



Aviation Investigation Final Report

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|--------------------------------|---|-------------------------|------------|
| Location: | Lincoln, Nebraska | Incident Number: | CHI06IA127 |
| Date & Time: | May 4, 2006, 18:00 Local | Registration: | N71MT |
| Aircraft: | Corporate Jets Limited BAE125-800A | Aircraft Damage: | None |
| Defining Event: | | Injuries: | 6 Minor |
| Flight Conducted Under: | Part 91: General aviation - Flight test | | |

Analysis

The airplane departed controlled flight as the flight crew conducted an intentional stall maneuver. The flight crew stated that the airplane rolled off to the right about 11 knots above the expected stick shaker speed. The pilot-in-command (PIC) stated that "as the airplane slowed through [approximately] 126 knots [indicated airspeed], it abruptly rolled off / dropped the right wing and the nose fell rapidly." He noted that, although the autopilot was on as required by the test procedure, he was holding the control wheel and felt "no vibration or abnormal indication" prior to the event. He reported that the airplane rolled 5 to 7 times, both to the right and the left. The second-in-command (SIC) stated that the right wing dropped and characterized it as a steady roll to the right, not a violent roll. He commented that the wing dropped "as though it was a root stall." He reported that he moved to push forward on the controls in order to unload the wing; however, the PIC instructed him to stay off the controls. He stated that the PIC did not unload the wing and the aircraft kept rolling. The aircraft subsequently rolled several times before it was recovered to controlled flight. The flight crew executed a no-flap landing without further incident. The SIC pilot reported that one of the mechanics had come forward during the flight and informed him some frost was present on the wings near the root. However, the SIC reported he did not observe any ice form on the aircraft nor did he observe the icing advisory light during the flight. Outside air temperatures were not below freezing. He added that from the pilot's seat approximately the outboard one-half of the wings are visible. In his post incident statement, one of the mechanics on the flight reported that a small amount of ice had accumulated on the wings during the initial tests, prior to the stall. He subsequently noticed that the ice was dissipating. He thought that this was due to warmer temperatures or the aircraft deice system. Post incident inspection of the airframe did not reveal any anomalies consistent with a premature stall and loss of control. Subsequent flight testing did not reveal any adverse stall characteristics. The Airplane Flight Manual required that all external airframe surfaces must be free of ice when performing intentional stalls.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: The pilot-in-command's failure to maintain control during the initial roll at onset of the stall due to his improper remedial action related to the stall recovery. A contributing factor was initiation of an intentional stall with residual wing ice contamination, resulting in the stall occurring at a higher than anticipated airspeed. An additional factor was the flight crew's failure to ensure all external surfaces were free of contamination prior the stall as required by the airplane flight manual.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: OTHER

Findings

1. (C) AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND
2. (C) REMEDIAL ACTION - IMPROPER - PILOT IN COMMAND
3. (F) PROCEDURES/DIRECTIVES - NOT COMPLIED WITH - FLIGHTCREW
4. (F) WING - CONTAMINATION

Factual Information

HISTORY OF FLIGHT

On May 4, 2006, about 1800 central daylight time, a Corporate Jets Limited BAE 125-800A, N71MT, owned and operated by Raytheon Aircraft Company on a maintenance test flight, lost control while setting up for a stall series at 17,000 feet mean sea level (msl) near Lincoln, Nebraska. The flight was being conducted under 14 CFR Part 91 on an instrument flight rules (IFR) flight plan. Visual meteorological conditions prevailed at altitude and during landing. Instrument meteorological conditions were encountered during the uncontrolled descent prior to recovery. The 2 pilots and 4 technicians sustained minor injuries. The local flight departed LNK at 1729 and landed at 1816.

The pilot-in-command (PIC) reported that the flight was entering a stall series in accordance with the planned flight test procedures. The PIC was the pilot flying at the time of the incident. Flight crew calculations indicated that the stick shaker was expected to activate at 115 knots, with stick pusher activation at 107.5 knots. Aerodynamic stall was expected at 105.5 knots at the current operating weight. The PIC stated that "as the airplane slowed through [approximately] 126 knots [indicated airspeed], it abruptly rolled off / dropped the right wing and the nose fell rapidly." He noted that, although the autopilot was on as required by the test procedure, he was holding the control wheel and felt "no vibration or abnormal indication" prior to the event. He reported that the airplane rolled 5 to 7 times, both to the right and the left.

