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## Avionics fire, McDonnell Douglas DC-9-32, November 29, 2000

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**Micro-summary:** This McDonnell Douglas DC-9-32 experienced an electrical fire after fluid from the forward lavatory leaked onto the electrical disconnect panel.

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**Event Date:** 2000-11-29 at 1350 EST

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

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

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  2. Readers are advised that each report is a glimpse of events at specific points in time. While broad themes permeate the causal events leading up to crashes, and we can learn from those, the specific regulatory and technological environments can and do change. ***Your company's flight operations manual is the final authority as to the safe operation of your aircraft!***
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		NTSB ID: DCA01MA005		Aircraft Registration Number: N826AT	
		Occurrence Date: 11/29/2000		Most Critical Injury: Minor	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place ATLANTA		State GA	Zip Code	Local Time 1350	Time Zone EST
Airport Proximity:		Distance From Landing Facility:		Direction From Airport:	
Aircraft Information Summary					
Aircraft Manufacturer Douglas		Model/Series DC-9		Type of Aircraft Airplane	
Sightseeing Flight: No			Air Medical Transport Flight: No		
Narrative					
Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:					
<p>HISTORY OF FLIGHT</p> <p>On November 29, 2000, about 1550 eastern standard time (all times in this brief are eastern standard time based on a 24-hour clock), the flight crew of a McDonnell Douglas (McDonnell Douglas is now known as Boeing, Douglas Product Division) DC-9-32, N826AT, operating as AirTran Airways flight 956, executed an emergency landing at Hartsfield Atlanta International Airport (ATL), Atlanta, Georgia. Shortly after takeoff, the flight crew observed that several circuit breakers had tripped and several annunciator panel lights had illuminated. Subsequently, about 2 minutes after takeoff, the flight crew requested a return to ATL. After the landing, one of the flight attendants reported to the flight crew that smoke could be seen emanating from the left sidewall in the forward cabin; air traffic control (ATC) personnel also notified the flight crew that smoke was coming from the airplane. The flight crew then initiated an emergency evacuation on one of the taxiways. Airport rescue and firefighting (ARFF) personnel assisted in subduing the fire. Of the 2 flight crewmembers, 3 flight attendants, and 92 passengers on board, 13 passengers received minor injuries. The airplane sustained substantial damage. Flight 956 was operating under 14 Code of Federal Regulations Part 121 as a regularly scheduled passenger flight from ATL to Akron-Canton Regional Airport, Akron, Ohio. Visual meteorological conditions prevailed at the time of the accident.</p> <p>The captain was the pilot flying. About 1541, ATC cleared the flight for takeoff. At 1543:10, as the airplane was climbing through about 3,800 feet, the cockpit voice recorder (CVR) recorded popping sounds consistent with the sound of circuit breakers tripping, which continued for about 34 seconds. During postaccident interviews, both flight crewmembers stated that during this time, they noticed that several circuit breakers had tripped. The flight crew also noted that the MASTER CAUTION light, several annunciator panel lights, the left and right fuel pressure lights, and the radio rack fan OFF annunciator lights had illuminated. At 1543:28, the captain told the first officer to tell ATC that they wanted to level off at 4,000 feet and return to the airport because "right now we have electrical problems." The captain stated that he then glanced over his shoulder to check for smoke but did not observe any smoke at that time.</p> <p>The ATL north departure controller instructed flight 956 to maintain 4,000 feet and asked whether the flight would need the ARFF equipment available upon landing; the first officer replied that they would need the equipment available. The captain stated that he selected emergency power, took the generators offline, and switched the cabin pressurization to manual to stop the circuit breakers from tripping. The captain stated that during the descent, the left side attitude directional indicator failed intermittently. He stated that, specifically, the failure flags appeared and the instrument was "jumpy." Further, he stated that the cockpit lights were flickering and that he was afraid that all of the cockpit instruments would fail.</p> <p>At 1544:47, flight data recorder data ceased, and, at 1544:51, there was an interruption of audio</p>					
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on all CVR channels. Intermittent CVR audio returned several minutes later and continued until 1549:11, at which time, the CVR recording ended (the airplane landed about 1 minute later). Signals from the airplane's radar transponder were also lost around 1544:51 but were regained briefly until they ended around the same time as the CVR recording ended.

At 1549:40, flight 956 was cleared to land on either runway 26L or 26R. The captain stated that there was no visible smoke or smell of smoke in the cockpit before landing. About 1550, the airplane landed on runway 26R. The captain stated that the landing and rollout were normal. During the airplane's exit from the runway onto taxiway B-3, the lead flight attendant opened the cockpit door and announced that there was smoke in the cabin. A short time later, the lead flight attendant again opened the cockpit door and reported that the amount of smoke in the cabin had increased and asked the captain if he wanted to evacuate.

