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CIVIL AVIATION AUTHORITY

AIRCRAFT INCIDENT INVESTIGATION

B-737 AP-BCB

WHICH OCCURRED ON

11TH AUGUST, 1993

AT

ISLAMABAD AIRPORT

CIVIL AVIATION AUTHORITY

KARACHI, PAKISTAN

AIRCRAFT INCIDENT INVESTIGATION

INCIDENT OF BOEING - 737-340 AIRCRAFT AP-BCB WHILE
OPERATING PK-380 ON 11-8-93 AT ISLAMABAD AIRPORT

Authority:- Director General Civil Aviation Authority,
Memorandum No. HQCAA/1901/160/SIB dated 11th
August, 1993.

COMPOSITION OF INVESTIGATION TEAM

- (a) Gp Capt (R) Rashid A Chaudhry Investigator-in-Charge
General Manager (Gen.Avn)
(North) CAA Walton Airport
- (b) Engr. Shamimuddin Investigator
Controller of Airworthiness
(North) CAA Islamabad Airport

1. AIRCRAFT INFORMATION

- 1.1. Registration Marking : AP-BCB
- 1.2. Aircraft type and maker's S.NO. : Boeing - 737-340
S.No.23295
- 1.3. Engine types, airframe : CFM 56-3B,
positions & maker's S.No. S.No.720-191 &
720-231
- 1.4. Certificate of Registration No. : 577
- 1.5. Certificate of Airworthiness : 530/1 valid till
No. and date of expiry. 9.6.94

1.6. Certificate of Maintenance date : and time (GMT) of issue and period of validity.	Issued on 11-5-93 valid till 19152:56 flying hours.
1.7. Date of construction of airframe :	May, 1985
1.8. Name and address of Owner :	M/s.PIAC, QIAP, Karachi
1.9. Gross Weights. Maximum permitted: by C. of A. for this flight & at the time of incident.	T/o Wt. 61235 KG Actual Take-off Wt.50745 KG, Actual Ldg Wt.48945 KG.
1.10.Loading. Centre of Gravity : limits in C. of A. and centre of gravity position at the time of incident and commencement of flt.	Loading was satisfactory.
1.11.Airframe history. (Give flying : times since manufacture, last overhaul and last periodic check. List also essential modifica- tions completed).	19,000 flying hours & 18,400 landings since manufacture
1.12.Engine history. (Give flying : time since manufacture, last overhaul and last periodic check. List also essential modifica- tion completed).	ENGINE #1 TSN 15,820 hrs CSN 15,359 Cycle TSI 2,315 hrs ENGINE #2 TSN 13,535 hrs CSN 12,922 Cycle TSI 3,050 hrs
1.13.Defects.	: There was no rele- vant Pilot reported defect prior to incident.

2. CREW INFORMATION

2.1. Pilot-in-Command

2.1.1. Name	:	Tanveer Ahmed Khan
2.1.2. Position in the cockpit	:	Captain
2.1.3. Date of Birth	:	31-12-1944
2.1.4. Type of Lic and No.	:	ALTP No.549
2.1.5. Medical date with status	:	9-5-93. Fit for ALTP renewal, subject to use of corrective glasses.
2.1.6. Rating		
2.1.6.1. Type(s) held	:	F-27, B-707/720, DC-10, B-737 & B-747
2.1.6.2. Type current	:	B-737
2.1.7. Flying Experience		
2.1.7.1. Grand total	:	10,241.00 hrs
2.1.7.2. Total-in-Command	:	3,651.00 hrs
2.1.7.3. Total-in-Command on the type of accident/incident occurred.		1,284.00 hrs
2.1.8. Medical	:	Results of medical test at the time of incident is attached as App.'A' & is satisfactory.