The PIC reported that during the resulting uncontrolled descent, the airplane entered an underlying cloud layer at 12,000 feet msl. The airplane exited the cloud layer about 10,000 feet msl and was "descending vertically." He stated: "I neutralized the ailerons with the yoke and began a higher than normal back pressure pull-out, experiencing [approximately] 4 - 5 Gs. The aircraft responded, and we stopped the descent somewhere below 7,000 [feet msl]."

The second-in-command (SIC) pilot reported that the takeoff was normal and the deice system was activated after takeoff. He noted that the flight encountered some high clouds during the initial portion of the flight. He reported that one of the mechanics had come forward and informed him some frost was present on the wings near the root. However, the SIC reported he did not observe any ice form on the aircraft nor did he observe the icing advisory light during the flight. Outside air temperatures were not below freezing. He added that from the pilot's seat approximately the outboard one-half of the wings are visible.

The SIC reported that the flight began the planned stall series at 17,000 feet msl above an underlying cloud layer estimated at between 9,000 and 10,000 feet msl. He noted that the autopilot was on as planned and he was anticipating autopilot disconnect. He stated that the right wing dropped about 11 knots prior to the calculated stick shaker activation speed of 115 knots. He added that it was a steady roll to the right, not a violent roll. He commented that the

wing dropped "as though it was a root stall." He reported that he moved to push forward on the controls in order to unload the wing; however, the PIC instructed him to stay off the controls. He stated that the PIC did not unload the wing and the aircraft kept rolling. The aircraft subsequently rolled several times before it was recovered to controlled flight.

The flight returned to LNK and the crew executed a no-flap landing without further incident.

In his post incident statement, one of the mechanics on the flight reported that a small amount of ice had accumulated on the wings during the initial tests, prior to the stall. He subsequently noticed that the ice was dissipating, and he thought that this was due to warmer temperatures or the aircraft deice system.

PERSONNEL INFORMATION

The pilot-in-command (PIC) held an Airline Transport Pilot certificate, with a multi-engine land class rating. He held eight type ratings, including a type rating for BAE-125 airplanes. He was issued a First Class airman medical certificate in April 2006, with a restriction that corrective lenses be worn. He reported a total flight time of 8,599 hours, which included 3,858 hours as PIC. He had acquired 1,146 hours in BAE 125-800 airplanes, with 583 hours as PIC. His most recent flight review was completed in December 2005.

The second-in-command (SIC) pilot held an Airline Transport Pilot certificate, with single-engine land and multi-engine land airplane ratings. He held nine type ratings, including a type rating for BAE-125 airplanes. He was issued a First Class airman medical certificate in September 2005, with no restrictions. He reported a total flight time of 20,000 hours. He reported 3,500 hours in BAE-125 airplanes. His most recent flight review was completed in April 2006.

AIRCRAFT INFORMATION

The airplane was a Corporate Jets Limited BAE 125-800A, Hawker 800, serial number 258230. The BAE 125-800 was a pressurized, corporate jet airplane, powered by two Allied Signal TPE731-5R-1H turbo fan engines. Each engine was capable of delivering 4,300 lbs. of thrust.

The incident airplane was manufactured in 1993 and had accumulated about 8,866 hours total flight time. The most recent inspection had been accomplished on May 1, 2006. An interior refurbishment and several maintenance phase inspections had been completed. The airplane was on a maintenance test flight at the time of the incident. Verification of the aircraft's stall characteristics was required due to the maintenance inspections performed.

METEOROLOGICAL INFORMATION

Conditions recorded by the Lincoln Airport Automated Surface Observing System (ASOS), at 1754, were: Wind was variable at 5 knots; visibility 10 statute miles; few clouds at 9,000 feet above ground level (agl); temperature 15 degrees Celsius; dew point 4 degrees Celsius; and altimeter 30.13 inches of mercury.

