SP-20
Rec 1794

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: May 14, 1985

Forwarded to:

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

SAFETY RECOMMENDATION(S)

A-85-5 and-6

On June 2, 1984, an inflight fire erupted in the No. 4 engine, a Pratt & Whitney JT9D-7J(CN), of an Air-India Boeing 747-200, (Indian Civil Aviation Registration VT-EDU), activating visual and aural engine fire warning indications in the cockpit. The fire warning indications occurred about 4 minutes after the flight had taken off from Bangkok, Thailand. The flightcrew secured the engine and discharged both of the fire extinguishing containers. The right container was discharged 12 seconds after the aural and visual fire warning indications began. The fire warning indications continued and the left container was discharged 45 seconds after the initial indications. The fire warning indications continued; the existence of a fire was visually confirmed from the passenger cabin.

As a result of the in-flight fire, the flightcrew landed the airplane (which was in excess of its authorized landing weight) at Bangkok Airport about 30 minutes after the initial fire warning. After landing, the Bangkok Airport Fire Department extinguished the engine fire with foam. The four leftside slides were used to evacuate the 293 passengers; seven minor passenger injuries, five minor crewmember injuries, and one serious passenger injury reportedly occurred during the evacuation.

The National Transportation Safety Board participated in the accident investigation, which was conducted by the Director General of Civil Aviation, Government of India Civil Aviation Department. The investigation revealed that the airplane's airworthiness was degraded as a result of the in-flight fire in the No. 4 engine. The fire destroyed the constant speed drive housing, the angle gearbox housing, and nearly all of the main gearbox housing. It also destroyed the pressure ratio bleed control valve, the air-to-fuel converter valve, the linear directional control valve, the bleed override valve, the pressurizing and drain valve, the starter and starter valve, and the fuel signal manifold assembly. The fire apparently propagated from the main gearbox area and along the nacelle raceway (radiation shield), causing a chimney effect that burned a 12- inch by 24-inch elongated hole in the front upper right side of the right-side cowl.

The damage was most pronounced in the lower left area of the engine, aft of the intermediate case and extending to the rear of the constant speed drive and primarily was confined to the area between the 4 and the 8 o'clock positions, as viewed from the rear of the engine. The most intensely damaged area was in the vicinity of the constant speed drive oil cooler.

The investigation revealed that the engine fire probably resulted from a fuel leak in one of the tube fittings on the pressure ratio bleed control valve, the air-to-fuel converter valve, the pressurizing and drain valve, or the fuel signal manifold assembly. Since all of these accessories were destroyed in the fire, their direct involvement with respect to the fuel leak could not be established. The fire was fed by residual combustibles including fuel that may have leaked before the fire began, residual fuel trapped between the engine and the spar-mounted fuel shutoff valve, engine and constant speed drive (CSD) lubricating oil, hydraulic fluid, and the magnesium housings of the CSD, the main gearbox, and angle gearbox. The ignition source could not be identified positively.

Another major in-flight engine fire associated with a fuel leak occurred in a JT9D series engine of a South African Airways Boeing 747 on October 17, 1980, while the airplane was departing Ilha do Sol, Cape Verde Islands. As in the Air-India accident, the in-flight fire could not be extinguished by the flightcrew, and had to be extinguished by ground personnel after the airplane was landed about 37 minutes later. A damage pattern similar to that described above was observed on the South African Airways Boeing 747, except the main gearbox housing was comparatively intact although burned in one area.

The Safety Board is concerned that these two engine fires may not have been detected soon enough by the detection system to permit effective use of the fire extinguishing system or, alternatively, that the fire extinguishing system is not adequate to extinguish a fire in this area of the engine. The Safety Board notes that the area where both of the fires erupted is remote from the lower fire warning dual element sensor (fire detector loop) installed at the 5 to 6 o'clock positions on the engine. In addition, the loop is shielded from the affected area by the generator and its cooling air inlet duct. The Safety Board believes that the location of the lower fire detector loop for the JT9D installation in the Boeing 747 may not be optimal to ensure immediate detection of a fire in this area of the engine.

The Safety Board understands that the engine manufacturer presently is reviewing the JT9D engine manual to ensure that adequate and clearly understandable procedures are specified to identify and correct fuel leaks. The Safety Board believes that the Federal Aviation Administration should monitor this review to assure that action is taken, if needed, to minimize the possiblity that a fuel leak in the engine will not be detected or, if detected, will not be corrected properly before the airplane is put into service.

Since engine fires of this type constitute a potentially serious safety hazard to the airplane and its occupants, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Review the installation of the engine fire detection and extinguishing systems used on the Boeing 747 series airplanes equipped with Pratt & Whitney JT9D series engines to verify that the components used to detect and extinguish an in-flight engine fire are configured and located to provide fully effective detection and extinguishing capabilities for the lower left area of the engine; if adequate capabilities do not exist, take action needed to require the necessary capabilities. (Class III, Longer-Term Action) (A-85-5)

Verify that the engine manufacturer's manual for the JT9D series engines specifies adequate and clearly understandable procedures to identify and correct fuel leaks in the engines. (Class II, Priority Action) (A-85-6)

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

By: Jim Burnett
Chairman