
Hard landing and tail strike, McDonnell Douglas DC-9-51, June 14, 2000

Micro-summary: This McDonnell Douglas DC-9-51 experienced a hard landing and tail strike.


Event Date: 2000-06-14 at 1710 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.
-

 National Transportation Safety Board FACTUAL REPORT AVIATION		NTSB ID: LAX00FA229		Aircraft Registration Number: N649HA	
		Occurrence Date: 06/14/2000		Most Critical Injury: Minor	
		Occurrence Type: Accident		Investigated By: NTSB	
Location/Time					
Nearest City/Place Lihue, Kauai		State HI	Zip Code 96766	Local Time 1710	Time Zone HST
Airport Proximity: On Airport		Distance From Landing Facility: 0		Direction From Airport:	
Aircraft Information Summary					
Aircraft Manufacturer McDonnell Douglas		Model/Series DC-9-51		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:					
HISTORY OF FLIGHT					
<p>On June 14, 2000, about 1710 Hawaiian standard time, a McDonnell Douglas DC-9-51, N649HA, operated by Hawaiian Airlines, Inc., as flight number 193, made a hard landing, striking its tail, on runway 35 at the Lihue Airport, Lihue, Hawaii. The airplane was substantially damaged. There were a total of 139 persons on board the airplane. Neither the airline transport certificated captain, the first officer, nor the three flight attendants were injured. Two of the 134 passengers received minor injuries. The flight was being performed under 14 CFR Part 121. Daytime visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed. The flight originated from Honolulu, Hawaii, about 1643, as a nonstop domestic passenger flight to Lihue. The flight's scheduled arrival time at Lihue was 1635.</p>					
<p>The captain reported, that on the day of the accident, he and the first officer were scheduled to fly three round trips to Lihue and a round trip to Kona, Hawaii. The captain flew the first flight to Lihue, and the first officer flew back to Honolulu. The captain indicated that the first officer "made a good landing in Honolulu." On the second flight to Lihue (the accident flight), the first officer was at the controls. The flight departed from Honolulu about 40 minutes behind schedule. The captain further reported that the takeoff, en route, and approach portions of the flight were normal. No evidence of any mechanical malfunction or flight control anomalies was noted during the flight. During the approach to Lihue, the first officer made "appropriate corrections" to maintain the glide slope.</p>					
<p>Approaching the airport, at 1702:31, the captain received an air traffic control clearance to perform a VOR/DME runway 35 instrument approach. At 1704:31, the crew reported having the field in sight, and at 1705:48, the airplane was cleared to land.</p>					
<p>In Hawaiian Airline's (the operator's) completed "Aircraft Accident Report," the operator indicated that the initial approach was conducted in accordance with the standards established in the approved "Flight Crew Operating Manual," including a Vref of 127 KIAS and use of the instrument landing system/precision approach path indicator (ILS/PAPI) as backup. The applicable crosswind corrections were applied. The final approach segment was commenced with stabilized engine thrust and with a stabilized rate of descent. The captain performed the duties of safety pilot, completing checklists, acknowledging tower instructions, and making required call-outs.</p>					
<p>The operator additionally reported that the approach terminated in a "higher-than-normal, although not excessive," deck angle, and an abnormally high rate of sink from 50 feet above ground level to touchdown. The resulting hard landing caused portions of the aft fuselage to come in contact with the runway.</p>					
<p>According to the captain, the landing was firmer than routine but he would not consider it to have</p>					
FACTUAL REPORT - AVIATION					
Page 1					

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: LAX00FA229
	Occurrence Date: 06/14/2000
	Occurrence Type: Accident

Narrative (Continued)

been a "hard landing." A Hawaiian Airlines flight attendant occupied the fourth flight attendant jump seat because the airplane was completely full. The flight attendant reported that the flight seemed normal until the "hard landing" occurred, which really shook him up. He was "alarmed by the loud sound of metal impacting the ground," and the seat belt shoulder harness kept him from becoming airborne. Several oxygen compartments opened resulting in oxygen masks hanging from the ceiling. The flight attendant then disembarked from the tailcone stairway exit. Upon looking at the outside airplane structure, the attendant "noticed the safety skid plate device (was) badly scraped and around the panel, liquid (was) dripping."

