FINAL INVESTIGATION REPORT

SERIOUS INCIDENT OF PAKISTAN INTERNATIONAL AIRLINES FLIGHT PIA 605, ATR 42-500 AIRCRAFT, REGISTRATION NO. AP-BHP AT GILGIT AIRPORT ON 20TH JULY, 2019

Dated: 04th July, 2024

SCOPE

Aircraft Accident Investigation Board (AAIB), Pakistan investigations are conducted in accordance with Annex-13 to the International Civil Aviation Organization (ICAO) Convention on International Civil Aviation and Civil Aviation Rules 1994 (CARs 94).

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ABBREVIATIONS

AAIB	Aircraft Accident Investigation Board
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ANO	Air Navigation Order
AP	Auto Pilot
APM	Airport Manager
ATPL	Air Transport Pilot License
BEA	Bureau of Enquiry and Analysis
CARs	Civil Aviation Rules
CAS	Calibrated Air Speed
CFIT	Controlled Flight into Terrain
CG	Centre of Gravity
CL	Condition Levers
COO	Chief Operating Officer
CPL	Commercial Pilot License
CRM	Crew Resource Management
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DP	Decision Point
EGPWS	Enhanced Ground Proximity Warning System
ETA	Estimated Time of Arrival
FCOM	Flight Crew Operating Manual
FDA	Flight Data Analysis
FI	Flight Idle
FL	Flight Level
FO	First Officer
ft	Feet
GI	Ground Idle
GS	Ground Speed
h	Hour(s)
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organization

IFR	Instrument Flight Rules
IIAP	Islamabad International Airport
kg	Kilogram(s)
kt	Knot(s)
L/G	Landing Gears
m	Meter(s)
min	Minute(s)
MLG	Main Landing Gear
MOR	Mandatory Occurrence Report
NLG	Nose Landing Gear
NM	Nautical Mile
PCAA	Pakistan Civil Aviation Authority
PF	Pilot Flying
PIA	Pakistan International Airlines
PM	Pilot Monitoring
RA	Radio Altimeter
ROD	Rate of Descent
R/T	Radio Telephony
R/W	Runway
s	Second(s)
SMS	Safety Management System
SOP(s)	Standard Operating Procedure(s)
TAS	True Air Speed
TOC	Top of Climb
TOGW	Take-off Gross Weight
TSN	Time Since New
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VS	Vertical Speed

INTRODUCTION

This occurrence was reported to AAIB Pakistan by Airport Manager (APM) / Chief Operating Officer (COO) Pakistan Civil Aviation Authority (PCAA) Gilgit Airport[1] and General Manager Safety & Quality Assurance Pakistan International Airlines (PIA)[2]. The occurrence was notified[3] in accordance with ICAO Annex-13 as a "Serious Incident". Ministry of Aviation, Government of Pakistan issued Memorandum and Corrigendum[4] authorizing AAIB Pakistan to investigate the occurrence.

[1] PCAA – APM / COO Gilgit Airport Accident Report
[2] PIA – Mandatory Occurrence Report (MOR) SIB 6102/2019
[3] ICAO Initial Notification
[4] Ministry of Aviation Memorandum dated 25th July, 2019 & Corrigendum

SYNOPSIS

Pakistan International Airlines (PIA) flight PIA 605, ATR 42-500 aircraft, Reg. No. AP-BHP was a scheduled passenger flight from Islamabad International Airport (IIAP), Islamabad to Gilgit Airport. The aircraft departed from IIAP, Islamabad as per plan with 49 passengers and 04 crew members. While approaching Gilgit for Landing, the aircraft descended at speeds much higher than normal. As a result of higher speed and reduced reaction time, the aircraft was unable to extend Flaps 35 as a result of which the aircraft made a high-speed touchdown with Flaps 15. After touchdown, the aircraft could not be stopped within the remaining length of Runway (R/W) and departed off the end of R/W. It finally stopped in the overrun of R/W 25 at a distance of 41 feet (ft) from the threshold of R/W 07. During the occurrence none of the passengers or crew sustained any injuries. The corresponding timings during the occurrence are mentioned in Co-ordinated Universal Time (UTC).

SECTION 1 - FACTUAL INFORMATION

1.1 **History of the flight**

1.1.1. PIA flight PIA 605 ATR 42-500 aircraft Reg. No. AP-BHP was a scheduled passenger flight from IIAP, Islamabad to Gilgit Airport. There was no abnormality reported in the aircraft prior to the flight. Aircraft loading was within normal limits of 24.7% Centre of Gravity (CG) with Take-off Gross Weight (TOGW) 18,600 kilograms (kg)[5]. The aircrew was current and had adequate experience both on the aircraft as well as for flights to Gilgit Airport. Gilgit Airport is located at an altitude of 4,784 ft Above Mean Sea Level (AMSL) with R/W dimensions 5,400 x 100 ft and is deemed fit for operations under PCAA regulations. For this sector, Captain was Pilot Flying (PF) while the First Officer (FO) was Pilot Monitoring (PM). The aircraft took off from IIAP, Islamabad at 02:02 hours (h) and Auto Pilot (AP) was engaged at 260 ft Radio Altimeter (RA) height and the climb was performed under AP using Vertical Speed (VS) mode. This mode is not recommended as per Flight Crew Operations Manual (FCOM). As a consequence the aircraft Indicated Air Speed (IAS) dropped to 130 knots (kt) as opposed to standard climb speed of 160 kt. However, the enroute flight at Flight Level (FL) 165 subsequently remained uneventful. During the cruise, the lowest RA height prior to descent was recorded as 2,636 ft; however, this is in accordance with PIA Standard Operating Procedures (SOPs) for Northern Area flights where minimum separation of 2,000 ft Above Ground Level (AGL) is allowed and considered mandatory due to mountainous terrain[6]. While approaching Gilgit Airport, Captain initiated the descent at 02:36:37 h at the designated point but maintained a higher speed accelerating up to 245 kt as opposed to the standard descent speed of 200 kt as per PIA SOPs. Despite being earlier than planned Estimated Time of Arrival (ETA) for Gilgit Airport, the Captain still elected to maintain higher speeds. The FO pointed out the anomaly of higher-than-normal speed, but Captain did not take any action to bring the aircraft to correct parameters. Moreover, the Enhanced Ground Proximity Warning System (EGPWS) warning also triggered at 02:45:10 h due to higher speeds as the aircraft descended into the valley for Approach.

1.1.2. The Approach is mandatorily as per Visual Flight Rules (VFR) whereby the aircrew is to remain visual all the time with the terrain. As Gilgit Airport is located in a valley, Approach for Landing is a visual approach whereby the aircraft executes a base turn to align with the R/W for Landing after Approaching almost perpendicular to the R/W on base leg. This is because a standard Approach is not possible due to the presence of mountains all around[7]. During base leg, at 02:48:54 h Captain announced tail wind picking up, whereas Gilgit Airport was reporting wind as calm. As per data available, the tail wind speed above 1,500 ft AGL was as high as 19 kt; however, it started to reduce progressively with decrease of altitude whereby it reduced to 4-5 kt upon touchdown. Due to high speed maintained by the Captain, the aircraft could not be brought to correct Landing configuration even during base leg. At 02:49:11 h, the Captain asked the FO's opinion for carrying out a 360° turn to reduce the speed for Landing configuration. However, the FO left the decision to the Captain as, in his opinion, the speed was too high for executing the turn inside the valley. Moreover, as the Captain was more experienced and also his instructor, he trusted the Captain's judgment and skill to make a successful Landing. Since the FO did not give any opinion

[5] PIA – TOGW data
[6] PIA – SOP Northern Area Page No. 11
[7] PIA – SOP Northern Area Page No. 07

on the Captain's suggestion for a 360° turn, the Captain continued the Approach[8].

1.1.3. As the aircraft continued towards the R/W, Flaps were selected to 15° below 180 kt and 491 ft AGL. Landing Gears (L/G) were lowered immediately after Flaps at 442 ft AGL and speed 174 kt instead of correct speed of 170 kt. Additionally, the Captain made an angling Approach to the R/W instead of executing a correct base turn as per procedure which describes a semi-circular arc. The Flaps came down to 15° position at 257 ft AGL whereas the L/G were in down and locked position only once the aircraft was rolling out on R/W heading at an altitude of approximately 50 ft AGL at a speed of 162-163 kt. Full Flaps could not be lowered and aircraft touched down on the R/W at time 02:47:50 h at approximately 150 kt in Flaps 15° configuration around 2,000 ft down the R/W. After touchdown, the Captain applied brakes, but without using Thrust Reversers. However, aircraft could not be stopped after the Landing Roll and departed from the far end of the R/W coming to a stop at 41 ft from the R/W threshold.

1.2 Injuries to person(s)

1.2.1 No injury was reported to any person on board.

Injuries	Crew	Passengers	Total in aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	04	49	53	-
TOTAL	04	49	53	-

Table 1 Injuries to Person(s)

1.3 Damage to aircraft

1.3.1 Both engines were running at the time of impact, and the right engine propeller blades struck the ground, causing all the propeller blades to break at approximately one third position from the propeller hub.

[8] PIA – SMS Investigation Report Page No. 8

Figure 1 Broken Propellor Blades of Right Engine

Figure 2 Broken Propellor Blade

1.3.2. Impact marks on fuselage above emergency door from broken propeller blades' strike.

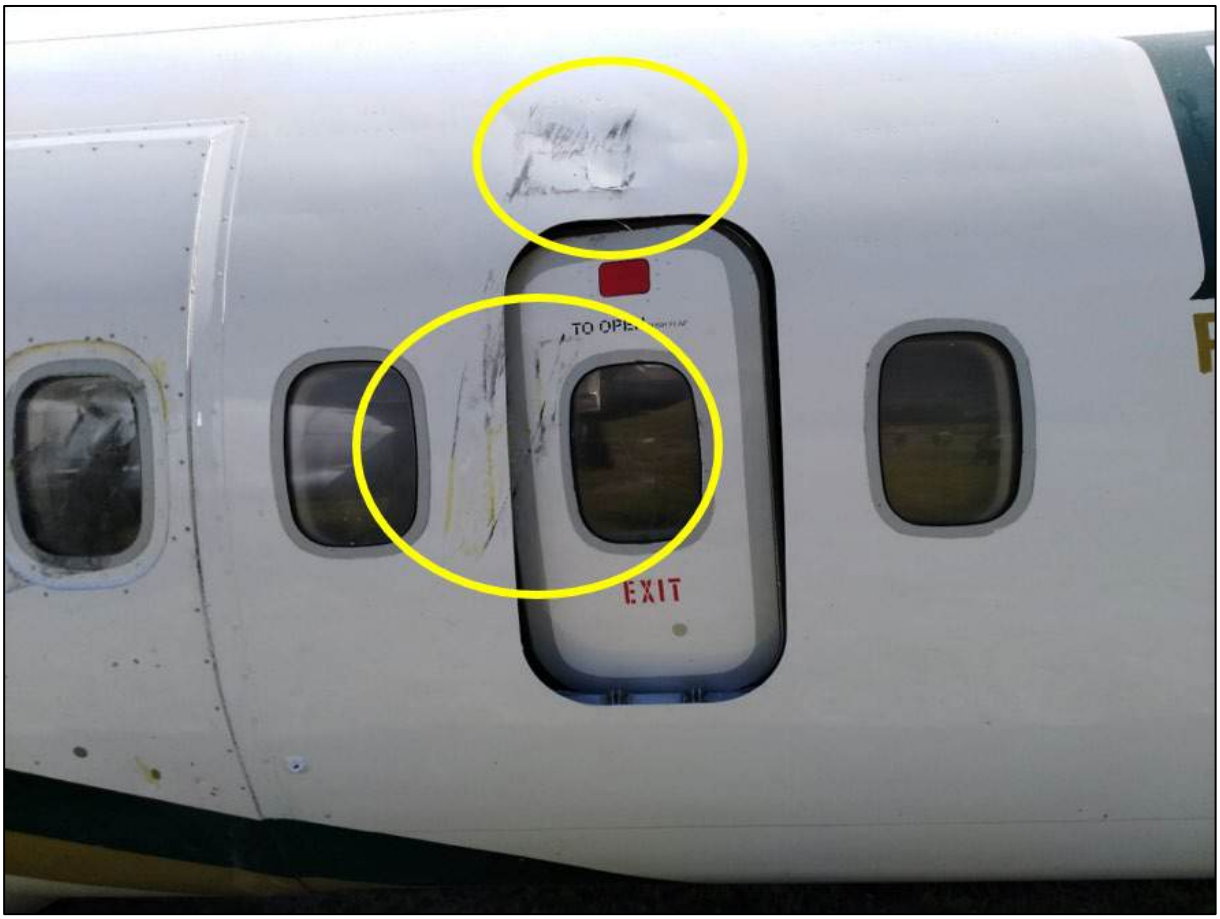


Figure 3 Impact Marks on Fuselage

1.3.3. Impact marks on fuselage between windows 4 & 5.

Figure 4 Impact Marks on Fuselage

1.3.4. Right Main Landing Gear (MLG) collapsed.

Figure 5 Right MLG Collapsed

1.3.5. Right MLG fairing area damaged.

Figure 6 Right MLG Fairing Area Damaged

1.3.6. Right wing navigation light damaged.

Figure 7 Right Wing Navigation Light Damaged

1.3.7. Right side ice shield / protection plate slightly damaged.

1.3.8. Nose Landing Gear (NLG) right wheel deflated and shock strut bent.

Figure 8 NLG damaged

1.3.9. Left MLG tilted outwards.

Figure 9 Left MLG damaged

1.3.10. Aft bottom Very High Frequency (VHF) radio antenna dislodged.

1.3.11. As a result of the damage sustained to the aircraft during the occurrence, PIA took the decision for permanent retirement and de-registration[9] of the aircraft.

