

FINAL INVESTIGATION REPORT



SERIOUS INCIDENT OF M/S PIAC FLIGHT PK-536
SECTOR (KARACHI - MOENJODARO) ATR 72-500
REG. NO. AP-BKX DATED 28-12-2017

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Synopsis

The serious incident was reported to Safety Investigation Board (SIB), Pakistan by the operator through Mandatory Occurrence Report (**Appendix 'A'**). Aviation Division, Government of Pakistan issued Memorandum vide letter No. HQCAA/1901/402/SIB dated 16th January, 2018 (**Appendix 'B'**) and investigation was conducted by SIB, Pakistan.

On 28-12-2017, M/s PIAC Flight PK-536 (Sector Karachi to Moenjodaro) ATR 72-500 aircraft, Reg. No. AP-BKX (Pakistan) landed at Moenjodaro, while carrying out post flight walk around inspection, paint found peeled off from the bumper due to tail skid.

1. FACTUAL INFORMATION

1.1 **History of Flight.** PK-536 was a scheduled passenger flight from Karachi to Moenjodaro. The flight departed from Karachi at 1835 hrs PST and arrived Moenjodaro at 1921 hrs PST. The First Officer was Pilot Flying (PF) and Captain was Pilot Monitoring (PM) for this sector. The flight remained uneventful from departure till final approach for landing. The flight carried out NDB letdown after arriving overhead Moenjodaro. During final approach the First Officer was unable to fly the aircraft as per desired parameters therefore the Captain took over the controls and asked FO to follow on controls. After taking over the controls, the Captain took actions deviating from OEM recommended procedures to salvage the situation. However, the aircraft did a thick touchdown and bounced once. The post flight inspection revealed paint peeled off from tail skid bumper.

1.2 **Injuries to Persons.** There were no injuries to any person during the incident.

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor / None	Nil	Nil	Nil

1.3 **Damage to Aircraft.** Nil

1.4 **Other Damages.** Nil

1.5 **Personnel Information.**

Captain	
Date of Birth	16-08-1971
License No.	ATPL 1531
Medical Date with status	Class-1 validity 31-01-2018
Type Rating	ATR 72/42
Flying Experience	7500 hrs (ATR, F-27, B-737, A310, B-777)
Total in Command	1000 hrs
Total in command on type	900 hrs

Date of Joining PIAC	November, 2003
• A type rated instructor (TRI) on ATR aircraft	

First Officer	
Date of Birth	09-03-1973
License held	CPL
Medical Date with status	Class-1 valid till May, 2018
Type Rating	ATR 72/42
Flying Experience	470 ATR
Date of Joining PIAC as Pilot	March, 2016
Date of joining PIAC as cabin crew	October, 2001

1.5.1 The FO, a lady pilot, has been serving as cabin crew in PIA for 12 years before joining PIAC as aircrew (P-2) in 2016. Her performance in flying has been marginal since her induction as pilot. The record indicated that she had repeated observations regarding inability to make an approach and safe land the aircraft independently. Brief history of her performance after attaining the status of P-2 is as follows:-

Date	Check Type	No. of SBs/ UnSat	SB in	Remarks
29-09-2016	Initial P-2 Route Check	04	- Taxing - IF: RNAV/GPS Approaches - Approach and Landing at Day - Situational Awareness	Cleared
23-12-2016	PPC/ IRT Check (in Malaysia)	02/01	- Engine Fire after V1 - Engine Failure after V1 - Single engine landing at Day	Unsatisfactory Performance
18-01-2017	PPC/IRT Check	05	- Air Work-Landing Config - Instrument Approach-ADF - Normal Landing - Single Engine Landing - Airmanship	Cleared with bare minimum standards
15-03-2017	Route Check	02	- Approach and Landing at Day - Situational Awareness	Cleared
19-07-2017	PPC/IRT	03/01	- Engine Failure after V1 - Instrument Approach-VOR - Emergency Descent - Drift Down	Unsatisfactory Performance Later put up to Evaluation Board
12-09-2017	PPC/IRT	03	- Engine Failure after V1 - TCAS Activation - Procedural Execution	Cleared