In preparation for their next flight, the captain performed a walk around visual inspection of the airplane. The captain reported that the "tail bumper compression indicator was safety wired and in its normal position." Thereafter, passengers boarded the airplane and they flew to Honolulu. The captain additionally reported that at Honolulu he "called maintenance out as a prudent matter of practice." He explained to the mechanics that the first officer had landed "firmer than routine," and he asked the mechanics to inspect the airplane and to paint the tail bumper if needed. The captain also reported that he did not enter a write-up in the logbook, "as there was no damage to the airplane and the tail bumper indicator pin was up, safetied and in its normal position in Honolulu as it was in Lihue."

The first officer similarly reported that he had performed a walk around inspection of the airplane following his firm landing, and no obvious damage was noted. The last four flights for the day in the airplane were routine.

PERSONNEL INFORMATION

Captain.

The captain possessed an airline transport pilot certificate and had approximately 11,725 hours total flight time. He possessed a type rating in the DC-9, and had about 6,678 hours of flying time as captain in the airplane. During the preceding 90 and 30 days, he had flown the airplane for 240 and 63 hours, respectively. The captain was not a designated check airman in the DC-9.

First Officer.

The first officer possessed an airline transport pilot certificate, and he had approximately 8,895 hours total flight time. He was not type rated in the DC-9. His total time flying the DC-9 was 61 hours, which was all obtained within 90 days of the accident flight. The first officer was type rated in the Embraer EMB-110.

Hawaiian Airline's Director of Flight Safety and Compliance reported to the National Transportation Safety Board investigator that the company had evaluated the first officer throughout his training.

The company opined that, by the conclusion of his required training, the pilot's performance had met the minimum acceptable standards to be released for line flying. The company noted, however, that the pilot's performance had been problematic. He had required about twice the number of hours in training, including landing practice, than the average pilot undergoing initial operating experience (IOE) training. The first officer satisfactorily completed the IOE line check in the DC-9 on June 9, 2000.

AIRPLANE INFORMATION

The airplane was manufactured in 1976. By the accident date, its airframe's total time was about 43,780.23 hours. The airplane had 64,951 total cycles.

The operator's management personnel reported that the airplane's weight and balance were within prescribed limits during the accident flight. The airplane's maintenance log indicated that the

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: LAX00FA229

Occurrence Date: 06/14/2000

Occurrence Type: Accident

Narrative (Continued)

number one (left) thrust reverser was inoperative and maintenance action was deferred in accordance with the Hawaiian Airlines DC-9 approved minimum equipment list. The cockpit was accordingly placarded. The flight crew had operated the airplane in this condition on three previous legs.

As described in the airplane's "Flight Crew Operating Manual" and related publications, the DC-9 is equipped with a tail bumper compression indicator. The indicator is attached to the bumper assembly by a hinge, and it is located next to a skid assembly, which is connected to a pneumatic strut in the aft belly of the airplane. The tail bumper compression indicator should normally be in the horizontal position. If the tail bumper has contacted the ground and has been compressed 3 inches or more, the indicator will be driven toward the vertical position. In this event a structural inspection of the airframe is necessary. If the indicator is not in the normal horizontal position, a visual check for damage to the tail bumper skid should be made.

METEOROLOGICAL INFORMATION

About 1655, Lihue's automatic terminal information service reported "Information Alpha" was in effect. In part, it stated that the weather was as follows: "wind zero seven zero at niner visibility one zero few clouds at four thousand five hundred temperature two seven dew point two one altimeter three zero zero one vor dme three five and visual approach in use...."

About 1706, the pilot was advised that Lihue's local wind was from 070 degrees at 8 knots.

AIDS TO NAVIGATION

According to Federal Aviation Administration (FAA) records of facility operations, all electronic aids to navigation pertinent to the airplane's approach and landing were functional on the day of the accident. No anomalies were reported.

AIRPORT AND GROUND FACILITIES

Lihue's runway 35 is 6,500 feet long by 150 feet wide. It has a grooved asphalt surface. The runway is equipped with a (PAPI) visual glideslope indicator system.

Hawaiian Airlines designated the Lihue Airport as being a "special airport," in accordance with federal aviation regulations.

FLIGHT RECORDERS

The Safety Board's Office of Research and Engineering, Washington, D.C., performed a study of the airplane's track to the Lihue Airport using recorded radar data. In summary, the study indicates that from a point about 3 miles south of the airport, to landing, the airplane tracked directly inbound following the runway's centerline extension. A comparison between a 3-degree glideslope and the airplane's descent profile indicated that the airplane's descent track was nearly consistent with the glideslope profile during the airplane's last 1 minute and 1 mile of flight. Some altitude variations were noted, as indicated in the study.

