Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A08W0232

LOSS OF SEPARATION

NAV CANADA
EDMONTON AREA CONTROL CENTRE
25 NOVEMBER 2008

Canada

Aviation Investigation Report

Loss of Separation

NAV CANADA
Edmonton Area Control Centre
25 November 2008

Report Number A08W0232

Summary

The WestJet Boeing 737-700 (C-FWSX) was operating as WJA618 from Vancouver, British Columbia, to Edmonton, Alberta. C-GPOS was a Cessna 525 (Citation CJ1) en route from Springbank to Grande Prairie, Alberta, and was established at flight level 320. In the vicinity of Rocky Mountain House, Alberta, WJA618 was cleared out of flight level 370 for flight level 320. During the descent, WJA618 responded to a traffic alert and collision avoidance system resolution advisory to climb. At 0950 mountain standard time, separation between WJA618 and C-GPOS was reduced to 600 feet vertical and 4.8 nautical miles lateral where 1000 feet or 5 nautical miles was required.

Ce rapport est également disponible en français.

Other Factual Information

The loss of separation occurred in the Alberta High specialty, which comprises four sectors: Jasper High, Canmore, Drumheller, and Lethbridge. It includes all airspace flight level (FL) 290 and above.

The Alberta High specialty controller was certified and qualified in accordance with the existing regulations. The controller had been employed at the Edmonton Area Control Centre (ACC) for about 14 years and had worked the Alberta High airspace for that entire time. He had worked in the Alberta High specialty since its inception in January 2008. The controller was working the fifth day of his schedule. His shift began at 0530 [1] and he had been on duty for four hours and twenty minutes, including a break 50 minutes prior to the occurrence.

The controller was tasked with both radar and data position responsibilities. The radar position provides positive control of aircraft within the sector and is in direct radio communication with these aircraft. The controller in this position also monitors a radar screen, which provides a graphic representation of the aircraft in relation to each other. Radar screen information includes aircraft identification, altitude, and ground speed.

The data position assists the radar controller with directing the flow of traffic within the sector. This position processes flight data for instrument flight rules (IFR) and controlled visual flight rules (CVFR) aircraft. This includes preparing flight data strips, determining estimates, and receiving and passing estimates with adjacent sectors. The data position also provides non-radar control service until radar control and separation can be established, as well as non-radar control services to aircraft that have been released by the radar controller. The controller in the data position can also serve as a second set of eyes and can forecast potential conflicts as they appear on the data board. While one controller typically occupies the radar position and another occupies the data position, it is not unusual for the positions to be combined, as was the case in this occurrence.

While controlling and monitoring the radar position, the Alberta High specialty controller was retrieving numerous flight data strips from the printer, processing them, and passing estimates to other controllers in adjacent sectors. At the time of the loss of separation, the Alberta High specialty controller was involved with tasks associated with the data position.

The traffic volume at the time of the occurrence was described as moderate and the nature of the traffic was complex. During the 15 minutes prior the occurrence, the controller had communicated with 10 aircraft and 6 sectors.

At the time WJA618 was given clearance to descend, WJA618's flight data strip was located above that of C-GPOS on the data board. The flight level that the controller had written on WJA618's flight progress strip was FL 330. C-GPOS' strip had FL 320 written on it (see Figure 1). WJA618 was given a clearance to descend to FL 320, with further descent to be expected in six minutes. WJA618 read back the descent clearance to FL 320, which the controller acknowledged.

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[1] All times mountain standard time (Coordinated Universal Time minus seven hours).

This is referred to as a Hear Back Type II Error. These are "controller errors in which the pilot correctly repeats the clearance that was issued, but the controller fails to notice that the clearance issued was not the clearance that he/she intended to issue." [2]

