

AVIATION INVESTIGATION REPORT

A01W0160

RISK OF COLLISION

NAV CANADA

EDMONTON AREA CONTROL CENTRE - ALSASK SECTOR

EMPRESS VOR, ALBERTA, 40 nm W

04 JULY 2001

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

### Risk of Collision

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### *Summary*

An Air Canada Boeing 737 (ACA3697) was en route from Winnipeg International Airport, Manitoba, to Calgary International Airport, Alberta, at flight level (FL) 350. A Canadian Regional Airlines Fokker F28 (CDR8510) departed Calgary en route to Regina International Airport, Saskatchewan, and was climbing to FL290 in a direction opposite to ACA3697. Both flights were in radar coverage under air traffic control. When ACA3697 was about 25 nautical miles east of the Empress VOR (VHF omnidirectional radio range), an air traffic controller cleared the aircraft to descend to FL290. After ACA3697 crossed the Empress VOR, the controller, to provide separation from another aircraft, instructed ACA3697 to maintain a heading that was nearly reciprocal that of CDR8510. When the two aircraft were about 6 nautical miles apart, a traffic alert and collision-avoidance system resolution advisory instructed CDR8510 to descend, which they did. The two aircraft passed with about 1000 feet horizontal and 1300 feet vertical spacing in an area where the required minimum separation was 5 nautical miles horizontally or 1000 feet vertically.

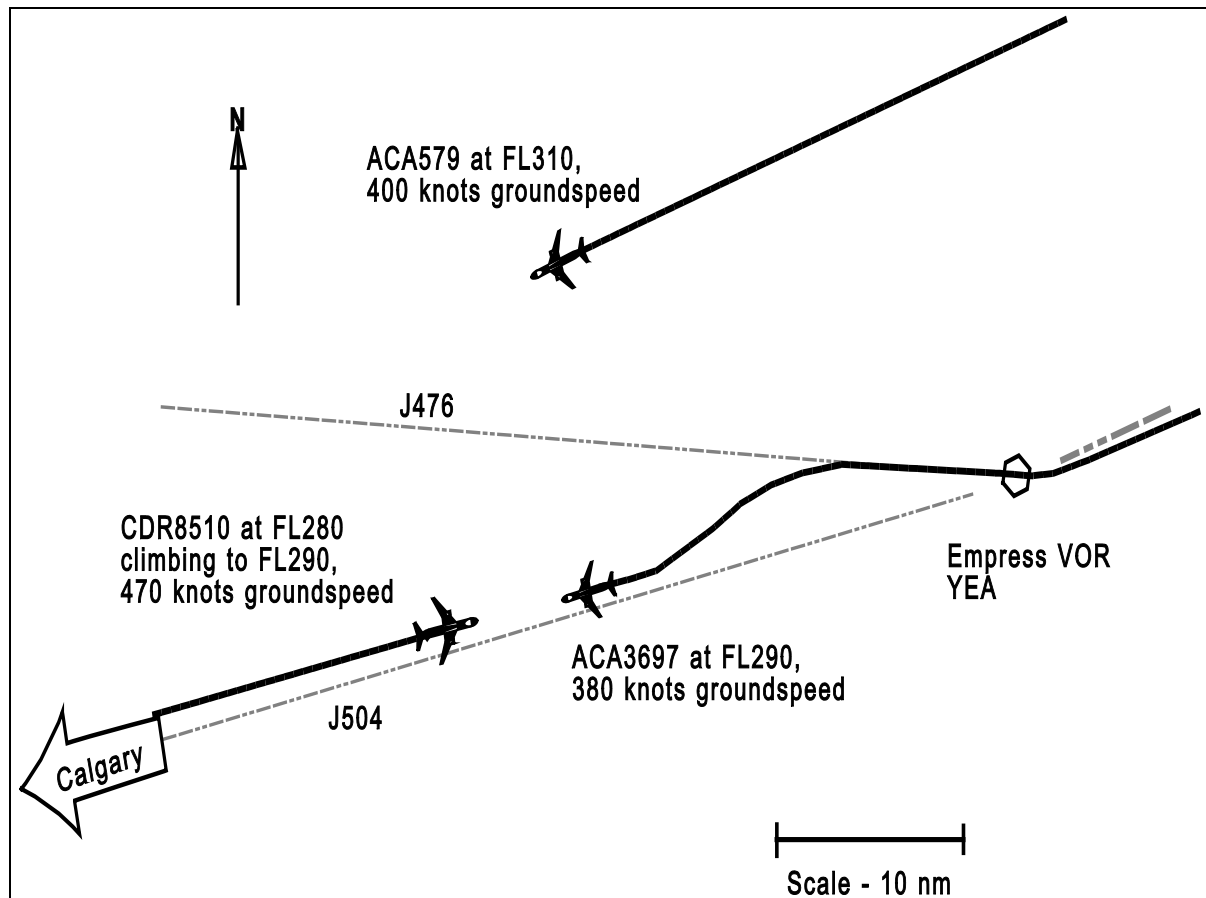
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## Other Factual Information

