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National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: August 14, 1990
In reply refer to: A-90-115 and A-90-116

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

The National Transportation Safety Board is concerned about the potential for damage to airplanes resulting from ice ingestion into engines and impact damage to the airframe. The Safety Board notes a history of ice-related incidents resulting from the formation and subsequent release of ice around or near ground service panels.

On April 30, 1974, the No. 3 engine separated from a National Airlines Boeing 727 while in flight 60 miles east of El Paso, Texas. A Safety Board investigation determined the probable cause of the separation to be a first-stage fan blade failure, which caused a sudden stoppage of the engine. The fan blade failure was probably caused by the ingestion of lavatory ice that had accumulated around a ground service panel near the forward lavatory drain outlet.

On April 16, 1985, an American Airlines Boeing 727, experienced an in-flight separation of the No. 3 engine while cruising over Las Cruces, New Mexico. The probable cause of the separation of the engine was again found to be the ingestion of lavatory ice and subsequent sudden stoppage resulting in the breaking away of the engine.

On January 16, 1989, a Boeing 737-300, operating as Continental Airlines flight 137, was diverted to Des Moines, Iowa, after an in-flight engine shutdown. The flight ended without injury to passengers or crew. Examination of the CFM 56-3 engine, manufactured by CFM International, revealed that a first-stage fan blade failed, which caused the engine to vibrate. A metallurgical examination indicated that the blade failed because of "soft-body" impact damage. Results from the investigation indicate that the engine ingested frozen blue lavatory fluid ("blue ice") that had been leaking from a lavatory service panel forward of the engine inlet.

The engine manufacturer has documented at least 10 prior occurrences of ice ingestion into CFM International or General Electric engines. These occurrences began in November 1979 and involved Boeing 737-300, McDonnell Douglas DC-10, and Airbus A300 airplanes. Most of the occurrences were recorded at cruise condition and at altitudes from flight level 290 to flight level 350.

On January 4, 1990, a Northwest Airlines Boeing 727 on a scheduled passenger flight from Miami, Florida, to Minneapolis-St. Paul, Minnesota, experienced a separation of the No. 3 engine from the airplane while cruising at flight level 350. The flight crew declared an emergency and diverted to Tampa, Florida where the airplane landed safely. There were no injuries to the 6 crewmembers or 139 passengers aboard the flight.

The No. 3 engine and cowling were located near Madison, Florida, on January 5, 1990. Examination of the engine at Atlanta, Georgia, revealed that the first stage low-pressure compressor exhibited "soft-body" impact damage. Examination of the airplane's records indicate that between November 24, 1989, and the date of the incident there were 23 writeups referring to the forward lavatory leaking or requiring service between flights. The Northwest Airlines maintenance trend analysis program monitors the writeups and had been set to flag leaking lavatory writeups when they occurred five times in 5 days. That threshold was never attained prior to the accident. Northwest has notified the Safety Board that single threshold for flagging leaking lavatories has been reset to flag any single writeup.

On February 12, 1990, a Boeing 727 registered to Eastern Airlines experienced an in-flight shutdown of the No. 3 engine. The flight was operating in regularly scheduled passenger service from Atlanta, Georgia, to Sarasota, Florida. The airplane sustained minor damage and there were no injuries to the passengers or crew. The flightcrew did not declare an emergency and continued to its destination after noting a loud noise and vibration prior to the engine shutdown. The engine was removed for further examination. Preliminary indications are that the number 1 and 2 low-pressure compressors were extensively damaged. The forward lavatory service door showed blue streaking aft of the door. Maintenance records indicate that on December 24, 1989, and on January 15, 1990, the forward lavatory had been leaking. The airplane was serviced and returned to flight status on both occasions.

Following the Safety Board's investigation of the 1974 incident involving the National Airlines Boeing 727 that experienced in-flight engine separation because of lavatory ice ingestion, the Board issued the following safety recommendation to the Federal Aviation Administration (FAA):

A-75-28

Issue an airworthiness directive to require that all external ground service fluid drains on Boeing 727 series airplanes be modified to incorporate a more positive method of sealing to prevent overboard leakage in flight of fluid subject to freezing in the flight environment.

In response to the recommendation, the FAA issued two general notices (GENOT 8320.168 and GENOT 8320.183) and an advance notice of proposed rulemaking (ANPRM 76-9). The GENOTs requested that maintenance inspectors review their operator maintenance programs and inspection procedures and provide detailed responses to questions in an attempt to validate the need for an airworthiness directive (AD). The ANPRM 76-9 was withdrawn on August 8, 1979; at that time, the FAA believed that increased vigilance of maintenance personnel and inspectors precluded the need for regulatory action.

In response to the 1985 in-flight engine separation, the FAA issued an AD (ammendment 39-5250) applicable to the Boeing 727 that became effective on 14 April 1986. This AD required inspection and leak checking, under pressure, for the various types of toilet tanks installed in the airplane. Terminating action involved the installation of a hinged drain cap with an integral flapper valve-type inner seal.

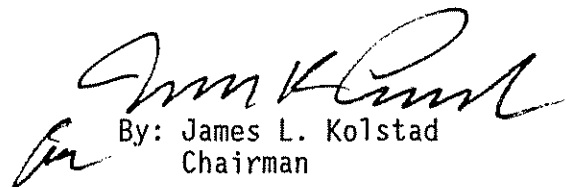
In response to the January 16, 1989, engine shutdown and subsequent investigation by the Safety Board, the FAA issued an AD (amendment 39-6233) that requires repetitive checks for forward lavatory service panel leaks on the Boeing 737-300 and -400 series airplanes. The Safety Board believes that this AD adequately addresses the subject airplanes; however, it does not address the potential icing problems found on other airplanes.

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

Conduct a directed safety investigation of all transport-category turbine-powered airplanes to evaluate the potential for (1) ice ingestion into engines, and (2) airframe damage from ice because of leaking ground service panels. (Class II, Priority Action) (A-90-115)

Following completion of the directed safety investigation described in Safety Recommendation A-90-115, take appropriate corrective action to preclude in-flight engine or airframe damage from impingement or ingestion of ice. (Class II, Priority Action) (A-90-116).

KOLSTAD, Chairman, COUGHLIN, Vice Chairman, and LAUBER and BURNETT, Members, concurred in these recommendations.


By: James L. Kolstad
Chairman