Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A00H0004

RUNWAY OVERRUN

MIAMI AIR INC.

BOEING 727-200A N806MA

OTTAWA, ONTARIO

15 SEPTEMBER 2000

Canada

Aviation Investigation Report

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Ottawa, Ontario
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Report Number A00H0004

Summary

The Miami Air Boeing 727-200A, serial number 22437, was inbound to Ottawa / MacDonald-Cartier International Airport, Ontario, from Miami, Florida, carrying nine crew members and no passengers. The flight crew conducted a radar-vectored, instrument landing system approach to runway 07, coupled to the autopilot. Spoilers were selected during the descent and the approach to slow the aircraft down. When the initial flap was selected, a configuration warning horn sounded, and the crew retracted the spoilers to silence the horn. The aircraft levelled off at 2000 feet above sea level on the localizer for about 30 seconds until it intercepted and descended on the glideslope. Twelve seconds later, the aircraft levelled off at 1850 feet for 10 seconds and then began descending.

The aircraft crossed the final approach fix at the appropriate altitude at approximately 180 knots indicated airspeed (KIAS); the applicable approach speed for the aircraft's weight was 130 KIAS. Ten seconds later, the aircraft again levelled, so the captain disconnected the autopilot and manually flew the aircraft to re-intercept the glideslope. As the aircraft approached 1000 feet above ground level, the flight crew had visual contact with the runway environment. The aircraft crossed the threshold at 160 KIAS and 110 feet above ground level and touched down 3800 feet past the threshold, at 148 KIAS. The crew selected idle reverse and applied minimal braking. As the aircraft approached the far end of the runway, reverse thrust and braking were increased to maximum. The aircraft stopped 234 feet beyond the end of the runway, at 0042 eastern daylight time. There was no damage to the aircraft or injury to the crew.

Ce rapport est également disponible en français.

Other Factual Information

The aircraft's weight and balance were within limits. The landing weight of the aircraft at the time of the occurrence was approximately 130 000 pounds. According to Miami Air documentation, a V_{ref} [1] of 126 knots indicated airspeed (KIAS) is required at that landing weight. The manufacturer indicates that a V_{ref} of 124 KIAS is appropriate for this aircraft weight, which would normally result in a touchdown speed of approximately 117 KIAS.

The Miami Air flight operations manual describes procedures to be followed by flight crew during normal descent and approach operations. The section on stabilized approaches indicates that the aircraft should have been stabilized at the proper approach speed by the time it crossed the final approach fix. Although this section of the manual does not indicate what flight crew are expected to do if the aircraft's approach is not stable at that point, other sections of the manual suggest that a go-around or a missed approach be conducted.

Miami Air Flight Operations Manual states that the desired touchdown point for a landing is 1000 feet from the threshold of the runway. It also states that it is acceptable to touch down within 500 feet of the desired touchdown point. A *Miami Air B-727 Home Study* handout on winter operations provides the flight crews with the recommended procedures for landing on wet or slippery runways. It states that, during the flare, the airplane should not float and that it should be flown firmly onto the runway at the aiming point, even if the speed is excessive. The captain's normal landing technique, as demonstrated in this occurrence, was to attempt a smooth landing by gently easing the aircraft on the runway. Flight data recorder (FDR) calculations indicate that the aircraft touched down approximately 3800 feet from the threshold of runway 07. The tower controller observed that the aircraft touched down between Echo and Foxtrot taxiways; this observation corresponds to the data from the FDR.

Runway 07 at Ottawa / MacDonald-Cartier International Airport is 8000 feet long by 200 feet wide and has an asphalt surface. The last 2000 to 1000 feet of runway 07 had rubber deposits from aircraft landing on runway 25. Runway 07 was wet at the time of the occurrence, but there was no standing water on the runway. The runway's magnetic heading and the localizer's course is 071 degrees (57 degrees true), and the glidepath angle is 3 degrees. The runway is served by an instrument landing system. This system was flight-checked by Nav Canada approximately 15 hours after the occurrence and was found to be within acceptable technical tolerances.

The aircraft's tires and the runway were examined for signs of hydroplaning. The tires showed no signs of reverted rubber or excessive wear to indicate hydroplaning or locked wheels. The runway showed no signs of reverted rubber steaming, indicating that hydroplaning had not occurred. The FDR indicated that there were no significant heading deviations, indicating that sideslipping had not occurred. There were light skid marks from all three gears in the last 75 feet of the runway. Nosewheel brakes were not installed on the aircraft; the nose-tire skid marks were caused from the aircraft turning at the last minute to avoid the approach lights.

