

AVIATION OCCURRENCE REPORT

TAKE-OFF/LANDING EVENT

**AIR CANADA
CANADAIR CL 600-2B19
FREDERICTON, NEW BRUNSWICK
08 APRIL 1996**

REPORT NUMBER A96A0050

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 Canadair Regional Jet landed on runway 15 at Fredericton, New Brunswick, at 2229 Atlantic daylight saving time (ADT). During the after-landing roll, at low speed, the aircraft yawed left and exited the runway about 5,500 feet beyond the threshold. The aircraft came to a stop when its nose gear sunk into the soft ground adjacent to the runway surface. There were no injuries to the crew or passengers and there was no damage to the aircraft.

Ce rapport est également disponible en français.

Other Factual Information

The captain had an airline transport pilot licence (ATPL) and 12,200 hours total flight time, of which 535 hours was as pilot-in-command on the aircraft type. The first officer had an ATPL and 8,500 hours total flight time, with about five hours on the aircraft type.

The aircraft weight and centre of gravity were within limits. There were no aircraft system deficiencies reported by the flight crew or identified by maintenance during the inspection following the incident.

The aircraft, operating as Air Canada flight 646 (ACA646), was cleared by Moncton Area Control Centre (ACC) for a straight-in instrument landing system (ILS) approach to runway 15 at Fredericton. Runway 15 is 6,000 feet long and 200 feet wide. The crew contacted the Fredericton Flight Service Station (FSS) when 100 miles west of the airport and requested the runway surface condition (RSC). The FSS specialist advised ACA646 that there was no James Brake Index (JBI) report, that the sweepers would be on the runway until about five minutes before their arrival, and that an updated RSC report would be given to the crew prior to their landing. About six minutes before touchdown, the flight crew received the following RSC: runway 15/33 100-foot centre line, 60% bare and wet, 20% light slush and 20% light snow, outside the centre line one inch of slush and snow mixed.

The actual surface weather record issued by Environment Canada at 2200 ADT (29 minutes before ACA646 landed) was as follows: precipitation ceiling 800 feet obscured, visibility 3/4 mile in light snow, temperature 0°C, dew point -1°C, and wind 030° true at 10 knots. The actual surface weather recorded at 2248 ADT, 19 minutes after ACA646 landed, was unchanged. About four minutes before touchdown, ACA646 was advised that runway 15 runway visual range (RVR) was 6,000 feet with light setting strength five. Two minutes before touchdown, the wind was reported to the flight crew as 060° magnetic at 10 knots.

During the after-landing roll, the aircraft yawed left as the indicated airspeed (IAS) was decreasing through 40 knots. To counteract the yaw, the pilot flying (PF) reduced reverse thrust and then stowed the reversers on both engines, while braking and maintaining full right rudder. The reversers were unintentionally stowed before the engines had spooled down to idle reverse. As a result, the aircraft transitioned to forward thrust with a higher than idle thrust setting. The left engine reverser, then the right engine reverser, was

redeployed, with the left engine thrust increasing above idle; the aircraft continued to the left and exited the runway.

The aircraft stopped when the nosewheel tire sunk into the soft ground. After the aircraft had stopped, left engine forward thrust was selected in an unsuccessful attempt to return the aircraft to the runway. The aircraft was shut down, and arrangements were made to transport the passengers to the terminal.

The flight data recorder (FDR) and cockpit voice recorder (CVR) were sent to the TSB Engineering Branch. TSB investigators had requested that the CVR circuit breaker be pulled after the occurrence; however, by the time the CVR was disabled, crew conversations prior to the runway excursion were recorded over and not available.

FDR data indicated that the aircraft approach and touchdown speeds were normal for the aircraft weight and landing configuration, and that the ground spoilers deployed at touchdown. Thrust reverse deployed after touchdown for 24 seconds and was maintained at 84% N1 for 17 seconds. Aileron and rudder inputs were applied to counteract the left crosswind.

The runway surface condition reported to the flight crew about six minutes prior to landing did not exceed the recommended runway surface condition limitations for the aircraft type. A JBI reading for the runway was not produced because the runway surface was contaminated with water and slush. The flight crew reported that the runway was 100% snow-covered when the aircraft landed.