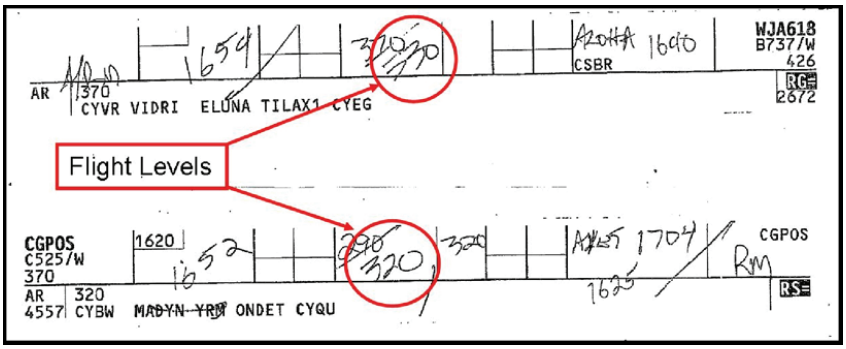

Figure 1. Flight strips

Three minutes and 30 seconds later, WJA618 advised the Alberta High specialty controller that they were beginning the descent, to which the controller provided traffic information that C-GPOS was at their 2 o'clock position, 20 miles away, moving in a north-westerly direction at FL 320. The controller called C-GPOS with traffic information about WJA618 and advised that they would pass over top of it, believing that WJA618 would be levelling off at FL 330.

At about one minute and 30 seconds later, WJA618 received a traffic alert and collision avoidance system (TCAS) resolution advisory (RA) to climb. Lateral separation was 5.6 nautical miles (nm) and the vertical separation was 680 feet. While WJA618 was initiating the climb, lateral separation was reduced to 4.8 nm with a vertical separation of 600 feet. Separation was regained when WJA618 climbed to FL 330.

The controller was made aware of the loss of separation by the radar data processing system (RDPS) that incorporates a conflict advisory (CA) function. The CA function provides traffic (TFC) and conflict (CON) alert warnings under predetermined parameters.

TFC alerts are announced when aircraft are predicted to violate each other's protected airspace. This alert will occur approximately 60 seconds before a predicted loss of radar separation. When this occurs, the controller is alerted to the potential loss of separation by a blinking TFC mnemonic at the top of the radar screen. Additionally, a bolded TFC mnemonic will appear in the last line of each track data tag. The controller is provided with a predicted incursion altitude next to the TFC mnemonic. Additionally, a predicted track line (PTL) vector is drawn from each present position symbol (PPS) to the point of predicted violation, and the PPS will change to a cartwheel symbol. In addition to providing these visual signals, the system provides an audible chime.

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2 K. Cardosi et al., "Pilot-Controller Communication Errors." Department of Transportation's Volpe Center, Washington D.C., 1999, page 13

Similar to the TFC alert, a CON alert is indicated when CON replaces TFC. The predicted incursion altitude is removed from both data tags. The PPS remains a cartwheel symbol and the PTL vectors that have been gradually reduced to nothing will disappear from the display. An audible alarm activates.

In CA processing, the separation standards are less than those used to provide actual separation of aircraft; CA processing also lags somewhat. As a result, the actual CA alerts (CON) are declared after the actual loss of separation.

"To avoid alerts when the aircraft are at the minimum applicable separation standard, and because of the RDPS (radar data processing system) VSP (variable system parameter) settings scale, the horizontal separation standards are set at a value slightly inferior to the normal radar separation standard for a given area….the horizontal separation standards to provide CON alerts will be respectively set at 2.98 NM, 4.98 NM, and 9.98 NM in lieu of the 3, 5, and 10 NM equivalent radar separation standards. Also, the vertical minima will be set at 780′ below FL 290 and 1580′ above FL 290 (except in RVSM [3] areas where it will be set to 900′) to avoid CA nuisance alerts." [4]

The controller did perceive the TFC alert; however, TFC alerts are a common occurrence and do not always require the controller to intervene. A United States (U.S.) Federal Aviation Administration (FAA) study on human factors and safety alerts determined that, of those alerts identified in the project, 62 per cent of the CAs in en route sectors were nuisance alerts. Although the number of alerts was not recorded, nor their effect on controller performance quantified, the human factors literature from other domains is clear:

> …professionals respond poorly to genuine alerts when those alerts occur in environments where many nuisance or low priority alerts occur. The high number of nuisance alerts decreases controller trust in the automation systems and desensitizes controllers toward CAs and MSAWs [minimum safe altitude warnings]. When controllers become desensitized, they are more likely to overlook genuinely hazardous situations because they are accustomed to treating most as nuisances.