The captain stated that he set the brakes and told the lead flight attendant that they would evacuate and that he would make an announcement to the passengers. However, the public address system had become inoperative, and the emergency evacuation commenced with the flight attendants making announcements to the passengers and directing the evacuation.

The captain stated that the first officer completed the emergency evacuation checklist and exited the airplane. The captain then donned protective breathing equipment and proceeded through the cabin looking for any incapacitated passengers. He reported that the visibility in the first class cabin was about 1 to 2 feet. He stated that he proceeded to the rear of the airplane to check the lavatories, at which time, he found the No. 3 flight attendant leaving with the last passenger. He reported that after ensuring that everyone had exited the airplane, he exited through the right overwing exit to further assist with the evacuation.

## DAMAGE TO AIRPLANE

Examination of the airplane revealed fire damage to the left forward areas of the fuselage and cargo compartment from fuselage stations (FS) 237 to 313 and damage to the cabin floor and sidewall. Fire damage was concentrated in an area just aft of the electrical disconnect panel located at FS 237, which is a junction panel for seven wire bundles. The fuselage exterior also exhibited heat discoloration in an area beneath the lavatory service panel located between FS 237 and 256 and a soot trail that extended aft from the radio rack vent, located just aft of the lavatory service panel. Soot was also present throughout the forward cargo compartment and on the cabin outflow valve near the rear of the airplane.

The floor structure and carpet of the passenger cabin exhibited fire damage from the left sidewall to the centerline of the airplane from FS 237 to 313. The seat tracks under seats 1A and 1C were buckled from heat exposure, the carpeting in front of seats 2A and 2C was burned and melted, and the floor in the aisle next to row 3 was spongy and buckled.

Further examination of the interior area between the forward cargo compartment and the fuselage revealed bluish stains, similar in color to lavatory rinse fluid (also known as blue water) on sidewall insulation blankets and components near FS 237. No drip shield, which was designed to protect the connectors at FS 237 from overhead fluid leakage, was installed over the FS 237 disconnect panel at the time of the accident, although the support brackets for the drip shield were in place. The drip shield was incorporated into the design of DC-9 series airplanes beginning with fuselage line number 271, which included N826AT. N826AT was delivered with the drip shield installed, but investigators could not determine why the shield was not in place at the time of the accident. Of the first 270 DC-9s manufactured, 80 included a forward lavatory.

The damaged wiring from the area around FS 237 was removed and sent to the Safety Board's materials laboratory for detailed examination. Beading was observed on the ends of many individual wires, which is consistent with heat damage from arcing. Each of the seven electrical connectors from the

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removed wire bundles was opened to determine the internal condition of the connector pins and grommet material. One connector exhibited more thermal damage than the other six and contained light-blue and turquoise-green crystalline deposits on the mating surfaces of its two sides and around nearly all of its pins. This connector also exhibited evidence of pin-to-pin shorts. Laboratory tests of the grommet material from this connector revealed elevated levels of sulfate (a basic chemical constituent in lavatory rinse fluid, which can be very conductive) as compared to undamaged grommet material.

## Examination of Other Airplanes

Safety Board investigators examined the area around the FS 237 disconnect panel on another AirTran DC-9 and on two DC-9s from another operator. Although a drip shield was installed above the FS 237 disconnect panel on the AirTran DC-9, protecting the components directly beneath it, bluish dried stains were observed on many surfaces near the FS 237 disconnect panel, including the bulkhead at FS 218 and on the ducts, wiring, insulation blankets, and sidewall. Neither of the DC-9s from the other operator had a drip shield installed over the FS 237 disconnect panel, and it was not determined whether these airplanes originally had the drip shields installed. Although no blue stains were observed on or near the area of the FS 237 disconnect panels in these airplanes, many components were covered with a white, mottled substance, which suggests that a fluid other than lavatory rinse fluid may have leaked from above.

## AIRPLANE INFORMATION

AirTran's records indicate that the accident airplane, serial number 47359, was manufactured on April 2, 1969, by McDonnell Douglas Corporation. The airplane was delivered to Delta Airlines new, where it was operated from 1969 to 1993. The airplane was bought back by Boeing in 1993 and stored from 1993 to 1994. In 1994, the airplane was bought by ValuJet and placed into revenue service until June 18, 1996, at which time it was placed in storage because ValuJet ceased operations. The airplane remained in storage until January 8, 1997, when it was returned to revenue service under AirTran Airways (ValuJet merged with AirTran Airways in 1997). At the time of the accident, the airplane had accumulated 78,255.3 flight hours and 88,367 cycles.

