Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

AIR TRANSPORTATION SAFETY INVESTIGATION REPORT A24A0038

HARD LANDING AND AFT FUSELAGE STRIKE

Porter Airlines Inc.
Bombardier Inc. DHC-8-402, C-GLQP
Fredericton International Airport (CYFC), New Brunswick
28 June 2024

History of the flight

At 1245[1] on 28 June 2024, the Bombardier Inc.[2] DHC-8-402 aircraft (registration C-GLQP, serial number 4271) operated by Porter Airlines Inc. departed Ottawa/MacDonald-Cartier International Airport (CYOW), Ontario, as flight PTR 2375, bound for Fredericton International Airport (CYFC), New Brunswick. The flight was a scheduled flight with 74 passengers, 2 flight crew members, and 2 cabin crew members on board. The captain was occupying the left seat and was the pilot flying (PF); the first officer was occupying the right seat and was the pilot monitoring (PM).

While at cruise altitude, the PF briefed the area navigation global navigation satellite system (RNAV [GNSS]) Z approach to Runway 27. Based on the landing weight and the flaps set at 15°, the planned target landing reference speed (V_{REF}) was 124 knots indicated airspeed (KIAS), and

[1] All times are Atlantic Daylight Time (Coordinated Universal Time minus 3 hours).

[2] The current type certificate holder is De Havilland Aircraft of Canada Limited.

the flight crew added a 10-knot buffer, increasing the planned approach speed to 134 KIAS. At 1356, the flight was cleared to land, and the control tower reported the winds to be from 350° magnetic at 11 knots.

At 1359:30, when the aircraft was 267 feet above touchdown zone elevation (TDZE), the PF disconnected the autopilot and began to fly the approach manually. When the aircraft was 135 feet above the TDZE, the aircraft was travelling at 126 KIAS, the descent rate was 700 fpm, and the pitch was 3.2°. When the aircraft was 20 feet above the TDZE, it was travelling at 124 KIAS, the descent rate had increased to 980 fpm, and the pitch was 1.1°. The headwind component decreased from 5.5 knots to 0.5 knots within 3 seconds, increasing the maximum descent rate to 1050 fpm. In response, over a period of 2 seconds, the PF increased the pitch from 1.1° to 6.8°. The power was consistently at 14% torque.

At 1359:53, the right main landing gear contacted the runway, followed by the left main landing gear. A vertical acceleration of 3.51 *g* was recorded. After the initial contact with the runway, the aircraft bounced, and the flight crew initiated a go-around in accordance with Porter Airlines Inc.'s standard operating procedures (SOPs).[3] Two seconds later, a second runway contact occurred with a recorded vertical acceleration of 1.42 *g*.

After the first touchdown, the TOUCHED RUNWAY warning light illuminated, indicating that a sensor near the tail section of the aircraft had been triggered by contact with the runway surface. In addition, the master warning light started flashing. During the climbout, the flight crew noticed the master warning and TOUCHED RUNWAY warning lights; however, they did not discuss the issue further at that time.

The flight crew were cleared by the tower controller to conduct a visual flight rules circuit and return to land. The aircraft landed uneventfully at 1408, and the flight crew taxied the aircraft to the apron and shut it down. Damage to the lower portion of the aft fuselage section was identified and company flight operations personnel were notified.

Flight crew information

Both flight crew members held the appropriate licences for the flight in accordance with existing regulations and had valid medical certificates.

The captain had accumulated approximately 3000 total flight time hours, including 1718 hours on the DHC-8-402.

The first officer had accumulated approximately 2200 total flight time hours, including approximately 500 hours on type.

[3] The standard operating procedures state that "[a] balked landing should be conducted if a bounce recovery is required. Once a Go-Around or Balked Landing has commenced it must be continued." (Source: Porter Airlines Inc., *Dash 8–400 Standard Operating Procedures*, Revision 15 (12 June 2023), Section 2.18: Go-Around, Balked Landing, and Discontinued Approach Procedures and Callouts.)

Aircraft information

The DHC-8-402 is a twin-engine turboprop regional airliner capable of seating 78 passengers.

There was no indication that a component or system malfunction played a role in this occurrence. The aircraft's weight and centre of gravity were within the prescribed limits.

The occurrence aircraft was equipped with a 2-hour cockpit voice recorder (CVR) and a flight data recorder (FDR). The data from both recorders was downloaded successfully.

Weather information

Weather conditions at CYFC are reported in the form of an aerodrome forecast (TAF) and an hourly automatic aerodrome routine meteorological report (METAR AUTO). The data for the METAR AUTO is gathered by an automated weather observation system. The weather data is broadcast to pilots through an automatic terminal information service (ATIS).

