



**PAKISTAN CIVIL AVIATION AUTHORITY**  
**(SAFETY & INVESTIGATION BOARD)**



**SERIOUS INCIDENT TO M/S SHAHEEN AIR**  
**B-737-200, AP-BHA, FLIGHT NO. NL-785**  
**ON 7 JANUARY 2008**  
**AT**  
**DUBAI – UAE**

## FINAL REPORT

### SERIOUS INCIDENT TO M/S SHAHEEN AIR B-737-200, AP-BHA, FLIGHT NO. NL-785 ON 7 JANUARY 2008 AT DUBAI – UAE

**Authority:** Director General Civil Aviation Authority Memorandum No. HQCAA/1901/320/SIB dated 29<sup>th</sup> February 2008. (**Appendix 'A'**).

#### **Synopsis**

A Shaheen Airlines Flight No. NL-785 took off from Dubai on 7<sup>th</sup> January 2008. However, after take off, the landing gear failed to retract. The aircrew recycled the gears two times but in vain. The hydraulic-A oil quantity observed to be zero. A cabin crew sitting near the aft rear door heard a "Bang" and informed the captain. The Captain consulted two engineers on board and considering the availability of quicker maintenance and administrative actions at home decided to divert the aircraft to Karachi. (**Appendix "B"**). A safe landing was made at Karachi, where post flight inspections discovered that the No. 2 main wheel tyre tread had peeled off and a large piece of 4 feet length was found stuck in the landing gear. Additionally and surprisingly a full grown black, dead and frozen cat was found sandwiched between landing gear geometry. There were number of other significant damages around the landing gear and wing areas including the most difficult to comprehend, the fractured LH actuator support link in two pieces. Boeing was notified of the details of the incident for expert advice.

#### **1. Factual Information**

- 1.1 **Type of Aircraft :** B-737-200
- 1.2 **Aircraft Registration No.:** AP-BHA
- 1.3 **Flight Number :** NL-785
- 1.4 **ATS:** The Dubai ATC did not observe any abnormality during take off roll or from runway.
- 1.5 **ATC Tape Extract :** N/A
- 1.6 **CVR :** N/A
- 1.7 **DFDR:** SAI did not have required technical facility to down load the DFDR.
- 1.8 **Defect History:** The defect history did not show any defect reported by aircrew or ground crew which could be related to the occurrence.
- 1.9 **Injuries to persons**  
There were no injuries to any person.

1.10 **Damage to Aircraft:** Rubber pieces from the No. 2 Main Wheel tyre hit the aircraft surface and a number of components in the left MLG bay. These pieces damaged the aircraft by hitting at high speed and also through entanglement with the main landing gear components as the MLG were retracting. The damages include:

- (a) Fracture to hanger link P/N. 65-46112-22
- (b) Distortion and bents to Walking Beam hanger pin board P/N 69-39464-4
- (c) Scratches at No. 2 main wheel P/N 3-1439-6
- (d) Left hand wing upper cover panel P/N 65-50820-285
- (e) Distortions at No. 1 EDP P/N 55-098-01
- (f) Structural damage to Left hand inboard fore flap P/N 65-46430-89
- (g) Damage to following Hydraulic lines:
  - i. 65-44510-3895
  - ii. 65-44510-3733
  - iii. 65-44510-3732
  - iv. 65-44510-3893
  - v. 65-44510-3731
  - vi. 65-44510-3913
- (h) Wing fillet fairing below rear spar found dented and repaired.

1.11 **Special Test & Research conducted:** The support link of left hand actuator was sent to Boeing, USA for metallurgical analysis. The report is attached as **Appendix 'C'**. Refer SEM photographs for fracture analysis. The details of broken actuator link are as follows:-

- (a) Part Number 65 46112 22      S/N 127169D
- (b) Installed on 26th May 2003
- (c) CSN                              19, 342
- (d) CSO                              5, 635
- (e) TSN                              27, 561 Hrs
- (f) TSO                              11, 014 Hrs

1.12 **Failed component details (No 2 Main Wheel Tire)**

- (a) P/N 419K42T1      S/N 9182T707
- (b) Retreated Goodyear(Thailand) R5
- (c) Manufacturer Goodyear
- (d) Landings 27

1.13 **Personnel information**

Aircrew information is attached as **Appendix 'D'**.