FLIGHT RECORDERS

The NTSB Vehicle Recorders Laboratory downloaded the digital flight data recorder (FDR). The data revealed that at FDR Subframe Reference Number (SRN) 428799 the airplane was at 16,982 feet pressure altitude, at 125.5 knots indicated airspeed. The autopilot was on at that time and the aircraft's roll attitude was 1.1 degrees right wing down. One-half second later the roll attitude was 8.1 degrees right wing down. One-half second after that, the autopilot was off and the indicated airspeed was 124.3 knots.

Data indicated that the right roll continued and the aircraft became inverted 4 seconds after the initial upset. Three seconds after becoming inverted, the engine speed increased above 100-percent. The data indicated that the aircraft rolled inverted again and the pitch attitude reached 87.7 degrees nose down. The aircraft rolled both left and right over the next 20 - 25 seconds. The aircraft lost approximately 11,000 feet during this time period, and leveled at 5,313.9 feet pressure altitude on recovery before climbing again. The aircraft reached an airspeed in excess of 300 knots during the descent. During recovery from the descent, the aircraft sustained downward acceleration forces in excess of 6 g's.

WRECKAGE AND IMPACT INFORMATION

A post accident inspection of the airframe structure did not reveal any structural damage. The inspection included the standard heavy turbulence inspection procedure and additional items identified by Raytheon Aircraft. These additional items included engine mount beams, wing links and attachment fittings, and control system components.

Wing incidence and contour were measured and were within design requirements. The wing leading edge stall triggers were inspected and determined to be in compliance with the manufacturer's specifications. The inspection did reveal denting in a non-structural wing fairing. The aircraft also sustained damage to interior furnishings during the event; such as seats, arm rests and cabin interior panels.

TESTS AND RESEARCH

Subsequent to the post accident inspections, Raytheon Aircraft performed a flight test in order to confirm and document the incident airplane's stall characteristics. The flight test conducted consisted of two phases. The first documented the stall characteristics and speeds for various airplane configurations. The second phase determined the effect of control and trim inputs at the airspeed associated with the loss of control incident.

Flight test evaluation of the incident airplane stall characteristics revealed no anomalies. No abnormal roll or aircraft buffet was observed. The stick shaker and stick pusher activated as required. Control inputs such as rudder deflection and opposite aileron did not produce a significant departure at stall. Application of rudder alone produced a roll rate of approximately 30 degrees per second. With the application of rudder and opposite aileron, the airplane remained controllable at stall. Autopilot disconnect was observed at stick shaker. A roll departure as described on the incident flight was not observed during the flight test maneuvers.

ADDITIONAL INFORMATION

The Airplane Flight Manual stated that intentional stalls were to be performed with the autopilot off. However, company maintenance test flight procedures required it be engaged in order to verify autopilot disconnect at stick shaker prior to approving the aircraft for return to service.

The AFM also specifically noted that all external airframe surfaces must be free of ice when performing intentional stalls.

In response to this uncommanded roll event during an intentional stall maneuver, Raytheon issued a Stall Training Syllabus that outlined operational considerations for stall testing and clarified approved recovery procedures. In addition, they discontinued the practice of approaching intentional stalls with the autopilot connected for in service aircraft until the stall characteristics of the aircraft have been ascertained.

The Federal Aviation Administration and Raytheon Aircraft were parties to the incident investigation.

Pilot Information

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| Certificate: | Airline transport | Age: | 49, Male |
| Airplane Rating(s): | Multi-engine land | Seat Occupied: | Left |
| Other Aircraft Rating(s): | None | Restraint Used: | |
| Instrument Rating(s): | Airplane | Second Pilot Present: | Yes |
| Instructor Rating(s): | None | Toxicology Performed: | No |
| Medical Certification: | Class 1 With waivers/limitations | Last FAA Medical Exam: | April 1, 2006 |
| Occupational Pilot: | Yes | Last Flight Review or Equivalent: | December 1, 2005 |
| Flight Time: | 8599 hours (Total, all aircraft), 1146 hours (Total, this make and model), 3858 hours (Pilot In Command, all aircraft), 89 hours (Last 90 days, all aircraft), 24 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft) | | |

