

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

AVIATION INVESTIGATION REPORT

A05W0248



LOSS OF SEPARATION

NAV CANADA

EDMONTON AREA CONTROL CENTRE – LA BICHE SECTOR

EDMONTON, ALBERTA, 70 nm N

19 DECEMBER 2005

Canada

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

Loss of Separation

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Edmonton Area Control Centre – La Biche Sector

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Summary

A Westjet Boeing 737-700, operating as WJA28, was on a scheduled passenger flight from Fort McMurray, Alberta, to Edmonton, Alberta. An Air Canada Jazz Bombardier CL-600-2B19, operating as JZA8369, was on a scheduled passenger flight from Calgary, Alberta, to Fort McMurray. WJA28 was at flight level (FL) 340 on a southwesterly heading and had been cleared to descend to 10 000 feet above sea level. JZA8369 was level at FL330 on a northeasterly heading. Both aircraft were under radar control of the La Biche Sector controller in the Edmonton Area Control Centre.

At approximately 0722 mountain standard time, the La Biche Sector's conflict alert program sounded an alarm. At about the same time, JZA8369 announced that they were executing a descending turn to the right due to a traffic alert and collision avoidance system (TCAS) resolution advisory (RA) indicating that there was an intruder 500 feet above and descending. JZA8369 had visual contact with WJA28 at the time of the TCAS RA. The La Biche Sector controller issued instructions to WJA28 to turn away from JZA8369 to avoid a possible collision. WJA28 had also received a TCAS RA and had JZA8369 visual. The minimum spacing between the two aircraft was 1.4 nautical miles (nm) laterally and 300 feet vertically. The minimum separation required was 5 nm laterally or 1000 feet vertically under reduced vertical separation minimum rules.

Ce rapport est également disponible en français.

Other Factual Information

The La Biche Sector controller held a valid air traffic controller licence and was certified and qualified for the La Biche Sector in accordance with the existing regulations. The La Biche Sector controller had been employed at the Edmonton Enroute Area Control Centre (ACC) for about four years, and had operated the La Biche Sector for about a quarter of that time.

The Edmonton Enroute Specialty is comprised of six sectors. A normal complement of controllers would be one supervisor and five controllers. At the time of the occurrence, there were one supervisor and four controllers on duty. The shift supervisor and a controller-in-training worked the Lloydminster Sector, one controller worked four combined sectors (Whitecourt, Grande Prairie, Fort St. John, and High Prairie) and the occurrence controller worked the La Biche Sector. A fourth controller, who was relieved by the occurrence controller, was on a scheduled break. If the workload increases to levels that require supplemental staffing, controllers who are on breaks can be recalled to assist the sector controllers as necessary.

The La Biche Sector controller reported for duty at 0700 mountain standard time¹ and was briefed about the operational status of the sector by the controller he was relieving. At the time of the occurrence, the La Biche Sector controller was tasked with both radar position and data position responsibilities. The radar position controller provides positive control of aircraft within the sector and is in direct radio communication with these aircraft. This controller 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 controller assists the radar controller with directing the flow of traffic within the sector. The data controller processes flight data for instrument flight rules (IFR) and controlled visual flight rules (CVFR) aircraft operating in the sector. This includes preparing flight data strips, determining estimates, and receiving and passing the estimates on to adjacent sectors. The data controller 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 data position controller can also serve as a second set of eyes and can forecast potential conflicts as they appear on the data board.

While controlling and monitoring the radar position, the La Biche Sector controller, to fulfill his responsibilities as the data position controller, had to retrieve numerous flight data strips from the printer, process them, and pass estimates to other controllers in preparation for the anticipated heavy traffic period.² At the time of the occurrence, the La Biche Sector controller was involved mostly with data position duties and with providing three estimates to another sector.

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

² Every day from 0730 to 0900, the number of aircraft flying from Calgary and Edmonton to Fort McMurray and into northern Alberta is significantly higher than during the rest of the day.

From the time the La Biche Sector controller assumed his position until the time of the occurrence, he sent or received 14 estimates. During this time, there were 13 radio communications leading up to the occurrence and 4 subsequent transmissions that dealt with regaining separation between WJA28 and JZA8369. In addition, from the time he took over the position until the occurrence, he prepared an unknown number of flight data strips. A total of 17 flight strips were processed at the La Biche Sector station from 0700 to 0800.

