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AIRCRAFT ACCIDENT INVESTIGATION REPORT

RUNWAY EXCURSION ON LANDING AT PESHAWAR

PK-7302 AP-BAY B-4 ON 21 JANUARY 2005

Safety & Investigation Board
Headquarters Civil Aviation Authority

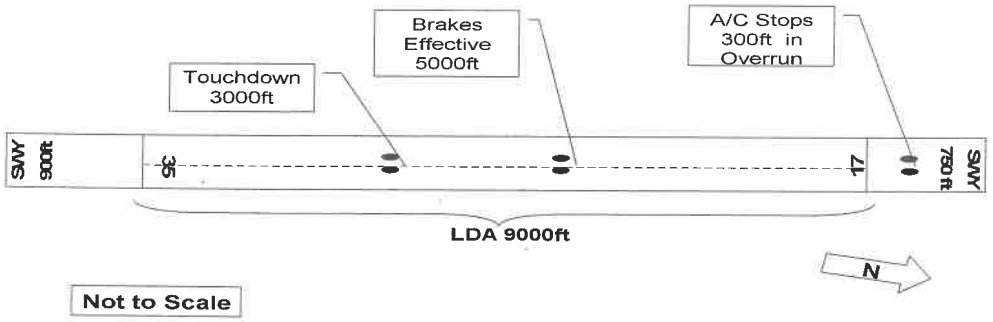
RUNWAY EXCURSION ON LANDING AT PESHAWAR
PK-7302 AP-BAY B-4 ON 21 JANUARY 2005

Authority

Memorandum HQCAA/1901/296/SIB dated 27 November, 2005 by Director General Civil Aviation Authority in exercise of the powers conferred by Rule 273 of the Civil Aviation Rules 1994.

SYNOPSIS

1. PK-7302 Airbus B-4 came in for a landing at Peshawar in day light when the sky was over cast and it was drizzling. The aircraft made a non-precision shallow approach and touched down about 3000 ft down on a 9000 ft long runway at Vref 131-2 Kts. The reverse thrust did not deploy and brakes became effective at hydro-planning speed of 117 kts when only 4000 ft RW was available to stop the aircraft. The aircraft braking performance after landing was optimum, yet, the aircraft over shot the Landing Distance Available (LDA) and came to a halt 300 ft down on the stop-way after crossing Fighter Aircraft Arrester Barrier. The ATC Peshawar ordered switch off on the stop-way due to low PCN. There were no injuries or damage to aircraft; however, Fighter Aircraft Arrester Barrier was damaged and stop way surface was ploughed by main wheels.



FACTUAL INFORMATION

History of Flight:

