Tail strike on landing, Lockheed L-1011, May 9, 2000

Micro-summary: **This Lockheed L-1011 experienced a tail strike on landing, damaging the aft pressure bulkhead.**

Event Date: **2000-05-09 at 0950 HST**

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

Investigative Body's Web Site: **http://www.ntsb.gov/**

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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.

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National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: LAX00LA192	Aircraft Registration Number: N192AT
Occurrence Date: 05/09/2000	Most Critical Injury: None
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
MAUI	HI	96732	0950	HST	

Airport Proximity: On Airport	Distance From Landing Facility:	Direction From Airport:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Lockheed	L1011-385-1	Airplane

Sightseeing Flight: No Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

On May 9, 2000, at 0950 hours Hawaiian standard time, ATA Flight 671, a Lockheed L1011-385-1, N192AT, sustained a tail strike during landing at the Kahului airport, Maui, Hawaii. The airplane was owned and operated by American Trans Air, Inc., as a regularly scheduled domestic passenger flight under 14 CFR Part 121 of the Federal Aviation Regulations. The airplane sustained substantial damage to the pressure bulkhead and several bell frames and stringers in the aft fuselage. None of the airline transport pilot licensed 3 flight crew, 10 flight attendants, or the 357 passengers were injured. An IFR flight plan was filed for the nonstop flight that originated in San Francisco, California, on the day of the accident at 0805 Pacific daylight time.

All three flight crewmembers submitted written statements. The captain was the flying pilot and they were landing on runway 2 using a flaps 42 (full down) setting. The crew reported that the Automated Terminal Information Service (ATIS) broadcast was reporting winds from 060 degrees at 18 knots with gusts to 26 knots. Both pilots stated that the Instrument Landing System (ILS) was tuned and used as flight path guidance. As the airplane descended through 30 to 40 feet agl, a sudden high sink rate developed. The captain added power and pitched the nose up to arrest the rate of descent. All three crewmembers said that the landing was harder than normal, but none would classify as a "hard landing." During the post flight walk around inspection, the flight engineer discovered an area of damage along the fuselage centerline from FS 1770 to FS 1815.

According to the Kahului airport METAR, the winds at 0954 were from 060 degrees at 22 knots with higher gusts to 27 knots.

Written statements were provided by the 10 cabin crewmembers. Several reported that the engine speed increased just before the airplane "slammed down" onto the runway. Two ceiling panels on the cabin left side around rows 30 and 31 fell down. Eight of the 10 flight attendants reported neck and back pain and were medically evaluated at an Urgent Care Medical facility near the airport. All were subsequently released.

AIRCRAFT INFORMATION

The maintenance records were reviewed with regard to the main landing gear assemblies. The left and right assemblies, serial numbers 178ELA and 1107EBA respectively, were last overhauled on July 15, 1990, and installed on the accident airframe on July 26 of that year. Both units had accumulated a total of 6,944 cycles since the overhaul. The component overhaul period for the main landing gear assemblies is 10 years or 10,000 cycles. The units were last inspected and serviced on April 19, 1999. Review of the records found no write-ups for the 180 days preceding the accident.

The left and right main landing gear assemblies were removed from the airplane and sent to Hawker Pacific Aerospace, a Federal Aviation Administration (FAA) approved repair station, for teardown.

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Narrative (Continued)

The examination disclosed that the internal condition of both assemblies were consistent with normal wear conditions. All dimensions were acceptable in accordance with overhaul manual repair limits.

FAA inspectors from the Honolulu Flight Standards District Office responded to the airport and examined the aircraft while parked at the gate. One inspector entered the cockpit and observed the captain's airspeed indicator bug settings. The three outer bugs were set at 178, 158, and 138, while the inner bug was set to 142.

According to the ATA L-1011 Operations Manual, the inner bug is set to the final approach speed, which is Vref (flaps 42) adjusted for 1/2 the steady state wind plus all of the gust additive. The final bug setting cannot be less than Vref + 5, nor more than Vref + 20. The outer bugs are set based on flaps 42 Vref and are in order; Vref + 60, Vref + 40, and Vref + 20. The manual stipulates that these speeds are calculated by the flight engineer and entered on a landing card, which is then presented to the captain.

