In-flight fire, McDonnell Douglas DC-9-82, November 29, 2000

Micro-summary: **This McDonnell Douglas DC-9-82 experienced an in-flight fire following a lightning strike.**

Event Date: **2000-11-29 at 1753 EST**

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: IAD01IA017	Aircraft Registration Number: N3507A
Occurrence Date: 11/29/2000	Most Critical Injury: None
Occurrence Type: Incident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
DULLES	VA	20166	1753	EST	

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 November 29, 2000, about 1753 Eastern Standard Time, a McDonnell Douglas DC-9-82 (MD-80), N3507A, operated by American Airlines as flight 1683, sustained minor damage from an in-flight fire that began shortly after take off from Ronald Reagan-Washington National Airport (DCA), Washington, DC. The 2 certificated airline transport pilots, 3 flight attendants, and 61 passengers were not injured. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the flight destined for Dallas/Fort Worth International Airport (DFW), Dallas, Texas. The scheduled passenger flight was conducted under 14 CFR Part 121.

The flight crew declared an emergency, and landed uneventfully at Washington Dulles International Airport (IAD), Dulles, Virginia, at 1823. An emergency evacuation was conducted on the runway without incident.

In a written statement, the captain stated:

"Normal take-off from runway 19 at DCA. Weather conditions were light rain with winds 210/8. Climbing through 9-10,000 feet radar displayed light rain with scattered areas of moderate rain. As we continued our climb, there was a bright flash/static discharge on the left side of the aircraft. There were no indications of any malfunctions in the cockpit. We began to notice a smell that we believed was electrical in nature. Shortly thereafter, the number one flight attendant notified me of smoke coming out of an overhead florescent light fixture. I directed her to turn off all of the overhead lighting and keep me advised of the situation in the cabin. After she turned off all of the lights, she informed me the smoke appeared to be dissipating. In a few moments, she notified me the smoke was beginning to increase in the forward section of the coach cabin. We declared an emergency, requested radar vectors to Dulles and notified ATC to have ARFF [airport rescue and fire fighting] available. On approximately a 20-mile final, a flight attendant notified me they were using the fire extinguisher on an overhead panel in the coach cabin. I immediately notified the flight attendants to prepare the aircraft for evacuation. We notified Dulles we would be evacuating. Flight landed 19R. Evacuation of passengers and crew was successfully completed."

In a written statement, the lead flight attendant (FA) said:

"Shortly after take-off, I heard a loud boom and saw a flash of light. The FA 2&4 called me. I said I thought the plane had been struck by lightning. I called the cockpit and they said we had static electricity. Soon thereafter, smoke started coming out of the fluorescent lighting in the [forward] entry areas. I turned the light off and called the cockpit. They said they believed the smoke was caused by ballast and that it was unrelated to the static electricity. A minute later smoke started coming out of the ceiling compartments in the front of the coach cabin. I opened the cockpit door to tell the captain and he said we were headed to Dulles for an emergency landing, we would be there in 10 minutes, and the evacuation signal would be 'easy victor.' He told me to

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Narrative (Continued)

prepare the cabin, and as we were doing so, the smoke got thicker. I called [name] and [name] and told them to come to the front of the coach cabin with their fire extinguishers. A passenger cut a hole in the ceiling and we used our fire extinguishers to extinguish the smoke. We never saw flames. The smoke became thicker at one point. When our captain told us to take our seats, I made an announcement briefing our passengers on our emergency landing procedures, I also asked four passengers to help at the bottom of the slides. When we landed and came to a complete stop the captain said 'easy victor.' The evacuation went really well."

The airplane was examined at IAD on November 29 and 30, 2000. Assisting the Safety Board in the on-scene examination were representatives from the Federal Aviation Administration (FAA), and American Airlines (AA).

Initial examination of the airplane's interior revealed that airport rescue and fire fighting (ARFF) personnel had removed the overhead panels between rows 7AB and 11AB. The interior framework of the fuselage was exposed, and covered with yellow insulation blankets. The ribs of the fuselage and ducting separated the blankets. The insulation consisted of fiberglass, overlaid by a layer of metallized Mylar. Examination of the insulation in the area between rows 7AB and 11AB revealed that the coating of metallized Mylar had burned away over a majority of the area, with the edges of the Mylar charred. The surface of the insulation was soot and fire damaged. The insulation above row 8AB exhibited the most fire damage, and extended from the air conditioning duct down to the top of the window frames.