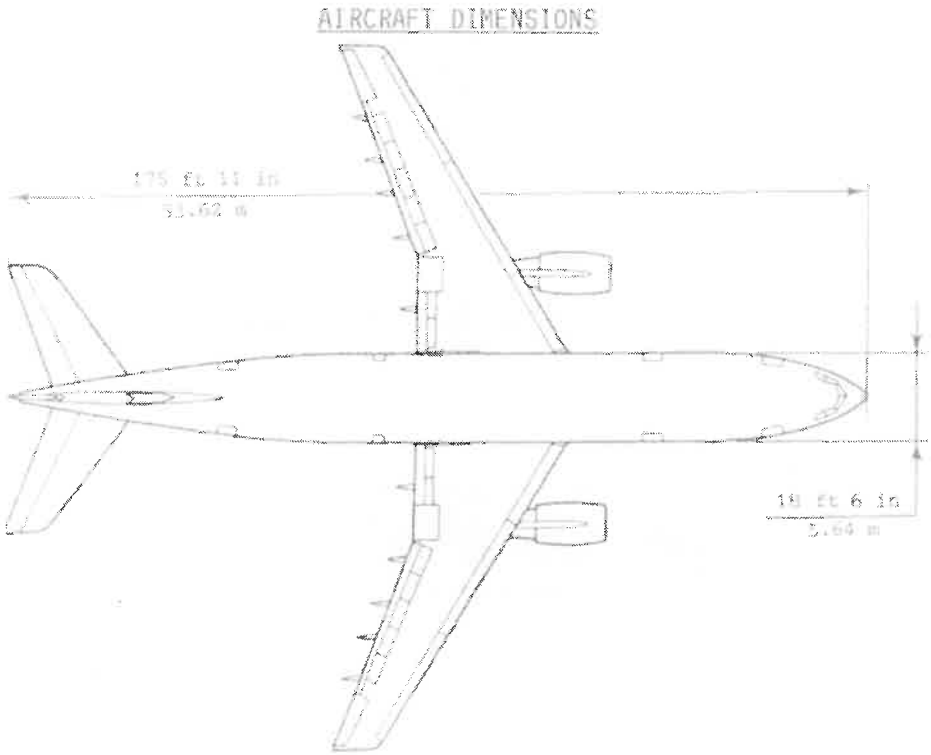
2. Pakistan International Flight PK-7302 was an Airbus-300 Registration AP-BAY scheduled flight from Jeddah to Peshawar. There were a total of 210 souls on Board including three cockpit crew and eight cabin crew. The take off gross weight (TOGW) was 146.3 Tons i.e. 11.7 Tons less than maximum Take off Gross Weight (MTOGW) and landing weight was 125.1 Tons i.e. nine Tons less than the maximum landing weight. The flight departed Jeddah, at 1030 Hrs LT and it arrived Peshawar at 1035 Hrs LT. i.e. Flight time of 3:05 hours. The flight was uneventful and while on approach to Peshawar, ATC informed that it was overcast, drizzling and there were water patches on the runway. The final approach, however, was clear of clouds. On approach, Medium auto brakes were selected and the glide path was progressively reduced from 3^{O} at 1000 ft AGL to about 1.2^{O} at 100 ft. After flare-out aircraft floated for a longer period and touch down was achieved at 3000 ft down on a 9000ft runway at Vref-2 kts. The spoilers deployed immediately, however, Thrust Reverse did not deploy after selection in spite of throttles movement in TR quadrant. Therefore, manual brakes were applied, which were also not effective, however, as the speed reduced to hydro-planning speed the brakes performance was optimum. The aircraft could not be stopped in available length of runway and it overshot into the stop way by 300ft at slow speeds after damaging the fighter aircraft arrester barrier. The ATC was informed of the overshoot by fighter aircraft arrester barrier control room. The aircraft attempted a right to left teardrop turn, however, ATC instructed for a switch off and normal disembarkation in the overrun to prevent stop way damage due to

low PCN. During the intended turn about main wheels ploughed the stop way and at the place of stop the aircraft wheels sunk in by 3-4 inches.

3. **Weight and Balance** The aircraft weighted 146.4 Tons on take off, which included 29.6 Tons fuel on take off. The calculated trip fuel was 21 Tones and therefore, the calculated landing weight was 125 Tons. The aircraft CG during flight was 62-57%. The aircraft carried 29 Tons fuel including 21 Tons trip fuel, therefore, landing weight was 125 Tons. The CG was calculated correctly between 57-62 %. There were 210 Souls on Board including 11 Crew. The Trim sheet is at Appendix 'A'.

4. Aircraft Details

Type	:	Airbus A-300 B-4 Serial # 98
Registration	:	AP-BAY
C of R	:	# 548 issued on 18 December, 2004
C of A	:	# 501 valid up to 06 March, 2005
Engines	:	2 x GE CF-C 50-62
Date of Manufacture		November, 1979
Airframe Hours		61317
Landings		33078



5. **Injuries** Nil

6. **Damage**. There was no damage to the aircraft, however, the military aircraft arrester barrier net was damaged beyond repair and the stop way was ploughed by main wheel for about 200 feet.

7. **Air Crew Information:**

Captain Mumtaz-ul-Haque PIC
Total P1: –10, 507 Hrs.
Total P2:– 6831 Hrs
P2 on B4:– 1279 Hrs.
P1 on B4:– 2905 Hrs.
Total: – 17339 Hrs.

First officer Chakar Ali Shah
Total P1: – 125 Hrs.
Total P2:– 2780 Hrs.
P2 on B4:– 104 Hrs.
Total:- 2905 Hrs.

