



REASSESSMENT OF THE RESPONSES TO AVIATION SAFETY RECOMMENDATION A02-04

POTENTIAL FOR WATER LINE RIBBON HEATER INSTALLATION FAILURES TO START A FIRE

Background

The Boeing 767-300 aircraft (C-GHML, serial number 24948), operating as Air Canada Flight 116 with 8 crew members and 177 passengers on board, was on a scheduled flight from Vancouver, British Columbia, to Toronto/Lester B. Pearson International Airport, Ontario. At 2132 Coordinated Universal Time, while on final approach, approximately 10 miles from the airport, the flight crew received an aft cargo bay fire warning. The flight crew followed emergency checklist procedures, activated the cargo bay fire extinguishers, and declared an emergency. The fire warning light extinguished approximately 50 seconds after activation of the fire extinguishers. Flight 116 landed on Runway 06L and stopped to allow airport firefighters to inspect the aircraft for indications of fire.

Firefighters, using infrared sensing equipment, did not detect any sign of fire, but an odour of smoke was noted by both the cabin crew and flight crew. The flight crew taxied the aircraft to the terminal but stopped approximately 40 feet back from the gate to allow firefighters to open the aft cargo compartment for a detailed inspection. When firefighters entered the cargo compartment, they encountered a significant amount of smoke but did not detect any other signs of fire. During this time, the flight crew had prepared the aircraft for emergency evacuation. However, the situation was secured and passengers were deplaned using portable stairs. The aircraft was taken to a hangar for further inspection; company maintenance personnel discovered substantial soot and fire damage on the floor of the cargo bay.

On 14 November 2002, the Board released interim safety recommendations as part of its investigation (A02O0123) into this occurrence.

Board Recommendation A02-04 (14 November 2002)

Widespread use of heater ribbons on transport category aircraft exposes the travelling public to the risks associated with heater ribbon fires. Recent actions taken to reduce these risks are not comprehensive and do not address the risk in the long term. Consequently, there remain inadequate defences against heater ribbon installations starting a fire. Therefore, the Board recommended that:

The Department of Transport take action to reduce the short term risk and eliminate the long term risk of heater ribbon installation failures starting fires, and coordinate and encourage a similar response from other appropriate regulatory authorities.

A02-04

Responses to A02-04 (Transport Canada - 05 February 2003 and Federal Aviation Administration - 25 February 2003)

As an interim response, the Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) 2002-11-11 requiring the performance of a one-time general visual inspection for foreign object debris or contamination in visually accessible areas on or near potable water and drain lines and for discrepancies of potable water and drain lines located below the cargo floor in the non-fully enclosed forward and aft cargo compartments, in accordance with Boeing Alert Service Bulletin 767-30A0037, dated 28 May 2002.

In its 05 February 2003 response, Transport Canada (TC) reported the following short-term actions:

- TC's Aircraft Certification Branch, Continuing Airworthiness Division, is working closely with the FAA to determine if this interim action is required for other model types that use similar heater tapes.
- On 27 December 2002, TC submitted a letter to the FAA and the manufacturer of the Boeing 767 aircraft, requesting that a review of the initial development of Maintenance Significant Items, which preceded the B767 Maintenance Review Board analysis, be performed. Should this review be found inadequate in light of the incident on 20 December 2002 at Edmonton International Airport, Alberta, involving an Air Canada Boeing 767-200 aircraft, it was requested that a complete re-analysis of the system be conducted to ensure that all failure modes are included.
- Boeing has been asked to take into consideration the overheating/arcing failure mode combined with combustible contaminants, which may result in a fire. In addition, a request for a review of the installation instructions of the heater ribbon tape and the configuration of the related electrical circuit, including the circuit breaker, will be made.
- TC contacted other foreign civil aviation authorities in January 2003, and requested their support in assessing the potential failure for similar heater ribbon installations on type-certified aircraft for which they are the responsible design authority. TC will share this information with the TSB once it is available.

The 05 February 2003 TC letter also reported the following long-term actions:

- TC is working closely with the FAA to determine corrective actions required to address this problem.
- Bombardier has been requested to provide TC with information regarding the type of heater tapes installed on aircraft for which they are the type certificate holder.

