Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A02A0046

WINDOW FAILURE AND RAPID DEPRESSURIZATION

LABRADOR AIRWAYS

BEECH 1900 D C-GLHO

STEPHENVILLE, NEWFOUNDLAND AND LABRADOR

38 NM ESE

25 APRIL 2002

Canada

Aviation Investigation Report

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Summary

Air Labrador Flight 8300, a Beech 1900D, serial number UE266, was en route from Stephenville, Newfoundland, to St. John's, Newfoundland, when the right cabin emergency exit window failed. The flight crew completed a rapid descent, requested and received a clearance to return to Stephenville, and declared an emergency. The aircraft landed at 0900 Newfoundland daylight time, without further incident. There were no injuries.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft departed Stephenville for St. John's at 0826[1], with two crew and nine passengers, including an infant, on board. The captain was the pilot flying (PF) and the first officer was the pilot not flying (PNF). At approximately 38 nautical miles (nm) from Stephenville, while the aircraft was climbing through 18 500 feet above sea level (asl), there was a loud bang, and both crew members experienced severe ear discomfort and the first officer experienced "dizziness". The first officer contacted Gander area control center (ACC), requested descent, and advised the controller that the aircraft cabin had depressurized. The crew received a descent clearance and the first officer then donned his oxygen mask and switched the microphone selector switch from the normal to the mask position. At about the same time, a passenger approached the cockpit and informed the crew that a cabin window had broken. The passenger then returned to her seat. The captain did not don his own oxygen mask nor did he deploy the passenger oxygen masks.

After donning his oxygen mask, the first officer attempted to communicate with ATC; however, he could not hear his voice (side tone) on his headset and assumed that he was not transmitting. Gander ACC, however, was receiving the transmission. Consequently, the captain intervened and requested a clearance to return to Stephenville. At an altitude of approximately 13 000 feet and one and one half minutes after the window failed, the first officer removed his oxygen mask and resumed communications using his normal microphone. The first officer then made a cabin announcement to the passengers using the passenger address (PA) system. The time required for descent to 10 000 feet was approximately five minutes.

After levelling off from the rapid descent and assessing the situation, the crew declared an emergency. The first officer initiated the Cabin Decompression emergency checklist; however, the captain redirected him to the Cabin Door or Cargo Door Unlocked emergency checklist. This latter checklist was the only emergency checklist actioned. The crew were able to determine that the third cabin window on the right side of the aircraft had failed, but were unable to establish if there was more extensive damage. The crew carried out an uneventful landing in Stephenville.

The company standard operating procedures (SOPs) and the aircraft emergency checklist require that in the event of a rapid cabin depressurization, the crew is to initiate an emergency descent and don their oxygen masks. After the descent and when the aircraft is stabilized in level flight below 13 000 feet, the Emergency Descent and Cabin Decompression checklists are to be called for and completed. Completion of the correct checklist ensures that important safety procedures have been followed.

Examination of the aircraft showed that most of the right cabin emergency exit window and a piece of interior window trim were missing, with only small window fragments still attached to the window seal. The failed window fragments and the two right side forward cabin windows were removed and sent to the manufacturer for further examination. Two of the fragments contained the area of the plastic side window that protruded beyond the rubber seal and was exposed to the environment in a similar manner as the two forward side windows. All the cracked edges appear to be the results of secondary cracking failures propagating from the original crack failure. Both pieces had surface chip gouges on the exterior surface between the

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[1] All times are Newfoundland daylight time (Coordinated Universal Time minus two and one half hours) unless otherwise noted.

rubber seal and the cracked edge. The chip gouges measured 0.022 inches deep by 0.050 inches wide and 0.028 inches deep by 0.075 inches wide. Under magnification, cracking vents were observed protruding internally from the chip gouges.

The *Beech 1900 Maintenance Manual* states that, for pressurized flight, the maximum allowable depth for scratches, gouges, or chips in a window is 0.015 inches. Examination of the two forward right side windows revealed many light scratches and small chipped gouges that ranged in depth from 0.009 to 0.026 inches, with one of the gouges reaching a maximum width of 0.125 inches.

Cabin windows in the aircraft, except for the forward cabin window on the right side, are constructed of single-ply cast acrylic. The forward cabin window uses multi-ply construction because it is located in the plane of rotation of the right propeller and consequently exposed to ice and other debris being thrown from the propeller.

