In-flight smoke and fire, Douglas DC-9-32, August 8, 2000

Micro-summary: **This Douglas DC-9-32 executed an emergency landing due to an in-flight fire and smoke in the cockpit.**

Event Date: **2000-08-08 at 1544 EDT**

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

Investigative Body's Web Site: **http://www.ntsb.gov/**

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National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: DCA00MA079	Aircraft Registration Number: N838AT
Occurrence Date: 08/08/2000	Most Critical Injury: Minor
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
GREENSBORO	NC		1544	EDT	

Airport Proximity: Off Airport/Airstrip	Distance From Landing Facility:	Direction From Airport:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Douglas	DC-9-32	Airplane

Sightseeing Flight: No Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

On August 8, 2000, about 1544 eastern daylight time, the flight crew of AirTran Airways flight 913, a McDonnell Douglas DC-9-32, N838AT, executed an emergency landing at Greensboro Piedmont-Triad International Airport (GSO) shortly after declaring an emergency due to an in-flight fire and smoke in the cockpit. An emergency evacuation was performed. Of the 58 passengers and 5 crewmembers on board, 3 crewmembers and 5 passengers received minor injuries from smoke inhalation. Five passengers and one ground crewmember received minor injuries during the evacuation. The airplane sustained substantial fire, heat, and smoke damage. The flight was operating on an instrument flight rules flight plan under the provisions of 14 Code of Federal Regulations Part 121 as a regularly scheduled passenger flight from Greensboro, North Carolina, to Atlanta, Georgia. Visual meteorological conditions prevailed at the time of the accident.

AIRPLANE INFORMATION

N838AT, a DC-9-32, serial number 47442, was delivered new to Turkish Airlines on August 24, 1970. It was registered to ValuJet on March 7, 1995 (ValuJet was acquired by AirTran Airways in 1997).

FIRE DAMAGE

Examination of the airplane revealed severe smoke and heat damage around the electric power center (EPC) and within the cockpit. Removal of the forward and aft EPC panels revealed heavy sooting, melted wire insulation, visibly broken wires, and localized heat damage. The lowest point of the fire damage on the cabin (aft) side of the EPC was in the upper compartment where it was noted that the aluminum stanchion brace that runs the length of that compartment was destroyed along with the AC bus feeder wires and numerous other airplane wiring bundles. No fire damage was noted in the lower aft compartment. The lowest point of the fire damage was on the cockpit side of the EPC, behind the lower right access panel where the AC ground service tie relay and the right and left heat exchanger cooling fan relays were located. The location of the fire damage is consistent with it being the point of origin for the fire.

TESTS AND RESEARCH

Relay Examination and Evaluation

Examination of the relays located in the area of the fire origin (R2-53 and R2-54) revealed that R2-53, the left heat exchanger cooling fan relay, was severely heat damaged, as were the other relays in this area. However, only the R2-53 relay had loose terminal studs and several holes that had burned through the relay housing. The largest of the burn holes observed in the R2-53 relay were on the terminal "A" side directly above the wiring bundles.

Removal of the R2-53 relay cover revealed that none of the rotating contacts, or armatures,

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were touching the stationary contacts, indicating that the relay was in the de-energized, or open, condition. This finding suggests that, initially, the relay functioned properly by returning the rotating armature to the open position after takeoff.

Disassembly of the relay revealed that the floor between the housing upper cavity and lower cavity was heavily heat damaged. Arc damage extended around three sides of the relay; only the side containing the "C" terminals remained intact. According to the manufacturer, Leach International Corporation, the damage to the relay housing was consistent with a phase-to-phase arc between terminals "A2" and "B2" of the relay. Disassembly of the relay also revealed that one of the wires that passes between the two coils in the lower housing adjacent to the armature shaft exhibited insulation damage. No evidence was observed to suggest that the wire arced or overheated, indicating that the wire did not cause or contribute to a short in the relay.

Relay Repairs

Visual examination and disassembly of the R2-53 relay revealed numerous repairs that did not conform to Leach production standards. For example, the baseplate and coil assembly time-delay circuit were attached with four slotted screws that exhibited mechanical damage and that did not have the typical coating of sealant, some of the diodes on the time-delay circuit board appeared to be different than those used by Leach during production, nonstandard shims were installed between the relay housing and the stationary contact, and nonstandard, pre-drilled two-hole washers were found installed below the contact carrier assembly.

According to Leach, no overhaul or component maintenance manual has been released to outside repair stations or vendors for repair of this part. Leach representatives reported that their facility does not overhaul this relay but might do minor repairs as part of warranty work, such as changing the time-delay circuit board. Additionally, according to Leach, any repairs performed at the facility would require stamping the outside of the relay housing with the letter "R." No such marking was found anywhere on the R2-53 relay housing.

Disassembly of the R2-54 relay revealed many of the same nonconforming repairs noted during the examination of the R2-53 relay. During the examination of the R2-54 relay, an alphanumeric stamp, "JNR 11-17-78," was discovered on the underside of the relay cover. Leach indicated that this stamp is not a Leach repair or manufacturing mark. The repair date code indicates that the repair was performed while the aircraft was owned and operated by Turkish Airlines.

