

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A04A0110



RUNWAY EXCURSION

MORNINGSTAR AIR EXPRESS INC.

BOEING 727 C-GMSX

GREATER MONCTON INTERNATIONAL AIRPORT,

NEW BRUNSWICK

31 AUGUST 2004

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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Summary

Morningstar Air Express Inc. Flight 8062 (MAL8062), a Boeing 727-200 cargo aircraft (registration C-GMSX, serial number 21673) was on a scheduled cargo flight from Toronto, Ontario, to Halifax, Nova Scotia, with stops at Montréal, Quebec, and Moncton, New Brunswick. The aircraft landed on Runway 29 at Moncton at about 1222 Atlantic daylight time. After touchdown, the aircraft hydroplaned and departed the runway at the Charlie Taxiway intersection. It crossed the taxiway and came to rest on an abandoned runway threshold a short distance from the taxiway. Damage was limited to tread damage to the four main landing gear tires and destruction of a taxiway light. There were no injuries.

Ce rapport est également disponible en français.

Other Factual Information

At 0325 Atlantic daylight time¹ on 31 August 2004, the flight crew (consisting of the captain, first officer, and flight engineer) reported for duty. The flight from Toronto to Montréal was uneventful. The aircraft departed Montréal for Moncton at 0706; however, because of thunderstorms in the Moncton area, the crew returned to Montréal and landed at 0954.

At 1110, the aircraft again departed Montréal for Moncton, with the captain as the pilot flying (PF). Before descent into Moncton, the crew received the Moncton Airport automatic terminal information service (ATIS) information Zulu, which included the following from a special weather observation taken at 1130: surface wind 180° magnetic (M) at 11 knots; visibility two statute miles (sm) in light rain showers and mist; scattered cloud at 500 feet above ground level (agl); overcast cloud at 1400 feet agl; temperature 23°C, dew point 22°C. The active runway was Runway 24.

At 1154, Moncton Area Control Centre cleared the aircraft to descend. During the descent, the crew received Moncton ATIS information Alpha, which included the following from a special weather observation taken at 1150: surface wind 190°M at 10 knots gusting to 17 knots; visibility 4 sm in light rain showers and mist. Because Runway 29 is serviced by a precision instrument landing system (ILS) approach, the crew members requested an ILS approach to Runway 29. They were told to plan for such an approach. Thunderstorm activity was indicated on the on-board weather radar equipment, and the flight was cleared to deviate around the storms.

At 1159, the aircraft was handed over to the Moncton Arrival controller. A pilot report (PIREP) from the crew of an aircraft that had just landed at Moncton was passed to C-GMSX. The PIREP indicated that there was continuous light turbulence on the approach and standing water on the runway, and that aircraft braking action was fair to poor. The aircraft was vectored to the ILS localizer final approach course and received clearance for the straight in ILS approach for Runway 29. Control of the aircraft was transferred to Moncton tower, and the crew members were informed that airport field maintenance personnel had reported up to ¼ inch of standing water on all airport surfaces. The current weather observation indicated light rain; however, heavy rain had been observed for the previous 30 minutes.

At 1220, the aircraft intercepted the ILS glideslope, and the crew completed the landing checks. The surface wind was 210°M at 8 knots. The aircraft was cleared to land. Runway 29's visual range was 3500 feet and decreasing. The surface wind equated to a crosswind from the left at about 8 knots. Flight data recorder (FDR) data show that, except for minor localizer and glideslope deviations, the approach was stable with runway environment acquired at 700 feet agl. At decision height, the aircraft was on the glideslope, slightly right of the runway centreline. During transition to landing, the aircraft regained the centreline briefly, drifted to the right, then corrected again to the centreline. There was also a modest deviation below the glideslope before touchdown.

¹ All times are Atlantic daylight time (Coordinated Universal Time minus three hours).

The aircraft landed approximately 1400 feet from the runway threshold at 135 knots indicated airspeed (KIAS) on a heading of 284°M, four degrees left of the runway heading of 288°M. Immediately following touchdown, the speed brakes were manually deployed, the wing flaps were raised from 30° to 25°, and the thrust reversers were deployed, all in accordance with the operator's standard operating procedures (SOPs). Three seconds after touchdown, the aircraft began to weathercock to the left. Reverse thrust reached a maximum engine pressure ratio (EPR) of 1.7 on the number one and two engines, and an EPR of 2.0 on engine number three. The higher EPR on the number three engine had been apparent on previous landings, indicating that the number three thrust lever was likely out of adjustment. However, the mismatch value was approximately twice as much on the incident landing, suggesting that it was used to counter the weathercocking tendency.