1.4 Other damage

1.4.1. Not Applicable.

1.5 Personnel information

1.5.1 The crew had valid medical fitness to undertake the flight. The details of the aircrew are as follows: -

Captain	
License type:	Air Transport Pilot License (ATPL)
On type:	1,210 h
Grand Total:	7,951 h
First Officer (FO)	
License type:	Commercial Pilot License (CPL)
On type:	557 h
Grand Total:	757 h

Table 2 Captain and First Officer Data

[9] PIA Letter – De-Registration of AP-BHP

1.6 Aircraft information

Aircraft Details	
Call Sign	PIA 605
Aircraft Make & Model	ATR 42-500
Registration Marking	AP-BHP
Year of Manufacture	2007
Manufacturer Serial No.	665
Owner / Operator	Pakistan International Airlines (PIA)
Sector	Islamabad to Gilgit
Flight conditions	Landing
No of Aircraft hours:	22,235
No of Aircraft cycles:	22,057

Table 3 Aircraft Details

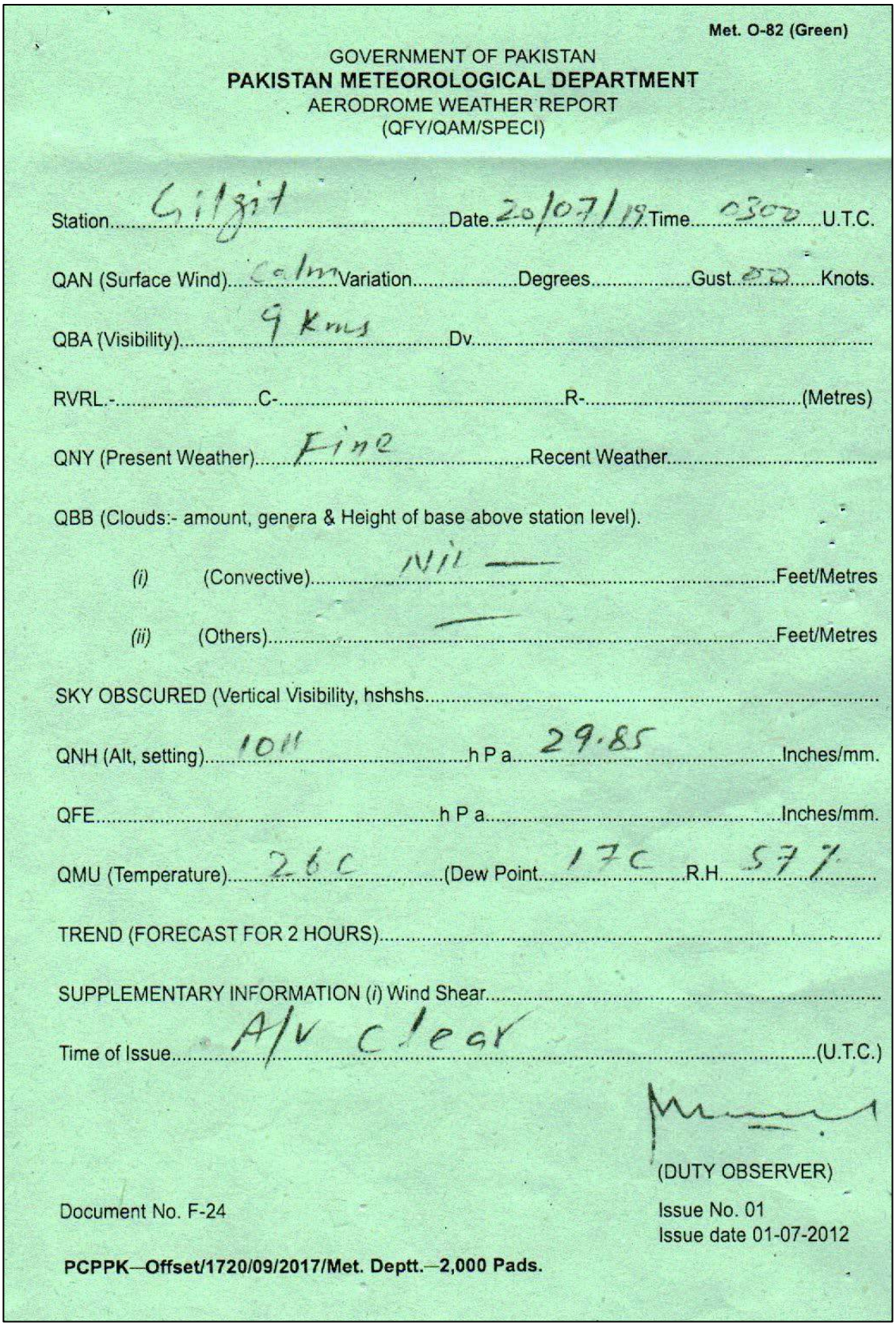
Engine Details		
A/C Reg	**AP-BHP # 1**	**AP-BHP # 2**
Engine Serial Number	ED 0530	ED 0315
Date of Installation	14th December, 2018	7th December, 2018
TSN at Installation	8,709	12,858
CSN at Installation	6,642	12,367

Table 4 Engine Details

1.6.1. Engine No. 1 was serviceable upon removal; however, Engine No. 2 had been damaged in the incident.

1.7 Metrological Information

1.7.1. No significant weather was reported for Gilgit Airport at the time of occurrence. Meteorological data for Gilgit Airfield at the time of incident is provided as below: -



Met. O-82 (Green)

GOVERNMENT OF PAKISTAN
PAKISTAN METEOROLOGICAL DEPARTMENT
AERODROME WEATHER REPORT
(QFY/QAM/SPECI)

Station Gilgit Date 20/07/19 Time 0300 U.T.C.

QAN (Surface Wind) Calm Variation Degrees Gust Knots.

QBA (Visibility) 9 Kms Dv.

RVRL.- C- R- (Metres)

QNY (Present Weather) Fine Recent Weather

QBB (Clouds:- amount, genera & Height of base above station level).

(i) (Convective) Nil Feet/Metres

(ii) (Others) Feet/Metres

SKY OBSCURED (Vertical Visibility, hshshs

QNH (Alt, setting) 1011 h P a 29.85 Inches/mm.

QFE h P a Inches/mm.

QMU (Temperature) 26C (Dew Point 17C R.H 57%

TREND (FORECAST FOR 2 HOURS)

SUPPLEMENTARY INFORMATION (i) Wind Shear

Time of Issue A/v Clear (U.T.C.)

(DUTY OBSERVER)

Document No. F-24

Issue No. 01
Issue date 01-07-2012

PCPPK—Offset/1720/09/2017/Met. Deptt.—2,000 Pads.

Figure 10 Meteorological data for Gilgit Airfield

1.8 **Aids to navigation**

1.8.1. Navigational aids for Gilgit Airfield are provided below. There was no abnormality reported at the time of the occurrence.

OPGT 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	GT	324.0 kHz	HJ	355512.55N 0742006.29E	-	Coverage 50NM

Table 5 Radio Navigation and Landing Aids

1.9 **Communications**

1.9.1. Communication frequencies for Gilgit Airfield are as provided below. There was no abnormality reported at the time of the occurrence.

OPGT AD 2.18 ATS COMMUNICATION FACILITIES

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
APRON	Gilgit Tower	260.20 MHZ	HJ	-
RADIORADIO	G/A/G	2923.00 KHZ	HJ	-
RADIORADIO	G/A/G	5601.00 KHZ	HJ	-
TWR	Gilgit Tower	119.10 MHZ	HJ	Primary Frequency
TWR	Gilgit Tower	121.80 MHZ	HJ	-

Table 6 Communication Frequencies for Gilgit Airport

1.10 **Aerodrome information**

1.1.4. Gilgit aerodrome data is as provided below. There was no abnormality reported at the time of the occurrence.

OPGT AD 2.2 AERODROME GEOGRAPHICAL AND ADMINISTRATIVE DATA

1. ARP coordinates and site at AD	355507.63N 0742001.12E (centre of RWY)
2. Direction and distance from (city)	1.25 NM East of city
3. Elevation/Reference temperature	4796 FT / 30.3 °C
4. MAG VAR/Annual change	02° E
5. AD Administration, address, telephone, telefax, AFS	CIVIL AVIATION AUTHORITY Chief Operating Officer/APM,Gilgit Tel: (05811) 920418 Fax: (05811) 920675 AFTN: OPGTYDYX e-mail: apm.gilgit@caapakistan.com.pk
6. Types of traffic permitted (IFR/VFR)	VFR
7. Remarks	-

Table 7 Aerodrome Geographical and Administrative Details

OPGT 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	Slope of RWY/SWY
1	2	3	4	5	6	7
07	71.56°	1646 x 30	15/F/C/Y/T Bitumen SWYs: Un-paved	355459.18N 0741909.97E	THR 1461.26 M / 4794.16 FT	0.040% up
25	251.56°	1646 x 30	15/F/C/Y/T Bitumen SWYs: Un-paved	355516.08N 0742032.27E	THR 1461.83 M / 4796.03 FT	-

SWY dimension (M)	CWY dimension (M)	Strip dimension (M)	RESA dimension (M)	Arresting system	Obstacle Free Zone	Remarks
8	9	10	11	12	13	14
91	91	-		-		-
81	81	-		-		-

Table 8 Aerodrome Information of Gilgit Airport

1.11 Flight recorders

1.11.1 The aircraft was equipped with a solid-state Digital Flight Data Recorder (DFDR) and a Cockpit Voice Recorder (CVR). The DFDR and CVR were undamaged in the occurrence and the data of the flight was subsequently extracted for analysis. The data from the DFDR was not only extracted in-country for obtaining the parameters in tabular form but was also sent to Bureau of Enquiry and Analysis (BEA) France for a detailed analysis of the flight. The CVR files were also downloaded to obtain audio files to have details regarding Radio Telephony (R/T) communication as well as intra-cockpit communication. Flight Data Analysis (FDA) was carried out on the obtained data to ascertain anomalies during the flight while focusing specifically on the Landing[10].

1.12 Wreckage and impact Information

1.12.1 Not Applicable.

1.13 Medical and pathological information

1.13.1 Pre-flight medical check did not indicate the presence of alcohol for the aircrew[11]. Similarly, Post incident medical examination revealed no alcohol or psychoactive substances present[12].

[10] PIA – DFDR Data
[11] Pre-Flight Alcohol Test
[12] Post-Flight Alcohol Test

1.14 Fire

1.14.1 There was no fire reported during the incident.

1.15 Survival aspects

1.15.1 Not Applicable.

1.16 Test and research

1.16.1 Not Applicable.

1.17 Organizational and management information

1.17.1 **Lack of supervision by PIA –** It was revealed during the investigation that the Captain had deliberately made a high-speed Approach (speeds higher than specified in PIA SOPs / FCOM) as a demonstration to FO to display a high-speed Approach and Landing[13]. However, it was done without any prior approval by the Operator. Moreover, the Captain also admitted that prior to this incident, there had been occasions where the Landing was made at high speed[14] but aircraft was stopped successfully without any untoward incident or occurrence**.** Nevertheless, as per the Captain's own admittance, despite having made high speed Landings, there had never been any debrief or cautionary advice given[15].

1.17.2 **Non-utilization of DFDR data for debriefs by PIA –** The policy for DFDR analysis and methodology for debrief was formulated by the operator[16]; however, it was not being followed in true letter and spirit. This is reflected in the Operator's statement which states that there was no preceding occasion which required that Captain be debriefed regarding violation of procedures or parameters[17] whereas the Captain admitted to prior violations of SOPs.

1.17.3 **PIA FDA Analysis Programme –** As per PCAA Flight Standards Directorate ANO-028-FSXX-3.0, PIA is not bound to carry out Flight Data Analysis (FDA) of ATR flights but FDA was still carried out as a proactive safety measure. However, overall FDA rate for PIA was negligible and dedicated Flight Data Analyst was not available in PIA Safety Department till event flight. Nevertheless, since July, 2020, almost all flights are being analysed by a dedicated Flight Data Analyst[18].

1.17.4 **Oversight by PCAA –** The statistics pertaining to PIA regarding Landing approaches provide data for destabilized approaches as well as Go-Around from final Approach[19]. During audit conducted in November 2017, it was highlighted that 03 sets of aircrew were debriefed for violations / unsafe practices during the year 2016. However, no observations were raised on the FDA program of the Operator in the year 2018 or 2019[20].

[13] PIA – Crew Statements, Question No. 35
[14] PIA – Crew Statements, Question No.55
[15] PIA – Crew Statements, Question No No. 29
[16] PIA – Policy for FDA Debriefing
[17] PIA – Stance Regarding FDA Program on ATR and Captain's Safety Record
[18] PIA – Stance Regarding FDA Program on ATR and Captain's Safety Record
[19] PIA – Destabilized Approach Data
[20] PCAA – Response on PIA FDM Analysis

1.17.5 **Lack of practice for Go-Around –** Although SOPs exist for Northern Area airfields which specify the Go-Around procedure, practically this practice has been prohibited with passengers on-board and aircrew do not have sufficient experience or practice in executing a Go-Around from a non-stabilized Approach at high altitude airfields in confined areas like Gilgit Airport. Although the same is briefed verbally to aircrew, the practice for Go-Around is done in simulator training for general awareness and practice of Go-Around only without specific practice for airfields situated in confined areas or at high elevation[21].

1.17.6 **Weak academic knowledge of aircrew –** Interviews with the aircrew involved in the occurrence revealed a weak knowledge of rudimentary aerodynamic principles whereby the aircrew were unable to explain basic relationships of IAS, Calibrated Air Speed (CAS), True Air Speed (TAS) & Ground Speed (GS) and their various effects on aircraft performance.

1.18 Additional information

1.18.1 Not Applicable.

1.19 Useful or effective investigation techniques

1.19.1 Standard investigation procedures and techniques were used.

[21] PIA – SMS Investigation Report Page No. 8 & 9

SECTION 2 – ANALYSIS

2.1 General

2.1.1 PIA flight PIA 605 ATR 42-500, aircraft Reg. No. AP-BHP was a scheduled passenger flight from IIAP, Islamabad to Gilgit Airport. The aircraft was scheduled to depart under Instrument Flight Rules (IFR) from IIAP, Islamabad; however, Landing was to be under VFR at Gilgit airfield as the airport is located in a valley and all approaches are mandatorily VFR. Gilgit Airport is located at an altitude of 4,784 ft AMSL with R/W dimensions 5,400 x 100 ft and is deemed fit for operations under PCAA regulations.

2.2 Pre-departure

2.2.1 There was no abnormality reported in the aircraft, particularly any defect which could affect aircraft performance during Landing Roll. Aircraft loading was also within normal limits of 24.7% with TOGW 18,600 kg. As per meteorological information, weather at Gilgit was fair with no significant weather reported. The aircrew was also current, having been flying regularly for the past three months with numerous flights to Gilgit and back. They held a valid medical category and were well rested prior to undertaking the flight.

