Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Report – 200500860
Final

Icing event-130 km north-west Brisbane, Qld
10 February 2005
VH-SBI
de Havilland Canada DHC-8-315

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Abstract

On 10 February 2005, a de-Havilland Canada Dash 8-315 aircraft, registered VH-SBI, was enroute from Gladstone to Brisbane Airport, Qld, on a regular public transport service. The aircraft was operating in instrument meteorological conditions and had accumulated ice on the airframe, wings, and propellers.

During the climb out of Gladstone, the anti-ice and de-icing equipment were selected ON in response to the inclement weather. While in the cruise at flight level 210, air traffic control (ATC) instructed the crew to 'set course Maleny time 24'. The flight crew acknowledged ATC and reduced power, in order to make good the instruction.

When the flight crew reduced speed in order to comply with the ATC instruction, they noticed a number of indications that they suspected were as a result of ice accretion. After initially increasing power, the crew again reduced power in response to an engine temperature warning. That power reduction was accompanied by the activation of the aircraft's stick shaker warning. The crew recovered the aircraft and landed at Brisbane without further incident.

Following a company investigation, the operator provided additional training for the flight crew and amended the company operations manual to specifically address the minimum speeds for operations in and out of icing conditions.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the Transport Safety Investigation Act 2003 and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au.

FACTUAL INFORMATION

Reported Information

The information presented below, including any analysis of that information, was prepared principally from information supplied to the Bureau.

On 10 February 2005, a de-Havilland Canada Dash 8-315 (Dash 8) aircraft, registered VH-SBI, was enroute from Gladstone to Brisbane Airport, Qld, on a regular public transport service. The flight was approximately 1 hour behind schedule. The aircraft was operating in instrument meteorological conditions and had accumulated a deposit of ice on the airframe, wings and propellers.

The pilot in command (PIC) was the pilot flying (PF) for the sector. During the climb from Gladstone, the anti-ice and de-icing equipment were selected ON in response to the inclement weather, as required by standard operating procedures[1] (SOP). The flight crew reported that the climb appeared to take longer than normal.

When the de-icing equipment was selected, the INCREASE REF SPEED advisory light illuminated, providing an indication to the pilot of the requirement to increase the aircraft speed to the required climb speed for operation in icing conditions. That advisory light is located on the captain's instrument panel and is cancelled by selecting the corresponding overhead switch to ON. It was unknown if the PF actioned that switch.

Shortly after becoming established in the cruise at flight level[2] (FL) 210, the crew noted a slight propeller vibration and a slightly higher than normal body angle. The crew suspected that that was the result of ice accretion on the propeller and elected to increase propeller speed to 1050 RPM. Shortly after, the vibration decreased and the propeller speed was reset to 900 RPM. Later in the flight, the propeller RPM was again increased to 1050 RPM as a result of ice accumulation. Sometime later, the PF noted that the speed command pointer[3] on the electronic attitude director indicator[4] (EADI) had activated.

At 19:00:33 Eastern Standard Time[5], air traffic control (ATC) instructed the crew to 'set course Maleny time 24'. That required the flight crew to reduce speed for arrival sequencing into Brisbane. The crew acknowledged the ATC instruction and the PF reduced power in order to slow the aircraft. However, the minimum speed

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1 Anti-ice/de-ice required to be selected ON when in visible moisture, or at or below a static air temperature (SAT) +5° C.

2 Level of constant atmospheric pressure related to a datum of 1013.25 mb, expressed in hundreds of feet; thus FL 210 indicates 21,000 ft.

3 The stall warning/stick pusher channels use true angle of attack and flap angle to provide relative approach speed information to the speed command pointer (fast/slow pointer) on the electronic attitude director indicator. The centre reading of the pointer represents an approach speed equivalent to a nominal 1.3 x the aircraft's stall speed (1.3Vs).

4 The EADI provides aircraft attitude and heading information.

5 The 24-hour clock is used in this report to describe the time of day, Eastern Standard Time, as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

appropriate for the conditions was neither calculated by, nor discussed between, the flight crew.

There was also conflicting and confusing information in the company's documentation suite as to what the appropriate speed should have been for the conditions. It was reported that the crew and other company pilots had a limited and varied understanding of the minimum airspeeds for operating in icing conditions, particularly when a speed reduction was required to meet an ATC instruction. Moreover, ATC was unaware that the aircraft was in icing conditions. The aircraft had encountered icing, but neither crew member considered the icing to be severe at the time.

