Severe windshear, McDonnell Douglas DC-9-82 (MD-82), June 5, 1996

Micro-summary: **This McDonnell Douglas DC-9-82 experienced severe windshear on landing.**

Event Date: **1996-06-05 at 1703 MDT**

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

Investigative Body's Web Site: **http://www.ntsb.gov/**

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National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: FTW96IA237	Aircraft Registration Number: N224AA
Occurrence Date: 06/05/1996	Most Critical Injury: Minor
Occurrence Type: Incident	Investigated By: FAA

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
ALBUQUERQUE	NM	87100	1703	MDT	

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:

On June 5, 1996, at 1703 mountain daylight time (ATC data), a McDonnell Douglas MD-82, N224AA, registered to Wilmington Trust, and operated as Flight 873 by American Airlines as a Title 14 CFR Part 121 domestic passenger flight sustained minor damage, during a hard landing on runway 17 at the Albuquerque International Airport, Albuquerque, New Mexico. Visual meteorological conditions prevailed and the flight was cleared for a visual approach. Three of the crew, 136 passengers, one occupant on the cockpit jumpseat, and one occupant on a cabin jumpseat were not injured. Two flight attendants and 3 passengers received minor injuries. The flight originated from Dallas/Fort Worth Airport, Texas.

On the enclosed statements, flight attendants (FA) reported that the "tail of the plane hit hard on the ground the seats #30EF broke backwards when we hit." Sore necks were reported by a passenger in seat 30F, FA #4, and the FA on the cabin junpseat. Two passengers at the row 12 seats reported back and neck pain.

During a telephone interview, conducted by the investigator-in-charge, and on the enclosed statements, two injured passengers reported that the airplane was "not over the end of the runway and began to drop quite fast. It seemed we dropped 15 to 20 feet, the rear of the airplane hit first, extremely hard, on the first 30 to 40 feet of the runway. The plane then pitched forward and hit on the main landing gear." The captain announced that "we had hit a wind shear just as we were coming in and that it had reduced our speed by 30 knots." The passenger further reported that he noted "a small dust devil just off the runway to our left as we were about to hit. It was just barely moving. There appeared to be no harsh or heavy wind or windshe[a]r affecting it."

Following the incident, an FAA airworthiness inspector examined the aircraft and reported that the aircraft was properly configured for the landing. The inspector stated that the crew "immediately employed windshear procedures, but the aircraft had reached a highly critical point in the landing." Examination of the aircraft by company maintenance personnel and the FAA inspector (enclosed statement) revealed that the aft lower skin area, an antenna, and the tail skid sustained damage. The inspector reported the cabin seats at aisle 30 collapsed aft and company personnel reported that the seatback's support tube had broken. The runway asphalt received a groove approximately 6 inches wide, 4 inches deep, and approximately 50 feet long.

During interviews, conducted by the investigator-in-charge, and on the enclosed statements, company personnel reported that on short final there was a "loss of airspeed and a cockpit oral warning for windshear." Windshear recovery procedures were initiated; however, the tail of the airplane struck the runway.

The captain reported (statement enclosed) that "final approach was normal until reaching an altitude of approximately 200 ft AGL, when the bottom seemed to fall out, i. e., sink uncontrollably." The captain stated that "based on a Vref of 134 kts we set a target airspeed of

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144 kts." The captain recalled that "virga was observed several miles east of the airport, generally over the mountains but at no time was virga observed near the airport nor did ATC or any other aircraft alert us to windshear related activities." The captain further noted that "no extra airspeed was added in anticipation of any unusual weather. Upon recognizing the windshear, the captain "immediately pushed the throttles full forward (firewall) while my first officer simultaneously called for power."

The first officer reported (statement enclosed) that "an altitude of 200-300 feet AGL, we encountered a windshear which caused us to lose approximately 20 to 30 knots in a few seconds." The first officer recalled "a windshear light, an aural windshear alert, and an FMA windshear annunciation after" the windshear encounter.

