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## Damage in cruise from partially detached thrust reverser, Douglas DC-9-31, October 13, 1995

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**Micro-summary:** This McDonnell Douglas DC-9-31 was substantially damaged during cruise flight, due to a partially detached top reverser door.

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**Event Date:** 1995-10-13 at 2051 CDT


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

**Investigative Body's Web Site:** <http://www.nts.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!***
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		NTSB ID: CHI96LA011		Aircraft Registration Number: N945AX	
		Occurrence Date: 10/13/1995		Most Critical Injury: None	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place CEDAR RAPIDS		State IA	Zip Code 52404	Local Time 2051	Time Zone CDT
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility:		Direction From Airport:	
Aircraft Information Summary					
Aircraft Manufacturer McDonnell Douglas		Model/Series DC-9-31		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>On October 13, 1995, at 2051 central daylight time (cdt), a McDonnell-Douglas DC-9-31, N945AX, operated as Flight 135 by Airborne Express, Incorporated, of Wilmington, Ohio, and crewed by an airline transport rated flight crew, was substantially damaged during cruise flight. The left engine's top thrust reverser door became partially detached and struck the engine's thrust reverser door repeatedly. Visual meteorological conditions existed at the time of the accident. The 14 CFR Part 121 cargo flight was operating on an IFR flight plan. The captain and first officer reported no injuries. The flight departed Des Moines, Iowa, at 2043 cdt.</p> <p>The flight crew reported hearing a loud bang and felt the airplane shuddering shortly after leveling off from a climb. The flight crew declared an emergency after observing no problems on the airplane. During the landing the thrust reversers were deployed. The 2 yellow thrust reverser unlock lights illuminated and then the right engine's thrust reverser's blue light illuminated. The airplane decelerated and was able to taxi to the parking area.</p> <p>An on-scene investigation was conducted by a Federal Aviation Administration (FAA) Principal Maintenance Inspector (PMI). The PMI reported the left engine's thrust reverser door had one of its driver linkages broken. Damage from the thrust reverser doors striking each other broke the left engine mount and pylon spar strap. The thrust reverser doors and exhaust nozzle were wrinkled. The exhaust nozzle end had about 25 percent of its end crushed upward. The outboard driver linkage arm (arm) was broken near its pivot point. The arm was bent upward 90 degrees about 24 inches forward of the break. The bolt and associated hardware were not found. One overcenter link was bent about 45 degrees at its midpoint.</p> <p>Examination of the thrust reverser assembly revealed that a pivot bolt had worked its way out of the driver linkage arm assembly. Excerpts from the McDonnell-Douglas DC-9 maintenance manual are appended to this report. These excerpts illustrate the bolt's location and relationship to the thrust reverser assembly. Due to the missing bolt, washers, nut and the cotterpin the reason for the bolt separation could not be determined. Evidence of a broken bolt was not found.</p> <p>The company examined other airplanes in its fleet. One airplane was found that had a missing cotterpin in a castellated nut on the same bolt as was missing on N945AX. A second airplane was found with a loose lower thrust reverser door. Examination of this airplane revealed the washers were overly thick. The overly thick washers would not allow the bolt threads to protrude beyond the end of the castellated nut. This situation would not allow the cotterpin to be installed because the hole in the bolt was not adequately exposed.</p> <p>The manufacturer's illustrated parts catalog and maintenance manual show different combinations of washers being used on the pivot point bolt. The maintenance manual text calls for a countersunk washer to be installed under the bolt head and one plain washer under the nut. The manual's illustration of this area shows the washer under the bolt head and two washers under the nut. The</p>					
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National Transportation Safety Board

**FACTUAL REPORT**

**AVIATION**




NTSB ID: CHI96LA011


Occurrence Date: 10/13/1995

Occurrence Type: Accident

Narrative (Continued)

illustrated parts catalog illustration of this area illustrates what the maintenance manual text called for.

