



National Transportation Safety Board Aviation Accident Final Report

Location:	MIAMI, FL	Accident Number:	MIA99FA005
Date & Time:	10/07/1998, 0709 EDT	Registration:	N66734
Aircraft:	Boeing 727-224	Aircraft Damage:	Substantial
Defining Event:		Injuries:	81 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

During the initial part of the takeoff, prior to the engines reaching takeoff power, the No. 2 engine had an uncontained failure of the 8th stage HPC disk. The takeoff was aborted, the passengers were bussed to the terminal, and the aircraft was towed to the gate. Metallurgical examination of the 8th stage HPC disk showed that a significant amount of cadmium was present on steel base metal in the area of the fracture surfaces and the surface had an inadequate nickel coating. The disk had accumulated 359 flight hours since overhaul. The disk had been nickel-cadmium plated in March 1996 and was stored until February 1998, when it was installed in the accident engine during repair. Other HPC disk installed in the accident engine, which had been nickel-cadmium plated by the same company as the 8th stage HPC disk, were also found to have inadequate nickel coating. During nickel-cadmium plating the nickel acts as a barrier coating between the cadmium and the steel part to prevent cadmium from contacting the steel part, which can cause cadmium embrittlement.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The catastrophic failure of the 8th stage high pressure compressor disk from cadmium embrittlement as a result of improper adherence to the prescribed plating procedures and requirements by the company that last plated the disk. Contributing to the accident was the failure of the engine repair company to provide adequate surveillance and oversight of the plating company, the engine repair companies use of an unauthorized repair vendor, the plating company, and the engine repair companies failure to inform the aircraft operator that they had used the plating company which was not on the aircraft operators vendor list. Also contributing to the accident was the aircraft operators failure to audit the engine repair company to the level of detail that they would have discovered the engine repair company was using an unauthorized repair vendor.

Findings

Occurrence #1: LOSS OF ENGINE POWER(PARTIAL) - MECH FAILURE/MALF
Phase of Operation: TAKEOFF - ROLL/RUN

Findings

1. (C) MAINTENANCE,OVERHAUL,MAJOR - IMPROPER - OTHER MAINTENANCE PERSONNEL
2. (C) IMPROPER USE OF PROCEDURE - OTHER MAINTENANCE PERSONNEL
3. (C) INADEQUATE SURVEILLANCE OF OPERATION - OTHER INSTITUTION
4. COMPRESSOR ASSEMBLY,ROTOR DISC - BRITTLE FRACTURE
5. COMPRESSOR ASSEMBLY,ROTOR DISC - FAILURE,TOTAL

Factual Information

HISTORY OF THE FLIGHT

On October 7, 1998, about 0709 eastern daylight time, a Boeing 727-224, N66734, registered to First Security Bank NA, and operated by Continental Airlines, Inc., as flight 1521, Title 14 CFR Part 121 scheduled domestic passenger service from Miami, Florida, to Houston, Texas, had an uncontained failure of the No. 2 engine during takeoff roll at Miami. Visual meteorological conditions prevailed at the time and an instrument flight rules flight plan was filed. The aircraft received substantial damage. The airline transport-rated captain, first officer, flight engineer, 3 flight attendants, and 75 passengers were not injured. The flight was originating at the time of the accident.

The captain stated he was flying the aircraft and advanced the engine power levers for takeoff. The engines spooled up, and just prior to maximum takeoff power being set, he heard a loud bang noise. He retarded the power levers and aborted the takeoff. He turned off the runway at the next taxiway. The No. 2 engine was identified as having failed and the engine shutdown procedure was accomplished and the fire handle was pulled. The fire bottles were then fired. He made contact with the fire department personnel who arrived shortly after the aborted takeoff and they reported there was no fire. A portable airstair was brought to the aircraft and the crew and passengers deplaned and were taken to the terminal building by bus.

PERSONNEL INFORMATION

Information on the flightcrew is contained in this report under First Pilot Information and in the Pilot/Operator Aircraft Accident Report.

