Spurious engine fire indication, McDonnell Douglas MD-11, March 31, 2002

Micro-summary: This McDonnell Douglas MD-11 crew received feedback of a #2 engine fire, and then diverted and ordered an evacuation.

Event Date: 2002-03-31 at 1945 EST

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

Investigative Body's Web Site: http://www.ntsb.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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National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: MIA02FA075	Aircraft Registration Number: N809DE
Occurrence Date: 03/31/2002	Most Critical Injury: Serious
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
Charlotte	NC	28208	1945	EST	

Airport Proximity: On Airport	Distance From Landing Facility: 0	Direction From Airport:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
McDonnell Douglas	MD-11	Airplane

Sightseeing Flight: No

Air Medical Transport Flight: No

Narrative

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

HISTORY OF FLIGHT

On March 31, 2002, about 1945 eastern standard time, a McDonnell Douglas MD-11, N809DE, registered to Delta Air Lines, Inc., operating as a Title 14 CFR Part 121 scheduled international passenger flight, Delta flight number 12, executed an emergency landing and passenger evacuation at the Charlotte/Douglas International Airport, Charlotte, North Carolina. Instrument meteorological conditions prevailed and an international instrument flight plan was filed. The aircraft received minor damage, and three flightcrew, 11 cabincrew and 215 passengers were not injured. Eleven passengers received minor injuries and five passengers sustained serious injuries. The flight departed Atlanta for London's Gatwick Airport at 1902.

The captain stated that he was the pilot flying and also he was acting as a Line Check Airman providing operating experience training to the first officer. This was the first officer's first operating experience segment as an MD-11 first officer. The takeoff and climb to the cruise altitude of 33,000 feet was conducted within normal parameters. After level off the relief pilot left the cockpit to begin his rest period. Within a few minutes he observed that the number 2 engine master warning light was illuminated, as well as a level 3 alert on the EAD (Engine and Alert Display) and a red light on the number 2 fire handle and fuel shutoff lever. The fire bell did not activate. He and the first officer performed the memory and initial action items on the hard card checklists for an engine fire. In addition, the captain discharged an engine fire bottle. The engine fire light continued to illuminate. The captain then fired a second engine fire bottle. The engine fire light continued to be illuminated. The captain requested that the relief pilot return to the cockpit. He then contacted ATC (Air Traffic Control) and told them that their No. 2 engine was on fire and that they intended to land at the nearest suitable field. ATC responded that Charlotte was 35 miles away with a 10,000-foot runway. He asked for radar vectors and an immediate descent into Charlotte. They were given a lower altitude. The relief pilot returned to the cockpit and he asked the relief pilot and the first officer to run the checklists. As they descended the aircraft encountered heavy rain, light hail, and moderate turbulence. In addition, they observed a bright flash to the left of the nose, which might have been a lightning strike. As they completed the descent and approach checklists he told the crew to expect an emergency evacuation upon landing and directed the first officer to so inform the flight attendants. The aircraft was configured for an engine out approach and they reviewed the loss of a second engine procedure. The remainder of the approach, touchdown and landing roll occurred within normal parameters. He brought the airplane to a stop on the runway. The engine fire indication remained illuminated. They completed the items on the evacuation checklist. He then ordered an evacuation of the airplane.

The first officer stated that the captain was the flying pilot. The takeoff roll and climbout from Atlanta were conducted within normal parameters. When the aircraft leveled at flight level 330, the relief pilot left the cockpit to begin his rest period. Within a few minutes , he observed a flashing red warning light, a level 3 alert on the EAD and a red light on the No. 2 engine fire

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Narrative (Continued)

handle and fuel shutoff lever. The captain began an immediate descent into Charlotte and requested that the relief pilot return to the cockpit. The first officer began to run the engine fire/severe damage checklist. He stopped to provide the relief pilot access to the cockpit. He then completed the items on the checklist with the assistance of the relief pilot. As they descended the captain called for fuel dump. The first officer accomplished the items on the fuel dump checklist. The aircraft was encountering heavy rain, light hail, and moderate turbulence. There were no strong echoes indicated on weather radar. In addition, they observed a bright flash to the left of the nose. The captain remarked that they had been struck by lightning. The first officer initiated and accomplished the descent checklist after changing the destination and setting up the landing runway in the flight management system. The relief pilot assisted him in the completion of the approach checklist. As they became established on the glideslope for runway 18 at Charlotte, the captain told then to expect an emergency evacuation upon landing and instructed the relief pilot to so inform the flight attendants. The airplane was configured for an engine out approach. While on final approach, the first officer announced and read the loss of second engine checklist. At 840 feet agl, he initiated and completed the before landing checklist. The captain brought the airplane to a stop on the runway and then called for the emergency evacuation checklist, which the relief pilot read and performed. The captain made a public address announcement and the first officer activated the evacuation horn.

