Uncontained engine failure, Boeing 727-224, October 7, 1998

Micro-summary: **This Boeing 727-224 experienced an uncontained engine failure on takeoff.**

Event Date: **1998-10-07 at 0709 EDT**

Investigative Body: **National Transportation Safety Board (NTSB), USA**

Investigative Body's Web Site: **http://www.ntsb.gov/**

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1. Accident reports can be and sometimes are revised. Be sure to consult the investigative agency for the latest version before basing anything significant on content (e.g., thesis, research, etc).

2. Readers are advised that each report is a glimpse of events at specific points in time. While broad themes permeate the causal events leading up to crashes, and we can learn from those, the specific regulatory and technological environments can and do change. ***Your company's flight operations manual is the final authority as to the safe operation of your aircraft!***

3. Reports may or may not represent reality. Many many non-scientific factors go into an investigation, including the magnitude of the event, the experience of the investigator, the political climate, relationship with the regulatory authority, technological and recovery capabilities, etc. It is recommended that the reader review all reports analytically. Even a "bad" report can be a very useful launching point for learning.

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National Transportation Safety Board **FACTUAL REPORT** **AVIATION**	NTSB ID: MIA99FA005	Aircraft Registration Number: N66734
	Occurrence Date: 10/07/1998	Most Critical Injury: None
	Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
MIAMI	FL	33159	0709	EDT	

Airport Proximity: On Airport	Distance From Landing Facility:	Direction From Airport:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Boeing	727-224	Airplane

Sightseeing Flight: No Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

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

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Occurrence Type: Accident

Narrative (Continued)

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

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FACTUAL REPORT
AVIATION

NTSB ID: MIA99FA005
Occurrence Date: 10/07/1998
Occurrence Type: Accident

Narrative (Continued)

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:

Avi Swartzon Wings Aviation Services, Inc. Miami, Florida

William F. Bain Action Plating Corporation Opa-Locka, Florida

Mike Careccia Independent Association of Continental Pilots ••Houston, Texas

John Martens General Electric Engines Services Cincinnati, Ohio

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

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FACTUAL REPORT AVIATION

NTSB ID: MIA99FA005

Occurrence Date: 10/07/1998

Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
MIAMI INTERNATIONAL	MIA	11 Ft. MSL	9L	10502	200

Runway Surface Type: Asphalt

Runway Surface Condition: Wet

Type Instrument Approach:

VFR Approach/Landing:

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Boeing	727-224	20663

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	156	169200 LBS	3

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Fan	P&W	JT8D-9A	14500 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Continuous Airworthiness	09/1998	312 Hours	3503 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?
No		

Owner/Operator Information

Registered Aircraft Owner	Street Address	City	State	Zip Code
FIRST SECURITY BANK NA TRUSTEE	79 SOUTH MAIN STREET	SALT LAKE CITY	UT	84111

Operator of Aircraft	Street Address	City	State	Zip Code
CONTINENTAL AIRLINES, INC.	2929 ALLEN PARKWAY	HOUSTON	TX	77019

Operator Does Business As:

Operator Designator Code: CALA

- Type of U.S. Certificate(s) Held:

Air Carrier Operating Certificate(s): Flag Carrier/Domestic

Operating Certificate:

Operator Certificate:

Regulation Flight Conducted Under: Part 121: Air Carrier

Type of Flight Operation Conducted: Scheduled; Domestic; Passenger Only

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FACTUAL REPORT AVIATION

NTSB ID: MIA99FA005

Occurrence Date: 10/07/1998

Occurrence Type: Accident

First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	44

Sex: M | Seat Occupied: Left | Principal Profession: Civilian Pilot | Certificate Number: On File

Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Type Rating/Endorsement for Accident/Incident Aircraft? Yes | Current Biennial Flight Review?

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--no waivers/lim. | Date of Last Medical Exam: 05/1998

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	14900	4500								
Pilot In Command(PIC)	7500	1800								
Instructor										
Last 90 Days	226	226								
Last 30 Days	53	53								
Last 24 Hours	1	1								

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? No | Second Pilot? Yes

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
Same as Accident/Incident Location		MIA	0709	EDT

Destination	State	Airport Identifier
HOUSTON	TX	IAH

Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing: Company

Method of Briefing:

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: MIA99FA005

Occurrence Date: 10/07/1998

Occurrence Type: Accident

Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
MIA	0656	EDT	11 Ft. MSL	1 NM	90 Deg. Mag.

Sky/Lowest Cloud Condition: Scattered 1900 Ft. AGL

Condition of Light: Day

Lowest Ceiling: None 0 Ft. AGL

Visibility: 10 SM

Altimeter: 30.00 "Hg

Temperature: 26 °C

Dew Point: 24 °C

Wind Direction: 40

Density Altitude: 1100 Ft.

Wind Speed: 3

Gusts:

Weather Condtions at Accident Site: Visual Conditions

Visibility (RVR): 0 Ft.

Visibility (RVV) 0 SM

Intensity of Precipitation: Unknown

Restrictions to Visibility: None

Type of Precipitation: None

Accident Information

Aircraft Damage: Substantial

Aircraft Fire: Ground

Aircraft Explosion Ground

Classification: U.S. Registered/U.S. Soil

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot				1	1
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer				1	1
Cabin Attendants				3	3
Other Crew					
Passengers				75	75
- TOTAL ABOARD -				81	81
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	81	81

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FACTUAL REPORT AVIATION

NTSB ID: MIA99FA005

Occurrence Date: 10/07/1998

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

JEFFREY L. KENNEDY

Additional Persons Participating in This Accident/Incident Investigation:

GARY CRANFORD
FAA FSDO
MIAMI, FL 33166

EUGENE A CARROLL
CONTINENTAL AIRLINES, INC.
HOUSTON, TX 77002

ROBERT J LARSON
BOEING COMMERCIAL AIRPLANE
MIAMI, FL 33126

RICHARD PARKER
PRATT AND WHITNEY
EAST HARTFORD, CT 06108