SP-20

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

Log 1829

ISSUED: October 25, 1985

Forwarded to:

Honorable Donald D. Engen
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-85-91 and -92

The National Transportation Safety Board is participating in the investigation of an in-flight fire which occurred aboard a Lockheed L-1011 operated by Royal Jordanian Airlines, on October 18, 1985. The investigation into the cause of the fire is continuing in Singapore, where the airplane landed; however, preliminary findings at this point suggest the need for urgent action to preclude similar fires in the future. Preliminary information from the flight crew and the cockpit voice recorder revealed that the flight was descending through about 20,000 feet for landing when an apparent electrical fault occurred followed shortly thereafter by a J-Area overheat warning in the cockpit. (The J-Area includes the left-side under-floor area outboard of the C-3 cargo compartment and immediately aft of the aft pressure bulkhead.) The crew then received a No. 2 engine fire warning, shut down the engine, and actuated the fire extinguisher. The warning light went out, but the cabin pressure was lost and smoke reportedly filled the cockpit and cabin. The airplane was landed successfully with no reported injuries.

Preliminary examination of the airplane has revealed that the fire originated in the left aft under-floor area of the fuselage aft of the C-3 cargo compartment and forward of the rear pressure bulkhead. A high-pressure bleed air duct, hydraulic lines and electrical cables are routed through this area. Severe fire damage is evident in the area forward of the rear pressure bulkhead and aft of compartment C-3. A hole about 8 inches in diameter was burned through the pressure bulkhead, the A and B hydraulic systems were depleted, electrical wires and cables were damaged, and the captain's stabilizer control linkage was burned through. About 3 feet of the bleed air duct was missing in the area immediately forward of the rear pressure bulkhead.

The examination also revealed that the No. 2 engine generator feeder cable, which is routed adjacent to the bleed air duct had evidence of fraying and possible arcing. According to the manufacturer, the cable is supposed to be routed about 1 to 1 1/2 inches away from the duct. Although the duct material

adjacent to the cable is missing, it appears that the clearance between the cable and the duct, either as originally installed or as the result of maintenance activities, may have been less than specified, and that actual contact and rubbing had occurred.

The high-pressure bleed air duct material is thin wall titanium. Titanium will "burn" if an ignition source of above 3,100 degrees Farenheit is present, and if high volumes of oxygen-enriched air are provided. The preliminary evidence suggests strongly that an electrical arc occurred, which burned a hole in the duct, and that the high pressure bleed air provided the oxygen to propagate a titanium fire. Other materials in the area may have contributed to the fire fuel sources to propagate the fire and to cause the extensive damage.

The Safety Board was advised by Lockheed personnel that a similar titanium bleed air duct failure had occurred several years ago in which an electrical wire arced to the duct and a hole was burned in the duct. This phenomenon reportedly was duplicated in a laboratory test by Lockheed.

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

> Issue a telegraphic Airworthiness Directive to require an immediate inspection of all Lockheed L-1011 airplanes to confirm the proper installation of electrical wires and cables adjacent to the titanium bleed air ducts. (Class I, Urgent Action) (A-85-91)
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> Immediately notify all foreign certificating authorities with responsibility concerning Lockheed L-1011 airplanes about the circumstances of the titanium fire occurrence at Singapore on October 18, 1985, and the need to consider an immediate inspection of the airplanes for proper installation of electrical wires and cable adjacent to titanium bleed air ducts. (Class I, Urgent Action) (A-85-92)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.

By: Jim Burnett
Chairman