American Airlines DC-9 Operating Manual (copy enclosed), in the section entitled "Windshear on Landing;" stipulates that when the Windshear Alerting and Guidance System (WAGS) cockpit warning for windshear activates, the following procedures are required without delay:

THRUST-MAX[IMUM] AVAILABLE; PITCH-AS REQUIRED; CONFIGURATION-MAINTAIN; ATC-ADVISE.

Company personnel reported that the recovery procedures per the operating manual (copy enclosed) required the crew to apply maximum available thrust and simultaneously pitch toward 15 degrees "nose up." Company personnel further reported that the airplane was "too low for the crew to attain an airplane attitude of 15 degrees pitch prior to the airplane striking the runway."

The last recurrent crew training was received by the captain on May 28, 1996, and by the first officer on March 16, 1996. Training was conducted in accordance with the American Airlines windshear program and the landing training included a windshear scenario at .5 mile from touchdown with a 7 knot/second decrease in airspeed. The flight crew training syllabus included as identifiers of dry microburst (copy enclosed) the following: virga, visual cues, and a 30 degree to 50 degree temperature/dew point spread.

American Airlines Flight Manual (Part 1, Section 12, Paragraph 8. WINDSHEAR) states in part:

unexpected changes in wind speed and direction can be hazardous to aircraft at low altitudes on approach to and departing from airports.

The air traffic control regional system specialist reported (statement enclosed) that the Albuquerque ATC facility Low Level Windshear Alert System (LLWAS) was functional and did not indicate windshear at the time of the accident. Immediately after the incident, two technicians, who carry LLWAS certification authority, performed a line check of the system using a calibration voltage, with all results within tolerance. The National Weather Service (NWS) ASOS recorded the following weather: at 1655 a temperature of 96 degrees Fahrenheit with a dew point of 15 degrees Fahrenheit and peak winds from 260 degrees at 27 knots with virga in the area; at 1700 the recorded winds were from 270 degrees at 12 knots with gust to 16 knots. The latest weather reported to the flight crew by the ATC controller was the 1700 ASOS winds of 270 degrees at 12 knots. The last company weather transmitted at 1446 to the flight crew via ACARS was the 1356 ABQ Metar (clear below 12,000, visibility 10, temperature 95 degrees Fahrenheit, dew point 17 degrees Fahrenheit, winds 200 degrees at 6 knots, altimeter 30.02). The crew received the 1656 ATIS Alpha that reported in part: temperature 96 degrees Fahrenheit, dewpoint 15 degrees Fahrenheit, check density altitude, wind 220 degrees at 9 knots. Calculated density altitude was 8,900 feet.

A review of the facility maintenance log by the investigator-in-charge revealed that the ABQ LLWAS from December 1994 through June 1996 received the weekly and monthly functional checks per FAA Order 6560.13B Appendix 2. The last maintenance log entry returning the North sensor to service was on February 27, 1996, following the replacement of the anemometer.

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Archived LLWAS data for June 5, 1997, revealed that the system generated alarms at the North sector from 2306:05 through 2306:55 during which time the recorded wind sequence was 230 degrees at 12 knots, 230 at 11 knots, 240 at 10 knots, 250 at 8 knots, and 230 at 8 knots. The LLWAS generated alarms at the other sectors during the following time periods:

2237:25 through 2237:55 (Southwest Sector), 2306:05 through 2306:55 (Center Sector), 2312:25 through 2314:55 (West Sector), 2312:45 through 2313:55 (Southwest Sector), 2317:15 through 2317:55 (West Sector), 2317:45 through 2325:35 (Center Sector), 2318:25 through 2325:35 (Southwest Sector), and 2318: 45 through 2324:47 (West Sector).

The LLWAS clock was 27 seconds behind UTC.