#### 1.14 Aerodrome Information

N/A

#### 1.15 Fire

N/A

### 2. Analysis

2.1 The aircraft after take off from Dubai following failures/events took place:

- (a) The left landing gear did not retract. The gears were recycled twice but in vain.
- (b) The hydraulic quantity was observed dropping to zero.
- (c) Cabin crew sitting at L2 (aft rear left) door heard a bang on fuselage which was conveyed to the Captain.
- (d) The First officer acted in accordance with Quick Reference handbook (QRH).
- (e) The Captain in consultation with two engineers on board decided to divert to Karachi.

2.2 The Captain decided to proceed to Karachi after consulting engineers on board.

2.3 The examination of the damaged left main landing gear area revealed following unique facts and affects for various aircraft parts: (See **Appendix 'E'** for photographs):

- (a) Tread of No. 2 tire of left MLG was found separated (Photographs 1 & 2).
- (b) A 4 feet long and 8 to 16 inches wide tire -tread piece was found entangled in landing gear. (See Photographs No 3)
- (c) The left hand actuator support link was found fractured in two parts. (See Photograph NO 4, 5 and 8)
- (d) Left Wing upper surface triangular panel found torn and pieces missing (See Photographs 5 & 6).
- (e) Hydraulic lines broken and protruding above wing surface. (See Photograph 9 & 10)
- (f) The main gear actuator assembly along with walking beam and hanger was protruding above wing surface with hanger link broken (See Photographs 9 & 10).

- (g) A full size black cat was found sandwiched between landing gear hold up beam and lower broken portion of hanger link (LMG actuator link). (See Photographs 4, 7, 8, 12 & 13).

#### **Was the Cat cause of link failure?**

- 2.4 The cat was found frozen and was lying exactly over the broken actuator link. It initially appeared that it might had caused an obstruction to the movement of the actuator link; however considering that facts that the cat was still intact i.e. not even ruptured or pressed between broken portions of the actuator link; it was quiet obvious that this animal consisting of soft tissues can not cause the failure of a metal component made of cast aluminum alloy. Hence presence of the cat to contribute to Landing Gear failure was ruled out.

#### **Presence of the "Big Cat" in the landing gear Bay.**

- 2.5 How the cat got into the landing gear bay and was not detected by ground/aircrew of SAI during their exterior inspections of the aircraft needs some deliberations at SAI flight operations and CAA Flight Standards. A review of the "Exterior Inspection" normal procedures for aircrew as per FCOM (Attached as appendix "D"), may provide a direction to make the inspection more effective to detect the presence of any foreign object, including animals, and take preventive actions. The airport security agencies also need to reevaluate the existing procedures to deter the presence of cats and other animals in the vicinity of aircraft parked in transit.

#### **Co relating the tearing of the tyre and failure of actuator link.**

- 2.6 The actuator link was dispatched to Boeing Air Safety Investigation, USA along with all necessary information and photograph. The Boeing carried out the fracture analysis with the help of Material and Process Technology, the report is attached as **Appendix 'C'**. The report has made the following conclusions:
- (a) Rework to support link exhibited a poor overall finish to the part. Primer adhesion was poor. The aluminum surface was abraded, partially anodized and not thoroughly shot peened.
  - (b) In cross-section, several shot preening folds to the outer corner radius of the center I-web section was observed.
  - (c) The support link fracture initiated by a fatigue crack. A shot preening fold likely contributed to the crack initiation.
  - (d) Scanning Electron Microscopy and striation analysis estimated that the fatigue crack Initiated shortly after the November 2002 overhaul.

- 2.7 In brief the Boeing metallurgical analysis has attributed presence of a “**Fatigue Crack**” as cause of actuator failure; and it confirms that the fatigue originally initiated in 2002 during its last overhaul. It further identifies “poor finish” and improper shot peening as the cause of fatigue initiation.

