# Aviation Investigation Final Report

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| **Location:** | WASHINGTON, District of Columbia | **Incident Number:** | IAD99IA059 |
| **Date & Time:** | August 23, 1999, 19:10 Local | **Registration:** | N926TS |
| **Aircraft:** | Boeing 727-200 | **Aircraft Damage:** | Minor |
| **Defining Event:** | | **Injuries:** | 171 None |
| **Flight Conducted Under:** | Part 121: Air carrier - Scheduled | | |

## Analysis

A Boeing 727-200 received minor damage when the left main landing gear side strut separated during taxi. Examination of the right main landing gear revealed that the side strut assembly was separated from the main shock strut and that the gear door was open. The threaded portion of the main strut attachment clevis was separated from the side strut assembly. The clevis remained attached to the main shock strut. The clevis bolt was dry, corroded, and the threads were broken and stripped. There was no evidence of lubrication on the clevis bolt. The retaining nut and the lock nut inside the lower end of the side strut were also dry, corroded, and displayed corresponding damaged and stripped threads inside the lock nut. Metallurgical examination revealed the threads suffered severe corrosion damage prior to being stripped. The aircraft manufacturer stated that a re-design for the side strut assembly was in development to block moisture, prevent corrosion, and improve lubrication for the assembly.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: The inadequate lubrication of the landing gear side strut assembly by company maintenance personnel. A factor in the accident was the inadequate design of the assembly that trapped water and prevented adequate lubrication.

## Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: TAXI - FROM LANDING

Findings
1. (C) LANDING GEAR,MAIN GEAR STRUT - SEPARATION
2. (C) MAINTENANCE,LUBRICATION - INADEQUATE - COMPANY MAINTENANCE PERSONNEL
3. (F) ACFT/EQUIP,INADEQUATE DESIGN - MANUFACTURER

## Factual Information

On August 23, 1999, at 1910 Eastern Daylight Time, a Boeing 727-200, N926TS, operated by US Airways Shuttle, received minor damage when the main landing gear side strut separated during taxi at the Ronald Reagan National Airport (DCA), Washington, DC. The three certificated flight crewmembers, 5 cabin attendants, and 163 passengers were not injured. Visual meteorological conditions prevailed for the scheduled passenger flight that originated at LaGuardia Airport (LGA), New York, New York, about 1800. An IFR flight plan was filed for the flight conducted under 14 CFR Part 121.

In a written statement, the Captain said:

"The entire flight was routine until we exited the landing runway at DCA. The aircraft was slowed and a gradual right turn off Runway 18 at "F" taxiway was made. As the aircraft was being reconfigured at my request, an intermittent aural warning sounded. This was accompanied by alternate flashing right main gear green and red warning lights. Additionally, there was a pulsating thump occurring simultaneously with the green and red lights. The aircraft was stopped. Air Traffic and Company personnel were notified that the aircraft would not be moved until it was inspected. Maintenance personnel advised me that there was a broken side strut on the right main landing gear."

The flight crew stopped the airplane and de-planed passengers on the taxiway.

Examination of the right main landing gear revealed that the side strut assembly was separated from the main shock strut and that the gear door was open. The threaded portion of the main strut attachment clevis was separated from the side strut assembly. The clevis remained attached to the main shock strut.

The clevis bolt was dry, corroded, and the threads were broken and stripped. There was no evidence of lubrication on the clevis bolt. The retaining nut and the lock nut inside the lower end of the side strut were also dry, corroded, and displayed corresponding damaged and stripped threads inside the lock nut.

The right main landing gear squat switch was broken, two torque tubes were bent, and honeycomb wheel-well fairing material was damaged.

Examination of maintenance records revealed that both the left and right side strut assemblies were overhauled in July 1996. At that time, the overhaul facility documented compliance with Boeing Service Bulletin 727-32-0338 Option 3.

The side strut and the attachment clevis were removed from the airplane and taken to the

Safety Board Materials Laboratory for further examination.

A Safety Board metallurgist examined the damaged right main landing gear components, and then the corresponding left main landing gear components for comparison. According to his report:

"The threads on the upper end of the clevis and the corresponding threads on the clevis assembly nut were damaged and apparently stripped over each other, allowing the clevis to separate form the remainder of the side strut lower segment."

The report further described severe corrosion damage to the threads of the clevis and the nut, and that corrosion deposits covered any undamaged fracture features. Partially hardened grease was caked around the upper side of the clevis assembly nut.

Disassembly and examination of the left main landing gear strut revealed fresh grease collected around the undamaged threads of the clevis and the clevis assembly nut. However, the clevis was loose inside the retainer nut assembly.

Inventory of the assembly's parts revealed that a spacer depicted in SB 727-32-0338 Option 3, was not installed in the left main landing gear side strut assembly.