The 1400 METAR AUTO, the most current report issued before the occurrence landing, stated the following:

- Winds from 320° true at 14 knots
- Visibility of 9 statute miles (SM)
- Broken ceiling at 7100 feet above ground level (AGL), broken cloud layer at 8000 feet AGL
- Temperature 21° C, dew point 10° C
- Altimeter setting 29.97 inches of mercury

In addition, at the time of landing, there was a headwind component of 5.5 knots, which decreased to 0.5 knots within 3 seconds. This rapid reduction in headwind most likely resulted in a decreased performance shear. Decreased performance shear

> occurs when the shear causes the [aircraft's] airspeed to decrease. […] A decreased performance shear results from a rapidly decreasing head wind or an increasing tail wind. The effect of shear on an aircraft is particularly important during take-off and landing because it can cause stalls, undershoots or overshoots depending on the situation.[4]

Pitch awareness and mitigations

In approximately 2003, after a series of DHC-8 aft fuselage strikes in which the flight crews reacted instinctively by quickly increasing the pitch to stop an excessive rate of descent, the aircraft manufacturer (Bombardier Inc.) produced a training video.[5] The video stresses the importance of monitoring the aircraft's pitch and managing its energy by controlling an excessive rate of descent by applying engine power rather than increasing pitch near the ground.

When the main landing gear oleos are compressed during a hard landing, the fuselage of the DHC-8-400 touches the ground at approximately 7° pitch.

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[4] National Defence, *Air Command Weather Manual* (17 December 2004), Chapter 11: Boundary Layer Winds and Turbulence.

[5] De Havilland Aircraft of Canada Limited (Bombardier Inc.), "Dash 8-Q400 Pitch Awareness" [video], (2003).

In 2008, even though the video had been out for 5 years, aft fuselage strikes were still occurring. In response, the manufacturer released a service letter on 11 September 2008.[6] The letter was intended solely for DHC-8-400 operators and reiterated the importance of pitch awareness during the flare and touchdown. The letter recommended including standard 5° and 6° pitch awareness calls in the procedures and managing the rate of descent below 200 feet AGL with the power levers. The service letter also referred to the training video and suggested that operators offer initial and recurrent training on pitch awareness.

In addition to this occurrence, there have been 13 other aft fuselage strike occurrences reported to the TSB on the DHC-8 aircraft since 2002: 1 for the 100 series, 6 for the 300 series, and 6 for the 400 series.[7] In these occurrences, the pitch had exceeded the limits stated in the aircraft operating manual.

Porter Airlines Inc. provides flight crews with awareness of and simulator training on the limitations of pitch, along with ways to mitigate the potential for a tail strike. The SOPs provide guidance to flight crews on pitch awareness and callouts when the pitch exceeds 5°.[8] Porter Airlines Inc. also has a no-fault go-around policy if the flight crew feels the safety margins are exceeded on an approach.

TOUCHED RUNWAY warning light

The red TOUCHED RUNWAY warning light (Figure 1) informs the flight crew that the lower aft fuselage structure of the aircraft came into contact with a hard surface. The illumination of the TOUCHED RUNWAY warning light requires an inspection of the aircraft by qualified maintenance personnel before further flight.

The TOUCHED RUNWAY warning light may be associated with possible structural damage to the aircraft. De Havilland Aircraft of Canada Limited recommends that, when circumstances permit, flight crews consider completing the landing rather than initiating a go-around when this light illuminates.

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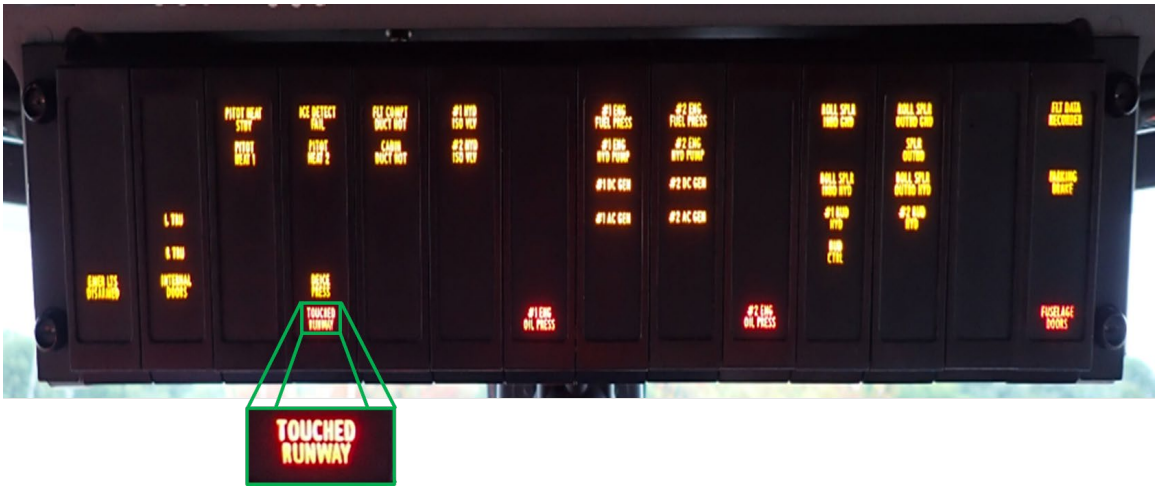
6 Bombardier Inc., Service Letter DH8-400-SL-00-020: Q400 Pitch Awareness Training (11 September 2008).