The Safety Board's Vehicle Recorders Division Flight Recorder Laboratory performed a readout of the airplane's digital flight data recorder. In summary, the data indicates that about 2 seconds prior to touchdown the airplane's indicated airspeed, pitch angle, and rate of descent were 130 knots, 3.6 degrees, and -437 feet per minute, respectively. About 1 second prior to touchdown the airplane's indicated airspeed, pitch angle, and rate of descent were 127 knots, 5.8 degrees, and -384 feet per minute, respectively.

About the time of touchdown, the airspeed was 126 knots, and the pitch angle increased to about 8 degrees. During the impact sequence, the vertical acceleration peaked at 2.344 g's, and then

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: LAX00FA229

Occurrence Date: 06/14/2000

Occurrence Type: Accident

Narrative (Continued)

decreased to 0.62 g's.

The airplane's cockpit voice recorder was also readout by Safety Board personnel. It was found totally overwritten and contained no useful data.

WRECKAGE AND IMPACT INFORMATION

Personnel from the State of Hawaii, Department of Transportation, Airports Division, examined the accident site and reported their observations regarding the tail strike damage to the runway's surface. The personnel indicated observing a laceration in the surface of runway 35 that was 2 inches wide and 1/4 inch deep, at its deepest point. The laceration was located 4 feet right of the runway's centerline, and was first evident 396.5 feet beyond the threshold. The laceration was 34 feet long. (See the diagram provided by the state for a drawing of the runway and the ground scar.)

On June 15, 2000, the airplane was examined by an FAA airworthiness inspector. The inspector reported that damage to the airplane had been found by a mechanic performing an overnight (preflight) inspection. The FAA inspector reported that he observed the following damage during his initial visit to the airplane: (1) abrasions/scrapes were evident on the skin of the underside (aft portion) of the fuselage forward of the auxiliary power unit (APU) compartment and APU access door panels; (2) the VHF antenna tip was worn down; (3) the skin area around the tail skid was distorted; (4) the top of the tail skid piston had impacted the underside of the ventral stair step; (5) rivets on the top right side of the tail skid cylinder housing/frame were missing; (6) the right side of the tail skid housing/frame had separated/pulled away from the canted frame (station 1230) and the bottom skin of the fuselage; and (7) the bottom aft pressure bulkhead T-fitting was distorted.

The FAA inspector additionally reported that following removal of the thermal blanket/pads and the ventral stairs, the canted frame (station 1230) was found deformed and fractured. Also, the tail skid cylinder frame was partially separated from the canted frame, and a crack was apparent at the bottom right side of the tail skid cylinder frame.

A Boeing damage evaluation report identified additional skin and underlying damage in the aft fuselage area including the aft jack pad. Also, the aft pressure bulkhead lower tee cap was found bent in an upward direction.

TESTS AND RESEARCH

Airplane-to-Ground Scar Contact Evidence.

Hawaiian Airline's Director of Flight Safety and Compliance reported to the Safety Board investigator that a comparison was performed between the ground scar on the runway surface and the damage sustained to the accident airplane. The director indicated that the observed contact evidence was consistent with the airplane's tail having impacted the runway. In pertinent part, the Director made the following statements: "...(T)he tail skid mark commences with a smear of red paint. This red paint is utilized by (Hawaiian) maintenance to signify the skid 'shoe' has been inspected...." The shoe, with its painted surface intact, "is visible evidence to a pilot conducting pre-flight of the aircraft that the tail skid has not been in contact with the ground since last inspected. The reddish-brown (rust) color of the tail skid track, which begins approximately 396 feet from the runway threshold...is consistent with the metal characteristics of the shoe."

Flight Crew Tail Bumper Operation Information.

The "Flight Crew Operating Manual" states that during normal operation the tail of the airplane

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: LAX00FA229

Occurrence Date: 06/14/2000

Occurrence Type: Accident

Narrative (Continued)

should not contact the ground. If an abnormal operation causes the tail to contact the ground, the tail bumper will prevent, or limit, structural damage. The bumper extends beyond the skin and is linked to a shock strut that will absorb impact forces.

Tail Bumper Examination.

