Tail strike on landing, Boeing 757-251, September 9, 2002

Micro-summary: This Boeing 757-251 collided with the runway at a high pitch angle, resulting in a tail strike.

Event Date: 2002-09-09 at 2246 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: NYC02LA187	Aircraft Registration Number: N534US
Occurrence Date: 09/09/2002	Most Critical Injury: None
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
Baltimore	MD	21240	2246	EDT	

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

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Boeing	757-251	Airplane

Sightseeing Flight: No Air Medical Transport Flight: No

Narrative

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

On September 9, 2002, at 2246 eastern daylight time, a Boeing 757-251, N534US, operated by Northwest Airlines as flight 170, was substantially damaged when it experienced a tail strike while landing at Baltimore-Washington International Airport (BWI), Baltimore, Maryland. There were no injuries to the 2 certificated pilots, 4 flight attendants, and 97 passengers. Visual meteorological conditions prevailed for the scheduled passenger flight that originated from Minneapolis/St. Paul International Airport (MSP), Minneapolis, Minnesota. The flight was conducted on an instrument flight rules (IFR) flight plan under 14 CFR Part 121.

The departure, en route, and initial approach phases were reported to be without incident.

According to the captain's statement, the flightcrew had briefed for a visual approach to runway 33L, and made a right turn to the runway. However, the airplane was aligned with runway 33R. The flightcrew was advised by the control tower of their runway alignment. The first officer called for a go-around; however, the captain had runway 33L in sight, and elected to maneuver the airplane to that runway for landing. The captain further stated:

"...The approach was flown inbound at what looking back was a low altitude. We crossed the threshold at about one dot low on glide slope. At this point, the co-pilot again suggested a go-around, but I had become fixated on landing the AC. I felt I was in a position to land, so I added power to return to the glide slope, but when I retarded the power to correct, I pulled off too much power and did not properly arrest the sink and we landed very firmly...."

According to the first officer's statement:

"...With calling for a go-around, I made no 1,000 inst. normal call. As we approached final, I believe the aural warnings ceased. We rolled out on final, on speed, but still a little low. I called 200' to touchdown and felt we were still low for a normal flare and touchdown, so I again called for a go-around. As we crossed the threshold, the captain retarded the throttles to idle, higher than usual for a normal landing. This resulted in a very firm landing...."

The airplane was taxied to the gate where the passengers deplaned through the jetway.

According to data from Northwest Airlines, the aft pressure bulkhead was buckled, and subsequently repaired with the addition of stiffeners. In addition, a portion of the lower aft fuselage skin was replaced.

According to data from the Federal Aviation Administration (FAA), runways 33L and 33R were separated by about 4,600 feet. The published airport elevation was 146 feet, and the published touchdown zone elevation (TDZE) for runway 33L was 129 feet. The published heading for runway 33L was 335 degrees magnetic.

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FACTUAL REPORT
AVIATION

NTSB ID: NYC02LA187

Occurrence Date: 09/09/2002

Occurrence Type: Accident

Narrative (Continued)

Northwest Airlines supplied flight recorder data for the last 11 minutes of flight and subsequent ground operation. There was a data loss at the time of touchdown, and the pitch attitude and "g" load at touchdown were not available.

According to flight recorder data, about 50 seconds prior to touchdown, the airplane initially lined up on a heading near 335 degrees, at an altitude of about 500 feet above the touchdown zone elevation of runway 33L. The airplane then turned left and then right, while descending. The airplane lined up near a heading of 335 degrees about four seconds prior to touchdown, when according to the radar altimeter, the airplane was passing through about 50 feet above ground level (AGL).

The speedbrakes were extended when the pilot initiated the descent from 5,000 feet, and remained extended through the touchdown. When interviewed by Northwest Airlines safety personnel, the flight crew reported that they were not aware that the speedbrakes were still extended at touchdown.

The pitch attitude of the airplane 2 seconds prior to touchdown was 14.06 degrees nose up. At one second prior to touchdown, the pitch attitude was 11.25 degrees nose up. According to Northwest Airlines safety personnel, with the main landing gear struts compressed, the tail of a Boeing 757-251 would contact the runway at a pitch attitude of 10.5 degrees nose up.

On final approach, the airplane was flown below the glide slope for 1 minute, 47 seconds, and only passed above the glide slope, 1 second prior to touchdown.

