AVIATION INVESTIGATION REPORT
A02A0107

RUNWAY OVERRUN

ARROW AIR INCORPORATED
DC-8-63F N441J
GANDER INTERNATIONAL AIRPORT,
NEWFOUNDLAND AND LABRADOR
10 SEPTEMBER 2002

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 Arrow Air cargo DC-8-63 aircraft, N441J, serial number 45988, was on a flight from Norfolk, Virginia, to Bahrain, with a planned technical stop in Gander. The five people on board were the captain, first officer, second officer and two cargo specialists. The cruise portion of the flight to Gander was uneventful. During descent, the controller at Gander Area Control Center (ACC) informed the flight crew to expect the straight in approach to Runway 04. The crew flew a radar-vectored, ILS (instrument landing system) approach to Runway 04 and landed, the aircraft touching down firmly 2800 to 3500 feet beyond the runway threshold at approximately 180 knots groundspeed. At the time of landing, there was a nine-knot tailwind component and the runway was wet.

After landing, the captain immediately applied reverse thrust and wheel braking; however, the aircraft could not be stopped before the runway end. It struck wooden barricades at the far end of the runway and came to rest between 6400 and 7100 feet from touchdown, 10 000 feet from the runway threshold and 100 feet beyond the barricades (See Appendix A). After determining that there was no damage to the aircraft, the crew taxied the aircraft to the main terminal apron. There were no injuries. The incident occurred at 1135 Newfoundland daylight time.

Ce rapport est également disponible en français.

Other Factual Information

While N441J was in descent to Gander, the ACC controller informed the crew that the winds at Gander were from 190° magnetic (M) at 10 knots, and suggested Runway 22 for the approach. The captain accepted the offer for Runway 22 and was given initial vectors for the approach. The ACC controller then contacted the tower controller to advise that the flight was 25 miles to the west for landing Runway 22. The tower controller advised the ACC controller that the threshold for Runway 22 had been displaced because of construction, and that there was no approach lighting on Runway 22. The ACC controller then informed the flight crew of this, and the crew requested an ILS approach to Runway 04 with a circling approach for Runway 22. The ACC controller then informed N411J that the cloud ceiling at Gander was 800 feet. As the circling altitude is 1000 feet, the crew decided they would continue the ILS approach to Runway 04 and land on Runway 04. The aircraft was 8.5 nautical miles west of the airport.

ACC vectored the aircraft for the straight-in ILS approach and, as the aircraft intercepted the localizer, the crew was asked to contact Gander tower. The tower controller issued landing clearance and advised that the surface wind was from 190°M at 10 knots. The temperature at the time was 10°C. The captain requested a surface wind check, and the tower controller repeated the surface wind condition. Inside the final approach fix, the aircraft groundspeed was between 190 and 200 knots, and the average rate of descent was 1000 feet per minute. At about 500 feet above ground level the captain reduced the engines to idle. Information from the flight data recorder (FDR) showed that the engines reached full idle about 16 seconds prior to touchdown. The aircraft crossed the runway threshold at approximately 90 feet above the runway and at 190 knots groundspeed.

A runway analysis chart is used to calculate the maximum landing weight of the aircraft for a particular runway. The chart takes into account wind and runway surface conditions and is based on the aircraft touching down at the calculated landing speed. The runway analysis chart used by the crew indicated a 1020 feet runway length reduction, leaving a usable runway length of 9180 feet. It should actually have reflected information from a published NOTAM indicating that the threshold of Runway 22 had been relocated 1100 feet (from 10 200 feet to 9100 feet), leaving a landing distance available for Runway 04 of 9100 feet.

The crew calculated the maximum landing weight, using zero wind conditions and wet runway conditions, and arrived at a value of 255 400 pounds. However, a nine-knot tailwind component existed at the time. For each knot of tailwind, the maximum landing weight must be reduced by 3200 pounds. With the nine-knot tailwind, the maximum landing weight would be reduced by 28 800 pounds. This would result in a maximum landing weight of 226 600 pounds. The actual landing weight of the aircraft was 249 500 pounds, 22 900 pounds over the chart maximum. The landing reference speed is referred to as V_{Ref}, and is based upon a particular flap setting and aircraft weight. For the landing on Runway 04, the crew calculated a V_{Ref} of 144 knots indicated airspeed (KIAS) at a flap setting of 35 degrees. For the occurrence aircraft, this would be the minimum speed until initiation of the landing flare. FDR data indicates that the aircraft touchdown speed was 158 to 168 KIAS.

