Nose gear collapse on landing, McDonnell Douglas DC-9-82, September 1, 1997

Micro-summary: **This September 1, 1997 experienced a collapse of the nose landing gear on landing.**

Event Date: **1997-09-01 at 2110 PDT**

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

FACTUAL REPORT AVIATION

NTSB ID: SEA97FA202	Aircraft Registration Number: N951AS
Occurrence Date: 09/01/1997	Most Critical Injury: Minor
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
SEATTLE	WA	98188	2110	PDT	

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

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
McDonnell Douglas	DC-9-82 (MD-82)	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

On September 1, 1997, at 2110 Pacific daylight time, N951AS, a McDonnell-Douglas DC-9-82 (MD-82), operating as Alaska Airlines flight 255 from Los Angeles, California, to Seattle, Washington, sustained substantial damage when its nose landing gear collapsed during landing roll-out on runway 16L at Seattle-Tacoma International Airport. The two flight crewmembers and three flight attendants were uninjured. Seventeen of the 111 passengers incurred minor injuries during the emergency evacuation commanded by the captain after the airplane slid to a stop. There was no fire.

According to the flight crewmembers, the airplane had departed Los Angeles, California with no indication of vibration or other abnormality. The flight was uneventful until the landing gear was extended and the nose landing gear warning light indicated an unsafe landing gear indication. At that time, the crew initiated a go-around (retracting the landing gear), climbed to a safe altitude in safe airspace, and then completed appropriate checklists in an attempt to obtain a safe gear-down indication with the landing gear extended. After completing appropriate checklists, the mechanical nose landing gear position indicator indicated that the nose landing gear was extended in a down and locked position, while the light continued to indicate an unsafe condition. The crew elected to land, and requested emergency equipment standing by.

The captain stated that he landed the airplane smoothly; at about 60 knots indicated airspeed, the nose settled onto the runway and the airplane slid to a stop. The airplane slid about 1300 feet and drifted slightly to the right of centerline. He commanded an evacuation. All slides were deployed manually and the passengers evacuated quickly.

During the course of recovering the airplane from the runway, it was determined that the nose landing gear upper lock link, part number 3914464-503, had failed, separating into two pieces. This item, which is subject to recurring non-destructive testing every 5000 cycles according to AD 97-02-10, had undergone an eddy current inspection 1075 cycles previous to the accident. This part was one of a series manufactured from plate stock, rather than being forged. Due to this changed process, according to the aircraft manufacturer, the lack of draft angle allowances on the machined parts reduced the load-carrying cross sectional area of the machined links to less than that of the forged links, resulting in a decrease in the overall strength. Metallurgical analysis revealed that approximately 10,000 major fatigue progression cycles had occurred within about .6 inches of the crack progression. Based upon the manufacturer's determination that there are two major stress cycles per gear retraction/extension cycle, the expected crack length 1075 cycles prior to the accident would have been greater than .25 inches.

The Safety Board determined that there have been seven cracked or fractured upper lock links reported; all have RM serial numbers indicating that they came from Ready Machine, a now-defunct supplier to the airplane manufacturer.

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AVIATION

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Occurrence Type: Accident

Narrative (Continued)

INJURIES TO PERSONS

Nineteen individuals sustained minor injuries during the evacuation, including three with neck or back pain or spasms, some knee injuries, and one with a sprained ankle.

FLIGHT RECORDERS

The flight data recorder readout for the approach, landing, and landing rollout is attached.

WRECKAGE AND IMPACT INFORMATION

The airplane was inspected on-scene. The cockpit switches and controls were found to be secured. Their positions were not recorded. The cockpit crew side windows were open and the cockpit door was locked. During interviews, the flight crew noted that after calling for evacuation, they had evacuated out the cockpit windows.

Damage included nose gear doors, skin scraping, and a wrinkled forward pressure bulkhead. During the course of on-scene investigation, it was noted that the jump seat at the mid-cabin flight attendant position was not retracted. The flight attendant at that duty station at the time of the accident noted that she did not notice that anomaly until after the evacuation was completed, and noted that it did not hamper the evacuation.

TESTS AND RESEARCH

The nose landing gear upper lock link, P/N 3914464-503, s/n RM 486, was analyzed by the material laboratory division of the NTSB. The metallurgist's factual report is attached.

The inspection procedure and process provided by the airframe manufacturer does not specify removal of the upper lock link from the aircraft prior to recurring non-destructive tests (NDT). During the course of investigation, NTSB investigators and FAA inspectors observed that access to the upper lock link for NDT is limited when the part remains installed in the airplane.

ADDITIONAL INFORMATION

The aircraft was moved from the scene to the Alaska Airlines maintenance facility at SEATAC airport on the night of the accident. The Safety Board did not take possession of the wreckage.

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Occurrence Date: 09/01/1997

Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
SEATTLE-TACOMA INTL	KSEA	420 Ft. MSL	16L	11900	150

Runway Surface Type: Asphalt

Runway Surface Condition: Dry

Type Instrument Approach: NONE

VFR Approach/Landing: Full Stop

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
McDonnell Douglas	DC-9-82 (MD-82)	49111

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	138	149500 LBS	2

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Fan	P&W	JT8D-217	20800 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
AAIP	08/1997	Hours	45378 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?

Owner/Operator Information

Registered Aircraft Owner	Street Address	City	State	Zip Code
INTEGRATED AIRCRAFT SERVICES	10 UNION SQUARE EAST	NEW YORK	NY	10003

Operator of Aircraft	Street Address	City	State	Zip Code
ALASKA AIRLINES	BOX 68900	SEATTLE	WA	98168

Operator Does Business As:

Operator Designator Code: ASAA

- 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

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: SEA97FA202

Occurrence Date: 09/01/1997

Occurrence Type: Accident

First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	47

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

Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): Instrument Airplane

Type Rating/Endorsement for Accident/Incident Aircraft? Yes | Current Biennial Flight Review?

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--w/ waivers/lim. | Date of Last Medical Exam: 03/1997

- 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	27388	1491	800							
Pilot In Command(PIC)	18068	1306	100							
Instructor										
Last 90 Days	222	222								
Last 30 Days	69	69								
Last 24 Hours	5	5								

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
LOS ANGELES	CA	KLAX	1821	PDT

Destination	State	Airport Identifier	
Same as Accident/Incident Location		KSEA	

Type of Clearance: IFR

Type of Airspace: Class B

Weather Information

Source of Briefing: Company

Method of Briefing:

National Transportation Safety Board

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Occurrence Date: 09/01/1997

Occurrence Type: Accident

Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
	0000		0 Ft. MSL	0 NM	0 Deg. Mag.

Sky/Lowest Cloud Condition: Clear 0 Ft. AGL

Condition of Light: Night/Dark

Lowest Ceiling: Broken 3800 Ft. AGL

Visibility: 10 SM

Altimeter: 30.00 "Hg

Temperature: 19 °C

Dew Point: 13 °C

Wind Direction: 220

Density Altitude: Ft.

Wind Speed: 6

Gusts:

Weather Condtions at Accident Site: Visual Conditions

Visibility (RVR): 0 Ft.

Visibility (RVV) 0 SM

Intensity of Precipitation: Unknown

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				3	3
Other Crew					
Passengers			19	92	111
- TOTAL ABOARD -			19	97	116
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	19	97	116

National Transportation Safety Board

FACTUAL REPORT AVIATION

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Occurrence Date: 09/01/1997

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

MICHAEL L. STOCKHILL

Additional Persons Participating in This Accident/Incident Investigation:

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