The initial application of reverse thrust was maintained for four seconds. However, the aircraft continued to drift toward the right side of the runway and the aircraft heading continued to decrease. The thrust levers were stowed and redeployed twice more in an attempt to regain directional control and counter the drift to the right, but the aircraft remained right of the centreline. During this time, the pilot applied full right rudder and a significant amount of right control wheel input with no significant result. At about 70 KIAS, with the aircraft heading about 250°M, tire friction began to take effect, and the aircraft departed the left side of the runway.

The left main landing gear struck a taxiway light just before Taxiway Charlie. The aircraft continued across a grassy area, entered Taxiway Charlie, and came to rest with all three landing gear on an abandoned runway threshold adjacent to Taxiway Charlie. Moncton tower personnel had observed the incident and notified the airport rescue and fire-fighting (ARFF) unit. ARFF personnel and equipment were at the aircraft in approximately two minutes.

Maintenance personnel inspected the aircraft and determined that it could be taxied safely. The aircraft was taxied to the operator's cargo ramp. Further inspection revealed tire damage that was consistent with hydroplaning (reverted rubber).

A special weather observation for Moncton Airport was taken shortly after the incident. The surface wind was 200°M at seven knots, and heavy thunderstorms and rain were evident.

The Boeing 727 aircraft operating manual contains a section titled "Landing on Wet or Slippery Runways" (see Appendix A). In this section, crosswinds and the use of reverse thrust are discussed.

The reverse thrust side force and a crosswind can cause the airplane to drift to the downwind side of the runway if the airplane is allowed to weathervane into the wind. As the airplane starts to weathervane into the wind, the reverse thrust side force component adds to the crosswind component and drifts the airplane to the downwind side of the runway. Main gear tire cornering forces available to counteract this drift will be reduced when the anti skid system is operating at maximum braking effectiveness for existing conditions. To correct back to the centreline, reduce reverse thrust to reverse idle and release the brakes. This will minimize the reverse thrust side force component without the requirement to go through a full reverser actuating cycle, and provide the

total tire cornering forces for realignment with the runway centreline. Use rudder, aileron and differential braking, as required to prevent overcorrecting past the runway centreline. When established on a track that will regain the runway centreline, reapply steady brakes and reverse thrust as required to stop the airplane.

The following is a partial excerpt from the operator's SOPs, discussing the recommended procedures to follow when directional control problems are encountered during a landing on a wet or slippery runway.

Immediately release brake pressure. Return to reverse idle. Use rudder, steering and differential braking if required, regain runway centreline. Rolling parallel with the runway and near the centreline, apply reverse thrust and brake pedal pressure to develop maximum braking.

Photo 1 shows the aircraft moments after the landing. There was significant precipitation and standing water, which would have been conducive to aircraft hydroplaning. The Transport Canada Aeronautical Information Manual (AIM) notes that, when hydroplaning occurs, "it is known that a 10-knot, crosswind will drift an aircraft off the side of a 200-foot wide runway in approximately 7 seconds under hydroplaning conditions."



Photo 1. Aircraft moments after runway excursion

The aircraft flight recorder installation included an FDR and a combined cockpit voice and flight data recorder (CVFDR). The CVFDR was sent to the TSB Engineering

Laboratory for analysis, where it was revealed that the audio data was of very poor quality. An intelligibility check had been performed on the audio portion of the CVFDR approximately two months before the occurrence and was determined to be acceptable, but several of the flight data parameters were not being captured. Although not critical in this instance, in a more serious incident, the loss of data could be crucial.

The captain had an airline transport pilot licence. The company provided information indicating that the captain had a total flight time of about 6000 hours with about 3200 hours on type. The first officer had about 3800 hours of total flight time with 1119 hours on type. As well, the company provided the following information: the captain's flight time in the last 30 days was 46.7 hours and the first officer's time was 35.1 hours; the captain was off duty for 72 hours before the occurrence, with 8.5 hours of sleep before the first flight. He had been awake 10 hours at the time of the occurrence. The first officer's equivalent times were 12 hours off duty, 5 hours of sleep, and he had been awake for 10 hours.

Analysis

No aircraft anomalies were identified at the time of the occurrence. The analysis will focus on those aspects that contributed to the loss of control of the aircraft after touchdown.

