CONFIDENTIAL

PAKISTAN CIVIL AVIATION AUTHORITY

(SAFETY INVESTIGATION BOARD)

INVESTIGATION REPORT

AIR BLUE FLIGHT ABQ-202 A-321 REG AP-BJB PAKISTAN CRASHED ON 28 JULY 2010 AT MARGALLA HILLS ISLAMABAD

LIST OF CONTENTS

CHAPTER #	DESCRIPTION	PAGE #
1.	SUMMARY	3
2.	AUTHORIZATION FOR INVESTIGATION	4
3.	FACTUAL INFORMATION – AIRCREW	5
4.	FACTUAL INFORMATION - AIRCRAFT	6
5.	SPECIFIC SAFETY FEATURES ONBOARD A/C	7
6.	AERODROME INFORMATION	15
7.	METEOROLOGICAL INFORMATION	20
8.	SEQUENCE OF EVENTS (HISTORY OF FLIGHT)	22
9.	POST CRASH INFORMATION	27
10.	FINDINGS	29
11.	CONCLUSION	32
12.	FINALIZATION	34
13.	SAFETY RECOMMENDATIONS	35
Appendix ‘A’	Names of Investigation Team Members	36
Appendix ‘B’	Names of Accredited Representatives	37
Appendix ‘C’	Extract of Sound and Alarms Chronology	38

CHAPTER – 1 : SUMMARY

ABQ-202, mishap aircraft A-321, AP-BJB, on 28 July 2010, operated by Airblue was scheduled to fly a domestic flight sector Karachi - Islamabad. The aircraft had 152 persons on board, including six crew members. The Captain of aircraft was Captain Pervez Iqbal Chaudhary. Mishap aircraft took-off from Karachi at 0241 UTC (0741 PST) for Islamabad. At time 0441:08, while executing a circling approach for RWY-12 at Islamabad, it flew into Margalla Hills, and crashed at a distance of 9.6 NM, on a radial 334 from Islamabad VOR. The aircraft was completely destroyed and all souls on board the aircraft, sustained fatal injuries. May Allah bless their souls.

Note: *All time references in the report are in UTC.*

CHAPTER – 2 : AUTHORIZATION FOR INVESTIGATION

The investigation was ordered by Government of Pakistan, as State of Occurrence and State of Registry, under Rule 273 CARs-1994 (Civil Aviation Rules, 1994). The composition of Investigation Team is attached as **Appendix "A".** The list of Accredited Representatives from BEA-France (Airbus), NTSB-USA (IAE) and BFU-Germany (IAE) as per ICAO Annex 13 Chapter 5 is attached as **Appendix "B"**. Necessary notifications as per ICAO SARPs to all stake holders were also issued. This investigation report was completed and submitted to the Director General Civil Aviation Authority on 07 March 2011. The sole objective of this investigation was the prevention of accidents and incidents and not to apportion blame or liability.

CHAPTER – 3 : FACTUAL INFORMATION - AIRCREW

3.1 Captain

a.	Nationality	: Pakistani
b.	ED Number	: 16815
c.	Age	: 61 years, 07 months,
d.	Date of initial medical assessment	: 10 July 1967
e.	Date of last medical assessment	: 14 June 2010
f.	ATPL # / validity	: 462 / 31 March 2011
g.	Rating	: A-319/320/321
h.	Date of last simulator check	: 29 March 2010
i.	Flying experience total	: 25497:00 hrs
j.	Flying experience on Airbus A-320	: 1060:00 hrs
k.	FDTL	: In accordance with Regulations

3.2 First Officer

a.	Nationality	: Pakistani
b.	ED Number	: 17238
c.	Age	: 34 years, 11 months,
d.	Date of initial medical assessment	: 07 July 2008
e.	Date of last medical assessment	: 24 July 2009
f.	CPL # / validity	: 2899 / 28 February 2011
g.	Rating	: A-319/320/321
h.	Date of last simulator check	: 6 March 2010
i.	Flying experience total	: 1837:00 hrs
j.	Flying experience on Airbus A-320	: 286:00 hrs
k.	FDTL	: In accordance with Regulations

3.3 ***Both the crew members were adequately experienced, possessed valid licenses, were rated for the type, and medically fit to undertake the flight on 28 July 2010.***

