



National Transportation Safety Board Aviation Accident Final Report

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| Location: | DETROIT, MI | Accident Number: | CHI97FA083 |
| Date & Time: | 03/14/1997, 0647 EST | Registration: | N753RA |
| Aircraft: | McDonnell Douglas DC-9-87 | Aircraft Damage: | Substantial |
| Defining Event: | | Injuries: | 111 None |
| Flight Conducted Under: | Part 121: Air Carrier - Scheduled | | |

Analysis

The airplane experienced a partial loss of power on both engines during takeoff. The flight returned and landed without further incident. Post accident examination of the engines revealed the compressor fan blades on both engines had sustained soft body impact damage. The airplane had been subjected to sub-zero temperatures during the previous flight and had landed with the wing tanks almost full. The airplane was on the ground for about two and a half hours prior to the accident takeoff during which time rain was falling. Both the captain and copilot reported that there were no signs of ice on the wings during their early morning preflight.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the captain's failure to have the airplane deiced prior to takeoff which resulted in ice ingestion into both engines. Factors associated with the accident were the icing weather conditions, wing ice, an inadequate detection of the ice during the preflight, and the dark lighting conditions when the first officer was performing the preflight.

Findings

Occurrence #1: LOSS OF ENGINE POWER(PARTIAL) - NONMECHANICAL
Phase of Operation: TAKEOFF

Findings

1. ALL ENGINES
2. (F) WEATHER CONDITION - ICING CONDITIONS
3. (F) WING - ICE
4. (F) LIGHT CONDITION - DARK NIGHT
5. (F) AIRCRAFT PREFLIGHT - INADEQUATE - COPILOT/SECOND PILOT
6. (C) ICE/FROST REMOVAL FROM AIRCRAFT - NOT PERFORMED - PILOT IN COMMAND
7. (C) ALL ENGINES - ICE INGESTION
8. COMPRESSOR ASSEMBLY, BLADE - FOREIGN OBJECT

Factual Information

On March 14, 1997, at 0647 eastern standard time (est), a McDonnell Douglas DC-9-87, N753RA, operated as Reno Air flight 153 from Detroit, Michigan, to Reno, Nevada, experienced a partial loss of power on both engines during takeoff. The flight returned to Detroit and landed at 0658 est without further incident. Neither the 5 crewmembers nor the 106 passengers were injured. The 14 CFR Part 121 scheduled passenger flight was conducted in instrument meteorological conditions and an IFR flight plan was filed.

The captain stated that he was aware that there had been an ice storm during the night prior to the accident. He reported that ice was visible on trees on the morning of the accident. He and the first officer discussed the likelihood of having the airplane de-iced prior to leaving for the airport. He reported that during the ride to the airport, he noticed that the streets were wet, not ice covered, and the precipitation was in the form of rain which was not freezing. He and the first officer once again discussed deicing the airplane and they agreed to "check the airplane very closely for ice."

The first officer reported that upon arriving at the airplane he initiated his exterior preflight. He reported that during the preflight he noted a layer of frost on the bottom of the right wing. He also reported that he used a ladder to inspect the top of both wings using the "stick" and his hand. He did not find any ice. In addition, after entering the cockpit he went outside once again and inspected the right wing for ice, using the stick and his hand. Once again, he did not detect any ice. According to the captain, he went into the cabin area and looked out the windows at the wings as the first officer was outside. He said the wings were wet, but there was no ice. At 0600 est, the captain informed the ground crew that the airplane would not need to be deiced.

The captain reported they were pushed back from the gate at 0635 est, were delayed, and began taxiing at 0637 est. At 0645 est the airplane taxied onto runway 03L for takeoff. The captain reported he held the brakes and ran the engines to 1.4 engine pressure ratio (EPR) which was about 70% N1. He reported all engine indications were normal so he stabilized the engines at 1.6 EPR. The captain then called for autothrottles ON and the power increased to 2.02 EPR. The first officer stated that the airspeed seemed to stagnate for "a second" at 100 knots during the takeoff roll. He said he called V1 a little slower than normal and the captain rotated slightly slower than normal.

Both pilots reported the first indication of a problem occurred immediately after liftoff at an altitude of 50 to 100 feet above the ground (agl). The captain reported the "right engine popped" and the No.1 engine EPR gauge fluctuated. The first officer reported hearing a loud popping sound and the airplane shuddered.

The pilots reported that they received clearance from the tower to land on any runway. The captain said he disengaged the autothrottles and pulled the left throttle back a half knob behind the right throttle because the left engine seemed more erratic. The captain then called for gear retraction.

The captain reported that at an altitude of about 200 agl the airspeed decreased to approximately V2 and the airplane had very little climb performance. They advanced the left throttle so it was even with the right and once the gear was retracted the rate of climb increased. The captain reported the EPRs were fluctuating above 2.02.

The crew reported they initially turned the airplane for a landing on runway 21L. The flaps remained extended 11 degrees and both engines were experiencing compressor stalls. The captain reported they climbed to an altitude of 3,400 feet mean sea level (msl). The crew completed the appropriate checklists and were cleared to descend to 3,000 feet msl. The first officer suggested they turn on the airfoil anti-ice system as the captain reduced the power to descend. The captain reported that when power on the engines was reduced through an EPR setting of 1.60 to 1.70 and the airspeed decreased to approximately 180 knots, the compressor stalls stopped. The crew elected to change runways to land on runway 3L due to weight conditions and runway length. The airplane landed without incident. Tests and Research

The airplane was equipped with Pratt & Whitney (P&W) JT8D-219 engines. Initial on scene examination of the engines showed that the fan blades on both engines were damaged. Both engines were removed and shipped to the American Airlines Maintenance & Engineering Center for teardown. The teardown began on April 8, 1997, under the direction of the NTSB. Inspection of the left engine, s/n 725674, revealed that 19 of the 34 compressor fan blades had soft body impact damage. In addition, five of the blades either had tip rub or leading edge nicks. Ten of the blades were not damaged. Inspection of the right engine, s/n 708177, revealed that 27 of the 34 compressor fan blades had soft body impact damage. In addition, two of the blades either had leading edge nicks and the remaining five blades were not damaged.