Flight Engineer Masood Saeed
P3 on B4:– 9524 Hrs.
Total P3:- 12,482 Hrs

AIRCRAFT SYSTEMS & PERFORMANCE

Auto Brake System

8. **General** The auto brake system permits to maintain a constant deceleration rate during landing roll or to apply maximum braking to cover the case of an aborted take off. The auto brakes are used for landing to reduce the brake and tire wear. Select the desired deceleration rate (normally "min") on the auto brake panel. After main wheel touchdown, immediately go into reverse thrust and fly the nose wheel onto the runway. The auto brake system has a 5 second delay before auto brake application using the "min or

med" selections, however, if the selected deceleration rate is achieved with reverse thrust the "green" lower half of the selected pushbutton will illuminate and the "white" light will extinguish. The "hi and max" selections do not have the delay. Allow the auto brakes to slow the aircraft to 60 knots. After 60 knots smoothly apply the brake pedals to disarm the auto brakes. Deceleration with thrust reversers causes the auto brakes to modulate brake pressure to achieve the desired deceleration. Heavy reversing reduces auto braking and resultantly less brake wear. Advantages given by the auto brake system are:

a. Reduction of pilot workload during landing
b. Obtention of optimized deceleration rate function of runway length available
c. Improvement of passenger comfort during landing roll.
d. Performance improvement at take off due to the reduction of the delay of brake application in case of aborted take off.
e. Brakes and tyre saving: the brakes only supply the torques necessary to maintain the selected deceleration.

9. ***Operation.*** The system is initiated by ground spoilers extension order (at throttles reduction if ground spoilers are armed). The pilot can take over at any moment by depressing one or both brake pedals (with different load threshold) Auto brakes system is operative with GREEN hydraulic braking system only. Auto-brake begins to be efficient 2 second after the impact. With modification 2897 embodied this delay is increased to 10 sec for MIN and MED modes in order to prevent auto brake from being applied before reverse thrust is at its maximum rate.

Thrust Reversers Control

10. **Reverse Thrust Control Lever**. The reverse thrust control lever is only operative when the throttle lever is at idle. When the lever is moved to reverse idle provided the main L/G shock absorber is compressed:

a. the fan reverser cowls translate

b. REV. UNLK amber light comes on.

c. Flight idle is selected.

The lever is locked at idle until the cowls has deployed 90 % of travel

a. The REV green light comes on

b. The reverse lever is unlocked

c. The max. reverse thrust can be applied

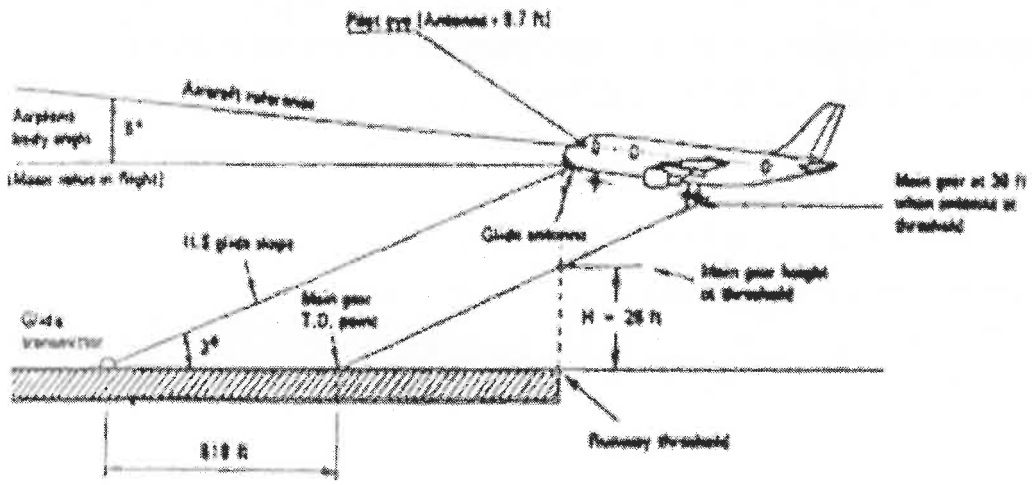
11. When reversers are fully deployed the REV. UNLK light goes off. The sequence duration is about 3 sec. The reverse thrust levers must be brought back to the idle position when IAS drops to 60 Knots. Reverse thrust cannot be used in flight but reverse idle, (and, in an emergency, full reverse) may be applied before the nose wheel is on the ground. Between touch down and the availability of maximum reverse thrust, the time delay is of 9 seconds. This delay has a very important effect in the participation of the reversers in the aircraft braking. Depending upon the required braking rate, the reverse thrust effect will be more or less efficient. As a reference, it is important to notice that the stopping time is round 15 seconds with the application of full pressure on brakes.

