National Transportation Safety Board
Aviation Incident Final Report

Location:	Houston, TX	**Incident Number:**	FTW02IA061
Date & Time:	01/03/2002, 0446 CST	**Registration:**	F-GCBG
Aircraft:	Boeing 747-228F	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	3 None
Flight Conducted Under:	Part 129: Foreign		

Analysis

After a normal touchdown and rollout, the 747 cargo airplane exited the runway onto a high-speed taxiway. The captain, noticed that the airplane was "dragging," to the right. The need for additional power for taxi seemed too great, so the crew stopped taxi and applied the parking brake. On-site examination revealed the right outboard main landing gear trunnion was completely fractured and separated several inches inboard of the aft trunnion bearing. Further visual inspection of the fractured area showed evidence of corrosion and what appeared to be a pre-existing crack on the upper portion of the outer cylinder of the trunnion and a metallurgical examination showed evidence of stress corrosion cracking (SCC). The inspection criteria outlined in Airworthiness Directive (AD) repalc90-06-18 R1 required the operator to perform a visual inspection, or a visual plus eddy current inspection of the wing landing gear at the trunnion, for cracks and corrosion. The inspection criteria outlined in AD 2001-17-25 required the operator to perform a detailed visual inspection using a bore scope to find cracking and corrosion of the aft trunnion outer cylinders of the wing landing gear, within 180 days from October 3, 2001. According to the operator's records, the bore scope inspection had not been performed, as per the AD, it was not due until April 3, 2002. Historical review of Service Difficulty Reports (SDR's) revealed 19 occurrences of SCC associated with corrosion of the aft trunnion outer cylinder stressed areas. Due to these SDR data, the manufacturer issued ASB 747-32A2465 revision 1, which was mandated by a new FAA AD 2001-17-25. AD 2001-17-25 included a bore scope inspection of the affected area of the trunnion due to the fact that the propagation of SCC cracking was internal on the cylinder and not readily detected by visual or eddy current methods as per the original AD 90-06-18 R1.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: Stress corrosion cracking (SCC) of the aft trunnion outer cylinder. A factor was the inadequate inspection criteria of the Airworthiness Directive to detect pre-existing SCC.

Findings

Occurrence #1: GEAR COLLAPSED
Phase of Operation: TAXI - FROM LANDING

Findings
1. (C) LANDING GEAR,MAIN GEAR STRUT - CORRODED
2. (C) LANDING GEAR,MAIN GEAR STRUT - CRACKED
3. LANDING GEAR,MAIN GEAR STRUT - FAILURE,TOTAL
4. (F) MAINTENANCE,SERVICE BULLETIN/LETTER - INADEQUATE

Factual Information

On January 3, 2002, about 0446 central standard time, a Boeing 747-228F airplane, French registration F-GCBG, experienced a wing landing gear collapse after landing on runway 15L at the Houston Intercontinental Airport, Houston, Texas. The cargo configured airplane was registered to and operated by Air France. The flight crew (Captain, First Officer, and Flight Engineer) were not injured. Dark night visual meteorological conditions prevailed and an Instrument Flight Rules (IFR) flight plan was filed for the 14 Code of Federal Regulations Part 129 international cargo flight that originated from Mexico City, Mexico, at 0245.

After touchdown and rollout, the airplane exited the runway onto a high-speed taxiway. The captain, noticed that the airplane was "dragging," to the right. The need for additional power for taxi seemed too great, so the crew stopped taxi and applied the parking brake. Two warning lights on the landing gear panel indicated that there was a problem with the right main wing gear. Additionally, the flight engineer's instrument panel confirmed an open hydraulic circuit (wheel brakes) on the right main wing gear. The airplane's engines were stopped, the APU was started, and ground personnel performed a visual inspection which revealed that the right wing landing gear assembly was partially collapsed and tilted inward toward the fuselage. The top of the right wing gear aft trunnion was found fractured and protruding upward through the top of the right wing surface. There was minor damage to surrounding wing structure and lines to the #4 hydraulic system (wheel brakes) were found ruptured.

On-site examination of the airplane by the NTSB investigator-in-charge, FAA air safety inspectors, Air France maintenance personnel, and a Boeing engineer confirmed that the right outboard main landing gear trunnion was completely fractured and separated several inches inboard of the aft trunnion bearing. Further visual inspection of the fractured area showed evidence of corrosion and what appeared to be a pre-existing crack on the upper portion of the outer cylinder of the trunnion. The lower portion of the outer cylinder was cut away to facilitate shipment of the parts to the NTSB Materials Laboratory, Washington, D.C., for detailed examination.

Examination of the parts was conducted at the Safety Board's Materials Laboratory on January 17-18, 2002. During the examination, the aft trunnion on the upper portion of the outer cylinder was found fractured through the outboard cross bolt hole. Very dark, thick deposits were noted on a portion of the fracture that intersected the cross bolt hole on a flat, 45-degree spiral plane. Evidence of pre-existing corrosion was found in the fractured surface of the outer cylinder. The predominate features of the fractures showed evidence of stress corrosion cracking (SCC). Typically, stress corrosion cracking propagates under sustained loading (not cyclic loading) which is the predominate loading that the outer cylinder is subjected to while resting on its landing gear. A detailed report of the materials examination is included as a supporting document to this report.