2.3 Ground operations

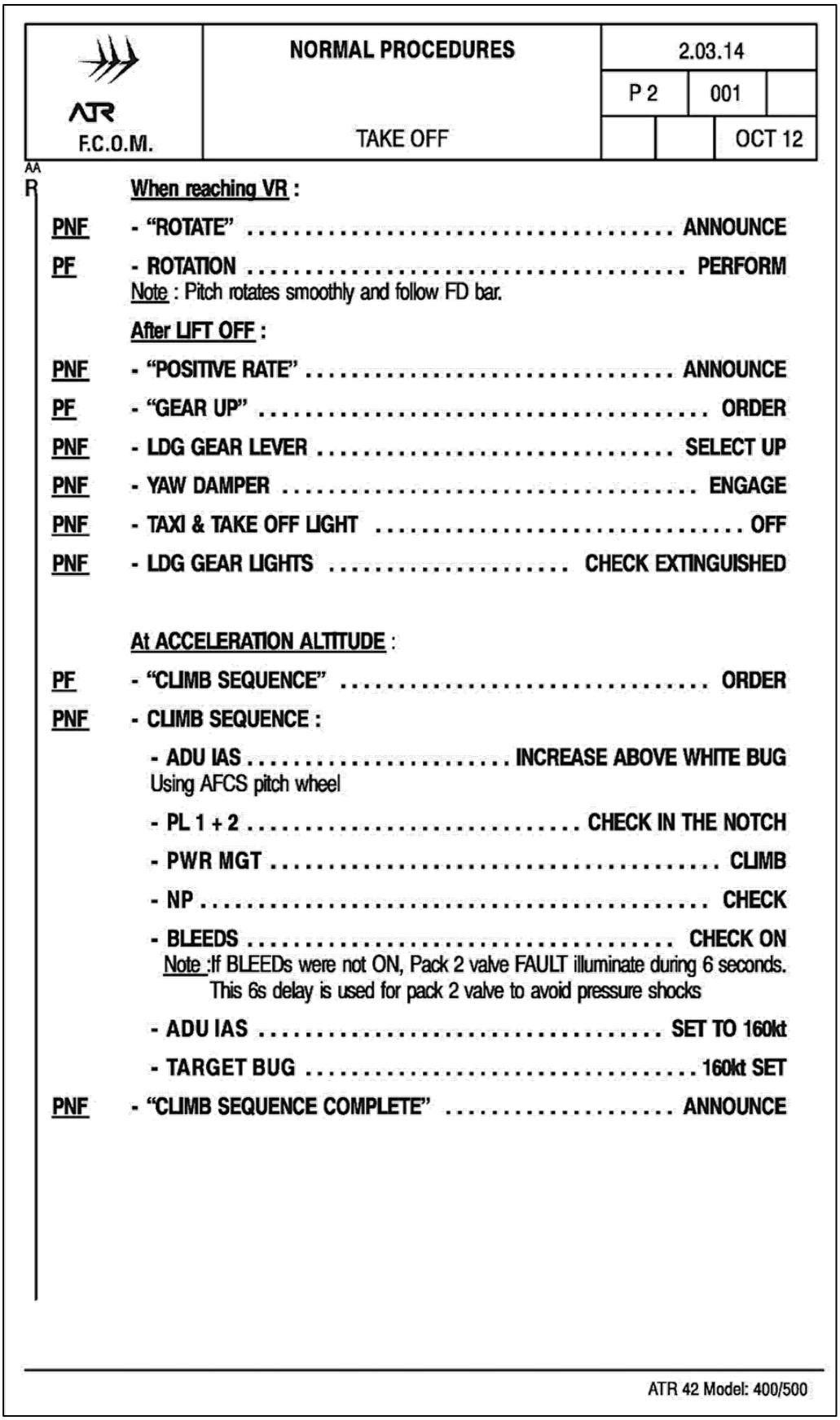
2.3.1 Ground operations were all normal.

2.4 Take-off

2.4.1 The aircraft took off from IIAP, Islamabad at 02:02 h. At 260 ft RA, the AP was engaged.

2.5 Climb

2.5.1 As the aircraft crossed 1,900 ft RA, VS mode was engaged. VS target was initially set at +400 ft/min which was subsequently increased to +1,700 ft/min and then to +2,000 ft/min which resulted in Pitch angle increasing to 15º and speed reducing to 130 kt as opposed to the standard climb speed of 160 kt. The VS mode remained engaged till Top of Climb (TOC). Crossing 13,200 ft, the VS target was reduced to +700 ft/min, then + 600 ft/min and finally to +500 ft/min. However, this still resulted in speed decrease to 178 kt. The ATR FCOM recommends to perform the climb in IAS vertical mode. However, this execution of climb after take-off to cruising level without adherence to FCOM defined parameters indicates a casual approach by PF which is exhibited by a disregard for procedures.



ATR F.C.O.M. | NORMAL PROCEDURES | TAKE OFF | 2.03.14 | P 2 | 001 | OCT 12

AA R

When reaching VR :

PNF - "ROTATE" ..... ANNOUNCE

PF - ROTATION ..... PERFORM

Note : Pitch rotates smoothly and follow FD bar.

After LIFT OFF :

PNF - "POSITIVE RATE" ..... ANNOUNCE

PF - "GEAR UP" ..... ORDER

PNF - LDG GEAR LEVER ..... SELECT UP

PNF - YAW DAMPER ..... ENGAGE

PNF - TAXI & TAKE OFF LIGHT ..... OFF

PNF - LDG GEAR LIGHTS ..... CHECK EXTINGUISHED

At ACCELERATION ALTITUDE :

PF - "CLIMB SEQUENCE" ..... ORDER

PNF - CLIMB SEQUENCE :

- ADU IAS ..... INCREASE ABOVE WHITE BUG
  Using AFCS pitch wheel
- PL 1 + 2 ..... CHECK IN THE NOTCH
- PWR MGT ..... CLIMB
- NP ..... CHECK
- BLEEDS ..... CHECK ON
  Note :If BLEEDs were not ON, Pack 2 valve FAULT illuminate during 6 seconds.
  This 6s delay is used for pack 2 valve to avoid pressure shocks
- ADU IAS ..... SET TO 160kt
- TARGET BUG ..... 160kt SET

PNF - "CLIMB SEQUENCE COMPLETE" ..... ANNOUNCE

ATR 42 Model: 400/500

Figure 11 FCOM Volume - II ATR 42-500

2.6 **Cruise**

2.6.1 The cruise was performed at FL165. During the cruise, the minimum RA height prior to descent was recorded as 2,636 ft; however, this is in accordance with PIA SOPs for Northern Area flights where minimum separation of 2,000 ft is mandatory due to mountains.

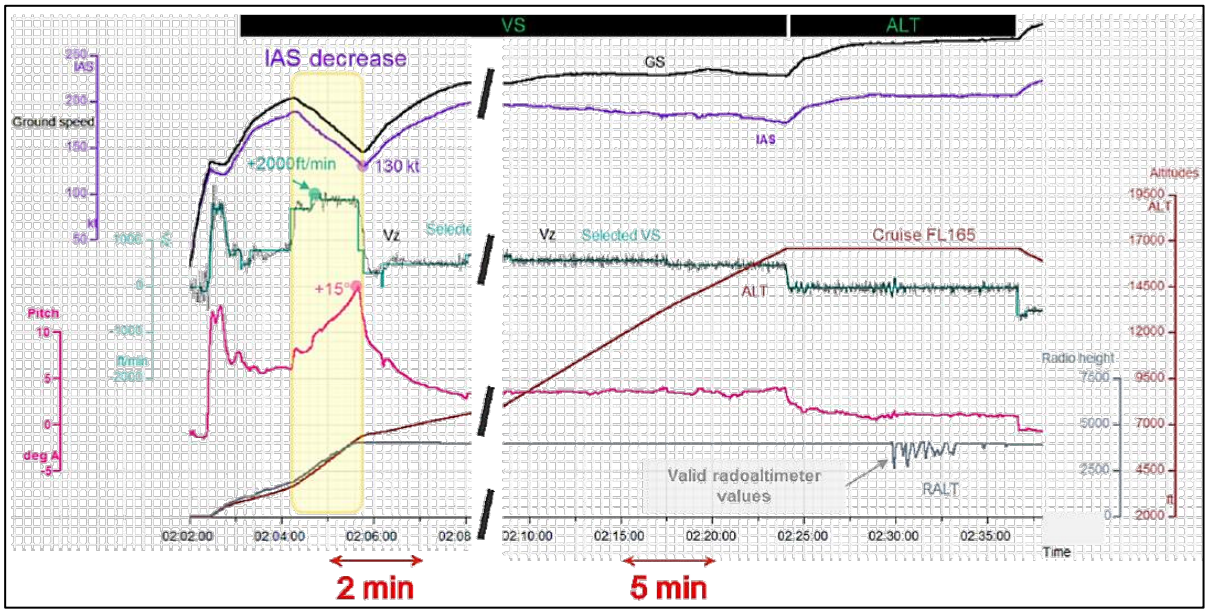


Figure 12 Flight Data (Take-off and Cruise)

2.7 **Descent for approach**

2.7.1 **PIA SOPs for Gilgit –** PIA has formulated SOPs specific for flights to Gilgit Airport in view of its geographical location and elevation so as to ensure safety during operations, to and from Gilgit. Some excerpts from PIA SOPs[22] for Gilgit are reproduced below: -

2.7.1.1 Operations for Gilgit Airport are VFR operations. IFR departures may be allowed from Islamabad / Peshawar; however, aircraft is to be in Visual Meteorological Conditions (VMC) before high terrain starts for approach to Gilgit.

2.7.1.2 Except for Take-off and Landing, obstacle clearance of 2,000 ft should be maintained. Aircraft should be flown in the center of the valley keeping the river in view at all times.

2.7.1.3 Normal descent Speed is 200 kt as per PIA SOPs. Crossing Bunji, Speed should be reduced to 180 kt.

2.7.1.4 Speed to be reduced further to 170 kt and configuration for landing should begin after Shighar valley.

2.7.1.5 As the speed reduces below 175 kt, Flaps 15 is selected and as speed reduces below 165 kt, L/G are lowered.

2.7.1.6 As the speed reduces further, Flaps 25 is selected below 155 kt and Flaps 35 below 145 kt.

[22] PIA – SOP Northern Area (Edition 2)

2.7.1.7 Aircraft should be fully configured for landing with checklist completed by the Broken Bridge.

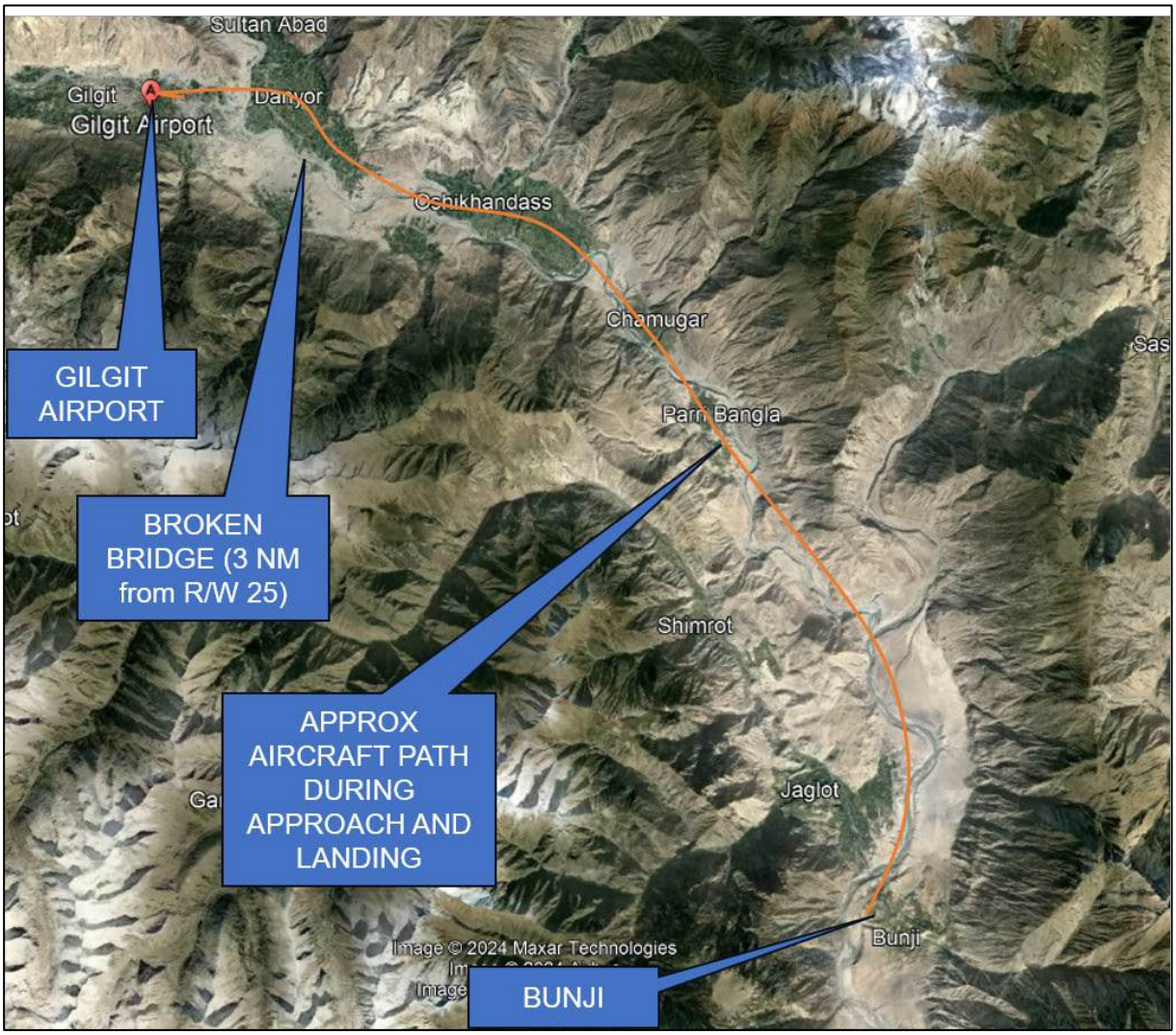


Figure 13 Approach to Gilgit Airport

2.7.1.8 R/W 25 shall be used for landing and excessive braking shall not be used unnecessarily.

2.7.1.9 In case needed, a normal Go-Around procedure shall be applied with some variations. Go-Around acceleration altitude is 5,800 ft on QNH. Reaching 5,800 ft AMSL, level off and maintain Flaps 25 with requisite speed limit to reduce the radius of the turn. Drift to the right of the valley and fly straight while keeping the Mosque on the left. Once abeam the Mosque, immediately turn left heading 070° to fly over the R/W. Once over the R/W, climb to 6,300 ft AMSL, maintain Speed White Bug+10 kt, and retract Flaps to 15. If another approach is anticipated, Flaps 15 may be maintained, and another approach may be attempted from beyond the Broken Bridge.