The Boeing Company, using the longitudinal deceleration parameters from the FDR, calculated the application of braking. From this parameter, the braking coefficient of the flight was

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[1] V_{ref} is the speed that the aircraft should cross the threshold of the runway at 50 feet above ground level.

calculated using known and certified aircraft aerodynamic parameters. The braking coefficient was then further analyzed to provide the percentage of stopping force from the brakes, reverse thrust, and aerodynamic braking. Four seconds after touchdown the brakes were applied and reverse thrust selected. For the next 6 seconds the stopping forces were, approximately, 5% from the brakes, 27% from reverse thrust, and the remainder from aerodynamic drag. The stopping force from the brakes then increased over the next 10 seconds to 70%. The stopping force from reverse thrust increased momentarily to 35% at 13 seconds after touchdown, then decreased gradually to 20% by 20 seconds after touchdown. In the final 9 seconds, the percentage of the stopping force from the brakes increased sharply to over 95%, with full reverse thrust selected until the aircraft stopped.

The aircraft was inspected by Miami Air maintenance personnel after the occurrence. They replaced the antiskid/autobrake control module and found the remainder of the aircraft to be serviceable. The antiskid/autobrake control module was sent to the manufacturer for testing. It passed all acceptance checks and was deemed to be serviceable. During the occurrence flight, the antiskid system was selected on, and the autobrakes were selected off.

The slippery runway landing distance chart for the Boeing 727 (B727) indicates a landing distance of approximately 3600 feet (including a distance to flare of 1000 feet), with flaps at 30 degrees, an aircraft weight of 130 000 pounds, zero wind, using maximum manual braking and idle reverse, on a wet runway. The chart has an adjustment for speed: for every 5 KIAS above V_{ref}, the landing distance is increased by 155 feet. Given the speed at which the aircraft crossed the threshold (160 KIAS), an additional approximately 1050 feet must be added to the landing distance, resulting in a total distance of 4650 feet from the threshold, or a stopping distance of 3650 feet. The threshold crossing height of 110 feet above ground level (agl) would add about 1000 feet to the landing distance.

The flight crew were qualified and certified for the occurrence flight. The captain had approximately 15 000 hours of flying experience, of which 8000 hours were on the B727. The first officer had approximately 5700 hours of flying experience, of which 500 hours were on the B727. The flight engineer had been an aircraft mechanic for approximately 29 years and had about 4000 hours of flying experience as a flight engineer.

The weather at 0000 eastern daylight time (EDT)[2] was as follows: few clouds at 200 feet agl, estimated broken layer of clouds at 2200 feet agl, an estimated overcast cloud layer at 4500 feet agl, visibility 2 miles in moderate rain and fog, temperature 14 degrees Celsius, wind 120 degrees true at 6 knots, and an altimeter setting of 29.69 inches of mercury. The 0033 weather, the latest issued before the occurrence, was as follows: measured cloud ceiling of a broken layer at 500 feet agl, overcast layer at 2200 feet agl, visibility 6 miles in light rain and fog with recent rain, wind 120 degrees true at 6 knots. No temperature, dewpoint, or altimeter was taken.

The flight crew received the 0000 weather information from the automatic terminal information service (ATIS) but did not receive the 0033 weather information. The tower controller is responsible for updating the ATIS, during quiet hours, with the current weather provided by the weather observer. Current weather reports are displayed to the controllers on operational information display system (OIDS) screens at the control positions. Whenever a new weather report is issued, the OIDS screen will change to reflect the latest weather. A second computer

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[2] All times are EDT (Coordinated Universal Time minus four hours).

system, using a Microsoft Windows platform to run a number of operational applications, will display a "new weather" message on the screen. This system is located at the air traffic operational specialist (ATOS) position located to the left and behind the airport control position and is used, in part, to record aircraft movements and to compile ATIS information.

From experience, the controllers expect the hourly weather reports to arrive five to eight minutes after the hour and would check their computers for these reports at about that time. Whenever special weather reports are issued, a faxed copy is sent to the control tower. If the controller is not viewing the OIDS display at the time the weather is updated, or is not looking at the ATOS position computers, or if the controller is at the ATOS computer but working in one of the other operational programs, the "new weather" message, which is automatically generated, will not be visible, and the controller will be unaware that new weather information has been issued. The fax machine has no system to alert that a fax is being received. On the night of the occurrence, a special weather report had been issued at 0033 and was faxed to the tower. However, at the time of the occurrence, the controller was not aware that a special weather report had been issued.

