

AIRCRAFT ACCIDENT REPORT 1/95

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INCIDENT TO BOEING 747-436, G-BNLY AT LONDON HEATHROW AIRPORT ON 7 OCTOBER 1993

SUMMARY

The flight from London Heathrow to Bangkok took off two minutes behind another heavy Boeing 747-400. As the aircraft climbed through about 100 feet agl with the landing gear retraction in progress, the aircraft suddenly pitched down from 14° nose-up to 8° nose-up due to uncommanded full down travel of the right elevators. The commander, who was the handling pilot, was able to maintain a reduced rate of climb using almost full aft control column until, a few seconds later, when the flying controls again responded correctly and a normal rate of climb was resumed. The flight to and onwards from Bangkok was continued without further incident.

The investigation identified the following causal factors:

- (i) The secondary slide of the servo valve of the inboard elevator Power Control Unit was capable of overtravelling to the internal retract stop; with the primary slide moved to the limit imposed by the extend linkage stop, the four chambers of the actuator were all connected to both hydraulic supply and return, the servo valve was in full cross flow resulting in uncommanded full down travel of the right elevators.
- (ii) A change to the hydraulic pipework associated with the right inboard elevator Power Control Unit was implemented on the Boeing 747-400 series aircraft without appreciation of the impact that this could have on the performance of the unit and consequently on the performance of the aircraft elevator system, in that it could exploit the vulnerability of the servo valve identified in (i) above.

Three Safety Recommendations were made during the course of the investigation. It was recommended that:

The Federal Aviation Administration should issue an Airworthiness Directive requiring all Boeing 747-400 aircraft to be modified in accordance with the Boeing proposal to swap the system No 3 supply and return connections with system No 4 supply and return connections at the inboard right elevator power control unit. [Recommendation No 94-55]

The Federal Aviation Administration should issue an Airworthiness Directive requiring modification of all Boeing 747-400, Parker Hannifin, inboard elevator power control unit servo valves to:

Reduce the secondary valve stroke extremes

Reduce the flow bucket exit ramp diameter

[Recommendation No 94-56]

The National Transportation Safety Board should, based on the findings of this investigation, consider re-issuing safety recommendation A-92-121 to verify that its full intent has been met.

[Recommendation No 94-57]

[A-92-121 The National Transportation Safety Board recommended that the Federal Aviation Administration:

Conduct a design review of servo valves manufactured by Parker Hannifin having a design similar to the B-737 power control unit servo valve that control essential flight control hydraulic power control units on transport-category airplanes certified by the Federal Aviation Administration to determine that the design is not susceptible to inducing flight control malfunctions or reversals due to overtravel of the servo slides. (Class II, Priority Action)(A-92-121)]