The aircraft were flying through the Alsask sector in the Calgary en route specialty. The specialty, situated in the Edmonton Area Control Centre (ACC), comprises six sectors. The Alsask sector is on the eastern boundary adjoining airspace controlled by Winnipeg ACC. For flights inbound to Calgary from the east, aircraft are issued descent to 12 000 feet and the appropriate standard terminal arrival routing (STAR).

After departure from Calgary, CDR8510 was established on Airway J504 eastbound on a track of 073° magnetic and cleared to flight level (FL) 250 while in Calgary Terminal Control airspace. Upon making contact with the Alsask controller at 1100 mountain daylight time,<sup>1</sup> CDR8510 was cleared to climb to their flight-planned altitude of FL290.

ACA3697 was cleared to proceed westbound at FL350 on Airway J504 to the Empress VOR (VHF omnidirectional radio range) (YEA), Airway J476 to the ALOMO intersection, and then to the Calgary airport via a published STAR. When ACA3697 was about 25 nautical miles (nm) east of YEA, the Alsask controller cleared the aircraft to descend to FL290 in preparation for handing control of the flight over to the Calgary terminal sector of Edmonton ACC. After crossing YEA, ACA3697 turned right on J476 in accordance with the clearance. (See Figure 1.)



<sup>1</sup> All times are mountain daylight time (Coordinated Universal Time minus six hours).

When ACA3697 was issued descent clearance, an Airbus A320 (ACA579) was westbound on a track of 252° at FL310 about 11 nm north of YEA. After determining ACA579's heading, the Alsask controller instructed ACA3697 to turn left to a heading of 250°, followed shortly by instructions to turn right to a heading of 270°. This manoeuvring assured separation between ACA3697 and ACA579, but placed ACA3697 on a track nearly reciprocal to CDR8510. ACA3697 leveled at FL290 approximately 5.9 nm in front of CDR8510, which was climbing through FL280 for FL290.

While climbing through FL280, CDR8510 received a traffic alert and collision-avoidance system (TCAS) resolution advisory (RA) to descend for traffic avoidance. Within 30 seconds, CDR8510 had descended to FL277, passing under ACA3697 at FL290. ACA3697 received a TCAS traffic advisory—information to assist the flight crew visually acquire conflicting traffic and to alert pilots of the possibility of an RA; the pilot took no evasive action. The sky was clear with unlimited visibility, and both flight crews had visual contact with the other aircraft when they passed. Aircraft flying in Canada are not required to be fitted with an on-board collision-avoidance system.

The radar data-processing system situational display (RSiT) includes a number of features that assist a controller in maintaining situational awareness. A controller normally tags radar targets with a number of parameters, including aircraft identity, altitude, and speed. S/he can select a halo<sup>2</sup> around a particular aircraft target to represent horizontal separation minima. A projected track line (PTL) presents a controller with information on the predicted path that an aircraft will follow for a selected period of time. As an aircraft track changes, the PTL continually changes to indicate the revised track that the aircraft will fly. The PTL can be either displayed or suppressed for each radar target.