2.7.1.10 When flying to Gilgit, in case of Engine failure occurs before Decision Point (DP), proceed to Islamabad. If failure occurs after DP, continue while maintaining visual contact with the terrain, stay in the center of the valley and follow Drift Down Procedure as per SOP / FCOM to an altitude which gives adequate terrain clearance.

Figure 14 Gilgit Airport Approach R/W 25 (Broken Bridge View)

Figure 15 Gilgit Airport Go-Around R/W 25(Mosque View)

2.7.2 For Approach to Gilgit Airport, Captain initiated the descent at 02:36:37 h with VS target set at -600 ft/min and altitude selected at 10,500 ft. During descent, the aircraft was accelerated up to 245 kt instead of maintaining 200 kt as per PIA SOPs.

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:46:42	11086	4150	241	0	20.71	38352.49	FLAPS 0	303.5	348.1	UP	292.99
0:46:43	11045	4150	241	0	20.62	38197.39	FLAPS 0	304.5	347.4	UP	292.77
0:46:44	11011	4150	241	0	20.54	38041.77	FLAPS 0	304.5	347	UP	292.72
0:46:45	10982	4150	242	0	20.46	37886.14	FLAPS 0	305	346.7	UP	293.72
0:46:46	10952	4150	243	0	20.37	37730.27	FLAPS 0	305.5	346	UP	294.96
0:46:47	10921	4150	243	0	20.29	37574.14	FLAPS 0	305.5	345.6	UP	294.79
0:46:48	10891	4150	243	0	20.2	37418	FLAPS 0	306	345.3	UP	294.63
0:46:49	10855	4150	243	0	20.12	37261.61	FLAPS 0	306.5	344.9	UP	294.44
0:46:50	10819	4150	243	0	20.04	37104.96	FLAPS 0	306.5	344.9	UP	294.5
0:46:51	10789	4150	244	0	19.95	36948.32	FLAPS 0	305.5	345.3	UP	295.49
0:46:52	10750	4150	246	0	19.87	36792.18	FLAPS 0	306.5	345.3	UP	297.58
0:46:53	10713	4150	244	0	19.78	36635.53	FLAPS 0	306	345.3	UP	295.09
0:46:54	10681	4150	245	0	19.7	36479.14	FLAPS 0	305.5	344.9	UP	296.19
0:46:55	10647	4150	244	0	19.61	36323.01	FLAPS 0	305	344.6	UP	294.87
0:46:56	10619	4150	243	0	19.53	36167.13	FLAPS 0	305	344.6	UP	293.57
0:46:57	10585	4150	242	0	19.44	36011.26	FLAPS 0	304.5	344.2	UP	292.25
0:46:58	10554	4150	242	0	19.36	35855.64	FLAPS 0	304	344.2	UP	292.09
0:46:59	10522	4150	241	0	19.28	35700.27	FLAPS 0	303.5	343.9	UP	290.78

HIGH SPEED DESCENT

Figure 16 DFDR data (Descent)

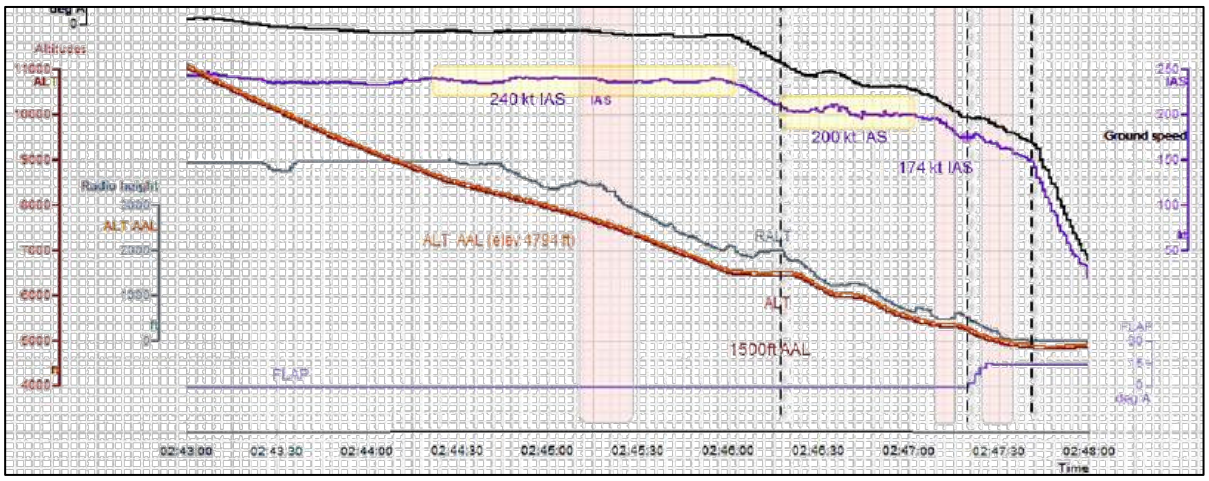


Figure 17 Flight Data (Descent)

2.7.3 Despite being earlier than planned ETA, the Captain still elected to maintain higher speed (contrary to SOPs) thereby compounding the problems subsequently. The FO pointed out the anomaly to Captain; however, Captain did not take any corrective action to reduce speed. Since the Captain did not pay any heed to the FO's caution, FO did not challenge the Captain at any further point in time. This reveals a failure of Crew Resource Management (CRM) on the part of both the aircrew. The Captain disregarded the FO's cautions completely while the FO also did not make any further attempts to correct the Captain. It also highlights the Captain's casual approach whereby the Captain was over-confident of her abilities and disregarded any cautions or safety aspects.

2.7.4 At 02:45:10 h, the EGPWS triggered an alert for 17 seconds (s). The aircraft position at this time was 10.1 Nautical Miles (NM) from R/W threshold at a height of 7,630 ft AMSL while the RA height varied between 3,000 to 3,500 ft during this alert. In case the speed criteria mentioned in PIA SOPs is adhered to, no EGPWS alerts are

generated as the aircraft is clear of terrain. This warning most likely triggered because of terrain in front of the aircraft which it would have reached in 55 s as per the parameters being maintained; however, if the aircraft had been flying at correct speed, then this alert could have been avoided. The aircraft levelled off at 2,000 ft AGL with AP engaged. The throttles were retarded to Flight Idle (FI) where they remained till touchdown. The speed gradually decreased from 240 kt to 200 kt.

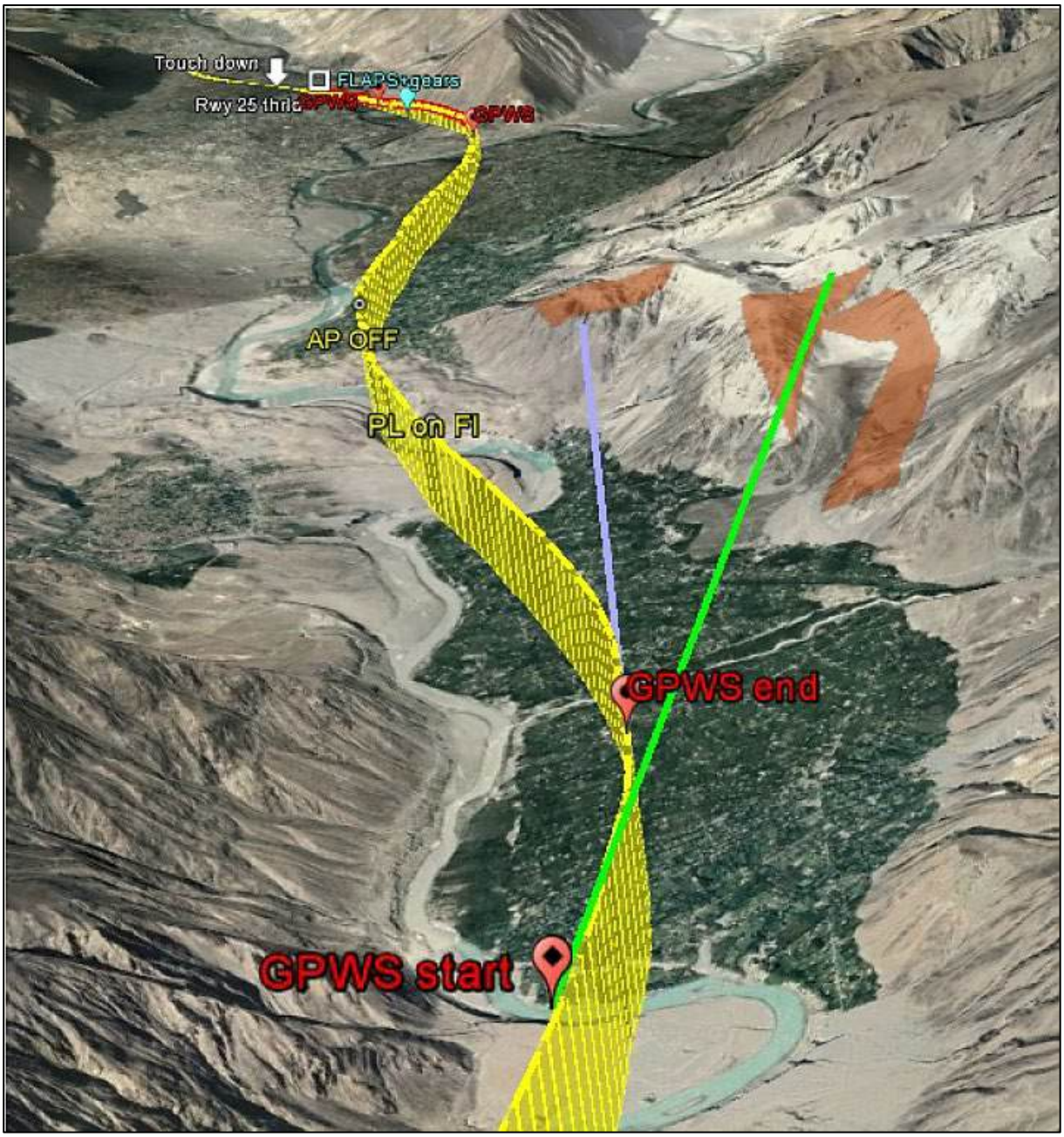


Figure 18 EGPWS Alert Depiction

2.8 **Base Leg**

2.8.1 The aircraft again started to descend after disengaging AP. As the aircraft was crossing 700 ft RA, the throttles were set to CL OVERRIDE position to increase drag. At 500 ft RA, the EGPWS alert and Master Warning were again triggered. The envelope and thresholds for EGPWS are as shown below: -

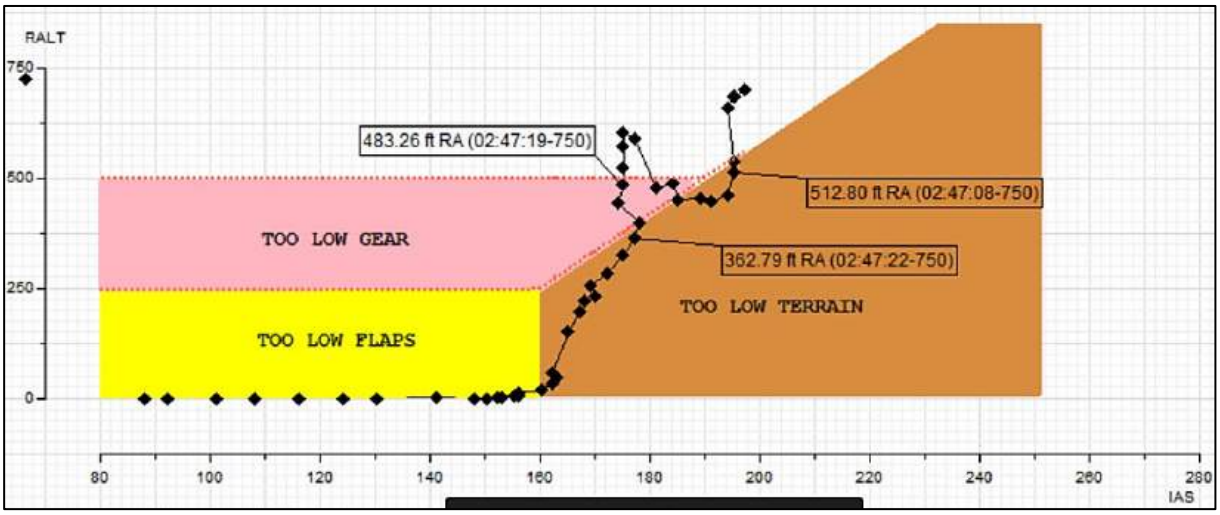


Figure 19 EGPWS Thresholds

2.8.2 At 02:47:08 h, once the aircraft was at 513 ft AGL, the “Too Low Terrain” warning sounded for 6 s due to high Rate of Descent (ROD) of 1,200 ft/min. During the base leg, at 02:48:54 h Captain announced tail wind picking up. Although the surface wind at this time was calm as per Meteorological Reports, but gusts were present during the Approach to the R/W.

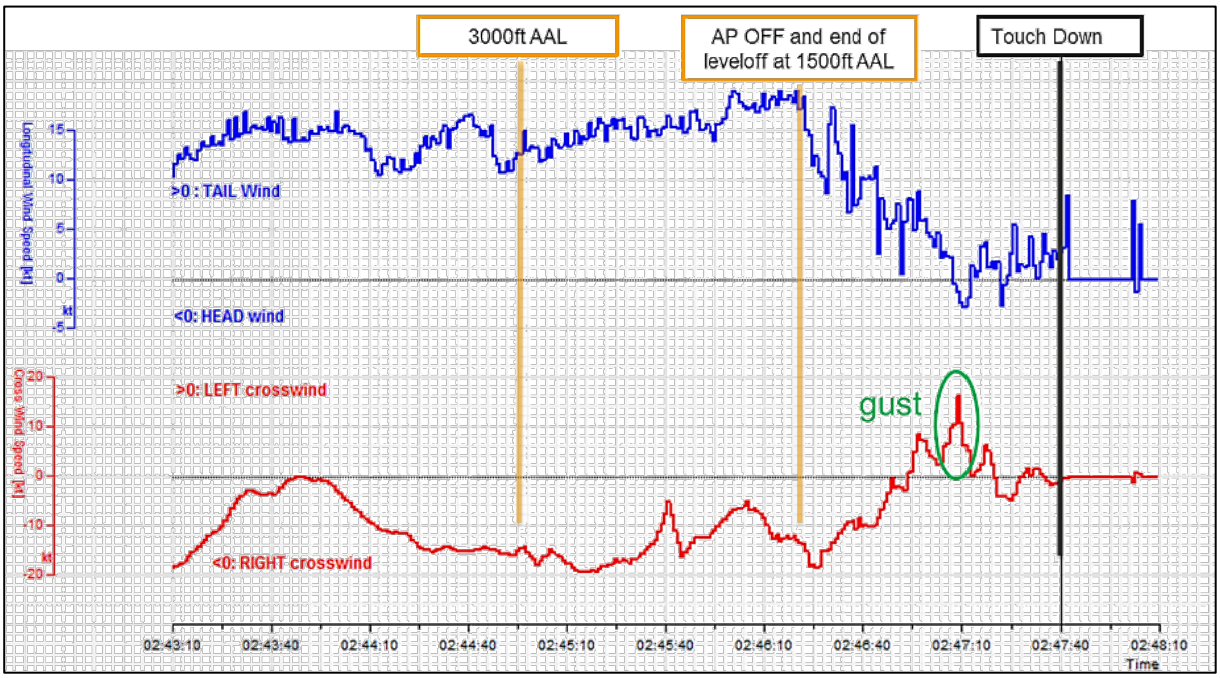


Figure 20 DFDR Data (Wind)

2.8.3 This is supported by DFDR data where the difference between TAS and GS is 1-5 kt once the aircraft is approaching R/W and on finals which indicates that wind on final Approach was not too significant and could have been catered for if the Approach had been made at correct speeds. Thus, while the tail wind may have contributed to increased float and Landing distance, it was not so significant that it could not have been catered by adhering to the correct speeds for Approach.

