Cargo compartment fire on ground, McDonnell Douglas MD-11, November 8, 1998

Micro-summary: This MD-11 experienced a fire in the center cargo compartment while at the gate.

Event Date: 1998-11-08 at 2100 EST

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

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

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1. Accident reports can be and sometimes are revised. Be sure to consult the investigative agency for the latest version before basing anything significant on content (e.g., thesis, research, etc).

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!

3. Reports may or may not represent reality. Many many non-scientific factors go into an investigation, including the magnitude of the event, the experience of the investigator, the political climate, relationship with the regulatory authority, technological and recovery capabilities, etc. It is recommended that the reader review all reports analytically. Even a "bad" report can be a very useful launching point for learning.

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National Transportation Safety Board		NTSB ID: ATL99IA015 Aircraft Registration Number: N811DE								
FACTUAL REPORT	ſ	Occurre	ence Date: 11/0	8/1998	Most Critical Injury: None					
AYIATION FTYBON	ľ	Occurrence Type: Incident Investigated By: NTSB								
Location/Time										
Nearest City/Place	State		Zip Code	Local Time	Time Zone					
ATLANTA	GA		30320	2100	EST					
Airport Proximity: On Airport	Airport Proximity: On Airport Distance From Landing Facility: Direction From Airport:									
Aircraft Information Summary										
Aircraft Manufacturer			Model/Serie	es			Type of Aircraft			
McDonnell Douglas			MD-11				Airplane			
Sightseeing Flight: No			Air Medical T	ransport Flight: N	D					
Narrative										
 Brief narrative statement of facts, conditions and circumstan On November 11, 1998, abo experienced a fire in the ce Hartsfield Atlanta Internatio Air Lines under the provisi conditions were undetermined. there were no injuries. The a of the fire. The airplane had arrived in scheduled departure of 2220 personnel informed a mechanic unit (PDU) powered rollers rollers move cargo bins forward According to the mechanic, personnel removed the last the McDonnell Douglas MD-11 return to the shop to revie breaker for the cargo contr did he tag the system out Manual. While the mechanic was away f service had a crew change. Th on the floor of the cargo com its connecting wires cut by th dropped off-line. It was reported previous occurrences short of the powered roller's w A Delta technician started the the airplane. Other Delta te flames behind a floor vent turned off as the technicia vent, and the flames were subse The CCU is mounted near the the airplane. It receives distributes power throughout electrically-powered rollers w 	Transmessioned to the control of the scotennodes: On November 11, 1998, about 2100 eastern standard time, a McDonnell Douglas MD-11, N811DE, perienced a fire in the center cargo compartment while the airplane was operated by Delta r tines under the provisions of Title 14 CFR Part 121. There was no flight plan and weather mditions were undetermined. There were no passengers or crewmembers aboard the airplane and nere were no injuries. The airplane received minor damage. The airplane was operated by Delta r the fire. The airplane had arrived in Atlanta from Portland, Oregon at 2007, and was being readied for a theduied departure of 2220 to London, England. During the trip check, airport customer service tresonnel informed a mechanic that one of the center cargo bay longitudinal spring-lift power drive the fire. The other control of the center cargo compartment. The output of the mechanic, he removed the powered rollers after the airport customer service tresonnel nemove cargo bins forward and aft in the cargo compartment. The advect of the last container from the cargo compartment. The shop to review the manual. According to the mechanic, he did not open the circuit true to the shop to review the manual. According to the mechanic, he did not open the direcu- turu to the shop to review the airplane obtaining a new powered roller, the airport customer service had a crew change. The new crew, unaware that the power source to the airplane and the floor of the cargo compartment, began loading cargo bins. The cannon plug had been left is connecting wires cut by the cargo bin. At that time, the external power source to the airplane topped off-line. It was not determined if the loss of ramp power was a coincidence as Delta toported previous occurrences of that ramp power dropping off line, or if it resulted from the is a connecting wires. The new repared to discharge a fire extinguisher through the cabin floor ent, and the flames were subsequently extinguished. The CCU is mounted near the aft cargo door and is an electri									
creering powered forrers which are mounted enoughout the cargo froor. The eeo is protected by										

FACTUAL REPORT - AVIATION



Narrative (Continued)

three 10-amp circuit breakers. Following the incident, the CCU and insulation material behind it were removed, and the airplane was put back into service.