CHAPTER – 4 : FACTUAL INFORMATION - AIRCRAFT

4.1 **General:**

Aircraft Model	: A321-231-A5
Manufacturer Serial Number	: 1218
Date of Manufacture	: 14-04-2000
Date of Induction	: 05-02-2006
Aircraft Registration	: AP-BJB
Certificate of Airworthiness	: valid up to 6 February 2011
A/C Flight Hrs	: 16179.26FH 6440FC at induction
	: 34018FH and 13566FC (accumulated)
Engine Model	: V2533 with thrust rating of 33K

4.2 **Details of engines at the time of crash are as below:**

Engine	Serial Number	Time Since New	Cycle Since New
Engine No 1	V10718	31452FH	12774FC
Engine No 2	V13039	5113FH	1941FC

4.3 Aircraft daily inspection / servicing was carried out on 28 July 2010 prior to the flight ABQ-202 and no defect was recorded. No anomaly in the aircraft system performance was recorded before and during the flight till the aircraft flew into Margalla Hills.

4.4 **Type of Fuel used:** Fuel JET A1

4.5 ***Aircraft was airworthy to undertake the flight****.*

CHAPTER 5 : SPECIFIC SAFETY FEATURES ONBOARD AIRCRAFT

5.1 The subsequent paragraphs explain the relevant safety and navigation equipment installed on Airblue mishap aircraft Reg. AP-BJB.

5.2 Flight Management and Guidance System (FMGS)

5.2.1 The Airbus A321 is equipped with a Flight Management and Guidance System (FMGS). It provides predictions of flight time, mileage, speed, economy profiles and altitude. It reduces cockpit workload, improves efficiency, and eliminates many routine operations generally performed by pilots. The FMGS contains following units:

a. Two Multifunction Control and Display Units (MCDU)
b. Two Flight management Guidance Computers (FMGC)
c. One Flight Control Unit (FCU)
d. Two Flight Augmentation Computers (FAC)

5.2.2 FMGCs aboard AP-BJB were manufactured by Honeywell, under PNo. B546CCM0106. The part number of the navigation database loaded into the FMGCs was ED11007.001, revision cycle No. 1007, valid from 1 to 28 July 2010.

5.2.3 During cockpit preparations, the pilot inserts a preplanned route from origin to destination, via the MCDUs, installed on the centre console between the 2 pilot seats.

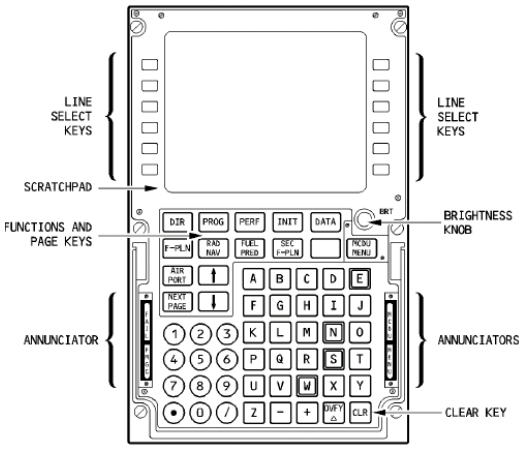


Figure 2 - MDCU

5.2.4 This route includes the departure, enroute waypoints, arrival, approach, missed approach and alternate route, as selected from the NAV database. The use of MCDU allows the flight crew to interface with the FMGC by selection of a flight plan for lateral and vertical trajectories and speed profiles. The crew may also modify selected navigation or performance data and specific functions of flight management, like revised flight plan or secondary flight plan. Waypoints can be inserted in a flight plan via the MCDU by entering the latitude and longitude of that waypoint, or by providing 2 bearings from 2 different waypoints that intersect, or by providing a bearing and a distance from an existing waypoint. When the latter method is used, and if no name is entered by the pilot, the waypoint is automatically named “PBD*xx*”, with *xx* being a two digit number between 01 and 20. Up to 20 waypoints can be inserted via the MCDU.