The ASR 9 (surveillance radar) used in conjunction with the Wind Shear Processor (WSP) is a trailer mounted radar which is owned by the FAA and under contract to Massachusetts Institute of Technology (MIT) Lincoln Laboratory for prototype studies in developing a WSP. Sites for the study included Albuquerque (ABQ) International Airport. The WSP prototype did not indicate any precipitous reflectivity in the Albuquerque area at the time of the incident. There is however, some evidence in the WSP base data for localized gust of 15 to 20 knots at the time and place of the incident, followed several minutes later by a more organized gust propagating across the airport and a significant crosswind for runway 17. The National Change Proposal (NPC) for continued experimental operation of the ASR 9 WSP developmental and prototype operations at Albuquerque have obtained FAA approval through April 1998.

In 1995, a LLWAS evaluation study at the Albuquerque International Airport was prepared for the FAA Southwest Region by the Raytheon Service Company at Pleasantville, New Jersey. On February 1 and 2, 1995 personnel for the study had visited the site for the purpose of evaluating the network and found that the stations did not conform to FAA Order 6560.21A.

FAA Order 6560.21A (copy enclosed) specifies in part:

Reliable and timely microburst detection and identification is a fundamental requirement of LLWAS. To obtain satisfactory performance, it is advisable to keep the stations approximately 2,500 feet to 3,000 feet to either side of the runway. The system will p satisfactorily most of the time if a station is as close as 1,000 feet from the runway If a station is less than 1,000 feet from the runway path, then there can be micro centered on the runway path for which detection may be significantly delayed. If the design departs significantly from this guideline, then there can be microbursts which impact the runway and for which the runway component estimates are significantly in error.

The 1995 LLWAS evaluation study (portions enclosed) further stated that the North sensor pole should be increased in height to 90 feet [current height 63 feet] to compensate for the obstructions [trees] in the North sector. To date this has not been accomplished due to the planned prototype experimental operation of the ASR 9 WSP utilizing the Center sensor station.

The DOT FAA Drawing No. SW-D-9604 shows the LLWAS North site (ground elevation 5,314 feet) at 1,300 feet east of the runway 17 centerline (elevation 5,317 feet) with the anemometer attached to a 60 foot steel tower. The Puerto Del Sol Golf Course with trees is located north of the runway 17 threshold for a distance of 2,500 feet and east of the runway 17 centerline for a distance of 880 feet.

A review of the air traffic data by the investigator-in-charge revealed the following information. The ATC specialists reported that the ATC facility recorded 12 airplane arrivals within the 20 minutes prior to the incident. At 1702:32, approach control (frequency 126.3) cleared Flight 873 for a visual approach to runway 17. At 1702:37, Flight 873 was cleared to leave the approach

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control frequency (126.3) and to contact the Tower (frequency 118.3). Flight 873 reported on the tower frequency at 1703:14 was not on the approach control frequency (126.3) at 1703:18, when a Cessna transmitted to approach control (frequency 126.3) "we got some kind major lookin[g] windshear up here in front of me [or] a microburst can we go eastbound from here?" Approach control cleared the Cessna for the deviation. There is no recorded information that the PIREP was either passed, or required by Air Traffic Control Order 7110.65 to be passed to the terminal controller.

Air Traffic Control Order 7110.65 Chapter 3 AIRPORT TRAFFIC CONTROL-TERMINAL Paragraph 3-1-8 LOW LEVEL WINDSHEAR ADVISORIES states in part:

> When low level windshear is reported by pilots (Pireps), controllers [terminal] shall issue the alert to all arriving and departing aircraft until the alert is bro on the ATIS and pilots indicate they have received the appropriate ATIS code. At locations equipped with a LLWAS, the local controller shall issue an advisory if the alert is received for the runway in use for arriving and departing aircraft. If multiple alerts are received, the controller shall issue an advisory and the centerfield wind direction and velocity.

