HQCAA/1901/310/SIB

PAKISTAN CIVIL AVIATION AUTHORITY
(SAFETY & INVESTIGATION BOARD)

AIRCRAFT INCIDENT INVESTIGATION REPORT

ELEVATOR TAB FAILURE ON PIAC B-737-300

REGISTRATION NO. AP-BCC

ON 03 SEPTEMBER 2006

AT

DOHA, QATAR

FINAL REPORT

INVESTIGATION OF ELEVATOR TAB FAILURE ON BOEING 737-300 AP-BCC ON 03-09-2006 AT DOHA, QATAR

Authority: Director General Civil Aviation Authority's Memorandum No. HQCAA/1901/310/SIB dated 12 September 2006

SYNOPSIS

A Boeing 737 while flying from Karachi to Doha on 3rd September 2006 experienced severe vibration. The aircrew reported that vibrations were so severe that a number of instrument bubbled out from their position in the instrument panels. On landing it was found that a portion of right elevator had broken and flown during the flight. The aircraft documents showed that this aircraft was experiencing severe vibrations for last one week; aircrew had been making serious observations; the second last states **"aircraft is unserviceable"**, however the ground crew was declaring aircraft fit for service after every aircrew reported defect of vibrations, in a routine manner. And this has not been first case. The incident could have been disastrous if the cracks which have developed on stabilizer due to vibrations propagated further and resulted into structural failure of right hand stabilizer. The elevator was dispatched to Boeing Company for material analysis. The investigations have indicated that non professionalism to rectify vibrations on part of maintenance crew and ineffective monitoring of serious repeat vibration defects by Quality Control System resulted into occurrence. PIA Management has already taken administrative actions against the persons involved in improper technical rectifications.

1. DEFECT HISTORY

a. On 27th Aug 2006, aircraft AP-BCC experienced light airframe vibration. On 29th Aug 2006, Pilot reported "Heavy nose wheel vibration/noise after 30 knots to retraction". Pilot recorded airframe vibration at different times on different areas of aircraft i.e.; control column, rudder pedal, nose wheel and main wheel area, vibration on aircraft structure with most amplitude were felt in aft galley area. Engine parameters during vibration were normal.

b. On 3rd Sep 2006 before occurrence, when aircraft arrived from Skz to Khi, pilot recorded medium airframe vibration, which started from 220 Kts and exceeded above 260 Kts and the engineer on board also confirmed "stab flap flutter". All snags pertaining to airframe vibration were recorded by pilots/engineers, were rectified by ground engineers .They inspect nose/main landing gear area, flight controls, cable tension, elevator tab, t/e flaps and external inspection for loose panels/fairing.

c. On 3rd Sep 2006 When said aircraft operated (Pk-257) from Karachi-Doha, pilot in command recorded "Pronounced vibrations during flying through climb, cruise and descent phase around Ft 270. There was a big bang and after that No. 2 engine N2 gauge stopped working and both Engine Oil Pressure Indicators gauges came out and were pushed back. On approach, upon selection of Gear down no indication of any landing gear position was available. Go around was made and low pass over the runway was made and main gear down was confirmed from cabin/ATC. As per brief defect history (tech log book) it was first reported on 27th August 2006 and there was no consistency in subsequent reporting. Rectifications also varied based on the defect reporting and on findings of the Engineers.

Tech Log reporting are as follows for reference (Refer appendix. 'A').

a. LOUD NOISE ALONGWITH VIBRATION ALL ALONG FUSELAGE
b. LIGHT AIRFRAME VIBRATION. AIRCRAFT ROLLS TO LEFT WITH FLAPS
c. VERY LIGHT AIRFRAME VIBRATION WITH JUDDERING SOUND
d. WITH FLAPS & GEAR DOWN AIRCRAFT ROLLS TO RIGHT
e. AIRFRAME VIBRATION FELT ON CONTROL WHEEL & RUDDER PEDALS
f. MILD VIBRATION SPECIALLY AT HIGH SPEED
g. PRONOUNCED VIBRATION THROUGHOUT THE AIRCRAFT
h. MEDIUM AIRFRAME VIBRATION
i. CAPTAIN LOGGED ONBOARD ENGINEER'S OBSERVATION CONFIRMING PHYSICAL STABILIZER FLUTTER ON 3RD SEPT 2006 JUST BEFORE SUBJET EVENTFUL FLIGHT

Aircraft had under gone Check-"C" on 16th June 2006, and its last check-"A" was carried out on 12th August 2006. During Check-"C" grounding as per number of scheduled task cards, elevator tabs are inspected for free plays Detail inspection of tab hinge and control mechanism, and lubrication is carried out. During Check "A" at every 250 hours, free play & detailed visual inspection of elevator tab hinges are carried out.