The relief pilot stated that he sat on the cockpit jumpseat during the takeoff roll and climbout from Atlanta. When the aircraft leveled at flight level 330, he left the cockpit to begin his rest period. Within a few minutes a flight attendant informed him that the captain had requested that he return to the cockpit immediately. Upon entering the cockpit he observed that the fire handle light for the No. 2 engine was illuminated and that the captain and first officer were in the process of running the engine fire checklist. The captain asked him to run the checklists with the first officer so that he could focus his attention on the operation of the aircraft and communications with ATC. As they completed the checklists the captain began an emergency descent into Charlotte. The engine fire light remained illuminated after completion of checklist items. As they descended, the aircraft encountered heavy rain, light hail, and moderate turbulence. In addition, they observed a bright flash to the left of the nose. The captain remarked that they had been struck by lightning. As they completed the descent and approach checklists and became established on the glideslope for runway 18 at Charlotte, the captain said to expect an emergency evacuation upon landing and directed the relief pilot to so inform the flight attendants. The aircraft was configured for an engine out approach. In addition, the flight crew reviewed the loss of second engine procedure. The remainder of the approach, touchdown and landing roll occurred within normal parameters. The captain brought the airplane to a stop on the runway. They then completed the items on the evacuation checklist. The relief pilot stated in interview with NTSB that they did not terminate the fuel dumping prior to landing.

The flight attendant positioned at the 1R door stated that about 10 minute after takeoff the flight attendants were given the 10,000-foot signal, but the seat belt sign was left on due to light turbulence. They began cabin service. A while later the pilots called back and told the flight attendants to take their seats. About 30 seconds later the pilots asked that they send the relief pilot to the cockpit, that they had a problem and needed him right away. The aircraft began descending and they stowed the carts. The aircraft continued the descent at a steep angle. The flight attendant positioned at the 1L door, who was the onboard leader, talked to the pilots and the pilots told her they had a fire in No. 2 engine and would be landing in Charlotte. The pilot also told her to prepare the cabin for an emergency landing and that he did not think they would have to evacuate the aircraft, but to review their emergency procedures. She passed this information to the other flight attendants. They completed the preparation for landing and took their seats. About 30 seconds from landing the onboard leader made an announcement to the passengers reminding them of the emergency lights. The landing was smooth and the aircraft stopped. The power went off and the emergency lights came on. The evacuation horn sounded. The onboard leader yelled through the cockpit door to confirmed the evacuation signal with the pilots, and someone yelled yes. He went to the 1R door, assessed the conditions outside, confirmed the door

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was armed, and opened the door. He saw the door move up into the ceiling and the slide/raft come out of the bottom of the door. As he reached for the assist handle near the door, the slide began to inflate. He could hear the rush of compressed air from the inflation bottle and the slide began to fill the doorway, pushing him against the windscreen in front of the row one seats. The slide inflated up to the ceiling from the floor, then bent and came into the aisle, then hit the floor, and bent back up to the ceiling and wrapped around the windscreen. It completely filled the doorway and into the aisle and the area near the cockpit door. He pulled himself out of the way of the slide and became worried that the slide might explode, because the inflation tubes were completely inflated. It was drum tight. He immediately blocked the exit and looked to the 1L door. The door was open and he began directing passengers to that door. As A zone emptied he moved to the 2R door. The flight attendant at the 1L door stated a cockpit crewmember exited the cockpit and deflated the slide at the 1R door with a crash axe. The flight attendant at the 4R door stated that when the evacuation signal activated, he initially thought it was the lavatory smoke detectors activating and he checked the lavatory for smoke. He then realized it was the evacuation signal and initiated evacuation through the 4R door.

The Charlotte/Douglas International Airport, Aircraft Rescue and Fire Fighting (ARFF) chief on duty at the time of the accident stated to NTSB personnel that the fire station was notified by air traffic controllers at 1942, of a MD-11 landing with a possible No. 2 engine fire. The ARFF equipment was pre-positioned near runway 18R. When the airplane landed it was followed by ARFF vehicles. The ARFF Chief radioed his vehicles to use caution because of the reduced visibility in the heavy rain and also because fuel was being sprayed on the vehicle's windshields from the airplane. He cautioned also that the runway was slippery from the rain-fuel mixture. He did not see fuel coming from the fuel dump pipes on the wings.

PERSONNEL INFORMATION

The captain held an airline transport pilot certificate for airplane multiengine land, type rated on the Boeing 737, 757, 767, Lockheed L1011, and the McDonnell Douglas MD-11. The date of his most recent proficiency check on the MD-11 was October 4, 2001. He was designated a company line check airman on the MD-11 on January 25, 2002. Company records indicate that at the time of the accident, he had accumulated 20,120 total flight hours with 1,647 hours in the MD-11 type aircraft. His most recent Federal Aviation Administration, (FAA) first-class medical certificate was issued on February 2, 2002, with no limitations or waivers. On this particular flight he was serving as a check airman for the purpose of providing the newly rated first officer with operating experience.