The load manifest for the flight listed the predeparture estimated landing weight as 348,700 pounds. The aircraft total weight indicator on the flight engineer's fuel panel was showing 352,000 pounds when examined by the FAA inspectors.

According to the charts in the ATA L-1011 Operations Manual for 352,000 pounds, the computed zero wind speeds for bug setting purposes would be: Vref (flaps 42) = 138 knots, Vref + 20 = 158 knots, Vref + 40 = 178 knots, and Vref + 60 = 198 knots. Based on the wind reports from the control tower, 060 degrees at 22 knots with gusts to 27 knots, the steady and gust headwind components at the time of the landing were 16 and 4 knots, respectively. The final Vref wind additive would therefore be 8 + 4 for a total of 12 knots, or an inner bug final approach setting of 150.

The ATA L-1011 Operations Manual discusses airspeed management on final approach and states: "After landing flaps are extended, complete the landing checklist and slow the aircraft to approach speed indicated by the Speed Command System [inner bug setting], or, if the SCS is inoperative, to Vref (plus one half the wind and all the gust factor, not to exceed Vref + 20 knots)."

The flaps 42 landing field length limit chart shows that for 352,000 pounds, a landing field length of 5,200 feet is required.

According to the ATA L-1011 Operations Manual, the maximum allowable aircraft nose up flare attitude is 12.5 degrees; this limit is predicated on tail clearance from the pavement during touchdown. The manual further notes that a normal flare consists of about 1.5 degrees additional nose up from the aircraft body attitude during the approach. The ATA L-1011 fleet manager used performance charts and other data in the manual to calculate the nose up attitude of the aircraft for the landing weight of 352,000 pounds, flaps set to 42, and flying a 3-degree glide slope. The calculations predicted that the airplane would have flown the approach about a 7-degree nose up attitude.

METEOROLOGICAL INFORMATION

A Safety Board staff meteorologist prepared a Meteorological Factual Report of the conditions existing during the aircraft's approach and landing. The complete report is appended to this report.

Review of the visible satellite image for 1000 hours showed clear skies at the Kahului airport, with no convective buildups present in the airport's vicinity. No weather radar echoes were present.

The airport is equipped with an ASOS wind-monitoring tower, which is located near the touchdown

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Narrative (Continued)

zone of runway 2. In pertinent part, the ASOS system records high-resolution wind data in the form of both 2-minute and maximum 5-second average velocities, with respect to the runway orientation and the computed crosswind component. The data shows that the maximum 5-second average wind peaked at 0948, at 27 knots, decreased to 22 knots at 0949, and finally increased to 24 knots at 0950. The computed maximum 5-second average crosswind component for those same time frames was 15 knots, 13 knots, and 12 knots, respectively.

AIRPORT INFORMATION

The Kahului airport has two hard surfaced runways. Runway 2 was used by the accident airplane and is 7,000 feet long by 150 feet wide. It is equipped with a V4L VASI aligned to a 3.0-degree glide slope with a designed threshold crossing height of 65 feet.

FLIGHT RECORDERS

The aircraft was equipped with a digital flight data (DFDR) and a cockpit voice recorder (CVR). Both recorders were removed from the aircraft and sent to the Safety Board's Vehicle Recorder Division laboratory in Washington, D.C., for readout and evaluation.

The CVR records for 30 minutes before the recording medium is overwritten by new material. Review of the CVR recording found conversations during the taxi-in and shutdown periods, with no conversations remaining covering the approach or landing. A formal readout was not performed.

The Lockheed Aircraft Service Company DFDR model 209F, serial number 111, was read out in the laboratory, and detailed data plots and tabular listings of the recovered parameters is included with the Flight Data Recorder Factual Report, which is appended to this report. In pertinent part, the data disclosed the following (the time in seconds noted is the FDR Subframe Reference Number, which is the time in seconds from the beginning of the data transcription):

1. The local maximums for the captain and first officer's control column position were recorded at 548 seconds and were -6.54 and -7.13 degrees aft column, respectively.

