Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A01W0129

LOSS OF SEPARATION

NAV CANADA

EDMONTON AREA CONTROL CENTRE

EDMONTON, ALBERTA

31 MAY 2001

Canada

Aviation Investigation Report

Loss of Separation

Nav Canada
Edmonton Area Control Centre
Edmonton, Alberta
31 May 2001

Report Number A01W0129

Summary

Two aircraft on parallel courses entered Canadian airspace over Baffin Island, Nunavut, 60 nautical miles apart. British Airways Flight BAW49, a Boeing 747-200, was en route from Heathrow, London, United Kingdom, to Seattle, Washington, USA, at flight level 330. Air Canada Flight ACA845, an Airbus A340-300, was en route from Frankfurt, Germany, to Calgary, Alberta, at flight level 350. BAW49 was eight minutes ahead of ACA845. To provide vertical separation from northbound polar traffic, BAW49 was to be issued climb clearance to flight level 350. However, to ensure continued lateral separation between BAW49 and ACA845 at that flight level during a later portion of the flight, ACA845 first had to be rerouted. At 1820 Coordinated Universal Time, ACA845 was issued an amended routing and BAW49 was then cleared to climb to flight level 350. At 1945, the crew of ACA845 advised that they had traffic in sight on their left and were altering course to the right. The two aircraft came within approximately 7 nautical miles of each other at the same flight level where 20 nautical miles lateral or 2000 feet vertical separation is required.

Ce rapport est également disponible en françois.

Other Factual Information

The north high specialty of Edmonton Area Control Centre (ACC) consists of five sectors that use procedural (non-radar) separation standards and one sector (Bison) that provides procedural and radar control. (See Appendix B.) Aircraft in the procedural control areas are separated by assigning specific routes and altitudes for the aircraft to fly. Confirmation of separation is provided by periodic position reports, which are typically passed by flight crews every 10° of longitude or over mandatory reporting points. Depending on the location of the aircraft, these reports are received by the controllers in one of two ways. In the Far North, reports are routed through very high frequency (VHF) or high frequency (HF) remote communications outlets (RCOs) to Arctic radio specialists in North Bay, Ontario. The information is then relayed to the Edmonton controllers via landlines. Further south, flight crews provide position reports via VHF RCOs that are directly accessible by Edmonton controllers.

The northern airspace display system (NADS) situational display (NSiT) is a computerized display tool that graphically shows aircraft positions in the north high specialty. A controller manually enters the aircraft's route and position reports into the system. The NSiT takes into account forecast winds at altitude to project the aircraft's position on the route between reporting points and calculates estimates for the reporting points. The system can also provide the controller with information on conflicting routes. However, the current software does not check route conformance; that is, the NSiT does not compare the position report coordinates against the route entered.

ARCTIC COMMUNICATIONS
VHF radio communications are generally very good, with little interference. HF radio communications are long range, and the receiving station can be beyond the line of sight. The quality varies widely, since the signal is susceptible to ionospheric disturbances caused by sunspot activity. It is not uncommon for HF "blackouts" to occur in the polar regions, in which case communications are not possible for 20 to 120 minutes at a time. The only alternative available is the use of aircraft satellite communications (SATCOM) or datalink services (for the relatively few aircraft so-equipped) through the airline's dispatch centre. Because these forms of communication have not yet received ICAO standardization, they are only used as a last resort for the flight. crew to communicate with air traffic control.

Because of the delays inherent in the communication process through Arctic radio, aircraft position reports are sometimes received after the NSiT has estimated that an aircraft has passed a reporting point. When this occurs, the system displays a warning to controllers. Dealing with these warnings can increase controller workload.

The voice switching communication system allows the controller to manage all the incoming communications via a touch-sensitive computer screen. The system has individual volume controls for incoming VHF frequencies and the hotline; a master volume control governs the speaker or headset. The interphone line for communications between sectors within and outside the Edmonton ACC has no independent volume control. External interphone calls (for example, those from Arctic radio) are at low volume compared to internal interphone communications. To raise the volume of external interphone calls, the controller must raise the master volume, thereby affecting all communication volume levels.

The *North High Operations Manual* outlines responsibilities for two-controller procedural operations. The NSiT controller handles VHF communications, applies separation minima,

processes position reports, and transfers communications. The data controller receives and forwards estimates with adjacent units/sectors, amends strips as required, and assists with the flow of traffic within a sector. At the time of the occurrence, the north high specialty was handling mostly westbound traffic from Europe headed for the western parts of North America. (See Appendix B.)