In a February 25 letter, the FAA provided the following comments:

- In its 06 February 2003 letter, the FAA's Seattle Office of Aircraft Certification (OAC) indicates that it agrees in part with the recommendation.
- A notice of proposed rule making (NPRM) is being prepared for the Boeing Model 747 aircraft to perform an inspection similar to that of AD 2002-11-11.

Additionally, the Seattle OAC has requested service bulletins from Boeing to address the long-term risk for Boeing 747 and 767 aircraft without fully enclosed cargo floors. One corrective action is to identify any drain line hoses that do not require heat to keep from freezing and remove the heater ribbon via the requested service bulletin. For the remaining drain and fill lines in the area under the cargo floor, a new, more reliable heater ribbon will be developed and installed in accordance with the requested service bulletin. It is estimated that the service bulletins will be issued by December 2003, and that ADs mandating the service bulletins will be issued by December 2004.

- The Seattle OAC does not agree that additional actions are required for other Boeing aircraft or for areas that are not accessible. It indicates that debris and contamination and not heater tape or insulation materials provide the fuel for a fire. Areas that are not accessible are not as exposed to debris or contamination; therefore, there is no risk of fire. It also indicates that there has never been a failure of a heater tape in an inaccessible area that has resulted in self-sustaining fire.
- In a letter to the TSB dated 25 February 2005, the FAA stated that its Safety Recommendation Review Board had classified Recommendation A02-04, "Closed-Acceptable Action."

Board Assessment of the Responses to A02-04 (30 September 2003)

Although TC has indicated that it intends to work with the FAA, and has made requests to the FAA, TC has not indicated an intent to take action to directly address the safety deficiency identified by the Board beyond the areas being addressed by the FAA.

The FAA response indicates that it intends to issue an AD to either remove unnecessary heater ribbons or to replace them with more reliable heater ribbons. The FAA estimates that the AD will be issued in December 2004. The AD will only be applicable to heater ribbons on Boeing 747 and 767 aircraft, and only to those heater ribbons located in open cargo floor areas of these aircraft. This action by the FAA should satisfactorily address the safety deficiency only on these aircraft models in the open cargo floor areas.

The FAA action is limited to the Boeing 747 and 767 aircraft because only these aircraft have open cargo floor areas. The FAA believes that heater ribbons do not need to be removed or replaced in closed-in areas because such areas do not accumulate sufficient debris and contamination to pose a risk of a self-sustaining fire. The TSB does not share this view. Both the TSB and the NTSB have previously issued safety communications concerning the fire hazard associated with the accumulations of lint, dust, and debris on wires. As detailed in the TSB Recommendation A02-04 document, dust and lint accumulation on wires has led to self-sustaining fires in closed-in areas and the potential for such fires still exists. Consequently, the lack of FAA action concerning closed-in areas perpetuates the safety deficiency in these areas.

FAA action should adequately address the potential for heater ribbon installations to start a fire in open cargo floor areas, but not in closed-in areas. Although the risk of a fire starting in open floor areas is likely greater due to their vulnerability to the accumulation of debris and contamination, the lower risk of a fire starting in a closed-in area will remain.

The new enhanced zonal analysis procedure (EZAP) maintenance process referred to in the FAA response to TSB Recommendation A02-04 could result in action in the short term to monitor the condition of wiring, and contaminated materials and debris. The proposed action is applicable to large transport type aircraft in both the open and closed areas of the fuselage. This action should make it less likely that a failed heater ribbon will start a fire.

The action proposed by the FAA will reduce the deficiency in both the short and long term, but not substantially reduce or eliminate it.

Therefore, the response is assessed as being **Satisfactory-in-Part**.

Next TSB Action (30 September 2003)

TC has indicated that it will provide an updated response to the TSB. The Air Branch will continue to monitor both the FAA's and TC's actions related to Recommendation A02-04. The assessment will be updated when more information is received.

Response to A02-04 (14 December 2005)

TC's letter dated 14 December 2003 did not include an update on the status of its action plan regarding Recommendation A02-04. Similarly, no further information has been received from the FAA.

