
Landing gear collapse on landing, Douglas DC-9-31, June 3, 2002

Micro-summary: The right main landing gear of this Douglas DC-9-31 collapsed on landing.


Event Date: 2002-06-03 at 1928 CDT

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

Investigative Body's Web Site: <http://www.nts.gov/>

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		NTSB ID: CHI02FA148		Aircraft Registration Number: N8986E	
		Occurrence Date: 06/03/2002		Most Critical Injury: None	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place Minneapolis		State MN	Zip Code 55401	Local Time 1928	Time Zone CDT
Airport Proximity: On Airport		Distance From Landing Facility: 1		Direction From Airport: 120	
Aircraft Information Summary					
Aircraft Manufacturer Douglas			Model/Series DC-9-31		Type of Aircraft Airplane
Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:					
HISTORY OF FLIGHT					
<p>On June 3, 2002, at 1928 central daylight time (cdt), a Douglas DC-9-31, N8986E, owned and operated by Northwest Airlines, sustained substantial damage when the right main landing gear (RMLG) collapsed during landing rollout on runway 12L (8,200 feet by 150 feet, concrete) at the Minneapolis-St. Paul International Airport (MSP), Minneapolis, Minnesota. The flight was being operated under the provisions of 14 CFR Part 121 as Northwest Airlines flight 877. Visual meteorological conditions prevailed at the time of the accident. The captain, first officer (FO), 2 flight attendants, and 66 passengers reported no injuries. The flight departed Louisville International Airport (SDF), Louisville, Kentucky, at 1836 eastern daylight time and was on an active instrument flight rules (IFR) flight plan.</p>					
<p>According to the captain's written statement, the FO was the flying pilot during the accident flight. The captain reported that the instrument landing system (ILS) runway 12L approach was flown on autopilot until approximately 1,000 feet above ground level (agl) when the airplane was below the overcast cloud layer. The remainder of the approach was hand-flown by the FO and the aircraft touched-down approximately 1,000 feet from the end of the runway. The captain reported, "The touchdown was smooth and on centerline. Both mains [main landing gear] touched the runway at the same time." The captain stated that the FO applied reverse thrust after the nose landing gear made contact with the ground. The captain reported that he took over control of the aircraft at approximately 60 knots and, "Immediately after my initial brake application the aircraft dropped sharply to the right and we began skidding down the runway with a continuous warning horn. I continued braking and the aircraft came to a stop on centerline with a significant right lean."</p>					
<p>According to the FO's written statement, "All aspects of the approach were normal and I disconnected the autopilot at 1,000[feet] msl [above mean sea level] when I reported seeing the runway and calling 'landing'. The final portion of the approach was normal and the touchdown was a smooth roll on with both mains touching down together." The FO reported, "I began normal braking below 100 knots and received a normal 80 knots callout from the captain at which time I began reducing the thrust reversing and at the 60 knot call completely stowed the reversers. As this was being done the captain told me he was joining me on the brakes and that he had control of the aircraft at which time I told him he had control of the aircraft. As this change was occurring I felt the brakes give an initial release followed by a hard tilt to the right with a continuous warning horn and I instinctively rode the controls with the captain until the aircraft came to a complete stop on centerline after about a 1,500 foot slide."</p>					
PERSONNEL INFORMATION					
<p>The captain was the holder of an airline transport pilot certificate with an airplane multi-engine land rating. The captain was type rated for the Douglas DC-9 aircraft. The captain's last medical</p>					
FACTUAL REPORT - AVIATION					
Page 1					

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: CHI02FA148

Occurrence Date: 06/03/2002

Occurrence Type: Accident

Narrative (Continued)

examination was conducted on May 15, 2002, and he was issued a first-class medical certificate with no limitations or restrictions.

According to company records, the captain had a total flight time of 8,043 hours, of which 884 hours were in the DC-9. The captain was reported to have flown 177 hours in the last 90 days and 8.0 hours in the last 24 hours. The captain's last currency checkride was satisfactorily completed in a Douglas DC-9 aircraft on January 01, 2002.

The FO was the holder of an airline transport pilot certificate with an airplane multi-engine land rating. The FO was not type rated for the Douglas DC-9 aircraft. The FO's last medical examination was conducted on July 24, 2001, and he was issued a first-class medical certificate with no limitations or restrictions.

According to company records, the FO had a total flight time of 1,844 hours, of which 1,844 hours were in the DC-9. The FO was reported to have flown 227 hours in the last 90 days and 8.0 hours in the last 24 hours. The FO's last proficiency check was satisfactorily completed in a Douglas DC-9 simulator on July 28, 2001.