2.2. Co-Pilot

2.2.1. Name : Syed Khurshid Kazim

2.2.2. Position in the cockpit : Co-Pilot

2.2.3. Date of Birth : 14-3-1961

2.2.4. Type of Lic & No. : CPL No.1407

2.2.5. Medical date with status : 8-6-93

2.2.6. Rating

2.2.6.1. Type(s) held : C-150/152, F-27 & B-737

2.2.6.2. Type current : B-737

2.2.7. Flying Experience

2.2.7.1. Grand total : 2,063:16 hrs

2.2.7.2. Total-in-Command : 293:00 hrs

2.2.7.3. Total-in-Command/ : Approx. 705 hrs
Co-Pilot/Flt.Engr
on the type
accident/incident
occurred

2.2.8. Medical : Results of medical
test at the time of
incident is attached
as App.'B' and is
satisfactory.

3. SUMMARY OF INCIDENT

3.1. Boeing 737-340 aircraft AP-BCB while operating PK-380 on 11-8-93 met with an incident at Islamabad Airport. The aircraft departed Lahore at scheduled time of 0800 hrs PST and landed at about 0845 hrs PST at Islamabad. The aircraft touched down at about 3,500 ft down R/W 30. About 500 ft before the end of runway aircraft veered to left of centre line and came to stop on the over-run area. Captain of the aircraft made left turn on the dumble of over-run area and started back tracking. At about 1,000 ft on R/W 12 he was told to stop the aircraft by CAA fire tender because tyres of both inboard wheels of main landing gears had burst. Passengers were asked to disembark on the runway from normal exit. There was no fire, smoke or injury to anyone. Aircraft was towed to parking bay. Runway remained blocked for about one hour from 0845 hrs PST to 0955 hrs PST.

4. INJURY TO PERSON(S)

4.1. None

5. DAMAGE TO AIRCRAFT

5.1. Tyres of both inboard wheels of main landing gears burst after scuffing. There was no secondary damage to aircraft. Small tyre pieces were found in the over-run area of R/W 30. Marks of aircraft tyres on runway and damage to tyres is shown in the photographs attached as Appendix 'C' to this report. Sketch of site is attached as Appendix 'D' to this report.

6. OTHER DAMAGES

6.1. None

7. METEOROLOGICAL CONDITION

7.1. Visibility was satisfactory but there was light drizzle for few minutes. There was no rain prior to this flight or after this flight on that day. Meteorological forecast and actual weather is attached as part of DATCO's statement.

8. NAVIGATION & LANDING AIDS

8.1. Not a factor in incident.

9. COMMUNICATION

9.1. There was no Communication problem. ATC tape transcript is attached as part of DATCO's statement. No useful information could be obtained from CVR as the relevant CB was not pulled out by Captain.

9.2. Most probably flight crew erased recording because recording of only 15 minutes is available as against provision of 30 minutes on CVR tape.

10. AERODROME & GROUND FACILITIES

10.1. Not a factor in incident.

11. FLIGHT RECORDERS

11.1. CVR & DFDR read outs have been obtained from PIAC facilities. However, CVR read out information does not pertain to the time frame required for investigation. DFDR read out is attached as Appendix'E'.

12. WRECKAGE & IMPACT INFORMATION

12.1. Nil

13. FIRE

13.1. There was no fire or smoke.

14. SURVIVAL ASPECTS

14.1. Crew and passengers disembarked from normal exit. There was no problem what so ever.

15. TEST & RESEARCH

15.1. Anti-skid control unit was sent to PIAC's overhaul shop for 'soak test' and 'shake up test'. Result of these tests did not reveal any abnormality.

15.2. #2 anti-skid transducer was tested at PIAC's facilities and found to be serviceable. However, wire on plug of this transducer was found broken on the aircraft.

15.3. Thrust reverser timing for deployment and stowing was checked & found to be satisfactory. However, there was a defect of late deployment of #2 thrust reverser on 4.8.93. As rectification both reverse modules were recycled by concerned AME. Even after the incident engine accessory unit was re-racked by concerned AME.

