
Multiple electrical failures, Boeing 737-209, April 26, 1994

Micro-summary: The failure of the battery transfer relay resulted in multiple system failures during approach for this Boeing 737-209.


Event Date: 1994-04-26 at 1942 HST

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

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

Cautions:

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.
 4. Contact us before reproducing or redistributing a report from this anthology. Individual countries have very differing views on copyright! We can advise you on the steps to follow.
-

		NTSB ID: LAX94IA206		Aircraft Registration Number: N804AL	
		Occurrence Date: 04/26/1994		Most Critical Injury: Minor	
		Occurrence Type: Incident		Investigated By: NTSB	
Location/Time					
Nearest City/Place HONOLULU		State HI	Zip Code 96820	Local Time 1942	Time Zone HST
Airport Proximity: Off Airport/Airstrip		Distance From Landing Facility: 7		Direction From Airport: 40	
Aircraft Information Summary					
Aircraft Manufacturer BOEING		Model/Series 737-209		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 April 26, 1994, at 1942 Hawaii standard time, one passenger sustained minor injuries during a slide evacuation of Aloha Airlines flight 289, at Honolulu, Hawaii. The aircraft, a Boeing 737-209, N804AL, experienced multiple system failures during the landing approach and the evacuation was prompted by smoke entering the cockpit and cabin. The remaining 53 passengers and five crew members were not injured. The aircraft was owned and operated by Aloha Airlines, Inc., and was on a scheduled domestic passenger flight under 14 CFR Part 121 of Federal Aviation Regulations. Visual meteorological conditions prevailed at the time and an IFR flight plan had been filed for the operation. The flight originated from Kona, Hawaii, at 1905 on the day of the incident.</p> <p>According to the flight crew, during a visual approach into Honolulu International airport, the crew lowered the landing gear approximately 7 minutes from runway 4R. The gear extension appeared to be normal, but neither the red nor green position lights illuminated. System evaluation procedures revealed that the press-to-test function of the gear lights still operated; however, the master caution system was found to be inoperative.</p> <p>The manual gear extension system was employed with no noticeable change or indication. The first officer went back to the cabin to check the main gear visually, but because he was not familiar with the sight location in this configuration, could not locate the view port on the cabin floor. The captain then elected to do a flyby on runway 4R at 1,000 feet above ground level (agl). The tower was unable to confirm that the gear was down. The crew then attempted another flyby on runway 8L at 800 feet agl, and both the tower personnel and the crew of another aircraft on the ground were able to confirm that the gear was down. The captain then attempted a public address call to the passengers and an interphone call to a flight attendant, but both systems were also found to be inoperative.</p> <p>The captain did not declare an emergency, but requested that airport emergency equipment be repositioned prior to landing. A visual approach was performed with a normal touchdown. During rollout, the crew discovered that the thrust reversers would not deploy. The aircraft was stopped using brakes and spoilers without further difficulty.</p> <p>After turning off runway 8L onto taxiway alpha en route to the gate, the flight attendants noticed what was described as a "burning odor." One attendant opened the cockpit door and informed the captain of the smell. The captain reported that he had also noticed the odor. As the flight attendant opened the door to the cockpit, the smoke alarm went off in the forward lavatory. The flight attendant opened the door to the lavatory, but found no smoke visible inside. As the same attendant looked toward the rear of the aircraft, he noticed there was hazy smoke accumulating in the mid-to-aft portion of the passenger cabin. During this time, the attendant reported that all the lights had gone out in the cabin.</p>					
FACTUAL REPORT - AVIATION					
					Page 1

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: LAX94IA206

Occurrence Date: 04/26/1994

Occurrence Type: Incident

Narrative (Continued)

The captain stopped on the taxiway and instructed the crew to initiate an emergency evacuation. The evacuation was conducted with the assistance of the captain and first officer, using the emergency slides located at the forward service and entry doors. One attendant reported that after the doors were opened the smoke dissipated. Another attendant reported that the smoke alarm in the aft lavatory had also sounded during this time. The evacuation proceeded normally with the exception of one passenger who received a minor sprain while using the emergency slide. That passenger was treated at the scene and released. There were no injuries as a result of the events prior to the evacuation.


The crew also reported that while inbound to Honolulu the autopilot had disengaged and could not be reengaged. There was a computer flag reported on the captain's ADI. The circuit breakers were recycled without effect.


Investigation after landing revealed that the multiple system loss was due to the 28-volt DC battery bus going off-line. The condition was duplicated during troubleshooting and the failed part was identified as a battery transfer relay (R2). The source of the on board smoke was not identified.

All of the inoperative systems were identified as being powered by the battery bus. The aircraft operations manual does not specify a troubleshooting procedure for identifying a bus failure or multiple system electrical failure. There are no cockpit indications that directly identify a bus failure or multiple system failure. The Boeing representative reported that when multiple systems are lost, the loss of a bus should be a reasonable conclusion; however, none of the current checklists relate to this possible condition. He also stated that there is no procedure that would enable the flight crew to restore power to the effected systems once bus failure has been experienced.