AIRCRAFT INFORMATION

The aircraft was a Douglas DC-9-31, serial number 47402. The Douglas DC-9-31 is a low-wing monoplane of all-metal semi-monocoque construction. The DC-9-31 has fully cantilevered wings, a T-tail empennage, and is powered by two Pratt & Whitney JT8D-7B engines, each producing 14,000 lbs of thrust. The accident airplane was configured to accommodate a maximum of 100 passengers and an 8-person flightcrew. The Douglas DC-9-31 has a certified maximum takeoff weight of 108,000 lbs and a maximum zero fuel weight of 87,000 lbs.

The accident airplane was maintained by compliance with a Federal Aviation Administration (FAA) approved continuous airworthiness program and accumulated a total time of 75,241.57 hours at the time of the accident.

METEOROLOGICAL INFORMATION

A weather observation station located at MSP recorded the weather approximately 11 minutes after the accident as:

Observation Time: 1939 cdt
 Wind: 090 degrees magnetic at 9 knots
 Visibility: 9 statute miles
 Sky Condition: 1,200 feet agl overcast
 Temperature: 13 degrees Celsius
 Dew Point: 11 degrees Celsius
 Pressure: 29.89 inches of mercury

FLIGHT RECORDERS

The solid state flight data recorder (FDR), Fairchild model F1000, serial number 01787, was removed from the accident aircraft and sent to the National Transportation Safety Board's (NTSB) laboratory in Washington, D.C., for readout and evaluation. No anomalies were noted during the touchdown and rollout until the RMLG collapsed. Landing vertical g-force peaked at 1.176, a value that is within the acceptable limits for the aircraft. Landing lateral acceleration peaked at 0.056 g, a value that is within the acceptable limits for the aircraft.

The NTSB FDR Factual Report is included with the docket material associated with this investigation.

National Transportation Safety Board

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Narrative (Continued)

WRECKAGE AND IMPACT INFORMATION

The aircraft came to rest 5,220 feet from the runway 12L threshold and 10 feet right of the runway centerline. The outer-cylinder of the right main landing gear strut had fractured into two sections approximately 2 inches above the designed-fuse section of the strut assembly. The lower portion of the right main landing gear (including the wheels, brakes, and hub assembly) was impacted up into the right inboard flap assembly. The outboard 1/2 of the right wing had scraping damage through the lower wing skin and into the main spar and surrounding wing structure.

SURVIVAL ASPECTS

The captain reported that he decided that an evacuation of the aircraft was not necessary after being notified by the control tower that there was no fire and/or smoke observed coming from the airplane. Airport crash/rescue confirmed there was no fire and/or smoke coming from the airplane and instructed the captain to shutdown both engines and the auxiliary power unit (APU). The passengers and flightcrew departed the airplane via a portable stairway located at the forward galley left-side entrance. The passengers were transported from the accident site in buses provided by Northwest Airlines. According to airport crash/rescue records, all passengers and flightcrew personnel were clear of the airplane at 2010 cdt. The flightcrew and 66 passengers reported no injuries as result of the accident and/or post-accident activities.

TESTS AND RESEARCH

The right main landing gear strut assembly was disassembled at a Northwest Airlines maintenance facility. The fractured outer-cylinder was sent to the NTSB Materials Laboratory Division in Washington, D.C., for examination.

According to the NTSB Materials Laboratory Factual Report, the outer cylinder (part number 5925371-502) of the RMLG was fractured through the transition area above the fused section, with the fracture located approximately 19 inches from the upper end of the cylinder. The report states the overall fracture "initiated on the forward side of the cylinder in a 1.5 inch machined radius located just below the forward projecting arm for the forward trunnion fitting. This area was located about 2.5 inches above the reduced diameter structural fuse area of the outer cylinder."

The factual report noted the fracture initiation point "lies in the parting plane for the cylinder forging. The dark spot [fracture initiation point] was orientated transverse to the gear about 28 7/8 inches from the lower end of the cylinder." The fracture initiation point was a "semi-elliptical shape measuring 0.1889 inches wide and extending 0.110 inches into the cylinder." The fracture initiation point was sectioned for additional examination. According to the factual report, multiple inclusions and intergranular cracks were uncovered within the examined sample. The inclusions were mostly oxides of aluminum and calcium and some inclusions contained small sulfides of iron and manganese.

