Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A01P0054

LOSS OF SEPARATION

NAV CANADA
VANCOUVER AREA CONTROL CENTRE
VANCOUVER TERMINAL SPECIALTY
VANCOUVER, BRITISH COLUMBIA
15 MARCH 2001

Canada

Aviation Investigation Report

Loss of Separation

Nav Canada
Vancouver Area Control Centre
Vancouver Terminal Specialty
Vancouver, British Columbia
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Report Number A01P0054

Summary

A Horizon Air de Havilland DHC-8 aircraft, flight QXE2190B, was inbound to Vancouver International Airport, British Columbia, from Portland, Oregon, and was on an instrument landing system approach to Runway 08 left. At the same time, an Air Canada Airbus A319, flight ACA234, was inbound to Vancouver from Winnipeg, Manitoba, and was following the DHC-8. The arrival low controller had issued the DHC-8 a speed restriction of 170 knots until the DAWG fix, which is 3.8 nautical miles (nm) from the threshold of Runway 08 left. He advised the A319 that speed was at the pilot's discretion and instructed the flight to transfer to the Vancouver tower frequency. When the controller noticed that the speed of the DHC-8 displayed on his indicator module was reducing to 120 knots while the aircraft was still 1 nm from DAWG, he requested the A319 to reduce its speed to 160 knots. The pilot of the A319 acknowledged the instructions and changed to the tower frequency as previously directed. The controller called the A319 again on the arrival frequency to reduce speed further but received no response. The controller then contacted the Vancouver tower by landline telephone and instructed the airport controller to have A319 carry out a missed approach (overshoot). By the time the A319 began the overshoot, it had closed to 1.9 nm behind DHC-8 in an area where the required longitudinal separation was 2.5 nm. There was no risk of collision.

Ce rapport est également disponible en français.

Other Factual Information

The Vancouver arrival low controller had 7 years' experience in the Vancouver Area Control Centre. At the time of the incident, he was receiving on-the-job training in the arrival low sector of the Vancouver terminal specialty. The on-the-job instructor (OJI) assigned to the trainee controller had 11 years' experience as a controller and 4 years' experience in the Vancouver terminal. They were working the third day of their shift cycle and had worked a day shift on each of the previous two days. They had been on duty for about 7 hours on the day of the incident and for about 30 minutes since the last relief break. Workload was assessed as moderate at the time of the incident.

Article 532.1 of the Nav Canada *Air Traffic Control Manual of Operations* (ATC MANOPS) and article 313 of the *Air Traffic Services Administration and Management Manual* specify the conditions under which aircraft on the same final approach course may be separated by 2.5 nautical miles (nm) when within 10 nm of the landing runway. Existing runway, weather, and equipment conditions at the time of the incident permitted the application of this particular separation standard for arrivals on Runway 08 left.

To implement the 2.5 nm separation standard between aircraft on approach to Runway 08 left, arrival controllers routinely rely on issuing speed control instructions to arriving aircraft. These speed instructions are imposed until the affected aircraft reaches the point on final approach where it must slow down for landing; for Runway 08 left, this point is normally the DAWG fix. Information gathered during this investigation indicated that controllers, to ensure the required minimum separation of 2.5 nm at the point of control transfer to the airport controller, aim to achieve about 4 nm spacing between aircraft when they are turned onto the localizer at 9 to 10 nm on final.

At 1544:16 Pacific standard time,[1] the arrival low controller instructed the aircraft ahead of the DHC-8 to cross DAWG at 170 knots. At 1545:48, he instructed the DHC-8 to also cross DAWG at 170 knots and then told the pilot to contact the tower; the DHC-8 was 8 nm from touchdown, and the aircraft ahead of it was 3 nm from touchdown. This 5 nm spacing, combined with the application of the appropriate speed limits, typically ensured that the normal speed reduction by the leading aircraft inside the fix would not erode aircraft spacing to less than the required 2.5 nm.

Nav Canada directives concerning instrument flight rules arrival procedures specify the locations and the conditions under which the Vancouver tower will assume control of landing aircraft. Weather permitting, the tower will advise the terminal that control of arriving aircraft should be transferred to the tower at 4 nm on final approach, that is, at DAWG. This procedure is termed "auto-over" and is displayed on the operational information display system as AUTOVR. When weather conditions are such that tower controllers cannot see arriving traffic at 4 nm, the transfer control point may be moved closer to the airport. During this incident, automatic transfer was set at 2 nm, displayed as AUTO2D. Until that point, the aircraft remained the responsibility of the arrival low controller and had to be separated by 2.5 nm. Once aircraft have been transferred to the control of the tower, they remain subject to instrument flight rules; however, the visual separation standard applies between the following and the leading aircraft. To mitigate controller-pilot communication difficulties, ATC MANOPS

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[1] All times are Pacific standard time (Coordinated Universal Time minus eight hours).

article 494.1 directs that communications transfer should occur "immediately prior to an aircraft entering the receiving controller's area of responsibility unless otherwise coordinated." In this incident, the DHC-8 was told to contact the tower about 6 nm before it would become the responsibility of the airport controller.