At 19:04:21 the copilot, who was the pilot not flying (PNF), advised ATC that they were unable to meet the set course time and would arrive at Maleny at 19:21. This was acknowledged and ATC advised the crew to expect radar vectors as required during the next sector in order to re-position the aircraft in the arrival sequence into Brisbane. The crew attempted to maintain a reduced speed to facilitate that arrival.

Aeronautical Information Publication (AIP) Enroute (ENR) 25.1 and 25.2 outline a number of pilot and ATC responsibilities in such circumstances, including that:

> 25.1.1 A pilot must:
>
> b. comply with ATC instructions while ensuring that separation is maintained from other aircraft;
>
> c. immediately advise ATC if unable to comply with a control instruction;
>
> 25.2.1 ATC will:
>
> b. issue instructions and/or traffic information to regulate traffic;

At 19:06:17, ATC cleared the aircraft to descend to FL150. At about that time, the PNF noted that the airspeed was too low, and informed the PF to that effect. The PF responded by increasing power to arrest the reducing airspeed. The PNF again informed the PF that they were too slow. The PNF then observed and communicated to the PF that the left engine inter-turbine temperature (ITT) over-temperature light had illuminated. The PF immediately reduced engine power, which was shortly followed by the activation of the stick shaker[6] warning. The crew commented that, when the ITT over-temperature light illuminated, the engine torque indications were lower than expected, probably indicating ice accumulation around the engine air intakes.

At 19:06:54 the PF disengaged the autopilot and lowered the nose of the aircraft in response to the stick shaker warning. The PNF simultaneously advanced the condition levers to maximum propeller RPM, and set maximum continuous power

6 The stall warning system provides the crew with a stick shaker warning to indicate an impending stall. The system, when triggered by the angle of attack passing a preset value, applies large oscillating forces to shake the control stick (normally a large yoke) rapidly through a small angle in the fore/aft plane.

in accordance with the aircraft's Quick Reference Handbook[7] (QRH) tables. Recorded ATC radar information indicated that the aircraft descended 400 feet before regaining level flight.

At 19:15:07, ATC instructed the crew 're-cleared Maleny 4, runway 14, descend FL130, cancel speed restrictions'. The flight did not experience any further delays and did not require radar vectors for sequencing into Brisbane.

7 An aircraft QRH may contain information pertaining to normal operations, including performance data, and non-normal operations, including emergency checklists.

ANALYSIS

There were a number of aircraft performance indications available to the flight crew during the early stages of the flight to alert them to the potential build-up of in-flight icing. Those included spending more time than expected in the climb, a slightly higher than normal body angle in the cruise, a number of instances of propeller vibration, and higher than normal engine inter-turbine temperatures for the corresponding engine torque indications. Collectively, those cues should have provided the flight crew with an appreciation of the state of, and performance implications for, the aircraft.

The crew had the option to reject the air traffic control instruction ‘set course time Maleny 24’ because of their immediate operational requirements. However, the crew persisted with a reduced speed required to make good the amended set course time over Maleny that proved inappropriate for the icing conditions. The action by the crew to maintain a lower speed increased the risk that the build-up of ice on the airframe might result in an aerodynamic stall. The activation of the stick shaker was an indication of an impending stall.

The lack of any discussion by the crew about a suitable airspeed for the situation reduced the opportunity for the crew to identify that the speed reduction was inappropriate for the circumstances. The conflicting information in the company documentation suite did not facilitate an accurate understanding of the importance of setting speeds that were appropriate to in-flight conditions such as those experienced during the flight.

If the INCREASE REF SPEED light had been actioned, it would have alerted the pilot flying (PF) to increase airspeed, a response to the icing. However, the PF may have interpreted that advisory as only being applicable to the approach reference speed for landing.

This occurrence highlights the importance of crews’ ability and training in recognising the presence of severe icing conditions, and of their acting immediately and decisively to maintain aircraft performance in those conditions.

FINDINGS

Contributing safety factors

- The crew did not recognise the apparent severity of the icing conditions.
- The crew allowed the aircraft's speed to reduce to below the minimum safe speed for flight in icing conditions.
- The crew was unsure of the minimum safe airspeed for flight in icing conditions.

Other safety factors

- There was inconsistent information in the operator's documentation suite as to the appropriate speed for flight in icing conditions.
- The operator's manuals contained minimal information on crew duties and communication when reducing speed in icing conditions.

SAFETY ACTION

Operator

As a result of this incident, the operator has undertaken the following safety actions:

- The crew received specific simulator exercises to explore minimum airspeeds in response to ATC or other holding requirements, both in and out of icing conditions.
- The operator's Dash 8 operations manual was amended to specifically address minimum speeds associated with operations in and out of icing conditions.