5.2.5 When a runway with no published instrument approach is selected in the flight plan, the FMGC automatically strings a final leg extending the runway centerline. It starts at a waypoint labeled "CF" (start of a **Course to Fix** leg) **created 5 NM from the runway threshold and ends at the runway threshold.**

5.2.6 Data that is entered into the MCDU that is illogical or beyond the aircraft capabilities will either be disregarded or will generate an advisory message. When the FMGS is in its normal mode (called “dual” mode), all data inserted into any MCDU is transferred to both FMGCs and to all peripherals.

5.2.7 The FMGCs can provide 2 types of guidance:

a. “Managed” guidance: the aircraft is guided along a pre-planned route, vertical, lateral and speed/mach profile. Predicted targets are computed by the FMGS.

b. “Selected” guidance: the aircraft is guided to the selected target, modified by the pilot. Targets are selected on the FCU located on the pilot’s glare-shield. The pilot may modify flight parameters like speed, heading, altitude or vertical speed on a short-term basis, and the FMGS will guide the aircraft to this manually selected target.

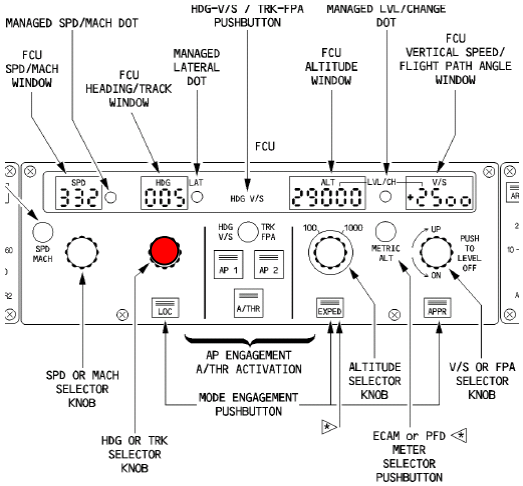


Figure 3 – FCU

5.2.8 The decision to engage a “selected” or “managed” guidance is always under the control of the pilot. Selected guidance has priority over managed guidance. When in managed guidance, the FCU windows display dashes and the white dots next to those windows light up. When in selected guidance, the windows display the selected numbers and the white dots do not light up. (Note: the altitude window always displays an altitude selected by the pilot and never displays dashes).

5.2.9 The FCU has 4 selector knobs:

a. SPD-MACH: speed or Mach
b. HDG-TRK: heading or track (highlighted in Red)
c. ALT: altitude
d. V/S-FPA: vertical speed or flight path angle

5.2.10 The selector knobs can be rotated, pushed-in or pulled-out. In order to arm or engage managed guidance for a given mode, the pilot pushes in the associated selector knob. In order to engage a selected guidance mode, the pilot turns the selector knob to set the desired value, ***and then pulls the knob out to engage the mode with the target value equal to the selected value*.**

5.2.11 In managed guidance, turning a selector knob without pulling it will replace the dashes in the corresponding window with a value that is the sum of the current target and the turn action value. The display remains 45 seconds in the HDG/TRK and V/S windows and 10 seconds in the SPD/MACH window before the dashes reappear.

5.2.12 HDG and TRK modes are two selected lateral guidance modes. The pilot uses the HDG V/S – TRK FPA pushbutton to select heading (HDG) or track (TRK). These modes guide the aircraft laterally along the heading or track selected by the flight crew. The HDG/TRK window of the FCU displays the target heading or track and the pilot uses the HDG or TRK selector knob to change his selection. ***When the pilot pulls out the HDG or TRK selector knob, HDG or TRK mode engages (not sooner than 5 seconds after lift-off). It also engages when LOC mode is lost.***

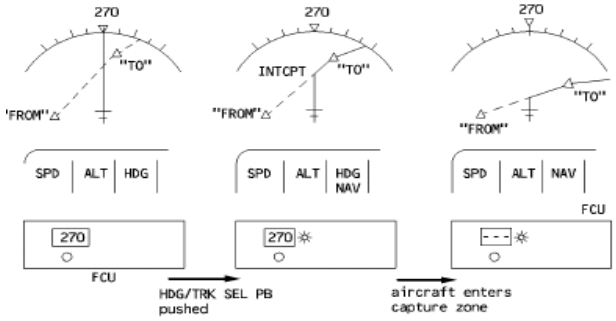
5.2.13 One of the managed lateral guidance mode is the NAV mode. If, for example, the pilot pushes in the HDG selector knob, he engages or arms the NAV mode. This mode steers the aircraft laterally along the flight plan defined in the FMGS. It is designed to have a zero cross-track error. The pilot can arm or engage the NAV mode if the MCDU contains a lateral flight plan.