Nav Canada allows airlines to file random routes to provide the most economical route possible. These random routes do not always ensure that required minimum separation standards will be maintained. As a result, the Nunavut and Polar sector controllers are often required to alter aircraft routes. These sectors do not have a traffic-planning position to assist in determining a suitable route.

The reroute procedure for aircraft entering Edmonton airspace from the northeast requires the controller to do the following: plan a proposed new route; enter the proposed route into the NSiT computer; probe the flight plan for conflicts and adjust the proposed route if necessary to eliminate conflicts; probe again; and issue the new route as a clearance to Arctic radio. Arctic radio passes the new route clearance to the aircraft. The NSiT then prints a new flight progress strip for each sector with reroutings, showing the new route portion in reverse highlight. (See Figure 1.)

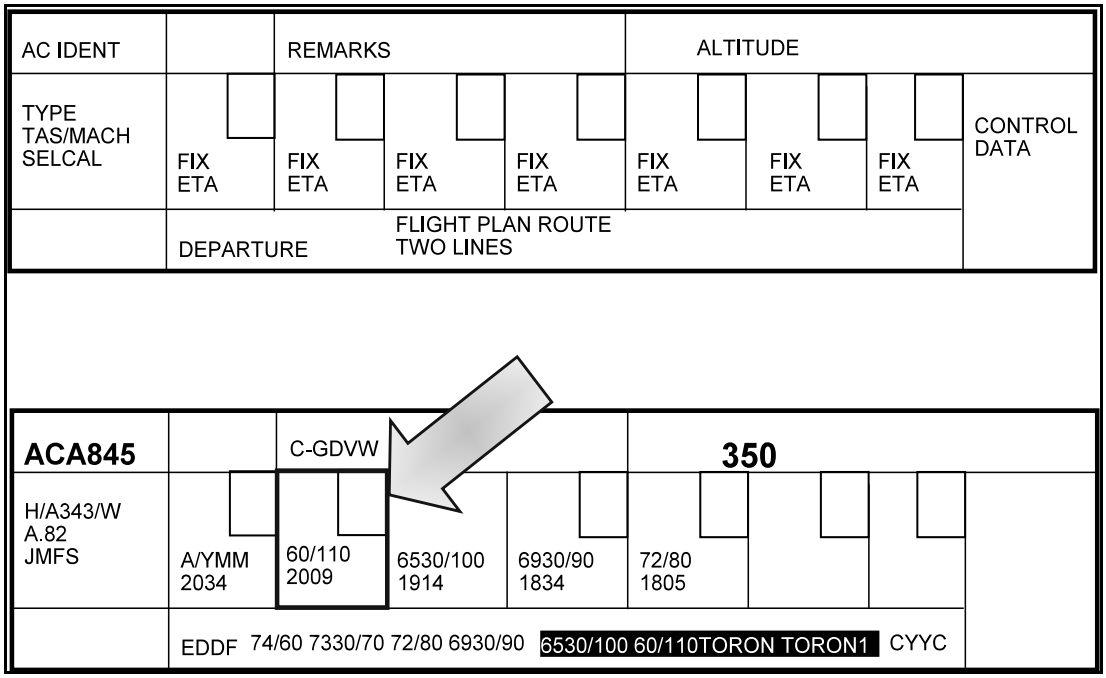


Figure 1 – Flight progress strip format (above) and revised ACA845 strip, as printed by the NSiT system for Franklin sector, showing the highlighted route segment.

On the day of the occurrence, the Nunavut and Polar sectors were combined. The traffic volume was described as moderate, with rerouting tasks. ACA845, at flight level (FL) 350, was to be rerouted by the Nunavut NSiT controller to achieve lateral spacing with BAW49 when BAW49 was cleared to climb from FL330 to FL350. The reroute was planned by the controller and entered into the NSiT. This new routing was passed on to Arctic radio at 1820; however, the planned reporting point of 60N110W was inadvertently omitted.

