Complete hydraulic failure, McDonnell-Douglas DC-9-82, september 2, 1993

Micro-summary: **This McDonnell-Douglas DC-9-82 experienced a total hydraulic failure while taxiing to the gate, which led it to coast to a stop in the rough.**

Event Date: **1993-09-02 at 1203 CDT**

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: CHI93IA352	Aircraft Registration Number: N918TW
Occurrence Date: 09/02/1993	Most Critical Injury: None
Occurrence Type: Incident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
ST. LOUIS	MO	63145	1203	CDT	

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	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 2, 1993, at 1203 central daylight time, a McDonnell-Douglas DC-9-82, N918TW, operated by Trans World Airlines, Incorporated, as Flight 359, experienced a total hydraulic failure while taxiing to the parking gate after landing. The 14 CFR Part 121 flight had been operating on an IFR flight plan. Visual meteorological conditions prevailed at the time of the incident. The pilot, three flight attendants, and 103 passengers were not injured. The flight originated from New York, New York, at 1026 eastern daylight time.

The captain on Flight 359 stated: "At approximately 700 AFE I completed the landing check list and noted that there were no warning lights illuminated on the annunciator panel. Touchdown and initial roll-out were normal and F/O Harski initiated proper reverse and braking techniques slowing the aircraft to approximately 65 knots." The captain said he took control of the aircraft at this time and continued braking the aircraft.

When the airplane was slowed to four to five knots, the captain said he attempted to turn the airplane's nose wheel to exit the runway. "...I attempted to turn the nose wheel steering wheel to exit the runway but found that it was extremely difficult to turn." He stated he was able to turn the aircraft to a 45 degree angle to the runway heading. The captain said he "...found out that not only could I not turn the aircraft any further to the left but also I could not straighten out the nosewheel." The pilot stated he applied brakes and found them not available. He said, "I applied full left rudder in hope this would further turn the airplane so that I could position the airplane..." on the taxiway.

The airplane turned back onto the taxiway and the pilot attempted to use reverse thrust to stop it. Reverse thrust did not stop the airplane and it rolled off the edge, coming to a stop in the grass area adjacent to the taxiway.

According to the captain, he and the first officer confirmed "...that the hydraulic gauges indicated that both left and right reservoirs had sufficient fluid in them to provide hydraulic pressure. We also confirmed that all four hydraulic pumps were on."

The on-scene investigation revealed the power transfer unit (PTU) made the hydraulic system pressure go to zero when it was opened while operating on the left or right hydraulic system. Closing the PTU returned the hydraulic system to normal. Examination of the PTU housing revealed it was cracked around its entire circumference. Hydraulic fluid had not leaked from the crack in the unit.

A November 9, 1992, Allied-Signal Aerospace Company service bulletin that applied to N918TW recommended the PTU's cast aluminum housings be replaced with a wrought iron housing due to previous unit housing cracking history. N918TW's PTU was the cast aluminum type.

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID:	CHI93IA352
Occurrence Date:	09/02/1993
Occurrence Type:	Incident

Narrative (Continued)

A McDonnell-Douglas service bulletin addressed procedures to handle low hydraulic pressure with the system annunciator lights illuminated. According to the flight crew, the system annunciator lights were not illuminated. The company's maintenance personnel performed an operational check of the annunciator panel. The check showed the system annunciator lights were functional.

The NTSB's Materials Laboratory Division examined the PTU housing. The report states: "Visual examination of the housing fracture surface indicated that the fracture was brittle and had no evidence of plastic deformation." The housing's fatigue fracture covered approximately 270 degrees of the circumference. The remaining portion of the fracture was typical of overstress separation. Examination revealed that in some areas the fatigue features stemmed from large shrinkage cavities. The metallurgists report states: "However, the vast majority of the fatigue crack origins were associated with large inclusions, which were identified as silicon inclusions... ."

The Allied Signal and McDonnell-Douglas service bulletins are appended to this report. The NTSB's Materials Laboratory Division metallurgist's report is appended to this report.

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: CHI93IA352

Occurrence Date: 09/02/1993

Occurrence Type: Incident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
LAMBERT-ST. LOUIS INT'L	STL	605 Ft. MSL	30R	11019	200

Runway Surface Type: Concrete

Runway Surface Condition: Dry

Type Instrument Approach:

VFR Approach/Landing: Full Stop

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
MCDONNELL DOUGLAS	DC-9-82	49367

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	132	140000 LBS	2

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Jet	GE	JT8D-209	18500 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
AAIP		Hours	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
TWA, INC.	100 S. BEDFORD ROAD	MT. KISCO	NY	10549

Operator of Aircraft	Street Address	City	State	Zip Code
TWA, INC.	100 S. BEDFORD ROAD	MT. KISCO	NY	10549

Operator Does Business As:

Operator Designator Code: TWAA

- 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: CHI93IA352

Occurrence Date: 09/02/1993

Occurrence Type: Incident

First Pilot Information

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

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

Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land

Rotorcraft/Glider/LTA:

Instrument Rating(s): Airplane

Instructor Rating(s): None

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

Medical Cert.: Class 1 | Medical Cert. Status: Unknown | Date of Last Medical Exam: 03/1993

- 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	11992	3878								
Pilot In Command(PIC)										
Instructor										
Last 90 Days	137									
Last 30 Days	37									
Last 24 Hours	5									

Seatbelt Used? | Shoulder Harness Used? | Toxicology Performed? No | Second Pilot? Yes

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
NEW YORK	NY	LGA	1029	EDT

Destination	State	Airport Identifier
Same as Accident/Incident Location		STL

Type of Clearance: IFR

Type of Airspace: Class B; Class D; Class E

Weather Information

Source of Briefing: Commercial Weather Service; Flight Service Station

Method of Briefing:

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: CHI93IA352

Occurrence Date: 09/02/1993

Occurrence Type: Incident

Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
STL	1251	CDT	605 Ft. MSL	0 NM	0 Deg. Mag.

Sky/Lowest Cloud Condition: Scattered 3300 Ft. AGL

Condition of Light: Not Reported

Lowest Ceiling: Broken 4000 Ft. AGL

Visibility: 8 SM

Altimeter: 29.00 "Hg

Temperature: 29 °C

Dew Point: 22 °C

Wind Direction: 210

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:

Type of Precipitation:

Accident Information

Aircraft Damage: None

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				103	103
- TOTAL ABOARD -				108	108
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	108	108

National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: CHI93IA352

Occurrence Date: 09/02/1993

Occurrence Type: Incident

Administrative Information

Investigator-In-Charge (IIC)

FRANK S. GATTOLIN

Additional Persons Participating in This Accident/Incident Investigation:

ROBERT E MULVANEY
FAA - FSDO
KANSAS CITY, MO 64153