## Maintenance Information

Records from the airplane's most recent C check, which was completed in October 1999, were reviewed for nonroutine maintenance actions accomplished in the area of the forward lavatory or that mentioned lavatory fluid leaks in this area. The following items were noted:

"Fwd lav dump chute flange very dirty and boot torn." Corrective action involved cleaning the forward lavatory dump chute flange and replacing its boot.

"Fwd lav dump pull cable binds." Maintenance discovered that the cable was twisted. Corrective action involved installing a new cable.

"Fwd lav shroud has blue water and filth under seat and backside of shroud." Corrective action involved cleaning the shroud seat and backside.

"Fwd lav large floor pan has build up of blue water stains, sealant, and grime." Corrective action involved cleaning the lavatory floor pan.

The airplane's flight logbook was also reviewed to determine if any electrical anomalies involving items in the area of the fire had occurred during the several months before the accident. An October 12, 2000, writeup noted that the radio rack fan OFF annunciator light had illuminated. The corrective action was noted as "reset [circuit breaker]; Ops check fan, checks good as per

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[Maintenance Manual] 21-00." A November 20th writeup noted that the circuit breakers for the forward lavatory flush motor popped twice and that each time the flush motor operated, the circuit breakers popped. The corrective action was noted as "reset CB's and serviced lav to proper level. No defects noted. OK for svc." A November 28th (the day before the accident) writeup indicated that both the forward and aft lavatory circuit breakers popped when the lavatories were flushed. It further indicated that maintenance personnel suspected anomalies related to the jetway power supply, which was providing ground power to the airplane at the time, and that a check using power from the airplane's auxiliary power unit revealed no further anomalies.

## ADDITIONAL INFORMATION

## Previous Incidents

The Safety Board is aware of two incidents involving C-9A airplanes (the military equivalent of the DC-9) that involved circumstances similar to the accident involving N826AT. On September 21, 1999, the flight crew of a U.S. Air Force (USAF) C-9A observed several warning lights illuminate and, immediately thereafter, heard numerous circuit breakers pop in succession. Details provided by the USAF indicated that lavatory fluid had leaked beneath the lavatory floor, leading to shorting, arcing, and fire damage to electrical components in the area of the forward cargo compartment. Additionally, on May 26, 2001, the flight crew of another C-9A noticed several warning lights illuminate and heard circuit breakers pop. Investigation revealed damage to electrical components in the forward cargo compartment area, which was caused by shorting and arcing from fluid saturation. Drip shields were installed above the FS 237 disconnect panels on both airplanes.

## Lavatory Servicing

According to Boeing's DC-9 Maintenance Manual, servicing the DC-9 lavatory waste disposal system consists of draining, washing, and flushing the waste tank and then recharging it by adding new lavatory rinse fluid. (The forward waste tank, which is located above FS 237, has a capacity of 14 gallons. DC-9s also have an aft lavatory waste tank, which is not located above an electrical disconnect panel.) Boeing's DC-9 Maintenance Manual recommends that a minimum of 3.5 gallons of new fluid be added to each waste tank during lavatory servicing to ensure proper flushing/cleaning. AirTran's current lavatory servicing procedures, which were in place at the time of the accident, stipulate that at least 3.5 gallons but no more than 4.0 gallons of rinse fluid should be added to each waste tank during lavatory servicing. Incompletely draining the tank can lead to excess fluid levels in the tank, which can then flow over the tank onto the lavatory floor; the fluid can then migrate to beneath the floor and drip onto components below, especially in areas where the floor panels are not properly sealed. At the time of the accident, neither Boeing's nor AirTran's procedures specified how to determine when the tank has been completely drained.

## Postaccident Actions

Following the accident involving N826AT, AirTran revised its lavatory servicing procedures with the following "Caution" to emphasize the importance of completely draining the waste tank to avoid overflows:

If NO waste flows from tank, investigate further by going inside aircraft and flushing toilet. If it flushes and "blue" water circulates, waste did not drain. Attempt to clear any obstructions by flushing a second time only if lavatory is not at a point close to overflowing. Do not attempt to service as an overflow of the toilet may occur. Notify maintenance of the problem.

