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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 28, 1987
In reply refer to: A-87-43
through -45

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

On March 23, 1987, the flight crew of an American Airlines, Inc., McDonnell Douglas MD-82 airplane operating between Chicago, Illinois, and Minneapolis, Minnesota, as flight 241 experienced engine surge and loss of power on the No. 2 engine while descending to land at the Minneapolis airport. The engine, a Pratt & Whitney (PWA) model JT8D-217A, was shutdown, and the airplane was landed without further incident.

The postaccident inspection of the airplane disclosed a 1 1/2- by 15-inch tear in the airplane cowling of the No. 2 engine at approximately the 3 o'clock position and bulging of the cowling outer skin at the 7 o'clock position. Both damage areas were located in the plane of the engine's low pressure turbine (LPT). Further examination revealed that the No. 2 engine experienced an uncontained failure of the LPT when all 44 anti-rotation pins used to circumferentially lock in position the LPT third-stage vane clusters to the outer circumference of the turbine case fractured. The LPT third-stage vane clusters were then free to rotate or spin in position when driven by forces imparted by the flowing combustion gases. While spinning, the third-stage vane clusters machined a 360° groove completely through the outer circumference of the turbine case, which liberated third-stage vane clusters with sufficient energy to fracture the outer fan case and damage the skin and structure of the airplane cowling. During liberation, some third-stage vane clusters broke into pieces and were ejected through the exhaust pipe of the engine while others were recovered from within the engine cowling. No other airplane damage was reported.

In December 1986, American Airlines experienced a similar incident on another JT8D-217A engine when fractures were discovered on all 44 third-stage vane cluster anti-rotation pins during repairs to the engine. However, the third-stage vane clusters had not rotated sufficiently to machine metal from the inner surface of the outer turbine case. In this failure, none of the 22 third-stage vane clusters were liberated.

In addition, Pacific Southwest Airlines and Muse Airlines each experienced similar types of failures of the LPT third-stage vane anti-rotation pins on March 29, 1985, and December 30, 1986, respectively. In each incident, the outer circumference of the turbine case was sufficiently machined so that the initial pin failures resulted in an uncontained failure when LPT third-stage vane clusters were liberated.

Because of very similar problems with the PWA JT9D model engine LPT vane cluster lock pins, the Federal Aviation Administration (FAA) issued Airworthiness Directive (AD) No. 86-09-01 in late 1986. The AD required replacement of anti-rotation pins in the LPT vane clusters of certain PWA JT9D series engines with stronger pins to prevent LPT case penetrations as a result of anti-rotation pin failures. The basic design of using axial pins to circumferentially lock the LPT vane clusters is very similar in the JT8D-200 series and the JT9D engine models. Therefore, as expected, the anti-rotation pin failure problems of each engine model is closely related, as demonstrated by the examination of pin failures from both JT8D and JT9D model engines.

Preliminary information indicates that approximately 26 (12 Unites States and 14 foreign) airlines worldwide are operating approximately 330 MD-80 series airplanes, many of which are potential candidates of this type of engine failure. PWA has stated that approximately 934 JT8D-200 series engines have been manufactured to date. However, engineering changes have been incorporated during production of some of these engines; in others, operators have modified the engine by incorporating provisions of a comparable JT8D service bulletin. Both procedures are intended to reduce the risk of anti-rotation pin failure.

Because third-stage vane cluster anti-rotation pin failure cannot be predicted, because no method other than on-wing radioisotope inspection or engine disassembly currently exists to determine the extent of anti-rotation pin fracture, and because the potential for an uncontained engine failure and possible airplane damage exists, the Safety Board believes that the FAA should take immediate and appropriate action, similar to that taken for the JT9D engine, to correct the problem.

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

> Conduct a directed safety investigation of the Pratt & Whitney JT8D-209, -217, -217A, -217C and -219 series engines to establish an appropriate inspection program that will verify the continued integrity of the low pressure turbine vane cluster retention for engines

that have not had production or field modifications and for engines that have extended operating time since the last shop visit of the low pressure turbine module. (Class I, Urgent Action) (A-87-43)

Require all operators of JT8D-200 series engines that have not been modified to reduce the risk of failure of the low pressure turbine vane cluster anti-rotation pins to implement a Federal Aviation Administration-approved inspection and replacement program that will provide early detection of anti-rotation pin fracture and that will specify a criteria for removal and replacement of broken pins and the replacement of existing pins with improved pins within a specified time but not later than the next shop visit for the low pressure turbine module. (Class I, Urgent Action) (A-87-44)

Notify appropriate foreign civil aviation authorities and foreign operators of airplanes equipped with Pratt & Whitney JT8D-209, -217, -217A, -217C, and -219 series engines of the failures associated with the low pressure turbine vane assembly anti-rotation pins and of the actions taken to minimize the risk and to prevent the failures. (Class I, Urgent Action) (A-87-45)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER and NALL, Members, concurred in these recommendations.

By: Jim Burnett
Chairman