Aviation Investigation Final Report

Location:	INDIANAPOLIS, Indiana	**Incident Number:**	CHI97IA205
Date & Time:	July 9, 1997, 08:40 Local	**Registration:**	N770AT
Aircraft:	Boeing B-727-200	**Aircraft Damage:**	Minor
Defining Event:		**Injuries:**	11 None
Flight Conducted Under:	Part 121: Air carrier - Non-scheduled		

Analysis

While the aircraft was being loaded with passengers, the flight engineer found that the right main landing gear had partially collapsed. The fractured right main landing gear had recently been overhauled and had accumulated 51 cycles and 126 hours since installation 21 days prior to the fracture. An examination was made of the aft portion of the upper and lower lugs of the trunnion. Chromium plating was apparent on sections of the trunnion where the overhaul manual stated that 'No Chrome' was to be applied. The spherical bearing assembly, locking bolt and anti-rotation washer were also examined. For normal assembly, the aft trunnion of the gear is inserted into the inner diameter of the wing mounted spherical bearing. The spherical bearing that contacted the trunnion journal had an inner diameter which measured approximately 3.50 inches. The aft trunnion journal of the failed landing gear had an outer diameter that measured approximately 3.25 inches. During landing gear replacement, the maintenance procedures require that the proper sized spherical bearings, either 3.50 inch or the 3.25 inch inner diameter, be matched with the appropriate outer cylinder aft trunnion outside diameter.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: the improper installation of the incorrect spherical bearing by the company's maintenance personnel. A factor was the improper plating of the trunnion with chromium by the landing gear overhaul facility.

Findings

Occurrence #1: MAIN GEAR COLLAPSED
Phase of Operation: STANDING

Findings
1. (F) LANDING GEAR,MAIN GEAR ATTACHMENT - IMPROPER
2. (F) MAINTENANCE,OVERHAUL - IMPROPER - COMPANY MAINTENANCE PERSONNEL
3. (C) LANDING GEAR,MAIN GEAR ATTACHMENT - FRACTURED
4. (C) MAINTENANCE,INSTALLATION - IMPROPER - COMPANY MAINTENANCE PERSONNEL

Factual Information

On July 9, 1997, at 0840 eastern standard time, a Boeing 727-200, N770AT, operated by American Trans Air, was determined to have received minor damage prior to pushback from the gate. During his pre-flight walk around, the Flight Engineer discovered that the aft trunnion on the shock strut of the right main landing gear had failed. The Captain was notified of the discrepancy by the Flight Engineer. The Captain halted the boarding of passengers. The seven crewmembers and four passengers were deplaned by normal means. There were no injuries. The 14 CFR Part 121, Flight 403/402, was scheduled to depart Indianapolis International Airport, Indianapolis, Indiana, with Las Vegas International Airport, Las Vegas, Nevada as the intended destination. Instrument meteorological conditions prevailed and an instrument flight plan had been filed.

The aircraft had landed at Indianapolis International Airport the night before and had received routine maintenance. The next morning the aircraft was towed to gate C-4 at the main terminal. The maintenance personnel who serviced the aircraft and towed the airplane to the gate reported that they did not notice anything unusual about the right wing or the right main landing gear of the airplane. The aircraft fueler reported that he noticed that the right wing was lower than the left wing. He notified maintenance personnel of the condition. About the same time, the Flight Engineer discovered and reported the condition of the right main landing gear to the maintenance personnel. It was determined that the outer cylinder trunnion had fractured and the actuator support beam was resting on the fractured stub of the outer cylinder trunnion. The airplane was towed to a hangar for removal and replacement of the shock strut and local repair of the main landing gear support beam.

It was determined that the fractured right main landing gear, p/n 65-17650-74, s/n 0171601597, had recently been overhauled and had accumulated 51 cycles and 126 hours since installation 21 days prior to the fracture. The aft trunnion of the right main landing gear and the trunnion bearing components were sent to the Materials Laboratory of the National Transportation Safety Board for examination.

The examination revealed that the aft portion of the trunnion was fractured into four pieces with the three largest pieces contained within a cylindrical repair sleeve encircling the trunnion. The repair sleeve, installed during a previous repair of the outer cylinder trunnion journal, was also longitudinally split at the approximate bottom centerline of the trunnion.

