		NTSB ID: DCA09FA065		Aircraft Registration Number: N387SW	
		Occurrence Date: 07/13/2009		Most Critical Injury: None	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place Charleston	State WV	Zip Code 25311	Local Time 1745	Time Zone EDT	
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility:			
Aircraft Information Summary					
Aircraft Manufacturer BOEING		Model/Series 737/3H4		Type of Aircraft Airplane	
Revenue Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
<p>Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:</p> <p>*** Note: NTSB investigators either traveled in support of this investigation or conducted a significant amount of investigative work without any travel, and used data obtained from various sources to prepare this aircraft accident report. ***</p> <p>History of Flight</p> <p>On July 13, 2009, about 1745 eastern daylight time, Southwest Airlines (SWA) flight 2294, a Boeing 737-3H4 (737), N387SW, experienced rapid decompression while in cruise flight at approximately 35,000 feet when the fuselage crown skin ruptured just forward of the vertical stabilizer. Passenger oxygen masks deployed automatically. The flight crew declared an emergency, and the flight landed uneventfully at Yeager Airport (CRW), Charleston, West Virginia. The flight, which was on an instrument flight rules flight plan, had departed Nashville International Airport, Nashville, Tennessee, and was scheduled to fly to Baltimore-Washington International Airport, Baltimore, Maryland.</p> <p>Flight data recorder data revealed that the airplane took off and climbed for about 25 minutes to an altitude of approximately 35,000 feet. At that point, the cabin altitude warning activated, and the captain disengaged the autopilot and began a descent. The altitude warning ceased as the airplane descended through approximately 9,000 feet. Cockpit voice recorder data and postincident interviews revealed that the flight and cabin crewmembers followed appropriate cockpit procedures following the rapid decompression and during the emergency descent and landing at CRW.</p> <p>Injuries to Persons</p> <p>No injuries occurred during the event.</p> <p>Damage to Aircraft</p> <p>A three-sided hole (flap) was located in skin assembly part number 65C35792-3 in the fuselage crown skin near the leading edge of the vertical stabilizer and measured about 17.4 inches longitudinally and between 11.5 and 8.6 inches circumferentially.</p> <p>Personnel Information</p> <p>The captain had accumulated 22,500 total flight hours, 19,300 hours of which were in the 737. He held an airline transport pilot (ATP) certificate and a class one medical certificate with a limitation/waiver for corrective lenses.</p> <p>The first officer had accumulated 10,100 total flight hours, 2,240 hours of which were in the 737. He held an ATP certificate and a class two medical certificate with no limitations/waivers.</p> <p>Aircraft Information</p>					
FACTUAL REPORT - AVIATION					
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National Transportation Safety Board

## FACTUAL REPORT

AVIATION

NTSB ID: DCA09FA065

Occurrence Date: 07/13/2009

Occurrence Type: Accident

## Narrative (Continued)

The airplane, serial number 26602, was delivered to SWA in June 1994. At the time of the SWA event, the airplane had accumulated approximately 42,500 cycles and 50,500 hours.

## Tests and Research

Skin assembly parts are made of an outer sheet of skin, which covers the entire assembly, and a waffle-pattern doubler sheet hot bonded to the inner surface of the part. Both pieces were 0.036-inch-thick, 2024-T3 clad aluminum sheets. Boeing indicated that the skin assembly was manufactured by forming and bonding two full sheets together, then selectively masking and chemically milling away pockets (bays) of the inner doubler sheet to create a waffle pattern. The bay immediately adjacent to the rupture is not chemically milled to provide for possible installation of an emergency locator transponder (ELT) antenna.

Magnified inspections of the fracture surface of the skin assembly part revealed bright faceted surfaces indicative of fatigue progress along the longitudinal section of the flap, which followed the chemically milled edge of the adjacent doubler. The circumferential crack regions displayed matte grey slant fracture surfaces and bulk deformation patterns indicative of overstress tearing away from the longitudinal portion of the crack.


The longitudinal fatigue crack was 13.7 inches long from approximately BS 831 to BS 844. Highly magnified inspections of the longitudinal crack revealed continuous fatigue thumbnail cracks propagating outward (through-thickness) from multiple origins at the inner surface of the skin. The visual depth of the fatigue regions varied along the crack length. Near the middle of the longitudinal crack, the fatigue crack appeared to completely penetrate the skin thickness for a distance of approximately 3 inches. Scanning electron microscope examinations clearly showed microscopic features typical of fatigue progression, including areas of striations, in the longitudinal crack region.


## Additional Information

The specific area of rupture and skin cracking (adjacent to the non-chemically milled skin to allow for a potential rear ELT antenna installation) associated with the SWA event was not subject to any inspection airworthiness directives (AD) or service bulletins (SB). However, Boeing finite element modeling suggests stress levels are higher in the skin at the edges of chemically milled steps adjacent to non-chemically milled bays due to the difference in stiffness.

