## Uncontained engine failure, Boeing 757, January 31, 1997

**Micro-summary:** **This Boeing 757 experienced an uncontained engine failure of the #1 engine during climb.**

**Event Date:** **1997-01-31 at 1610 EST**

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

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

**Cautions:**

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.

4. Contact us before reproducing or redistributing a report from this anthology. Individual countries have very differing views on copyright! We can advise you on the steps to follow.

National Transportation Safety Board

# FACTUAL REPORT AVIATION

| | |
|---|---|
| NTSB ID: ATL97IA035 | Aircraft Registration Number: N611DL |
| Occurrence Date: 01/31/1997 | Most Critical Injury: None |
| Occurrence Type: Incident | Investigated By: NTSB |

## Location/Time

| Nearest City/Place | State | Zip Code | Local Time | Time Zone | |
|---|---|---|---|---|---|
| ATLANTA | GA | 30320 | 1610 | EST | |

| Airport Proximity: | Distance From Landing Facility: | Direction From Airport: |
|---|---|---|
| Off Airport/Airstrip | 35 | 270 |

## Aircraft Information Summary

| Aircraft Manufacturer | Model/Series | Type of Aircraft |
|---|---|---|
| Boeing | 757-232 | Airplane |

Sightseeing Flight: No

Air Medical Transport Flight: No

## Narrative

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

On January 31, 1997, about 1610 eastern standard time, a Boeing 757, N611DL, experienced an uncontained failure of the number one (left) engine during climb, near Atlanta, Georgia. The airplane, Flight 602, was operated by Delta Air Lines under instrument flight rules, and the provisions of Title 14 CFR Part 121, as a scheduled, domestic, passenger flight. An instrument flight plan was activated. Visual meteorological conditions prevailed. There were no injuries to the two flight crewmembers, the five flight attendants, and the 161 passengers, and the airplane incurred minor damage. Origination of the flight was Atlanta, Georgia, about 1600 on the same day. The flight was destined for Dallas, Texas.

According the captain, the airplane was climbing through about 15,000 feet when "the engine failed abruptly". The cockpit and aft cabin filled partially with smoke which cleared quickly. The captain requested an immediate return to Atlanta's William B. Hartsfield International Airport. The landing was uneventful. After being visually inspected for fire, the airplane was able to taxi back to the gate without further incident.

The left engine was a Pratt and Whitney PW2037 turbofan, serial number 716582. Delta's records indicate the engine had accumulated 19,243 hours total time and 9,823 cycles since new. The engine had operated 3,518 hours and 1,719 cycles since its last heavy maintenance visit on September 26, 1996.

An examination by Delta, Pratt and Whitney, and the Powerplants Group of the National Transportation Safety Board revealed the Stage 1 high pressure turbine (HPT) disk, Part Number 1B3621, had fractured and was missing the lug between two blade root slots. According to the report by the Powerplants Group, this rupture liberated one Stage 1 lug and two Stage 1 HPT blades. One blade was recovered from the cowling and determined to be "battered and fractured transversely across the airfoil adjacent to the blade root platform".

A visual examination showed the fracture surface was "smooth and had a purple discoloration from the front side that faded to a gold color towards the rear" of the disk. According to the Powerplants Group report, the "fir tree serrations on the adjacent lugs were intact." At the time of separation, according to Delta's records, the Stage 1 HPT disk had accumulated 9,825 cycles since new, and 1,719 cycles since the last heavy maintenance. Part Number 1B3621 Stage 1 HPT disks are life limited to 15,000 cycles.

The remaining rotating parts of the HPT were intact, with impact damage on the blades. The low pressure turbine (LPT) was intact. Its vanes and blades both had "nicks and dents". The remainder of the engine appeared normal and was not disassembled.

A metallurgical examination was completed by Pratt and Whitney's material laboratory in February, 1997. The examination showed that the "HPT disk blade retention lug had separated

National Transportation Safety Board

**FACTUAL REPORT**

**AVIATION**

NTSB ID: ATL97IA035

Occurrence Date: 01/31/1997

Occurrence Type: Incident

Narrative (Continued)

because of a low cycle fatigue (LCF) fracture that had initiated from multiple origins along the front sideplate snap radius and propagated axially rearward. The origins of the fatigue fracture were parallel to circumferential machining marks that were just inboard of the snap radius".

After this and other similar HPT failures, Pratt and Whitney produced an Alert Service Bulletin (ASB). This bulletin, PW2000 A72-592, described a modification of the HPT disk assembly for all PW2037, PW2037(M), PW2040, PW2240, and PW2337 engines. This Service Bulletin attempted to prevent further blade attachment lug liberations by enlarging the front and rear sideplate snap radii. This modification was designed to reduce the stresses and eliminate the cracking in the radii which was allowing the blades to be liberated.

