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## Structural damage on landing, Boeing 727-232, December 7, 1995

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**Micro-summary:** This Boeing 727-232 encountered structural damage on landing.

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**Event Date:** 1995-12-07 at 2124 MST


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

**Investigative Body's Web Site:** <http://www.nts.gov/>

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 <b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b>		NTSB ID: SEA961A027		Aircraft Registration Number: N543DA	
		Occurrence Date: 12/07/1995		Most Critical Injury: None	
		Occurrence Type: Incident		Investigated By: NTSB	
<b>Location/Time</b>					
Nearest City/Place BOISE		State ID	Zip Code 83715	Local Time 2124	Time Zone MST
Airport Proximity: On Airport		Distance From Landing Facility:		Direction From Airport:	
<b>Aircraft Information Summary</b>					
Aircraft Manufacturer Boeing		Model/Series 727-232		Type of Aircraft Airplane	
Sightseeing Flight: No			Air Medical Transport Flight: No		
<b>Narrative</b>					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:					
<p>On December 7, 1995, approximately 2124 mountain standard time, a Boeing 727-232, N543DA, operating as Delta Air Lines flight 2019, a 14 CFR 121 scheduled domestic passenger flight from Salt Lake City, Utah to Boise, Idaho, scraped its left wingtip on the runway on landing at Boise. The airplane received minor damage and there were no injuries to the 3 cockpit crewmembers (including the airline transport pilot-in-command), 3 cabin attendants, or 124 passengers on board. Instrument meteorological conditions existed and an instrument flight rules (IFR) flight plan was filed.</p> <p>The Boise 2115 special weather observation indicated an indefinite ceiling of 100 feet; sky obscured; visibility 1/4 mile in fog; temperature and frostpoint of 26 degrees F; and winds from 300 degrees magnetic at 4 knots. An abbreviated remark read "TWR VSBY 1/4 (LH)". The captain, who stated he was the pilot flying the aircraft at the time, reported: "...The [Boise] Approach Control indicated that the RVR [runway visibility range] for [runway] 10R was 2800 feet. I set up and briefed a CAT I ILS approach to RW 10R and coupled the autopilot. Once inside the final approach fix (FAF), tower reported that the RVR had decreased to 2000 feet. [NOTE: The instrument approach procedure for a straight-in ILS approach to Boise runway 10R specifies the minimum RVR as 2,400 feet.] Since we were inside the FAF, I knew that we were legal to continue the approach and I verbalized this with my crew...At more than one hundred feet above minimums, I could see the sequence flashers. [At] fifty feet above minimums, I had the threshold lights, runway edge lights and the runway in sight. At approximately sixty feet above the runway, I disengaged the autopilot in preparation for landing. The sight picture looked good to me with the aircraft aligned down the center of the runway. Landing was in the touchdown zone and on speed. However, just as the main landing gear touched down, I immediately saw a rapid drift to the right toward the runway edge lights. The First Officer later said that he thought he felt the aircraft start to slip to the right at about the time of autopilot disengagement, but neither crewmember visually detected any movement. When I noticed the rate of the aircraft sliding to the right, it was obvious that substantial aircraft control inputs would be needed to stay on the runway. From that point, it was pure pilot reaction with rudder and aileron controls being used....After completing the landing and taxi into the gate, a report by the outbound Second Officer and subsequent inspection revealed damage to the left wing tip area and flaps...."</p> <p>The first officer's and flight engineer's statements were in general agreement with the captain's statement as to the sequence of events. The first officer noted in his statement: "...Inside the Final Approach Fix (FAF) the RVR was reported as 2000'. The Captain verbally reviewed the Ops Specs that allow us to continue to minimums under this condition....During touchdown, I detected a slight slipping sensation and the aircraft appeared to drift to the right, but I saw that the Captain already had a left bank in, and the aircraft corrected back to center-line...." The flight engineer stated: "...Inside the Final Approach Fix, I remember hearing that the RVR had decreased to 2000 feet, but the Captain confirmed that we could proceed to minimums according to our Ops Specs....From my position, it is difficult to evaluate the landing position; however, it appeared</p>					
FACTUAL REPORT - AVIATION					
Page 1					

National Transportation Safety Board

## FACTUAL REPORT

AVIATION

NTSB ID: SEA96IA027

Occurrence Date: 12/07/1995

Occurrence Type: Incident

## Narrative (Continued)

that the aircraft touched down on the left main gear first and then started a slow slide to the right....When this trend was noted by the Captain, flight control corrections were made...."

The cockpit crewmembers stated that they noted the anti-skid cycling during the landing rollout, and that the ramp was slippery during a post-flight inspection of the aircraft. On page 47 of the Delta Air Lines B-727 Flight Training Pilot's Reference Manual, dated March 1, 1996, the "LANDING ON WET OR SLIPPERY RUNWAYS/Maintaining Directional Control" section states: "Maintain directional control with appropriate flight control inputs, especially rudder. Rudder control is relatively effective down to 60-40 knots."