AIRCRAFT INFORMATION

The No. 2 engine was a Pratt and Whitney model JT8D-9A, serial number 657091. At the time of the accident the engine had accumulated 68,784 total flight hours and 57,530 total cycles. The engine had accumulated 4,846 flight hours since overhaul and 359 flight hours since repair. On March 2, 1998, 359 flight hours before failure, the No. 2 engine was repaired by General Electric Engine Services, Miami, Florida. The N1 and N2 compressors, hot section, N2 turbine and exhaust case were repaired under heavy maintenance criteria. The N1 turbine and main accessory gearbox were repaired under heavy repair criteria. Installed were the C-5, C-6, C-8, C-9, and C-10 disks.

The C-8 or 8th stage high pressure compressor (HPC) disk, which was installed at this time, had been overhauled by General Electric Engine Services (formerly Greenwich Air Services), Miami, Florida, on February 11, 1998. Records showed the disk was received by Greenwich Air Services in March 1996. The disk was sent to Action Plating Corporation, Opa-Locka, Florida, for stripping. The disk was then returned to Greenwich Air Services, where it was inspected. The disk was then sent by Greenwich Air Services to Wings Aviation Services, Miami, Florida, for plating with diffused nickel-cadmium. The disk was then stored until February 1998. (Additional aircraft information is contained in this report under Aircraft Information and in the Powerplants Group Chairman Factual Report).

METEOROLOGICAL INFORMATION

Visual meteorological conditions prevailed at the time of the accident. Additional meteorological information is contained in this report under Weather Information.

FLIGHT RECORDERS

The cockpit voice recorder from N66734 was not retained by NTSB, for it remained electrically powered after the accident and the event was over written. The digital flight data recorder from N66734 was retained by NTSB after the accident and forwarded to the NTSB Vehicle Reorders Division, Washington, D.C., for readout. The readout showed the aircraft aligned with the takeoff runway and engine power was advanced. The engine pressure ratios increased to 1.44, 1.51, and 1.46, on engines 1, 2, and 3 respectively. The recording on the digital flight data recorder then ends. (See Flight Data Recorder Specialist's Factual Report of Investigation).

WRECKAGE AND IMPACT INFORMATION

Examination of the aircraft after the accident showed the No. 2 engine had experienced an uncontained failure of the 8th stage HPC disk. The two forward pieces of the No. 2 engine cowling separated and were found on the runway. Damage to the vertical tail had occurred from ejected engine components. Pieces from the 8th stage HPC disk were located inside the vertical tail of the aircraft, about 500 feet to the right of the aircraft, and about 500 feet to the left of the aircraft. (Additional Wreckage and Impact information is contained in the Powerplants Group Chairman Factual Report)

MEDICAL AND PATHOLOGICAL INFORMATION

There were no reported injuries from the three flightcrew members, 3 flight attendants, and 75 passengers. The flightcrew members did not submit to toxicology testing after the accident.

TESTS AND RESEARCH

Metallurgical examination of the 8th stage HPC hub fracture surfaces revealed the presence of a crack extending inboard from the rim radius, intersecting a shielding hole, and continuing partially into the bore. Elemental analysis of the fracture surface revealed a significant amount of cadmium in contact with the steel base material. The hub was nickel-cadmium (NiCd) plated during its last overhaul in March-April 1996, by Wings Aviation Services Inc. (Wings) in Miami. The NiCd plating operation requires applying a base layer of nickel followed by a top layer of cadmium and then baking to diffuse the two elements together. The nickel acts as a barrier coating between the cadmium and the base material (steel) to prevent the cadmium from contacting the steel base material, which may cause cadmium embrittlement.

The remaining Wings plated HPC disks from the accident engine were metallurgically examined and found to have inadequate Ni coating. The Federal Aviation Administration (FAA) issued an Airworthiness Directive (AD) to require the removal of JT8D and JT3D HPC disk that had been NiCd plated by Wings based on the number of hours in service that the disk had accumulated since being NiCd plated. (See Powerplants Group Chairman Factual Report and NTSB Materials Laboratory Factual Report).