16. OBSERVATIONS

- 16.1. As per cockpit procedures given in Flight Operations Manual of PIAC (attached as Appendix 'F'); crew is required to remove power from CVR by pulling out relevant CB to preserve recording in case of certain accidents/incidents. In our opinion, this may be amended to include all occurrences/mishaps because CVR is a vital aid in investigation. In the present case the crew did not pull out CB as it is not called for in the said document.
- 16.2. As per CAA approved MEL (attached as Appendix 'G') anti skid system is a 'go' item with certain operational restrictions and the thrust reversers being operative. However, some maintenance actions are called for in Despatch Deviations Procedures Guide (DDPG) (attached as Appendix 'H') in case of anti-skid system being U/S. This is an anomalous situation. In our opinion, MEL should be amended to indicate that maintenance action is required in accordance with DDPG.
- 16.3. As per duties and responsibilities of Senior Purser laid down by PIAC (attached as Appendix 'J'); cabin crew is required to inform cockpit crew regarding any abnormality noticed by them. In this case the cabin crew failed to inform Captain regarding sound of tyre bursts and flapping noise of burst tyres. The sound of tyre bursts and flapping noise of burst tyres were quite distinct and were noted by Investigator-in-Charge who happened to be on board.

16.4. It was noticed that the time given by radar control and tower were upto minutes and not seconds. Moreover, there was some discrepancy in times given by them and also as compared to DFDR read out. It is, therefore, recommended that all clocks in ATC system throughout Pakistan should be synchronised with national standard to the level of seconds. Moreover, Pilots should be provided this time so that aircraft clocks are also in synchronisation with this standard to the level of seconds. This is imperative as the DFDR gives read out to the level of seconds. In addition to this the ATC transcripts should also provide time to the level of seconds. This will go a long way in ensuring uniform time standard and will help in future investigations.

16.5. Runway friction test ater the incident and on previous day is attached as Appendix 'K'.

17. WITNESSES

17.1. Statement of following is attached as Appendices to this report:

Pilot	:	'L'
Co-Pilot	:	'M'
Cabin Crew	:	'N'
DATCO	:	'O'
AMEs	:	'P'

18. INVESTIGATION

18.1. Scheduled domestic passenger flight PK-380 (Lahore-Islamabad) was operated with Boeing 737-340 aircraft AP-BCB on 11th August, 1993 by Captain Tanveer Ahmed

Khan and First Officer Syed Khurshid Kazim. A total of 122 passengers (10 F/C and 112 Economy) and 6 cabin crew (2 F/C + 4 Economy) were on board. First Officer reported at PIAC operations Lahore at 0700 hrs PST whereas Captain reported at 0720 hrs PST. As per PIAC procedures flight crew is required to report at operations one hour before the scheduled departure time; in case of domestic flight. As such the Captain reported late by 20 minutes. The aircraft was checked by flight crew and found to be OK. There was no carried forward (C/F) defect. Aircraft departed from Lahore at scheduled departure time of 0800 hrs PST.

- 18.2. On reaching reporting point 'INDEK' (52 nm short of Islamabad) weather was encountered and the air traffic control was handed over to Islamabad Radar. Flight crew requested for diversion of about 10 nm left of ATS route and started descent into Islamabad. Weather was mainly scattered cumulus clouds with some isolated CBS and light to moderate turbulence. Islamabad Radar vectored the aircraft and established it on ILS of Runway 30 at a distance of about 8 nm and an altitude of about 3900 feet. Aircraft reported established on ILS at about 0842 hrs PST and air traffic control was handed over to tower for landing instructions. As per observation of radar controller on the scope the aircraft made normal landing at about 0845 hrs PST. As per meteorological warning there was 70% probability of thunderstorm/rain, north westerly wind of 15-25 knots gusting to 45 knots and 2-4 KM visibility at and around Islamabad from 0815 to 1115 hrs PST. However, as per actual weather at the time of incident wind was 310 degree, 10 knots; visibility was 4 KM; 1/8 CB at 3,500 feet; 4/8 SCCU at 4,000 feet and 7/8 ACAS at 10,000 ft.