Landing Procedures

12. **Approach**. The optimum and most consistent landing performance is achieved through the use of a stabilized approach. *A stabilized approach is defined as flight on the desired glide path, visual or electronic, at a constant rate of descent, at the target approach speed, in trim, with the proper thrust setting.* Approach planning which results in a stabilized approach at and below 1,000 feet AGL will provide the most optimum landing performance. Un-stabilized approaches must not be allowed to continue below 500 feet. Target speed for a normal approach is to be a minimum of Vref + 5k and a maximum of Vref + 20k subject to configuration change and surface wind. The pilot should coordinate pitch attitude and power changes on the approach in order to maintain constant glide path that will provide an aim point at the

1,000 foot mark on the runway. Maintaining the pitch attitude and power setting that has maintained the constant glide path until the flare point is reached.

13. **Flare and Landing**. During a visual approach, the main landing gear should cross the runway threshold at 50 feet. The main gear touchdown will occur just beyond 1,000 feet assuming the glide path angle is 03^{O} ***-do not deviate from the glide path*** in an attempt to touchdown sooner. Initiate the flare when the main gear is approximately 30 feet above the runway by increasing the pitch attitude approximately 2 degrees. At 20 feet, begin smoothly reducing the throttles to idle. To avoid aft fuselage contact, fly the aircraft onto the runway at the desired touchdown point. " do not " hold the aircraft off the runway for a soft landing.



13. **Landing on Wet or Slippery Runways.** Once on the ground, the importance of the early use of all means of stopping the airplane cannot be overemphasized. Timely execution of the following actions will permit stopping the airplane with the least landing roll:

a. Check that the auto spoilers deploy immediately after the main gear contacts the runway. If the spoiler handle fails to actuate automatically after initiating reverse thrust, immediately actuate the

speed brakes manually. The spoilers will reduce lift, increase drag and increase main gear loading. Quick extension of the spoilers is important because the effects of the reduced lift and increased drag are additive in shortening the landing roll.

b. At touchdown immediately start lowering the nose before initiating reverse thrust. This is desirable because reducing the airplane attitude decrease lift, increases main gear loading, and improves directional stability. Holding the nose off and delaying braking is undesirable as aerodynamic braking is relatively ineffective.

c. Use the thrust reversers as soon as possible during the landing roll. Reverse thrust is most effective at high speeds.

14. **Auto Brakes on Wet RW**. Arm the auto brake system before landing by selecting "med" or as applicable. At main gear touchdown, after wheel spin-up, the auto brake system smoothly begins to apply symmetrical braking and to control airplane deceleration. Either pilot can disarm the auto brake system and take over manual braking.

15. **Landing Performance.** The aircraft landing distance is calculated from 50 ft to a complete stop with brakes, anti skid, spoilers and without reverse thrust on a hard runway in no wind conditions at sea level. The distance so obtained is only a reference with normal operations of all systems and following the correct approach procedure. In a normal 125 Tons landing weight 25°/25° flaps are to be selected. The Vref for 125 Tons landing weight is 132 Kts and approach speed 137 Kts. On a wet runway during drizzle a water layer of a maximum ¼ inch may be on the RW. In this situation Auto-brakes – Medium selection is recommended; the landing distance at sea level in no wind condition is 1730m or 5700 ft. Peshawar RW being at 1180 ft elevation, the distance increases to almost 6000 ft in given temp. For given tire pressures the hydro-planning speed is 116 Kts.

Airfield Details

16. Peshawar Runway 35/17 has an elevation of 1180 ft AMSL. It is a 9000 ft long and 150 ft wide RW having 10 ft shoulders on both sides. There is 750 stop-ways for RW 35 and 900 ft stop-way for RW 17. The PCN of stop-ways is 1/3rd of the RW PCN as per National Aerodrome Policy. The Landing Distance Available (LDA) for both the RW is 9000 ft and fighter aircraft arrester barriers are positioned at both ends of LDA. However, stop-ways are part of Accelerate Stop Distance Available (ASDA) for both RW.

17. **Landing Aids** The Instrument Landing System (ILS) is not available at Peshawar. A glide path estimation of 03^{O} for a non-precision approach is available on PAPI/VASI. In addition, NDB and VOR/DME are also available navigation/approach aids.