The report noted there were fracture features that were consistent with overstress separation "emanating from the dark spot [fracture initiation point] with mostly ductile dimple formations and some cleavage like features."

The complete NTSB Materials Laboratory Factual Report is included with the docket material associated with this investigation.

The outer-cylinder (part number 5925371-502, serial number FA117) had a total flight time of 71,665.47 hours, consisting of 67,467 cycles. The outer-cylinder accumulated 17,866 cycles, over 21,546.47 flight hours, since the last component overhaul. Eastern Airlines completed the last overhaul in 1988 and the next overhaul was projected to be completed December 2002. Northwest Airlines reported normal overhauls are completed every 20,000 cycles or 10 years.

National Transportation Safety Board

FACTUAL REPORT

AVIATION

SAFETY BOARD

NTSB ID: CHI02FA148

Occurrence Date: 06/03/2002


Occurrence Type: Accident


Narrative (Continued)

ADDITIONAL DATA/INFORMATION

The accident aircraft was released back to a representative of Northwest Airlines on June 5, 2002. The fractured main landing gear strut was released back to a representative of Northwest Airlines on August 26, 2002.

Parties to the investigation included the FAA, Northwest Airlines, The Boeing Company, Air Line Pilots Association (ALPA), and Aircraft Mechanics Fraternal Association (AMFA).

 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: CHI02FA148			
		Occurrence Date: 06/03/2002			
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Landing Facility/Approach Information					
Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
Minneapolis/St. Paul Intl	MSP	841 Ft. MSL	12	8200	150
Runway Surface Type: Concrete					
Runway Surface Condition: Dry					
Type Instrument Approach: ILS-complete					
VFR Approach/Landing: None					
Aircraft Information					
Aircraft Manufacturer		Model/Series		Serial Number	
Douglas		DC-9-31		47402	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 108	Certified Max Gross Wt.	108000 LBS	Number of Engines: 2	
Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:		
Turbo Fan	Pratt & Whitney	JT8D-7B	14000 LBS		
- Aircraft Inspection Information					
Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time		
Continuous Airworthiness		Hours	75241.6 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed? No	ELT Operated? No	ELT Aided in Locating Accident Site? No			
Owner/Operator Information					
Registered Aircraft Owner		Street Address			
Northwest Airlines, Inc.		5101 Northwest Drive			
		City	State	Zip Code	
		St. Paul	MN	55111	
Operator of Aircraft		Street Address			
Same as Reg'd Aircraft Owner		Same as Reg'd Aircraft Owner			
		City	State	Zip Code	
Operator Does Business As:			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 Only					
FACTUAL REPORT - AVIATION					

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: CHI02FA148
	Occurrence Date: 06/03/2002
	Occurrence Type: Accident

First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 46
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Sex: M	Seat Occupied: Left	Principal Profession: Civilian Pilot	Certificate Number: On File
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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? 01/2002
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Medical Cert.: Class 1	Medical Cert. Status: Valid Medical--no waivers/lim.	Date of Last Medical Exam: 05/2002
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- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air
						Actual	Simulated			
Total Time	8043	884								
Pilot In Command(PIC)										
Instructor										
Last 90 Days	177									
Last 30 Days										
Last 24 Hours	8									

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? No	Second Pilot? Yes
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Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point Louisville	State KY	Airport Identifier SDF	Departure Time 1836	Time Zone EDT
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Destination Same as Accident/Incident Location	State	Airport Identifier MSP	
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Type of Clearance: IFR

Type of Airspace: Class B

Weather Information

Source of Briefing: Company


Method of Briefing: Unknown

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: CHI02FA148
	Occurrence Date: 06/03/2002
	Occurrence Type: Accident

Weather Information					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
MSP	1939	CDT	841 Ft. MSL	NM	Deg. Mag.
Sky/Lowest Cloud Condition:				Ft. AGL	Condition of Light: Dusk
Lowest Ceiling: Overcast			1200 Ft. AGL	Visibility: 9 SM	Altimeter: 29.89 "Hg
Temperature: 13 °C	Dew Point: 11 °C	Wind Direction: 90		Density Altitude: 837 Ft.	
Wind Speed: 9	Gusts:	Weather Conditions 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				1	1
Second Pilot				1	1
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants				2	2
Other Crew					
Passengers				66	66
- TOTAL ABOARD -				70	70
Other Ground					
- GRAND TOTAL -				70	70

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	Occurrence Date: 06/03/2002
	Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)
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