- 18.3. Flight crew 'Armed' spoilers (speed brakes) and selected autobrake switch to position '2' against the requirement of '3' for wet or slippery runways. Aircraft encountered drizzle/rain on short finals so the windshield wipers were turned on. At about 0843 hrs PST the aircraft came in contact with tower. The aircraft was given landing clearance with information about drizzle/rain. Aircraft was cautioned about runway condition as it was not possible to have friction tested within this short time. The Captain exercised his option and made smooth touch down between taxiway Charlie and Bravo. At the time of touch down the drizzle/rain stopped. The drizzle/rain lasted for about 3 minutes. There was a patch of cloud which was encountered by the aircraft. There was no rain before or after the incident on that day. There was no water on the runway it had become just wet. The runway friction test after clearance of runway revealed an average value of 0.77 whereas it was 0.68 on previous day when there was heavy down pour.
- 18.4. As per statement of F/O, at threshold the aircraft height was about 50 ft and speed about 145 Knots. But this could not be corroborated with read out of CVR. The aircraft touched down smoothly at about 3,500 ft down R/W 30 with a CAS of about 136 Knots. Spoilers (speed brakes) deployed automatically on touch down. Command for reverse thrust was given by Captain immediately on touch down on both engines simultaneously and power was increased. 'Reverser Unlocked' amber light one for each engine is located on centre instrument Panel P-2. The light comes 'ON' when the reverser is out of full stowed position as sensed by not stowed proximity sensors. The light goes 'OFF' in reverse condition. No.1 thrust reverser unlocked

after 2 secs. However, there was considerable delay in unlocking of No.2 thrust reverser. This delay caused yawing moment. The effect of yawing moment was to turn the nose to left. This was perceived by Captain as skidding/weather vaning as he did not notice late unlocking of No.2 reverser. It would be worth mentioning here that as per actual weather the cross wind component was only 1.74 Knots ($10 \text{ knots} \times \sin 10 \text{ degree}$). Captain adopted procedure for weather vaning given in operations manual of Boeing 737 aircraft. The procedure calls for reducing reverse thrust to reverse idle and releasing brakes to bring the aircraft back to centre line. Therefore, he reduced reverse thrust to gain directional control of aircraft. Subsequently, he increased reverse thrust and again decreased it before finally unreversing or stowing. During unreversing also #1 thrust reverser stowed/locked after 3 secs. However, there was considerable delay in stowing/locking of #2 thrust reverser. This delay caused yawing moment with tendency to turn nose to right. However, it was less pronounced due to low engine power. In accordance with operational test given in maintenance manual the thrust reverser should fully deploy within 2 secs and fully stow within 4 secs. No.2 thrust reverser did not meet this criteria both during deployment and stowing as per DFDR read out.

- 18.5. Braking is the primary means of stopping aircraft. Since Pilot had selected autobrake he was not required to apply brakes manually. However, anti-skid inop amber warning light located on centre instrument panel P-2 had come 'ON'. When the light comes 'ON' the autobrake system is not available. Since the light remained unnoticed by Captain he did not resort to manual braking for quite some time. As such the aircraft deceleration

was due to spoilers (speed brakes) and reverse thrust only. Since the reverse thrust was also decreased this resulted in reduction of deceleration. Late and smooth touch down combined with partial anti-skid failure and delay in unlocking of #2 thrust reverser due mechanical causes resulted in loss of precious time and runway length. Pilot could have easily noted late unlocking of #2 thrust reverser and 'antiskid inop' warning light had he been vigilant. After the 'anti-skid inop' warning light was noticed by Captain he resorted to hard manual braking. He also sought assistance from F/O in applying manual brakes. This was resorted to almost at the end of runway.