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:51:08	4964	363	177	0	0.47	863.13	TRANSIT DW	196.5	262.6	DOWN	198.26
0:51:09	4931	326	175	0	0.41	763.07	TRANSIT DW	195.5	261.9	DOWN	195.94
0:51:10	4912	283	172	0	0.36	663.52	TRANSIT DW	194.5	261.2	DOWN	192.58
0:51:11	4884	257	169	0	0.3	564.49	FLAPS 15	194	260.5	DOWN	189.19
0:51:12	4865	230	170	15	0.25	465.72	FLAPS 15	190.5	260.5	DOWN	190.3
0:51:13	4848	221	168	15	0.2	368.75	FLAPS 15	189	259.1	DOWN	188.05
0:51:14	4830	198	167	15	0.15	272.54	FLAPS 15	187.5	256.7	DOWN	186.81
0:51:15	4817	151	165	15	0.1	177.11	FLAPS 15	185.5	255.6	DOWN	184.57
0:51:16	4801	56	162	15	0.04	82.71	FLAPS 15	185	253.9	DOWN	181.14
0:51:17	4784	48	163	15	-0.01	-11.43	FLAPS 15	183	251.7	DOWN	182.19
0:51:18	4771	32	162	15	-0.06	-104.54	FLAPS 15	180.5	249.6	DOWN	180.9
0:51:19	4756	20	160	15	-0.11	-196.37	FLAPS 15	180	249.3	DOWN	178.65
0:51:20	4737	11	156	15	-0.16	-287.94	FLAPS 15	178.5	249.3	DOWN	174.27
0:51:21	4736	6	156	15	-0.2	-378.74	FLAPS 15	176.5	248.6	DOWN	174.27
0:51:22	4727	5	155	15	-0.25	-468.51	FLAPS 15	174	248.9	DOWN	173.14
0:51:23	4717	2	153	15	-0.3	-557	FLAPS 15	173.5	248.9	DOWN	170.91
0:51:24	4716	2	152	15	-0.35	-645.22	FLAPS 15	171.5	248.6	DOWN	169.8
0:51:25	4710	0	150	15	-0.4	-732.42	FLAPS 15	170	248.6	DOWN	167.58
0:51:26	4722	0	148	15	-0.44	-818.85	FLAPS 15	168	248.6	DOWN	165.42

Figure 21 DFDR Data: TAS & GS (Final Approach)

2.8.4 A notable difference existed between TAS & GS (10 kt & more) as shown by DFDR data indicating the presence of tail wind 1,200 ft AGL and above. As the CAS was already high from descent onwards (contrary to SOPs), the TAS and GS were also notably high. The increased GS resulted in faster ground travel, thus reducing reaction time for the aircrew. This difficulty had not been anticipated by the Captain which demonstrates a poor academic knowledge of basic aerodynamic and performance principles.

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:50:13	6113	1411	205	0	3.89	7207.26	FLAPS 0	242	306.9	UP	233.05
0:50:14	6068	1333	206	0	3.82	7083.79	FLAPS 0	241.5	308.4	UP	233.97
0:50:15	6028	1291	203	0	3.76	6960.58	FLAPS 0	245.5	309.4	UP	230.49
0:50:16	5989	1273	202	0	3.69	6835.31	FLAPS 0	245.5	309.8	UP	229.32
0:50:17	5947	1256	206	0	3.62	6710.04	FLAPS 0	246.5	308.7	UP	233.56
0:50:18	5911	1232	207	0	3.56	6584.26	FLAPS 0	246.5	308	UP	234.6
0:50:19	5877	1211	210	0	3.49	6458.48	FLAPS 0	247.5	308	UP	237.76
0:50:20	5856	1201	208	0	3.42	6332.19	FLAPS 0	246	308	UP	235.66
0:50:21	5844	1199	211	0	3.35	6206.66	FLAPS 0	245.5	308.7	UP	238.91
0:50:22	5823	1203	203	0	3.28	6081.39	FLAPS 0	245.5	308.4	UP	230.12
0:50:23	5841	1213	208	0	3.22	5956.13	FLAPS 0	243	306.9	UP	235.7
0:50:24	5836	1211	206	0	3.15	5832.15	FLAPS 0	241.5	309.1	UP	233.48
0:50:25	5835	1218	202	0	3.08	5708.94	FLAPS 0	239	311.2	UP	229.07
0:50:26	5829	1230	200	0	3.02	5587.01	FLAPS 0	237	312.2	UP	226.87
0:50:27	5811	1231	199	0	2.95	5466.12	FLAPS 0	236	313.6	UP	225.7
0:50:28	5808	1226	198	0	2.89	5345.74	FLAPS 0	234.5	314	UP	224.58
0:50:29	5792	1218	195	0	2.82	5226.13	FLAPS 0	232.5	312.9	UP	221.2
0:50:30	5789	1215	202	0	2.76	5107.55	FLAPS 0	231	312.2	UP	228.82
0:50:31	5749	1201	199	0	2.69	4989.74	FLAPS 0	232.5	311.9	UP	225.35

Figure 22 DFDR Data: TAS & GS (1,200 ft AGL & above)

2.8.5 Due to late speed reduction, the CAS could not reduce to be within limits for the aircraft to be configured for Landing (Speed 30-40 kt higher than L/G lowering speed). At 02:49:11 h, the Captain asked the FO's opinion for carrying out a 360° turn to reduce the speed for Landing configuration. However, the FO left the decision to the Captain as, in his opinion, the speed was too high and the radius of turn might result in a Controlled Flight Into Terrain (CFIT). Also, they were not trained for such manoeuvres in a confined space like the valley. Moreover, as the Captain was more experienced and also his instructor, he trusted the Captain's judgment and skill to make a successful

Landing. Since the FO did not give any opinion on Captain's suggestion for a 360° turn, the Captain continued the Approach. This again is a perfect example of CRM failure where the FO failed to voice his concerns owing to the Captain's stature and seniority; and the Captain failed to comprehend the FO's hesitation by taking it as a sign to continue despite the abnormal parameters.

2.9 Base turn & Landing configuration

2.9.1 As per PIA SOPs, the aircraft must be in landing configuration by minimum 3 NM from the R/W (abeam Broken Bridge). However, due to higher speed, the aircraft could not be configured for Landing at the designated point prior to base leg or even during base leg. At 02:47:14 h, the "Too Low Gear" warning sounded for 2 s due to incorrect configuration once the aircraft was at 488 ft RA at a speed of 184 kt. The same warning was again triggered due to the same reason at 02:47:20 h when the aircraft was at 500 ft RA at 175 kt. Despite repeated warnings, the Captain made no attempt to discontinue the Approach, or take any remedial measures and no actions were initiated on EGPWS warnings. The aircraft is supposed to be in correct Landing configuration prior to commencement of base leg; however, L/G were lowered upon initiation of base turn at a height of 442 ft AGL with remaining distance to R/W 0.57 NM.

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:51:03	5130	587	175	0	0.74	1362.65	FLAPS 0	197	259.5	UP	196.65
0:51:04	5099	562	175	0	0.68	1262.34	FLAPS 0	197	258.4	UP	196.54
0:51:05	5066	491	175	0	0.63	1162.02	TRANSIT DW	196	258.4	UP	196.42
0:51:06	5030	442	174	0	0.57	1062.22	TRANSIT DW	195.5	259.8	DOWN	195.11
0:51:07	4995	399	178	0	0.52	962.67	TRANSIT DW	195.5	261.6	DOWN	199.38
0:51:08	4964	363	177	0	0.47	863.13	TRANSIT DW	196.5	262.6	DOWN	198.26
0:51:09	4931	326	175	0	0.41	763.07	TRANSIT DW	195.5	261.9	DOWN	195.94
0:51:10	4912	283	172	0	0.36	663.52	TRANSIT DW	194.5	261.2	DOWN	192.58
0:51:11	4884	257	169	0	0.3	564.49	FLAPS 15	194	260.5	DOWN	189.19
0:51:12	4865	230	170	15	0.25	465.72	FLAPS 15	190.5	260.5	DOWN	190.3

Figure 23 DFDR Data: Configuration Change

2.9.2 Moreover, the Captain did not carry out an academic base turn. Instead, the aircraft approached the R/W at an angle of 10°-15° from final R/W heading by cutting corners and heading directly for the R/W threshold.

