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.

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National Transportation Safety Board		NTSB ID: ATL97IA035 Aircraft Registration Number: N611DL								
FACTUAL REPORT		Occurre	ence Date: 01/3	1/1997	Most Critical Injury: None					
AVIATION		Occurrence Type: Incident Investigated By: NTSB								
Location/Time					1					
Nearest City/Place	State	e Zip Code Local Time Time Zone								
ATLANTA	GA	30320 1610 EST								
Airport Proximity: Off Airport/Airstrip Distance From Landing Facility: 35 Direction From Airport: 270										
Aircraft Information Summary										
Aircraft Manufacturer Model/Series Type of Aircraft										
Boeing			757-232				Airplane			
Sightseeing Flight: No			Air Medical T	ansport Flight: No	D					
Narrative										
<pre>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 HFT 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 dis</pre>										
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										
FACTUAL REPORT - AVIATION Page 1										

ARANSO National Transportation Safety Board	NTSB ID: ATL97IA035	
FACTUAL REPORT	Occurrence Date: 01/31/1997	
AVIATION ETYBON	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	B ID: AT	L97IA035									
FACTUAL REPORT	Оссі	urrence D;	ate: 01/31/1997								
AVIATION	Оссі	urrence T	ype: Incident		1						
Landing Facility/Approach Information	n										
Airport Name	1	Airport IE	Airport ID: Airport Elevation Runway Used Runway Length Runw								
HARTSFIELD INTERNATIONAL	ATL	TL 1026 Ft. MSL 27L 11889				9	150)			
Runway Surface Type: Concrete	Runway Surface Type: Concrete										
Runway Surface Condition: Dry											
Type Instrument Approach: NONE											
VFR Approach/Landing: Precautionary Landing											
Aircraft Information											
Aircraft Manufacturer Boeing		Мо 75	del/Series 7-232				Serial N 22818	Number 8			
Airworthiness Certificate(s): Transport											
Landing Gear Type: Retractable - Tricycle											
Homebuilt Aircraft? No Number c	223800	223800 LBS Number of E			Engines: 2						
Engine Type: Turbo Fan	Engine Manufacturer:Model/Series:P&WPW2037						Rated Power: 37530 LBS				
- Aircraft Inspection Information											
Type of Last Inspection		Date of Last Inspection Time Since Last Inspection						Airframe To	otal Time		
Continuous Airworthiness		01/1997 106 Hours						37395 Hours			
- Emergency Locator Transmitter (ELT) Inform	mation			. <u> </u>							
ELT Installed? No EL	.T Operated?			ELT Aideo	d in Locating Ac	cident S	Site?				
Owner/Operator Information											
Registered Aircraft Owner		Stre	et Address 1020 DE	LTA BLVC)						
DELTA AIR LINES			City State Zip								
	Street Address										
Operator of Aircraft	Same as Reg'd Aircraft Owner										
Same as Reg'd Aircraft Owner	City State							Zip Code			
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 12	1: Air Carrier										
Type of Flight Operation Conducted: Schedu	uled; Domestic	; Passen	ger Only								
FACTUAL REPORT - AVIATION Page 2											

National Transportation Safety Board NTSB ID: ATL97IA035														
F	FACTUAL REPORT Occurrence Date: 01/31/1997													
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	ETYBO	A		Occurren	ce rype. In	cident								
First Pilot Information														
Name						City					State	Da	te of Birth	Age
On File On File On File 5											58			
Sex: M	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	t Rating(s): Airpl	ane												
instrument														
Instructor	Rating(s): NON	5												
Type Ratir	ng/Endorsement fo	or Accident/Ir	ncident Aircra	^{aft?} Yes			C	Current E	Biennial Fl	ight R	eview?			
Medical Co	ert.: Class 1	Medica	al Cert. Statu	is: Valid Me	dicalno w	/aivers/	lim.		Date	e of La	ist Medica	l Exa	m: 11/1996	
- Flight Tir	me Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Airplane Nig Single Engine Mult-Engine Nig				Instrument Actual Simu		Rotorcr	aft	Glider	Lighter Than Air
Total Time	9	15000	2751											
Pilot In Co	ommand(PIC)													
Instructor														
Last 90 Da	ays	225	225			_								
Last 30 Da	ays										_			
Last 24 Ho	ours													
Seatbelt U	Ised? Yes	Shou	Ider Harnes	s Used? Yes	;		Toxico	ology Pe	erformed?	No		Seco	ond Pilot? Ye	S
Flight Pla	an/Itinerary													
Type of Fli	ight Plan Filed: IF	R												
Departure Point							State Airr		Airport Id	irport Identifier		Departure Time		Time Zone
Same as Accident/Incident Location ATL 1600									EST					
Destination							State	;	Airport Id	irport Identifier				
DALLAS TX DFW														
Type of Clearance: IFR														
Type of Airspace: Class B														
Weather	Information													
Source of	Briefing:													
	Compa	any												
Method of	Briefing:													
				FACTUAI	REPORT	- AVL	ATIO	N						Page 3

