AVIATION INVESTIGATION REPORT

A99W0144

RISK OF COLLISION

BETWEEN

KOREAN AIR BOEING 747-200 HL-7471

AND

LUFTHANSA GERMAN AIRLINES BOEING 747-200 D-ABZH

JOWIT INTERSECTION (58°40' N, 110° W), ALBERTA

5 AUGUST 1999

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

The Korean Air Boeing 747-200, flight number 257 (KAL257), serial number 20652, was on a cargo flight from Anchorage International Airport, Alaska, USA, to John F. Kennedy International Airport, New York, USA. The Lufthansa German Airlines Boeing 747-200, flight number 493 (DLH493), serial number 23622, was operating as a scheduled passenger flight from Vancouver International Airport, British Columbia, to Frankfurt International Airport, Germany. Both aircraft were cruising at flight level 330 and their planned tracks converged approximately two nautical miles east of the JOWIT intersection. Both aircraft were under radar control of the Edmonton Area Control Centre's Bison sector controller. At approximately 1854 mountain daylight time, the Bison sector controller issued turning instructions to both aircraft to avoid a possible collision. The minimum distance between the two aircraft was estimated to have been 1.3 nautical miles horizontally while they were at the same altitude. During their turns, both aircraft received resolution advisories on their traffic alert and collision avoidance systems. DLH493 climbed and KAL257 descended and achieved 900 feet of separation in approximately 10 seconds. The minimum separation required is five nautical miles or 2000 feet.

Ce rapport est également disponible en français.

Other Factual Information

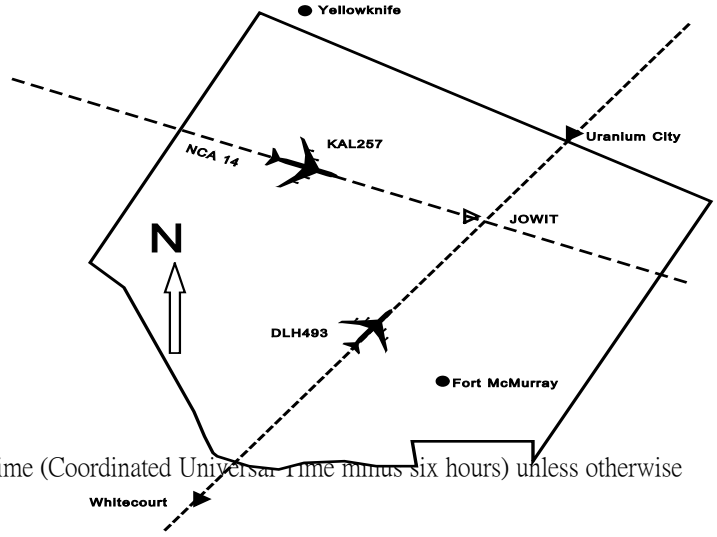
The Edmonton Area Control Centre (ACC) comprises a number of Specialties; the Bison sector is one of four sectors located in the Northern High Specialty. The Northern High Specialty was staffed with four controllers, one for each sector. Because of the light traffic at that time of day, no supervisor was scheduled for the Northern High Specialty. The staffing requirement for the Bison sector is a minimum of one controller. Traffic conditions were described as light, and complexity as normal.

The Bison sector controller possessed a valid air traffic control licence and medical certificate. He had 20 years of experience as an air traffic controller, with 13 years of experience in instrument flight rules (IFR) procedures. The controller was working day four of a nine-day rotation, with one day off in the last eight days. While working the evening of the August 4, he was notified in writing that he had to extend his shift by four hours, which then ended at 0300 mountain daylight time.[1] The controller obtained seven hours of sleep and began his shift on the day of the occurrence at 1400. Workload during the shift was described as light. He had been working thirty minutes after the dinner break when the incident occurred.

Both radar and non-radar procedures are used to control aircraft in the Bison sector. Edmonton ACC procedures require that information on aircraft proceeding into surrounding non-radar sectors be entered into the Northern Airspace Display System (NADS). It is the Bison sector controller's responsibility to confirm that all estimates received and departures authorized for his aircraft have been entered. NADS controllers may assist sector controllers in the provision of non-radar control service to IFR aircraft, but the separation of aircraft remains the sole responsibility of the sector controller.

KAL257 was on northern control area track 14 (NCA 14), which begins in a non-radar sector and transits into the Bison sector. The information for KAL257 would have been already entered into the NADS system. DLH493 was transiting from the Bison sector to a non-radar sector north of Bison. This information would have to be entered into the NADS prior to entering the non-radar sector. Once the information for both aircraft is in the NADS, the system has the capability to alert the controller to any conflicts. The Bison sector controller did not recall when DLH493 was entered into NADS and the controller did not receive a conflict advisory from NADS. The NADS system has no ability to record and store events for analysis.