Weather

18. At the time of landing weather was complete overcast and it was drizzling. The RW had standing water patches and wet surface. At circuit/ approach attitude there were 02 Octa clouds below 3000 ft AGL, however, there were no clouds at or below 1500 ft AGL on final approach. The temperature was 10.5° C, wind calm and visibility was 3.5 Km.

Data Records

19. The aircraft is equipped with Digital Flight Data Recorder (DFDR) and Cockpit voice Recorder (CVR). The DFDR extracts were made available for analysis by DFDR shop PIAC, however, CVR extract read out facility is not available and neither PIAC could arrange its extracts read-out from abroad in reasonable time, however, it was arranged by SIB after the lapse of eight months. ATC approach and landing frequency recording was made available by Peshawar ATC.

DFDR Analysis

20. The salient points from DFDR are as follows:-

a. The approach is destabilized in glide path, which is progressively reducing from 3 ^{O} at 1000 ft AGL to 1.5 ^{O} at 300 ft AGL and 1.2^{O} at 100ft.

b. The approach speed below 1000 ft AGL is fluctuating between Vref + 5 to Vref +10 with changes in power setting between 50% to 72% and higher towards lower height.

c. Flare-out is initiated at 50 ft and Vref+13 Kts, therefore, aircraft floats for 16 seconds and touches down after 3500 ft.

d. The touch down is achieved at 130 Kts (Vref-2) about 3000 ft down the LDA.

e. Spoilers are deployed immediately on auto selection and throttles are moved in Reverse Thrust Selection with increase in Engine # 1 N1 to 55 % and Engine #2 N1 gradually dropping to 37%.

f. The throttle lever angle corresponds to reverse position but there is no indication of Reverse Thrust Interlock or extension.

g. A number of changes are made on Throttle Lever Angle in Thrust Reverse quadrant.

h. The aircraft decelerates to 117 Kt i.e. up to hydro-planning speeds, in 11 seconds and consumes 2300 ft RW before brakes become effective. A time elapse corresponding to brakes effectiveness with modification 2987 in auto brakes Min/Med.

i. The deceleration to 40 Kts is in next 23 seconds and after that Throttle Lever Angle is brought in ground idle. The spoilers are also retracted simultaneously.

j. In ground-idle position of throttle and the N1 on Engine #1 correspond to air-idle 42.5% N1.

k. The Engine #1 air-idle N1 comes to ground-idle when aircraft jumps over the obstruction of fighter aircraft arrester barrier without any change in Throttle Lever angle.

l. The aircraft comes to a halt after 6300 ft ground roll.

m. In last 500 ft ground roll the aircraft is turned right by 20 degrees and then reversed by 25 degrees before a complete halt.

21. **Cockpit Voice Recorder.** The cockpit voice recorder was taken to AAIB UK for analysis. All the four recorded tracks were found blank, indicating no recording. The technical inspection revealed a break in the recording circuit. The CVR report is at Appendix "B".

22. **ATC Tape Extracts**

a. On first Radio contact PK-7302 was cleared for VOR/DME approach on RW 35.

b. On down wind PK-7302 is cautioned for wet RW and drizzle.

c. Landing clearance is given after visual contact.

d. Three minutes after final landing clearance ATC inquired if everything was normal, to which PK-7302 acknowledged in affirmative.

e. PK-7302 announced his ability to turn about but ATC stopped from doing so and cautioned for sinking due to low PCN.

f. Two minutes after aircraft was told to hold in stop-way, the emergency services were advised to proceed to the aircraft.

Cockpit Crew Interviews

23. Following are the salient points from the cockpit crew interview:

a. Salient aspects of interviews are as follows:-

b. The cockpit crew was aware of the wet RW conditions.

c. Touch down was about 2000 ft down LDA.

d. It took 5-7 seconds to realize that TR had not deployed.

e. Selection of auto brakes–MED was considered/ recommended.

f. Spoilers deployed on auto-selection.

g. Manual brakes were applied to maximum when TR did not deploy and auto-brakes were found ineffective.

h. There was a difference in understanding of wheel braking effectiveness in wet and dry conditions and reason for not selecting Anti-skid switched off.

i. Braking was more effective at slower speeds.

j. Cockpit crew give different time period for landing roll.

k. Cockpit crew's understanding of stop-way availability in LDA indicates no difference between LDA and ASDA for a RW.

l. The understanding of Hydro-planning and anti-skid system was inadequate.

m. Cause of RW Excursion has been attributed to multiple failures i.e. Thrust Reverse, wheel Braking etc.

n. The comments on approach or any influence of weather on approach were not offered.

o. Aircraft main tires sunk a maximum of 3"-4" in stop-way.

