



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

Date: February 3, 1998

In reply refer to: A-98-6

Honorable Jane F. Garvey  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

On August 20, 1997, the left outboard aileron of a Boeing 747-312 (747), operating as Ansett Airlines flight 826, deflected to the full-down position while the airplane was taxiing for takeoff at Brisbane International Airport, Brisbane, Australia. Postincident examination of the aileron control system was conducted by the Bureau of Air Safety Investigation (BASI), Commonwealth of Australia. The examination revealed that one of the left aileron cables (AA-11) that connect the inboard aileron quadrant to the aileron cable drum was broken. An adjacent cable (AB-13) that connects the aileron cable drum to the outboard aileron quadrant via a turnaround pulley was frayed. The aileron cable drum forward guide pin exhibited signs of wear consistent with abrasion by an aileron control cable. The airplane was manufactured in 1983, production line number 590, serial number (S/N) 23029, and had 11,027 cycles and 62,399 hours since new. The airplane had been operated 1,022 flight hours since both cables were replaced on June 2, 1997.

The 747 aileron control system comprises a cable loop system and hydraulic aileron actuators. Rotation of the cockpit control wheel moves cables routed along the rear spar of the wings to provide control inputs to inboard and outboard aileron power control units (PCUs).

Each wing has two AA and two AB aileron cable assemblies (see Figure 1.), one inboard and one outboard. The inboard AA cable run connects the aileron programmer quadrant to the aileron cable drum, and the inboard AB cable run connects the same quadrant to the inboard aileron PCU quadrant. The outboard AA cable run connects the aileron cable drum to the outboard aileron quadrant, and the outboard AB cable run connects the drum to the same quadrant via a turnaround pulley. The aileron cable drum, which is located at wing station (WS) 776.98, is a four-slotted pulley with a guide pin and is used to provide a complete (closed) cable loop to the inboard aileron even if the outboard segment is lost because of malfunction. The guide pin's purpose is to ensure that all four cables remain in the correct pulley slots at all times.