During the descent and approach into Moncton, there were indications to the crew that standing water was present and that there was a crosswind from the left of at least 10 knots (8-knot full crosswind component). Standing water can result in an aircraft hydroplaning and the Transport Canada AIM advises that a runway excursion can occur with standing water and a 10-knot crosswind. Given the presence of standing water at the time of the occurrence and the associated potential for variable wind conditions, directional control difficulty was highly probable but not anticipated by the crew.

Even though the pilot was using the recommended techniques, he could not control the aircraft when it began to weathercock and drift right of the centreline. When the aircraft speed reduced to the point at which the tire made runway contact and tire friction became effective, the aircraft proceeded along the vector of the weathercock. Because of the 40-degree heading difference from the runway heading, the aircraft exited the runway before the pilot could make appropriate corrections. Damage to the tires was consistent with that caused by hydroplaning (reverted rubber) and the skidding that occurred when tire-runway contact occurred.

The following TSB Engineering Laboratory report was completed:

LP123/2004 - CVFDR Analysis

This report is available upon request from the Transportation Safety Board of Canada.

Findings as to Causes and Contributing Factors

1. The crew did not anticipate the effects of the adverse landing conditions and elected to continue the approach and landing.
2. The pilot was unable to maintain directional control of the aircraft because of the combination of hydroplaning and a crosswind.
3. Once tire-runway contact occurred, there was insufficient time for the pilot to avoid the runway excursion.

Finding as to Risk

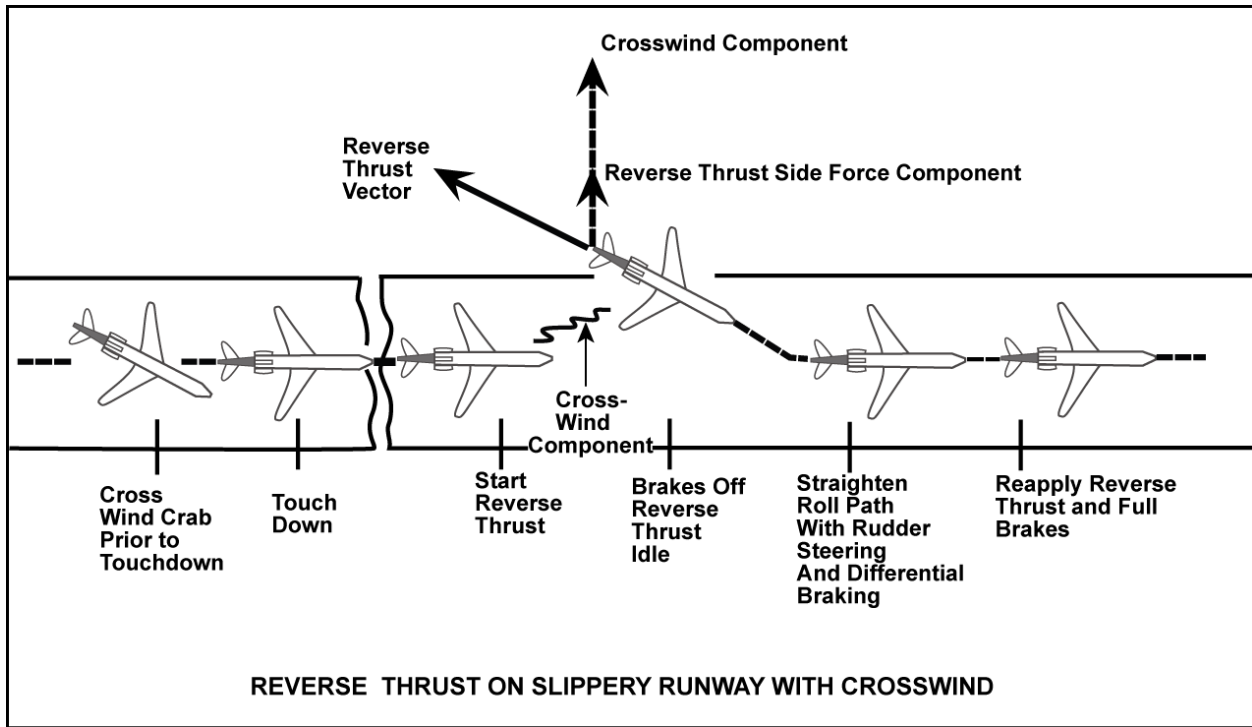
1. The flight data recorder (FDR) portion of the cockpit voice and flight data recorder (CVFDR) had not been checked in accordance with regulations and therefore poor data quality with some of the parameters on the recorder had not been identified.

