
Electrical problems, Boeing 737-400, November 11, 1999

Micro-summary: Electrical problems motivate the crew of this Boeing 737-400 to return to the airport.


Event Date: 1999-11-11 at 1520 PST


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

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

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 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: SEA001A019		Aircraft Registration Number: N772AS	
		Occurrence Date: 11/11/1999		Most Critical Injury: None	
		Occurrence Type: Incident		Investigated By: NTSB	
Location/Time					
Nearest City/Place PORTLAND		State OR	Zip Code 97224	Local Time 1520	Time Zone PST
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility:		Direction From Airport:	
Aircraft Information Summary					
Aircraft Manufacturer Boeing		Model/Series 737-400		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 November 11, 1999, approximately 1520 Pacific standard time, Alaska Airlines flight 500, a Boeing 737-400 (N772AS), returned to land when the crew noted fuel low pressure lights and popped circuit breakers after departure and climb-out from Portland International Airport, Portland, Oregon. There were no injuries to the five crewmembers or 140 passengers, and the airplane's electrical wiring system sustained minor damage. The flight was operated under 14 CFR 121, and was on an instrument flight plan, en route to San Francisco, California.</p> <p>The crew stated during climb-out from Portland, the #2 fuel tank low pressure light illuminated. Thirty seconds later, the center tank fuel low pressure light illuminated. Circuit breakers for the center right pump and the #2 fuel pump popped. The crew elected to pull the aft pump circuit breaker, and returned to Portland for an uneventful landing.</p> <p>During the trouble-shooting process, the circuits were repowered. A master caution light illuminated and other circuit breakers opened. Inspection revealed heavily sooted and compromised wires (with melted insulation) in wiring bundles near station 410 in the cargo hold.</p> <p>The captain was interviewed during the course of the investigation. He noted that the first indication of a problem was when climbing through 11000 feet MSL, when he saw the master caution fuel indication and an indication of low fuel pressure on the right tank. He turned around and noted that the boost pump circuit breakers were in. He then noted low pressure light on the center tank. Anticipating fuel contamination, he opened the crossfeed manifold. The crew leveled at 15000 feet near Deschute. Turning again to the circuit breakers, he noted that the center tank right pump circuit breaker was out, the right tank forward circuit breaker was out, the right tank aft pump was still in. The respective switches were still on.</p> <p>At that time they had elected to return to land at Portland. During descent, the crew went through the QRH, which included the precaution to not reset the circuit breakers. At that time, the left center pump continued functioning. During descent the aft pump circuit breaker was pulled. Voltages and frequencies for both generators were okay. The P-6 electrical distribution panel circuit breakers were all in.</p> <p>After landing, the crew performed a normal shutdown. During taxi in, they noted an electrical smell, which they originally attributed to use of the galley ovens. When they elected to disembark the passengers, passengers leaving the airplane who had been seated mid-cabin noted that they had smelled electrical smoke.</p> <p>Alaska's maintenance crew found that the ground refueling valve was open. That valve was closed by mechanics, but it did not change the problem. The problem appeared to be affecting both the left and right busses. The mechanics tried a bus protection panel and swapping the three generator control units. None of these units seemed to change the problem. At that time, the mechanics</p>					
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Narrative (Continued)

started to see various indications in the cockpit, including right wing anti-ice and right wing overheat.

Technicians isolated an electrical short to the forward cargo compartment. When they touched the panel around station 410, they saw some sparks. Power was removed from the aircraft once the damage was found. The technicians opened the ceiling panel to gain access to the area. When they touched the bottom of the raceway clamp, it fell apart.


FAA and NTSB investigators documented the damaged wiring bundles at station 420 above the forward cargo compartment ceiling on the right side of the airplane, and had them sectioned for further inspection and testing. The wire bundle channel and clamp were also removed for inspection and analysis.


A total of 113 conductors were reported by Alaska Airlines to have been involved in the electrical arcing.

Analysis by the Boeing Equipment Quality Analysis (EQA) group could not determine the cause for the electrical arcing that burned numerous wires of the subject bundles in two. According to Boeing EQA, the extent of the arc damage observed and documented appeared to be consistent with arc tracking of the polyimide (Kapton) insulated wires. Besides the polyimide wires, there were nine Teflon insulated wires that had been severely damaged by the electrical arcing. The insulation on one of the Teflon insulated wires, W336-003-10, had evidence that it might have been damaged prior to the electrical arcing. W336-003-10, and two other 10 gauge wires in the bundles, were conductors for the three-phase 115VAC system A electric hydraulic pump.