Subsequently, the insulation blanket, the powered roller, its associated cannon plug and wiring, and the CCU were examined by Delta Air Lines, Safety Board, and Lucas Aerospace Cargo Systems investigators. Several of the cannon plug wires were severed and exhibited blackening and sooting of the wire insulation consistent with electrical arcing. The lower shelf of the CCU that served as the mounting point for the input cannon plugs exhibited sooting that disappeared beneath the CCU back plate. The back plate exhibited a blackened and sooted area adjacent to the AC power output line for the printed circuit card J4. This is the circuit card that distributes AC power to the powered rollers. Several powered rollers are protected by a 10 amp 3-phase circuit breaker upstream from the CCU. According to Delta Air Lines maintenance supervisors, this circuit breaker was found closed following the event.

The manufacturer of the cargo handling system installed in the airplane, Lucas Aerospace Cargo Systems, stated that Lucas Aerospace Service Bulletin 462650-25-01, dated April 17, 1998, had not been incorporated into the CCU installed in this airplane. The purpose of the Service Bulletin was to upgrade the motherboard power input connector pins, as problems had been previously identified with the original CCU motherboard electrical pins due to their undersized diameters and the use of a copper alloy that had higher resistance than desired. The installed CCU was of a configuration that was known to be susceptible to damage when exposed to short circuits.

The examination of the failed CCU indicated that the damage was consistent with the circuit location observed in the wire harness for the damaged powered roller. The power input connector pins (connector J4) associated with the damaged roller were observed to be blackened and melted. The CCU back plate installed in contact with the burned metalized mylar insulation blanket displayed heavy sooting and evidence of overheating that was aligned with the damaged connector pins. The damaged insulation blanket exhibited the maximum scorching damage at its contact point with the area of scorching on the CCU back plate.

The examination of the CCU revealed that the wiring damage created an excessive electrical current that vaporized several electrical pins inside the CCU. The pins are designed to distribute electrical power from the airplane's 115-volt AC ground power bus to the CCU's printed circuit motherboard assembly, but were not capable of sufficiently conducting the excessive current spike. Failure of the pins allowed hot gases to escape the back cover of the CCU and ignite the adjacent mylar insulation blanket.

Following the examination of the CCU, a discussion was held among the Lucas Aerospace Cargo Systems, Boeing Aircraft, Delta Air Lines, and Safety Board investigators. It was noted that there had been similar short circuit events that resulted in a similarly damaged CCU, even with the upgraded configuration. In its engineering report, Lucas states, "It was clear that Lucas Service Bulletin 462650-25-01, while improving the current carrying capability of the CCU, does not eliminate all possibility of damage resulting from shorted power lines." During the discussion, it was agreed that (1) low impedance short circuits occurring in circuits controlled by the CCU result in current spikes which can exceed 1000 amps, and (2) the 10 amp circuit breakers (P/N 5D0003-10) in the Boeing Long Beach circuit breaker panel do not respond to these current spikes quickly enough to prevent damage to the CCU.

Subsequently, testing by Lucas to mitigate the effects of short circuit occurrences resulted in the following actions; (1) a service modification by Boeing to replace all 3-phase 10 amp circuit breakers upstream of the CCU with 5 amp breakers, (2) a Service Bulletin by Boeing to "add a fire resistant barrier between the CCU and the flammable liner of the insulation blanket," and (3) replacement of all motherboard connector pins, by Lucas Aerospace Cargo Systems, with newer enhanced pins having higher conductivity and larger diameters.

FACTUAL REPORT - AVIATION

National Transportation Safety Board	NTSB ID: ATL99IA015	
FACTUAL REPORT	Occurrence Date: 11/08/1998	
AVIATION ETYBON	Occurrence Type: Incident	
Newsting (2 din 1)		

Narrative (Continued)

According to the McDonnell Douglas MD-11 Maintenance Manual, instructions for removal of the longitudinal power rollers states; "WARNING: tag and use safety clips to safety the circuit breakers. If the circuit breakers are not opened, tagged, and safetied, injury to persons and damage to equipment can occur."

