

AVIATION INVESTIGATION REPORT

A02A0079

LOSS OF SEPARATION

NAV CANADA

GANDER AREA CONTROL CENTRE, CYMON SECTOR

GANDER, NEWFOUNDLAND AND LABRADOR 180 NM ENE

20 JUNE 2002

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.

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Summary

British Airways Flight BAW93 was en route from Heathrow, England, to Toronto, Ontario, at flight level (FL) 340. Air Canada Flight ACA861 was en route from Heathrow to Halifax, Nova Scotia, at FL360. United Airlines Flight UAL971 was en route from Milan, Italy, to Washington, United States, at FL350. BAW93 requested and received a clearance from Gander Area Control Centre to climb to FL360. The aircraft climbed to FL360 and, as a result, the required separation between BAW93 and the other two aircraft was lost. The controller subsequently issued a clearance to BAW93 to restore required separation.

Ce rapport est également disponible en français.

Other Factual Information

Gander Area Control Centre (ACC) is responsible for air traffic control in the Gander Domestic and Oceanic Flight Information Regions (FIR). The FIR is divided into three areas or specialties: ICAO, high-level domestic, and low-level domestic. As aircraft transit from oceanic to domestic airspace, they enter an adjoining sector in high-level domestic specialty. At the time of the incident, five sectors were operating within the high-level domestic specialty. Traffic density and complexity in the CYMON sector was decreasing at the time of the incident because the westbound flow was nearing the end.

The CYMON sector controller had a total of eight years' experience, all in the Gander ACC. He was on his second day of work after four days' leave. He had been on duty for 5 hours 40 minutes since the beginning of his shift and had been on a 45-minute rest break before taking over the CYMON sector. He had been working this sector for 46 minutes before the incident. The incident occurred at 1310 Newfoundland daylight time,¹ approximately 1 hour 50 minutes before the end of his shift.

The radar data processing system (RDPS) situational display (RSiT) provides high-level controllers with radar target position data, including data tags associated with radar targets. The information presented on the data tags for radar-identified aircraft includes aircraft call sign, altitude, speed, and other related information (known as a full data block). Aircraft that are not radar identified are normally displayed as a splat, which is a star shaped icon (*), along with the aircraft's altitude. Aircraft entering the domestic airspace from the oceanic airspace are presented on the controller's display as splats. When the aircraft is assigned a discrete transponder (beacon) code, the air traffic control computer system recognizes the code, changes the target symbol to a different type, and adds a full data block.

Depending on traffic density, complexity, and other factors, one or two controllers may be working in the sector. When two controllers are working at a sector, one is responsible for controlling the aircraft using the radar-displayed information, and the other controller is responsible for maintaining the flight progress strips on the flight data board and coordinating with other sectors and units. At the time of the incident, the CYMON sector was staffed by a single controller: the controller was therefore responsible for managing the flight progress strips on the flight data board and for controlling the aircraft utilizing primarily the information displayed on the RSiT. Single staffing of the CYMON sector was considered a normal practice for the density and complexity of traffic at the time of the incident.

Paper flight progress strips are used to provide information (such as aircraft call sign, route, airspeed, and altitude) for all aircraft for which the controller has control responsibilities or will have in the near future. Controllers normally receive such flight progress strips automatically at the sector before an aircraft enters their airspace. On initial contact, the controllers confirm the altitude indicated on the flight progress strip and are required to place a check mark on the strip next to the aircraft altitude. When a request for an altitude change is received, the requested altitude is written on the strip and circled. When the controller issues the clearance to climb and

¹ All times are Newfoundland daylight time (Coordinated Universal Time minus two and one-half hours).

the clearance has been acknowledged, a slash is drawn through the circled altitude and the cleared altitude is written beside the slash. The flight progress strip for BAW93 did not indicate that a climb to FL360 had been issued by the CYMON sector controller.

BAW93, a Boeing 747, was en route at FL340² with a routing of 51° north, 50° west³ at 1304, estimating the CYMON reporting point at 1330. ACA861, a Boeing 767, was en route at FL360 with a routing of 51° north, 50° west at 1306, estimating CYMON at 1332. UAL971, a Boeing 767, was en route at FL350 with a routing of 51° north, 50° west at 1307, estimating CYMON at 1334.

At approximately 1309, the CYMON sector controller radar identified BAW93 and cleared the aircraft direct to the MILLS reporting point. The CYMON sector controller asked the crew for their requested altitude, and BAW93 requested FL360. The CYMON sector controller wrote the requested altitude on the flight progress strip, circled the altitude, and then cleared the aircraft to FL360. BAW93 read back the clearance to climb and commenced the climb at 1310:15. The CYMON sector controller did not normally clear an aircraft to the requested altitude immediately after initial contact. His normal practice was to complete a conflict check of all other traffic in the area before issuing a clearance to change altitudes.

At the time BAW93 was cleared to FL360, neither ACA861 nor UAL971 were communicating with the CYMON sector controller. The targets for ACA861 and UAL971 were being displayed as splats and were not radar identified. The radar target for ACA861 overlapped the radar target of BAW93 at the time the clearance to climb was issued. No form of separation was applied between ACA861 and BAW93. Because ACA861 was within 1 nautical mile (nm) of BAW93, and UAL971 was only two minutes or 16 nm in trail, when BAW93 commenced climbing, there was a loss of separation between BAW93 and UAL971, and then between BAW93 and ACA861. The required separation minima was 10 minutes longitudinal or 1000 feet vertical.