The eighth and ninth stage compressor blades from both engines received a fluorescent penetrant inspection. The left engine compressor blades did not show any indication of cracking. Seventeen eighth stage blades and one ninth stage blade on the right engine showed indications of cracks. These blades were examined further using a binocular microscope. This examination revealed that all of the blades had transverse cracks on the convex side of the airfoil either in or just above the blade root platform fillet radius. See attached Powerplants Group Chairman's Factual Report of Investigation for further details.

Additional Information

The accident airplane departed Reno, Nevada, at 0035 est and arrived in Detroit at 0419 est on the morning of the accident. During this flight from Reno the crew logged instrument reading which indicated that at FL330 the static air temperature was -47 degree celsius and the ram air temperature was -22 degrees celsius. The airplane was on the ground in Detroit for approximately two hours prior to it being refueled. According to the refueling record the airplane landed with both the left and right wing tanks approximately full.

Parties participating in the investigation were the Federal Aviation Administration, Reno Air, United Technologies Pratt & Whitney, American Airlines, and Douglas Aircraft.

Pilot Information

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| Certificate: | Airline Transport; Commercial; Flight Engineer | Age: | 51, Male |
| Airplane Rating(s): | Multi-engine Land; Single-engine Land | Seat Occupied: | Left |
| Other Aircraft Rating(s): | None | Restraint Used: | Seatbelt, Shoulder harness |
| Instrument Rating(s): | Airplane | Second Pilot Present: | Yes |
| Instructor Rating(s): | None | Toxicology Performed: | No |
| Medical Certification: | Class 1 Valid Medical--w/ waivers/lim. | Last Medical Exam: | 11/20/1996 |
| Occupational Pilot: | | Last Flight Review or Equivalent: | |
| Flight Time: | 14000 hours (Total, all aircraft), 9700 hours (Total, this make and model), 200 hours (Last 90 days, all aircraft) | | |

Aircraft and Owner/Operator Information

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|--------------------------------------|------------------------------|---|--------------------|
| Aircraft Manufacturer: | McDonnell Douglas | Registration: | N753RA |
| Model/Series: | DC-9-87 DC-9-87 | Aircraft Category: | Airplane |
| Year of Manufacture: | | Amateur Built: | No |
| Airworthiness Certificate: | Transport | Serial Number: | 49587 |
| Landing Gear Type: | Retractable - Tricycle | Seats: | 174 |
| Date/Type of Last Inspection: | Continuous Airworthiness | Certified Max Gross Wt.: | 140000 lbs |
| Time Since Last Inspection: | | Engines: | 2 Turbo Fan |
| Airframe Total Time: | | Engine Manufacturer: | P&W |
| ELT: | Installed, not activated | Engine Model/Series: | JT8D-219 |
| Registered Owner: | INVESTORS ASSET HOLDING CORP | Rated Power: | 21700 lbs |
| Operator: | RENO AIR | Air Carrier Operating Certificate: | Flag carrier (121) |
| Operator Does Business As: | | Operator Designator Code: | ORJA |

Meteorological Information and Flight Plan

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|----------------------------------|------------------------|-------------------------------|--------------|
| Conditions at Accident Site: | Instrument Conditions | Condition of Light: | Dawn |
| Observation Facility, Elevation: | DTW, 640 ft msl | Observation Time: | 0640 EST |
| Distance from Accident Site: | 0 Nautical Miles | Direction from Accident Site: | 0° |
| Lowest Cloud Condition: | Scattered / 600 ft agl | Temperature/Dew Point: | 1° C / -1° C |
| Lowest Ceiling: | Overcast / 4000 ft agl | Visibility | 4 Miles |
| Wind Speed/Gusts, Direction: | 13 knots, 100° | Visibility (RVR): | 0 ft |
| Altimeter Setting: | 29 inches Hg | Visibility (RVV): | 0 Miles |
| Precipitation and Obscuration: | | | |
| Departure Point: | | Type of Flight Plan Filed: | IFR |
| Destination: | RENO, NV (RNO) | Type of Clearance: | IFR |
| Departure Time: | 0645 EST | Type of Airspace: | Class B |

Airport Information

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|----------------------|--------------------------|---------------------------|----------------|
| Airport: | METRO-WAYNE COUNTY (DTW) | Runway Surface Type: | |
| Airport Elevation: | | Runway Surface Condition: | |
| Runway Used: | 0 | IFR Approach: | |
| Runway Length/Width: | | VFR Approach/Landing: | Forced Landing |

Wreckage and Impact Information

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|---------------------|----------|----------------------|-------------|
| Crew Injuries: | 5 None | Aircraft Damage: | Substantial |
| Passenger Injuries: | 106 None | Aircraft Fire: | None |
| Ground Injuries: | N/A | Aircraft Explosion: | None |
| Total Injuries: | 111 None | Latitude, Longitude: | |

Administrative Information

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|-----------------------------------|--|---------------|------------|
| Investigator In Charge (IIC): | WESLEY M ROBBINS | Adopted Date: | 02/28/2000 |
| Additional Participating Persons: | RICHARD MERRILL; BELLEVILLE, MI STEVEN LUND JEFFREY BUKIO; RENO, NV ALAN WEAVER; E. HARTFORD, CT | | |
| Publish Date: | | | |
| Investigation Docket: | NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ . | | |

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