(Copies of Assessment attached as Appendix 'C')

1.6 Aircraft Information.

Aircraft Information	
Aircraft Registration	AP-BKX
Aircraft Make and Model	ATR 72-500
Aircraft Manufacture Serial No. (MSN)	1037
Aircraft Manufacturing Year	2012

- 1.7 **Meteorological Information.** There was no contribution of weather in causation of the incident as prevailing weather at the time of incident was well within permissible limits for safe conduct of flight. The weather parameters recorded at the time of incident are appended below:-

Visibility	Outlook	Wind	Clouds	Temperature	QNH
4000m	Haze	03/240	Nil	19°C	1013

- 1.8 **Aids to Navigation.** Moenjodaro airport is equipped with only NDB as navigation aid, which was serviceable at the time of incident. All onboard aircraft navigation aids and related equipment was also serviceable.

- 1.9 **Communications.** Radio communication services i.e. primary and emergency frequencies were serviceable at the time of incident. Similarly, the onboard aircraft radio equipment was also serviceable.

- 1.10 **Aerodrome Information.** The Moenjodaro airport detailed aerodrome data is appended below:-

OPMJ AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	True bearing	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
08	076.46°	1981 x 30	50/F/C/X/T Bitumen	271959.06N 0680800.09E	THR 46.8 M / 154 FT
26	256.46°		50/F/C/X/T	272014.06N 0680909.90E	THR 46.4 M / 152 FT

Designations RWY NR	Slope of RWY/SWY	SWY dimension (M)	CWY dimension (M)	Strip dimension (M)	Obstacle Free Zone
7	8	9	10	11	12
08	0.07%	121	760	2560 X 76	-
26		121	912		-

OPMJ AD 2.14 APPROACH AND RUNWAY LIGHTS

Designations RWY NR	APCH LGT type LEN INTST	THR LGT colour WBAR	VASIS (MEH) PAPI	TDZM LGT LEN	RWY Centre line LGT Length, spacing, colour, INTST	RWY EDGE line LGT Length, spacing, colour, INTST	RWY End LGT spacing colour WBAR	SWY LGT LEN (M) colour	Remarks
1	2	3	4	5	6	7	8	9	10
08	SALS, LIL	GREEN	PAPI Left 3.05°	-	-	1981 M, 60 M. White, LIL	RED	-	-
26	SALS, LIL	GREEN	PAPI Left 2.98°	-	-	60 M. White, LIL	RED	-	-

OPMJ AD 2.18 ATS COMMUNICATION FACILITIES

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
TWR	Moenjodaro Tower	119.8 MHZ	NOTAM	Primary frequency.
	Moenjodaro Tower	239.8 MHZ	NOTAM	
APRON	Moenjodaro Tower	121.5 MHZ	NOTAM	Emergency frequency
	Moenjodaro Tower	121.8 MHZ	NOTAM	

OPMJ AD 2.19 RADIO NAVIGATION AND LANDING AIDS

TYPE OF AID	ID	Frequency	Hours of operation	Site of transmitting antenna coordinates	Elevation of DME transmitting antenna	Remarks
1	2	3	4	5	6	7
NDB	MJ	304 KHZ	NOTAM	271951.48N 0680627.77E	-	