An etched longitudinal metallographic section was cut through the initiation area of the upper aft lug fracture. The metallographic section uncovered a thin layer of plating on the outer diameter surface of the lug. The plating was determined to be chromium by energy dipersive spectrographic analysis. The plating extended from the fracture location aft through the transition radius and onto the outer diameter of the lug. The plating was thickest on the lug

diameter (0.0022 inch), thinned in the radius, and at an intermediate thickness (0.00035) adjacent to the fracture.

Another section was cut from the lower lug showing a portion of the journal diameter, the trunnion end face and the transition radius from the end face to the lug outer diameter. Chromium plating was apparent on the entire manufactured surface visible in this section. On the journal diameter the plating thickness measured 0.005 inch. The plating extended aft over the corner chamfer onto the end face and throughout the transition radius.

The Boeing Commercial Airplane Overhaul Manual indicated that chromium plating was only to be applied to the trunnion journal outer diameter and a portion of the end face. It also specifically denoted areas for chromium plate runout that bound these areas. Further, the figure had a "No Chrome" notation for the journal surface immediately adjacent to the chamfer. The landing gear overhaul facility's "workorder traveler" for the gear indicated similar chromium plating details. Flag note 13 in figure 406 indicated plating the aft lugs and surrounding areas with either titanium-cadmium or low hydrogen embrittlement (LHE) cadmium. Work order documents supplied by the overhaul facility indicated that LHE cadmium was used.

In addition to the trunnion section of the landing gear, the spherical bearing assembly, locking bolt and anti-rotation washer were received. For normal assembly, the aft trunnion of the gear is inserted into the inner diameter of the wing mounted spherical bearing.

The spherical bearing that contacts the trunnion journal had an inner diameter which measured approximately 3.50 inches. The aft trunnion journal of the failed landing gear had an outer diameter that measured approximately 3.25 inches. During landing gear replacement, the maintenance procedures require that the proper sized spherical bearings, either 3.50 inch or the 3.25 inch inner diameter, be matched with the appropriate outer cylinder aft trunnion outside diameter. (See Metallurgist's Factual Report)

Boeing had issued Service Bulletins in 1980 and 1991 which detailed the requirements to ensure that the correct trunnions and spherical bearings were matched during landing gear replacement.

Pilot Information

Certificate:	Airline transport	**Age:**	51,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	February 19, 1997
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	6500 hours (Total, all aircraft), 160 hours (Last 90 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	**Registration:**	N770AT
Model/Series:	B-727-200 B-727-200	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	21953
Landing Gear Type:	Retractable - Tricycle	**Seats:**	176
Date/Type of Last Inspection:	June 20, 1997 Continuous airworthiness	**Certified Max Gross Wt.:**	197700 lbs
Time Since Last Inspection:	162 Hrs	**Engines:**	3 Turbo jet
Airframe Total Time:	52509 Hrs	**Engine Manufacturer:**	P&W
ELT:	Installed, not activated	**Engine Model/Series:**	JT8D-17
Registered Owner:	AMERICAN TRANS AIR	**Rated Power:**	16000 Lbs thrust
Operator:		**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Unknown	**Visibility**	1 miles
Lowest Ceiling:	Overcast / 300 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	360°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	17°C / 16°C
Precipitation and Obscuration:	N/A - None - Drizzle		
Departure Point:	(IND)	**Type of Flight Plan Filed:**	IFR
Destination:	LAS VEGAS , NV (LAS)	**Type of Clearance:**	None
Departure Time:	18:25 Local	**Type of Airspace:**	

Airport Information

Airport:	INDIANAPOLIS INTL IND	**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	7 None	**Aircraft Damage:**	Minor
Passenger Injuries:	4 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	11 None	**Latitude, Longitude:**	39.729999,-86.289459(est)

Administrative Information

Investigator In Charge (IIC):	Silliman, Jim
Additional Participating Persons:	LEONARD SWOPE; INDIANAPOLIS , IN HANK COLL; SUN VALLEY , CA PHILIP LANGFORD; SEATTLE , WA JAMES DEBNEY; INDIANAPOLIS , IN
Original Publish Date:	May 4, 1998
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=10468