During Arctic radio's landline readback of the clearance, another aircraft called in with a position report on a VHF frequency at a higher volume level. The Nunavut NSiT controller did not detect that the 60N110W reporting point was missing from the readback. At this time, the data controller was also replacing ACA845's strip with a new strip reflecting the changed routing. This action disrupted the NSiT controller's normal practice of physically pointing to each position in the route during the readback to confirm its accuracy. This revised clearance, without the 60N110W reporting point, was then issued to ACA845 by Arctic radio. The route that ACA845 was cleared to follow did not conform to the route displayed on the NSiT controller's display and depicted on the flight progress strip.

The first position report received from ACA845, after the rerouting, was in the Franklin sector at 1840 Coordinated Universal Time[1] for position 6930N90W. The position report was transmitted in a standard format and included the aircraft identification, position, time over that position, flight level, next reporting point with the estimated time of arrival (ETA), and the name of the next reporting point. The strip that the Franklin data controller was referring to at the time of the position report contained the revised routing, including the necessary 60N110W reporting point. ACA845's position report at 6930N90W included an ETA for 6530N100W (the next mandatory reporting point) and indicated TORON intersection as the next reporting point rather than 60N110W. While receiving the position report, the Franklin data controller was not seated in front of the strips and had to reach across the Franklin NSiT controller to write the estimate on the strip. The Franklin data controller did not recognize that 60N110W should have been reported as the appropriate next reporting point instead of TORON. (See Figure 1.)

The NSiT program will often determine positions along an aircraft's route and calculate estimates for points that are not specified in the clearance. These points will correspond to the location where the aircraft's route crosses a sector boundary and are used for internal control purposes. These positions are printed in the left one or two boxes of the flight progress strips. No estimate is received or expected from the aircraft for these points. Controllers are generally able to discriminate between these internally generated positions and regular mandatory reporting positions because they are not normally part of the aircraft's route clearance and may have a format such as "abeam [a geographic location]" (for example, "A/YMM" means "abeam Fort McMurray"), as was the case for ACA845. The box second from the left may also contain a computer-generated fix. However, on ACA845's flight progress strip, this box contained the mandatory reporting point 60/110 because it was included in the route that had been entered in the NSiT.

ACA845's next position report was at 1915 for position 6530N100W. A second Franklin NSiT controller had rotated into the Franklin sector and received the position report. Instead of providing an ETA for 60N110W, which would have been expected at approximately 2009 according to the NSiT-derived estimate, the pilot provided an estimate of 2105 for TORON and indicated that the next reporting point would be ATHLO. Although 60N110W was on the strip, the second Franklin NSiT controller did not realize that this position should have been the next mandatory reporting point.

Since the second Franklin NSiT controller did not recognize the 60N110W position as a mandatory reporting point, he did not expect the aircraft to provide an estimate for that point. The controller still expected the aircraft to overfly the waypoint, since computer-generated positions are still on the flight route as held by the computer system and shown on the flight

[1] All times are Coordinated Universal Time.

progress strip. The controller did not normally check the estimate boxes against the routing box of the strip while receiving a position report. The investigation noted variations in controller practices when checking and receiving position reports.

ACA845 proceeded from 6530N100W direct to TORON as it had been cleared. BAW49 was on a converging track from 6430N100W to Uranium City (YBE), Saskatchewan. Both aircraft observed each other on the traffic alert and collision-avoidance system (TCAS) and visually. The flight crew of ACA845 contacted BAW49 directly because the two aircraft were out of the Franklin sector's VHF radio range, and it was evident that the aircraft were going to cross paths. ACA845 parallelled BAW49's flight for approximately five minutes until they were able to contact the Bison sector controller directly via the assigned VHF frequency.

ACA845 contacted the Bison radar controller at 1945 and advised that they were deviating to the right for traffic and that they had been heading direct to TORON. When the controller asked ACA845 to verify that they were proceeding to 60N110W as their next reporting point, ACA845 replied that they had been cleared direct to TORON from 6530N100W. ACA845 was then cleared to maintain FL370, and separation was regained.

Analysis

Several factors might have increased the Nunavut NSiT controller's workload and distracted him such that he omitted the 60N110W waypoint when issuing the clearance to Arctic radio and did not realize the omission in the readback. The louder call from an aircraft on VHF during the readback might have distracted the controller. The replacement of the original ACA845 strip with a revised strip at the time of the readback interrupted the controller's normal practice of visually and physically following the printed information on the strip while listening to the readback. Compounding these two factors around the time of the occurrence was the extensive activity to develop revised routes.