AIP
PAKISTAN

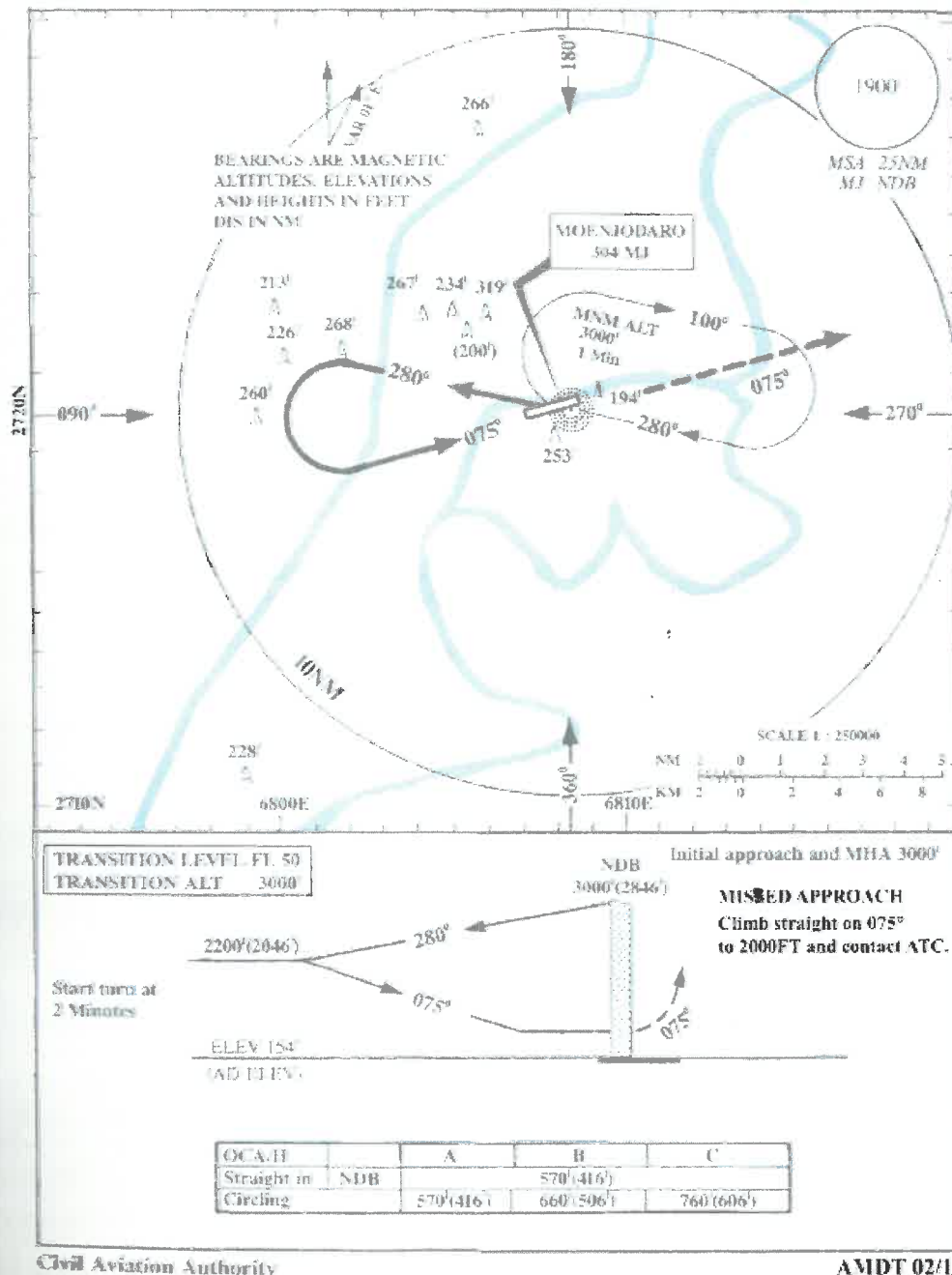
AD 2.OPMJ-7
31 DEC 13

INSTRUMENT
APPROACH
CHART - ICAO

AD ELEV 154'
HEIGHTS RELATED TO
AERODROME ELEV

TWR 119.6

MOENJODARO/
Moenjodaro
NDB RWY 08



Civil Aviation Authority

AMDT 02/13

- 1.11 **Retrieval of data from Flight Data Recorder / Cockpit Voice Recorder.** The data from FDR was successfully downloaded and available for assessment at Safety Investigation Board (SIB).
 - 1.11.1 The data from CVR could not be downloaded due to incompatible software / hardware issues. The PIAC was requested to preserve the CVR soon after the occurrence was reported. However, the CVR data could not be preserved and made available by PIAC with the following explanation:-
 - 1.11.1.1 The subject CVR was serviceable with 120 minutes recording capability.

- 1.11.1.2 This was only one unit having voice recording architecture different from rest 16 units in PIAC inventory. For this CVR unit, the decoding software could only decode the last 30 minutes (design limitation). Thus software decoded only last 30 minutes and remaining previous 90 minutes were not decoded. The recording of subsequent flight from Moenjodaro to Karachi was the only voice track decoded which was of no use for the analysis of occurrence under discussion (**Appendix 'D'**).
- 1.12 **Wreckage and Runway Marks Information.** Not applicable.
- 1.13 **Medical and Pathological Information.** Not applicable.
- 1.14 **Fire.** There was no evidence of in-flight or post incident fire available after the occurrence.
- 1.15 **Survival Aspects.** Not applicable.
- 1.16 **Tests and Research.** Not applicable.
- 1.17 **Organizational and Management Information.** Not applicable.
- 1.18 **Additional Information.** Not applicable.
- 1.18.1 **ATC Tape Extracts.** Not required.

2. ANALYSIS

2.1 Operational Analysis

- 2.1.1 PK-536 was a scheduled passenger flight from Karachi to Moenjodaro. It departed from Karachi at 1835 hrs PST and arrived Moenjodaro at 1921 hrs PST.
- 2.1.2 The Captain as well as First Officer had valid licenses and medical fitness to undertake the flight.
- 2.1.3 Since the First Officer was a trainee, scheduled with a Type Rated Instructor (TRI), hence a comprehensive pre flight brief was conducted by the Captain. The pre flight brief included detailed discussion on arrival, NDB letdown and landing procedure at Moenjodaro.
- 2.1.4 The First Officer was pilot flying (PF) and Captain was Pilot Monitoring (PM) for this sector.
- 2.1.5 The operating FO carried out pre flight inspection; during which she did not see the condition of tail skid.
- 2.1.6 **Approach and Landing.** The flight remained uneventful from departure till final approach for landing. After arriving overhead Moenjodaro, the First Officer executed NDB let down which was followed by visual approach for landing. During the initial approach the Captain kept assisting the First Officer however during final approach segment the FO was unable to maintain the desired flight parameters of a visual approach at night time. Observing her performance, the Captain took over controls at final approach (approximately 1000 feet AGL) and asked FO to follow on controls. Statements of Captain and First Officer attached as **Appendix 'E'**.
- 2.1.7 The FDR indicated all controls inputs at final approach were given by the Captain.
- 2.1.8 The FO while following the controls kept silent and did not speak the mandatory callouts about approach parameters despite approach ending up unstablized.
- 2.1.9 The unstablized approach parameters are appended below. The deviations are marked in red color.

Dist to R/W THR (NM)	Speed Kts	Left AOA	Right AOA	Height (ft)	Vertical speed ft/min)	Pitch (deg)	Engine 1 torque	Engine 2 torque
1.9	130.5	0.4	0.3	1034	-840	-3	26.5	25.75
1.8	130.5	0.5	0.4	1002	-803	-2.6	26.25	25.75
1.8	130.5	0.7	0.5	990	-810	-2.5	26.5	25.75
1.7	130.5	0.6	0.4	990	-803	-2.5	26.5	25.75
1.7	130.5	0.4	0.3	984	-803	-2.5	26.25	25.75
1.7	130.5	0.3	0.1	968	-818	-2.9	26.5	25.75
1.6	130.5	***	***	954	-795	-3.2	26.5	25.75
1.6	130.5	***	***	923	-833	-3.1	26.5	25.75
1.6	130.5	0.2	0.2	919	-840	-2.9	26.25	25.75
1.5	130.5	0.2	0.2	894	-885	-3.2	26.25	25.75
1.5	130.5	***	***	870	-908	-3.8	26	25.75
1.5	131.5	***	***	859	-938	-3.8	25.75	25.75
1.4	131.5	***	***	843	-983	-4	25.75	25.75
1.4	131.5	***	***	823	-1020	-4.4	25.5	25.5
1.4	131.5	***	***	805	-1050	-4.6	25.5	25.75
1.3	132.5	***	***	786	-1065	-4.7	25.5	25.75
1.3	133.5	***	***	764	-1095	-4.7	25.5	25.5
1.3	133.5	***	***	742	-1110	-4.8	25.5	25.5
1.2	134.5	***	***	711	-1118	-4.9	25.5	25.5
1.2	134.5	***	***	696	-1125	-4.9	25.5	25.5
1.2	135.5	***	***	683	-1103	-4.8	25.5	25.5
1.1	135.5	***	***	671	-1065	-4.8	25.5	25.5
1.1	136.5	***	***	653	-1035	-4.6	25.5	25.5
1.1	136.5	***	***	635	-1013	-4.3	25.5	25.5
1.0	136.5	***	***	628	-975	-4.3	25.5	25.5
1.0	136.5	***	***	598	-900	-4.3	25.5	25.5
0.99	137.5	***	***	591	-840	-3.3	25.5	25.5
0.96	136.5	0.1	***	585	-803	-2.6	25.5	25.5
0.92	136.5	***	***	574	-780	-2.8	25.5	25.5
0.88	136.5	***	***	567	-788	-3.1	25.25	25.25
0.85	135.5	***	***	561	-803	-3.8	24.25	24.5
0.81	135.5	***	***	554	-833	-3.9	23	23.25
0.78	135.5	***	***	514	-878	-4	21.75	22
0.74	135.5	***	***	475	-945	-4.6	10.5	15
0.71	134.5	***	***	468	-1028	-4.7	4.25	4
0.67	133.5	***	***	441	-1073	-4.3	2.25	1.5
0.64	133.5	***	0.2	427	-1125	-4	1.5	0.75
0.60	132.5	0.1	0.5	411	-1178	-4	1.25	0.25
0.57	132.5	0.1	0.3	386	-1193	-4.4	0.75	0
0.53	131.5	0.1	0.2	370	-1208	-4.7	0	0
0.50	130.5	0.1	0.3	354	-1215	-4.9	0	0

0.46	130.5	1	1.1	335	-1215	-4.3	0	0
0.43	129.5	1.8	1.8	304	-1230	-3.6	0.25	0
0.40	129.5	1.8	1.9	283	-1215	-3.4	0.75	0
0.36	128.5	1.8	1.9	264	-1223	-3.8	1	0.25
0.33	127.5	1.5	1.3	244	-1193	-4.7	0.5	0
0.30	125.5	1.7	2	226	-1178	-4	0	0
0.26	125.5	2.7	3.7	200	-1072	-2.8	0	0
0.23	124.5	3.1	4.1	180	-1025	-2.7	0	0
0.20	123.5	3	3.4	158	-994	-2.4	0	0
0.17	122.5	4.4	5.2	138	-925	-0.7	0	0
0.13	121.5	5.4	5.8	120	-892	-0.3	0	0
0.10	120.5	5.4	5.5	100	-830	0	0.25	0
0.07	119.5	5.5	5.8	84	-779	0.7	0.5	0
0.04	116.5	5.6	5.8	71	-755	0.2	0.5	0
0.01	113.5	5.3	5.4	58	-773	-0.1	0.75	0
-114 ft	112.5	6.4	7.9	45	-721	1.8	0.75	0
-300 ft	109.5	8.5	9.7	32	-620	3.1	1	0
-485 ft	107.5	8.9	9.8	20	-534	3.5	1	0
-668 ft	105.5	***	***	11	-432	5.8	1.25	0
-848 ft	102.5	8.1	7.5	3	-337	3.1	1.25	0
-1027 ft	101.5	6	5.5	2	-237	-0.1	1.25	0
-1202 ft	99.5	0.2	0.4	0	-149	-0.9	1.25	0

• Indicates value not recorded

2.1.10 Since the ATR recommends to be on stable parameters below 800 feet AGL during final approach, so a reference of 800 feet AGL was taken to compare the height, speed, vertical speed and distance to runway threshold. The related incident flight data compared with required (based on analysis for many different flights) at 800, 400 feet AGL and at touchdown is appended below:-

Height ft	Height Req ft	Speed kts	Speed Req kts	Vertical Speed ft/min	Vert Spd Req Ft/min	Distance to THR NM	Dist to THR Req NM
805	800	131	116	-1050	-675	1.4	2.54
396	400	132	112	-1193	-585	0.57	1.43
At touchdown		101	99	-149	-50	-	-

2.1.11 The aircraft had very high rate of descent at two intervals below 1000 ft AGL height with high speed. These parameters necessitated an immediate mandatory go around which was to be followed by a missed approach. The Captain, however decided to reduce the power to minimum (both torque zero) and salvage against OEM recommended procedure which is appended below:-

(2): Stabilized means:

- On the final approach segment flight path.
- Landing flaps selected, VAPP reached.
- Final checklist completed.

(3): Any failure that is not completely treated before 800ft AGL, or that occurs below 800ft AGL shall always lead to a missed approach.

2.1.12 While making an approach with a high rate of descent and idle power the aircraft became difficult to control at round out height. The Captain applied sudden control input at this stage (20 ft AGL height) to control the high vertical speed (-534 ft/min) and avoid a hard touchdown. At this time max vertical acceleration +5.8 g was recorded. Although the vertical speed reduced but due very limited height available it could not be arrested fully. In this bargain, the aircraft had a thick touch down on the runway with recorded vertical speed of -149 ft/min.

2.1.13 **Assessment of Tail Strike.** As per ATR 72-500 FCOM Procedure 2.05.06 P-3 (Reduced Flaps Landing) the aircraft may strike its tail with ground if the pitch attitude exceeds 8 degrees during flare depending upon vertical speed at touchdown. The highest pitch recorded in FDR in this incident is +5.8 degrees at 11 feet AGL besides vertical speed -432 feet/min. whereas at touchdown the pitch is -0.9 degrees with vertical speed -149 feet/min.

2.1.13.1 Presumably, it would be difficult to say that when the aircraft had max recorded pitch (+5.8 deg which is well below +8 deg threshold) with high vertical speed -432 feet/min had tail strike because the aircraft was still 11 feet above ground level.

2.1.13.2 Similarly, at touch down the aircraft is in negative pitch (-0.9 deg) with -149 feet/min vertical speed, so even with these parameters tail strike is most likely improbable.

2.1.13.3 With these parameters and tail strike criteria mentioned in FCOM, it appears that the tail strike did not occur during this landing. The paint peeled off from bumper may be either an earlier tail strike. This fact is more assumable, as it was acknowledged by the aircrew that tail bumper was not seen during pre flight inspection before departure from Karachi.

3. FINDINGS

3.1 Operational Findings

- 3.1.1 PK-536 was a scheduled passenger flight from Karachi to Moenjodaro. It departed from Karachi at 1835 hrs PST and arrived Moenjodaro at 1921:36 hrs PST.
- 3.1.2 The Captain as well as First Officer had valid licenses and medical fitness to undertake the flight.
- 3.1.3 Since the First Officer was a trainee, scheduled with a Type Rated Instructor (TRI), hence a comprehensive pre flight brief was conducted by the Captain. The pre flight brief included detailed discussion on arrival, NDB letdown and landing procedure at Moenjodaro.
- 3.1.4 The First Officer was pilot flying (PF) and Captain was Pilot Monitoring (PM) for this sector.
- 3.1.5 The operating FO carried out the pre flight inspection, during which she did not see the condition of tail skid.
- 3.1.6 The flight remained uneventful from departure till final approach for landing.
- 3.1.7 After arriving over Moenjodaro, the First Officer executed NDB let down which was followed by visual approach for landing.

- 3.1.8 During the initial approach the Captain kept assisting the First Officer however during final approach segment the FO was unable to maintain the desired flight parameters of a visual approach at night time.
- 3.1.9 Observing her performance, the Captain took over controls at final approach (approximately 1000 feet AGL) and asked FO to follow on controls.
- 3.1.10 The FDR indicated all controls inputs at final approach were given by the Captain.
- 3.1.11 The FO while following the controls kept silent and did not speak the mandatory callouts about approach parameters despite approach ending up unstabilized.
- 3.1.12 Since the ATR recommends to be on stable parameters below 800 feet AGL during final approach, so a reference of 800 feet AGL was taken to compare the height, speed, vertical speed and distance to runway threshold. The related incident flight data compared with required (based on analysis for many different flights) at 800, 400 feet AGL and at touchdown is appended below:-

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396	400	132	112	-1193	-585	0.57	1.43
At touchdown		101	99	-149	-50	-	-

- 3.1.13 The aircraft had very high rate of descent at two intervals below 1000 ft AGL height with high speed. These parameters necessitated an immediate mandatory go around which was to be followed by a missed approach. The Captain, however decided to reduce the power to minimum (both torque zero) and salvage against OEM recommended procedure which is appended below:-

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- On the final approach segment flight path.
- Landing flaps selected. VAPP reached.
- Final checklist completed.

(3): Any failure that is not completely treated before 800ft AGL, or that occurs below 800ft AGL shall always lead to a missed approach.

- 3.1.14 While making an approach with a high rate of descent and idle power the aircraft became difficult to control at round out height. The Captain applied sudden control input at this stage (below 20 ft AGL height) to control the high vertical speed (-534 ft/min) and avoid a hard touchdown. At this time max vertical acceleration +5.8 g was recorded. Although the vertical speed reduced but due very limited height available it could not be arrested fully. In this bargain, the aircraft had a thick touch down on the runway with recorded vertical speed of -149 ft/min.
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- 3.1.15.1 Presumably, it would be difficult to say that when the aircraft had max recorded pitch (+5.8 deg which is well below +8 deg threshold) with high vertical speed -432 feet/min had tail strike because the aircraft was still 11 feet above ground level.
- 3.1.15.2 Similarly, at touch down the aircraft is in negative pitch (-0.9 deg) with -149 feet/min vertical speed, so even with these parameters tail strike is most likely improbable.
- 3.1.15.3 With these parameters and tail strike criteria mentioned in FCOM, it appears difficult to assume that the tail strike occurred during this landing. The paint peeled off from bumper may be either an earlier tail strike or simply due to some other reason. This fact is more assumable, as it was acknowledged by the aircrew that tail bumper was not seen during pre flight inspection before departure from Karachi.
- 3.2 **Cause of Occurrence.** The occurrence was caused due to violation of OEM recommended landing procedure by the Captain i.e. landing through unstabilized approach. The Captain pressed on with the unstable approach for training purpose of the First Officer.

4. SAFETY RECOMMENDATIONS

- 4.1 All aircrew may be advised to follow OEM recommended landing procedure meticulously, even in training environment or demonstration to inexperienced aircrew.
- 4.2 PIAC should sent the under discussion CVR unit for either modification or replacement in order to have 2 hrs voice data available for downloading.
- 4.3 The most critical maneuver in commercial airline flying is landing. Some operators have a setup at their safety centres, where data of all landings is available for assessment immediately after the landing, and later debrief to the concerned aircrew. In this regard following is recommended:-
- 4.3.1 PIAC should study different models of such systems and incorporate most suitable in PIAC with the concurrence of PCAA.
- 4.3.2 PCAA may also look into this matter and standardize one model for all airline operators in Pakistan.