As BAW93 changed course toward MILLS and started its climb, the tracks between ACA861 and BAW93 started to diverge, and their radar target symbols could be distinguished on the CYMON sector controller's display. Both aircraft had traffic alert and collision-avoidance systems (TCAS) installed; however, neither BAW93 nor ACA861 received a TCAS alert or advisory. During the climb, the crew of BAW93 had ACA861 in sight, and there was no risk of collision.

When BAW93 levelled at FL360, the CYMON sector controller saw the conflict and asked the crew of BAW93 to confirm their altitude. The CYMON sector controller did not remember issuing the clearance for BAW93 to climb to FL360. The spacing between the two aircraft was 0.9 nm. The CYMON sector controller took action to re-establish separation between the aircraft by clearing BAW93 to turn right 15 degrees and to climb to FL370. He then notified his supervisor, who confirmed the loss of separation. The CYMON sector controller then was replaced by another controller in accordance with standard operating procedures.

² Flight levels are in feet above sea level with an altimeter setting of 29.92 inches of mercury (ex. FL360 ≈ 36 000 feet).

³ Approximately 216 nm ENE of Gander, at the boundary between oceanic and domestic controlled airspace.

The radar targets for BAW93 and ACA861 were approximately 1 nm apart at the time the two aircraft entered the CYMON sector. The tracks started to diverge when BAW93 was cleared to proceed direct to MILLS intersection. On the range scale that the CYMON sector controller was using on the RSiT, the two targets would overlap each other. The altitude returns on the two aircraft were inconsistently displayed because of the secondary radar beacon code garbling.⁴ The overlap of aircraft targets is a common occurrence in this airspace, because aircraft often enter the high-level domestic sectors from the oceanic sector with little or no lateral or longitudinal spacing but with the appropriate vertical spacing.

Conflict-alert systems assist air traffic controllers in avoiding loss-of-separation situations between aircraft. Conflict alert is a function of the RDPS, which examines radar tracks for potentially conflicting traffic. Radar tracks are evaluated to determine if separation standards will be compromised within a specified time. When necessary, alerts are sent to the radar display in two stages. Sixty seconds before loss of separation is predicted, a traffic alert is generated. If separation is actually lost, a conflict alert is generated. At the time of the incident, no functioning conflict-alert system was installed at the Gander ACC.⁵

Analysis

The CYMON sector controller cleared an aircraft to a requested altitude immediately after the initial request from the aircraft without completing his usual check for conflicting aircraft. As well, he did not draw the required slash through the requested altitude on BAW93's flight progress strip after issuing the clearance to climb to FL360, although he normally would. This seems to support the inference that the CYMON sector controller did not intend to clear BAW93 to climb at the time he issued the clearance.

Two factors contributed to the CYMON sector controller not detecting the erroneous clearance once it had been issued. The CYMON sector controller did not mark the flight progress strip to show that a clearance to climb had been issued. This indicates that he did not cross-check the information printed on the flight progress strips for all the aircraft in the vicinity of BAW93 at the time the clearance was issued and that he was relying primarily on the RSiT to control the aircraft. The garbled and overlapped aircraft targets on the RSiT prevented the CYMON sector controller from seeing that BAW93 was climbing until after BAW93 had levelled at FL360. When the targets diverged on the display because of different cleared flight paths after entering the CYMON sector, the CYMON sector controller detected the conflict and took action to restore separation.

Errors of omission, such as forgetting to carry out a step in a sequence, are common in repetitive, skill-based tasks. Unintentional errors of this type are typically associated with inattention or over-attention. Having cleared multiple aircraft to various altitudes during the earlier, busier part of the shift, the controller likely jumped ahead in the action sequence and inadvertently issued a clearance to climb to BAW93. The incident occurred during a period of decreased traffic density and complexity, near the end of his shift, which might have caused the controller to relax his attention.

⁴ The phenomenon of garbled beacon replies is a limitation common to all secondary radar systems, especially in congested airspace. Garbled beacon replies occur when two or more aircraft are at the same approximate range and bearing but at different altitudes. When these replies overlap, interference occurs, and the ground station receives garbled signals that it is unable to use. The garbled beacon replies cause a partial loss of data or swapping of information from one target to the other.

⁵ On 22 July 2002, but not in direct response to this incident, NAV CANADA activated a conflict-alert system at the Gander ACC.

Because the aircraft were diverging before the climb, there was no risk of collision in this occurrence, although safety was not assured. Additional defences were in place to help minimize the risk of collision. Primarily, the crew of BAW93 had visual contact with ACA861 during the climb. All of the aircraft involved were equipped with functioning TCASs. No TCAS advisories were received because the aircraft were on diverging tracks. Had the aircraft not been diverging, TCAS is designed to warn the crew of both aircraft of the conflict. A conflict-alert system for controllers would likely have assisted the CYMON sector controller in detecting and resolving the developing conflicts.

Findings as to Causes and Contributing Factors

1. The CYMON sector controller inadvertently cleared BAW93 to climb to FL360, resulting in a loss of separation with both UAL971 and ACA861.
2. The CYMON sector controller was relying primarily on the radar data processing system situational display (RSiT) to ensure separation between aircraft and did not review or properly mark the flight progress strips before clearing BAW93 to change its altitude.

Findings as to Risk

1. The co-location of the radar targets resulted in the garbling of displayed information on the RSiT and prevented the CYMON sector controller from seeing that BAW93 was climbing until after the radar targets started to diverge.

This report concludes the TSB's investigation into this occurrence. Consequently, the Board authorized the release of this report on 08 October 2003.

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