According to Northwest Airlines, Flight Operations Manual (FOM), Section 9.2.2 Approach:

"A stabilized approach has the following criteria...the airplane is aligned with the intended landing runway prior to reaching a point 500 feet above the TDZE unless on a prescribed approach procedure.

According to the Northwest Airlines, FAA approved, Boeing 757, Aircraft Operating Manual (AOM):

"...When using speedbrakes the PF [pilot flying] should keep one hand on the speedbrake lever as a reminder to lower the speedbrakes when they are no longer required."

According to Northwest Airlines Boeing 757 Aircraft Operating Manual, the airplane was equipped with multiple caution and warning systems, including an aural caution for extension of the speed brakes, with the airplane in the landing configuration, and the radar altimeter indicating less than 800 feet. In addition, there was a verbal caution alert for glide slope deviations that was activated when the radar altitude was indicating less than 1,000 feet, and the airplane was more than 1.3 dots low on the glide slope.

The captain's total flight experience was about 7,500 hours, with 142 hours in the Boeing 757. His previous position was a Boeing 747 first officer. The captain reported that he had initially planned on having 7,200 pounds of fuel onboard upon arrival at Baltimore. However, with a delayed departure, and en route speed restrictions, the fuel reserve had decreased to about 5,800 pounds. The captain reported that he wanted to land with a minimum of 4,000 pounds of fuel onboard, and estimated the airplane would burn 2,000 pounds in the go-around. However, upon further questioning by personnel from the Northwest Airlines safety department, the captain said his estimates were based upon his previous Boeing 747 experience, and he admitted that the go-around could have been accomplished with less fuel burn than he had initially calculated.

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FACTUAL REPORT AVIATION

NTSB ID: NYC02LA187

Occurrence Date: 09/09/2002

Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
Baltimore-Washington Intl Arpt	BWI	146 Ft. MSL	33L	9519	150

Runway Surface Type: Asphalt

Runway Surface Condition: Dry

Type Instrument Approach: Visual

VFR Approach/Landing: Full Stop

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Boeing	757-251	24265

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	189	227500 LBS	2

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Fan	Pratt & Whitney	2037	37500 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Continuous Airworthiness	08/2002	327 Hours	47466 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
Northwest Airlines Inc.	5101 Northwest Drive	St, Paul	MN	55111

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: Northwest Airlines

Operator Designator Code: NWAA

- 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/Cargo

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: NYC02LA187

Occurrence Date: 09/09/2002

Occurrence Type: Accident

First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	49

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

Certificate(s): Airline Transport; Commercial; Flight Engineer

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? 06/2002

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--w/ waivers/lim. | Date of Last Medical Exam: 03/2002

- 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	7300	142								
Pilot In Command(PIC)	1033	142								
Instructor										
Last 90 Days										
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
Minneapolis	MN	MSP	1958	EDT

Destination	State	Airport Identifier
Same as Accident/Incident Location		BWI

Type of Clearance: IFR

Type of Airspace: Class B

Weather Information

Source of Briefing: Company

Method of Briefing: In Person

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: NYC02LA187

Occurrence Date: 09/09/2002

Occurrence Type: Accident

Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
BWI	2254	EDT	146 Ft. MSL	NM	Deg. Mag.

Sky/Lowest Cloud Condition: Ft. AGL

Condition of Light: Night/Dark

Lowest Ceiling: Broken 25000 Ft. AGL

Visibility: 10 SM

Altimeter: 30.00 "Hg

Temperature: 19 °C

Dew Point: 14 °C

Wind Direction:

Density Altitude: 582 Ft.

Wind Speed: Calm

Gusts:

Weather Condtions at Accident Site: Visual Conditions

Visibility (RVR): Ft.

Visibility (RVV) SM

Intensity of Precipitation:

Restrictions to Visibility: None

Type of Precipitation: None

Accident Information

Aircraft Damage: Substantial

Aircraft Fire: None

Aircraft Explosion None

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

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				2	2
Second Pilot					
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants				4	4
Other Crew					
Passengers				97	97
- TOTAL ABOARD -				103	103
Other Ground					
- GRAND TOTAL -				103	103

National Transportation Safety Board

FACTUAL REPORT
AVIATION

NTSB ID: NYC02LA187

Occurrence Date: 09/09/2002

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

Robert L. Hancock

Additional Persons Participating in This Accident/Incident Investigation:

Frank L Mohler
Aviation Safety Inspector
Federal Aviation Administration
Baltimore, MD

Michelle Messer
Air Safety Investigator
Northwest Airlines
St. Paul, MN