- 18.6. At about 500 ft before end of the runway aircraft veered to left of centre line because of skidding. There were wear marks of all four wheels on the over-run area of runway. Both the inboard wheels had scuffing and then burst. After bursting marks of only outer wheels were there. Both inboard wheels locked simultaneously and burst together. Both had similar scuffing. It would be worth mentioning here that scuffing is caused by wheel locking on a dry runway. The wheel locking was due to partially unserviceable antiskid system and hard braking. The outer wheels did not get locked because antiskid protection was still available to these. Captain made left turn on the dubmle of over-run area and started back tracking. After reaching about 1,000 ft on runway 12; he was stopped by CAA fire tender and was informed that tyres on both inboard main wheels have burst. Aircraft was, therefore, parked on runway and the passengers disembarked there from normal exit through passenger stairs. Neither the inboard tyres were hot nor their

fusible plug had melted. Moreover, tyres were smooth throughout the circumference except for scuffing and bursting. The outboard tyres had scratches and marks throughout the circumference due to the rough surface of over-run area. There was no secondary damage to aircraft. There was no fire, smoke or injury to anyone. The aircraft was later on towed and parked on bay. The runway remained closed for about one hour.

- 18.7. As per landing performance field length limits graph, given in operations manual of Boeing 737 aircraft, for landing weight of 49 MT the field length required in case of wet runway with antiskid operative and inoperative is about 5,000 ft and 9,000 ft respectively. The load sheet, flight plan and graph are attached as Appendix 'Q', 'R' & 'S' respectively. The aircraft was correctly refuelled and properly loaded. The CG position and landing weight were within limits. Had the antiskid system been unserviceable before landing the crew would have not landed at Islamabad Airport because of field length requirement. As per special weather operation given in Flight Operations Manual of PIAC (attached as Appendix 'T'); crew is required to aim for firm touch down about 1,000 ft down the runway. In case an unsatisfactory approach is likely to cause a touch down far down the runway a go-round and second approach must be performed. In addition, it calls for use of idle reverse as soon as possible after touch down & reverse thrust only if no directional control problems are encountered during landing roll. In case of directional control problems during landing roll, modulated use of wheel brakes should be considered to regain cornering capability of aircraft.

18.8. Reportedly the aircraft height was correct & approach speed was within computed limits for the configuration & prevailing wind conditions. However, the aircraft touched down smoothly at about 3,500 feet down the runway with a CAS of about 136 Knots. The touch down speed is within computed limits. As the captain could not make a firm touch down about 1,000 ft down the runway he should have attempted second approach. Captain selected reverse immediately on touch down and increased reverse thrust without ensuring that there is no directional control problem during landing roll. With antiskid system fully serviceable & optimum use of thrust reversers the remaining length of runway was just enough for stopping the aircraft (i.e 3,500 ft + 5,000 ft = 8,500 ft on runway of 9,000 ft). Since the Captain did not notice late unlocking of No.2 thrust reverser, the resulting yawing moment was perceived by him as weather vaning/skidding of aircraft. He, therefore, reduced reverse thrust to correct weather vaning. This reduction in reverse thrust and non-availability of autobrakes (due to partial unserviceability of anti-skid system) reduced deceleration of aircraft & caused the landing roll to exceed computed distance considerably. Thus aircraft speed was quite high at the end of the runway. As the 'antiskid inop' amber light also remained un-noticed by Captain he apparently depended on autobrake system & did not use manual brake. The aircraft was finally stopped by applying hard manual braking and came to stop after traversing about 800 ft on the over-run area. Hard braking alongwith partial unserviceability of antiskid system caused locking of both inboard wheels. This resulted in scuffing & bursting of tyres on these wheels.

18.9. In technical log book pilot reported "inner tyres of both main gears bursted due skidding on runway. Please check". Pilot did not report regarding 'anti-skid inop' light coming 'ON'. Apparently, he got so engrossed in controlling the aircraft that most probably he did not notice the said light coming 'ON'. The concerned AMEs carried out all relevant checks as per Maintenance Manual, replaced all four wheel assemblies and carried forward defect of anti-skid system as per MEL. The defect of anti-skid system was C/F because of unserviceability of #2 antiskid transducer during BITE check. Action was taken in accordance with DDPG and the aircraft was released for service. Photostat copy of relevant pages of technical log book are attached as Appendix 'U' to this report.

19. **FINDINGS**

19.1. The aircraft was airworthy.

19.2. Crew licences were appropriate and valid.

19.3. Captain reported late for the flight.

19.4. Captain had 'armed' spoilers (speed brakes) and selected autobrake switch to position '2' (against the requirement of position '3') before landing.