The fourth controller was not recalled from his break until after the loss of separation had occurred. He replaced the occurrence controller at the La Biche Sector position.

The traffic volume at the time of the occurrence was light, and the complexity was moderate. The northbound JZA8369 was originally at FL340. However, due to the change in direction when passing Edmonton, JZA8369 was re-cleared to the directionally appropriate altitude of FL330. WJA28 was preceded by SYN22, a Cessna Citation, flying the identical route from Fort McMurray to Edmonton that WJA28 would fly. SYN22 was at FL320 and subsequently cleared to descend, at the pilot's discretion, to 10 000 feet above sea level (asl).

When WJA28 entered the La Biche Sector, the flight crew contacted the La Biche Sector controller and reported in at FL340 with a route change request. The La Biche Sector controller acknowledged the route change request, but did not repeat WJA28's stated altitude, nor was it a requirement in accordance with NAV CANADA's Manual of Operations (MANOPS). The MANOPS does, however, indicate that the controller, "record altitude reports by entering a tick mark beside the appropriate altitude [on the flight progress strip] when an aircraft on initial contact reports the assigned cruising altitude." This was not done.

The La Biche Sector controller continued to monitor and control, pass estimates, and work with the flight data strips to prepare for the heavy traffic period. He then received a phone call from the Red Deer Sector to coordinate the passage of Chinook 254. The La Biche Sector controller discussed how to post the unusual route of this flight with his colleagues and then returned to controlling, monitoring, preparing, and passing estimates to other controllers. It was during this period that the La Biche Sector controller gave WJA28 clearance to descend to 10 000 feet asl in preparation for their arrival into Edmonton. When the La Biche Sector controller cleared WJA28 to descend, at the pilot's discretion, to 10 000 feet asl, he assumed that WJA28 was at FL320 (as was SYN22) and would not be in conflict with JZA8369. At 0722:21, WJA28 announced that they were beginning to descend. At 0722:26 the conflict alert (CA) alarm sounded. At 0722:42, the La Biche Sector controller determined that WJA28's descent would conflict with JZA8369's flight path.

Perceptual confusion is the acceptance of one object as a match for another object because it looks like the intended object, is in the expected location, and/or it does a similar job.³ Perceptual confusion is more likely to occur during highly routine tasks.

³ *An Integrated Process for Investigating Human Factors*, Transportation Safety Board of Canada, 1998, p. A-3.

Faced with limited time, controllers can manage their workload by prioritizing tasks according to urgency; more urgent tasks are afforded a higher priority and are completed first. When the workload becomes too high for all of the tasks to be completed in a given amount of time, prioritization of tasks can lead to task shedding,⁴ which is the discarding or postponement of tasks. In most cases, the tasks that are considered less urgent are shed. Although this can be an effective means of managing workload, when time is constrained further, the effective prioritization and the shedding of appropriate tasks can be compromised, leading to the wrong tasks being shed.⁵

The on-station work of a controller (actively controlling and monitoring) involves constantly prioritizing numerous time-sensitive tasks. They are expected to rapidly alternate between many tasks such as working with radar screens, flight data boards, telephone and radio communications, and sporadically solving problems with unfamiliar situations. The time available for each of these tasks is limited because the controller must keep up with constantly changing traffic situations. It is difficult to perform all of these tasks simultaneously; therefore, the controller must prioritize according to urgency.

NAV CANADA uses a radar data processing system (RDPS) that incorporates a 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.

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 will also activate.

⁴ O. Goteman, "On flight deck callouts and automation awareness," Proceedings of the Annual Conference on Human Factors in Aviation, Swedish Centre for Human Factors in Aviation, Linköping Institute of Technology, Linköping, Sweden, 2001.

⁵ M. Raby, *Scheduling In-Flight Workload Management*, Master Thesis, Department of Psychology, Urbana-Champaign, Illinois: University of Illinois, 1990, pp. 13-18.

Horizontal separation parameters to provide CON alerts are set at 2.98, 4.98, and 9.98 nm rather than at the separation parameters specified in the MANOPS, which are 3, 5, and 10 nm. The vertical minimum is set at 780 feet below FL290 and 1580 feet above FL290 (except in reduced vertical separation minimum [RVSM] areas where the vertical limits are set to 900 feet). These parameters are set to avoid CA nuisance alerts.⁶

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

All air traffic control equipment was reported to be operating as required.

