

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A05P0018



CONTROL DIFFICULTY DUE TO AIRFRAME ICING

NORTHERN THUNDERBIRD AIR INC.
BEEHCRAFT KING AIR 200 C-FCGL
KELOWNA, BRITISH COLUMBIA, 80 nm NE
19 JANUARY 2005

Canada

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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Northern Thunderbird Air Inc.
Beechcraft King Air 200 C-FCGL
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Summary

The Beechcraft King Air 200 (registration C-FCGL, serial number BB190), with two pilots and two paramedics on board, departed Prince George Airport, British Columbia, at 1228 Pacific standard time on an instrument flight rules medical evacuation flight to Cranbrook, British Columbia. The flight was dispatched to transport two patients from Cranbrook to Kelowna.

During cruise flight at 15 000 feet above sea level, the aircraft was in icing conditions. The aircraft's ice-protection equipment dealt effectively with the icing conditions until about 45 minutes after take-off, when the aircraft began to accumulate ice at a rate that exceeded the capabilities of the ice-protection equipment. The airspeed decreased to the point that a descent was required, and, despite the crew selecting maximum available engine power, the aircraft descended from 15 000 to 10 800 feet, below the minimum obstacle clearance altitude for the area. Vancouver air traffic control issued emergency vectors to guide the aircraft down the Arrow Lakes area to avoid high terrain. Several minutes later, the pilots advised that they were clear of cloud and proceeding to Kelowna. Accumulated ice, up to six inches thick, was shed during the approach to Kelowna, where an uneventful landing was made.

Other Factual Information

About 20 minutes¹ prior to departure from Prince George, the pilot-in-command (PIC) reviewed TAFs, METARs and SIGMETs² via an Internet weather information site. None of the information that was reviewed indicated icing conditions, forecast or actual, along the intended route. Based on this information, the PIC determined that the weather conditions were suitable for an instrument flight rules flight at 15 000 feet from Prince George to Cranbrook to Kelowna. The graphical area forecast, which the PIC did not review, called for mixed moderate icing between the freezing level and 16 000 feet for about two-thirds of the planned flight route.

The Transport Canada-approved flight manual for the Beechcraft King Air 200 states, in part, that although the aircraft is approved for flight in icing conditions as described in the U.S. Code of Federal Regulations (CFR),³ it is not approved for flight in severe icing conditions or other conditions that exceed the capabilities of the aircraft ice-protection equipment. "Flight into icing conditions which lie outside the CFR-defined conditions is not prohibited; however, pilots must be prepared to divert the flight promptly if hazardous ice accumulations occur."

In cruising flight, the aircraft's true airspeed was 230 knots, providing an estimated time en route of 1 hour 30 minutes. For about 40 minutes after departing Prince George, the icing conditions encountered were light to moderate and the aircraft's ice-protection equipment prevented excessive ice accumulation. However, the accumulation of ice began to exceed the capabilities of the ice-protection equipment and the aircraft's speed started to decrease. The pilots began planning descent and diversion but determined that there were no suitable airports within range.

The ice accumulation increased and, when the airspeed decreased to 150 knots, the crew had to start descending. The pilots requested a descent to the lowest possible safe altitude for the area, and the controller issued a descent to 13 900 feet, the 100 nautical mile safe altitude for Cranbrook Airport. The descent was continued, but on reaching the assigned altitude, the descent could not be arrested, although the power levers were advanced until the engines were operating at their redline inter-turbine temperature (ITT).

The airspeed decreased to 140 knots, the descent rate was 1500–2000 feet per minute, and there was significant airframe and control surface buffeting. As the aircraft descended, in a power-on stall condition, through 12 000 feet, the pilots notified air traffic control (ATC) that they were unable to maintain altitude and further descent was required. The pilot then advanced the engine power levers to the forward stops, causing both engines to continuously exceed the maximum ITT and torque limits. ATC instructed the King Air to turn left 90° to bring the aircraft over Upper Arrow Lake and clear of high terrain. Although the King Air stopped accumulating ice as it descended through 11 000 feet, the ice already accumulated prevented the aircraft from

¹ All times are Pacific standard time (Coordinated Universal Time minus eight hours).

² TAF (terminal aerodrome forecast); METAR (aviation routine weather report); SIGMET (significant meteorological report).

³ CFR Title 14, Part 25, Appendix C.

levelling off. Radar data indicate that the aircraft descended as low as 10 800 feet. Shortly after, the controller advised the pilots that they were likely over Arrow Lake and 10 000 feet was a safe altitude for their location.

An overflying de Havilland DHC-8 informed ATC that the weather appeared better to the west of Arrow Lake. The controller vectored the King Air southwest toward Kelowna. Shortly thereafter, the King Air entered visual meteorological conditions and the pilot was able to retard the engine power levers to bring all engine operating parameters within the approved limits.

During the period the King Air was in severe icing conditions, the aircraft nose attitude was maintained 5° and 10° up and the pilots experienced significant airframe and flight control buffeting, with the rudder pedals buffeted almost half-deflection. Although the portion of the leading edge of the horizontal stabilizer that the flight crew could see appeared to be shedding ice, the aircraft was in a full power-on stall during much of the descent to 11 000 feet. When the controller instructed the King Air to turn left to follow the lake, the pilots had great difficulty in banking the aircraft more than 5°.

Subsequent to the incident, both engines were removed from service because they had been operated above their temperature and torque limits for about seven minutes.

Findings as to Causes and Contributing Factors

1. The pilot-in-command (PIC) did not review the available graphical area forecast weather information and was not sufficiently informed to avoid the forecast icing conditions.
2. The severe in-flight icing conditions caused an ice accumulation that the aircraft's ice-protection systems were unable to prevent or remove. As a result, the aircraft entered a power-on stall condition and an uncontrollable descent.
3. The PIC did not detect the severe ice accumulation in sufficient time to alter the flight route to avoid the icing conditions.

Safety Action Taken

Following an internal investigation into the occurrence, the company, as an interim safety action, distributed a memorandum to advise flight crews to review *all* available weather data before flights. The company has since developed a syllabus, examination and emergency checklist regarding severe icing and has implemented them as part of its training program to provide flight crews with more in-depth knowledge of severe icing conditions and exit strategies.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 June 2005.

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