The first officer held an airline transport certificate for airplane multiengine land, type rated on the McDonnell Douglas MD-11. The date of his initial type-rating check ride was March 20, 2002. Company records indicate that at the time of the accident, he had accumulated 8,363 total flight hours with 5 hours in the MD-11 aircraft. His most recent FAA first-class medical certificate was issued on December 5, 2001, with no limitations or waivers. This particular segment of the flight was his first exposure to MD-11 crew operating experience. His most recent previous position with the company was as a B-727 captain.

The relief pilot held an airline transport certificate for airplane multiengine land, type rated on the McDonnell Douglas MD-11. Company records indicate that at the time of the accident, he had accumulated 11,500 total flight hours with 1,268 hours on the MD-11 aircraft. His most recent company proficiency check on the MD-11 was during February, 2002. His most recent FAA first-class medical certificate was issued on March 3, 2002, with no limitations or waivers. His most recent previous position with the company was as a B-767 first officer.

Eleven flight attendants were assigned to Flight 12. All flight attendants were qualified on the MD-11 aircraft.

AIRCRAFT INFORMATION

Narrative (Continued)

The cockpit warning for an engine fire on the MD-11 aircraft consists of an aural and visual warning. A continuous bell rings and is automatically inhibited on landing from 100 feet radar altitude to 80 knots airspeed. The visual indications are a MASTER WARNING light on the cockpit glare shield as well as the CRTs [displayed by the EAD, (engine and alert display) feature of the EIS (electronic instrument alerting system)] and a red "ENG FIRE, (1, 2, or 3)" in the engine fire handle and the engine fuel switch. The fire warning system consists of dual detection loops that require either, (1) detection of an overheat or fire by both loops or, (2) a failure of one loop and a fire detection of the other loop.

An inflatable evacuation slide/raft is installed in a slide stowage container, mounted on the inside, bottom of every cabin door. Opening the door, when the arming lever adjacent to the door is in the SLIDE ARMED position, will automatically inflate and deploy the slide/raft. A manual inflation handle is installed in the slide/raft assembly and becomes visible when the slide is deployed. If the automatic inflation feature malfunctions, the manual handle can be pulled to inflate the slide/raft.

METEOROLOGICAL INFORMATION

The 1851 observed weather for the Charlotte airport was reported as: winds from 360 degrees at 7 knots, 2 statute miles visibility in light drizzle and mist, ceiling was overcast at 300 feet, ambient temperature and dew point both 55 degrees F, altimeter setting 29.87 inHg., with a remark that surface visibility was 5 statue miles. While the flight was on final approach, Charlotte tower relayed surface winds of 010 degrees at 10 knots, visibility of 2 miles in mist.

FLIGHT RECORDERS

The airplane was equipped with a L-3 Communications model FA2100 digital solid state, 2-hour, cockpit voice recorder (CVR). The CVR was taken to the NTSB Vehicle Recorders Laboratory, Washington, D.C., for readout. A transcript of the final 17 minutes and 20 seconds of the recording was prepared. See NTSB CVR Specialist's Factual Report.

The airplane was equipped with a Loral Fairchild Model F-1000 digital flight data recorder (DFDR). The DFDR was taken to the NTSB Vehicle Recorders Laboratory for readout. The data indicated the No. 2 engine fire warning activated at 1928:41, when the aircraft was in cruise flight at 33,000 feet. At 1928:51, the No. 2 engine was shutdown. Fuel quantity began decreasing rapidly at about 1934 and continued to decrease rapidly until the recording ended at 1945, shortly after the airplane landed. See NTSB Specialist's Factual Report of Investigation, Digital Flight Data Recorder.

WRECKAGE AND IMPACT INFORMATION

According to Delta Air Lines representatives, examination of the No. 2 engine by company maintenance personnel found one fire loop chafed through an adjacent cable, an integrated drive generator (IDG) feeder cable, inside the No. 2 engine cowling. This allowed a direct 115 volt AC connection between the IDG and the fire detection control unit. The result was an electrical short and complete failure of the detection control unit that was indicated in the cockpit as a fire warning. There was no evidence of fire in the No. 2 engine.