3. SEQUENCE OF OCCURRENCE

Before occurrence of the incident, pilot conducted flight from Sukhar to Karachi on 3rd Sept 2006.As per Tech log slip no-98 , Capt. of aircraft experienced medium airframe vibration at 220Kts and more prominent above 260Kts. On board aircraft engineer confirmed tab fluttering. Capt reported serious problem in the aircraft after landing at Karachi. However, Maintenance engineers cleared the aircraft after inspection/operational checks of elevator control system, cable tension and all hinges of Tab.

On 3rd Sept, 2006 when aircraft took off from Karachi airport, vibration was felt at all level (Take off, climb, cruise). While passing Fl 270 a big ban was heard and engine #2 N2

gauge was stopped working with both engine oil pressure indicators gauges left their position and came out. During approach when landing gear down position was selected in cockpit no response was observed from indicators. Gear down position was visually confirmed from cabin and aircraft made safe landing. After landing external inspection was performed by crew/engineer and observed that half of right elevator tab missing/broken.

4. INJURIES

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5. DAMAGE TO AIRCRAFT

During post flight at DOH, following damage were observed during inspection

a. Right elevator found damaged with out board portion missing.

b. Right elevator tab inboard side found missing with its both control rods broken near eye ends.

c. After removal of stabilizer lower access panels elevator hinge fittings on stabilizer rear spar and centre balance panel found broken.

d. Stabilizer upper skin was found damaged at some locations.

e. Stabilizer lower skin had two cracks.

f. There was a deep mark on the elevator indicating stucking of bolt between Elevator and Stabilizer. This had been restricting movement of the elevator at one end, thus causing twist in elevator during every operation.

6. RETRIEVAL AIRCRAFT.

"At Doha elevator was replaced along with effected fittings and temporary repair was made for cracks in the stabilizer for retrieving the aircraft to Karachi."

7. AIRCRAFT INFORMATION / ADDITIONAL INFORMATION

Boeing 737-300 aircraft with engine CFM56-3B
Registration Number AP-BCC
Passenger capacity 118

Max Take off weight 61235KG

Max Altitude 37000FT

The causes of airframe vibration can be numerous. Airframe vibration is usually manifested by either sound or feel, but can have elements of both. Sound is transmitted through the frame of the airplane and, therefore, it can be difficult to locate. Since high frequency can be associated with wear, the amplitude and pitch of the vibration may change significantly with time. Eventually, component(s) causing the vibration may fatigue and possibly break if not rectified in time. Vibrations associated with control surfaces must be diagnosed and repaired quickly to ensure safe operation (Refer Appendix. 'B').

8. METEOROLOGICAL CONDITION

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9. AERODROME DETAILS

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10. IMPACT AND DAMAGE PATTERN

Details pertaining to aircraft damage are enclose as appendix 'C'.

11. INTERVIEWS

All those aircraft engineers who performed rectification work Pertaining to aircraft vibration against the reported defect at different times were interviewed. Their statement are enclosed as appendix- 'D' .

During interview Moula Bukhsh, Aircraft Engineer (AME-1679) told that he was accompanied with the flight PK-393 Ex-SKZ-KHI dated: 03.09.2006 "after take off Capt. called me in cockpit and requested to observe the flight controls one by one to pin point the cause of airframe vibration. I did observe the controls & found that R/H horizontal stabilizer flutter and also confirmed it two to three times. He informed when aircraft arrived at Karachi Captain made the entry in tech log and declared the aircraft unserviceable." Mr. Moula Bukhsh, also briefed to shift in charge of LM-I what he had seen in flight.

Shift In charge of LM-I detailed the aircraft engineers to rectify the above mentioned defect. The detailed engineers checked the flight controls in neutral position & their movements, H/stab, elevator & elevator tab their movement & physical condition were also checked and aircraft declared serviceable as no broken, missing, delamination and abnormal sound or any other abnormality was observed.

Mr. Anwar Ahmed, Aircraft Engineer, (P-54102) was on board PK-257 KHI - Doha. During interview he stated that after take off he heard a noise of some thing struck and after that vibration started and increased with increase in aircraft speed and vice versa. Initially vibration was more prominent and few gauges came out from there location and in cockpit indication light went off. When gear down position was selected no indication was available in cockpit so ground ATC confirmed gear position and same was confirmed from cabin. After landing, external inspection was carried out and it was found that elevator had damaged and trim tab missing.

12. ORGANISATION AND MANAGEMENT

PIAC

ANALYSIS

13. INCIDENT

a. The defect on Boeing 737-300 aircraft AP-BCC have been scrutinized for period startingfrom 1st Aug 2006 till the occurrence of the incident. This revealed that the first defect of current series of Airframe vibration was reported on 27.08.2006 an subsequently repeated 11 times on different flights operated from 29thAugust to 3rd September 2006 till the incident of elevator tab damage was reported at Doha, Qatar. The entries made by the cockpit crew related to aircraft vibrations indicate slight variation at different occasions. The rectification performed by the AMEs on vibration defects is already enclosed as "Appendix"- 'A'.

b. Investigation revealed that the defect was not properly investigated by the concerned Aircraft Maintenance Engineers in accordance with the guidance provided by Boeing Aircraft Company. The proper trouble shooting pertaining to aircraft vibrations is in chapter-5 of Maintenance Manual (copy enclosed as appendix 'E') and SL No. 737-SL-02-002C, 28th April, 1999. As such, cause of the problem could not be rectified and the defect kept on repeating in different forms.