From Pratt and Whitney's Alert Service Bulletin, the FAA produced a Telegraphic Airworthiness Directive (TAD) 97-11-51T, which required serviceable disks to be operated in accordance with Pratt and Whitney's ASB No. PW2000 A72-592.

National Transportation Safety Board

# FACTUAL REPORT AVIATION

NTSB ID: ATL97IA035

Occurrence Date: 01/31/1997

Occurrence Type: Incident

## Landing Facility/Approach Information

| Airport Name | Airport ID: | Airport Elevation | Runway Used | Runway Length | Runway Width |
|---|---|---|---|---|---|
| HARTSFIELD INTERNATIONAL | ATL | 1026 Ft. MSL | 27L | 11889 | 150 |

Runway Surface Type: Concrete

Runway Surface Condition: Dry

Type Instrument Approach: NONE

VFR Approach/Landing: Precautionary Landing

## Aircraft Information

| Aircraft Manufacturer | Model/Series | Serial Number |
|---|---|---|
| Boeing | 757-232 | 22818 |

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

| Homebuilt Aircraft? | Number of Seats: | Certified Max Gross Wt. | Number of Engines: |
|---|---|---|---|
| No | 190 | 223800 LBS | 2 |

| Engine Type: | Engine Manufacturer: | Model/Series: | Rated Power: |
|---|---|---|---|
| Turbo Fan | P&W | PW2037 | 37530 LBS |

- Aircraft Inspection Information

| Type of Last Inspection | Date of Last Inspection | Time Since Last Inspection | Airframe Total Time |
|---|---|---|---|
| Continuous Airworthiness | 01/1997 | 106 Hours | 37395 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 |
|---|---|---|---|---|
| DELTA AIR LINES | 1020 DELTA BLVD | ATLANTA | GA | 30320 |

| Operator of Aircraft | Street Address | City | State | Zip Code |
|---|---|---|---|---|
| Same as Reg'd Aircraft Owner | Same as Reg'd Aircraft Owner | | | |

Operator Does Business As:

Operator Designator Code: DALA

- 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

National Transportation Safety Board

# FACTUAL REPORT AVIATION

NTSB ID: ATL97IA035

Occurrence Date: 01/31/1997

Occurrence Type: Incident

## First Pilot Information

| Name | City | State | Date of Birth | Age |
|---|---|---|---|---|
| On File | On File | On File | On File | 58 |

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

Certificate(s): Airline Transport

Airplane Rating(s): Multi-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: 11/1996

| - 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 | 15000 | 2751 | | | | | | | | |
| Pilot In Command(PIC) | | | | | | | | | | |
| Instructor | | | | | | | | | | |
| Last 90 Days | 225 | 225 | | | | | | | | |
| Last 30 Days | | | | | | | | | | |
| Last 24 Hours | | | | | | | | | | |

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 | | ATL | 1600 | EST |

| Destination | State | Airport Identifier |
|---|---|---|
| DALLAS | TX | DFW |

Type of Clearance: IFR

Type of Airspace: Class B

## Weather Information

Source of Briefing: Company

Method of Briefing:

National Transportation Safety Board

# FACTUAL REPORT AVIATION

NTSB ID: ATL97IA035

Occurrence Date: 01/31/1997

Occurrence Type: Incident

## Weather Information

| WOF ID | Observation Time | Time Zone | WOF Elevation | WOF Distance From Accident Site | Direction From Accident Site |
|---|---|---|---|---|---|
| ATL | 1556 | EDT | 1026 Ft. MSL | 35 NM | 270 Deg. Mag. |

Sky/Lowest Cloud Condition: Unknown 0 Ft. AGL

Condition of Light: Day

Lowest Ceiling: Broken 25000 Ft. AGL

Visibility: 10 SM

Altimeter: 29.00 "Hg

Temperature: 15 °C

Dew Point: -1 °C

Wind Direction: 260

Density Altitude: 1200 Ft.

Wind Speed: 11

Gusts: 15

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: Minor

Aircraft Fire: None

Aircraft Explosion None

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 | | | | | |
| Cabin Attendants | | | | 5 | 5 |
| Other Crew | | | | | |
| Passengers | | | | 161 | 161 |
| - TOTAL ABOARD - | | | | 168 | 168 |
| Other Ground | 0 | 0 | 0 | | 0 |
| - GRAND TOTAL - | 0 | 0 | 0 | 168 | 168 |

National Transportation Safety Board

# FACTUAL REPORT AVIATION

NTSB ID: ATL97IA035

Occurrence Date: 01/31/1997

Occurrence Type: Incident

## Administrative Information

Investigator-In-Charge (IIC)

PRESTON E. HICKS

Additional Persons Participating in This Accident/Incident Investigation:

FRAN DEJOSEPH
GEORGIA FSDO

REGAN H CAMPBELL
NTSB-ATLANTA OFFICE