SNAG HISTORY

24. Following snags were recorded on brakes and engine in last 30 days:

- 23/12 Probe anti-skid off LSA fault light came on MWP OFF.
- 24/12 #2 Brake fwd wear indicator missing
- 25/12 During cruise config, probes and anti-skid off light came on.
- 27/12 Please check #6 brakes for binding
- 28/12 Left hand side brakes are catchy and a/c pulls to the left during tear.
- 29/12 #3 & #5 brakes ground test US.
- 01/01 During cruise anti-skid off light came on.
- 08/01 #5 brake catchy and temp rises during taxi.
- 09/01 On selection of L/G down with #1 system selected anti-skid – OFF light came on.
- 13/01 During flight Eng. #1 went to ground idle with safety relay CB pulled became normal.
- 14/01 During flight Eng. #1 went to ground idle with safety relay CB pulled became normal.
- 21/01 During landing both TR failed to deploy.

25. **Snags on Brakes** In preceding 30 days there were a total of 09 brakes/anti-skids malfunctions. There were five snags regarding anti-skid – OFF indication coming ON in flight i.e. indication problems, while remaining were catchy brakes. These snags were not observed in the incident.

26. **Snags on Engine** There was no snag on T/R in preceding 30 days, however, in preceding 10 days Engine # 1 was reported to go in ground idle position in flight. While in incident flight the engine did not get into ground idle after landing, resulting in non deployment of T/R in spite of Throttle levers selection in Reverse quadrant.

ANALYSIS

Landing Performance on Wet RW

26. The approach speed is 5Kts higher than Vref i.e. the threshold speed. The Vref for a given weight and configuration is about 30% higher than stall speed. Therefore, possibility of a stall on threshold and beyond is ruled out as higher angle of attach would result in tail scrapping the RW before stall. In wet RW conditions A-300 B-4 has 116Kts aqua planning speed reference above which wheel braking would not be effective. Deceleration above this speed would be possible with spoilers and TR only. Subject to calculated Vref, positive touch down close to aquaplaning speed ensures earlier availability of wheel breaking. A study of previous flight DFDR shows a normal touch down at 122 Kt when Vref was 135 Kts. Other aircraft touch downs have also been around same speed in 25/25 and same weight category. High speed touch downs and late touch down are result of de-stabilize approach. If approach speeds are higher the threshold speed would also be higher, hence corresponding touch down either be on higher speed or later than 1000 ft down LDA. Similarly, if glide path is shallow (less than 3°) then aircraft momentum/speed is not reduced after flare height. In this incident aircraft glide path was barely 02^{O} from 300 ft AGL and 1.2^{O} at 100 ft AGL. The selected engine power on short finals also shows a dragging shallow approach. A 13 Kts higher approach speeds on threshold and a very shallow glide path's cumulative affect was no flare out and longer float. The aircraft floated 3500 ft from 50 ft AGL before touch down. The float time of 15 seconds at an average speed of 138 Kts, though throttle levers were brought to idle 08 seconds before touch.

27. Touch down was about 14 Kts higher than aquaplaning speed and 2 kts lower than Vref. During this period aircraft wheel braking was not available and T/R did not deploy, however, spoilers were available. The deceleration with only spoilers is achieved up to 11 seconds until aquaplaning speed and thus aircraft decelerated by 14Kts in this time. Further more, time delay in auto brake MIN/MED application is also 10 seconds after touch down

with modification 2897. The wheel brakes thus became affective 11 second after touch down i.e. aground roll of 2300 ft without any meaningful deceleration. In view of slow deceleration above aquaplaning speeds, the brakes were acquired manually and maximum manual braking with anti-skid was utilized for remaining 4000 ft LDA below 116 Kts. This ground roll distance corresponds to actual ground roll distance for landing on wet RW in given conditions and indicates optimum performance of brakes in manual use.

28. Engine #1 N1remained at 55% after touch down and failure of micro switch in left landing gear shock absorber, which allows Fan Reverse Cowls translation and selection of air idle along with amber UNLK light. This malfunction adversely affected deceleration until crossing of arrester barrier.. The Engine # 1 N1 remained about 55% until below 40 Kts when RT was de-selected. The Engine # 1 after RT De-selection settled at 43 % N1, which is air-idle N1 of CF-6 engine at 1000 ft AMSL (Peshawar). This shows that aircraft deceleration was adversely affected due to higher N1 in TR quadrant without having the RT.