At 1703:28 (10 seconds after the PIREP and 2 minutes 37 seconds before the first LLWAS alarm at the North sensor) the local controller (frequency 118.3) cleared Flight 873 for the landing. After touchdown, at 1703:40, Flight 873 reported on the tower frequency (118.3) "a whole bunch of tailwind on that base leg you might get [them] to turn us earlier." At 1704:47, the crew reported to the local controller, that they had a "windshear loss on final" and advised the controller to "send the next aircraft around." At 1704:57, USA Flight 186 reported that Flight 873 "hit his tail." At 1705:01, Flight 873 reported a loss of "20 or 30 knots" on short final. At 1705:45, the controller advised UPS Flight 2852H, to go-around due to the windshear Flight 873 reported on landing. At 1706:46 (the controller changed the landing runway to runway 35. At 1707:03, the crew of UPS Flight 2852H reported a 15 knot decrease at 7,000 feet MSL over the airport.

The Flight Data Recorder which was readout by American Airlines, revealed that at an indicated airspeed of 150.0 knots (radar altimeter 162.7 feet) the longitudinal acceleration decreased from 0.010 to -0.049 (radar altimeter 134.3 feet) and the N1 decreased from 62.1% N1 to 43.8%. Within the next 2 seconds, the indicated airspeed of 157.3 knots (radar altimeter 134.3 feet) decreased to 152.8 knots (radar altimeter 92.6 feet) and the pitch increased to 0.7 degrees and N1 to 41.5%. Within the next 3 seconds, the indicated airspeed decreased to 134.3 knots (radar altimeter 41.7 feet) and the pitch attitude increased to 3.2 degrees and N1 to 70.95%. Company personnel reported Vref as 134 knots. Two seconds later the airspeed had decreased to 122 knots (radar altimeter 8.6 feet), with the pitch at 7 degrees and N1 at 89.8% (maximum takeoff N1 at 91.1%). Company personnel reported that, according to FDR data, the airplane struck the runway in this configuration.

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Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
ALBUQUERQUE INTERNATIONAL	ABQ	5352 Ft. MSL	17	10000	150

Runway Surface Type: Asphalt

Runway Surface Condition: Dry

Type Instrument Approach: Visual

VFR Approach/Landing:

Aircraft Information

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

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

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

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Jet	P&W	JT8D-217A	

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Continuous Airworthiness	06/1996	10 Hours	39709 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
WILMINGTON TRUST COMPANY	RODNEY SQUARE NORTH CORP.	WILMINGTON	DE	19890

Operator of Aircraft	Street Address	City	State	Zip Code
AMERICAN AIRLINES	MD 5425 P. O. BOX 619616	DFW AIRPORT	TX	75261

Operator Does Business As: AMERICAN AIRLINES

Operator Designator Code: AALA

- 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

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First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	36

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): 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: 12/1995

- 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	5002	3725								
Pilot In Command(PIC)										
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
DFW AIRPORT	TX	DFW	1629	CDT

Destination	State	Airport Identifier
Same as Accident/Incident Location		ABQ

Type of Clearance: IFR

Type of Airspace: Class C

Weather Information

Source of Briefing: Company

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
ABQ	1705	CDT	5352 Ft. MSL	0 NM	0 Deg. Mag.

Sky/Lowest Cloud Condition: Clear 0 Ft. AGL

Condition of Light: Day

Lowest Ceiling: Unknown 0 Ft. AGL

Visibility: 10 SM

Altimeter: 29.00 "Hg

Temperature: 36 °C

Dew Point: -9 °C

Wind Direction: 300

Density Altitude: 8900 Ft.

Wind Speed: 16

Gusts: 20

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: Minor

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	1	3
Other Crew				2	2
Passengers			3	136	139
- TOTAL ABOARD -			5	141	146
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	5	141	146

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Administrative Information

Investigator-In-Charge (IIC)

JOYCE M. SMITH

Additional Persons Participating in This Accident/Incident Investigation: