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TYRE BURST INCIDENT INVESTIGATION

B-737 AP-BCB

WHICH OCCURRED ON
23RD DECEMBER, 1991

AT
MULTAN AIRPORT

CIVIL AVIATION AUTHORITY
KARACHI, PAKISTAN

AIRCRAFT INCIDENT INVESTIGATION REPORT

INVESTIGATION REPORT OF LANDING INCIDENT INVOLVING B-737
AIRCRAFT, REGISTRATION MARK AP-BCB OPERATING PK-333
FROM LAHORE TO MULTAN ON 23RD DECEMBER 1991, IN
WHICH THREE TYRES BURST (NO.1,2 & 4) ON
LANDING AT MULTAN AIRPORT

AUTHORITY: Director General of Civil Aviation Authority
Memorandum No. HQCAA/1901/142/AIB dated 23rd December
1991, (Appendix "A").

1. AIRCRAFT INFORMATION

1.1. Registration Marking	AP-BCB
1.2. Aircraft Type & Maker's Serial No.	B-737 - 340 S.No. 23295
1.3. Engine Types, Airframe Positions and Maker's Serial No.	CFM 56-3 No. 1 S/N 720192 No. 2 S/N 720242
1.4. Certificate of Registration No. and validity.	577/1 Permanent

1.5. Certificate of Airworthiness No. and date of expiry.	530 Valid upto 9.6.1992
1.6. Certificate of Maintenance date & time of issue & period of validity	Date of issue 15.11.1991 due after 750 hours
1.7. Date of Construction of Airframe	1985
1.8. Name and address of owner	M/S. PIAC, QIAP, KHI
1.9. Gross Weights	
1.9.1.Max. Permitted by "C of A"	51,670 Kg
1.9.2.At the time of incident	43,500 kg (Landing weight)
1.10.Loadings (Center of Gravity)	
1.10.1.CG limits in "C of A"	5% - 26% MAC
1.10.2.CG at Commencement of flight	Take-Off CG 18.6% MAC (Within Limits)
1.10.3.CG at the time of incident	Landing CG 20.2% MAC (Within Limits)
1.11.Airframe History	
1.11.1.Time Since New	14960:39 Hours

1.11.2. Time Since last periodic check	Check-C on 6.4.91 @ 13299:41 Check-A on 9.12.91 @ 14880:5
1.11.3. Modifications	All modifications complied with
1.12. Engine History	
1.12.1. Model & Serial No.	PORT: CFM56-3-B2 S/N720192 STBD: CFM56-3-B2 S/N720242
1.12.2. Time Since New (TSN)	PORT: 10729:33 STBD: 8980:56
1.12.3. Time Since Overhaul (TSO)	PORT: 10729:33 STBD: 8980:56
1.12.4. Modification	P O R T : A l l modifications complied with. P O R T : A l l modifications complied with.
1.13.1. Accessory History	Not applicable

1.14.Defects

1.14.1.Anti-skid System	Inoperative since 18.12.91 MEL Cat. 'C' item
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1.14.2.No. 2 Thrust Reverser	Inoperative Since 20.12.91 MEL Cat. 'B' item
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2. CREW INFORMATION

2.1. PILOT-IN-COMMAND

2.1.1.	Name	Capt. Naveed Aziz
2.1.2.	Position in the Cockpit	Left control seat
2.1.3.	Date of birth	31st July 1957
2.1.4.	Type of Lic.&No.	ALTP No. 597
2.1.5.	Medical Date with	Fit for ALTP renewal. To remain under surveillance of PIAC Chief Flight Surgeon for control of obesity and hyperlipidaemis, blood cholesterol LDL.HDL

Triglycerides.

Lipids Sargar - v -
GT on next medical
must reduce by 12
Lbs during next six
months.

2.1.6.Rating

2.1.6.1. Type(s) held	F-27,B-707/720,A-300 B-737, B-747.
2.1.6.2. Type Current	B-737

2.1.7.FLYING EXPERIENCE

2.1.7.1. Grand Total	8230:45
2.1.7.2. Total in Command	2199:14
2.1.7.3. Total in Command on the Type incident occurred.	75:00 (P-1+U/S)

2.1.8.Where Trained	P.I.A.C.
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2.2. CO-PILOT

2.2.1.Name	M.Ayaz
2.2.2.Position in the Cockpit	Right control seat
2.2.3.Date of Birth	1-3-1962

2.2.4.Type of Lic.& No.	CPL-1216 & ALTP-802
2.2.5.Medical Date with status	Fit for CPL renewal. Advised to reduce weight.
2.2.6.RATING	
2.2.6.1. Type(s) held	C-150/152, C-172, F- 27, B-737
2.2.6.2. Type Current	B-737
2.2.7.Flying Experience	
2.2.7.1. Grand Total	2052:00
2.2.7.2. Total in Command	775:40
2.2.7.3. Total as Co-Pilot on the Type Incident Occurred	325:54
2.2.8.Where Trained	PIAC

3. SUMMARY OF INCIDENT

- 3.1. Capt. Naveed Aziz, P-35219, was the commander of PK-333/231291, on B-737 Registration No. AP-BCB. First Officer, M. Ayaz was the Co-Pilot on this schedule flight from Lahore to Multan on 23rd December 1991.
- 3.2. Multan weather was cloudy, QNH 1013, temperature 17 deg. C and slight drizzle. The runway surface was wet and the pilot was cautioned by ATCO of wet runway condition.
- 3.3. PK-333 carried out visual cum ILS approach as the runway was visible from 15 NM, the landing weight of the aircraft was 43,500 kg. During approach the aircraft maintained glide slope and approach speed of 135 knots, on touchdown the speed was 130 knots and the touchdown took place roughly 2300 ft down the runway. V-ref from the FCOM should have been 122 knots. Approach and touch down speeds were fast.
- 3.4. Anti-skid system and No. 2 reverser were inoperative and were covered under MEL.
- 3.5. As the anti-skid system was inoperative, the auto-brake system/and auto spoiler system were not available. Manual extension of speed brakes was available.
- 3.6. No.1 reverser was available but was not used due to wet surface of the runway and the possibility of aircraft losing directional control.

- 3.7. DFDR indicates that speed brakes (ground spoilers) were not used. (manual extension was required). The Pilot stated that he used spoilers.
- 3.8. Manual brake application was carried out incorrectly, which resulted in bursting of three tires. (See Appendix - "B-1 to B-7") which shows positively that they burst due to locking of wheels.
- 3.9. Around 80 kts thud/noise was heard and the deceleration rate increased. The aircraft came to a stop about 1000 ft short of runway 18 threshold.
- 3.10. Evacuation was carried out on the runway, normal stairs were used.

4. INJURY TO PERSONS

- 4.1. There were no injuries to the occupants.

5. DAMAGE TO AIRCRAFT

- 5.1. The following tires were burst:-
 - 5.1.1. Wheel position 1, S/N 2969
 - 5.1.2. Wheel position 2, S/N 3672
 - 5.1.3. Wheel position 4, S/N 3194
- 5.2. No. 4 wheel fairing was damaged due to tire burst.

5.3. Damage report is attached as appendix "J".

6. **OTHER DAMAGE**

6.1. No other damage was reported.

7. **METEOROLOGICAL CONDITION**

7.1. Weather was cloudy, QNH 1013, temperature 17 deg. C, surface wind was 3 knots northerly and slight drizzle was reported.

7.2. Met report attached as Appendix "D1 to D8".

8. **NAVIGATION & LANDING AIDS**

8.1. Aids to navigation were operating normal.

8.2. Aids to navigation were not a factor in this incident.

9. **COMMUNICATIONS**

9.1. All communication facilities were serviceable and were available.

9.2. Communication was not a factor in this incident.

10. **AERODROME AND GROUND FACILITIES**

10.1. Runway at Multan is bitumen surfaced 9000 feet long, aligned 18 and 36.

10.2. Runway was wet , it was drizzling.

10.3. All other normal aerodrome facilities were available at the airport.

11. FLIGHT RECORDERS

11.1. The DFDR was removed for analysis.

11.2. Record of communication during landing and approach was erased as the circuit breaker of Cockpit Voice Recorder was not pulled out by the flight crew after the incident. The Pilot is required to preserve communications on the CVR tape after a notifiable occurrence by removing power to the CVR.

11.3. Read out of the DFDR did not include radio altimeter heights because of limitations of the read out facilities.

12. WRECKAGE & IMPACT INFORMATION

12.1. Three tires were burst because of locking of wheels due to incorrect braking technique, and the aircraft came to a stop at 8500 ft down the runway.

12.2. The aircraft was taxied off the runway after replacement of tires. Tires were not available at Multan. However, tires were removed from another B-737 AP-BCB to clear the runway. While taxiing off the runway the brakes were checked and found to be operating normally. (See App."J").

13. **FIRE**

13.1. No fire occurred. Fire facilities were activated immediately but their services were not required.

14. **SURVIVAL ASPECTS**

14.1. It was a survivable incident.

14.2. All occupants evacuated the aircraft safely on the runway by normal aircraft stairs.

15. **TEST AND RESEARCH**

15.1. Brakes were tested after the wheels were changed, and whilst taxiing off the runway. Brakes were found to be operating normally.

16. **OBSERVATIONS**

16.1. Spare wheels for replacement were not available at Multan Airport causing runway blockage for 6 hours. The wheels of another aircraft awaiting departure were removed and used to taxi the aircraft off the runway. During this taxiing the brakes were checked and found to be operating normally. (See App. "J")

16.2. B-737 aircraft jack at Multan Airport was unserviceable. F-27 jack had to be used for replacement of wheels.

- 16.3. The Pilot and Co-Pilot were taken to CMH Multan for collection of blood & urine samples as the kit for collecting samples was not available with CAA Medical Officer.

17. INVESTIGATIONS

- 17.1. Investigator-in-Charge proceeded to Multan. He arrived after the aircraft had been removed from the runway. He took possession of the DFDR and CVR from the aircraft. He examined the runway and the failed tires, also examined the aircraft. Witnesses statements were recorded including statements by the Flight Crew. See appendixs R 1 to R 8.
- 17.2. From statements by the Flight Crew and the S.A.T.C.O. Multan the touch down point of the aircraft on landing was established at 2,300 feet approximately.
- 17.3. Calculations from the F.C.O.M. indicated V-ref 122 knots at the Landing Weight of the aircraft and the calculated landing field length, corrected for inoperative anti-skid and wet runway surface, works out to be 8600 feet. Note that the V-ref stated by the Pilot-in-Command was 13 knots faster. This would result in increased stopping distance everything else being normal. The touch down speed recorded by the DFDR was 124.5 Knots, which works out at 7.5 knots in excess of the touch down speed from a V.ref of 122 Knots.

18. WITNESSES

18.1. Statements of the following witnesses were taken in addition to those of the crew and are attached as Appendix No. shown against each name.

18.1.1. M. Essa Jatoi, Senior Purser (Appendix "R4")

18.1.2. Malik Muhammad Amin, Airport Manager, Multan (Appendix "R 5").

18.1.3. Sabih un Nisar, FIO on duty (Appendix "R 6").

18.1.4. Dr. Farhat Ali, AMO on duty (Appendix "R 3").

18.1.5. Mohammad Anwar Shaheen, ATCO on duty (Appendix "R 7").

18.1.6. Mohammad Ashfaq Hussain, Actg. SATO on duty (Appendix "R 8").

19. DISCUSSION

19.1. The aircraft was released with antiskid system inoperative and No.2 reverser inoperative, both on MEL, without considering the cumulative affect on aircraft performance of such multiple items on MEL. Also the additional work load imposed on the cockpit crew due to MEL was not taken into consideration.

- 19.2. Acceptance of the aircraft for flight by Pilot-in-Command, with two items related to stopping the aircraft on MEL, was a poor decision. The existence of MEL does not in any way absolve the Captain from ensuring that the aircraft is safe for a particular flight (App."P"). The Captain has to ensure that the crew members are properly acquainted with any revision of procedures, duties or limitations.
- 19.3. With anti-skid inoperative, one reverser not available, and reported wet runway surface, diversion to alternate airport would have been a better decision than to land at Multan in view of the landing field length requirement for the existing conditions of 8,600 feet which left little or no room for error on the 9000 foot runway.
- 19.4. Special Weather Operation Procedures in Flight Operation Manual of PIA requires touch down within 1000 ft of runway threshold during bad weather. The touch down point of this flight was approx. 2300 ft down the runway, which reduced the remaining runway available for landing roll and stopping the aircraft. Had the Pilot employed correct braking the tires would not have burst. Incorrect braking resulted in bursting of tires and the aircraft stopping on the runway. Stopping of an aircraft in this way is fraught with the danger of wheel fires and airframe failures and could effect safe evacuation of occupants.

- 19.5. Speed brakes (ground spoilers) are required to be manually extended when anti-skid system is inoperative. Speed brakes reduces the speed of the aircraft after touch down and increases weight on the wheels by reducing lift of the wings increasing rolling friction, and hence reduces the landing roll and the distance to stop the aircraft. DFDR indicates that the spoilers were not deployed. The Captain, however has stated that the spoilers were deployed manually. In the absence of the CVR read out, the Captain's statement could not be confirmed.
- 19.6. Although one reverser was available, it was not used as the crew were of the opinion that loss of directional control on the wet runway could occur due to unsymmetrical reverse thrust. Dispatch Deviations Procedures Guide recommends that techniques for controlling the aircraft with unsymmetrical reverse thrust should be developed and used in training. The increased thrust on engine with reverser in locked position, is compensated by the reverse effects of the operable reverser, resulting in a net retrading force. (See pages 2.78 - 1.2 of the Boeing 737 Dispatch Deviation Procedures Guide App."S").
- 19.7. Captain Naveed Ahmed Aziz ALTP No.597 was given notice under rule 331 of Civil Aviation Rules, 1978 when the available evidence, during the investigation into the incident involving Boeing 737 a/c AP-BCB on 23rd December, 1991 was found to be indicative that he as the Captain may be held responsible for the incident. (App."T").

19.8. Captain Naveed Ahmed Aziz submitted a further statement (App."U"). The statement made by the Captain has been carefully considered. Comments para-wise follow:-

- (a). At the landing weight of the aircraft of 43500 Kg the V.ref i.e., the speed to be achieved at 50 feet above the threshold was 122 Knots. The touch down speed in these conditions would be at least 5 Knots below this speed i.e., 117 Knots. The landing distance requirement at a V.ref of 122 Knots and a landing weight of 43500 Kg on a wet runway without anti-skid and reverse thrust, and manual deployment of spoilers works out at 8600 feet. This landing field requirement is on the basis that the V.ref is achieved, that touch down is at or before 1500 feet, and that all actions by the Pilot are correct including manual deployment of spoilers, and correct application of brakes avoiding locking of wheels. The tires burst due to locking of wheels implying incorrect braking action. Had the Captain considered the effect of no anti-skid, one thrust reverser deactivated, the requirement of manual spoiler deployment and wet runway conditions, he should have concluded that operation in such conditions were marginal and should have exercised his discretion and not accepted the aircraft, and at the very least on finding the conditions at Multan were not absolutely

safe, should have diverted. Director Engineering PIA letter concerning release of the aircraft with multiple defects affecting one system is placed at App."V". He has stated that the acceptance or non-acceptance of the aircraft in such conditions is at the discretion of the Captain.

If the Captain as he states had sufficient landing field length available then there was no need to lock the wheels. Touch down was at 2300 feet down the runway, touch down speed was 7.5 knots fast, spoilers were not deployed manually, and braking caused the wheels to lock and burst. It is only because the tires burst that the aircraft stopped on the runway.

- (b) The conditions were very marginal as discussed above. All conditions were not met. Decision to divert would have been correct.
- (c) This paragraph goes to show that the Captain is not clear as to the meaning of V.ref. When he mixes up touch down speed with V.ref. V.ref is the speed to be achieved at 50 feet above the threshold during an approach to land, touch down will be about 5 knots lower than this speed. The aircraft touched down 7.5 Knots faster and not 2.5 Knots.

(d) The visibility at Multan was 15 Kilometers and since the approach is Visual-Cum-ILS the Captain should have been able to adjust his approach to touch down within 1000 feet of the threshold. In any case touch down was at 2300 feet which is 800 feet beyond the 1500 feet touch down catered for by the ILS. Touch down was far from normal.

19.9. Captain Naveed Ahmed Aziz in his further statement (App."U") has not introduced any new evidence or point which changes the opinion expressed in the notice given under Rule 331 of Civil Aviation rules, 1978. The landing weight of 41500 Kg mentioned is 2,000 Kg less than the 43500 Kg stated by him in his initial handwritten statement.

20. FINDINGS

20.1. The following information was obtained from the documents:-

20.1.1. The aircraft was properly registered bearing nationality and registration mark AP-BCB.

20.1.2. The aircraft was properly maintained in accordance with approved maintenance schedule. The aircraft had a valid "C of A" "C of M".

- 20.1.3. The flight was properly authorised. The flight crew were properly qualified and medically fit. They held valid licences.
- 20.1.4. Anti-skid system and reverser No.2 were released on MEL. The Captain accepted the aircraft in this condition.
- 20.2. No system exists, as required by the MEL Preamble, to evaluate the cumulative effect on aircraft performance with multiple items on MEL.
- 20.3. Pilot failed to follow the procedures laid down in Flight Operations Manual of PIA for "Special Weather Operation" by touching down late i.e. at 2300 feet down the runway. In the existing circumstances he should have used extra care.
- 20.4. DFDR read out did not include the radio altimeter heights . This was stated to be due to deficiency in the soft ware for read out.
- 20.5. Manual extension of the speed brakes was available, but the speed brakes were not extended as indicated by the DFDR read out.
- 20.6. Spare wheels were not available at Multan Airport.
- 20.7. Aircraft hydraulic Jack (B-737) at Multan Airport was unserviceable.

20.8. Proper kit for collecting samples of blood and urine was not available.

20.9. The Captain failed to ensure that the power supply to the Cockpit Voice Recorder was removed as is required by the PIA Flight Operations Manual.

21. CAUSE(S)

21.1. This incident was caused due to acceptance by the Captain of the aircraft on MEL with multiple inoperative systems associated with stopping the aircraft, and his opting to land on a wet runway in which condition stopping distance available was marginal.

21.2. Other factors that contributed to the incident are:-

21.2.1. Pilots poor judgement to land long and fast on a wet runway as he should have diverted to alternate airport in view of the landing field length requirements which left little or no margin for error.

21.2.2. Failure to deploy speed brakes (Ground spoilers) manually.

22. RECOMMENDATIONS

- 22.1. A system must be developed by PIA Engineering Management in co-ordination with PIA operations to evaluate the cumulative effect on aircraft performance of multiple items on MEL.
- 22.2. Pilots must be advised to strictly follow all procedures laid down in Flight Operation Manual.
- 22.3. Enough spares must be carried by PIA engineering at all stations for quick recovery of aircraft.
- 22.4. Aircraft support equipment must be kept serviceable.
- 22.5. Proper kit for collecting samples of blood, urine etc must be provided by CAA to medical officers at all stations.
- 22.6. Action under the Civil Aviation Rules 1978 may be taken against Captain Naveed Aziz, ALTP No.597 for not following the procedures laid down in FOM special weather operation, and for failing to remove the power from of the CVR, thereby losing important evidence for investigation of the incident.
- 22.7. Aircraft Maintenance Engineer, Mr. Ovais Ahmed Siddique, AME 1200, be warned of the cumulative effect on aircraft performance of multiple items on MEL before releasing the aircraft.

- 22.8. Director Engineering of PIA to ensure that all Engineering personnel of the need to consider the cumulative effect on aircraft with multiple items on MEL on any system. When in doubt these should be discussed with Flight Operation before the aircraft is released. Chief of Airworthiness to monitor action taken.
- 22.9. Chief of Airworthiness is to ensure that the short comings in the read out of the DFDR for the B-737 and indeed for the DFDRs of all aircraft operated by PIA are corrected.
- 22.10. Director ATS to ensure that on all ILS runways the markings are clearly visible, and that fixed distance markings in accordance with Annex-14 are included.

APP



3

A





APP B

4



APP i

APP. 8



5



APP.



APP