The tail bumper cylinder was examined. In pertinent part, the following was noted by an FAA airworthiness inspector, and by the operator who made the following statements:

1. The cylinder's piston exhibited markings consistent with being compressed approximately 2 inches. (Note, during a subsequent inspection of the compression distance performed by Boeing personnel, the compression distance was measured to be about 2.875 inches.)

2. The cylinder pressure was measured at 260 pounds per square inch (psi). (The Safety Board investigator notes that the cylinder's specification indicates that during servicing, it should be pressurized to 300 psi, plus or minus 20 psi.)

3. The indicator, in the horizontal position, did not contact the fuselage skin when the cylinder was manually compressed to match the compression mark on the piston.

4. When the cylinder was manually compressed no oil was ejected from the cylinder servicing port. It appeared the cylinder was properly serviced.

5. By this testing and observation, it was concluded that the cylinder had not compressed sufficiently to displace the indicator from the horizontal position.

ADDITIONAL INFORMATION

Special Airport Designation and FARS.

Pursuant to the pilot operating limitations and pairing requirements section of 14 CFR Part 121.438, if the second-in-command has fewer than 100 hours of flight time as second-in-command in operations under this part in the type airplane being flown, and the pilot-in-command is not an appropriately qualified check pilot, the pilot-in-command must make all takeoffs and landings at special airports designated by the certificate holder.

First Officer Qualifications and Obligations.

The operator's policy, as indicated in its "Flight Operations Manual," (dated June 1, 1998, Rev. 68, page 2-1-11) specifies that first officers having a minimum experience level less than 100 hours flight time in the DC-9, are not permitted to takeoff or land at Lihue, which is a designated special airport. Also, the first officer is to advise the captain if he does not have the 100 hours experience in the DC-9. On the accident flight, the first officer had less than 100 hours experience in the DC-9.

Initial Report of Airplane Damage, and Flight Dispatch.

According to a Hawaiian Airlines mechanic, about 1800 on June 14, he received a call from Hawaiian's Maintenance Control alerting him that an oxygen panel had fallen down on airplane number 49 (the accident airplane). At the time, the airplane was parked next to the mechanic's location. The mechanic proceeded to the airplane's jetway and waited during the offloading of its passengers.

The airplane's captain exited the airplane and spoke with the mechanic. The captain indicated that there might be more than one panel to check, and also told the mechanic to look at the tail skid because the first officer might have contacted it during landing. The mechanic entered the cabin and observed that four oxygen panels had red tabs showing. He reopened the panels and reset

National Transportation Safety Board

FACTUAL REPORT

AVIATION

NTSB ID: LAX00FA229

Occurrence Date: 06/14/2000

Occurrence Type: Accident

Narrative (Continued)

the tabs.

Regarding the airplane damage, the mechanic reported he then went outside to check the airplane's tail skid. The mechanic stated: "When I got there, I noticed the tab (tail bumper compression indicator) was in the upright position and it was safetied. That was the first time I had seen a tail skid scraped that hard...so I called the supervisor."

The mechanic was subsequently instructed to return to his previously assigned work, and he complied as directed. Another mechanic was directed to respond to the (accident) airplane, and upon arrival he observed that the airplane was in a "boarding status." The mechanic happened to meet the first officer, who advised him that during an earlier flight they hit the tail skid and that the skid would probably need red paint. The mechanic stated that he inspected the tail skid and found that the tail shoe showed signs of having contacted the ground. The safety wire on the aft end of the skid block was still intact. The indicator was also intact and showed no signs of being disturbed.


The mechanic, in consultation with a supervisor, concluded that the airplane would be dispatched. The mechanic then applied red paint to the skid. The flight departed at 1848.


About 2130, another mechanic examined the airplane after it had returned to Honolulu. This mechanic stated that while performing a post flight check of the left-hand exterior fuselage, he noticed that the bottom tail, aft jackpad area, and the auxiliary power unit door had been scraped.

Also, the skin adjacent to the tail skid was buckled and the skid plate was scraped. The skid safety wire was not broken. Subsequently, the full magnitude of the damage was observed.

Wreckage Release.

The accident was reported to the Safety Board personnel on June 15, 2000. The Safety Board investigator verbally released the airplane to the operator during the following week.