The aircraft operating manual states that, on approach, airspeed must be within + 10 KIAS of the target airspeed, with the nominal touchdown point on landing 1000 feet past the runway threshold. The manual also states that touchdown should be accomplished within minus 500 to plus 1500 feet from the nominal touchdown point, that is, from 500 feet to 2500 feet beyond the runway threshold.

The FDR recorded airspeed parameter was inaccurate, and ATC radar information was used to establish the aircraft's speed. TSB Engineering Branch analysis of the FDR found that, in addition to the recorded airspeed errors, the longitudinal and vertical acceleration inputs into the FDR were wired incorrectly and the parameters were reversed. Also, the roll parameter was functioning only intermittently. All other FDR parameters appeared to be valid and no corrections were applied. The established requirement for FDR calibration is every 5900 airframe hours or every two years. The date of the most recent FDR calibration prior to the incident could not be ascertained. The longitudinal acceleration values indicate that no significant loss of friction occurred between the tires and the runway. In addition, there was no visible damage on the main landing gear tires and no tire marks on the runway. These factors indicate that hydroplaning did not occur during the landing.

Engineering landing simulations for the wet runway were conducted by the manufacturer. These resulted in a nominal stopping distance of 5940 feet for a flap setting of 35 degrees.

Analysis

The nine-knot tailwind was not factored into the crew's landing calculations. During the descent, the final runway selection was not made until the aircraft was 8.5 nautical miles from the airport. It is not known if the timing of this decision contributed to the omission of the tailwind during the calculation of landing performance. The tailwind had not been factored into the landing calculation, even though the captain asked the tower controller to repeat the surface wind on final approach.

During the approach the tailwind made it difficult to maintain a normal descent profile. The rate of decent and airspeed were both higher than normal. The captain reduced the engine power to idle 16 seconds prior to touchdown, likely because he recognised that the approach was in jeopardy because of excessive speed. The touchdown speed of the aircraft was 14 to 24 knots above the calculated $V_{Ref.}$. The excess speed would have exacerbated the effect of the tailwind, resulting in a further increase in the stopping distance.

The discrepancy between the stopping distance calculated by the engineering landing simulation (5940 feet), and the actual stopping distance (6400-7100 feet) may be due to factors such as flare technique, braking technique, and differences between the actual runway conditions and estimated runway conditions. The combination of the high threshold crossing height, excessive approach and touchdown speeds, and the extended touchdown point resulted in the aircraft overrunning the runway and striking the barricades. The approach was not a stable one, and a missed approach (go-around) would have been an appropriate course of action.

Some of the FDR parameters were faulty, resulting in erroneous recordings and difficulty in interpreting actual aircraft performance.

Findings as to Causes and Contributing Factors

1. The crew did not factor in the nine-knot tailwind into the landing calculations.

2. The captain did not initiate a missed approach when the aircraft was clearly not on a stable approach.

3. The combination of the high threshold crossing height, excessive approach and touchdown speeds, and the extended touchdown point resulted in the aircraft overrunning the runway and striking the barricades.

Other Findings

1. Several of the flight data recorder (FDR) parameters were faulty.

Safety Action Taken

The operator has taken the following safety actions:

1. Immediate review of Flight Operations procedures for tail wind landing policy and clarification on wind additives as required.

2. Flight crews have been alerted as to the precision required when determining maximum landing weight for given conditions at a specific airport.

3. Increased training in Cockpit Resource Management (CRM) and implementation of the latest version of Threat and Error Management CRM (TEM CRM). This TEM CRM is currently taught during recurring ground training modules.

4. Stressing the importance of performance analysis charts in training scenarios (simulators) and line checks.

5. Reemphasizing the definitions of wet runway in the FOM.

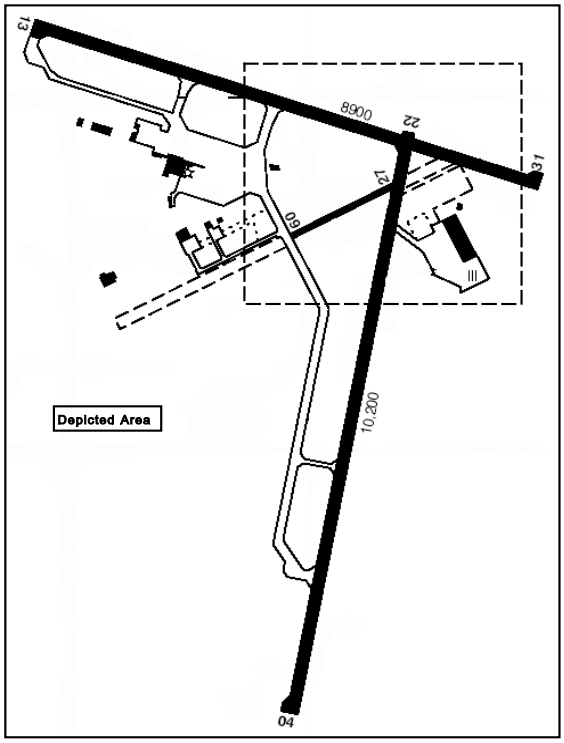
6. Informing flight followers to give consideration to wet runway and tail wind conditions when flight planning.

