
Runway excursion, Douglas DC-8-62, December 30, 1996

Micro-summary: This Douglas DC-8-62 departed the runway following difficulties ensuring directional control.


Event Date: 1996-12-30 at 2226 EST

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

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

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		NTSB ID: MIA971A050		Aircraft Registration Number: N804AX	
		Occurrence Date: 12/30/1996		Most Critical Injury: None	
		Occurrence Type: Incident		Investigated By: NTSB	
Location/Time					
Nearest City/Place ORLANDO		State FL	Zip Code 32827	Local Time 2226	Time Zone EST
Airport Proximity: On Airport		Distance From Landing Facility: 1		Direction From Airport: 360	
Aircraft Information Summary					
Aircraft Manufacturer Douglas		Model/Series DC8-62		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 December 30, 1996, about 2226 eastern standard time, a Douglas DC8-62, N804AX, registered to ABX Air, Inc., ran off the right side of the runway when directional control was lost during takeoff roll at Orlando International Airport, Orlando, Florida, while on a Title 14 CFR Part 121 scheduled domestic cargo flight. Visual meteorological conditions prevailed at the time and an instrument flight rules flight plan was filed. The aircraft received minor damage and the airline transport-rated captain, first officer, flight engineer, and two passengers were not injured. The flight was originating at the time of the incident.</p> <p>The flightcrew stated the captain taxied the aircraft on to the runway and after aligning it on the runway center line, gave control to the first officer, who would be flying the leg. The first officer advanced the thrust levers slowly toward takeoff power. After stabilizing engine power at 80 percent, the first officer continued to move the thrust levers toward takeoff power. The aircraft began to drift to the left. The first officer applied full right rudder; however, the aircraft continued to drift left. He reported this to the captain who took control of the aircraft. When the captain could not regain directional control, he aborted the takeoff. He applied reverse engine thrust and brakes in an attempt to stop the aircraft. The aircraft turned to the right and departed the runway where it came to rest.</p> <p>Examination of the departure end of runway 18 right at Orlando International Airport showed that about 400-500 feet from the threshold, two parallel sets of light-to-moderate dark tire tracks about 20 feet apart were found beginning in the vicinity of the runway centerline. The tracks continued down the runway to the left of and away from the centerline at an initial angle of 20-30 degrees, then gradually arced back to the right. As the tracks crossed the runway centerline, a wide, very dark track appeared about midway between them. This track consisted of what appeared to be tire rubber residue, and was on average about 2 feet wide. All tracks continued off the right side of the runway to the point where N804AX had left the runway and come to rest. The aircraft went off the runway about 2,250 feet from the threshold and stopped on a heading about 50 degrees to the right of runway heading, about 75 feet from the runway edge.</p> <p>Examination of the aircraft at the point it came to rest was performed by an FAA inspector. The aircraft had no obvious damage or mechanical failure/malfunction. The main landing gear and the nose landing gear had dug into the ground after the aircraft departed the runway, and the resultant trenches extended from the runway edge up to the respective landing gear. All of the landing gear tires were partially buried in the ground and only the tops of the tires were visible. All of the tires appeared to be intact. Examination of the nose gear revealed that it was turned about 45 to 55 degrees to the left.</p> <p>Examination of the aircraft after removal from the runway showed the left nose landing tire was worn and had no tread remaining. The right nose landing gear tire had tread remaining. The nose landing gear strut was extended about 8.35 inches. The nose gear steering operated normally. At the</p>					
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request of NTSB the nose landing strut was serviced by ABX Air, Inc. personnel, using aircraft manufacturer procedures. After servicing the nose strut was extended about 6 inches. The nose landing gear strut fluid was found to be serviced to the proper level and the ground to air sensor was found to be adjusted within normal parameters.

Examination of the main landing gear showed that each strut was extended about 6.25 inches. After servicing the main gear struts were again extended about 6.25 inches. Each wheel turned freely and there was no evidence of failure or malfunction of the wheel brakes and anti-skid system.