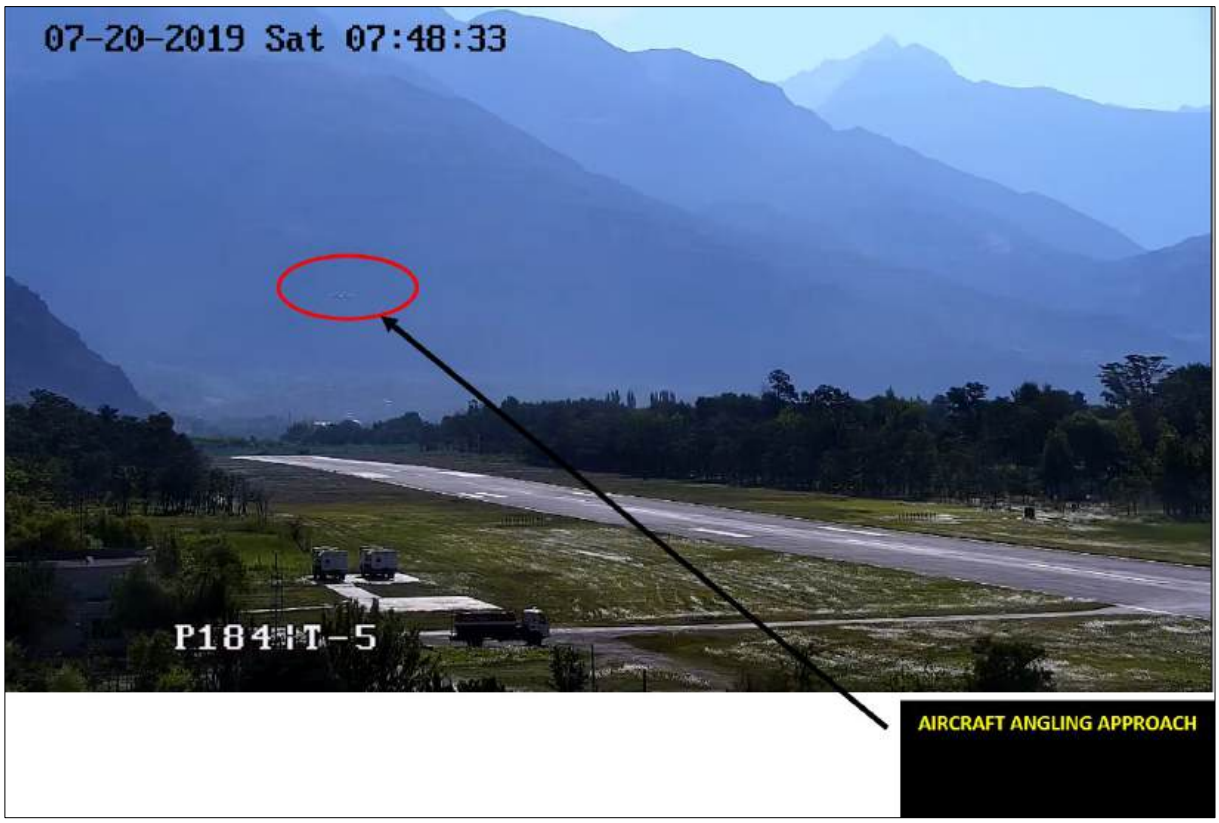


Figure 24 Aircraft Approach Path

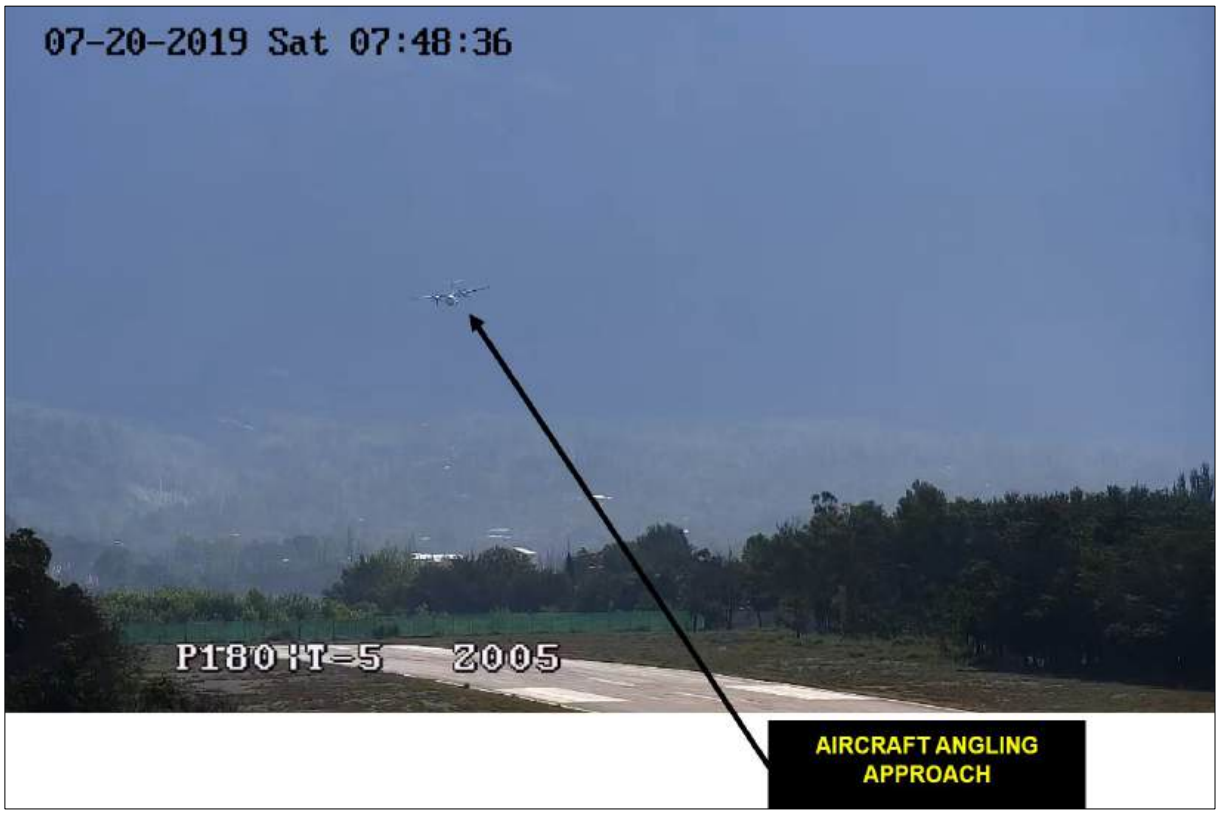


Figure 25 Aircraft Angling Approach – 1

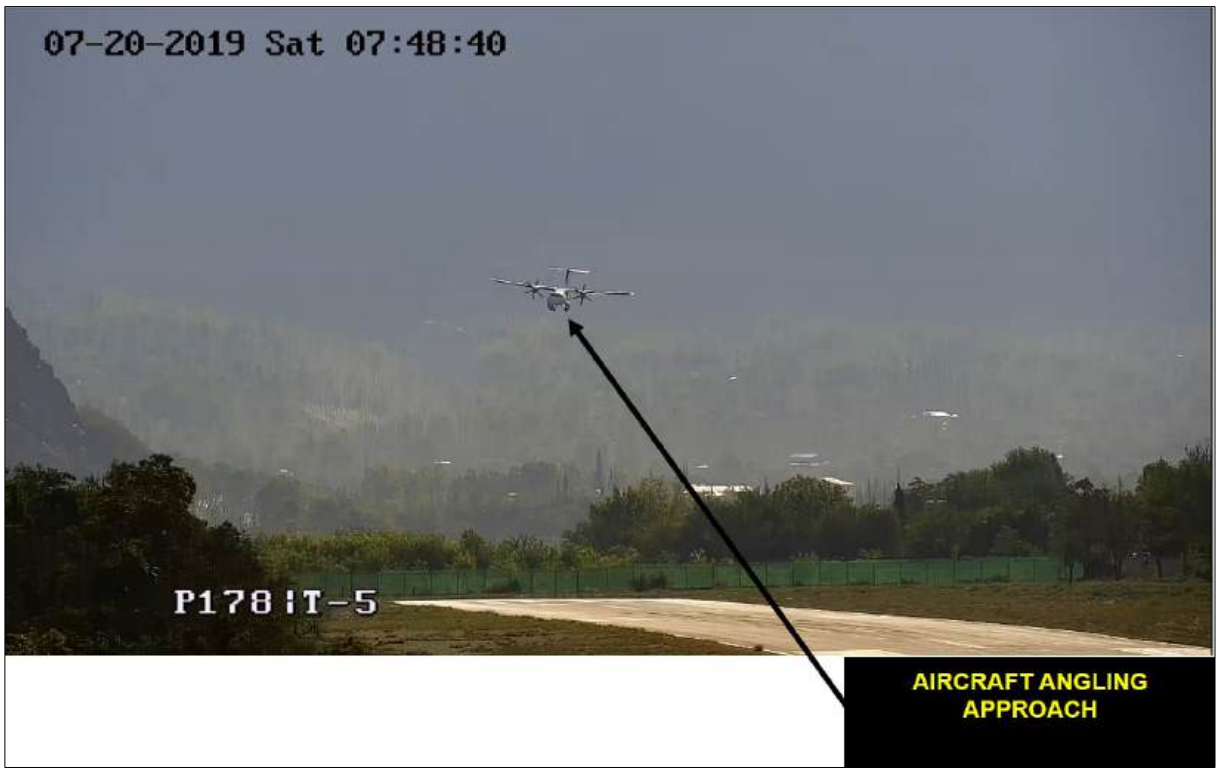


Figure 26 Aircraft Angling Approach – 2

2.9.3 This action resulted in reduced track length and lesser speed depletion. As the aircraft was heading towards the R/W, the aircraft was brought to partial Landing configuration. The Flaps were selected to 15° at 175 kt (Speed for Flaps 15°: 180 kt) and 491 ft AGL followed immediately by lowering of L/G at 442 ft AGL. The L/G, however, were lowered at 174 kt whereas the speed for L/G lowering is 170 kt. The aircraft veered right and then turned left to align itself with the R/W. At 02:47:25 h, another EGPWS warning triggered when the aircraft crossed the threshold of 500 ft AGL with L/G still not in down and locked position. Despite this EGPWS warning at such a low height, no attempt was made by the Captain to Go-Around from the Approach. The Flaps came down to 15° position at 257 ft AGL whereas the L/G attained down and locked position only once the aircraft was rolling out on R/W heading at an altitude of approximately 50 ft AGL at a speed of 162-163 kt.

AIRCRAFT CONFIGURATION CHANGE

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:51:02	5146	604	175	0	0.79	1464.51	FLAPS 0	200	258.4	UP	196.71
0:51:03	5130	587	175	0	0.74	1362.65	FLAPS 0	197	259.5	UP	196.65
0:51:04	5099	562	175	0	0.68	1262.34	FLAPS 0	197	258.4	UP	196.54
0:51:05	5066	491	175	0	0.63	1162.02	TRANSIT DW	196	258.4	UP	196.42
0:51:06	5030	442	174	0	0.57	1062.22	TRANSIT DW	195.5	259.8	DOWN	195.11
0:51:07	4995	399	178	0	0.52	962.67	TRANSIT DW	195.5	261.6	DOWN	199.38
0:51:08	4964	363	177	0	0.47	863.13	TRANSIT DW	196.5	262.6	DOWN	198.26
0:51:09	4931	326	175	0	0.41	763.07	TRANSIT DW	195.5	261.9	DOWN	195.94
0:51:10	4912	283	172	0	0.36	663.52	TRANSIT DW	194.5	261.2	DOWN	192.58
0:51:11	4884	257	169	0	0.3	564.49	FLAPS 15	194	260.5	DOWN	189.19
0:51:12	4865	230	170	15	0.25	465.72	FLAPS 15	190.5	260.5	DOWN	190.3
0:51:13	4848	221	168	15	0.2	368.75	FLAPS 15	189	259.1	DOWN	188.05
0:51:14	4830	198	167	15	0.15	272.54	FLAPS 15	187.5	256.7	DOWN	186.81
0:51:15	4817	151	165	15	0.1	177.11	FLAPS 15	185.5	255.6	DOWN	184.57
0:51:16	4801	56	162	15	0.04	82.71	FLAPS 15	185	253.9	DOWN	181.14
0:51:17	4784	48	163	15	-0.01	-11.43	FLAPS 15	183	251.7	DOWN	182.19
0:51:18	4771	32	162	15	-0.06	-104.54	FLAPS 15	180.5	249.6	DOWN	180.9
0:51:19	4756	20	160	15	-0.11	-196.37	FLAPS 15	180	249.3	DOWN	178.65

GEARS DOWN & LOCKED

Figure 27 DFDR Data: Configuration Change

Figure 28 L/G in Transition – 1

Figure 29 L/G in Transition – 2

Figure 30 L/G in Transition Approaching Roll Out Point

Figure 31 L/G Down & Locked Short of Roll Out

2.10 **Roll out & runway alignment**

2.10.1 After selecting the Flaps to 15° and L/G lever down, the aircraft was put in left bank at a height of 230 ft AGL to align with the R/W. As the L/G became down & locked at approximately 50 ft AGL, the aircraft continued to remain in bank and rolled out in line with R/W heading at a height of approximately 30 ft AGL, upon entering the R/W. Just short of overflying the R/W threshold in left bank, EGPWS “Too Low Terrain” warning was triggered with aircraft at 55 ft RA and ROD 800 ft / min.

Figure 32 Aircraft in Bank Short of Entering R/W

Figure 33 Aircraft after Entering Runway

2.10.2 As a result, full Flaps could not be lowered since the speeds for selecting 25° and 35° Flaps are 160 kt and 150 kt respectively. Owing to a combination of incorrect / reduced base turn track, late Landing configuration and partial Flaps, the speed depletion rate on base turn and final Approach remained low and correct Landing configuration could not be attained prior to touchdown.

2.11 **Touchdown**

2.11.1 The aircraft entered the R/W at approximately 160 kt (Approach speed calculated for Landing weight: 103 kt[23]) and despite the higher speed (Approach speed may be maintained up to 110-115 kt CAS in case of wind gusts), was made to

[23] PIA – Aircraft Landing Data

touchdown by the Captain approximately 2,000 ft down the R/W at 150 kt (Ground speed: 170 kt), leaving approximately 3,400 ft for the aircraft to decelerate to taxi speed. As the aircraft touched down, the Captain retarded the throttles initially to reverse but then set them to just below Ground Idle (GI) position. Meanwhile the FO pushed the aircraft nose down on his controls. However, despite Landing at high speed, Captain did not use Thrust Reversers. The throttles must be held back in Reverse position otherwise they return to GI position upon releasing them. The Captain thus only applied brakes to stop the aircraft.

Figure 34 Aircraft on Flare Out – 1

Figure 35 Aircraft on Flare Out – 2

Figure 36 Aircraft Touchdown

Figure 37 Aircraft Touchdown Distance

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:51:20	4737	11	156	15	-0.16	-287.94	FLAPS 15	178.5	249.3	DOWN	174.27
0:51:21	4736	6	156	15	-0.2	-378.74	FLAPS 15	176.5	248.6	DOWN	174.27
0:51:22	4727	5	155	15	-0.25	-468.51	FLAPS 15	174	248.9	DOWN	173.14
0:51:23	4717	2	153	15	-0.3	-557	FLAPS 15	173.5	248.9	DOWN	170.91
0:51:24	4716	2	152	15	-0.35	-645.22	FLAPS 15	171.5	248.6	DOWN	169.8
0:51:25	4710	0	150	15	-0.4	-732.42	FLAPS 15	170	248.6	DOWN	167.58
0:51:26	4722	0	148	15	-0.44	-818.85	FLAPS 15	168	248.6	DOWN	165.42
0:51:27	4662	0	141	15	-0.49	-904.25	FLAPS 15	165.5	249.3	DOWN	157.52

Figure 38 Aircraft Touchdown Distance (DFDR Data)

2.12 **Braking**

2.12.1 Assuming that in case the aircraft had approached at correct speeds and had touched down at 100 kt followed by instantaneous brake application, the brake application would have commenced at 130 kt GS.

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:51:25	4710	0	150	15	-0.4	-732.42	FLAPS 15	170	248.6	DOWN	167.58
0:51:26	4722	0	148	15	-0.44	-818.85	FLAPS 15	168	248.6	DOWN	165.42
0:51:27	4662	0	141	15	-0.49	-904.25	FLAPS 15	165.5	249.3	DOWN	157.52
0:51:28	4666	-1	130	15	-0.53	-988.36	FLAPS 15	161.5	249.3	DOWN	0
0:51:29	4670	-1	124	15	-0.58	-1070.41	FLAPS 15	150	248.2	DOWN	0
0:51:30	4668	-1	116	15	-0.62	-1146.55	FLAPS 15	141	248.9	DOWN	0
0:51:31	4658	-1	108	15	-0.66	-1218.06	FLAPS 15	138.5	248.9	DOWN	0
0:51:32	4656	-2	101	15	-0.7	-1288.28	FLAPS 15	130.5	248.2	DOWN	0
0:51:33	4658	-1	92	15	-0.73	-1354.39	FLAPS 15	122.5	248.2	DOWN	0
0:51:34	4668	-1	88	15	-0.76	-1416.38	FLAPS 15	118.5	248.2	DOWN	0

Figure 39 Appropriate Brake Application Parameters (DFDR Data)

2.12.2 However, due to brake application at 170 kt GS with no Thrust Reversal, the braking proved to be insufficient to successfully stop the aircraft within the remaining length of R/W.