Historical information on the airplane and the landing gear assembly were provided by the operator. A review of the information provided revealed the following. The airplane's total time since new was 81,124 hours, and 15,988 cycles since new. The right wing landing gear assembly, P/N: 65B01464-34, S/N: CP001482, was installed on December 27, 1994 during a heavy "D" check. The assembly had accumulated 11,599 cycles since new, and 5,496 cycles since overhaul. The outer cylinder P/N: 65B01430-18, S/N: 3701, was installed together with

the wing landing gear assembly on December 27, 1994. The cylinder had accumulated 5,496 cycles since overhaul.

Mandatory inspections of the wing landing gear assembly were outlined in Boeing Service Bulletin (SB) 747-32-2190 revision 7, and Alert Service Bulletin (ASB) 747-32A2465 revision 1. These service bulletins were respectively mandated by FAA Airworthiness Directives (AD) 90-06-18 R1, and AD 2001-17-25. AD 2001-17-25, issued on October 3, 2001, superceded AD 90-06-18 R1. Entries in the operators maintenance records showed that SB 747-32-2190 revision 7 was complied with during the wing landing gear replacement performed on December 27, 1994. Entries in the records also showed visual and eddy current inspections at 18-month intervals since December, 1994. According to the records, the last visual and eddy current inspection was performed on July 21, 2001, and did not reveal any defects.

The inspection criteria outlined in AD 90-06-18 R1 required the operator to perform a visual inspection, or a visual plus eddy current inspection of the wing landing gear at the trunnion, for cracks and corrosion. The inspection criteria outlined in AD 2001-17-25 required the operator to perform a detailed visual inspection using a bore scope to find cracking and corrosion of the aft trunnion outer cylinders of the wing landing gear, within 180 days from October 3, 2001. According to the operator's records, the bore scope inspection had not been performed, as per the AD, it was not due until April 3, 2002.

Historical review of Service Difficulty Reports (SDR's) revealed 19 occurrences of SCC associated with corrosion of the aft trunnion outer cylinder stressed areas. Due to these SDR data, the manufacturer issued ASB 747-32A2465 revision 1, which was mandated by a new FAA AD 2001-17-25. AD 2001-17-25 included a bore scope inspection of the affected area of the trunnion due to the fact that the propagation of SCC cracking was internal on the cylinder and not readily detected by visual or eddy current methods as per the original AD 90-06-18 R1.

Pilot Information

Certificate:	Airline Transport	**Age:**	57, Male
Airplane Rating(s):	Multi-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	07/25/2001
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	16031 hours (Total, all aircraft), 8004 hours (Pilot In Command, all aircraft), 136 hours (Last 90 days, all aircraft), 72 hours (Last 30 days, all aircraft), 8 hours (Last 24 hours, all aircraft)		

Co-Pilot Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Flight Engineer Information

Certificate:		**Age:**	
Airplane Rating(s):		**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):		**Second Pilot Present:**	
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	**Registration:**	F-GCBG
Model/Series:	747-228F	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	22939
Landing Gear Type:	Retractable - Tricycle	**Seats:**	3
Date/Type of Last Inspection:	11/27/2001, AAIP	**Certified Max Gross Wt.:**	285762 lbs
Time Since Last Inspection:	377 Hours	**Engines:**	4 Turbo Fan
Airframe Total Time:	81124 Hours at time of accident	**Engine Manufacturer:**	General Electric
ELT:	Installed, not activated	**Engine Model/Series:**	CF6-50E2
Registered Owner:	AIR FRANCE	**Rated Power:**	52500 lbs
Operator:	AIR FRANCE	**Operating Certificate(s) Held:**	Foreign Air Carrier (129)
Operator Does Business As:	Air France	**Operator Designator Code:**	UTA3

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Night
Observation Facility, Elevation:	IAH, 97 ft msl	**Distance from Accident Site:**	
Observation Time:	0353 CST	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.45 inches Hg	**Temperature/Dew Point:**	-3°C / -7°C
Precipitation and Obscuration:			
Departure Point:	Mexico City (MMEX)	**Type of Flight Plan Filed:**	IFR
Destination:	Houston, TX (KIAH)	**Type of Clearance:**	IFR
Departure Time:	0245 CST	**Type of Airspace:**	Class A

Airport Information

Airport:	Bush Intercontinental Airport (IAH)	**Runway Surface Type:**	Concrete
Airport Elevation:		**Runway Surface Condition:**	Dry
Runway Used:	15L	**IFR Approach:**	ILS
Runway Length/Width:	12001 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	3 None	**Aircraft Damage:**	Minor
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	29.980278, -95.339722

Administrative Information

Investigator In Charge (IIC):	Alexander Lemishko	**Report Date:**	01/24/2005
Additional Participating Persons:	John Loomis; FAA; Houston, TX Dennis Rodriguez; Boeing; Seattle, WA Gerald Gaubert; BEA; France,		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		