The Franklin data controller who received the first position report from ACA845 was not seated directly in front of the strips and, therefore, had to view the flight progress strip from an acute angle. He also had to reach across and in front of the NSiT controller to record the estimates. This made it more difficult to directly view the information on ACA845's flight progress strip. Had the data controller been seated directly in front of the strips during the position report, he would have been able to view the routing and estimate boxes more clearly.

ACA845's next position report, to the second Franklin NSiT controller, also did not include the 60N110W reporting point and was not corrected. This controller had been conditioned to expect that the second-to-last box from the left on the flight progress strip often contained NSiT-generated waypoints for which no ETA would be received from the aircraft. The controller, therefore, did not find it unusual not to receive this information from the pilot, although she still expected that the aircraft would proceed via that point. It could not be determined why the second Franklin NSiT controller did not react to the inclusion of the TORON estimate and the mention of ATHLO as the next reporting point. The second Franklin NSiT controller was also in the habit of not checking the estimate boxes against the routing box of the strip while receiving a position report.

The NSiT system does not check route conformance. The current position and time, the name and estimate for the next reporting point, and the reporting point following—as received from the flight crew, if included in the information entered in the NSiT—might provide a

confirmation that expected and actual routes were in accord. The look and feel of the NSiT display is similar to the radar-based situational display, which may reinforce this accordance.

The NSiT flight progress strip printing routine does not differentiate between mandatory reporting points and NSiT-generated waypoints. Each controller must draw upon experience to determine which waypoints are valid. With the wide variety of experience levels in the north high specialty, the potential for confusion exists.

The position report is the basis for maintaining separation in procedural controlling. How that position report is communicated from the flight crew to the controller is essential to the accuracy of the information received. HF blackouts, time-consuming communication transfers through third parties, and sparse VHF coverage all contribute to less-than-ideal methods of communicating position reports. As a result, controllers encounter delays in receiving position reports and are sometimes inundated with late reports, shown as highlighted or flashing warnings on the NSiT. These delays can add to the workload and distract the controller.

Findings as to Causes and Contributing Factors

1. It could not be determined why the Nunavut controller did not include the 60N110W position in the clearance read to the Arctic radio specialist.

2. When ACA845 passed the position report at 1840, the Franklin data controller did not question that the reporting point after 6530N100W was given as TORON instead of the required reporting point of 60N110W. Neither did he confirm whether the stated route corresponded to the NSiT (northern airspace display system [NADS] situational display) flight-planned route. The controller thereby missed the opportunity to correct the planned route.

3. When ACA845 passed the position report at 1915, the second Franklin controller did not question that the next reporting point would be TORON with ATHLO next instead of the required reporting point of 60N110W with TORON next. The controller thereby missed the opportunity to correct the planned route.

Findings as to Risk

1. The Polar and Nunavut sectors do not have a route-planning position. The workload of the controller responsible for separating aircraft is therefore increased, which may result in the controller's attention being divided among several critical tasks.

2. The voice switching communication system equipment is not able to control the volume levels of all incoming communications. The need to continually adjust the volume between radio and landline calls adds to the controller's workload. This may result in some transmissions being masked by others coming in at a higher volume.

3. The lack of continuous, direct controller-to-pilot communications in procedurally controlled Canadian northern airspace results in delays in receiving position reports. Warnings generated by the NSiT increase the distraction to controllers.

4. The NSiT does not check route conformance and alert controllers that an aircraft is following a route other than what is expected, increasing the risk of a loss-of-separation incident.

5. The NSiT does not differentiate, graphically or otherwise, between mandatory and computer-generated waypoints on the flight progress strips. Controllers may therefore not be aware that an aircraft is flying a route different from that intended by the controller.

Safety Action Taken

Nav Canada has been corresponding with the voice switching communication system (VSCS) manufacturer to determine the best way to fix the inconsistent volume levels in the VSCS. A software modification has been provided by the manufacturer and is currently undergoing testing. Implementation in operational units is anticipated to start in the second quarter of 2002.

Nav Canada facilities have developed and demonstrated technical datalink capabilities for controller-pilot datalink communications with aircraft equipped with the Future Air Navigation System (FANS)-1/A. The current plan is to integrate these capabilities into NSiT (northern airspace display system [NADS] situational display) by late fall 2002.

