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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Forwarded to:

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

SAFETY RECOMMENDATION(S)

A-85-34

On January 19, 1985, a Boeing 747 airplane, operated by UTA (a French airline), experienced a failure of its No. 4 General Electric CF6-50 engine approximately 17 minutes after takeoff from Brassaville, Congo. Some of the fragments from the failed engine punctured a wing fuel tank. The airplane, however, was able to return to and land safely at Kinshasa, Zaire, uneventfully. The French Bureau Enquetes-Accidents is conducting the investigation.

Initial examination of the failed engine disclosed that the stage 1 low-pressure turbine disk had ruptured and separated from the remainder of the engine; only a few small pieces of the ruptured disk were recovered. Other damage to the engine included multiple separations and extensive deformation of the aft end of the left-side cooling air tube which supplies cooling air from the seventh stage of the compressor to the stage 1 low-pressure turbine disk cavity. This seventh stage airflow represents about 80 percent of the cooling of the stage 1 low-pressure turbine disk. Some pieces of the tube were missing and were not recovered.

The recovered pieces of the cooling air tube and the several small fragments of the stage 1 low-pressure turbine disk, along with other parts of the engine, were examined at the General Electric plant in Evendale, Ohio, by a metallurgist from the Safety Board. This examination revealed a significant amount of fatigue cracking in the cooling air tube.

An examination of the records at the General Electric plant revealed that there have been 72 reported failures of the left-side cooling air tube since 1972. Failure of this tube will result in the stage 1, and possibly the stage 2, turbine disks operating above their design temperatures. While none of the previous 72 tube failures resulted in a disk rupture, 19 stage 1 disks in engines which experienced a left-side cooling air tube failure have been removed and examined. Four of these disks were found to have bore growth which was beyond the acceptable serviceable limit, most likely as a result of overheating.

In 1975, General Electric issued Service Bulletin 75-46, applicable to CF6-50 and CF6-45 engines, which, in part, recommends the installation of a sleeve and support clamp on the left-side cooling air tube to reduce vibratory stress in the area where failures have been experienced. Only one air tube with a sleeve and support clamp has failed; in that case, there was evidence that the added clamp had been misaligned during installation. Currently, General Electric records indicate that 53 percent of its worldwide fleet of over 1,900 engines and 25 percent of the 255 engines operated by U.S. carriers have been modified to incorporate the sleeve and support clamp described in the service bulletin.

Although the cause of the disk rupture of the UTA airplane engine has not been determined conclusively, the Safety Board is concerned that fatigue cracking and deformation failure of the left-side cooling air tube may result in overheating and subsequent rupture of the stage 1 low-pressure turbine disk. The Safety Board believes also that modification of the left-side cooling air tube in accordance with General Electric Service Bulletin 75-46 might eliminate the initiation of the failure sequence leading to the rupture of the stage 1 low-pressure turbine disk.

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

Issue an Airworthiness Directive (AD) to require that operators of General Electric CF6-50 and CF6-45 engines, at the next scheduled maintenance interval:

(1) inspect the left-side cooling air tube using an FAA-approved method capable of detecting incipient fatigue cracks and replace defective tubes, and

(2) install a sleeve and support clamp on the engine left-side cooling air tube in accordance with General Electric Service Bulletin 75-46. (Class II, Priority Action) (A-85-34)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in this recommendation.

By: Jim Burnett
Chairman