5.2.14 Satisfying one of the following conditions arms the NAV mode:

a. The aircraft is on the ground with no HDG/TRK preset and no other lateral mode except runway (RWY) mode.
b. The flight crew pushes-in the HDG/TRK selector knob, unless the LOC mode is engaged.
c. The flight crew presses the APPR pushbutton, if a non-ILS approach is selected.

5.2.15 The NAV mode engages:

a. Automatically at 30 ft (radio-altitude) after takeoff (if armed on the ground).
b. When the flight crew orders direct-to a waypoint (by pushing the “DIR” button on the MCDU), except below 700 ft (radio-altitude) in LOC mode.
c. When the pilot pushes-in the HDG/TRK select knob when the aircraft is close to the active flight plan leg (within approximately 1 NM).
d. Automatically in flight when NAV is armed and the aircraft reaches the capture zone for the active flight plan leg. This is illustrated on the figure below. The following is a typical NAV mode engagement sequence:



5.2.16 The aircraft flies in HDG mode towards the active flight plan leg, materialized by the “FROM” and “TO” waypoints:

a. The NAV mode is armed by pushing on the HDG/TRK SEL pushbutton. The interception point is computed by the FMGC and displayed on the ND as “INTCPT”. The white dot next to the HDG/TRK window lights up:

b. The aircraft reaches the capture zone, and the NAV mode engages. Dashes are displayed in the window. The aircraft will intercept the active flight leg, turn and fly towards the "TO" waypoint.

5.2.17 ALT mode is a longitudinal mode that maintains a target altitude. This target altitude is either the FCU selected altitude or an altitude constraint delivered by the FMGS. The altitude that ALT mode holds is the altitude it memorized when engaged. It is not affected by a change of reference in the ALT window or by change in the barometric correction. It is changed via the altitude selector knob on the FCU.

5.2.18 OPEN DESCENT is a selected longitudinal mode. It maintains a speed or a Mach (selected or managed) with the AP/FD pitch mode, while /THR (if active) maintains IDLE thrust. OPEN DESCENT engages if the FCU-selected altitude is lower than the present altitude and the crew pulls on the ALT selection knob.

5.2.19 When the AP/FD longitudinal and lateral modes are respectively engaged in GS and LOC, and the crew pulls on the ALT selection knob with a FCU selected altitude below the present altitude:

a. the longitudinal mode reverts to OPEN DESCENT,
b. the A/THR mode changes to THR IDLE, then to SPEED when the target altitude is reached,
c. and the lateral mode reverts automatically to HDG or TRK mode.

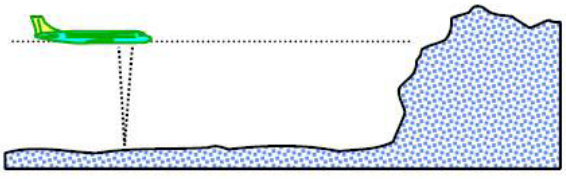
5.2.20 This mode reversions cause a triple click aural warning.

5.3 Enhanced Ground Proximity Warning System (EGPWS)

5.3.1 The aircraft was equipped with an Enhanced Ground Proximity Warning System manufactured by Honeywell. Its part number was 965-0976-003-206-206. ***The purpose of this system is to detect inadvertent flight toward terrain and provides warnings against Controlled Flight Into Terrain (CFIT).*** This is a type of accident where an airworthy aircraft under the control of a capable flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew. It can occur during most phases of flight, but CFIT is more common during the approach-and landing phase.

5.3.2 The 5 basic modes of the EGPWS of the accident aircraft are:

a. Mode 1: Excessive rate of descent.
b. Mode 2: Excessive terrain closure rate.
c. Mode 3: Altitude loss after takeoff.
d. Mode 4: Unsafe terrain clearance.
e. Mode 5: Too far below glideslope.