ADDITIONAL INFORMATION

The aircraft was released by NTSB to Guy Puglia, Senior Manager Propulsion Engineering, Continental Airlines, Inc., on October 10, 1998. The No. 2 engine and accessories, and the digital flight data recorder, which were retained by NTSB, were released by NTSB to Eugene A. Carroll, Director Safety Investigations, Continental Airlines, Inc., on December 16,

1998.

Additional parties to the NTSB investigation were:

Florida	Avi Swartzon	Wings Aviation Services, Inc.	Miami,
Florida	William F. Bain	Action Plating Corporation	Opa-Locka,
	Mike Careccia	Independent Association of Continental Pilots	
	Houston, Texas		
Ohio	John Martens	General Electric Engines Services	Cincinnati,

Additional NTSB personnel assigned to this investigation were:

	Jean-Pierre Scarfo-Powerplants Group Chairman	Jean Bernstein-
Metallurgist	David Case- Flight Data Recorder	Jeffrey Guzzetti-
Powerplants	George Anderson-Powerplants	Debbie Bruce-Powerplants

Pilot Information

Certificate:	Airline Transport	Age:	44, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	Last Medical Exam:	05/20/1998
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	14900 hours (Total, all aircraft), 4500 hours (Total, this make and model), 7500 hours (Pilot In Command, all aircraft), 226 hours (Last 90 days, all aircraft), 53 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	Boeing	Registration:	N66734
Model/Series:	727-224 727-224	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	20663
Landing Gear Type:	Retractable - Tricycle	Seats:	156
Date/Type of Last Inspection:	09/01/1998, Continuous Airworthiness	Certified Max Gross Wt.:	169200 lbs
Time Since Last Inspection:	312 Hours	Engines:	3 Turbo Fan
Airframe Total Time:	3503 Hours	Engine Manufacturer:	P&W
ELT:	Not installed	Engine Model/Series:	JT8D-9A
Registered Owner:	FIRST SECURITY BANK NA TRUSTEE	Rated Power:	14500 lbs
Operator:	CONTINENTAL AIRLINES, INC.	Air Carrier Operating Certificate:	Flag carrier (121)
Operator Does Business As:		Operator Designator Code:	CALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	MIA, 11 ft msl	Observation Time:	0656 EDT
Distance from Accident Site:	1 Nautical Miles	Direction from Accident Site:	90°
Lowest Cloud Condition:	Scattered / 1900 ft agl	Temperature/Dew Point:	26° C / 24° C
Lowest Ceiling:	None / 0 ft agl	Visibility	10 Miles
Wind Speed/Gusts, Direction:	3 knots, 40°	Visibility (RVR):	0 ft
Altimeter Setting:	30 inches Hg	Visibility (RVV):	0 Miles
Precipitation and Obscuration:			
Departure Point:	(MIA)	Type of Flight Plan Filed:	IFR
Destination:	HOUSTON, TX (IAH)	Type of Clearance:	IFR
Departure Time:	0709 EDT	Type of Airspace:	Class D

Airport Information

Airport:	MIAMI INTERNATIONAL (MIA)	Runway Surface Type:	Asphalt
Airport Elevation:	11 ft	Runway Surface Condition:	Wet
Runway Used:	9L	IFR Approach:	
Runway Length/Width:	10502 ft / 200 ft	VFR Approach/Landing:	

Wreckage and Impact Information

Crew Injuries:	6 None	Aircraft Damage:	Substantial
Passenger Injuries:	75 None	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	On-Ground
Total Injuries:	81 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	JEFFREY L KENNEDY	Adopted Date:	09/12/2000
Additional Participating Persons:	GARY CRANFORD; MIAMI, FL EUGENE A CARROLL; HOUSTON, TX ROBERT J LARSON; MIAMI, FL RICHARD PARKER; EAST HARTFORD, CT		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.