The Vancouver Area Control Centre radar data-processing system displays *calculated aircraft ground speed* on the controller's indicator module. This calculation uses current and previous track data to smooth deviations and to provide a more stable speed estimation. However, when speed deviations are precipitous, successive displays will minimize the differential from one to the next. Starting with large values, the smoothing parameters are reduced with each successive correlation. As a result, when an aircraft slows abruptly, the next calculated data block speed will indicate a higher target speed than the system has detected. The value of the displayed speed approaches the detected speed as the aircraft speed stabilizes.

When the DHC-8 approached DAWG, the pilot assessed that he was overtaking the aircraft ahead and slowed his aircraft down; he did not advise air traffic control that he was slowing below the speed previously assigned. Radar data show that the indicated ground speed of the DHC-8 target on the controller's indicator module slowed from 200 knots at 8 nm from touchdown, to 150 knots at 5.5 nm from touchdown, and to 110 knots as the aircraft crossed DAWG (3.8 nm from touchdown).

When the A319 was at 8 nm on final, indicating 190 knots on the controller's indicator module, the DHC-8 was 3 nm ahead with a displayed ground speed of 120 knots. At that point, the arrival low controller advised the A319 that speed was at the pilot's discretion and directed the crew to contact the tower. After this transmission, the OJI, recognizing that there was a significant discrepancy in the displayed speeds of the aircraft, counselled the arrival low controller that he (the controller) should closely control the speed of the A319. The arrival low controller then advised the A319 to maintain 160 knots until DAWG. The A319 had not yet switched frequencies, so the pilot received and acknowledged the instruction and began to slow the aircraft down. Fifteen seconds later, at 2247:29, the arrival low controller realized that this speed reduction was insufficient to preserve the required spacing and instructed the A319 to reduce to final approach speed. By this time, however, the A319 had changed to the Vancouver tower frequency and did not receive the instruction.

The arrival low controller was at an advanced point in the process for qualification to the terminal specialty. Information gathered in this and similar TSB investigations indicates that OJIs are sometimes reluctant to intervene assertively or early to correct suspected deficient performance when the trainee is approaching qualification. This hesitance stems from the belief that the trainees should be given the time to solve their own problems.

The arrival high controller, working in the Vancouver terminal specialty at the same time, recognized the overtake situation and contacted the tower on a direct line when the DHC-8 was 3.7 nm from touchdown. He advised the airport controller in the tower to request the DHC-8 to increase its speed. The tower controller requested the DHC-8 pilot to keep the speed up as much as safely possible; however, by this time separation had been lost with the A319, now 2.4 nm behind the DHC-8. The arrival low controller subsequently requested the airport controller to instruct the A319 to carry out an overshoot. During this manoeuvre, the longitudinal spacing between the aircraft eroded to no less than 1.9 nm.

Analysis

To maintain minimum separation, controllers impose and then rely on pilots to adhere to speed restrictions. In 4 nm, the DHC-8 appeared to slow from a displayed speed of 200 knots, to 150 knots, to 110 knots. Radar data showed a 60-knot speed differential over a period of 34 seconds, or 7 radar updates. The radar display of the aircraft's speed might have lagged the actual speed and led the arrival low controller to underestimate the DHC-8's speed reduction.

Although air traffic control procedures provided for the transfer of control of the aircraft at 2 nm, the arrival low controller was in the habit of transferring communications of landing aircraft to the tower after he had determined that he had no further need to retain the aircraft. As a result, when the DHC-8 unexpectedly slowed, he was unable to directly contact that aircraft by radio. Although the A319 had already been instructed to contact the tower, the arrival low controller fortuitously was able to issue one speed reduction instruction to that aircraft, but later could not issue another because the aircraft had changed frequency as directed.

The practice of permitting trainee controllers to resolve potential conflicts on their own, before the OJI intervenes, is effective pedagogy within limits. However, because there is no margin provided for normal levels of human error, the following three operational circumstances invariably contribute to loss-of-separation incidents:

- when the trainee aims for the minimum permitted level of separation (2.5 nm in this incident) and then does not recognize a deviation,
- when the trainee hesitates in taking corrective action when an aircraft deviation affects separation, and
- when OJIs are hesitant to intervene at an early stage.

Findings as to Causes and Contributing Factors

1. The arrival low controller did not detect the rate of overtake by the A319 on the DHC-8 in sufficient time to issue appropriate speed control instructions to the A319. As a result, his initial control instruction to the A319 was insufficient to avert the loss of separation.

2. The arrival low controller transferred direct controller-pilot communications with the DHC-8 and the A319 to the tower before relinquishing control responsibility, which inhibited timely control instructions to both aircraft.

3. The DHC-8 slowed down before the DAWG fix, contrary to the instructions previously accepted and without advising air traffic control.

4. The on-the-job instructor recognized the developing overtake situation but did not intervene in sufficient time or with sufficient assertion to alter the arrival low controller's instructions and prevent the loss of separation.

Findings as to Risk

1. The use of the minimum 2.5-nautical mile separation standard in an on-the-job training environment leaves no margin for error. The use of this minimum standard increases the possibility that unexpected aircraft deviations—that may be missed or unrecognized by the trainee controller and in which the on-the-job instructor does not immediately intervene—will lead to a loss of separation.

Other Findings

1. The actual speed of the DHC-8 might have decreased more rapidly than the speed displayed on the indicator module, leading the arrival low controller to underestimate the rate of deceleration.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 06 February 2002.