Weight and balance calculations performed by ABX Air, Inc. showed the aircraft weighed 215,012 pounds and the center of gravity was at 30.11 percent mean aerodynamic chord at the time of the incident. The zero fuel weight was 167,812 pounds and the zero fuel center of gravity was 26.99 percent mean aerodynamic chord. The maximum allowable takeoff weight for the aircraft is 335,000 and the center of gravity limits, which are calculated for the zero fuel weight, are 18.20 percent mean aerodynamic chord forward limit and 31.66 mean aerodynamic chord aft limit. After the incident the cargo was removed from the aircraft and weighed under the supervision of an FAA inspector. The weights were found to be consistent with those used for the weight and balance calculations. (See attached weight and balance information and FAA Inspector Statement)

Readout of the digital flight data recorder (DFDR) from N804AX was performed by the NTSB Vehicle Performance Laboratory. The DFDR data indicate that the aircraft began its rolling takeoff on runway 18. About 2 seconds after being lined up with the departure runway the aircraft began a gradual turn to the left. At the same time a disparity in the Engine Pressure Ratios (EPRs) for engines 1 and 4 developed with engine 1 lagging the others in spooling up and engine 4 preceding the others in coming up to power. The left turn and engine disparity continued for another 7-8 seconds, at which point the power was reduced on engines 3 and 4 and the aircraft began a right turn which continued over the next 12 seconds finally resulting in a heading of 240 degrees. Engine 1 and 2 power was reduced slightly after engine 3 and 4 power was reduced but remained at about 1.40 EPR. After reduction of power on engine 3 power was increased momentarily to about 1.65 EPR. During the takeoff roll the maximum displacement of the control column was about 5 degrees nose down. The maximum airspeed attained by the aircraft was 68 knots. (See Flight Data Recorder Specialist's Factual Report of Investigation)

Readout of the cockpit voice recorder (CVR) from N804AX was performed by the NTSB Engineering and Computer Services Division. The contents of the CVR were transcribed. The transcript starts at time 2203:19 and continues to 2228:08 when electrical power was removed from the CVR. (See Cockpit Voice Recorder Group Chairman Factual Report)

A sound spectrum study of the CVR recording was performed by the NTSB Office of Research and Engineering. The purpose of the study was to determine the engine power settings during the takeoff roll. For most of the initial takeoff roll four distinct engine traces could be identified. At the start of the takeoff the engine traces show a continuous and smooth acceleration from about 41 percent N1 to about 94 percent N1. It took about 12 seconds for the engines to reach 94 percent N1. The signatures remained at 94 percent N1 for about 5 seconds. At this point all of the engines started to decrease. Two engine signatures decreased to a low of 44 percent N1. One of these traces then increased to 98 percent N1 for about 2 seconds and then decreased to 45 percent N1. The remaining two engines decreased to 85 percent N1 and remained there for 15 seconds before being reduced to about 43 percent N1. (See Specialist's Sound Spectrum Study)

Information about this incident was analyzed by personnel of Boeing Commercial Airplane Group-Douglas Products Division. The difference in power being produced by the No. 4 engine to that being produced by the No. 1 engine was determined to be about 2,700 pounds of thrust. They stated an EPR split of about 0.2 between two engines is not considered to be particularly unusual and is normally easily controlled via nose wheel steering through the rudder pedal from either pilot position.

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Boeing personnel stated the finding of the nose landing gear being service to an extension of 8.35 inches is higher than the usual extension of 2 to 6 inches. They also stated that the nose up movement of .5 degrees as recorded on the DFDR during application of takeoff engine thrust would cause the nose landing gear to extend about another 6.4 inches making total nose gear extension about 15 inches. They stated that as the nose gear strut extends beyond 10.7 inches the nose gear is mechanically centered and steering inputs are restricted to +/- 4 degrees. When the strut is compressed below 10.7 inches the nose steering will move +/- 10 degrees. Boeing personnel stated further that the first officer's report that the aircraft did not respond to nose steering through the rudder pedals was probably due to the nose wheel steering being restricted by the centering cam.

Boeing personnel stated "it appears that the right turning moment from asymmetric thrust, combined with a possible right steering input from rudder pedal steering (possibly input to counteract the initial left heading swing, and becoming effective at about time 152 when the nose strut compressed per the decrease in pitch attitude), resulted in the aircraft turning sharply to the right and departing the runway."

Boeing personnel stated another DC-8-62 operator experienced similar difficulties on three occasions. In these cases, asymmetric thrust power increase combined with an over serviced nose gear strut and an aft center of gravity resulted in directional control difficulties. (See Boeing Report)


The Airborne Express DC-8 Operation Manual states in Chapter 1-6, page 26, Takeoff Technique, that "as the takeoff progresses, forward pressure on the control column should be used to keep the nosewheel firmly on the runway until Vr." In a flight crew letter dated November 18, 1996, the Airborne Express DC-8 Flight Manager discusses aft center of gravity operations. The pilots are instructed that "on takeoff roll, hold slight forward pressure on the yoke (2-3 inches forward of neutral) to keep positive tracking ability on the roll." The Douglas DC-8 study guide states in the section on normal takeoffs "the pilot should hold a slight positive forward pressure on the control column until approaching rotation speed."