The controller had selected a PTL for ACA3697 but not for CDR8510. When the controller instructed ACA3697 to turn to a heading of 250°, its PTL intersected the target for CDR8510. However, the controller did not detect the conflict. Range halos were not selected for any of the aircraft involved in the incident.

Flight progress strips were available and showed direction of flight, altitude, and appropriate marks indicating that the estimates had been passed to concerned sectors. The controller had passed all relevant information about CDR8510 to Winnipeg ACC, including the estimated time at YEA and the aircraft's flight-planned altitude of FL290.

The RSiT system has been operational at Edmonton ACC since 2000. All controllers were given a two-day course in its use, and recurrent training is provided when the system is upgraded. The controller involved in this incident received his initial RSiT training in 2000, recurrent training in April 2001, and was considered to be competent using the display system.

The controller, who was licensed and current in accordance with existing regulations, had 30 years experience, with 20 years in the Calgary en route specialty. He was a specialty team supervisor and worked a controller position as required.

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<sup>2</sup> A halo is a display feature that places a green circular ring around a selected moving target. The user can select a radius according to modifiable system values.

On the day of the occurrence, he reported for work at 0600 in a controller position; another supervisor was on duty. At the time of the occurrence, he was working the Alsask sector alone and performed data and controller duties. The incident occurred about 3½ hours before the end of his shift. Workload was described as light to moderate, with a total of five aircraft in the Alsask sector at the time of the occurrence. The controller considered himself to be well rested and without health problems.

Canadian Aviation Regulation (CAR) 602.34 specifies that FL290 is an altitude reserved for eastbound aircraft unless otherwise assigned by air traffic control (ATC). FL290 was assigned to westbound ACA3697, and although it was landing in Calgary, the flight was operating in the en route airway structure. Nav Canada *Air Traffic Control Manual of Operations* (ATC MANOPS), section 430, provides additional guidance and limitations for controllers when assigning an altitude inappropriate for the direction of flight, including the markup of flight progress strips in a distinct and standard manner. However, the controller was not in the habit of marking the flight progress strip altitude box to indicate an aircraft flying at an altitude not appropriate for direction of flight when an aircraft was landing at an airport. Controllers are not required to indicate an altitude inappropriate for direction of flight on the radar display using an available display tool. There was no other traffic in the vicinity that required ACA3697 to be level at FL290 to maintain the required separation. No other form of separation was applied between ACA3697 and CDR8510 during the time the two aircraft were both cleared to maintain FL290.

The Empress VOR is a common crossing point for eastbound and westbound traffic operating through the Alsask sector of Edmonton ACC. Since 1998, five recorded loss-of-separation incidents have occurred near the Empress VOR, with all of these incidents involving aircraft flying in opposite directions at the same altitude. Procedures had been modified in other Edmonton ACC specialties to minimize conflicts between opposite-direction traffic.

TSB recommended (A00-15) that Nav Canada commit, with a set date, to the installation and operation of an automated conflict prediction and alerting system installed at the nation's ATC facilities to reduce the risk of midair collisions. Conflict alert was implemented in the North High and Edmonton En Route specialties of the Edmonton ACC on 07 July 2002, and is planned for the North Low and Calgary En Route specialties by 31 October 2002. Functionality will be established in all national high level airspace by the end of 2002.

## *Analysis*

ACA3697 and CDR8510 were initially properly separated, both vertically (FL350 versus FL290) and laterally (J476 versus J504). The problem the controller faced was to descend ACA3697 to an appropriate altitude in order to hand over the flight to the next sector for landing at Calgary airport. The controller chose to clear ACA3697 to FL290, a wrong-way altitude. However, he did not mark the flight progress strip for ACA3697 to indicate that the flight was at an altitude inappropriate for the direction of flight, nor was he in the habit of doing so in this situation. Controllers are not prevented, by regulation or procedures, from assigning altitudes not appropriate for the direction of flight to aircraft being positioned for landing at an airport. However, by clearing ACA3697 to FL290, the flight was placed at a higher risk of being involved in a loss-of-separation incident with opposite-direction traffic, with a resulting greater potential for a midair collision.