Two flight attendants submitted statements regarding the incident. One stated that "Just prior to landing...the aircraft dipped to the Captain's side..." and the other stated that "...on landing the aircraft was angled with the right wing high and the left wing down..." Both stated that they were not aware that the wingtip had contacted the runway until the passengers pointed out to them that they had seen sparks from the left wingtip and that the left wingtip appeared damaged. They also stated that upon becoming aware of the occurrence, the flight attendants attempted to call the cockpit but got no response. One of the flight attendants said: "It was not a hard or even jarring landing and if [the] passengers had not made any comments none of us would have known it had happened."

The FAA provided a statement from the second officer of Delta flight 1918, who was scheduled on the follow-on flight of the aircraft back to Salt Lake City. The follow-on second officer stated that as he prepared to conduct a preflight inspection of the aircraft, he noted that the plane's left wingtip slat appeared to be extended. He stated that at this point, the crew of flight 2019 was still in the aircraft performing their shutdown checklist. He also stated that he noted the aircraft's flaps in the full up position.

The FAA also forwarded a letter from an individual who stated he had been a passenger on flight 2019. This individual stated that he was in seat 32D and had "an unobstructed view of what happened when the plane landed." He reported: "...the landing was very hard, in fact it was one of the hardest I've ever experienced...The hard landing caused me to look out of the window to my left, where I saw sparks flying from what I thought was the wing of the airplane touching the ground. This lasted about a second and a half, then stopped, and then started again for about a second and then stopped....At the same time it seemed that the plane was moving to the left...the pilot corrected and straightened out the plane...." Another passenger, who submitted a statement to the NTSB investigator-in-charge (IIC) and stated he was sitting in seat 23C, stated: "Aircraft was banked heavily with left wing down at a 30-40 [degree] angle when a jolt was felt-we pitched to the right side...bouncing back to the left side before straightening it out...."

A post-accident examination of the aircraft conducted at Boise by FAA inspectors revealed damage to the #1 and #2 leading edge slat assemblies, left outboard trailing edge flap and its associated fairings, and left wingtip area. Additionally, there was a dent in the left wing leading edge aft of the inboard end of the #1 leading edge slat, and an actuator rod on the #1 leading edge slat assembly was bent.

Delta Air Lines performed a readout of the aircraft's flight data recorder (FDR) under FAA supervision on December 11, 1995, and furnished the results of the readout to the NTSB IIC. The FDR read out aircraft flight data parameters against "relative time" expressed in hours, minutes, and seconds. The parameters for the relative time interval from 00:54:21 to 00:54:33 on the readout were examined in detail with emphasis on altitude, heading, vertical acceleration, pitch and roll indications. The data showed that from 00:54:21 to 00:54:28, the indicated altitude decreased from 2,743 to 2,660 feet; the aircraft heading indicated between 100.5 and 101.2 degrees; vertical acceleration remained between 0.99 and 1.10 g; and roll remained between 0 and +4.52 degrees. At 00:54:29, altitude indicated 2,635 feet; heading increased to 101.7 degrees; vertical acceleration read from 1.04 to 1.07 g; and roll was +0.91 degrees. At 00:54:30, altitude decreased

National Transportation Safety Board

## FACTUAL REPORT

AVIATION

NTSB ID: SEA961A027

Occurrence Date: 12/07/1995


Occurrence Type: Incident


## Narrative (Continued)

to 2,618 feet; heading increased further to 103.0 degrees; vertical acceleration indicated 0.99 to 1.05 g; and roll indicated -4.85 degrees. At 00:54:31, the altitude indication attained its minimum value of 2,610 feet and vertical acceleration also attained its peak value, 1.65 g. Heading increased again to 103.7 degrees and roll indication was -7.50 degrees. One second later, at 00:54:32, roll increased to its maximum negative value of -14.90 degrees. The pitch indication at 00:54:32 was 3.88 degrees. The roll indication subsequently returned toward zero but was still -14.57 degrees in the next second (00:54:33).

A Delta air safety investigator stated to the NTSB IIC that although the cockpit voice recorder (CVR) circuit breakers had been pulled immediately after the occurrence to stop the CVR tape, a maintenance technician later reset the circuit breakers in error and the CVR tape was overwritten as a result.

Boeing furnished a chart which showed pitch and roll attitudes to ground contact for the model 727-200 at a gross weight of 148,000 pounds. The chart showed that in a normal landing (defined on the chart as a one g wing load and no gear load) at a body pitch angle of 3.9 degrees, the outboard slat will touch the ground at a body roll angle of approximately 12.9 degrees with flaps down 30 degrees, or at a body roll angle of approximately 11.6 degrees with flaps down 40 degrees. For a hard landing (defined on the chart as a 10 foot per second sink rate) at the same body pitch angle, the chart indicated that both the outboard slat and outboard flap will contact the ground at a body roll angle of 8.7 degrees with flaps 30 degrees, or 7.45 degrees with flaps down 40 degrees. The FDR altitude indication decreased by 8 feet between 00:54:30 and 00:54:31 (the time at which the minimum altitude and maximum vertical acceleration readings were attained.)