Safety Action

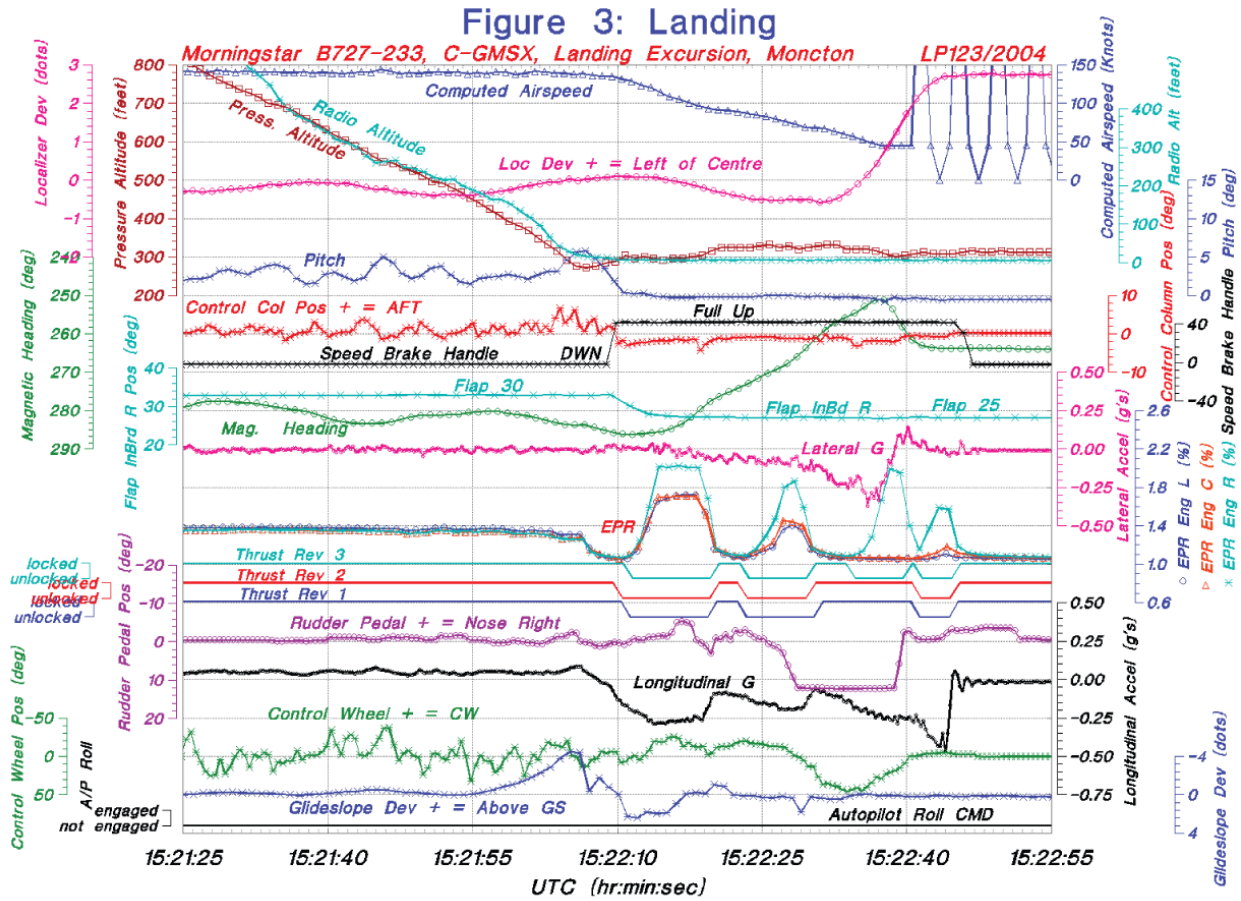
Since the occurrence, Morningstar Air Express Inc. has modified flight operations procedures and training with respect to slippery runway conditions. Also, flight crew and maintenance procedures have been amended for the maintenance/testing portion of the CVFDR.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 02 October 2006.

Appendix A – Jet Aircraft Technique for Directional Control when Hydroplaning



Appendix B – Flight Data Recorder Plot of Landing



Preliminary Data

Revised: February 03, 2005

Recorders & Vehicle Performance Division - TSBC