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Log 2255



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: January 24, 1991
In Reply refer to: A-91-9 and -10

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On August 1, 1990, Pan American World Airways flight 100, a Boeing 747-121 (N659PA), en route from New York, New York, to London, England, experienced severe vibration and subsequent loss of a fiberglass honeycomb panel on the left wing during cruise at FL 290 over the North Atlantic Ocean. The panel separated from an area of the wing above the inboard trailing edge flaps between the inboard spoiler and the fuselage. The airplane received minor secondary damage to the flaps and diverted to Shannon, Ireland, where it landed without further incident. There were no injuries to the 338 passengers and 16 crewmembers.

The National Transportation Safety Board is participating in the investigation by the Government of Ireland in accordance with the provisions of Annex 13 to the Convention on International Civil Aviation.

Examination of the airplane revealed that the aft portion of the left wing inboard fixed trailing edge upper panel (P/N 65B11623) had separated and the remaining portion showed evidence of delamination. The foreflaps, midflaps and tie rods of the left inboard trailing edge flaps received secondary damage from the panel as it separated.

This panel was the subject of two Boeing production modifications that reinforced the panel. Production Revision Record (PRR) 75262-2 (SB 747-57-2072, dated June 1, 1972), effective on production line number 193, reinforced the panel lower surface to make it less vulnerable to foreign object impact damage—specifically, separation of landing gear tire tread. PRR 75552 (no retrofit), effective on production line number 205, reinforced the panel trailing edge to improve the resistance to concentrated loads from personnel walking or standing on the panel. The incident airplane, which was production line number 142, did not receive the production reinforcements, and Pan American did not perform the actions recommended by SB 747-57-2072 on any of its airplanes.

The same panel was the subject of Boeing Service Bulletin (SB) 747-57-2155, dated July 15, 1977, which was issued after an operator reported finding trapped moisture and delamination of the panel. Subsequent inspections of several aircraft revealed that, in some cases, potting compound did not completely surround the fasteners of the panel, thereby providing an entry for moisture. The service bulletin called for a visual inspection of fastener holes and a repotting of those lacking sufficient potting compound. The service bulletin applied to Boeing 747 airplanes with line numbers 1 to 336, exclusive of SP models, which have a different trailing edge flap configuration.

Boeing has indicated that there have been 105 reports of damage to panel 65B11623 on B-747 airplanes: 56 involving inflight separations of the panel and 49 involving cracks and/or delaminations. Many of these events have led to unscheduled landings. Approximately one-half of the 105 damage reports were received after release of SB 747-57-2155. The Safety Board is unaware of the number of operators that have accomplished the recommended SB action and is unable to evaluate the effectiveness of the SB. Pan American officials have advised Safety Board investigators that they have not adopted SB 747-57-2155 on any of the airline's B-747 airplanes.

Panel 65B11623 was redesigned in 1978 and designated P/N 65B22845, effective with Boeing 747 line position 337. The redesign added extra structural plies, modified a support rib, relocated potting compound, revised rigging instructions, and installed fasteners with wet sealant. However, those modifications to the panel did not eliminate damage reports. There have been 21 reports of damage on the redesigned panel: 4 involving inflight separations and 17 involving cracks/delaminations.

Although the investigation of the August 1 incident is continuing and the reason for the separation has not yet been determined, the Safety Board is concerned that the failure and separation of the wing panel might have been prevented if Pan American had accomplished the inspections recommended by the noncompulsory SB 747-57-2155. The Safety Board also believes that the inboard trailing edge flaps may have contributed to the damage to the panels because these flaps, in their retracted position, force the panels upward. This upward load on the panel provides a tighter fit between the flaps and the panel and ensures smoother airflow across their surfaces. However, the Safety Board is concerned that the upward deflection could result in excessive stress on the panel.

The upper surface of the inboard midflap is the portion that actually contacts the panel but only along the panel's inboard trailing edge. The outboard end should clear the midflap. Boeing specifications require that this clearance be between 0.02 inch and 0.12 inch. Adjustment of the panel is accomplished by changing the lengths of the diagonal tie rods at three adjustable ribs. This procedure applies to both the left and right wing panels. Boeing has stated that a proper adjustment would result in an upward deflection of the panel of approximately 0.5 inch at the inboard trailing edge.

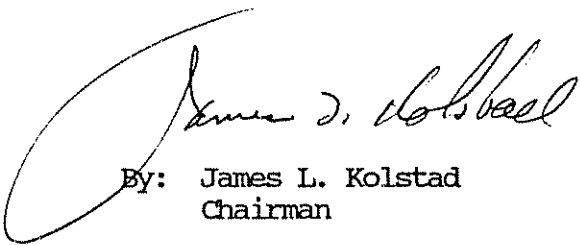
Although the number of incidents involving the subject panels has decreased following introduction of production changes, the Safety Board is concerned that these actions, and those in SB-747-57-2072 and SB-747-57-2155, may not prevent other similar occurrences. The Safety Board is also concerned that inflight panel separations may result in a more serious incident. The Safety Board believes that further study should be conducted by Boeing to determine the reason(s) for the cracking, delamination, or inflight separation of the panels, and specifically whether the damage is a direct result of the upward preloading by the retracted flaps, and that appropriate corrective actions should be taken to prevent future separations.

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

Determine the cause of cracking, delamination, and inflight separations of the wing inboard fixed trailing edge upper panels on Boeing 747 airplanes (P/N 65B11623 or P/N 65B22845) and require, if necessary, the replacement or rerigging of the panels on all applicable Boeing 747 airplanes. (Class II, Priority Action) (A-91-9)

As an interim measure, require that the inspections recommended in Boeing Service Bulletin 747-57-2155 be made mandatory through an Airworthiness Directive. (Class II, Priority Action) (A-91-10)

Chairman KOLSTAD, Vice Chairman COUGHLIN, and Members BURNETT, LAUBER, and HART concurred in these recommendations.


By: James L. Kolstad
Chairman