 <b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b>		NTSB ID: SEA96IA027			
		Occurrence Date: 12/07/1995			
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<b>Landing Facility/Approach Information</b>					
Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
BOISE AIR TERMINAL-GOWEN	BOI	2858 Ft. MSL	10R	9763	190
Runway Surface Type: Asphalt					
Runway Surface Condition: Wet					
Type Instrument Approach: ILS-complete					
VFR Approach/Landing:					
<b>Aircraft Information</b>					
Aircraft Manufacturer		Model/Series		Serial Number	
Boeing		727-232		22392	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 156	Certified Max Gross Wt.	184200 LBS	Number of Engines: 3	
Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:		
Turbo Fan	P&W	JT8D-15A	15500 LBS		
- Aircraft Inspection Information					
Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time		
Continuous Airworthiness	09/1995	420 Hours	44286 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?			
<b>Owner/Operator Information</b>					
Registered Aircraft Owner		Street Address			
DELTA AIR LINES, INC.		HARTSFIELD ATLANTA INTL ARPT			
		City	State	Zip Code	
		ATLANTA	GA	30320	
Operator of Aircraft		Street Address			
Same as Reg'd Aircraft Owner		Same as Reg'd Aircraft Owner			
		City	State	Zip Code	
Operator Does Business As:			Operator Designator Code: DALA		
- 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					
FACTUAL REPORT - AVIATION					

 <p><b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b></p>	NTSB ID: SEA96IA027
	Occurrence Date: 12/07/1995
	Occurrence Type: Incident

<b>First Pilot Information</b>				
Name On File	City On File	State On File	Date of Birth On File	Age 53

Sex: M	Seat Occupied: Left	Principal Profession: Civilian Pilot	Certificate Number: On File
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Certificate(s): Airline Transport; Flight Engineer

Airplane Rating(s): Multi-engine Land

Rotorcraft/Glider/LTA:

Instrument Rating(s): Airplane

Instructor Rating(s):

Type Rating/Endorsement for Accident/Incident Aircraft? Yes	Current Biennial Flight Review?
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Medical Cert.: Class 1	Medical Cert. Status: Valid Medical--no waivers/lim.	Date of Last Medical Exam: 09/1995
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- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Multi-Engine	Night	Instrument		Rotorcraft	Glider	Lighter Than Air
						Actual	Simulated			
Total Time	17589	5200								
Pilot In Command(PIC)										
Instructor										
Last 90 Days	224	224								
Last 30 Days										
Last 24 Hours	11	11								

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? Yes	Second Pilot? Yes
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**Flight Plan/Itinerary**

Type of Flight Plan Filed: IFR	
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Departure Point SALT LAKE CITY	State UT	Airport Identifier SLC	Departure Time 2014	Time Zone MST
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Destination Same as Accident/Incident Location	State	Airport Identifier BOI	
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Type of Clearance: IFR

Type of Airspace: Class C

**Weather Information**

Source of Briefing:  
Company

Method of Briefing:

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	Occurrence Date: 12/07/1995
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<b>Weather Information</b>					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
BOI	2115	MST	2858 Ft. MSL	0 NM	0 Deg. Mag.
Sky/Lowest Cloud Condition: Unknown			0 Ft. AGL	Condition of Light: Night/Dark	
Lowest Ceiling: Obscured		0 Ft. AGL		Visibility: 0.25 SM	Altimeter: 30.00 "Hg
Temperature: -3 °C	Dew Point: -3 °C	Wind Direction: 300		Density Altitude: 1063 Ft.	
Wind Speed: 4	Gusts:	Weather Conditions at Accident Site: Instrument Conditions			
Visibility (RVR): 2000 Ft.	Visibility (RVV) 0 SM	Intensity of Precipitation: Unknown			
Restrictions to Visibility: Fog					
Type of Precipitation: None					

<b>Accident Information</b>		
Aircraft Damage: Minor	Aircraft Fire: None	Aircraft Explosion: None

Classification: U.S. Registered/U.S. Soil					
<b>- Injury Summary Matrix</b>	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot				1	1
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer				1	1
Cabin Attendants				3	3
Other Crew					
Passengers				124	124
- TOTAL ABOARD -				130	130
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	130	130

National Transportation Safety Board

**FACTUAL REPORT**  
**AVIATION**



NTSB ID: SEA96IA027

Occurrence Date: 12/07/1995

Occurrence Type: Incident

Administrative Information

Investigator-In-Charge (IIC)

GREGG NESEMEIER

Additional Persons Participating in This Accident/Incident Investigation:

CHUCK KNIPPLE  
FAA FSFO  
BOISE, ID 83705