19.5. It had drizzled for about 3 minutes prior to landing as such runway became just wet but the runway friction was good.

19.6. Captain made a smooth touch down at about 3,500 ft down the runway. The exact height of aircraft over threshold could not be ascertained because CVR tape was earsed.

- 19.7. As captain could not make a firm touch down about 1000 ft down the runway he should have attempted second approach, as required by PIAC's Flight Operations Manual.
- 19.8. Spoilers (speed brakes) deployed automatically on touch down.
- 19.9. Captain selected reverse immediately on touch down & increased power without ensuring that there is no directional control problem during landing roll. He should have ensured directional control before increasing reverse thrust as required by PIAC's Flight Operations Manual.
- 19.10. No.2 thrust reverser unlocked after considerable delay but it remained un-noticed by Captain.
- 19.11. Yawing moment due to late unlocking of No.2 thrust reverser caused nose to turn left.
- 19.12. Captain perceived it as weather vaning/skidding and adopted procedure for the same.
- 19.13. 'Antiskid inop' warning light came 'ON' during landing roll. Due to this autobrake was not available.
- 19.14. Captain resorted to hard manual braking almost at the end of runway.
- 19.15. At about 500 ft before end of Runway the aircraft veered to the left of centre line due to skidding.

19.16. Due to partial un-serviceability of antiskid system both inboard wheels got locked. This resulted in scuffing and then bursting of tyres on these wheels.

19.17. CVR did not have recording relevant to the time frame of incident as CB was not pulled out by Captain.

19.18 Most probably flight crew erased recording because recording of only 15 minutes is available as against provision of 30 minutes.

20. CAUSE(S)

20.1. The cause of incident was late and smooth touch down and application of reverse thrust without ensuring that there is no directional control problem during landing roll. The situation became worst when the yawing moment due to late deployment of No.2 thrust reverser was perceived by Captain as weather vaning/skidding. The 'antiskid inop' amber light also remained un-noticed by Captain as such manual braking was resorted to quite late.

21. RECOMMENDATIONS

21.1. Flight crew training should be reviewed to enhance time and emphasis for landing on wet or slippery runways because PIAC has had quite a few accidents/incidents in such circumstances.

21.2. Captain should be warned for reporting late, selecting autobrake to position '2' (instead of '3'), making late and smooth touch down, not being vigilant in noticing No.2 'Reverser Unlocked' amber light coming 'ON' late and coming 'ON' of 'antiskid inop' amber light.

- 21.3. Cockpit procedure regarding CVR given in flight Operations Manual of PIAC should be amended to include all occurrences/mishaps. There should also be prohibition regarding erasing of CVR tape.
- 21.4. CAA approved MEL should be amended to indicate that maintenance action is required in accordance with DDPG in case of Antiskid System being U/S.
- 21.5. Cabin crew should be warned for not having informed flight crew regarding sound of tyre burst and flapping noise of burst tyre and should be advised to adhere to laid down procedures.
- 21.6. PIAC engineering should be advised to ensure recording of time of deployment and stowing of thrust reversers and to keep it within limits specified in maintenance manual.
- 21.7. All clocks in ATC system through out Pakistan should be synchronised with national standard to the level of seconds. Aircraft clocks should also be synchronised with ATC clocks to the level of seconds. Moreover, all ATC transcripts should provide time to the level of seconds.



APP. 'C'
10F 6

Both main landing gears wheels (both inner and outer) marks on over-run area.



Both main landing gears wheels (outer only) marks upto end of over-run area.

APP. C'
2 of 6



Left main landing gear wheels with inboard tyre burst.



Left main landing gear wheels with inboard tyre burst and scuff.

APP. 'C'
3 of 6



Left main landing gear inboard tyre burst (close up).

APP. 'C'
4 of 6



Right main landing gear wheels with inboard tyre burst.

APP. 'C'
5 OF 6



Right main landing gear wheels with inboard tyre burst and scuff.



APP. 'c'
6 of 6

Right main landing gear inboard tyre burst (close up).