National Transportation Safety Board NTSB ID: ATL99IA015											
FACTUAL REPORT	Occi	urrenc	ce Date:								
AVIATION	Occurrence Type: Incident										
Landing Facility/Approach Informatic	 on					I					
Airport Name		Airpo	ort ID:	inway Width							
HARTSFIELD ATLANTA INT'L		ATL	-	Ft	. MSL	0					
Runway Surface Type:											
Runway Surface Condition:											
Type Instrument Approach:											
VFR Approach/Landing:											
Aircraft Information									.		
Aircraft Manufacturer McDonnell Douglas			Model/ MD-1	Series 1					Serial 4856	Number 6	
Airworthiness Certificate(s): Transport											
Landing Gear Type: Retractable - Tricycle											
Homebuilt Aircraft? No Number of Seats: 262 Certified Max Gross Wt. 625500 LBS Num							Numbe	er of Engin	es: 3		
Engine Type: Turbo Fan	Enç P{	Engine Manufacturer:Model/Series:P&W4460/4000							Rated Power: 60000 LBS		
- Aircraft Inspection Information											
Type of Last Inspection Date of Last Inspection Time Since Last In							nce Last Inspe	ection		Airframe	Total Time
Continuous Airworthiness	11/	11/1998 0 Hours						ours		23781 Hours	
- Emergency Locator Transmitter (ELT) Info	ormation										
ELT Installed? No E	LT Operated?	_T Operated? ELT Aided in Locating Accident Site?									
Owner/Operator Information											
Registered Aircraft Owner			Street A	ddress 1100 N I	MARK	ET ST	RODNEY S	Q			
WILMINGTON TRUST CO.	City State								Zip Code		
WILWINGTON DE 1989 Street Address Street Addres<								19090			
Operator of Aircraft	HARTSFIELD ATLANTA INTL APT										
DELTA AIR LINES INC.	City ATLANTA							State GA	Zip Code 30320		
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 C	Certifica	ate:					
Regulation Flight Conducted Under: Part 1:	21: Air Carrier										
Type of Flight Operation Conducted: Sched	duled; Internatio	onal; F	Passen	ger Only							
FACTUAL REPORT - AVIATION Page 2											

Nation	TRANS	Safety Board	1	١	NTSB ID:	ATL99IA0)15								
F	ACTUAL RI	EPORT			Occurrence Date: 11/08/1998										
_	AVIATI	ØN			Occurren	ce Type: In	cident								
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First Pilo	First Pilot Information City State Date of Birth Age														
Name							City					512	ale	Date of Birth	Age
Sex: U Seat Occupied: Unknown Principal Profession: Unknown Certificate Number:															
Certificate	(s):														
Airplane R	ating(s):														
Rotorcraft/Glider/LTA:															
Instrument	t Rating(s):														
Instructor	Rating(s):														
Type Rating/Endorsement for Accident/Incident Aircraft? Current Biennial Flight Review?															
Medical Cert.: Unknown Medical Cert. Status: Unknown Date of Last Medical Example.									xam:						
- Flight Tir	me Matrix	All A/C	All A/C This Make Airplane Airplane Night Actual Single Engine Mult-Engine Night							Instrument	Simulated		Rotorcraft	Glider	Lighter Than Air
Total Time	9														
Pilot In Co	Pilot In Command(PIC)														
Instructor															
Last 90 Da	ays														
Last 30 Da	ays														
Last 24 Ho	ours														
Seatbelt U	lsed?	Shou	ılder Harr	ness Us	sed?			Toxic	ology P	erformed	?		S	econd Pilot?	
Flight Pla	an/Itinerary														
Type of Fli	ght Plan Filed: Ur	nknown													
Departure	Point							State	9	Airport I	dentifie	er	Depa	rture Time	Time Zone
													0000		
Destination State Airport Identifier															
Local Flight								;	Airport	aentino	er				
Type of Cl	earance:														
Type of Ai	rspace:														
Weather	Information														
Source of	Briefing:														
	-														
Method of	Briefing:														
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Inclusion: University in the second	Nation	al Transportation Safety	Board	NTS	B ID: ATI	L99IA0	015						
Occurrence Type: Incident Weather Information Work Pib Observation Time Time Zone WOF Elevation WOF Distance From Accident Site Direction From Accident Site 0000 0	F	ACTUAL REPOI	Occ	Occurrence Date: 11/08/1998									
Weather Information Time Zone WOF Elevation WOF Distance From Accident Site Direction From Accident Site 0000 0 FL MSL 0 FL MSL 0 NM 0 Deg. Mag. Sky/Lowest Cloud Condition: Unknown 0 FL AGL Visibility: 0 SM Altimeter: "Hg Lowest Ceiling: Unknown 0 FL AGL Visibility: 0 SM Altimeter: "Hg Temperature: °C Dew Point: *C Visibility: 0 SM Altimeter: "Hg Vind Speed: Gusts: Visibility (RV): 0 FL Visibility (Precipitation: Unknown Density Altivale: FL Visibility: 0 FL Visibility (RV): 0 SM Intensity of Precipitation: Unknown Restrictions to Visibility: 1 Aircraft Fire: Ground Aircraft Explosion None Classification: U.S. Registered/U.S. Soil		AVIATION Occurrence Type: Incident											
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National Transportation Safety Board	NTSB ID: ATL99IA015	
FACTUAL REPORT	Occurrence Date: 11/08/1998	
AVIATION	Occurrence Type: Incident	
Administrative Information		
Investigator-In-Charge (IIC)		
PRESTON E. HICKS		
Additional Persons Participating in This Accident/Incide	ent Investigation:	
ATLANTA FSDO ATLANTA, GA 30337		