Circuit Breakers Examination and Evaluation

During the on-scene portion of the investigation, three of the four circuit breakers in the left heat exchanger cooling fan were found in the tripped position. To determine why only three of the four circuit breakers tripped, all four were submitted to the Materials Integrity Branch at Wright-Patterson Air Force Base, Dayton, Ohio, for further examination. The circuit breakers were visually examined and were subjected to an insulation resistance measurement, a contact resistance test, a voltage drop test, and a calibration test (which measured minimum and maximum ultimate trip times). Testing and examination determined that the circuit breaker that did not trip exhibited no anomalies that would prevent normal operation, met all specifications required for the selected tests, and operated properly during the calibration test. Although this circuit breaker appeared to have functioned properly during testing, the lab report noted that, as a thermal device, the circuit breaker is designed to trip when a sustained current overload exists and that it is possible during the event that intermittent arcing or a resistive short occurred or that the circuit opened before the breaker reached a temperature sufficient to trip the device.

ADDITIONAL INFORMATION

As a result of this accident, AirTran inspected its entire DC-9 fleet for anomalies in the R2-53 and R2-54 relays. Five relays were removed from service due to loose terminal studs. A DC-9 fleet campaign was conducted to inspect R2-53 and R2-54 relays and to determine if relay

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degradation was time-related and whether a hard-time inspection was warranted. The results of the survey indicate that a hard-time service limit is not warranted; however, several relays showed clear indications that unauthorized repairs had been performed, similar to those apparently performed on the accident R2-53 relay.

The Safety Board also learned during its investigation of this accident that neither flight attendant on board flight 913 attempted to locate the source of the smoke in the cabin or to use any of the firefighting equipment available to them. It was also learned that AirTran's flight attendant training program does not include any drill involving hidden fires but does include a drill that uses a visible, open flame. Based on this accident (and others involving in-flight fires), the Safety Board issued five safety recommendations to the FAA on January 4, 2002, regarding improved crewmember training for fighting in-flight fires.

The Safety Board's investigation also revealed that after donning his oxygen mask, the first officer removed it to address the passengers on the public address system, exposing himself to the smoke and the potential for incapacitation. He reported in a postaccident interview that he continued to feel the effects of the smoke after he replaced his mask. The first officer was treated for smoke inhalation after evacuating the airplane.

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NTSB ID: DCA00MA079

Occurrence Date: 08/08/2000

Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
PIEDMONT TRIAD INTERNATIONAL	GSO	Ft. MSL	0		

Runway Surface Type: Asphalt

Runway Surface Condition: Dry

Type Instrument Approach: NONE

VFR Approach/Landing: Precautionary Landing

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Douglas	DC-9-32	

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	119	LBS	2

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Jet	Pratt & Whitney	JT8D	14500 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Unknown		Hours	Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?

Owner/Operator Information

Registered Aircraft Owner	Street Address		
	City	State	Zip Code

Operator of Aircraft	Street Address		
AIRTRAN AIRLINES INC	9955 AIR TRAN BLVD		
	City	State	Zip Code
	ORLANDO	FL	32827

Operator Does Business As:

Operator Designator Code: VJ6A

- 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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Occurrence Date: 08/08/2000

Occurrence Type: Accident

First Pilot Information

Name	City	State	Date of Birth	Age
On File			On File	51

Sex: M | Seat Occupied: Left | Principal Profession: Civilian Pilot | Certificate Number: On File

Certificate(s): Airline Transport; Commercial

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

Rotorcraft/Glider/LTA: Helicopter

Instrument Rating(s): Airplane; Helicopter

Instructor Rating(s):

Type Rating/Endorsement for Accident/Incident Aircraft? Yes | Current Biennial Flight Review? 04/2000

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--no waivers/lim. | Date of Last Medical Exam: 06/2000

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	22000	15000								
Pilot In Command(PIC)		10000								
Instructor										
Last 90 Days										
Last 30 Days										
Last 24 Hours										

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? | Second Pilot?

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
Same as Accident/Incident Location			0000	

Destination	State	Airport Identifier	
ATLANTA	GA	ATL	

Type of Clearance:

Type of Airspace:

Weather Information

Source of Briefing:

Method of Briefing:

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NTSB ID: DCA00MA079

Occurrence Date: 08/08/2000

Occurrence Type: Accident

Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
			Ft. MSL	NM	Deg. Mag.

Sky/Lowest Cloud Condition: Clear Ft. AGL

Condition of Light: Not Reported

Lowest Ceiling: None Ft. AGL

Visibility: 10 SM

Altimeter: "Hg

Temperature: °C

Dew Point: °C

Wind Direction:

Density Altitude: Ft.

Wind Speed: Calm

Gusts:

Weather Condtions at Accident Site: Visual Conditions

Visibility (RVR): 0 Ft.

Visibility (RVV) 0 SM

Intensity of Precipitation:

Restrictions to Visibility:

Type of Precipitation: None

Accident Information

Aircraft Damage: Substantial

Aircraft Fire: In-flight

Aircraft Explosion None

Classification: U.S. Registered/U.S. Soil

- 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			2	1	3
Other Crew					
Passengers			10	48	58
- TOTAL ABOARD -			13	50	63
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	13	50	63

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Administrative Information

Investigator-In-Charge (IIC)

Lorenda Ward

Additional Persons Participating in This Accident/Incident Investigation:

ROBERT HENLEY
AAI-100