In order to descend ACA3697 to the required altitude before handoff to the Calgary arrival sector, the controller first had to ensure the appropriate lateral spacing with another westbound flight, ACA579 several miles to the north at FL310. The controller's attention then became focused on this separation problem, to the detriment of his overall situational awareness. To solve the separation problem between the two Air Canada flights, the controller chose to clear ACA3697 to FL290 and issue a vector to the southwest, away from the other aircraft. In doing so, the controller created a conflict with CDR8510 where none had existed.

The controller did not see the impending conflict with CDR8510. He did not indicate the conflict between ACA3697 and CDR8510 on the RSiT, nor did he perceive the conflict even though the PTL from ACA3697 pointed directly at CDR8510. The controller's attention was fixed on one separation problem to the exclusion of another, significantly increasing the risk of a midair collision. The controller relied solely on his own memory to retain situational awareness and did not establish other effective defences for CDR8510.

In the absence of ATC radar-based conflict alerting, only a TCAS RA to the pilots of CDR8510 prevented a much closer encounter between the two aircraft.

### *Findings as to Causes and Contributing Factors*

1. The Alsask controller lost situational awareness when his attention became focused on separating two of the five aircraft in his sector, to the detriment of seeing and resolving another separation problem involving CDR8510.
2. The controller did not use appropriate procedures to mark the flight progress strips for ACA3697 and CDR8510 to indicate inappropriate altitudes or potential conflicts. As a result, two aircraft converged with a clearance to the same altitude.
3. The controller did not adequately scan the radar display and detect the conflict between ACA3697 and CDR8510 because his attention was focused on two of the five aircraft he was controlling.

### *Finding as to Risk*

1. Nav Canada radar systems in Edmonton ACC are not yet equipped with automatic defences to alert controllers to impending aircraft conflicts.
2. TCASs/ACASs are not mandatory for transport-category aircraft in Canada. No other airborne defences are in place to assist pilots in preventing a midair collision in cases where aircraft are not provided with at least the minimum separation required by regulations.
3. There are no air traffic control procedures in place that require controllers to indicate potential conflicts on the radar display in a standard manner, similar to that required for flight progress strips. This increases the risk that controllers will forget about a conflict because it may not be evident on the radar display.

## *Safety Action Taken*

In response to a rising number of operating irregularities, Nav Canada has re-issued a *Staff Information Bulletin* titled "A Reminder: Nav Canada Focus on Safety In ATS". The bulletin reaffirms the goal of safety and identifies specific areas of concentrated attention.

Since this occurrence, Nav Canada has taken steps to reduce the possibility of conflict between opposite-direction aircraft near the Empress VOR (VHF omnidirectional radio range). A new intersection, SHAWI, north of YEA will form part of a one-way routing for westbound aircraft destined for Calgary. J504 will be used primarily for eastbound traffic.

In addition to implementing conflict-alert functionality in the Moncton ACC high level sectors, Nav Canada has established a conflict-alert system in the Winnipeg and Edmonton ACC high level sectors. In particular, the system has been established in the North High and Calgary en route specialties, including the Alsask sector on July 07, 2002. The system will be functioning in all national high level airspace by the end of 2002.

TSB Report No. A00C0211 references Transport Canada's Notice of Proposed Amendment (NPA) 2000-130 to the *Canadian Aviation Regulations*. The NPA, which was presented initially at the June 2000 Canadian Aviation Regulations Advisory Council technical committee meeting, proposed essentially that after 01 January 2003, all turbine-powered aeroplanes certified to carry more than 30 passengers be equipped with ACAS. Further, NPA 2001-069, proposed in June 2001, ensures that software associated with the ACAS meets the higher standards required for operation in reduced vertical separation minima airspace.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 9 October 2002.*

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