Time	Baro Alt (ft)	Radio Ht (ft)	Calib Air Speed _CAS (kts)	Flaps _CONF	Dist to THR NM	Dist to THR METERS (m)	Flaps Posit _FLAPS	Gnd speed _GS (kts)	Hdg (rad)	Land Gear Sel _LDG_SEL	True air speed _TAS (kts)
0:51:20	4737	11	156	15	-0.16	-287.94	FLAPS 15	178.5	249.3	DOWN	174.27
0:51:21	4736	6	156	15	-0.2	-378.74	FLAPS 15	176.5	248.6	DOWN	174.27
0:51:22	4727	5	155	15	-0.25	-468.51	FLAPS 15	174	248.9	DOWN	173.14
0:51:23	4717	2	153	15	-0.3	-557	FLAPS 15	173.5	248.9	DOWN	170.91
0:51:24	4716	2	152	15	-0.35	-645.22	FLAPS 15	171.5	248.6	DOWN	169.8
0:51:25	4710	0	150	15	-0.4	-732.42	FLAPS 15	170	248.6	DOWN	167.58
0:51:26	4722	0	148	15	-0.44	-818.85	FLAPS 15	168	248.6	DOWN	165.42
0:51:27	4662	0	141	15	-0.49	-904.25	FLAPS 15	165.5	249.3	DOWN	157.52

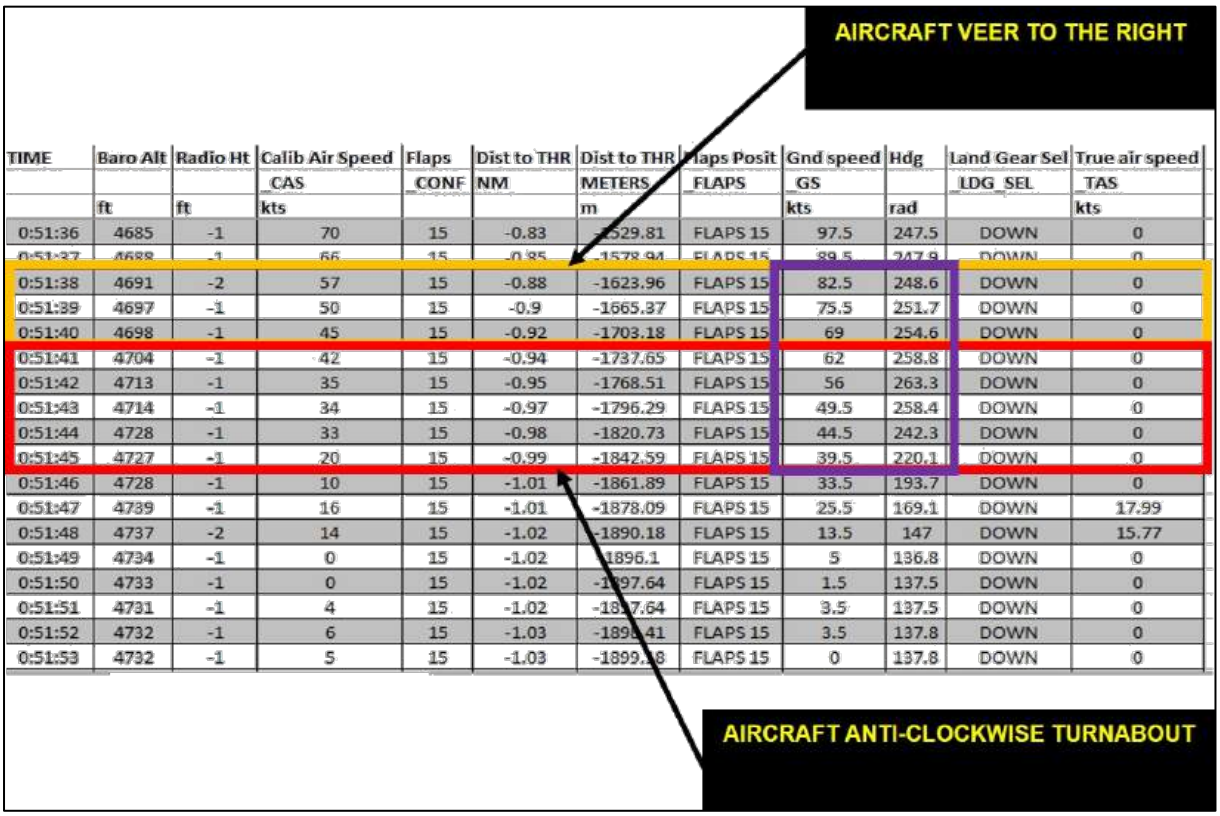
Figure 40 Actual Brake Application(DFDR Data)

2.12.3 The higher momentum as a result of higher touchdown speed {above 115 kt GS (average touchdown speed 100 kt + 15 kt)} versus remaining R/W length resulted in inability of the brakes to reduce the aircraft speed as required.

2.13 **Runway excursion**

2.13.1 As the aircraft approached end of R/W, the Captain realized that the aircraft would not be able to slow down sufficiently to stop on the R/W. To avoid going off the R/W, the Captain tried to turn about the aircraft. At 02:47:53 h, the aircraft was veered to the right at 75 kt.

Figure 41 Aircraft Tyre Marks

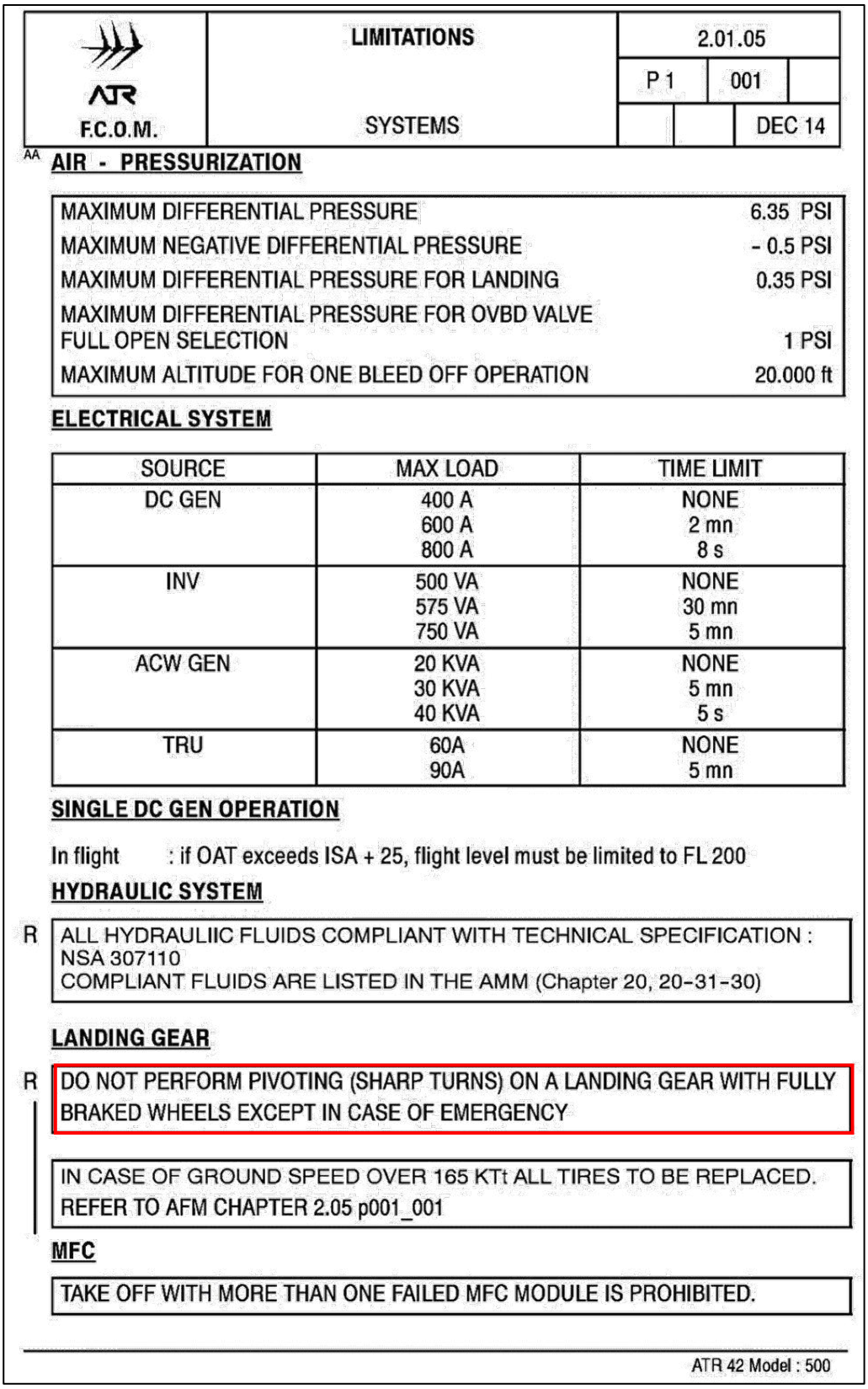


TIME	Baro Alt	Radio Ht	Calib Air Speed	Flaps	Dist to THR	Dist to THR	Flaps Posit	Gnd speed	Hdg	Land Gear Sel	True air speed
			CAS	CONF	NM	METERS	FLAPS	GS		LDG_SEL	TAS
	ft	ft	kts			m		kts	rad		kts
0:51:36	4685	-1	70	15	-0.83	-1529.81	FLAPS 15	97.5	247.5	DOWN	0
0:51:37	4688	-1	66	15	-0.85	-1578.94	FLAPS 15	89.5	247.9	DOWN	0
0:51:38	4691	-2	57	15	-0.88	-1623.96	FLAPS 15	82.5	248.6	DOWN	0
0:51:39	4697	-1	50	15	-0.9	-1665.37	FLAPS 15	75.5	251.7	DOWN	0
0:51:40	4698	-1	45	15	-0.92	-1703.18	FLAPS 15	69	254.6	DOWN	0
0:51:41	4704	-1	42	15	-0.94	-1737.65	FLAPS 15	62	258.8	DOWN	0
0:51:42	4713	-1	35	15	-0.95	-1768.51	FLAPS 15	56	263.3	DOWN	0
0:51:43	4714	-1	34	15	-0.97	-1796.29	FLAPS 15	49.5	258.4	DOWN	0
0:51:44	4728	-1	33	15	-0.98	-1820.73	FLAPS 15	44.5	242.3	DOWN	0
0:51:45	4727	-1	20	15	-0.99	-1842.59	FLAPS 15	39.5	220.1	DOWN	0
0:51:46	4728	-1	10	15	-1.01	-1861.89	FLAPS 15	33.5	193.7	DOWN	0
0:51:47	4739	-1	16	15	-1.01	-1878.09	FLAPS 15	25.5	169.1	DOWN	17.99
0:51:48	4737	-2	14	15	-1.02	-1890.18	FLAPS 15	13.5	147	DOWN	15.77
0:51:49	4734	-1	0	15	-1.02	-1896.1	FLAPS 15	5	136.8	DOWN	0
0:51:50	4733	-1	0	15	-1.02	-1897.64	FLAPS 15	1.5	137.5	DOWN	0
0:51:51	4731	-1	4	15	-1.02	-1897.64	FLAPS 15	3.5	137.5	DOWN	0
0:51:52	4732	-1	6	15	-1.03	-1898.41	FLAPS 15	3.5	137.8	DOWN	0
0:51:53	4732	-1	5	15	-1.03	-1899.18	FLAPS 15	0	137.8	DOWN	0

Figure 42 Aircraft Turns (DFDR Data)

2.13.2 At time 02:47:56 h, the aircraft was turned anti-clockwise at 56 kt while applying brakes. Simultaneously, right throttle was pushed forward for 6 s while left throttle remained at idle. As per ATR 42-500 FCOM Volume 2, pivoting (sharp turns) on L/G with fully braked wheels is prohibited except in emergencies.

Figure 43 Aircraft Tyre Marks During R/W Excursion



ATR F.C.O.M.	LIMITATIONS SYSTEMS	2.01.05 P 1 | 001 DEC 14

AA **AIR - PRESSURIZATION**

MAXIMUM DIFFERENTIAL PRESSURE	6.35 PSI
MAXIMUM NEGATIVE DIFFERENTIAL PRESSURE	- 0.5 PSI
MAXIMUM DIFFERENTIAL PRESSURE FOR LANDING	0.35 PSI
MAXIMUM DIFFERENTIAL PRESSURE FOR OVBD VALVE FULL OPEN SELECTION	1 PSI
MAXIMUM ALTITUDE FOR ONE BLEED OFF OPERATION	20.000 ft

ELECTRICAL SYSTEM

SOURCE	MAX LOAD	TIME LIMIT
DC GEN	400 A 600 A 800 A	NONE 2 mn 8 s
INV	500 VA 575 VA 750 VA	NONE 30 mn 5 mn
ACW GEN	20 KVA 30 KVA 40 KVA	NONE 5 mn 5 s
TRU	60A 90A	NONE 5 mn

SINGLE DC GEN OPERATION

In flight : if OAT exceeds ISA + 25, flight level must be limited to FL 200

HYDRAULIC SYSTEM

R ALL HYDRAULIIC FLUIDS COMPLIANT WITH TECHNICAL SPECIFICATION : NSA 307110
COMPLIANT FLUIDS ARE LISTED IN THE AMM (Chapter 20, 20-31-30)

LANDING GEAR

R DO NOT PERFORM PIVOTING (SHARP TURNS) ON A LANDING GEAR WITH FULLY BRAKED WHEELS EXCEPT IN CASE OF EMERGENCY

IN CASE OF GROUND SPEED OVER 165 KTt ALL TIRES TO BE REPLACED.
REFER TO AFM CHAPTER 2.05 p001_001

MFC

TAKE OFF WITH MORE THAN ONE FAILED MFC MODULE IS PROHIBITED.

ATR 42 Model : 500

Figure 44 FCOM Volume - II ATR-42-500: Limitations

2.13.3 Due to high centrifugal forces resulting from high-speed turn, the aircraft could not be controlled and went off the R/W. As the aircraft departed the R/W, the unpaved ground exerted further stress on the Landing gears. The right MLG, already under strain due centrifugal forces, was unable to withstand the extra force and collapsed. This resulted in damage to the airframe as well as the engine which was running at the time. As the right MLG collapsed and the aircraft came to a stop, the aircrew shut down the engines and other systems.

Figure 45 Aircraft Post R/W Excursion

2.14 **Post excursion actions**

2.14.1 Contrary to procedures, the Captain instructed the Cabin Crew to remain at their stations and did not ask for immediate evacuation as it was felt that there was no immediate danger and thus no cause for immediate evacuation. The passengers were subsequently evacuated safely.

2.15 **Supervisory and contributory lapses**

2.15.1 **Lack of FDA analysis and debrief by PIA –** The absence of a dedicated analyst and resultant low FDA ratio along with absence of debriefs / cautions to the aircrew by PIA may have contributed towards previous unsafe trends of the aircrew which ultimately resulted in the aircraft making a high-speed Approach (above 200 kt during Approach & above 110-115 kt during finals) and going off the R/W during Landing.

2.15.2 **Lack of supervision by PCAA –** The absence of monitoring of FDA debriefs vs non-stabilized approaches indicates a large disparity and lack of supervision by PCAA on PIA.

2.15.3 **Weak academic knowledge of aircrew –** The lack of knowledge regarding understanding of basic aerodynamic principles thus leading to lack of situational awareness as well as general understanding of variations and their effects on aircraft performance at high altitudes and high elevation airfields contributed towards the occurrence.