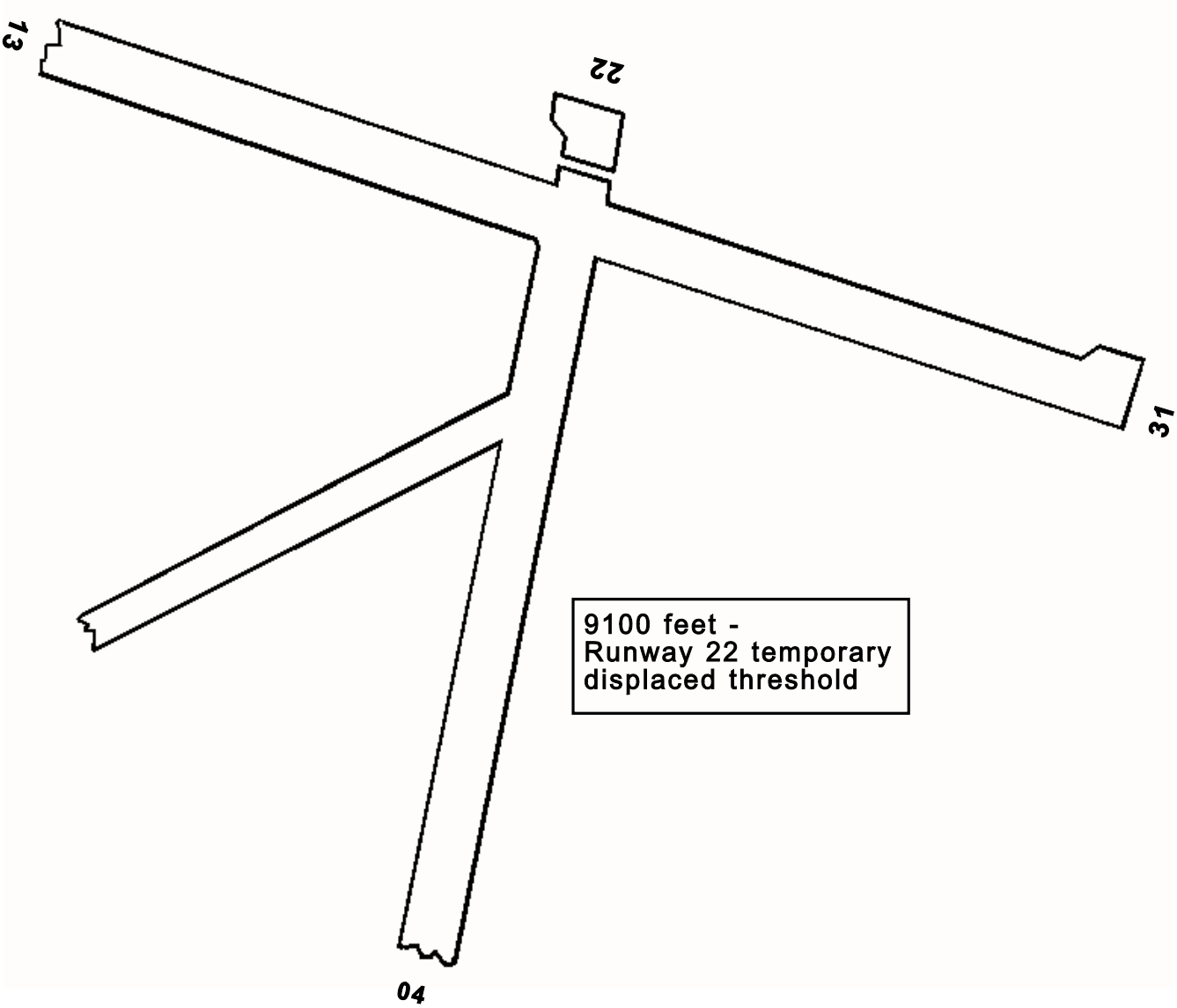
7. Reviewing of NOTAMs and weather during every training event.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 25 March 2004.

Visit the Transportation Safety Board of Canada web site - www.tsb.gc.ca - for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A - Runway Diagram




13
22
31
04
9100 feet -
Runway 22 temporary
displaced threshold