Analysis

The time period from 0730 to 0900 was known by the Edmonton ACC as a period of potentially high traffic volume that required a lot of preparation. By 0717, the La Biche Sector controller was performing all of his normal tasks, including active problem solving with his colleagues as they tried to determine a flight posting for the unusual route of Chinook 254. In addition to this workload, the controller was also preparing flight data strips and estimates for the high traffic period.

Prioritization and perceptual confusion may have led to task shedding. Two important tasks were not completed and were likely shed. Therefore, there may have been too many tasks to accomplish within the 30 minutes before the high traffic period. The first task was shed at 0717:24, when WJA28 initially checked in with the controller. Although the La Biche Sector controller confirmed the route change request, the altitude was not checked on the flight progress strip. The second task was shed at 0718:37, when the La Biche Sector controller gave WJA28 clearance to descend to 10 000 feet asl to prepare for their arrival in Edmonton. The WJA28 altitude was not checked at this point, although the La Biche Sector controller had written the new altitude (10 000 feet asl) onto WJA28's flight progress strip, which had the previously assigned FL340 altitude on it.

Shedding the altitude confirmation meant that if WJA28 was at FL320 its flight path would not immediately conflict with aircraft at higher altitudes. Therefore, the altitude check tasks could have been seen as less urgent (or not even required) and been given a lower priority than the other tasks in which the La Biche Sector controller was engaged. The relatively lower priority of these tasks likely led to them being shed and the La Biche Sector controller continuing to work under the assumption that WJA28 was at FL320. The La Biche Sector controller recognized that WJA28 was not at the assumed altitude 21 seconds after WJA28 announced their descent out of FL340.

⁶ NAV CANADA, CA—Conflict Alert, Lesson Plan, Operational Systems Requirements Division, April 2004, p. 15.

The La Biche Sector controller's workload increased with the addition of the preparation activities. Since the number of staff available for on-station work at any time was limited, requests for assistance during high workloads are made strategically. It is normal for controllers to attempt to balance their immediate need for assistance with their future needs, as well as their colleagues' need for breaks from on-station work. The La Biche Sector controller knew that his workload was high during the first 20 minutes of his shift. However, the workload associated with the high traffic period was anticipated to be even greater. The La Biche Sector controller likely did not request assistance during the first 20 minutes of his shift because he wanted to increase the probability that he would receive assistance when it became imperative.

At the beginning of the shift, JZA8369 and WJA28 were at FL340. The La Biche Sector controller had to check the flight data strips on the flight data board to adjust JZA8369's altitude down to FL330. This is a very routine task, which controllers perform in the same way many times per shift. At that time, the board was full of data strips, and several more were at the printing station waiting processing. WJA28 and SYN22 were travelling similar routes, and the data strips displayed similar information. It is therefore possible that, when the La Biche Sector controller checked the WJA28 information on the flight data board before adjusting JZA8369's altitude, he saw the similar SYN22 flight data strip and associated its FL320 altitude with WJA28. From that point on, the La Biche Sector controller was working under the assumption that WJA28 was at FL320.

NAV CANADA's conflict alerting software was designed to provide a TFC alert warning within 60 seconds of a predicted conflict. However, under some conditions, the relative positions of the aircraft may not provide sufficient time for the CA function to provide a traffic alert before loss of separation. In this case, only a conflict alert will be generated.

Findings as to Causes and Contributing Factors

1. The La Biche Sector controller was preoccupied with the data position tasks, which precluded active monitoring of the radar environment. The controller believed that WJA28 was at flight level (FL) 320, rather than FL340 as indicated by the radar display and flight data strip, when he issued clearance for WJA28 to descend to 10 000 feet above sea level (asl).
2. The controller issued a descent clearance to WJA28 that would result in a descent through FL330 along a track that would conflict with JZA8369 at FL330.

Finding as to Risk

1. Conflict alerting software may not provide timely traffic warning indications under certain conditions.

Safety Action Taken

The Edmonton Area Control Centre (ACC) has established a corridor for traffic operating between Edmonton and Fort McMurray. Aircraft operating within this corridor are assigned eastbound altitudes for flights northbound to Fort McMurray and westbound altitudes for flights southbound to Edmonton. Controllers are also directed to segregate northbound and southbound traffic laterally.

NAV CANADA is in the process of developing RNAV (area navigation) routes that will provide lateral separation along the Fort McMurray-Edmonton corridor.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 November 2006.