When there is rapid cabin decompression and supplemental oxygen is not used, the crew and passengers are at risk of exposure to the effects of hypoxia. Hypoxia is described as a lack of oxygen in the blood and will occur to some extent at altitudes above 10 000 feet asl. It is caused by the reduction in atmospheric pressure as altitude increases. The effects of hypoxia are wide-ranging and, even at a relatively low altitude, such as in this occurrence, symptoms such as faulty memory and poor judgement can occur. Supplemental oxygen is made available for flight crew and passengers in pressurized aircraft to ensure the effects of hypoxia are minimized in the event of cabin decompression.

A search of the TSB accident and incident database did not reveal any other cabin window failures with the Beech 1900 series aircraft.

The cockpit voice recorder (CVR) was removed and sent to the TSB Engineering Branch for further analysis. Approximately 32 minutes of high-quality data was retrieved.

Analysis

The analysis will focus on the failure of the cabin window, the crew actions after the rapid decompression, and the difficulties that the first officer experienced communicating with his oxygen mask on.

The surface chip gouges on the cabin windows and exit window fragments indicate that they had been exposed to impact from some form of small coarse material. During take-off, propellers can pick up debris and drive it towards the cabin along the propeller plane; the rearward propeller wash may also carry debris aft and expose other surfaces to damage. Debris being thrown from the jet blast or propeller wash from other aircraft while on the ground could also cause surface chip gouges, although it is likely that this scenario would cause damage over a larger area. Consequently, it appears that at some time during the aircraft's operating history, a take-off was conducted from a runway surface that had excessive debris on it, and this debris was blown against the windows by the right-hand propeller, causing the surface chip gouges. With only small fragments from the failed window available for examination, the exact cause of the window failure could not be determined. However, these fragments and the adjacent windows had surface chip gouges in excess of the recommended tolerance and some of the gouges had crack vents protruding internally. Therefore, it is probable that a cracking failure occurred due to the excessively damaged condition of the exterior surface of the window.

The crew did not follow the SOPs applicable to the event. At the first indication of the rapid depressurization, the captain, who was the pilot flying, should have initiated an emergency descent while the first officer donned his oxygen mask. Once the first officer had his mask on, control of the aircraft should have been transferred and the captain should have donned his oxygen mask. Also, passenger oxygen should have been selected once the crew had their masks donned. Non-adherence to SOPs put the crew and passengers at unnecessary risk after the rapid decompression.

The first officer's oxygen mask microphone was found to be serviceable, yet he had difficulty communicating after he had donned his mask. It could not be clearly established why this occurred.

Findings as to Causes and Contributing Factors

1. Fragments from the failed window and the two adjacent windows had surface chip gouges in excess of the recommended tolerance.

2. It is probable that a cracking failure occurred due to an excessively damaged condition of the exterior surface of the window.

Findings as to Risk

1. Non-adherence to SOPs after the rapid decompression put the crew and passengers at unnecessary risk.

Other Findings

1. The first officer had difficulty communicating through his oxygen mask microphone.

Safety Action Taken

The failed window, two windows forward of the failed window (one single-ply and the one multi-ply) and the three forward windows on the left side of the incident aircraft were removed by the operator and replaced with multi-ply windows; the two forward windows removed from the right side were sent to the manufacturer for further analysis. Other similar aircraft within the operators fleet are being inspected at regular intervals.

Prior to this incident, the operator measured window surface damage with a needle tip dial indicator. During laboratory testing, Raytheon used a 966Al Optical Micrometer and a SPI scale comparator. The operator has since purchased an Optical Micrometer for window inspections. In tandem with this, a Quality Assurance Bulletin was issued changing the inspection schedule from 1200 hours to 200 hours; the bulletin also states that any window with questionable limits is to be replaced before flight.

The following action is being undertaken by Transport Canada with regard to Labrador Airways only:

An inspector qualified on aircraft type will be assigned to conduct the following:

1. Review of the standard operating procedures (SOPs) currently in use to determine if improvements can be recommended.

2. Conduct in-flight inspections with particular emphasis on the intelligibility of public announcements and radio transmissions via the mask microphone.

3. Review and/or monitor of High-Altitude Indoctrination training.

4. Monitor of Technical Ground and Flight/Simulator training and Pilot Proficiency Checks, with emphasis on SOP usage, rapid decompression and proper oxygen mask usage.

Transport Canada is considering the requirement for action on a national basis.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 25 June 2003.