7 TSB aft fuselage strike investigations: A24W0038, A22C0093, A22C0094, A20Q0013, A16Q0002, A14W0079, A13O0098, A12Q0161, A12O0156, A09O0073, A08W0229, A05Q0054, and A02O0317.

8 Porter Airlines Inc., *Dash 8–400 Standard Operating Procedures*, Revision 15 (12 June 2023), Section 2.16.3: Pitch Awareness and Callouts.

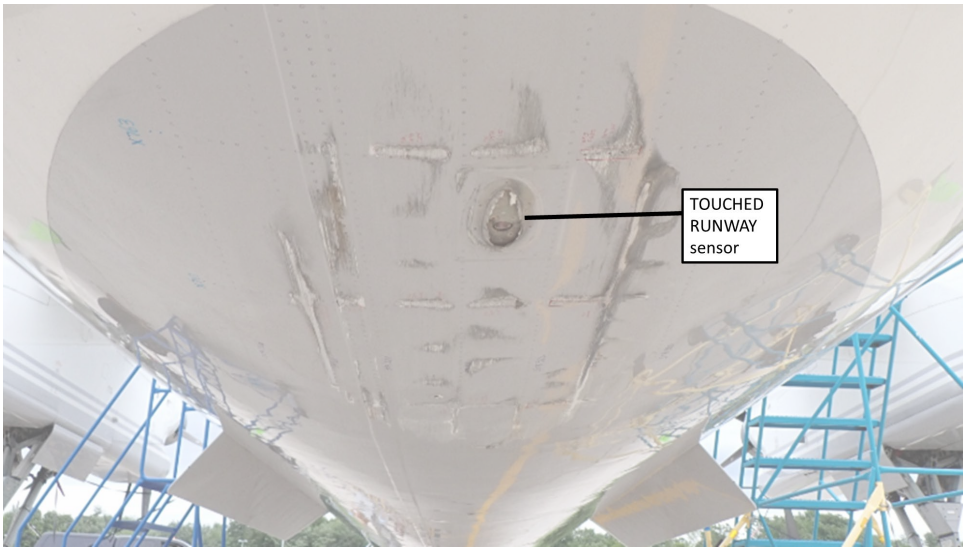
Figure 1. Red TOUCHED RUNWAY warning light, with close-up view in inset (Source of main image and inset: TSB)



Damage to aircraft

The occurrence aircraft sustained substantial damage to the fuselage and main landing gear as a result of the first landing attempt. The vertical *g* exceeded the main landing gear tolerance of 2.8*g*; therefore, the gear had to be replaced. The TOUCHED RUNWAY sensor was sheared off from the fuselage upon impact with the runway surface (Figure 2).

Figure 2. Damage to the occurrence aircraft's TOUCHED RUNWAY sensor (Source: TSB)



TSB laboratory reports

The TSB completed the following laboratory reports in support of this investigation:

- LP105/2024 – CVR Download and Analysis
- LP106/2024 – Flight Data Recovery and Analysis

Safety action taken

Following the occurrence, the Porter Airlines Inc. flight operations management team debriefed the flight crew, who then completed a return to flying program. After meeting this requirement, both flight crew members returned to flying.

In addition, the flight operations department added a section to the pilot report form so that flight crew can provide feedback on individual runway approaches and departures. This information can then be added to the company route manual.

In December 2024, Porter Airlines Inc. published a new revision of its SOPs. The revision includes a new landing techniques section, which states that during the recovery after a bounced landing, pilots are to "apply full power and maintain a pitch attitude of no more than 6 degrees until the aircraft has reached an altitude where a tail strike is not possible, then continue with the normal go-around."[9]

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 29 January 2025. It was officially released on 06 February 2025.

[9] Ibid., Section 2.17: Landing Techniques.

ABOUT THIS INVESTIGATION REPORT

This report is the result of an investigation into a class 4 occurrence. For more information, see the Policy on Occurrence Classification at www.tsb.gc.ca

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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