Following the SWA event, on September 3, 2009, Boeing issued SB 737-53A1301, calling for repetitive external inspections to detect cracks in the fuselage skin along the chemically milled step at stringers S-1 and S-2 right and between BS 827 and BS 847. (The hole from the SWA event was within those boundaries.) If cracks are detected, operators are to contact Boeing for repair instructions. On January 12, 2010, the Federal Aviation Administration issued AD 2010-01-09, which mandated the inspection requirements in SB 737-53A1301.

Updated on Aug 18 2010 1:52PM

 <b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b>		NTSB ID: DCA09FA065				
		Occurrence Date: 07/13/2009				
		Occurrence Type: Accident				
<b>Landing Facility/Approach Information</b>						
Airport Name Yeager Airport, Charleston, WV		Airport ID: CRW	Airport Elevation Ft. MSL	Runway Used N/A	Runway Length	Runway Width
Runway Surface Type:						
Runway Surface Condition:						
Approach/Arrival Flown: NONE						
VFR Approach/Landing:						
<b>Aircraft Information</b>						
Aircraft Manufacturer BOEING		Model/Series 737/3H4		Serial Number 26602		
Airworthiness Certificate(s): Transport						
Landing Gear Type: Retractable - Tricycle						
Amateur Built Acft? No		Number of Seats:		Certified Max Gross Wt. LBS		Number of Engines: 2
Engine Type:		Engine Manufacturer:		Model/Series:		Rated Power:
- Aircraft Inspection Information						
Type of Last Inspection Continuous Airworthiness		Date of Last Inspection 06/2009		Time Since Last Inspection Hours		Airframe Total Time 50888 Hours
- Emergency Locator Transmitter (ELT) Information						
ELT Installed?/Type No		ELT Operated? No		ELT Aided in Locating Accident Site? No		
<b>Owner/Operator Information</b>						
Registered Aircraft Owner US Bank NA Trustee		Street Address One Federal Street				
		City Boston		State MA	Zip Code 02110	
Operator of Aircraft SOUTHWEST AIRLINES CO		Street Address 2702 Love Field Drive				
		City Dallas		State TX	Zip Code 75235	
Operator Does Business As:				Operator Designator Code: SWAA		
- 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 Only						

 <p><b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b></p>	NTSB ID: DCA09FA065
	Occurrence Date: 07/13/2009
	Occurrence Type: Accident

**First Pilot Information**

Name On File	City On File	State On File	Date of Birth On File	Age 53
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Sex: M	Seat Occupied: Left	Occupational Pilot? Yes	Certificate Number: On File
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Certificate(s): Airline Transport; Commercial; Private

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Current Biennial Flight Review? 06/2009

Medical Cert.: Class 1	Medical Cert. Status: With Waivers/Limitations	Date of Last Medical Exam: 02/2009
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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	22500	19300			2000	300				
Pilot In Command(PIC)	17500	15200								
Instructor										
Instruction Received										
Last 90 Days	225	225								
Last 30 Days	75	75								
Last 24 Hours										

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? No	Second Pilot? Yes
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**Flight Plan/Itinerary**

Type of Flight Plan Filed: Unknown

Departure Point Nashville	State TN	Airport Identifier BNA	Departure Time	Time Zone CDT
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Destination Baltimore	State MD	Airport Identifier BWI	
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Type of Clearance: IFR

Type of Airspace:

**Weather Information**

UAT C/S Source of Wx Information:

 <p><b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b></p>	NTSB ID: DCA09FA065
	Occurrence Date: 07/13/2009
	Occurrence Type: Accident

<b>Weather Information</b>					
WOF ID	Observation Time	Time Zone	WOF Elevation Ft. MSL	WOF Distance From Accident Site NM	Direction From Accident Site Deg. Mag.
Sky/Lowest Cloud Condition:				Ft. AGL	Condition of Light:
Lowest Ceiling:			Ft. AGL	Visibility: SM	Altimeter: "Hg
Temperature: °C	Dew Point: °C	Weather Conditions at Accident Site:			
Wind Direction:		Wind Speed:		Wind Gusts:	
Visibility (RVR): Ft.		Visibility (RVV) SM			
Precip and/or Obscuration:					

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

- 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				3	3
Other Crew					
Passengers				126	126
- TOTAL ABOARD -				131	131
Other Ground					
- GRAND TOTAL -				131	131

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National Transportation Safety Board

**FACTUAL REPORT**

**AVIATION**



NTSB ID: DCA09FA065

Occurrence Date: 07/13/2009

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

Robert P. Benzon

Additional Persons Participating in This Accident/Incident Investigation:

David Keenan  
FAA AAI-100  
Washington, DC