Further, Boeing issued Alert Service Bulletin (ASB) DC9-24A190 on July 31, 2001, to all operators of DC-9 airplanes. The ASB recommends that operators visually inspect the connectors at the FS 237 disconnect panel for evidence of lavatory rinse fluid contamination and that they install a drip shield over the disconnect panel. To prevent waste tank overflows, Boeing also issued Service

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Letter DC9-SL-53-101 on March 22, 2002, to operators to stress the importance of properly sealing floor panels and adhering to lavatory servicing procedures specified in its DC-9 Maintenance Manual.

On July 9, 2002, the Safety Board issued the following safety recommendations to the FAA as a result of this accident:

Require all DC-9 operators to visually inspect the electrical connectors at fuselage station 237 for evidence of lavatory rinse fluid contamination and for the presence of a drip shield above the disconnect panel in accordance with Boeing Alert Service Bulletin DC9-24A190. Connectors with internal contamination should be replaced. (A-02-13)

Issue a flight standards information bulletin to principal inspectors of DC-9 operators that discusses the circumstances of the accident involving AirTran flight 956 and stresses the importance of properly servicing and draining lavatory waste tanks and sealing floor panels in areas of probable fluid contamination, as indicated in Boeing Service Letter DC-9-SL-53-101. (A-02-14)

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<b>Landing Facility/Approach Information</b>						
Airport Name		Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
THE WILLIAM B HARTSFIELD ATLAN		ATL	Ft. MSL	26R		
Runway Surface Type:						
Runway Surface Condition:						
Type Instrument Approach:						
VFR Approach/Landing:						
<b>Aircraft Information</b>						
Aircraft Manufacturer		Model/Series		Serial Number		
Douglas		DC-9		47359		
Airworthiness Certificate(s): Normal						
Landing Gear Type: Retractable - Tricycle						
Homebuilt Aircraft? No		Number of Seats:		Certified Max Gross Wt.	LBS	Number of Engines: 2
Engine Type:		Engine Manufacturer:		Model/Series:		Rated Power:
Turbo Fan		Pratt & Whitney		JT8D		
- Aircraft Inspection Information						
Type of Last Inspection		Date of Last Inspection		Time Since Last Inspection		Airframe Total Time
Continuous Airworthiness		11/2000		Hours		78255 Hours
- Emergency Locator Transmitter (ELT) Information						
ELT Installed? No		ELT Operated? No		ELT Aided in Locating Accident Site? No		
<b>Owner/Operator Information</b>						
Registered Aircraft Owner		Street Address				
		City		State	Zip Code	
Operator of Aircraft AIRTRAN AIRWAYS INC		Street Address 9955 AIRTRAN BLVD				
		City ORLANDO		State FL	Zip Code 32827	
Operator Does Business As:				Operator Designator Code: ZZDA		
- 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						
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<b>First Pilot Information</b>				
Name On File	City	State	Date of Birth On File	Age 38

Sex: M	Seat Occupied: Left	Principal Profession: Unknown	Certificate Number: On File
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Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land; Single-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: 06/2000
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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	12000	6000								
Pilot In Command(PIC)		5000								
Instructor										
Last 90 Days										
Last 30 Days										
Last 24 Hours										

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

Type of Flight Plan Filed: IFR	
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Departure Point Same as Accident/Incident Location	State	Airport Identifier	Departure Time 1540	Time Zone
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Destination AKRON/CANTON	State OH	Airport Identifier	
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Type of Clearance: IFR

Type of Airspace: Class B

**Weather Information**

Source of Briefing:

Method of Briefing:

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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
KATL	1553	EST	0 Ft. MSL	0 NM	0 Deg. Mag.
Sky/Lowest Cloud Condition: Thin Broken			Ft. AGL	Condition of Light: Day	
Lowest Ceiling: Broken		2700 Ft. AGL		Visibility: 4 SM	Altimeter: 30.14 "Hg
Temperature: 11 °C	Dew Point: 10 °C	Wind Direction: 270		Density Altitude: Ft.	
Wind Speed: 7	Gusts:	Weather Conditions at Accident Site:			
Visibility (RVR): Ft.	Visibility (RVV) SM	Intensity of Precipitation: Light			
Restrictions to Visibility:					
Type of Precipitation: Rain					

<b>Accident Information</b>		
Aircraft Damage: Substantial	Aircraft Fire: Ground and In-flight	Aircraft Explosion

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					
Cabin Attendants				3	3
Other Crew					
Passengers			13	79	92
- TOTAL ABOARD -			13	84	97
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	13	84	97

National Transportation Safety Board

**FACTUAL REPORT**

**AVIATION**



NTSB ID: DCA01MA005

Occurrence Date: 11/29/2000

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

FRANK HILLDRUP

Additional Persons Participating in This Accident/Incident Investigation:

BOB HENLEY