Secure Date: 0:1/31/1997 Occurrence Date: 0:1/31/1997 Occurrence Type: Incident Weather Information Worf ID Doservation Time Time Zone WOF Elevation WOF Distance From Accident Site Direction From Accident Site ATL 1556 EDT 1026 Ft. MSL Visibility: 10 SM Altimeter: 29.00 "H9 SkylLowest Cloud Condition: University 25000 Ft. AGL Visibility: 10 SM Altimeter: 29.00 "H9 Temperature: 15 °C Dew Point: -1 °C Wind Direction: 260 Density Altitude: 1200 Ft. Visibility (RVR): 0 Ft. Visibility (RVV) 0 SM Intensity of Precipitation: Uncent Fire: None Alticraft Fire: None Alticraft Fire: None Alticraft Fire: None Coldent Information Alticraft Fire: None Alticraft Fire: None Alticraft Fire: None Coldent Information Secord Piel Alticraft Fire: None	Nationa	TRANSP al Transportation Safety	NTSB ID:	NTSB ID: ATL97IA035									
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O FL AGL Condition Light: Day Lowest Ceiling: Broken 25000 FL AGL Visibility: 10 SM Attimeter: 29.00 "Hg Temperature: 15 °C Der Point: -1 °C Wind Speed: 11 Density Altitude: 1200 FL Wind Speed: 11 Gusts: 15 Gusts: 15' Weatterton: 260 Density Altitude: 1200 FL Visibility (RVR): 0 FL Visibility (RVI): 0 SM Intensity of Precipitation: Unknown Restrictions to Visibility: None Aircraft Fire: None Aircraft Explosion None Intensity of Precipitation:	ATL	ATL 1556 EDT 1026 Ft. MSL 35 NM 270 Deg. Mag.											Mag.
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Restrictions to Visibility: None Type of Precipitation: None Accident Information Aircraft Damage: Minor Aircraft Fire: None Classification: U.S. Registered/U.S. Soil - Injury Summary Matrix Fatal Serious Minor None TOTAL First Plot 1 Second Pilot 1 Student Pilot 1 Flight Instructor 1 Clabin Attendante 5 Other Crew 1 Passengers 161 -1014 ABOARD- 168 0 0 0 0	Visibility (R	RVR): 0 Ft.	Visibility ((RVV) 0	SM	Intensity	/ of Precipita	tion: (Jnknown				
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Student PilotImage: Student PilotImage: Student PilotImage: Student PilotFlight InstructorImage: Student PilotImage: Student PilotImage: Student PilotCheck PilotImage: Student PilotImage: Student PilotImage: Student PilotCabin AttendantsImage: Student PilotImage: Student PilotImage: Student PilotPassengersImage: Student PilotImage: Student PilotImage: Student PilotOther GroundImage: Student PilotImage: Student PilotImage: Student PilotImage: Student PilotImage	Second	d Pilot				1	1						
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Other Crew Image: Constraint of the second sec	Cabin A	Attendants				5	5						
Passengers Image: Marcon Control of C	Other C	Crew											
- TOTAL ABOARD - Image: Marcon M	Passen	igers				161	161						
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	- GRAND) TOTAL -	0	0	0	168	168						
				FACTUAI	L REPO	RT - AV	IATION					Ρ	age 4

National Transportation Safety Board	NTSB ID: ATL97IA035	
FACTŲAL REPORT	Occurrence Date: 01/31/1997	
AVIATION	Occurrence Type: Incident	
Administrative Information		
Investigator-In-Charge (IIC)		
PRESTON E. HICKS		
Additional Persons Participating in This Accident/Incide	ent Investigation:	
FRAN DEJOSEPH GEORGIA FSDO		
REGAN H CAMPBELL NTSB-ATLANTA OFFICE		