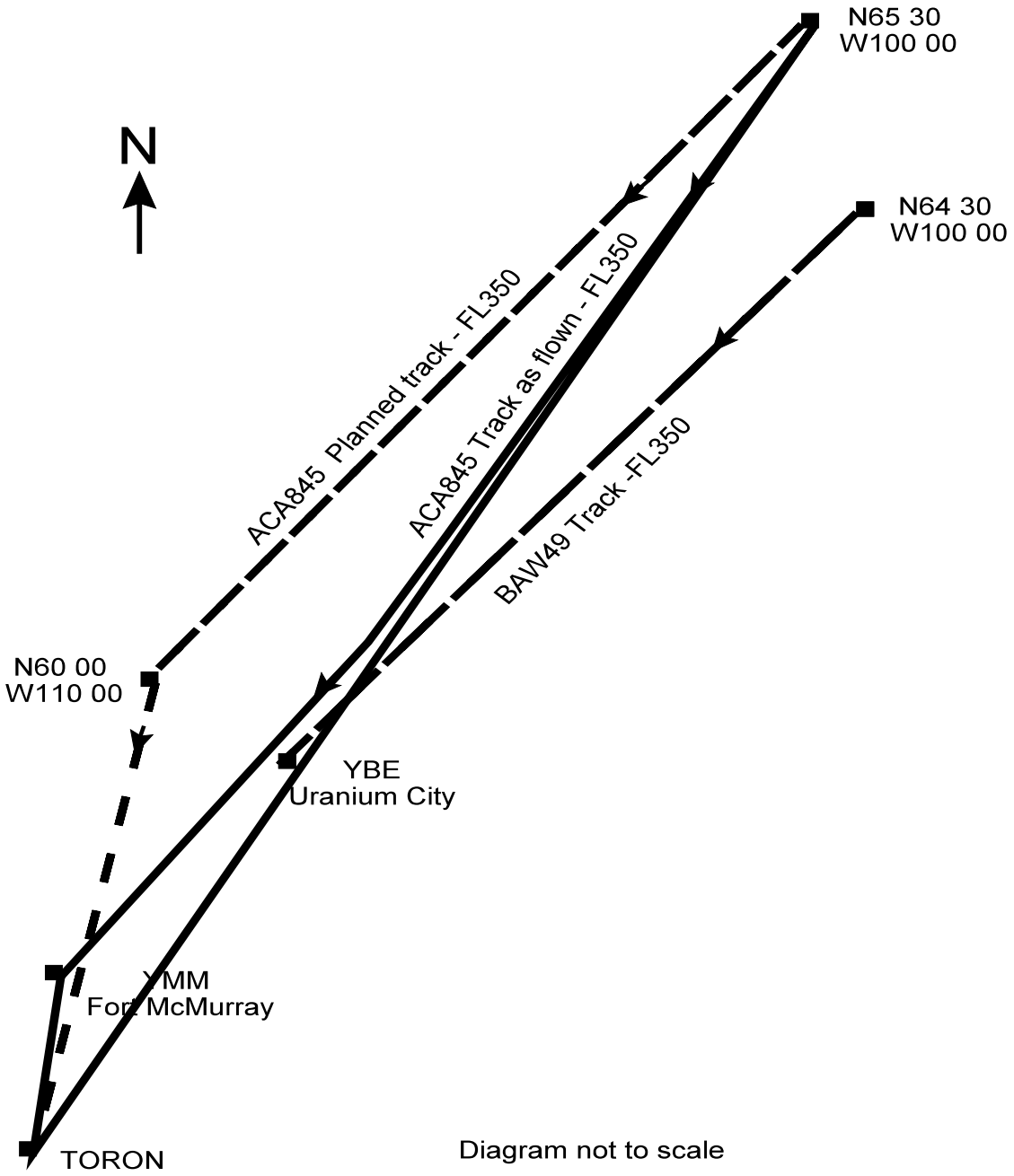
Nav Canada has approved the commissioning of the following radar sites in northern Canada: Iqaluit, Nunavut (July 2002); La Ronge, Saskatchewan (December 2002); Chisasibi, Quebec (summer 2003); and Stony Rapids, Saskatchewan (winter 2003). Nav Canada plans to have additional sites at Puvirnituq, Quebec; Arviat, Nunavut; Fort Severn, Ontario; and Coral Harbour, Nunavut.

Under the Northern PALs (Peripheral Stations) project, Nav Canada is delivering VHF PAL stations to the following communities: Hay River, Northwest Territories (June 2002); Fort Simpson, Northwest Territories (August 2002); Norman Wells, Northwest Territories (August 2002); and Coral Harbour, Nunavut (August 2002).