The eyebrow panels were removed, and the overhead bins were dropped. The insulation was removed and the fuselage wall was examined. The fire did not extend to the exterior wall of the fuselage, except in a contained area above row 8AB. However, no discoloration of the metal was noted.

The top section of the overhead bins was burned, but there was no damage to the interior of the bins. One of the overhead bin support brackets was discolored from heat damage. The backside of the eyebrow panel for row 7AB was also burned. The ballast lights in the overhead bins for rows 7AB through 11AB, were intact and appeared undamaged.

Further examination of the area above rows 7AB through 11AB found two mechanically cut cables installed in the ceiling. Also, a 1-inch wide wire bundle ran along the top of the overhead bins. The wire bundle exhibited localized areas of soot and heat damage.

Markings, consistent with lightning interaction, were located on the airplane's exterior; the forward right fuselage, the right wing tip, and the tail cone fairing.

Along the right side of the fuselage, 1 to 5-inch long tracks were embedded into the airplane's skin. The tracks began at the radome, moved in a downward direction, and then swept back up toward the window line and ended at the right wing.

The strobe light's plastic housing on the right wing tip was burned, melted, and stretched.

The tail cone fairing was composed of composite material, and was damaged externally and internally on both the left and right sides. On the left side, a burn hole about 1/4-inch wide was noted about 6 inches from the trailing edge of the fairing. A faint exhaust trail was visible from the aft section of the hole back to the trailing edge of the fairing. On the right side of the fairing, and opposite of the hole on the left side, was a small section of cracked composite material. About 4 inches forward of that damage was a 3-inch long by 1/2-inch wide section of exposed composite material, with imbedded dark pinholes.

The tail cone fairing was removed, and the internal wall of the fairing was examined. The examination revealed that there were two darkened circular areas located around both external penetrations.

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Narrative (Continued)

An Omega antenna system was supported by a bracket and housed inside the tail cone fairing. The antenna system consisted of the antenna box and two coaxial cables. Only one of the cables was connected at the back of the antenna box, and the other cable, a spare, was secured to the base of the support bracket. A pencil-sized burn hole was located on the connected cable, about 1 foot from the attached fitting. The protective insulation on the cable was melted, and the area around the hole was covered with soot.

The front end of the antenna housing was raised off of the support bracket. On the front left face of the housing was a small circular burn mark. The housing was cracked from the burn mark up to the top of the left front corner and back along the top left edge of the housing. Soot was found along the seams of the crack.

Both cables were tie-wrapped together, turned 180 degrees, and fed through the center of the support bracket toward the front of the fuselage. Both cables ran parallel to each other and were clamped to support fasteners along the left side of the fuselage between the air conditioning duct and overhead bins. The space between the two cables was about 1-inch. The cables were installed between the interior side of the insulation and overhead ceiling panels. The cables ended at row 7AB and had dropped from their fastener that had melted in the fire. Examination of the cables revealed that both cables had been mechanically cut and were heavily sooted near the ends. There was no protective coating or capping on either of the open ends. Rounding of the wire ends were noted on both cables.

When the cables were held up to the fastener, the two open ends of the cables were parallel to each other above row 7AB (station 446). To the right of the cable ends, the insulation was burrowed and crater shaped.

According to an American Airline systems engineer, the Omega antenna system had been deactivated, so a more advanced global positioning system (GPS) could be installed. Engineering change order (ECO) K2084EX, titled: Omega Antenna Cable Removal and GPS Antenna Cable Installation outlined the process and procedures for this modification. According to the ECO, the process to remove and discard the Omega antenna cables depended on which maintenance checks the airplane was scheduled for. During a Heavy C-check, the cables were to be removed from the fuselage. If the airplane was scheduled for a "mod-line" or special visit, the ECO stated,

"Cut the Omega antenna cables in the cabin overhead near fuselage station 420. Remove and discard the cables between station 420 and the radio racks. The aft portion of the cable will stay in the aircraft until the next heavy C-check. Cover and stow the cut cables in the cabin with heat shrink tubing or other suitable material."

According to representative of American Airline's safety department, 57 of the 259 MD-80 airplanes operated by the company had undergone partial removal of the Omega antenna cables, and 21 airplanes still had the full Omega antenna system installed (total 78 aircraft). The other 181 aircraft had already undergone a complete removal of the Omega antenna system.