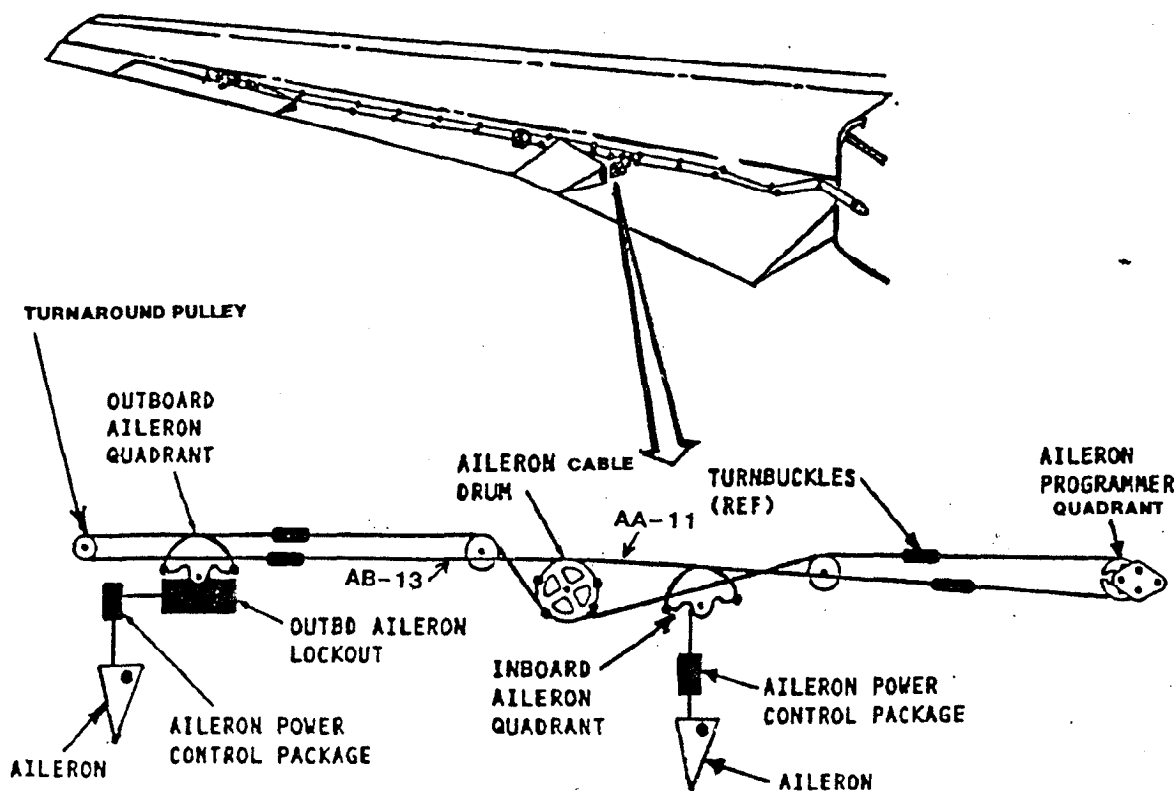


Figure 1. Aileron Wing Control Cable System.

Further investigation by BASI revealed that the two aileron control cable decals<sup>1</sup> on the aileron cable drum's inboard and outboard mounting brackets at WS767 and WS780 were installed incorrectly. The decal for WS767 was fitted at WS780 and vice versa. BASI also found that a similar 747 aircraft, S/N 23028, production line number 584, had the aileron cable replaced because of excessive wear, and the cable was frayed down to one remaining strand. This aircraft also had the two aileron control cable decals on the aileron cable drum's inboard and outboard mounting brackets at WS767 and WS780 fitted incorrectly and interchanged. Because of the decals' transposition, the Safety Board requested a U.S. operator to randomly inspect its 747 airplane aileron control systems for the aileron cable drum decal identification at WS767 and WS780. An inspection on November 24, 1997, of one 747-251, S/N 21707, production line number 378, revealed similar decal transposition on the right WS767 and WS780.

According to Boeing, if these decals are interchanged during installation, the transposition results in incorrect cable routing information at the aileron cable drum and may lead to incorrect cable positioning during installation. A review of the applicable engineering drawings shows that instructions for the decal installations are correct. A check of undelivered 747s at the Boeing factory (production line number 1130 and onward) revealed correct decal installations.

A BASI record review identified eight airplanes from various operators that have had aileron cable installation decals incorrectly installed. Boeing issued Service Letter 747-SL-27-98-

<sup>1</sup> Aileron control system decals are affixed to the airplane in strategic locations to provide illustrative and textual information about the type and routing of cables.

A on May 6, 1991, which addresses the incorrect installation of aileron control cable decals at WS1336.97, and suggests that the operators ensure the cables are properly installed per the applicable drawing. Boeing informed the Safety Board that it is planning to release a service bulletin (SB) to recommend that operators of 747s, produced before production line number 1130, check their airplanes for (1) correct routing of aileron control cables on the aileron cable drum located at WS776.98; and (2) correct installation, and replacement as required, of aileron cable decals at WS767 and WS780.


Boeing's February 8, 1996, In-Service Activities Report 96-02-2711-10 (747) details cable wear occurrences to three other airplanes and attributes the cable wear to misrouting of the cables at the aileron cable drum. Each of the three airplanes had accumulated 40,000-50,000 flight hours and 10,700-11,000 cycles. In each case, the cable appeared to have been chafing on the forward-most guide pin of the aileron cable drum as a result of cable misrouting. The data available regarding these incidents provides no information about whether the installation decals were properly located.

The BASI investigation concluded that the Brisbane incident was caused by misrouting of cables on the aileron cable drum at WS776.98 and that transposition of the aileron control cable decals on the aileron cable drum at WS767 and WS780 has the potential to cause misalignment of the aileron control cables during installation. The Safety Board is concerned that airplanes with mispositioned aileron cable installation decals may be susceptible to aileron cable failures in flight, which could jeopardize flight safety. The Safety Board believes that the Federal Aviation Administration should issue an airworthiness directive to require operators of 747s, produced before production line number 1130, to conduct a one-time inspection of the aileron control system to ensure correct routing of aileron control cables on the aileron cable drum located at WS776.98 and correct installation of aileron cable decals at WS767 and WS780 at the earliest possible inspection interval.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Issue an airworthiness directive to require operators of Boeing 747 airplanes, produced before production line number 1130, to conduct a one-time inspection of the aileron control system to ensure correct routing of the aileron control cables on the aileron cable drum located at wing station (WS)776.98 and correct installation of aileron cable decals at WS767 and WS780 at the earliest possible inspection interval. (A-98-6)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

  
By: Jim Hall  
Chairman