



National Transportation Safety Board Aviation Incident Final Report

Location:	CHICAGO, IL	Incident Number:	CHI95IA142
Date & Time:	05/01/1995, 1120 CDT	Registration:	N1811U
Aircraft:	MCDONNELL DOUGLAS DC10-10	Aircraft Damage:	Minor
Defining Event:		Injuries:	192 None

Flight Conducted Under: Part 121: Air Carrier - Scheduled

Analysis

The flightcrew reported that during the application of takeoff power, when the throttles were in approximately the vertical position, the numbers 1 and 3 engines were indicating approximately 70% N1. The number 2 engine was indicating about 48% N1 and not accelerating. They heard a 'crack' and aborted the takeoff. Examination of the engine revealed that the low pressure turbine (LPT) stage one disk had separated from the LPT rotor at the stage one to two flange joint. Seven intact toroid bolts and sets of associated hardware were recovered. No evidence of fatigue cracking or corrosion (pitting) was noted on any of the bolt pieces recovered from the engine. The shank of one of the toroid bolts exhibited significant damage. The lug arm, used for safetying the bolt, exhibited relatively minor damage. Examination of several of the lug arms revealed 'noticeable wear patterns' and 'crack arrest positions indicative of fatigue cracking.' Statements by UAL maintenance personnel indicate failures of the toroid bolt safeties are occasionally discovered when the engines are disassembled for major overhaul.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: failure of the safety wire and/or safety wire lug arm on one of the stage one to two disk flange bolts due to an inadequate safetying method.

Findings

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

Findings

1. 1 ENGINE
2. (C) TURBINE ASSEMBLY,AIR SEAL - DISCONNECTED
3. (C) PROCEDURE INADEQUATE - MANUFACTURER

Factual Information

On May 1, 1995, about 1120 central standard time, a McDonnell Douglas DC10-10, N1811U, operated by United Airlines (UAL) as United Airlines Flight 492, sustained minor damage following the uncontained failure of the number two engine during takeoff roll.

The flight crew aborted the takeoff, returned to the gate, and deplaned the passengers without further incident. There were no injuries to the crew of 12, or the 180 passengers aboard the airplane. The scheduled domestic passenger flight, operated under 14 CFR Part 121, originated at the Chicago O'Hare International Airport with a planned destination of the Washington Dulles International Airport, Washington, D. C. An IFR flight plan was filed, and visual meteorological conditions prevailed in Chicago.

The flight crew reported that during the application of takeoff power, when the throttles were in approximately the vertical position, the number one and three engines were indicating approximately 70 percent N1. The number two engine was indicating about 48 percent N1 and not accelerating. They heard a "crack". They aborted the takeoff, pulled the number two engine fire handle and discharged the fire bottle.

The airplane was transported to the UAL maintenance hanger at O'Hare International airport where it was subsequently examined. Fragments of the turbine blades, shroud material, bolts, and the engine case were recovered from the runway, and from within the engine cowl and the engine. A gap was located in the thrust reverser latch seam which spanned approximately three inches at the trailing edge and .25 inches at the leading edge. The left cowling had a six inch by 21 inch puncture at the ten o'clock position and the right side cowling had a four inch by eighteen inch puncture at the four o'clock position.

The engine was removed from the airframe revealing a circumferential penetration of the engine case, about one inch wide, extending around about 270 degrees of the circumference from the three o'clock position to the twelve o'clock position, in the vicinity of the first low pressure turbine. One oil line on the left side of the engine was fractured and the upper surface of the left stabilizer was oil covered.

The engine was transported to the UAL engine overhaul facility, San Francisco, California, where it was examined in the presence of the Powerplants Group Chairman. In his factual report of the examination, he reported "the LPT stage one disk was separated from the LPT rotor at the stage one to two flange joint. The bore, web and rim portion of the disk were intact...Several stage one to two disk flange bolts were recovered in the debris. The fracture surfaces on the majority of the recovered bolt fragments were smoothed and rounded. Six stage one to stage two flange bolts were fractured in the shank, adjacent to the threads, in which two bolts had coarse looking fracture surfaces with varying degrees of discoloration."

The LPT components were examined by a National Resource Specialist at the NTSB laboratory, Washington, D. C. In his factual report he stated that "the internal surfaces of the engine hardware in the low pressure turbine section contained multiple small-object impact marks". Seven intact toroid bolts and sets of associated hardware were recovered. X-ray energy dispersive spectroscopy (EDS) examination of the discolored areas of the bolts revealed substantial peaks for oxygen, aluminum, sulfur, and silver. "No evidence of fatigue cracking or corrosion (pitting) was noted on any of the bolt pieces recovered from the engine." A portion of the missing bolt, identified as an unthreaded portion of the shank, designated as bolt

number six, was located with the fragments recovered from within the engine. The shank of the bolt exhibited significant damage. The lug arm, used for safetying the number six bolt, exhibited relatively minor damage. Examination of several of the lug arms revealed "noticeable wear patterns" and "crack arrest positions indicative of fatigue cracking."

Statements by UAL maintenance personnel indicate failures of the toroid bolt safeties are occasionally discovered when the engines are disassembled for major overhaul.

Pilot Information

Certificate:	Airline Transport; Flight Instructor; Flight Engineer	Age:	56, 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):		Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	Last FAA Medical Exam:	01/02/1995
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	19011 hours (Total, all aircraft), 2909 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	MCDONNELL DOUGLAS	Registration:	N1811U
Model/Series:	DC10-10 DC10-10	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	46610
Landing Gear Type:	Retractable - Tricycle	Seats:	302
Date/Type of Last Inspection:	07/23/1994, Continuous Airworthiness	Certified Max Gross Wt.:	433000 lbs
Time Since Last Inspection:	1903 Hours	Engines:	3 Turbo Jet
Airframe Total Time:	63749 Hours	Engine Manufacturer:	CFM
ELT:	Installed, not activated	Engine Model/Series:	CF6-6
Registered Owner:	UNITED AIRLINES	Rated Power:	39000 lbs
Operator:	UNITED AIRLINES	Operating Certificate(s) Held:	Flag carrier (121)
Operator Does Business As:		Operator Designator Code:	UALA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	ORD, 668 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	1015 CST	Direction from Accident Site:	0°
Lowest Cloud Condition:	Scattered / 4000 ft agl	Visibility	15 Miles
Lowest Ceiling:	None / 0 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	15 knots / 24 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	70°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	11° C / 3° C
Precipitation and Obscuration:			
Departure Point:	, IL (ORD)	Type of Flight Plan Filed:	IFR
Destination:	WASHINGTON, DC (IAD)	Type of Clearance:	IFR
Departure Time:	1120 CST	Type of Airspace:	Class D

Airport Information

Airport:	O'HARE INTERNATIONAL (ORD)	Runway Surface Type:	Asphalt
Airport Elevation:	668 ft	Runway Surface Condition:	Dry
Runway Used:	9L	IFR Approach:	None
Runway Length/Width:	7967 ft / 150 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	12 None	Aircraft Damage:	Minor
Passenger Injuries:	180 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	192 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	WESLEY M ROBBINS,	Report Date:	04/18/1996
Additional Participating Persons:	JEFFREY S BARNETT; SCHILLER PARK, IL JEFF PLANTZ; CHICAGO, IL ROBERT A RECCHIUTI; CINCINNATI, OH		
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 pubinquiry@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

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