#### **Cause of actuator link failure**

- 2.8 However, to determine as to actually what caused actuator link to finally “**fracture**” in two parts, in this flight after take off needs an analysis of all failures in this flight. What failed earlier? , the tire tread or actuator link, what caused failure of landing gear to retract after take off/ Did the actuator link failed prior to the tearing off of the tyre during take off at Dubai?. Answers to these questions would lead us to the actual cause of occurrence. It may be noted that during the take off roll, the tire tread will peel away and hit the landing gears when the wheels are on the ground and landing gears are in fully down and locked position. The landing gear doors are open to permit the peeled off tire pieces to hit the landing gears and get stuck in it. Once the aircraft is airborne, the landing gear cycle will initiate. It is the landing gear retraction cycle where the tire pieces have caused obstruction to the movement of hydraulic actuator and the link failed due to presence of a fatigue crack in its link.
- 2.9 Hence the sequence of damages, keeping out the presence and freezing of the cat between landing gear links appended as follows:
- (a) The tyre peeled off during take off roll, and one big piece hit and got stuck in the geometry of landing gear.
  - (b) Poor maintenance or poor quality of re-treading of tires remains a major cause of tire failures during take off.
  - (c) Other piece hit different panels and hydraulic line, resulting in local damage.
  - (d) Hydraulic oil leaked out from damaged pipes and union.
  - (e) The large pieces of tire tread which was entangled with LG actuator and mechanical braces caused solid obstruction to retraction cycles.
  - (f) The actuator support link fractured due to non designed loads and presence of a Fatigue Crack in its cross section..

### 3. Findings

- 3.1 The Captain in consultation with engineers on board decided to proceed to Karachi with known failures and the fact that cabin crew had heard a "bang".
- 3.2 A big cat got into the landing gear while the aircraft was in transit checks at Dubai airport.
- 3.3 The presence of security agency personnel at Dubai airport transit area, the exterior inspections carried out by aircrew and ground service providers could not detect the presence of a Big Cat in the main landing gear bay.
- 3.4 DFDR was not preserved after the incident.
- 3.5 The right wheel of the main landing gear peeled off during take off roll.
- 3.6 The torn-off tire pieces damaged left main landing gear bay structure and number of pipes and panels.
- 3.7 A large piece from the tire got stuck with the landing gear geometry and caused obstruction to the retraction of MLG. The obstruction and other damages resulted in abnormal stresses on the LG actuator and its support link.
- 3.8 The LHG support link had developed a fatigue crack (stress-raiser) due to poor surface finish during its last overhaul in 2002.
- 3.9 The actuator link fractured in two pieces due to presence of a fatigue crack and application of abnormal stresses.
- 3.10 Poor maintenance or poor quality at re-treading of tires can not be ruled out as cause of tire tearing off.
- 3.11 This tire was re-treaded at Goodrich (Thailand) and had done only 27 landings.

**Conclusion:** A re-treaded tire with only 27 landings on record failed during take off roll. The tearing of tire tread during take off caused damages to a number of structural parts, hydraulic lines and obstruction to landing gear retraction cycle. The actuator link which already had a fatigue crack broke in two parts instantaneously due to high stresses developed as its movement was obstructed in designed retraction movement. The aircrew in consultation with engineers on board diverted the flight to Karachi.

### Finalization

#### Primary

Failure of tire due poor maintenance and/or re-treading quality - Avoidable

#### 4. **Safety Recommendations**

- 4.1. Aircrew and ground crew should be vigilant during go-around inspection of aircraft especially the landing gear bays where chances for presence of foreign objects and small animals are high.
- 4.2. Aircraft tyres be maintained as per applicable Maintenance Manual to avoid such sudden tyre failure.
- 4.3. SAI to monitor the Quality of "Re-treaded" tires from Goodyear, Thailand.
- 4.4. DFDR must be preserved after occurrence.
- 4.5. Aircrew decision to proceed to Karachi may be reviewed by Flight Standards (PCAA) and SAI (Flight Operations).



B737-200 -- AP-BHA (SHAHEEN AIR INT'L)  
WHEEL TREAD PEEL-OFF & LDG GEAR ACTUATOR FITTING INCIDENT



Photograph - 1 TYRE TREAD  
PEELED-OFF



Photo 2



Photo 3 A 4 feet long tyre piece was held up in M24.

