log # 2453

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: February 14, 1994

In reply refer to: A-94-14 and -15

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On June 18, 1993, the left engine and nacelle on an American Airlines McDonnell Douglas MD-82, N467AA, powered by two Pratt & Whitney JT8D-217A engines, were substantially damaged by fire during departure from the Savannah, Georgia, airport. As the airplane climbed through 2,000 feet, the flightcrew observed the visual and aural warnings for a left engine fire. The crew retarded the associated throttle to flight idle, and the fire warning became intermittent. Soon afterward, the crew secured the left engine and discharged fire extinguishing agent to the engine. After the engine was shut down, the fire warning ceased. The flightcrew declared an emergency and returned to Savannah, where the airplane landed without further incident. Fire trucks responded to the emergency and assisted with the evacuation. No one was injured.

The damaged engine and nacelle were removed from the airplane and examined at the American Airlines maintenance facility in Tulsa, Oklahoma. Engine disassembly disclosed that a fuel leak in the No. 7 fuel nozzle burned a hole in the diffuser case, allowing hot compressor discharge gases to escape from the engine. The hot gases burned a fan duct inner liner, and entered the fiberglass fairing surrounding the oil pressure line, scavenge line, and breather line for the No. 4/5 bearing compartment. The hot gases inside the fiberglass fairing melted the aluminum B-nuts on the stainless steel oil lines at the outer fan duct. Leaking oil from the B-nut was then ignited by the hot gases. The ensuing fire burned the fairing and the fan duct, causing heavy damage to the engine and nacelle.

Close examination of the fuel nozzle revealed that the nozzle support mount flange, the nozzle support heat shield, and the nozzle head swirl vanes had partially

melted. Leak and flow checks confirmed leakage across the gasket at the nozzle support-to-head interface and the flow pattern was found marginally unacceptable.

On July 3, 1993, the left engine on an Alitalia McDonnell Douglas MD-82 sustained similar fire damage during departure from Rome, Italy. The flightcrew secured the engine and returned to Rome without further damage to the airplane. This in-flight engine fire was also directly attributed to leakage of the No. 7 fuel nozzle, which subsequently burned through the diffuser case, ignited the engine oil, and caused engine and nacelle damage. During the teardown of the Alitalia engine, it was discovered that the fuel leakage and subsequent damage were nearly identical to that of the above-cited American Airlines engine.

The JT8D-217A engine has a full length annular fan duct where the primary and secondary air are discharged through a common exhaust nozzle. Fan duct liners, attached to the engine cases, are added to form a smooth surface for unobstructed fan air flow. Beneath the fan duct liners is a fuel manifold that is routed circumferentially around the diffuser case and is supplied by fuel lines that run radially outward at several locations around the fan duct. The fuel manifold, supply lines, and end fittings are fabricated from stainless steel. Adjacent to the fuel manifold are the oil pressure line, scavenge line, and breather line for the No. 4/5 bearing compartment. These oil lines are also routed circumferentially around the diffuser case, then run radially outward across the fan duct in one location. These oil lines pass through the fan duct in line with the No. 7 fuel nozzle and are fitted with a fiberglass fairing. As the oil lines reach the outer diameter of the duct, they are secured to stainless steel bulkhead fittings. Two of the three stainless steel lines, the oil pressure and scavenge lines, are fitted with aluminum B-nuts where they are attached to the fan duct bulkhead fittings. The other end of the three stainless steel lines are fitted with stainless steel B-nuts where they attach to the diffuser case.

According to Pratt & Whitney Aircraft, random leakage from the engine's nine fuel nozzles is a continuing concern. Although Pratt & Whitney has issued detailed refurbishment and assembly procedures, reports of fuel nozzle leakage events are increasing. As of March 1993, twelve incidents of diffuser case burn-through have been reported. All of these incidents have reportedly occurred on refurbished nozzles. While the nine nozzles are identical, damage external to the engine has only occurred when the No. 7 fuel nozzle leaks and burns through the diffuser case, in line with the No. 4/5 bearing compartment oil lines. Fuel nozzle leakage and diffuser case burn-throughs in other locations have not caused damage external to the engine.

The Safety Board acknowledges that Pratt & Whitney is working to solve the refurbished fuel nozzle leakage problem and believes that continuing action is necessary. Further, the FAA and Pratt & Whitney should address the inadequate heat resistance of the aluminum B-nuts on the No. 4/5 oil pressure and scavenge lines, to reduce the potential for oil to be introduced to the fire should a diffuser case burn-

through occur at the No. 7 fuel nozzle. The Safety Board believes this action will minimize the potential for future JT8D-200 series engine fires, emergency in-flight engine shutdowns, and accidents.

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

> Issue an airworthiness directive requiring that Pratt & Whitney Aircraft JT8D-200 series engines have adequate heat resistant B-nuts on the No. 4/5 oil pressure and scavenge lines inside the fan duct fairing so a burn-through in the diffuser case at the No. 7 fuel nozzle does not compromise the integrity of the engine oil system. (Class II, Priority Action) (A-94-14)
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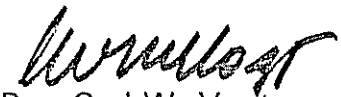
> Study the refurbishment and assembly practices of the JT8D-200 series engine fuel nozzle, determine why the nozzle is susceptible to leakage, and implement corrective actions as appropriate. (Class III, Longer Term Action) (A-94-15)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT and HALL concurred in these recommendations.



By: Carl W. Vogt
Chairman