Board Reassessment of the Responses to A02-04 (12 July 2006)

TC's letter to the TSB dated 14 December 2005 did not include an update to its original action plan with respect to Recommendation A02-04. It is the Board's understanding that TC remains committed to its original action plan, which, if fully implemented, will reduce but not substantially reduce or eliminate the deficiency associated with Recommendation A02-04.

Therefore, the assessment remains at **Satisfactory-in-Part**.

Next TSB Action (12 July 2006)

TSB Air Branch staff will liaise with TC to solicit an activity update with respect to the deficiency described in Recommendation A02-04.

Response to A02-04 (07 February 2007)

TC's letter dated 07 February 2007 indicated the following:

- TC subjected these concerns to a risk assessment using a risk management process;
- TC has reviewed the use of heater ribbon (tapes) on Canadian registered aircraft and in aircraft for which it is the responsible design authority. It states that its review did not reveal any in-service difficulties on these aircraft that would require additional safety action;
- In addition, for foreign designed aircraft on the Canadian register, TC requested additional information and received responses from the responsible foreign Civil Aviation Authorities (CAA). Again, after performing the appropriate review, no concerns related to heater tapes were identified;
- TC states that although there is a safety concern identified by the TSB, it must be pointed out that the factors of type, installation and use have an influence on tape performance and these factors vary among aircraft; and
- In conclusion, after reviewing the use of heater tapes TC has no service history related to safety events that would lead it to necessitate corrective actions similar to the Boeing occurrence.

Board Reassessment of the Responses to A02-04 (24 July 2007)

TC has done a thorough review and has identified no further concerns on Canadian manufactured aircraft or Canadian registered foreign aircraft. TC considers the issue closed. Although there have been no further identified failures that have led to fire and TC's research indicates there are no further concerns in Canada, the residual risk associated with heater ribbon installation failures as identified in Recommendation A02-04 will remain.

As the actions taken by TC will reduce but not substantially reduce or eliminate the safety deficiency the assessment remains at **Satisfactory-in-Part**.

Next TSB Action (03 October 2007)

TSB staff will follow up in writing with TC as to options that could further mitigate the risks associated with the deficiency identified in Recommendation A02-04.

Response to A02-04 (11 March 2008)

In its response of 11 March 2008, TC repeats its response of 7 February 2007. Specifically, TC considers this recommendation CLOSED because:

- After reviewing the use of heater tapes, TC has no service history related to safety events that would lead it to necessitate corrective actions similar to the Boeing occurrence;
- TC has completed the task and has communicated to the Board in response to the recommendation; and
- Appropriate mitigation is in place for the risks identified in the risk assessment process.

TC has decided not to take further action.

Board Reassessment of the Responses to A02-04 (13 August 2008)

TC action taken to date has reduced the risk of fires starting in Boeing 747 and 767 aircraft with open cargo floor areas, where debris and contamination could accumulate and provide a source of fuel for a fire. However, no similar effort has gone into addressing the situation in the closed-in areas of these aircraft or of areas where heater ribbons are located in other aircraft.

Although TC's review of the use of heater tapes has not identified further concerns on Canadian manufactured aircraft or Canadian registered foreign aircraft, the risk of fires starting from heater ribbon failures in closed-in areas still remains.

The actions taken by TC will reduce but not substantially reduce or eliminate the safety deficiency associated with Recommendation A02-04.

Therefore, the assessment remains as **Satisfactory-in-Part**.

Next TSB Action (13 August 2008)

TSB Air Branch staff will continue to monitor occurrences reflecting similar type deficiencies upon which this recommendation was based.

Review of A02-04 Deficiency File Status (23 September 2009)

In its latest position statement regarding the deficiency identified in Recommendation A02-04 TC states that appropriate mitigation is in place to deal with the risk. Additionally, TC considers this recommendation closed and plans no further action.

Therefore, the assessment remains at **Satisfactory-in-Part**.

The Board also concludes that, as no further action is planned by TC, continued reassessment will not likely yield further results.

Next TSB Action (23 September 2009)

TSB Air Branch staff will not actively monitor TC's regulatory activities to reduce the short term risk and eliminate the long term risk of heater ribbon installation failures starting fires.