UNIT 1: THE HISTORY OF THE UNITED STATES  
UNIT 2: THE HISTORY OF THE UNITED STATES

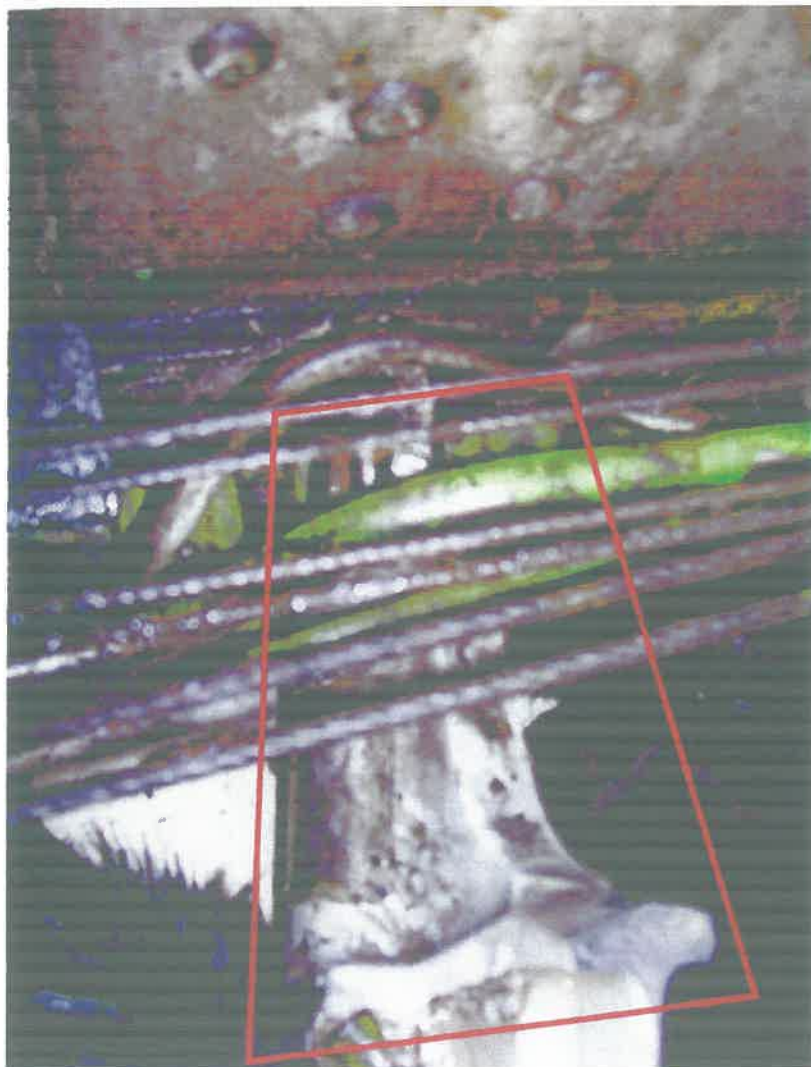


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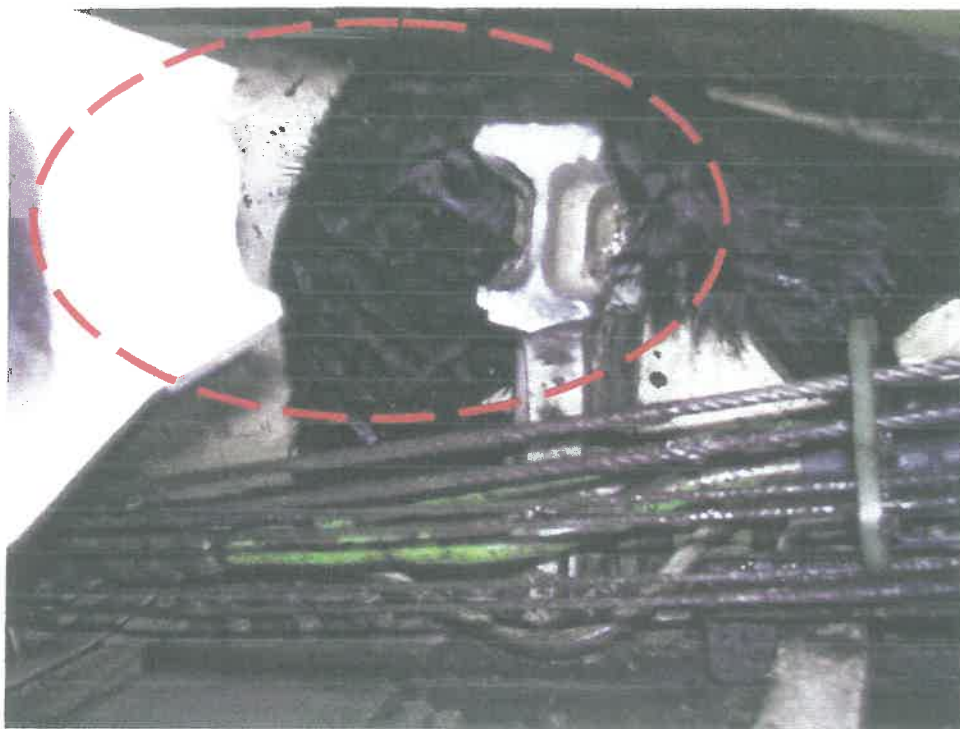
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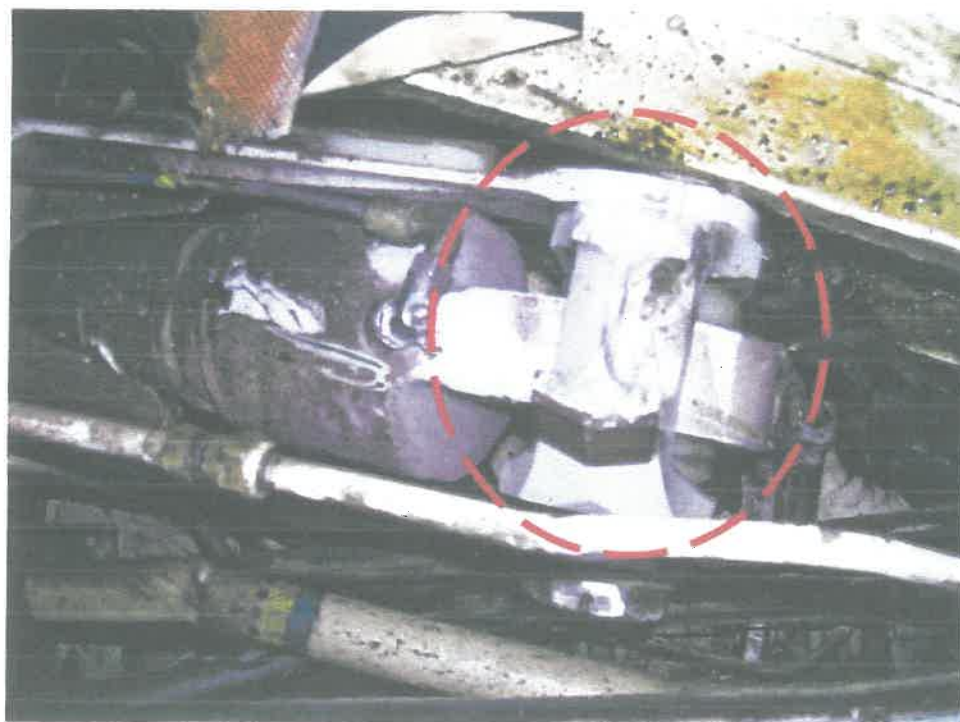
Photograph 6