2. The maximum normal vertical acceleration recorded was +2.047 G's at 549 seconds. After a local minimum value of +0.706 G's at 550 seconds, a second local maximum of +1.374 G's was recorded at 551 seconds.

3. Local lateral and longitudinal acceleration maximums of 0.158 and 0.434 G's, respectively, were recorded at 549 seconds.

4. From 490 through 538 seconds, the calibrated airspeed varied from 154 to 145 knots. From 539 through 548 seconds, the airspeed varied from 143 to 130 knots. The calibrated airspeed at 549 seconds was recorded as 130 knots. In the period from 538 to 539 seconds, the airspeed decreased from 143 to 135 knots, then increased to 143 knots by 541 seconds, and then steadily decayed to the 130-knot value recorded at 548 seconds.

5. The local maximum pitch value of 8.79 degrees aircraft nose up was recorded at 549 seconds.

The data set values from the Nos. 3 and 4 right leading edge slats and the L5 and L6 spoilers were considered erroneous.

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Occurrence Date: 05/09/2000

Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation	Runway Used	Runway Length	Runway Width
KAHULUI	OGG	54 Ft. MSL	2	7000	150

Runway Surface Type: Asphalt

Runway Surface Condition: Dry

Type Instrument Approach: Visual

VFR Approach/Landing: Full Stop; Traffic Pattern

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Lockheed	L1011-385-1	139C-1057

Airworthiness Certificate(s): Transport

Landing Gear Type: Retractable - Tricycle

Homebuilt Aircraft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	379	452000 LBS	3

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Fan	Rolls-Royce	RB-211-22	40140 LBS

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
Continuous Airworthiness	05/2000	5 Hours	63701 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?	ELT Operated?	ELT Aided in Locating Accident Site?
Yes	No	

Owner/Operator Information

Registered Aircraft Owner	Street Address		
AMERICAN TRANS AIR, INC.	7337 W. WASHINGTON STREET		
	City: INDIANAPOLIS	State: IN	Zip Code: 46231

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:

Operator Designator Code: AMTA

- 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

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FACTUAL REPORT AVIATION

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Occurrence Date: 05/09/2000

Occurrence Type: Accident

First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File		58

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: 03/2000

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	24769	8178								
Pilot In Command(PIC)	16339	8156								
Instructor										
Last 90 Days	165	165								
Last 30 Days	57	57								
Last 24 Hours	5	5								

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

Flight Plan/Itinerary

Type of Flight Plan Filed: IFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
SAN FRANCISCO	CA	SFO	0805	PDT

Destination	State	Airport Identifier
Same as Accident/Incident Location		OGG

Type of Clearance: IFR

Type of Airspace: Class D

Weather Information

Source of Briefing: Company

Method of Briefing:

National Transportation Safety Board

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Occurrence Type: Accident

Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
OGG	0954	HST	54 Ft. MSL	0 NM	0 Deg. Mag.

Sky/Lowest Cloud Condition: Scattered 3000 Ft. AGL

Condition of Light: Day

Lowest Ceiling: None 0 Ft. AGL

Visibility: 10 SM

Altimeter: 30.00 "Hg

Temperature: 80 °C

Dew Point: 65 °C

Wind Direction: 60

Density Altitude: Ft.

Wind Speed: 22

Gusts: 27

Weather Condtions 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: 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				1	1
Cabin Attendants				10	10
Other Crew					
Passengers				357	357
- TOTAL ABOARD -				370	370
Other Ground	0	0	0		0
- GRAND TOTAL -	0	0	0	370	370

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FACTUAL REPORT
AVIATION

NTSB ID: LAX00LA192

Occurrence Date: 05/09/2000

Occurrence Type: Accident

Administrative Information

Investigator-In-Charge (IIC)

JEFF RICH

Additional Persons Participating in This Accident/Incident Investigation:

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