The aircraft's maximum demonstrated crosswind component for landing or taking off is 24 knots, which is not considered to be limiting (dry runway). The operator's Airplane Operating Manual (AOM) states that another runway should be considered when the crosswind on a wet or slippery runway exceeds 15 knots. The crosswind component was 10 knots when ACA646 landed. Although Canadair recommends that reverse thrust be at less than 30% N1 at speeds below 60 knots to reduce the possibility of foreign object damage to the engines, the flight crew maintained reverse at 84% N1 until 35 knots.

Main gear tire cornering forces available to counteract a drift will be at a minimum when the anti-skid is operating at maximum braking effectiveness for the existing conditions.

¹ Indications are that the selection of power on only the left engine was not intentional.

The Air Canada CL-65 AOM identifies the appropriate pilot actions when landing on a slippery runway with a crosswind, and cautions:

When changing thrust from reverse to forward idle, pause at idle reverse to allow the engines to unspool before selecting forward idle. If the reversers are stowed while the engines are still spooled up, there will be a noticeable decrease in deceleration or a forward surge of the aircraft.

The AOM advises that reverse thrust levels be reduced symmetrically, if necessary, if control difficulties are experienced. The AOM, Normal Procedures Landings, also states in part, "If directional control difficulties are experienced, release the brakes." During the investigation, landings were carried out in the flight simulator, with wind and runway conditions approximating those that existed at the time of the occurrence. The left veer off the runway could not be duplicated in the simulator. When the crosswind approached 20 knots, a left yaw and a slide to the right (downwind side), as identified in the flight crew training manual, were experienced. When the crosswind was increased to about 20 knots, the aircraft exited the runway off the right side.

Analysis

Since it was still snowing, runway contamination at touchdown would have been greater than reported in the RSC that was passed to the flight crew. The runway 15 RVR was 6,000 feet and would have allowed the flight crew to see the departure end runway lighting at touchdown.

Braking effectiveness was reduced because of the slippery runway surface condition. Also, the aircraft's proximity to the end of the runway during deceleration would have resulted in the crew continuing to use a high reverse thrust setting at a speed below that recommended by Canadair. The combination of the left crosswind, the slippery runway surface condition, and the high reverse thrust at low speed resulted in the aircraft weathercocking left into the wind. Since the engines had not spooled down to idle reverse before the reversers were stowed, the resultant forward thrust was sufficient to arrest the deceleration and result in the runway excursion.

When reverse thrust was reselected, the idle reverse thrust on the left engine contributed to the increased rate of turn of the aircraft heading to the left. Also, with braking maintained after the veer, tire cornering forces were negligible. If the brakes had been released, the increased tire cornering forces could have helped to counteract the veer and maintain the aircraft on the runway. The rudder would have been ineffective at the low forward speed. After the aircraft

yawed left during deceleration, the PF moved the thrust reverse levers to idle reverse; however, in his haste to accomplish this, he pushed the levers past idle reverse and unintentionally stowed the thrust reversers. Had the engines spooled down to idle before the reversers were stowed, the aircraft might have stopped on the runway.

The flight simulator landings did not result in the aircraft going left as the occurrence aircraft did. However, after the veer to the left, reverse thrust was reduced to idle reverse and transition to forward thrust was not simulated.

The following TSB Engineering Branch report was completed:

LP 41/96 - FDR Analysis.

The TSB Engineering Branch and the aircraft manufacturer, Canadair, have each produced a computer animation tape of the runway excursion, available on request from the TSB.

Findings

1. On landing, the PF was unable to maintain directional control of the aircraft at low speed.
2. The loss of directional control was initiated by the left crosswind and the slippery runway surface condition.
3. The engines had not spooled down to idle before the reversers were stowed. As a result, the transition to forward thrust arrested the aircraft's deceleration.
4. The runway surface condition and crosswind component did not exceed the landing limitations.
5. The pilot maintained braking after the weathercock. This minimized the tire cornering forces available to counteract the veer.
6. The rudder was ineffective in counteracting the veer due to the aircraft's low forward airspeed.

Causes and Contributing Factors

The flight crew was unable to maintain directional control of the aircraft on landing. Contributing to the loss of control was the crosswind, the slippery runway surface, and the forward thrust that resulted when the reversers were stowed before the engines reached idle power.

Safety Action

Operator Action Taken

Air Canada has indicated that they are producing an Information Supplement as part of the winter operation package; the supplement will augment the crosswind slippery landing information already in the CL-65 Operating Manual.

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 14 February 1997.