B737-200 - AP-BHA (SHAHEEN AIR INT'L)  
VIEW OF LH LDG GEAR ACTUATOR ATTACH FITTING -- BROKEN



Photograph 7



Photograph 8

**B737-200 -- AP-BHA (SHAHEEN AIR INT'L)**  
**WHEEL TREAD PEEL-OFF & LDG GEAR ACTUATOR FITTING INCIDENT**



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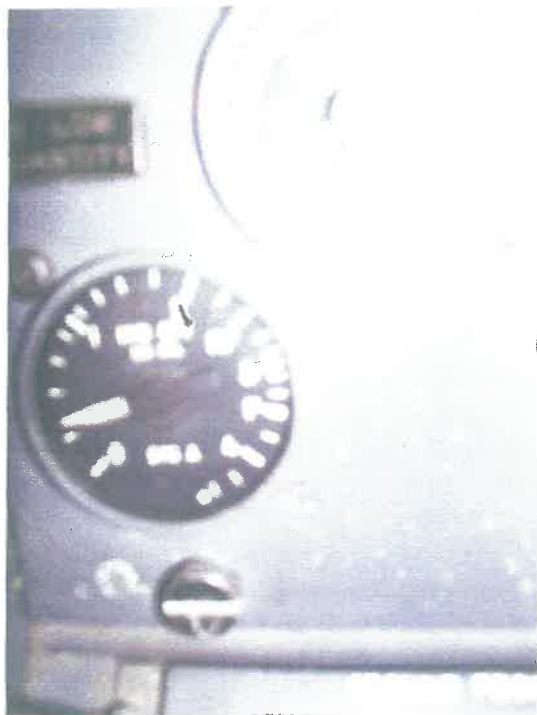


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B737-200 -- AP-BHA (SHAHEEN AIR INT'L)  
WHEEL TREAD PEEL-OFF & LDG GEAR ACTUATOR FITTING INCIDENT





**B737-200 -- AP-BHA (SHAHEEN AIR INT'L)**  
**WHEEL TREAD PEEL-OFF & LDG GEAR ACTUATOR FITTING INCIDENT**

