



Aviation Investigation Final Report

Location:	Chicago, Illinois	Accident Number:	CHI08FA050
Date & Time:	December 14, 2007, 15:55 Local	Registration:	N220UA
Aircraft:	Boeing 777-222	Aircraft Damage:	Minor
Defining Event:		Injuries:	1 Serious, 263 None
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

Analysis

On approach for landing, about 13 miles from the airport, the flight crew was informed that the cabin was filling with smoke. The cabin crew was unable to determine the source of the smoke. The captain declared an emergency in order to get the airplane on the ground as soon as possible. The first officer performed a normal landing and turned off on the first high-speed taxiway, at which time he noticed a low oil indication on the right engine. The engine was subsequently shut down. The captain elected to initiate an emergency evacuation due to the uncertainty of the situation and the possibility of a fire on-board. During the evacuation, one passenger sustained a fracture of a vertebra. Post accident examinations revealed a low oil quantity in the right engine, with metallic deposits on one of the engine chip detectors. A detailed teardown inspection of the right engine revealed the #2 bearing had failed. The compressor gas path exhibited oil deposits consistent with oil migration into the airplane's environmental system. The cabin pressurization system utilized 8th and 15th stage engine compressor bleed air. No evidence of an engine or cabin fire was observed. The engine manufacturer had released an improved bearing design prior to the accident. At that time, the operator began replacing the bearings on an attrition basis when the original bearings were no longer serviceable. However, the operator has revised that policy and is proactively replacing the original bearings, regardless of the condition, with the improved bearings.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Emergency evacuation due to dense smoke in the cabin and the possibility of an on-board fire, which resulted in a serious injury to one of the 264 passengers and crew. An additional cause was the failure of an engine bearing, allowing oil to migrate into the environmental system, and resulted in the smoke in the cabin.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION

Phase of Operation: APPROACH

Findings

1. (C) ENGINE ASSEMBLY,BEARING - FAILURE
2. (C) AIR COND/HEATING/PRESSURIZATION - CONTAMINATION
3. (C) AIR COND/HEATING/PRESSURIZATION - SMOKE
4. (C) EVACUATION - INITIATED - PILOT IN COMMAND

Factual Information

HISTORY OF FLIGHT

On December 14, 2007, at 1555 central standard time, a Boeing 777-222, N220UA, operated by United Airlines as flight 836, sustained minor damage when smoke entered the cabin during approach for landing at O'Hare International Airport (ORD), Chicago, Illinois. The international air carrier flight was being conducted under 14 CFR Part 121 on an instrument flight rules flight plan. One passenger was seriously injured during the subsequent emergency evacuation. The remaining 248 passengers, 11 cabin crew members, and 4 flight crew members were not injured. The flight departed Pudong International Airport (PVG), Shanghai, China, about 0900 UTC. ORD was the intended destination.

The captain was advised that the business class lavatory sinks were overflowing about 4 hours into the flight. He decided to close the affected lavatories for the remainder of the flight. There were no further issues until the flight began a descent from cruise altitude in preparation for landing at ORD. At that time, one of the Relief First Officers reported that the lavatory immediately aft of the flight deck also had water problems.

The captain stated that while on approach for landing, about 13 miles from the runway threshold at 5,000 feet mean sea level (msl), he was informed that the cabin was filling with smoke. The flight attendant commented that she could not see the aft end of the airplane due to the density and that it was getting worse. The cabin crew was unable to determine the source of the smoke. The captain elected to declare an emergency and to get the airplane on the ground as soon as possible.

The captain reported that approximately 5 miles from the runway, the Instrument Landing System (ILS) localizer and glide slope display indicated that the data was unreliable. The Engine Indication and Crew Alerting System (EICAS) indicated that the autopilot was operating in a degraded mode. The flight crew thought that these indications may have been related to the previous lavatory water issues. The captain elected to continue the approach, noting that the presence of a high broken cloud layer would still give them sufficient time to transition to a visual approach and land safely. The first officer performed a normal landing and turned off on the first high-speed taxiway. As the captain took control of the airplane, the first officer noticed a low oil indication on the right engine. The engine was subsequently shut down.

Due to the indications of multiple problems with the airplane, the captain elected to initiate an emergency evacuation. During the evacuation, one passenger sustained a serious injury.

PERSONNEL INFORMATION

The captain held an Airline Transport Pilot certificate with single and multi-engine class ratings, and a Boeing 777 type rating. He was issued a First-Class Airman Medical certificate

in September 2007. He had accumulated 4,327 hours in Boeing 777 airplanes at the time of the accident. His most recent flight check was completed in March 2007.

The first officer flying at the time of the accident held an Airline Transport Pilot certificate with single and multi-engine class ratings, and a Boeing 777 type rating. He was issued a First-Class Airman Medical certificate in July 2007. He had accumulated about 4,597 hours flight time in a Boeing 777. His most recent flight check was completed in July 2006.