		NTSB ID: LAX00FA229			
		Occurrence Date: 06/14/2000			
		Occurrence Type: Accident			
Landing Facility/Approach Information					
Airport Name Lihue	Airport ID: LIH	Airport Elevation 153 Ft. MSL	Runway Used 35	Runway Length 6500	Runway Width 150
Runway Surface Type: Asphalt					
Runway Surface Condition: Dry					
Type Instrument Approach: VOR/DME; Visual					
VFR Approach/Landing: Full Stop; Straight-in					
Aircraft Information					
Aircraft Manufacturer McDonnell Douglas		Model/Series DC-9-51		Serial Number 47715	
Airworthiness Certificate(s): Transport					
Landing Gear Type: Retractable - Tricycle					
Homebuilt Aircraft? No	Number of Seats: 133	Certified Max Gross Wt. 115000 LBS	Number of Engines: 2		
Engine Type: Turbo Fan	Engine Manufacturer: Pratt & Whitney	Model/Series: JT8D-17	Rated Power: 16000 LBS		
- Aircraft Inspection Information					
Type of Last Inspection Continuous Airworthiness	Date of Last Inspection 05/2000	Time Since Last Inspection 124 Hours	Airframe Total Time 43780 Hours		
- Emergency Locator Transmitter (ELT) Information					
ELT Installed? No	ELT Operated?	ELT Aided in Locating Accident Site?			
Owner/Operator Information					
Registered Aircraft Owner HAWAIIAN AIRLINES, INC.		Street Address 3375 KOAPAKA ST., SUITE G350			
		City HONOLULU	State HI	Zip Code 96819	
Operator of Aircraft Same as Reg'd Aircraft Owner		Street Address Same as Reg'd Aircraft Owner			
		City	State	Zip Code	
Operator Does Business As:			Operator Designator Code: HALA		
- 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: LAX00FA229
	Occurrence Date: 06/14/2000
	Occurrence Type: Accident

First Pilot Information

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

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

Certificate(s): Airline Transport; Flight Instructor

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

Rotorcraft/Glider/LTA: None

Instrument Rating(s): Airplane

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

Type Rating/Endorsement for Accident/Incident Aircraft? Yes	Current Biennial Flight Review? 03/2000
---	---

Medical Cert.: Class 1	Medical Cert. Status: Valid Medical--no waivers/lim.	Date of Last Medical Exam: 02/2000
------------------------	--	------------------------------------

- 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	11725	9839	251	11474	2709	896	260			
Pilot In Command(PIC)	6678	6178	189	6489	1354	420	96			
Instructor	10		10							
Last 90 Days	240	240		240	60	4				
Last 30 Days	63	63		63	15					
Last 24 Hours	4	4		4	2					

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

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point HONOLULU	State HI	Airport Identifier HNL	Departure Time 1643	Time Zone HST
-----------------------------	-------------	---------------------------	------------------------	------------------

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


Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing: Company

Method of Briefing: In Person


 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: LAX00FA229
	Occurrence Date: 06/14/2000
	Occurrence Type: Accident

Weather Information					
WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
LIH	1655	HST	153 Ft. MSL	0 NM	Deg. Mag.
Sky/Lowest Cloud Condition: Few			4500 Ft. AGL	Condition of Light: Day	
Lowest Ceiling: None			Ft. AGL	Visibility: 10 SM	Altimeter: 30.01 "Hg
Temperature: 27 °C	Dew Point: 21 °C	Wind Direction: 70		Density Altitude: Ft.	
Wind Speed: 9	Gusts:	Weather Conditions at Accident Site: Visual Conditions			
Visibility (RVR): Ft.	Visibility (RVV) SM	Intensity of Precipitation:			
Restrictions to Visibility: None					
Type of Precipitation: None					

Accident Information		
Aircraft Damage: Substantial	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			2	132	134
- TOTAL ABOARD -			2	137	139
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	2	137	139

--	--

 <p>National Transportation Safety Board FACTUAL REPORT AVIATION</p>	NTSB ID: LAX00FA229
	Occurrence Date: 06/14/2000
	Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

WAYNE POLLACK

Additional Persons Participating in This Accident/Incident Investigation:

Mike Spencer
FAA Inspector
WP-FSDO
135 Nakolo Place
Honolulu, HI 96819

H. Norman Davies, Jr.
Vice President Safety & Security
Hawaiian Airlines
P.O. Box 30008
Honolulu, HI 96820

David Wolz
Chief Accident Investigator
ALPA
P.O. Box 30008
Honolulu, HI 96820