A review of Federal Aviation Administration (FAA) safety data reports for the Boeing 737 aircraft failed to reveal any prior instances of relay or bus failures. Boeing reported two prior incidents, in 1971 and 1988, in which the battery bus lost power due to the failure of the R-1 battery relay. The failures were attributed to high resistance in the relay contact. The source of the resistance was identified as contact surface contamination caused by potassium bicarbonate residue.

The contamination occurred during the manufacturer's cleaning process. The surface contamination resulted in a voltage drop which then allowed the bus to go off-line. Boeing reported that the relay part manufacturer implemented manufacturing and process improvements to prevent cleaning material from contaminating the contact surface. There have been no reported discrepancies with R-1 relays manufactured after April 26, 1988.

		NTSB ID: LAX941A206			
		Occurrence Date: 04/26/1994			
		Occurrence Type: Incident			
Landing Facility/Approach Information					
Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
HONOLULU INTERNATIONAL	HNL	12 Ft. MSL	8L	12357	200
Runway Surface Type: Asphalt					
Runway Surface Condition: Dry					
Type Instrument Approach: Visual					
VFR Approach/Landing: Straight-in					
Aircraft Information					
Aircraft Manufacturer		Model/Series		Serial Number	
BOEING		737-209		21719	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 124	Certified Max Gross Wt.	120000 LBS	Number of Engines: 2	
Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:		
Turbo Jet	P&W	JT8D-9A	14500 LBS		
- Aircraft Inspection Information					
Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time		
Continuous Airworthiness	04/1994	48 Hours	34431 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed? Yes	ELT Operated?	ELT Aided in Locating Accident Site?			
Owner/Operator Information					
Registered Aircraft Owner		Street Address			
GATX CAPITAL CORP.		4 EMBARCADERO CENTER, STE 2200			
		City	State	Zip Code	
		SAN FRANCISCO	CA	94111	
Operator of Aircraft		Street Address			
ALOHA AIRLINES, INC.		P.O. BOX 30028			
		City	State	Zip Code	
		HONOLULU	HI	96820	
Operator Does Business As: ALOHA AIRLINES, INC.			Operator Designator Code: TSAA		
- 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 Only					
FACTUAL REPORT - AVIATION					

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: LAX94IA206
	Occurrence Date: 04/26/1994
	Occurrence Type: Incident

First Pilot Information

Name On File	City On File	State On File	Date of Birth On File	Age 49
-----------------	-----------------	------------------	--------------------------	-----------

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

Certificate(s): Airline Transport

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

Medical Cert.: Class 1	Medical Cert. Status: Valid Medical--w/ waivers/lim.	Date of Last Medical Exam: 12/1993
------------------------	--	------------------------------------

- 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	9500	7500		9300	950	425	950			
Pilot In Command(PIC)	3800	3000		3900	390	195	380			
Instructor	500	500		500	400	100	400			
Last 90 Days	150	150		150	15	7	15			
Last 30 Days	50	50		50	5	2	5			
Last 24 Hours	5	5		5			15			

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

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point KONA	State HI	Airport Identifier KOA	Departure Time 1905	Time Zone HST
-------------------------	-------------	---------------------------	------------------------	------------------

Destination Same as Accident/Incident Location	State	Airport Identifier HNL	
---	-------	---------------------------	--


Type of Clearance: IFR

Type of Airspace: Class D; Class E

Weather Information

Source of Briefing:
Commercial Weather Service; Flight Service Station; PATWAS

Method of Briefing:

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: LAX94IA206
	Occurrence Date: 04/26/1994
	Occurrence Type: Incident

Weather Information					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
HNL	1953	HST	12 Ft. MSL	7 NM	40 Deg. Mag.
Sky/Lowest Cloud Condition: Scattered			2300 Ft. AGL	Condition of Light: Dusk	
Lowest Ceiling: None		0 Ft. AGL	Visibility: 15	SM	Altimeter: 30.00 "Hg
Temperature: 24 °C	Dew Point: 19 °C	Wind Direction: 60		Density Altitude: Ft.	
Wind Speed: 9	Gusts:	Weather Conditions at Accident Site: Visual Conditions			
Visibility (RVR): 0 Ft.	Visibility (RVV) 0	SM	Intensity of Precipitation: Light		
Restrictions to Visibility: None					
Type of Precipitation: Rain Showers					

Accident Information		
Aircraft Damage: None	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				3	3
Other Crew					
Passengers			1	53	54
- TOTAL ABOARD -			1	58	59
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	1	58	59

National Transportation Safety Board

FACTUAL REPORT

AVIATION



NTSB ID: LAX94IA206

Occurrence Date: 04/26/1994

Occurrence Type: Incident

Administrative Information

Investigator-In-Charge (IIC)

ROBERT R. CRISPIN,

Additional Persons Participating in This Accident/Incident Investigation:

STEVE OKAMOTO

FAA FSDO

HONOLULU, HI 96819