14. FINDINGS

a. PIAC Quality System Department did not report the defect (and its repetition) to CAA (Airworthiness) on the form CAA-055 to as per prescribed procedure till the time incident happened.

b. In this incident (QC) was in picture about the repetitions of snag but they did not participate & did not initially raise any TSR in light of Chapter – 5 of AMM.

c. The Quality Engineers perform their monitoring according to defect details available on computer. It has been noted that the defect details are not promptly entered in computer and at times there is lag of days in this process.

d. The Quality Engineer dealing with Boeing 737-300 was on training in PIA Training Centre and no substitute was there to look after B-737 aircraft in his absence. However, the incumbent was attending the office in the evening.

e. To identify & correcting the cause of in-flight Airframe vibration. Boeing has introduced a Service Letter 737-SL-02-002 D dated: 03rd July, 2001 which is prepared with the experience of Boeing and operators, to trouble shoot in flight airframe vibration. This Service Letter was not consulted during 11 times repeated snag.

f. During investigation it was observed that there is no system to elaborate service letters issued by manufacturers to guide the engineers and technician working in Line Maintenance.

g. It has also been noted during investigation that shift engineer has no access to study the de briefs of pilot reported defects.

h. S.B 737-55A1070 – II, III calls for "check the free play of elevator tab hinges & was complied during check 'C' on 16th June,2006(Refer Appendix'F'). The result of

axial and redial play was not recorded as the requirement was not given on the task card.

i. As per statement of on board engineer (Flt PK-257 dated:03-09-2006, KHI – DOHA) that just after T/O a thunder noise was heard and sever vibration was experienced.

j. There was a deep mark on the elevator indicating stucking of bolt between Elevator and Stabilizer. This had been restricting movement of the elevator at one end, thus causing twist in elevator during every operation.

15. CONCLUSION

It has been concluded from the above finding that.

a. Despite of 11 repetition of the vibration defect, PIA Quality System of (Tech. Service) did not play its role in investigation of this defect. As per SOP or 3rd repetition of a defect QS was suppose to participate in defect rectification.

b. No setup was found to elaborate the SL in LM staff, and also in this case no one was familiar with SL 737 SL-02-002 dated: 3rd July, 2001 regarding in-flight airframe vibration.

c. At different occasions this defect was cleared by different engineers. Rectification statements made by engineer in Tech. Log showed not seeking guidance from Chapter 05-51-67 regarding Airframe vibration. However, it was

d. During last flight after T/O when thudding noise was experienced and sever vibration was felt, pilot should leased reviewed continuation of the flight to Doha.

16. CAUSE OF INCEDENT

a) In adequate rectification of the reported defects by Maintenance Engineers.

17. CONTRIBUTORY FACTORS

a) Stucking of a bolt between stabilizer and elevator.

b) Play in elevator Tab hinges.

c) Continuation of Flight No. PK-257 dated: 03.09.2006 to Doha after experiencing vibration during take off and climb.

d) In adequate action by PIA QC to check the rectification by production engineers.

e) Wear in aircraft parts measured under service Bulletins not recorded.

18. REMEDIAL ACTION BY THE "OPERATOR".

a. A one time inspection of elevator and tab on B737 fleet was initiated as per TSR as an immediate preventive action.

b. Letters for comments of the Engineer and shift in-charge responsible to release aircraft from base have been issued. Warning letters to Engineers failing to investigate/ isolate and repair the defect in time have also been initiated.

19. RECOMMENDATIONS

In light of above investigation following is recommended:

i) Pilots should be advised to land back in case of such serious problems.

ii) Warning may be issued to following AME for releasing aircraft after improper trouble shooting / rectification.

a)	Bilal Niaz,	AME-1092
b)	Alam Zaib,	AME-1681
c)	Anwar Ahmed,	AME-1729
d)	M. Ahsan Ansari,	AME-1218
e)	Atif Nisar,	AME-1534

iii) The Maintenance Section should have central systems for analyzing chronic defects instead of leaving defect rectification just the mercy of Shift Engineers.

iv) CE (QS) must introduce a system for monitoring and implementation of the service letters and other instructions.

v) Wear in aircraft parts measured under service Bulletins should be properly recorded for follow up.

vi) PIA QS should actively monitor rectification of aircraft defects.

vii) A substitute of engineer must be provided when an individual is nominated for training/course.