Examination of the 1R slide/raft by NTSB and representatives of Air Cruisers, the manufacturer of the slide/raft, Boeing, and Delta Airlines showed that the manual inflation handle was fully stowed. The inflation valve was found one ratchet notch from the fully open position. According to the manufacturer, this condition typically occurs when the valve is opened slowly instead of quickly as would happen if the inflation lanyard activated the valve had the slide fell outside from the door opening. Further examinations were conducted to explain why the valve opened slowly. It was found that if the inflation lanyard had snagged on something as the door began to move, and

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the slide/raft began to move out of it's container, the tension on the lanyard would cause the reservoir's valve to open slowly and not reach it's fully open position. It was concluded that the most likely cause of a snag on the inflation lanyard were mini-nuts that protruded toward the slide/raft. The mini-nuts fastened the girt bar viewing windows and also the wiper on the hinged panel at the bottom of the decorative cover on the door. The mini-nuts were found only at the 1L and 1R exit doors. All other doors had counter sunk screws whose heads faced the slide/raft and did not protrude into the path of the slide/raft during deployment.

MEDICAL INFORMATION

Three flightcrew, 11 cabincrew, and 215 passengers were not injured. Eleven passengers received minor injuries and five passengers sustained serious injuries.

TESTS AND RESEARCH

Boeing Service Bulletin MD11-71-086 was issued on May 21, 1996. The subject of the service bulletin was "Power Plant - Electrical Harness - Replace/Modify Integrated Drive Generator (IDG) Wire Harness Support Brackets". On May 21, 2001, Boeing elevated the service bulletin to the "Alert" level. Boeing recommended that aircraft operators accomplish the service bulletin within 1 year. According to Delta Air Lines personnel, in November 2001, Delta Air Lines Aircraft Engineering issued a Engineering Order to comply with Alert Service Bulletin MD11-71A086. The Engineering Order stated that all engines should be inspected and modified by November 2002. All three engines on the accident aircraft were inspected and modified in accordance with the Engineering Order on March 3, 2002. On March 28, 2002, the No. 2 engine was changed and the engine installed had not been modified by the Engineering Order.

The Delta Airlines descent, approach, and before landing checklists dated June 30, 2000, and which were in use at the time of the accident, required the pilots to check the Engine and Alert Display. When fuel dumping is activated, a message is displayed on the Engine and Alert Display.

ADDITIONAL INFORMATION

The aircraft was released by NTSB to Delta Air Lines on April 4, 2002. The cockpit voice recorder, digital flight data recorder, and the 1-R slide which were retained by NTSB were subsequently released to Delta Air Lines.

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Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
Charlotte Douglas Internationa	KCLT	748 Ft. MSL	18R	10000	150

Runway Surface Type: Concrete

Runway Surface Condition: Wet

Type Instrument Approach: ILS-complete

VFR Approach/Landing: Unknown

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
McDonnell Douglas	MD-11	40480

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	282	628000 LBS	3

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Jet	Pratt & Whitney	PW 4460	60000 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
AAIP	02/2002	20 Hours	40531 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?
No	No	No

Owner/Operator Information

Registered Aircraft Owner	Street Address		
Delta Air Lines, Inc.	Hartsfield Atlanta International Airport D595		
	City: Atlanta	State: GA	Zip Code: 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; International; Passenger Only

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First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	57

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

Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

Type Rating/Endorsement for Accident/Incident Aircraft? Yes | Current Biennial Flight Review? 10/2001

Medical Cert.: Class 1 | Medical Cert. Status: Valid Medical--no waivers/lim. | Date of Last Medical Exam: 02/2002

- 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	20120	1647								
Pilot In Command(PIC)										
Instructor										
Last 90 Days	191	191								
Last 30 Days										
Last 24 Hours	5	5								

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? No | Second Pilot? Yes

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
Atlanta	GA	KATL	1902	EST

Destination	State	Airport Identifier
London		ELGW

Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing: Company; TV/Radio Weather

Method of Briefing: In Person

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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
CLT	1951	EST	748 Ft. MSL	0 NM	Deg. Mag.

Sky/Lowest Cloud Condition: Ft. AGL

Condition of Light: Night

Lowest Ceiling: Overcast 300 Ft. AGL

Visibility: 2 SM

Altimeter: 29.85 "Hg

Temperature: 12 °C

Dew Point: 12 °C

Wind Direction: 360

Density Altitude: 800 Ft.

Wind Speed: 10

Gusts:

Weather Condtions at Accident Site: Instrument Conditions

Visibility (RVR): Ft.

Visibility (RVV) SM

Intensity of Precipitation: Light

Restrictions to Visibility: None

Type of Precipitation: Rain

Accident Information

Aircraft Damage: Minor

Aircraft Fire: None

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				11	11
Other Crew				1	1
Passengers		5	11	215	231
- TOTAL ABOARD -		5	11	229	245
Other Ground					
- GRAND TOTAL -		5	11	229	245

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Administrative Information

Investigator-In-Charge (IIC)

Jeffrey L. Kennedy

Additional Persons Participating in This Accident/Incident Investigation:

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Charlotte, NC 28273

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Atlanta, GA 30320

Peter Frey
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