The tower controller informed the flight crew that emergency response services (ERS) vehicles were responding; they arrived at the aircraft shortly thereafter. While the ERS vehicles were en route to the aircraft, the ERS supervisor radioed the control tower to ask for the number of passengers, the amount of remaining fuel, and whether any dangerous goods were on board. The tower controller did not have that information. In accordance with the *Canadian Aviation Regulations*, the Ottawa airport has a documented emergency response plan. This plan lists actions that the control tower staff should complete in the event of an aircraft crash at the airport. The first action is to activate the crash alarm. The second action, in part, is to notify ERS by radio of the number of passengers on board, the amount of remaining fuel, and any dangerous goods on board.

Analysis

Post-occurrence examination of the aircraft and its systems revealed that the braking system was serviceable, and it is concluded that the aircraft did not hydroplane. The brakes were operating, as shown by the skid marks in the last 75 feet of the runway. At the correct threshold crossing height and speed, the aircraft could easily have been stopped on the wet runway. Considering the actual threshold crossing height and speed, the aircraft could have been stopped on the runway with autobrakes set to medium.

The manner in which the descent and the approach were conducted contributed to the approach being unstable. A go-around was not conducted. The unstable approach resulted in the aircraft being high and fast over the runway threshold. The aircraft's excessive altitude and speed over the threshold, combined with the lack of a more aggressive landing technique, resulted in the long landing and the high touchdown speed. The long landing and the high touchdown speed, combined with the lack of immediate and sustained aggressive application of braking and reverse thrust, resulted in the overrun.

The flight crew had a number of opportunities to correct for the aircraft's high speed and altitude during the approach and landing. The method in which they were using the autopilot to conduct the approach was inefficient, particularly with the two inadvertent level-offs. The captain attempted to slow the aircraft by applying the spoilers, but when the configuration warning horn sounded, he retracted the spoilers. The aircraft's approach, as it crossed the outer

marker, was not stabilized in accordance with the requirements of the flight operations manual's section on normal descent and approach operations. Although that section of the manual does not provide direction to flight crews on commencing a missed approach or a go-around if the approach is not stabilized, that option was available to the flight crew until landing. Also, the captain elected to extend the flare to provide for a smooth landing. At the higher-than-normal landing speed, the aircraft would float for considerable distance.

The tower controller did not conform with the Ottawa airport emergency response plan checklist for an aircraft crash on the airport. The controller first initiated the alarm then talked to the flight crew but did not ask them about the number of passengers, the amount of fuel on board, or any dangerous goods. As the ERS vehicles were approaching the aircraft, they needed to know that information, but the controller was unable to provide it. For the safety of the passengers on board an aircraft and the ERS personnel, ERS should be informed of potential hazards as soon as possible.

During the approach into the Ottawa airport, a special weather observation had been issued. The flight crew were not informed of the weather change, and the weather was significantly different from that which had previously been provided to them. The tower controller, who was responsible for informing the flight crew of the new weather, was not aware that new weather had been issued. The change in the weather did not contribute to this occurrence. The air traffic control environment has no standard, reliable method to alert controllers that new weather sequences have been issued. Consequently, controllers may not be aware of new weather information that should be passed to flight crew.

The following TSB Engineering Laboratory Report was completed:

LP 96/2000—Anti-skid Brake Control Unit

Findings as to Causes and Contributing Factors

1. The manner in which the descent and the approach were conducted resulted in the approach being unstable, and a go-around was not conducted.

2. The unstable approach resulted in the aircraft being high and fast over the runway threshold.

3. The aircraft's excessive altitude and speed over the threshold, combined with the lack of a more aggressive landing technique, resulted in the long landing and the high touchdown speed.

4. The long landing and the high touchdown speed, combined with the lack of immediate and sustained aggressive application of braking and reverse thrust, resulted in the overrun.

Findings as to Risk

1. The emergency response services (ERS) vehicles approached the aircraft with no knowledge of the number of passengers, the amount of fuel on board, or whether any dangerous goods were on board. The tower controller did not have that information

to pass on to the ERS personnel, potentially delaying or slowing ERS operations and therefore jeopardizing ERS and passenger safety.

2. The air traffic control environment has no standard, reliable method to alert controllers that new weather sequences have been issued. Consequently, controllers may not be aware of new weather information that should be passed to flight crew.

Other Findings

1. The aircraft's braking system was serviceable.

2. The overrun was not a result of hydroplaning.

Safety Action

Nav Canada has reviewed the Ottawa airport's procedures concerning the provision of essential information to ERS personnel responding to an emergency and has briefed all controllers at the unit on the requirement to obtain and relay detailed information in accordance with the emergency response plan.

On 14 May 2001, Transport Canada issued Aerodrome Safety Circular ASC2001-008 informing airport and air operators of the introduction of a national discrete radio frequency to allow flight crews to speak directly to the senior firefighter in command of an airport fire crew. Most airport firefighting crews are now equipped with this new frequency; all must be equipped by the end of December 2001.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 31 October 2001.