AIRCRAFT INFORMATION

The accident airplane was a Boeing 777-222 airplane. The airframe had accumulated approximately 26,287 hours at the time of the accident. The most recent inspection under the operator's continuous airworthiness inspection program was completed on August 10, 2007.

The airplane was powered by two Pratt and Whitney PW-4090 turbo fan engines. Each engine was capable of developing 90,000 pounds of thrust. The left and right engines had accumulated 22,211 hours and 39,502 hours time in service, respectively.

METEOROLOGICAL INFORMATION

The Chicago O'Hare Airport Automated Surface Observing System (ASOS) recorded conditions at 1551 as: Broken clouds at 2,200 feet above ground level (agl), 10 miles visibility, winds variable at 4 knots, temperature -4 degrees Celsius, dew point -9 degree Celsius, and altimeter 30.40 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The airplane landed normally on runway 10 (10,144 feet by 150 feet, asphalt/concrete) and exited on taxiway M5. The emergency evacuation was conducted on the taxiway.

A post accident inspection revealed that white smoke was being emitted from the right engine. Further on-scene investigation noted a low oil quantity in the right engine. Metallic deposits were observed on one of the engine chip detectors. In addition, oil deposits were located in the compressor section of the engine. No evidence of an engine or cabin fire was observed.

Water infiltration was observed in the electrical equipment compartment located below the flight deck. The infiltration was in the area of the ILS navigation receivers. Further examination revealed that the business class lavatory drainage system was obstructed at the drain masts, due to a failure of the drain mast heaters.

SURVIVAL ASPECTS

An emergency evacuation was conducted on the taxiway after landing. All exit doors operated without any reported difficulties and all exit slides deployed properly.

One 68-year-old passenger, who exited on the right side of the airplane, sustained a compression fracture of a vertebra. The remaining passengers and crew were not injured.

TESTS AND RESEARCH

A detailed teardown inspection of the right engine revealed the #2 bearing had failed. The compressor gas path exhibited oil deposits consistent with oil migration into the airplane's environmental system. The cabin pressurization system utilized 8th and 15th stage engine compressor bleed air.

The right engine had accumulated 39,502 hours and 5,814 cycles in service. The #2 bearing had been in service 34,440 hours since new and 10,315 hours since it was last overhauled. The magnetic chip detectors had been inspected and cleaned 240 hours/26 cycles prior to the accident.

The engine manufacturer had released an improved bearing design prior to the accident. At that time, the operator began replacing the bearings on an attrition basis when the original bearings were no longer serviceable. However, the operator has revised that policy and is proactively replacing the original bearings, regardless of the condition, with the improved bearings.

Pilot Information

Certificate:	Airline transport	Age:	58, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	September 1, 2007
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	March 1, 2007
Flight Time:	4327 hours (Total, this make and model)		

Co-pilot Information

Certificate:	Airline transport	Age:	58,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Rear
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):		Toxicology Performed:	No
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	July 1, 2006
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	July 1, 2007
Flight Time:	4597 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	Registration:	N220UA
Model/Series:	777-222	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Transport	Serial Number:	30222
Landing Gear Type:	Retractable - Tricycle	Seats:	270
Date/Type of Last Inspection:	August 1, 2007 Continuous airworthiness	Certified Max Gross Wt.:	640000 lbs
Time Since Last Inspection:		Engines:	2 Turbo fan
Airframe Total Time:	26287 Hrs at time of accident	Engine Manufacturer:	Pratt & Whitney
ELT:		Engine Model/Series:	PW-4090
Registered Owner:	United Airlines Inc	Rated Power:	90000 Lbs thrust
Operator:		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 (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	ORD,668 ft msl	Distance from Accident Site:	
Observation Time:	15:51 Local	Direction from Accident Site:	
Lowest Cloud Condition:		Visibility	10 miles
Lowest Ceiling:	Broken / 2200 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	4 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.39 inches Hg	Temperature/Dew Point:	-4°C / -9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Shanghai (PVG)	Type of Flight Plan Filed:	IFR
Destination:	Chicago, IL (ORD)	Type of Clearance:	IFR
Departure Time:	09:00 UTC	Type of Airspace:	

Airport Information

Airport:	Chicago O'Hare Intl ORD	Runway Surface Type:	Asphalt;Concrete
Airport Elevation:	668 ft msl	Runway Surface Condition:	Dry
Runway Used:	10	IFR Approach:	ILS;Visual
Runway Length/Width:	10144 ft / 150 ft	VFR Approach/Landing:	Full stop

Wreckage and Impact Information

Crew Injuries:	15 None	Aircraft Damage:	Minor
Passenger Injuries:	1 Serious, 248 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious, 263 None	Latitude, Longitude:	41.97861,-87.904724

Administrative Information

Investigator In Charge (IIC):	Sorensen, Timothy
Additional Participating Persons:	Samuel Latorre; FAA-O'Hare FSDO; Des Plaines, IL John McCoy; United Airlines; San Francisco, CA
Original Publish Date:	December 24, 2008
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=67320

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).