Conflict Alert System

The conflict alert system is a function of the radar data processing system, which examines radar tracks for potential conflicting traffic. Based on three-dimensional predicted positions, tracks are evaluated to determine if separation standards will be violated within a specified time. Alerts are generated and sent to the displays in two stages. Sixty seconds before loss of separation is predicted, a traffic alert is generated. A conflict alert is generated after separation is lost. ATC conflict alerts in the airspace where the occurrence took place were set at separation parameters of less than 5 nm laterally and 800 feet vertically.

Source: Adapted from the NAV CANADA *Conflict Alert DSC [Data System Coordinator] Manual*,

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[3] Reduced vertical separation minimum

[4] NAV CANADA, CA—Conflict Alert, Lesson Plan, Operational Systems Requirements Division, April 2004, page 15

> They were nuisances in that no additional action from the controller was necessary after the alert to prevent the situation from developing into an operational error (OE). In addition, of the aircraft involved with CAs that received a controller response, 67% received the response before the alert activated. Of the aircraft involved with minimum safe altitude warnings (MSAW) that received a controller response, 68% received the response before the alert activated. Although not entirely nuisances, these alerts can be considered redundant or unnecessary. Furthermore, of all the CAs we examined, 31% lasted such a short time that controllers took action to address the situation prior to the alert activation or the alert situation resolved itself without action. Taken together, we estimate that as many as 87% of CAs and 97% of MSAWs did not provide useful information beyond what the controllers already knew and were not necessary to maintain safety. [5]

All air traffic control equipment was reported to be operating as required and provided the appropriate alerts.

Analysis

The flight data strips for WJA618 and C-GPOS were located next to each other on the data board. Although the controller had written down WJA618's assigned altitude of FL 330, it is likely that, due to relative proximity of C-GPOS' flight data strip to that of WJA618, the controller inadvertently transposed the lower altitude of FL 320 into the clearance given to WJA618.

Flight crews are required to read back IFR clearances that they receive from air traffic control. In this case, WJA618 correctly read back the clearance to descend to FL 320. The controller confirmed the clearance, but had experienced what is described as a Hear Back Type II Error. This error could be attributed to the crew of WJA618 repeating the cleared altitude of FL 320 and the controller failing to notice that the clearance was not the one he/she intended to issue.

NAV CANADA's conflict alerting software was designed to provide a TFC alert warning within 60 seconds of a predicted conflict. However, under some circumstances, the relative positions of the aircraft may not provide sufficient time for the CA function to provide a traffic alert before a loss of separation. In this case, the CA went off shortly after the TFC alert warning was activated.

The human factors literature suggests that professionals respond poorly to genuine alerts in environments where many nuisance alerts occur. As a result, they lose trust in the automation systems and become desensitized to real events. Under these conditions, they are more likely to overlook genuine alerts because they are accustomed to treating most as nuisances.

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[5] K. Allendoerfer et al., Human Factors Analysis of Safety Alerts in Air Traffic Control, FAA. Atlantic City, U.S., 2007, page 40

The following TSB Engineering Laboratory report was completed:

LP 164/2008 – WJA618 Quick Access Recorder (QAR) Analysis

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

Findings as to Causes and Contributing Factors

1. It is likely that the controller inadvertently read the altitude assigned to C-GPOS and subsequently cleared WJA618 to that flight level, resulting in both aircraft being cleared to the same flight level.

2. During the read back of the descent clearance by WJA618, the controller did not recognize that the flight level was not the one intended, resulting in WJA618 starting a descent to the same flight level as C-GPOS.

3. The conflict alerting software did not provide timely traffic warning indications, thereby reducing the time available to the controller to initiate corrective action, resulting in a loss of separation.

Finding as to Risk

1. The number of nuisance alerts may desensitize controllers to real traffic conflicts, thereby increasing the risk of a genuine conflict being dismissed as a nuisance alert.

Safety Action Taken

NAV CANADA plans to implement the Canadian automated air traffic system in Edmonton by the end of October 2009. This will enable the use of electronic strips in the future on the national Canadian Automated Air Traffic System (CAATS) platform. This will allow controllers to automate the cleared altitude function of the system, which will further reduce false alarms.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 29 July 2009.