Co-pilot Information

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| Certificate: | Airline transport; Flight instructor | Age: | 62, Male |
| Airplane Rating(s): | Single-engine land; Multi-engine land | Seat Occupied: | Right |
| Other Aircraft Rating(s): | None | Restraint Used: | |
| Instrument Rating(s): | Airplane | Second Pilot Present: | Yes |
| Instructor Rating(s): | | Toxicology Performed: | No |
| Medical Certification: | | Last FAA Medical Exam: | |
| Occupational Pilot: | Yes | Last Flight Review or Equivalent: | April 1, 2006 |
| Flight Time: | 20000 hours (Total, all aircraft), 3500 hours (Total, this make and model), 20000 hours (Pilot In Command, all aircraft), 100 hours (Last 90 days, all aircraft), 35 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft) | | |

Aircraft and Owner/Operator Information

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|--------------------------------------|--------------------------------------|---------------------------------------|-----------------|
| Aircraft Make: | Corporate Jets Limited | Registration: | N71MT |
| Model/Series: | BAE125-800A | Aircraft Category: | Airplane |
| Year of Manufacture: | | Amateur Built: | |
| Airworthiness Certificate: | Transport | Serial Number: | 258230 |
| Landing Gear Type: | Retractable - Tricycle | Seats: | 11 |
| Date/Type of Last Inspection: | May 1, 2006 Continuous airworthiness | Certified Max Gross Wt.: | 27520 lbs |
| Time Since Last Inspection: | 0 Hrs | Engines: | 2 Turbo fan |
| Airframe Total Time: | 8866 Hrs as of last inspection | Engine Manufacturer: | Allied Signal |
| ELT: | Installed, not activated | Engine Model/Series: | TFE731-5R-1H |
| Registered Owner: | Raytheon Aircraft Co. | Rated Power: | 4300 Lbs thrust |
| Operator: | | Operating Certificate(s) Held: | None |

Meteorological Information and Flight Plan

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| Conditions at Accident Site: | Visual (VMC) | Condition of Light: | Day |
| Observation Facility, Elevation: | LNK,1219 ft msl | Distance from Accident Site: | |
| Observation Time: | 17:54 Local | Direction from Accident Site: | |
| Lowest Cloud Condition: | Few / 9000 ft AGL | Visibility | 10 miles |
| Lowest Ceiling: | None | Visibility (RVR): | |
| Wind Speed/Gusts: | 5 knots / 0 knots | Turbulence Type Forecast/Actual: | / |
| Wind Direction: | | Turbulence Severity Forecast/Actual: | / |
| Altimeter Setting: | 30.12 inches Hg | Temperature/Dew Point: | 15°C / 4°C |
| Precipitation and Obscuration: | No Obscuration; No Precipitation | | |
| Departure Point: | Lincoln, NE (LNK) | Type of Flight Plan Filed: | IFR |
| Destination: | | Type of Clearance: | IFR |
| Departure Time: | 17:29 Local | Type of Airspace: | |

Airport Information

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|-----------------------------|------------------|----------------------------------|------|
| Airport: | Lincoln Muni LNK | Runway Surface Type: | |
| Airport Elevation: | 1219 ft msl | Runway Surface Condition: | |
| Runway Used: | | IFR Approach: | None |
| Runway Length/Width: | | VFR Approach/Landing: | None |

Wreckage and Impact Information

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|----------------------------|---------|-----------------------------|----------------------|
| Crew Injuries: | 2 Minor | Aircraft Damage: | None |
| Passenger Injuries: | 4 Minor | Aircraft Fire: | None |
| Ground Injuries: | N/A | Aircraft Explosion: | None |
| Total Injuries: | 6 Minor | Latitude, Longitude: | 40.851112,-96.759162 |

Administrative Information

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| Investigator In Charge (IIC): | Sorensen, Timothy |
| Additional Participating Persons: | Daniel Petersen; FAA-Lincoln FSDO; Lincoln, NE Michael J Gibbons; Raytheon Aircraft Company; Wichita, KS |
| Original Publish Date: | January 31, 2008 |
| Last Revision Date: | |
| Investigation Class: | Class |
| Note: | |
| Investigation Docket: | https://data.nts.gov/Docket?ProjectID=63674 |

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).