According to Boeing analysis, electrical arcing had damaged approximately twelve inches of insulation on wire W336-003-10. The exposed conductors at one end of the wire had sustained arc damage at two locations. The arcing burned several wire strands in two, which became unraveled from the rest of the strands. There was approximately one third of the insulation left in this area of the wire. A small area of the edge of the insulation appeared to have been cut prior to the occurrence of the electrical arcing. According to Boeing EQA, this would suggest that the insulation might have been missing before the electrical arcing occurred.

The wire bundle channel (bracket) and clamp were also analyzed. Evidence indicated that an unidentified wire that was involved in the arcing/burning event had been out of place, along the side of the bracket between the cushioning foam and the plastic (nylon) frame before or during the event. The analysis of these two parts could not determine what type of wire had caused the damage to the side of the cushion clamp or the nylon channel.

 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: SEA00IA019			
		Occurrence Date: 11/11/1999			
		Occurrence Type: Incident			
Landing Facility/Approach Information					
Airport Name	Airport ID:	Airport Elevation Ft. MSL	Runway Used 0	Runway Length	Runway Width
Runway Surface Type:					
Runway Surface Condition:					
Type Instrument Approach: NONE					
VFR Approach/Landing:					
Aircraft Information					
Aircraft Manufacturer Boeing		Model/Series 737-400		Serial Number 25105	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 148	Certified Max Gross Wt.	143500 LBS	Number of Engines: 2	
Engine Type: Turbo Fan	Engine Manufacturer: Cfm	Model/Series: CFM56-3C-1	Rated Power: 22000 LBS		
- Aircraft Inspection Information					
Type of Last Inspection Continuous Airworthiness	Date of Last Inspection 11/1999	Time Since Last Inspection 57 Hours	Airframe Total Time 22732 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?			
Owner/Operator Information					
Registered Aircraft Owner FIRST SECURITY BANK		Street Address 79 S. MAIN STREET			
		City SALT LAKE CITY	State UT	Zip Code 84111	
Operator of Aircraft ALASKA AIRLINES		Street Address BOX 68900			
		City SEATTLE	State WA	Zip Code 98168	
Operator Does Business As:			Operator Designator Code: ASAA		
- 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/Cargo					

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	Occurrence Type: Incident

First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 42
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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

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

Instructor Rating(s): None

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: 08/1999
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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	7334	3409								
Pilot In Command(PIC)										
Instructor										
Last 90 Days	27	27								
Last 30 Days										
Last 24 Hours	5	5								

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 Same as Accident/Incident Location	State	Airport Identifier KPDX	Departure Time 1520	Time Zone PST
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Destination SAN FRANCISCO	State CA	Airport Identifier KSFF	
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Type of Clearance: IFR

Type of Airspace:

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
	0000		0 Ft. MSL	0 NM	0 Deg. Mag.

Sky/Lowest Cloud Condition: Unknown	0 Ft. AGL	Condition of Light: Not Reported
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Lowest Ceiling: Unknown	0 Ft. AGL	Visibility: 0	SM	Altimeter: "Hg
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Temperature: °C	Dew Point: °C	Wind Direction:	Density Altitude: Ft.
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Wind Speed:	Gusts:	Weather Conditions at Accident Site:
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Visibility (RVR): 0 Ft.	Visibility (RVV) 0	SM	Intensity of Precipitation: Unknown
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Restrictions to Visibility:

Type of Precipitation:

Accident Information

Aircraft Damage: Minor	Aircraft Fire: In-flight	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					
Cabin Attendants				3	3
Other Crew					
Passengers				140	140
- TOTAL ABOARD -				145	145
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	145	145

National Transportation Safety Board

FACTUAL REPORT

AVIATION



NTSB ID: SEA00IA019

Occurrence Date: 11/11/1999

Occurrence Type: Incident

Administrative Information

Investigator-In-Charge (IIC)

MICHAEL L. STOCKHILL

Additional Persons Participating in This Accident/Incident Investigation:

RICHARD DAVIS
HILLSBORO FSDO
HILLSBORO, OR

KEN NEWTON
ALASKA AIRLINES
SEATTLE, WA

RICHARD ANDERSON
BOEING
RENTON, WA

CHRISTINA DAWSON
FAA
SEATTLE, WA