DFDR data shows that as the aircraft taxied to takeoff the control column position was zero. As the aircraft turned onto the runway and during the initial takeoff roll the control column position changed to -2 degrees or column forward. Boeing reported that the control column limits of movement are 10.25 degrees forward and 20.25 degrees aft and that for the conditions at the time of the occurrence a full forward control column would have exerted 500 pounds of nose down force. Representatives of the Teamsters Union, who represent ABX Air, Inc. pilots, stated that in normal operations elevator control forces are not effective until the aircraft reaches a speed of about 100 knots are more.

Postaccident drugs screens were performed on specimens obtained from the flightcrew members by National Medical Review Offices, Inc., Los Angeles, California. The drug screens for all 3 flightcrew members were negative for drugs of abuse. Breath alcohol tests were performed about 18 hours after the incident on each flight crew member, by Airport Medical Center, Miami, Florida. The tests were negative for all 3 flightcrew members.

The aircraft was released to ABX Air, Inc. by NTSB on December 31, 1996. The CVR was returned to ABX Air, Inc. on January 24, 1997. The DFDR was returned to ABX Air, Inc. on February 4, 1997.

An additional party to the NTSB investigation was Mike Young, Pratt and Whitney Aircraft Engines, Hartford, Connecticut.

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Landing Facility/Approach Information					
Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
ORLANDO INTERNATIONAL	MCO	96 Ft. MSL	18R	12004	200
Runway Surface Type: Concrete					
Runway Surface Condition: Dry					
Type Instrument Approach:					
VFR Approach/Landing:					
Aircraft Information					
Aircraft Manufacturer		Model/Series		Serial Number	
Douglas		DC8-62		45987	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 6	Certified Max Gross Wt.	338000 LBS	Number of Engines: 4	
Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:		
Turbo Fan	P&W	JT3D-3B	18000 LBS		
- Aircraft Inspection Information					
Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time		
AAIP	12/1996	1 Hours	5539 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed? No	ELT Operated?	ELT Aided in Locating Accident Site?			
Owner/Operator Information					
Registered Aircraft Owner		Street Address			
		145 HUNTER DRIVE			
ABX AIR, INC.		City	State	Zip Code	
		WILMINGTON	OH	45177	
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: AIRBORNE EXPRESS			Operator Designator Code: ABXA		
- Type of U.S. Certificate(s) Held:					
Air Carrier Operating Certificate(s): Cargo					
Operating Certificate:			Operator Certificate:		
Regulation Flight Conducted Under: Part 121: Air Carrier					
Type of Flight Operation Conducted: Scheduled; Domestic; Cargo					
FACTUAL REPORT - AVIATION					

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: MIA97IA050
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First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 55
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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; Flight Instructor

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

Rotorcraft/Glider/LTA: Helicopter

Instrument Rating(s): Airplane

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

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--w/ waivers/lim.	Date of Last Medical Exam: 09/1996
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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	15000	3546	300					3000		
Pilot In Command(PIC)	12000	1200	300	10000						
Instructor			50	1400				400		
Last 90 Days	130	130								
Last 30 Days	60	60								
Last 24 Hours										

Seatbelt Used? Yes	Shoulder Harness Used? Yes	Toxicology Performed? Yes	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 MCO	Departure Time 2226	Time Zone EST
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Destination WILMINGTON	State OH	Airport Identifier ILN	
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Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing:
Company

Method of Briefing:

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Weather Information


WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
MCO	2235	EST	96 Ft. MSL	1 NM	180 Deg. Mag.
Sky/Lowest Cloud Condition: Unknown			0 Ft. AGL	Condition of Light: Night/Dark	
Lowest Ceiling: Broken		6000 Ft. AGL		Visibility: 10 SM	Altimeter: 30.00 "Hg
Temperature: 20 °C	Dew Point: 19 °C	Wind Direction: 70		Density Altitude: 400 Ft.	
Wind Speed: 3	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					

Accident Information

Aircraft Damage: Minor	Aircraft Fire: None	Aircraft Explosion: None
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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				1	1
Cabin Attendants					
Other Crew					
Passengers				2	2
- TOTAL ABOARD -				5	5
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	5	5

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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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