2.16 **Human factor analysis**

2.16.1 There are five identified hazardous attitudes in aviation[24] which can adversely affect the outcome of a flight and flying operations. These are: -

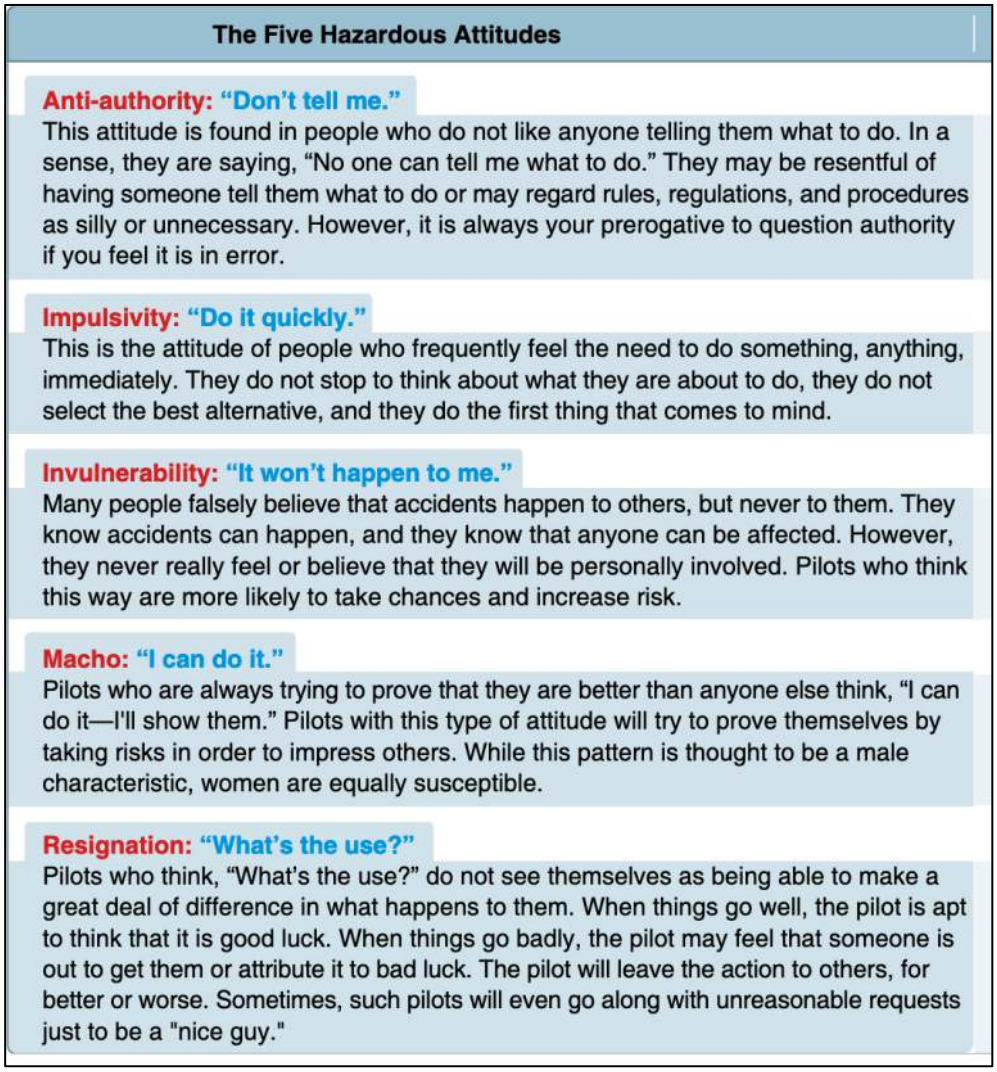


Figure 46 The Five Hazardous Attitude in Aviation

2.16.2 Analysis of the flight and aircrew actions revealed several actions by the Captain contrary to FCOM and PIA SOPs. These are: -

2.16.2.1 Maintaining of higher ROC with resultant low speed for climb.

2.16.2.2 Maintaining of higher-than-normal speed in valley while descending and approaching the airfield.

2.16.2.3 Demonstration of high-speed Approach and Landing to FO without prior authorization or briefing.

2.16.2.4 Disregard of SOPs.

2.16.2.5 No attempt to discontinue Approach despite incorrect parameters.

2.16.2.6 Non-usage of Thrust Reversal despite excessively high Landing speed.

[24] Neff, P. S. (2022). The Five Hazardous Attitudes, A Subset of Complacency. *International Journal of Aviation, Aeronautics, and Aerospace, 9(1)*.

2.16.3 In light of the actions taken by the aircrew, the Captain exhibited the following Hazardous Attitudes during the occurrence flight: -

2.16.3.1 **Anti-authority –** Disregard for SOPs stated in FCOM as well as operating procedures specified by PIA.

2.16.3.2 **Impulsivity –** In-flight decision to make a high-speed approach without prior authorization or briefing and without considering the subsequent consequences.

2.16.3.3 **Invulnerability –** Considering one's self to be immune to accidents and believing that nothing would happen despite exceedance of parameters.

2.16.3.4 **Machoism –** Need to demonstrate professional superiority resulting from over-confidence.

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SECTION 3 - CONCLUSIONS

3.1 **Findings**

3.1.1 PIA flight PIA 605 aircraft Reg. No. AP-BHP was a scheduled passenger flight from IIAP, Islamabad to Gilgit Airport.

3.1.2 The aircrew was qualified, medically fit, current, and experienced for flying the aircraft to Gilgit.

3.1.3 There was no reported abnormality in the aircraft, particularly any defect related to aircraft performance during Landing Roll.

3.1.4 The aircraft loading was at 24.7% CG which was within limits with a TOGW of 18,600 kg.

3.1.5 Weather at Gilgit was reported to be fair with no significant weather.

3.1.6 Ground operations were uneventful.

3.1.7 The Captain was PF while FO was PM for the flight.

3.1.8 After Take-off AP was engaged at 260 ft RA.

3.1.9 Upon crossing 1,900 ft RA, VS mode was engaged contrary to FCOM procedures. VS target was initially +400 ft/min which was increased to +1,700 ft/min and then +2,000 ft/min causing the Pitch attitude to increase to 15º and speed to reduce to 130 kt as opposed to standard climb speed of 160 kt.

3.1.10 VS mode remained engaged till TOC.

3.1.11 Crossing 13,200 ft, VS target was reduced to +700 ft/min, then + 600 ft/min and finally +500 ft/min; however, this still resulted in speed reduction to 178 kt.

3.1.12 The cruise was done at FL165.

3.1.13 During cruise, the minimum RA height was recorded to be 2,636 ft; however, this is acceptable as per PIA SOPs for Northern Area flights where minimum separation of 2,000 ft is mandatory due to mountains.

3.1.14 For Approach to Gilgit Airport, Captain initiated descent with VS target at -600 ft / min.

3.1.15 Captain elected to descend for Approach to the airport at higher than normal speeds reaching up to approximately 245 kt CAS rather than maintaining the standard descent speed of 200 kt CAS as per PIA SOPs.

3.1.16 The anomaly in descent parameters was indicated to the Captain by the FO. However, the Captain did not take any corrective action and the FO did not make any further attempts to point out any discrepancies to the Captain.

3.1.17 At 10.1 NM from R/W threshold, once crossing 7,630 ft AMSL, the EGPWS triggered an alarm for 17 s while the RA height varied between 3,000 to 3,500 ft AGL, however the Captain did not take any corrective actions. This alarm was triggered due to terrain but could have been avoided if the aircraft was maintaining correct speed as per SOPs.

3.1.18 The aircraft levelled off at 2,000 ft AGL and the throttles were retarded to FI position where they remained till Landing.

3.1.19 The speed reduced from 240 kt to 200 kt.

3.1.20 Descent was resumed after disengaging AP.

3.1.21 Crossing 700 ft RA, throttles were set to CL OVERRIDE position to increase drag.

3.1.22 At 513 ft RA, the EGPWS alert was again triggered due to high ROD of 1,200 ft / min without any corrective action taken by the Captain.

3.1.23 During base leg, the Captain announced increase in tail wind; surface wind at the time was reported to be calm but gusts were present. The maximum tail wind at touchdown was 4-5 kt.

3.1.24 Due to higher altitude, the TAS of the aircraft was also quite high and with no attempt to reduce speed, the CAS could not reduce sufficiently for the aircraft to be brought to Landing configuration due which the aircraft flew base leg in clean configuration as opposed to the normal procedure of configuring the aircraft for Landing prior to base leg.

3.1.25 During base leg, Captain asked the opinion of the FO regarding a 360° turn in the valley to reduce speed for attaining Landing configuration.

3.1.26 The FO was apprehensive of making a 360° turn because in his opinion, the speed was too high for such a manoeuvre inside the valley. Moreover, he had no prior training or experience of such a manoeuvre in such a situation.

3.1.27 Since the Captain had not paid heed to the FO's observations previously and also because of the experience, seniority and instructor status of the Captain, the FO did not voice any opinion but left the decision to Captain.

3.1.28 Captain, on not hearing any opinion from the FO, decided to continue with the Approach.

3.1.29 At 488 ft RA and speed 184 kt, "Too Low Gear" warning sounded due to incorrect aircraft configuration. The same warning was again repeated after 6 s at 500 ft RA; however, no action was taken by the Captain.

3.1.30 Captain initiated the base turn; however, it was not an academic pattern as the aircraft headed for R/W threshold at an angle of 10°-15° from R/W heading, instead of describing a circular arc.

3.1.31 On initiation of base turn, 15° Flaps were selected at 175 kt (speed for 15° flap lowering: 180 kt) and at a height of 491 ft AGL.

3.1.32 Immediately after selecting Flaps, L/G lever was selected to Down position at 442 ft AGL and at a speed of 174 kt, 0.57 NM from R/W whereas the speed for lowering L/G is 170 kt.

3.1.33 EGPWS warning triggered without any reaction from the Captain as aircraft crossed 500 ft AGL with gears still not down and locked.

3.1.34 The Flaps came down to 15° position at 257 ft AGL.

3.1.35 At a height of 230 ft AGL, the aircraft was put in a bank to align with the R/W for Landing.

3.1.36 The gears attained down & locked position once the aircraft was rolling out in line with R/W 25 at a height of approximately 50 ft AGL and speed 162-163 kt.

3.1.37 Just short of entering R/W threshold, EGPWS warning of "Too low terrain" was triggered at 55 ft AGL and ROD 800 ft / min without any action taken by the Captain.

3.1.38 The aircraft was still in bank once entering R/W and straightened out on R/W heading at approximately 30 ft AGL.

3.1.39 At no time during base turn or finals did Captain attempt a Go-Around.

3.1.40 Full Flaps could not be selected as the speeds were too high once the aircraft entered R/W at 160 kt.

3.1.41 Due to high speed, the aircraft tendency was to float for longer distance; however, Captain made the aircraft touchdown approximately 2,000 ft down the R/W at 150 kt CAS (GS: 170 kt) with 3,400 ft of R/W length remaining to stop the aircraft.

3.1.42 Despite the higher Landing speed (more than 115 kt GS), Captain did not use Thrust Reversal and applied only brakes to stop the aircraft. The throttles were initially retarded to reverse but then placed just below GI position.

3.1.43 Due to higher aircraft momentum as a result of higher speed, the brake application was insufficient to stop the aircraft on the R/W.

3.1.44 To avoid going off the R/W, the Captain veered the aircraft to the right at 75 kt and then attempted to turn the aircraft anti-clockwise at 56 kt GS while advancing right throttle.

3.1.45 Due to centrifugal forces at high speed, the aircraft could not be controlled and departed from the R/W surface.

3.1.46 The unpaved ground added further stresses onto the MLG.

3.1.47 As the Captain was attempting to turn the aircraft anti-clockwise while it was being pulled radially outwards, the Right MLG was already being stressed towards the outer side. Coupled with further stress from the unpaved ground, it ultimately collapsed.

3.1.48 Due to the collapse of Right MLG, the aircraft suffered major structural damage.

3.1.49 At this time, the engines were also running and the right engine suffered major damage once the propeller hit the ground.

3.1.50 As the aircraft came to a stop Captain shut down the engines and then shut down all systems.

3.1.51 Captain instructed the Cabin Crew to maintain stations as it was felt that there is no further immediate cause for alarm requiring immediate evacuation.

3.1.52 All the passengers were subsequently evacuated safely from the aircraft.

3.1.53 Post accident investigation revealed that the Captain was in habit of making high speed approaches and had done so on numerous occasions but without any undesirable consequences.

3.1.54 The Captain had never been cautioned or reprimanded for violation of SOPs prior to the accident.

3.1.55 FDA analysis and debrief was a neglected area at PIA as FDA debrief constituted only 5% of the total number of flights undertaken by PIA.

3.1.56 Supervision of FDA debriefs by PCAA was also neglected and was not ensured despite PCAA being responsible for supervision of safety practices by PIA.

3.1.57 As a result of the damage sustained to the aircraft during the occurrence, PIA took the decision for permanent retirement and de-registration of the aircraft.

3.2 **Causes / Contributing factors**

3.2.1 **Primary Causes: -**

3.2.1.1 **Involuntary Runway Excursion (RE)** due intentional high-speed Approach and Landing by PF.

3.2.1.2 Failure to adhere to SOPs.

3.2.1.3 Lack of situational awareness and anticipation resulting in inadequate decision making.

3.2.2 **Contributing Factors: -**

3.2.2.1 Lack of assertiveness by PM.

3.2.2.2 Inadequate application of Crew Resource Management (CRM).

Note: Aviation Occurrence Category (ADREP Taxonomy)

***"Runway Excursion (RE)** – A veer off or overrun off the runway surface applicable during either the take-off or Landing phase.*

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SECTION 4 – SAFETY RECOMMENDATIONS

4.1 Safety Recommendations

4.1.1 PIA

4.1.1.1 DFDR analysis and debrief policy may be followed in true letter and spirit for aircrew with special emphasis on flights to Northern Area airfields.

4.1.1.2 Aircrew with unsafe trends may be identified and necessary steps be taken to ensure safe flight parameters.

4.1.1.3 Special training flights for aircrew may be arranged to practice Go-Around, especially for Northern Area airfields.

4.1.1.4 Simulator practice may be tailored to include practice Go-Around specifically for Northern Area airfields.

4.1.1.5 Aircrew may be given refresher lectures to improve their knowledge and understanding of aerodynamic phenomenon and its effects on aircraft performance.

4.1.1.6 Periodic check flights may be undertaken for aircrew undertaking flights to Northern Area airfields.

4.1.1.7 CRM training with periodic refreshers may be undertaken for all aircrew to emphasize the importance of communication and teamwork. This may include special emphasis for FOs to be vigilant and be assertive in ensuring safety of aircraft in case any violations or anomalies are observed. Similarly, emphasis must be laid for Captains to pay heed to the FO's advice instead of relying on their own judgement and experience.

4.1.1.8 Landing procedures may include mandatory use of Thrust Reversers to reduce Landing distance.

4.1.1.9 Aircrew may be instructed to ensure standard procedure of immediate evacuation of passengers in case of any accident / serious incident.

4.1.1.10 Aircrew may be given training to anticipate and be ready for variations in parameters and take necessary steps to deal with the situation.

4.1.1.11 All data pertaining to any aircraft / crew involved in an accident / serious incident may be retained till the time the investigation has not been finalized.

4.1.2 PCAA

4.1.2.1 PCAA may ensure oversight of FDA program with emphasis on periodic aircrew debriefs especially in case of exceedances / violations of SOPs.

4.1.2.2 Audit of FDA and Aircrew debriefs may be carried out on yearly basis to identify any shortcomings.