29. The snag history indicates that aircraft had problem with air and ground idle parameters on Engine #1, where aircraft would go into ground – idle in flight when throttle lever was retarded to idle. Although, PIA Engineering and Airworthiness inspector did not observe repetitions of the snag in post incident ground run of the engine, which was under taken to check the serviceability of RT. It is evident that neither pilots nor Engineers observed the correct cause of RT deployment, which was due to Engine #1 remaining in air-idle after touch down as RT can be selected on ground only. The DFDR shows the reversion of Engine #1 N1from air-idle to ground-idle after the aircraft got a jolt when it jumped over fighter aircraft arrester barrier.

OBSERVATIONS

30. The contingency plans for different emergency situations are available but same are not being practiced by PCAA or the operator. In case of RW blocking the entire exercise is left to the operator who is to provide requisite

equipment and conduct the activity. In this RW excursion incident, the RW remained blocked for 40 hours including two complete day light hours, though, the situation was simple as aircraft was on landing gears with all tires serviceable. The operator had not identified the support equipment and location of its availability for positioning at the scene of incident. The limitations of available tow equipment in pulling the aircraft out tail first were learnt after many attempts. SIB's coordination with Corps HQ made the tow equipment available from Pakistan Army Engineers in Peshawar.

FINDINGS

31. The board finds that:

a. PK-7302 was a scheduled flight from Jeddah to Peshawar.

b. The landing was at 1033 AM LT and the cockpit crew were given weather information on drizzle and wet RW.

c. The approach below circuit altitude was clear of clouds.

d. The approach was destabilized below 1000 ft AGL in speed and glide path both, where as glide slope was only 1.2^{O} at 100 AGL and threshold speeds were 13 kts higher.

e. Higher speeds and shallow glide slope resulted in absence of flare out, longer float and touch down about 3000 ft down the RW at 130 kts, though, an earlier touch down at higher speeds is recommended instead of a late and smooth touch down at slower speed.

f. Above aquaplaning speeds, the aircraft deceleration was by spoilers only and RT did not deploy due to engine # 1 remaining in air idle.

g. Higher than aquaplaning speed at touch down resulted in absence of wheel braking for 11 seconds up to 116 kts.

h. When wheel brakes became effective, only about 4000 ft RW was available.

i. Engine # 1 RPM increased to 55% N1 with Throttle Lever in RT quadrant without RT being deployed thus adversely affected aircraft deceleration.

j. The aircraft overshot the landing distance available and came to halt 300 ft on stop-way after crossing and damaging the fighter aircraft arrested barrier.

k. The stop way was ploughed in the overrun and area around halt position was damaged deeper by main wheels.

l. The landing roll after brakes became effective corresponds to landing performance data given by the manufacturer.

m. In preceding 10 days aircraft had snags on engine going to ground idle during flight.

n. Cockpit crew's knowledge on aircraft landing performance was inadequate.

o. The snag on RT was cleared arbitrarily without checking facts from DFDR extracts and no such instructions were given by senior Engineering Management.

p. Cockpit Voice Recorder extract could not be arranged by PIAC until SIB made the necessary coordination with AAIB, UK. The CVR was found unserviceable on inspection.

q. The operator and airport management do not practice emergency/contingency plans and contingency equipments and its location is not identified.

Cause of the Serious Incident

32. **Primary.** Human Factor – Cockpit Crew – Avoidable.
Incorrect Approach and Landing Technique On Wet RW.

33. **Contributory.** Human Factor – Engineering -Avoidable
Repetitive failure in Engine # 1 ground / air idle selection resulted in failure of TR deployment after landing on wet RW condition.

Recommendations

34. The board recommends:

a. Cockpit crew be made aware of implication of de-stabilized approach and wet RW effects on braking in recurrent training.

b. Repetitive engine related failures be monitored by engineering supervisors and rectification carried out after investigation.

c. Engineering to verify snags' write ups of occurrences from DFDR/PMR before rectification.

d. Engineering to evolve a periodic serviceability inspection procedure of DFDR and CVR.

e. PIAC and Airport Managements to identify equipment and its location for Aircraft Accident/ Recovery plans.