 <b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b>		NTSB ID: CHI96LA011			
		Occurrence Date: 10/13/1995			
		Occurrence Type: Accident			
<b>Landing Facility/Approach Information</b>					
Airport Name	Airport ID:	Airport Elevation Ft. MSL	Runway Used 0	Runway Length	Runway Width
Runway Surface Type:					
Runway Surface Condition:					
Type Instrument Approach:					
VFR Approach/Landing: Precautionary Landing					
<b>Aircraft Information</b>					
Aircraft Manufacturer McDonnell Douglas		Model/Series DC-9-31		Serial Number 47551	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 2	Certified Max Gross Wt.	105000 LBS	Number of Engines: 2	
Engine Type: Turbo Fan	Engine Manufacturer: P&W	Model/Series: JT8D-9A	Rated Power: 14500 LBS		
- Aircraft Inspection Information					
Type of Last Inspection Continuous Airworthiness	Date of Last Inspection 12/1995	Time Since Last Inspection 584 Hours	Airframe Total Time 50975 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed? No	ELT Operated?	ELT Aided in Locating Accident Site?			
<b>Owner/Operator Information</b>					
Registered Aircraft Owner ABX AIR INC		Street Address			
		City WILMINGTON	State OH	Zip Code 45177	
Operator of Aircraft AIRBORNE EXPRESS INC		Street Address			
		City	State	Zip Code	
Operator Does Business As: AIRBORNE EXPRESS			Operator Designator Code: ABXA		
- 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: Non-scheduled; Domestic; Cargo					
FACTUAL REPORT - AVIATION					

 <p><b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b></p>	NTSB ID: CHI96LA011
	Occurrence Date: 10/13/1995
	Occurrence Type: Accident

**First Pilot Information**

Name On File	City On File	State On File	Date of Birth On File	Age 40
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Sex: M	Seat Occupied: Left	Principal Profession: Civilian Pilot	Certificate Number: On File
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Certificate(s): Airline Transport

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

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): Airplane Multi-engine; Airplane Single-engine; Instrument Airplane

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: 04/1995
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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	10775	5250	2000	8775	7650	1200	50			
Pilot In Command(PIC)	9000	3500	1500	8700	4500	600				
Instructor	1400		1400		100	100				
Last 90 Days	140	140		140	140	12				
Last 30 Days	70	70		70	70	6				
Last 24 Hours	5	5		5	5	1				

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: IFR

Departure Point DES MOINES	State IA	Airport Identifier DSM	Departure Time 2043	Time Zone CDT
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Destination WILLMINGTON	State OH	Airport Identifier ILN	
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Type of Clearance: IFR

Type of Airspace: Class E

**Weather Information**

Source of Briefing:

Method of Briefing:

 <p><b>National Transportation Safety Board</b> <b>FACTUAL REPORT</b> <b>AVIATION</b></p>	NTSB ID: CHI96LA011
	Occurrence Date: 10/13/1995
	Occurrence Type: Accident

<b>Weather Information</b>					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
CID	2052	CDT	0 Ft. MSL	0 NM	0 Deg. Mag.
Sky/Lowest Cloud Condition: Unknown			0 Ft. AGL	Condition of Light: Night/Dark	
Lowest Ceiling: Overcast		15000 Ft. AGL		Visibility: 20 SM	Altimeter: 29.00 "Hg
Temperature: 12 °C	Dew Point: 8 °C	Wind Direction: 240		Density Altitude: Ft.	
Wind Speed: 5	Gusts:	Weather Conditions at Accident Site: Visual Conditions			
Visibility (RVR): 0 Ft.	Visibility (RVV) 0 SM	Intensity of Precipitation: Unknown			
Restrictions to Visibility: None					
Type of Precipitation: None					

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

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					
Other Crew					
Passengers					
- TOTAL ABOARD -				2	2
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	2	2

National Transportation Safety Board

**FACTUAL REPORT**

**AVIATION**



NTSB ID: CHI96LA011

Occurrence Date: 10/13/1995

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

FRANK S. GATTOLIN

Additional Persons Participating in This Accident/Incident Investigation:

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