which failed, and the engine separated from the aircraft. At the same time, the ski continued to rotate rapidly toward its physical limit, exerting downward force on the landing gear leg. The nut on the AN-7 bolt failed and the floor was punctured.

When the engine separated, the aircraft pitched up as a result of aerodynamic forces and the shift in its centre of gravity. The ski then cut the right wing strut and the leading edge aft to the main spar. During this

sequence, the forward carry-through structure was damaged, allowing the two wings to tear off. Finally, lacking a viable structure, the fuselage separated at the aft door pillar. Transfers of colour from the ski were also found on the vertical stabilizer and left elevator, suggesting that the fuselage rotated to the right after losing the right wing. After a descent of about 3,500 feet, the various pieces crashed on the ground.

When the skis were being installed, the AME did not research the ADs in effect, and did not notice that there was a note to that effect in the technical log-book. Consequently, AD CF-80-18 was not completed by the AME when the Airglas skis were installed. The CARs provide that the responsibility for complying with ADs rests with the person who has legal control of the aircraft unless that responsibility is specifically delegated in a document setting out the agreement.

The following laboratory reports were completed:

LP 034/97 - Structural Examination - In-Flight Breakup

LP 52/97 - Examination - Aircraft Engine & Propeller

Findings

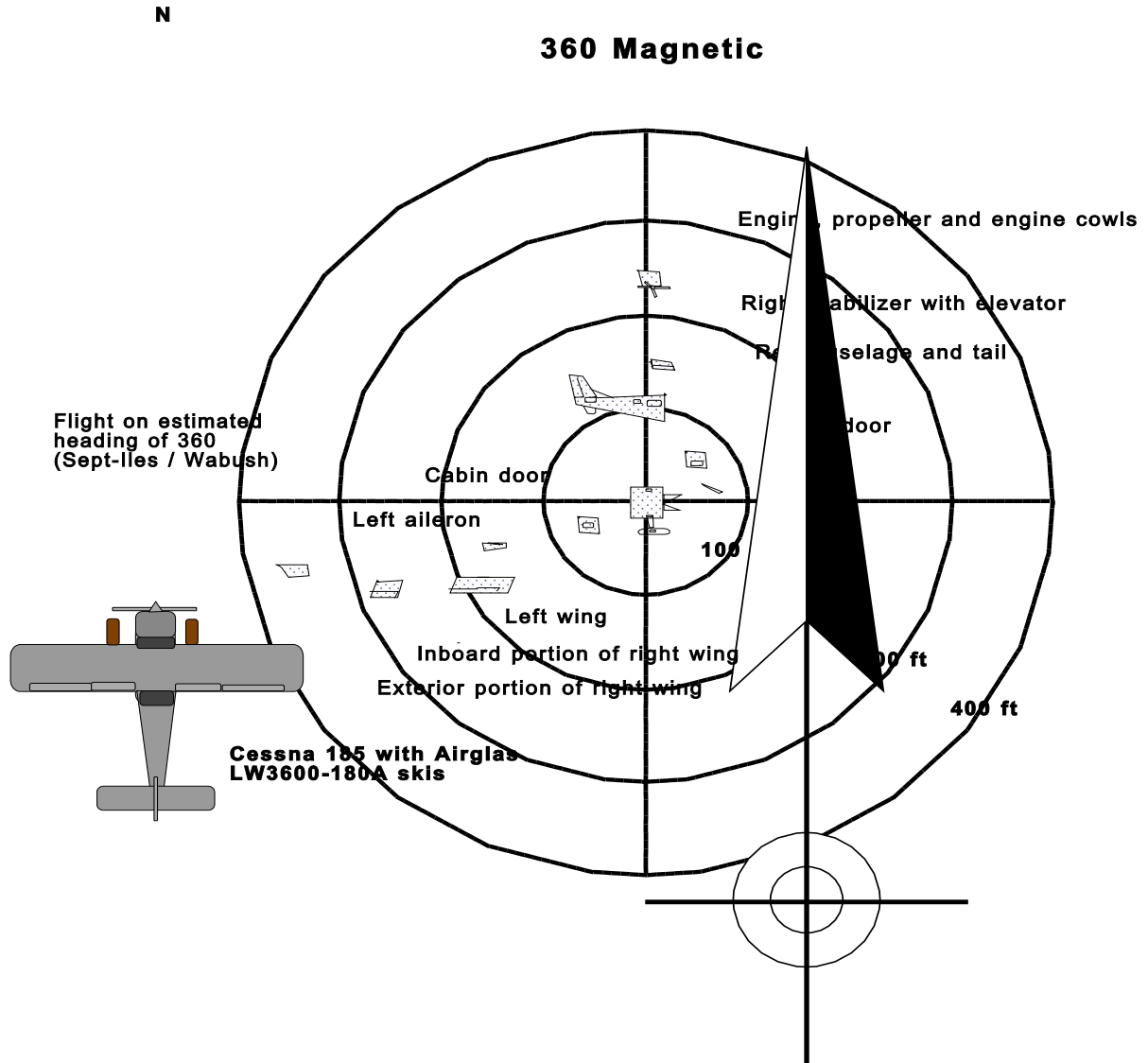
1. The pilot was qualified for the flight.
2. Airworthiness Directive CF-80-18 relating to the installation of steel cables and bungees had not been complied with.
3. The nut on bolt AN-7 that fastens the landing gear leg was incorrectly tightened when the skis were being installed, and the bolt failed in flight.
4. The bungee on the right ski failed in flight and allowed the ski to rotate downward. The bracket tore off the ski and was thrown into the propeller causing the engine mounts to fail.
5. The right ski and landing gear separated and struck the right wing of the aircraft.
6. The aircraft broke up into several pieces in flight.

Causes and Contributing Factors

An incorrectly tightened bolt and non-compliance with an airworthiness directive allowed the right ski and landing gear to separate from the aircraft in flight and strike the right wing. The aircraft subsequently broke up and fell to the ground in pieces.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 04 February 1998.

Appendix A - Wreckage Distribution Diagram



Appendix B - In-Flight Breakup Sequence