ECO 2398XX was developed and implemented by American Airlines on December 7, 2000. ECO 2398XX stated:

"This ECO isolates the Omega antenna and cables in the empennage from the antenna cable in the cabin on 78 MD-80 aircraft. These 78 aircraft have either full or partial Omega antenna cables installed. The cable, which runs down the vertical stabilizer, is cut and grounded to structure in the aft accessory compartment. A portion of the cable, which runs through the aft pressure bulkhead, is removed and the feed through is sealed. The intent of this action is to protect the cable in the cabin from lightening damage."

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Narrative (Continued)

According to a representative of American Airline's safety department, as of December 22, 2000, 76 aircraft were modified in the field. Two aircraft underwent the modification prior to release from a C-check in Tulsa, Oklahoma, on January 3 and 11, 2001.

Weather at DCA at 1751 was wind from 200 degrees at 10 knots, visibility 7 statute miles in light rain, ceiling broken at 4,000 feet, overcast at 8,000 feet, temperature 8 degrees C, dew point 3 degrees C, and altimeter 30.00 inches of mercury.

Weather at DCA at 1851 was wind calm, visibility 8 miles, few clouds at 5,000 feet, ceiling overcast at 8,000 feet, temperature 7 degrees C, dew point 4 degrees C, and altimeter 29.96 inches of mercury. There were remarks that a thunderstorm began at 1754 and ended at 1833, with the rain ending at 1839.

There were no SIGMETS or Center Weather Advisories current at the time. However, convective SIGMET 16E was issued at 1655 and was valid until 1855 for sections of West Virginia and Virginia. The area included the locations from 60 miles northwest of Cassanova, Virginia (CSN), to 50 miles east-northeast of Beckley, West Virginia (BKW). A line of thunderstorms 15 miles wide was moving from 270 degrees at 30 knots, with tops to 26,000 feet. The convective outlook from 1855 to 2255 indicated that a line of low-topped thunderstorms would continue along the cold front and move rapidly eastward with the front. Weak instability, aided by moderate to strong mid- and upper level features (trough), supported the development.

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Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
DULLES INTERNATIONAL	IAD	313 Ft. MSL	19R	11501	150

Runway Surface Type: Asphalt

Runway Surface Condition: Wet

Type Instrument Approach: ILS-complete

VFR Approach/Landing: Precautionary Landing

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
McDonnell Douglas	DC-9-82	49801

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	172	161000 LBS	2

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Fan	P&W	JT8D	

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Continuous Airworthiness		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
AMR CORPORATION		DALLAS/FT.WORTH	TX	75261

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: AMERICAN AIRLINES

Operator Designator Code: AALA

- Type of U.S. Certificate(s) Held: None

Air Carrier Operating Certificate(s):

Operating Certificate:

Operator Certificate:

Regulation Flight Conducted Under: Part 121: Air Carrier

Type of Flight Operation Conducted: Scheduled; Domestic; Passenger Only

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First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File		43

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

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?

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--no waivers/lim. | Date of Last Medical Exam: 09/2000

- 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	11000	5528								
Pilot In Command(PIC)	8000									
Instructor	1000									
Last 90 Days		209								
Last 30 Days		62								
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
WASHINGTON DC	VA	DCA	1749	EST

Destination	State	Airport Identifier
DALLAS/FT WORTH	TX	DFW

Type of Clearance: IFR

Type of Airspace: Class B

Weather Information

Source of Briefing: National Weather Service

Method of Briefing:

National Transportation Safety Board

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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
DCA	1751	EST	15 Ft. MSL	5 NM	200 Deg. Mag.

Sky/Lowest Cloud Condition: Unknown 0 Ft. AGL

Condition of Light: Night/Dark

Lowest Ceiling: Broken 4000 Ft. AGL

Visibility: 7 SM

Altimeter: 30.00 "Hg

Temperature: 5 °C

Dew Point: 0 °C

Wind Direction: 200

Density Altitude: Ft.

Wind Speed: 10

Gusts:

Weather Condtions at Accident Site: Instrument Conditions

Visibility (RVR): 0 Ft.

Visibility (RVV) 0 SM

Intensity of Precipitation: Unknown

Restrictions to Visibility: None

Type of Precipitation: Rain

Accident Information

Aircraft Damage: Minor

Aircraft Fire: In-flight

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				61	61
- TOTAL ABOARD -				66	66
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	66	66

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Administrative Information

Investigator-In-Charge (IIC)

LEAH D. YEAGER

Additional Persons Participating in This Accident/Incident Investigation:

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APFA
DALLAS, TX