Nav Canada has conducted refresher training for all north high specialty controllers, emphasizing the need to confirm readbacks and to verify routings.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 02 April 2002.

Appendix A—Aircraft Tracks



Appendix B—Sector Boundaries and Original Flight-Planned Tracks

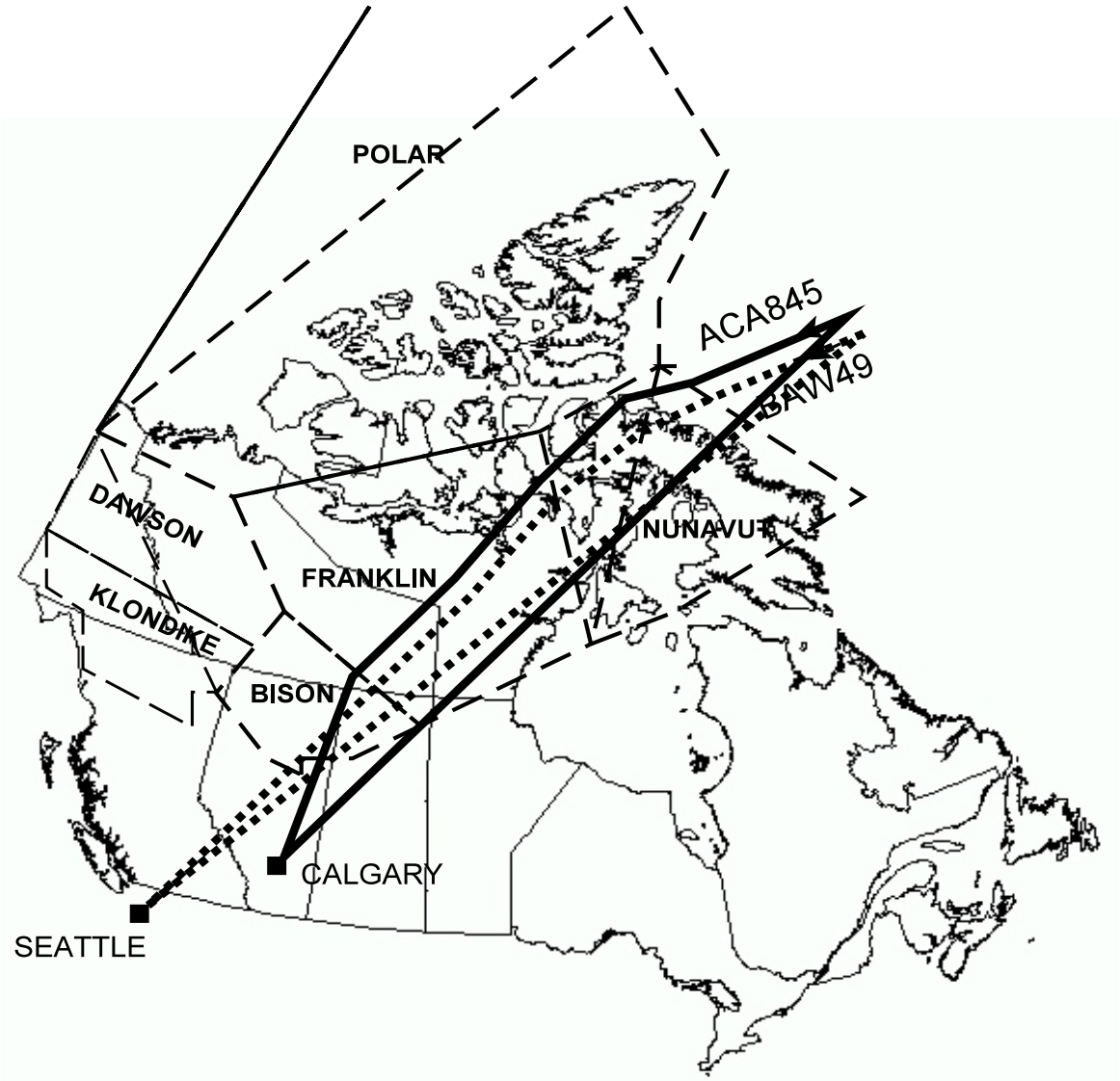


Diagram not to scale; sector boundaries are approximate