In a telephone interview, an engineer with the Boeing Aircraft Company said that while side-strut assembly failures have occurred in the past, none have resulted in either a gear collapse or an accident. He added that, as of July 2000, a re-design of the clevis joint was in development. The Boeing engineer discussed the specifics of preliminary design work with a Safety Board engineer, who then forwarded a summary of Boeing's proposed changes that included the following:

1. Recommend that the [clevis] nut be installed with Mastinox BMS 327 (a corrosion preventative). 2. Add plug at the end of the clevis that would prevent moisture [from getting] inside and under the threads that results in corrosion. 3. Modification to allow an easier grease path for moving parts.

According to USAirways Shuttle maintenance personnel, the normal interval for lubrication of the main landing gear was every 500 hours or 500 cycles.

The flight data recorder (FDR) was removed from the airplane and examined at the Safety Board FDR Laboratory in Washington, DC, on August 24, 1999. Data from the last takeoff from LGA and the landing at DCA revealed only nominal vertical and lateral loads on the airplane.

## Pilot Information

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| **Certificate:** | Airline transport | **Age:** | 53,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 Valid Medical--w/ waivers/lim | **Last FAA Medical Exam:** | March 13, 1999 |
| **Occupational Pilot:** | Yes | **Last Flight Review or Equivalent:** | |
| **Flight Time:** | 16000 hours (Total, all aircraft), 6000 hours (Total, this make and model), 114 hours (Last 90 days, all aircraft), 62 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft) | | |

## Aircraft and Owner/Operator Information

| | | | |
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| **Aircraft Make:** | Boeing | **Registration:** | N926TS |
| **Model/Series:** | 727-200 727-200 | **Aircraft Category:** | Airplane |
| **Year of Manufacture:** | | **Amateur Built:** | |
| **Airworthiness Certificate:** | Transport | **Serial Number:** | 20774 |
| **Landing Gear Type:** | Retractable - Tricycle | **Seats:** | 171 |
| **Date/Type of Last Inspection:** | August 22, 1999 AAIP | **Certified Max Gross Wt.:** | 175500 lbs |
| **Time Since Last Inspection:** | 14 Hrs | **Engines:** | 3 Turbo jet |
| **Airframe Total Time:** | 46587 Hrs | **Engine Manufacturer:** | P&W |
| **ELT:** | Installed, not activated | **Engine Model/Series:** | JT8D-7B |
| **Registered Owner:** | SHUTTLE INC | **Rated Power:** | 14000 Lbs thrust |
| **Operator:** | | **Operating Certificate(s) Held:** | Flag carrier (121) |
| **Operator Does Business As:** | US AIRWAYS | **Operator Designator Code:** | |

## Meteorological Information and Flight Plan

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| **Conditions at Accident Site:** | Visual (VMC) | **Condition of Light:** | Day |
| **Observation Facility, Elevation:** | DCA ,16 ft msl | **Distance from Accident Site:** | |
| **Observation Time:** | 18:51 Local | **Direction from Accident Site:** | |
| **Lowest Cloud Condition:** | Scattered / 5000 ft AGL | **Visibility** | 10 miles |
| **Lowest Ceiling:** | Overcast / 20000 ft AGL | **Visibility (RVR):** | |
| **Wind Speed/Gusts:** | 12 knots / | **Turbulence Type Forecast/Actual:** | / |
| **Wind Direction:** | 140° | **Turbulence Severity Forecast/Actual:** | / |
| **Altimeter Setting:** | 30 inches Hg | **Temperature/Dew Point:** | 27°C / 19°C |
| **Precipitation and Obscuration:** | No Obscuration; No Precipitation | | |
| **Departure Point:** | NEW YORK , NY (LGA ) | **Type of Flight Plan Filed:** | IFR |
| **Destination:** | (DCA ) | **Type of Clearance:** | IFR |
| **Departure Time:** | 18:00 Local | **Type of Airspace:** | Class B |

## Airport Information

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| **Airport:** | RON REAGAN NATIONAL ARPT DCA | **Runway Surface Type:** | Asphalt |
| **Airport Elevation:** | 16 ft msl | **Runway Surface Condition:** | Dry |
| **Runway Used:** | 18 | **IFR Approach:** | None |
| **Runway Length/Width:** | | **VFR Approach/Landing:** | Traffic pattern |

## Wreckage and Impact Information

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| **Crew Injuries:** | 8 None | **Aircraft Damage:** | Minor |
| **Passenger Injuries:** | 163 None | **Aircraft Fire:** | None |
| **Ground Injuries:** | N/A | **Aircraft Explosion:** | None |
| **Total Injuries:** | 171 None | **Latitude, Longitude:** | 38.909942,-77.020767(est) |

## Administrative Information

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| **Investigator In Charge (IIC):** | Rayner, Brian |
| **Additional Participating Persons:** | RUSSEL J JONES; PITTSBURGH , PA<br>CHARLES MARLER; FLUSHING , NY |
| **Original Publish Date:** | May 17, 2001 |
| **Last Revision Date:** | |
| **Investigation Class:** | Class |
| **Note:** | |
| **Investigation Docket:** | https://data.ntsb.gov/Docket?ProjectID=47787 |