The Bison sector controller had his radar display set at the 230 nautical miles scale in order to see his entire sector. When he noticed that the aircraft were in close proximity, he issued an instruction to DLH493 to turn left 40 degrees and then instructed KAL257 to turn left 20 degrees. KAL257 did not respond to the instruction, so



[1] All times are mountain daylight time (Coordinated Universal Time minus six hours) unless otherwise noted.

the controller queried KAL257, at which time the flight crew acknowledged the controller's instruction. KAL257 then began a right turn, not a left turn as requested by the controller. At the same time, the DLH493 flight crew questioned the controller regarding the left turn because he had traffic on his left. The DLH493 flight crew again queried the controller about the left turn and the controller replied with an instruction to descend to flight level (FL) 310. Shortly after that, the traffic alert and collision avoidance system (TCAS) resolution advisory alert sounded in each aircraft. The DLH493 flight crew responded by climbing to FL335 and the KAL257 flight crew descended to FL326. The time between the first instruction to turn and the time that TCAS manoeuvres were performed was 58 seconds. NAV CANADA does not train its controllers in techniques for resolving losses of separation in time-critical situations.

When both aircraft were in the radar-controlled portion of the Bison sector, the controller used the projected track line (PTL) feature of the radar display several times before the incident. The PTL feature extends a line from the target to a distance equivalent to a pre-determined time value. The recorded radar tapes showed the PTL was set to 20 minutes and during the last recorded activation of it, the two lines extending from DLH493 and KAL257 touched. The controller recalled computing a crossing time for an aircraft departing from Yellowknife, Northwest Territories, and had begun to enter DLH493 into NADS in the 20 minutes leading up to the incident. Other than the controller-activated PTL, the radar display system contains no conflict alert software.

Analysis

The PTL feature of the radar showed that the track lines from DLH493 and KAL257 intersected during the last recorded activation; however, the controller did not react to the situation. Given that the aircraft would not be nearing each other for 20 minutes, and his low traffic workload, the controller completed other tasks, which took his attention away from the possible conflict. When the controller noticed the aircraft in close proximity on the radar screen, he reacted.

The radar processing system installed in the Edmonton ACC is unable to provide automated collision avoidance notification. This incident occurred in radar-controlled airspace, and such a system could have effectively alerted the controller to the risk of collision several minutes in advance.

The NADS system did not give a warning for the potential conflict. In order for NADS to issue a conflict alert, both aircraft must be entered into the system. (It could not be verified whether both aircraft were entered into the system, as there is no ability to record and store the NADS events that are monitored.) KAL257 was flying on NCA 14; therefore, it would have been entered into NADS according to sector procedures. DLH493 would eventually have had to be entered into NADS before it left radar-controlled airspace. The loss of separation occurred well before it left the radar-controlled portion of the Bison sector.

When the controller recognized the loss of separation, the instructions given were not effective. The DLH493 pilot queried the initial turn as it would have him turn into the traffic he saw on his TCAS display. The controller's inability to provide a timely and effective resolution to the merging aircraft resulted in the aircraft performing TCAS manoeuvres.

During the controller's attempt to resolve the conflict, he instructed KAL257 to turn left 20 degrees. However, because of overlapping radio transmissions, the instructions and the responses from KAL257 were virtually impossible to understand by either recipient. The crew of KAL257 interpreted the instruction as a turn to the right. From a review of recorded radar data, it is apparent that a turn by KAL257 in either direction would not have materially affected the distance between the two aircraft. Although KAL257 turned right rather than left, this did not contribute to the lack of separation.

Findings as to Causes and Contributing Factors

1. DLH493 and KAL257 were both cleared to maintain FL330, with their flight paths crossing in the vicinity of JOWIT intersection.

2. When using the PTL feature, the controller did not respond to the potential conflict.

3. The controller did not recognize a conflict between KAL257 and DLH493 early enough to prevent a loss of separation.

Findings as to Risk

1. DLH493 was not entered into NADS, nor was it required to be entered at the time of the occurrence.

2. NAV CANADA does not provide training in time-critical conflict resolution.

3. The radar processing system does not have conflict alert software.

Other Findings

1. Staffing in the Edmonton ACC Northern High Specialty met unit standards.

2. The traffic in the Bison sector was determined to be light, and the complexity normal.

3. A unit supervisor was not scheduled for the shift, nor was one required by unit standards.
4. The TCAS system in each aircraft assisted the flight crews in avoiding a potential collision.

5. A turn by KAL257 in either direction would not have materially affected the distance between the two aircraft.

Safety Action Taken

The Transportation Safety Board sent an Aviation Safety Advisory letter (615-A990050-1) to NAV CANADA suggesting that they may wish to take action to better prepare controllers to reduce the potential for collision once a loss of separation has occurred.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 20 December 2000.