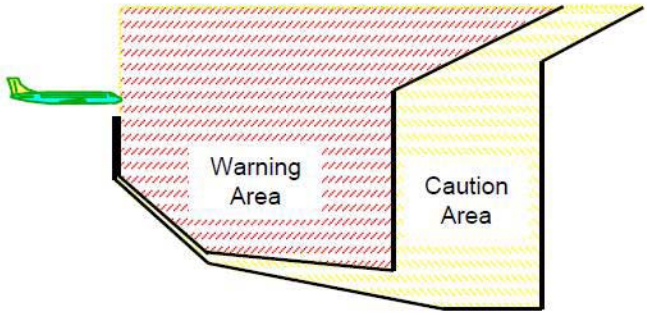
5.3.3 These basic modes are based on radio altitude and other aircraft parameters. They do not provide alerts in case of terrain ahead of the aircraft.

5.3.4 This is why the EGPWS also provides a predictive "look ahead" terrain alerting, based on

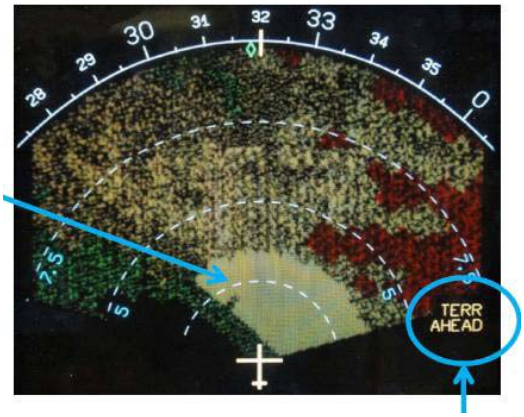
a. 3-D aircraft position (Latitude, Longitude, Altitude)

b. aircraft flight path
c. on-board terrain and airport database.

5.3.5 A global terrain database with 100% coverage is resident within the EGPWS. By using the input latitude, longitude, altitude as well as flight path angle, turn rate and groundspeed, the EGPWS can place the aircraft position within the terrain data and "look ahead" to potential conflicts with terrain. ***This mitigates the risk of impacting abruptly rising terrain. It issues cockpit voice and visual annunciations approximately 60 seconds before predicted terrain conflict and provides a cockpit display of terrain relative to aircraft elevation as well.***



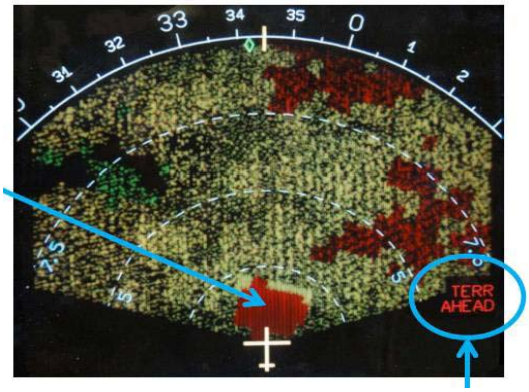
5.3.6 ***If an obstacle penetrates the caution area, then an aural "TERRAIN AHEAD" sounds, the ND displays the dangerous terrain with various yellow density areas and an amber "TERR AHEAD" message appears in the lower right corner (see figure below). An GPWS enunciator light also illuminates next to the PFD.***



Automatic terrain Display on ND

Automatic terrain display on ND

5.3.7 ***If the aircraft gets closer to the conflict terrain, and an obstacle penetrates the warning area, an aural "TERRAIN AHEAD, PULL UP" sounds, the ND displays the dangerous terrain with various red density areas and an red "TERR AHEAD" message appears in the lower right corner (see figure below). A GPWS enunciator light also illuminates next to the PFD.***



Automatic terrain Display on ND

Figure 5 EGPWS warning on ND

5.4 Standard Operating Procedures in case of EGPWS alerts

5.4.1 To cope with EGPWS alerts, Airbus published an "emergency procedure" as a memory item in QRH 1.14 as follows (this procedure is also detailed in FCOM 3.02.34 page 15):

A318/A319/A320/A321 airblue | EMERGENCY PROCEDURES | REV 42 SEQ 100 | 1.14

EGPWS ALERTS

CAUTION
During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis.
During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert stops or a safe trajectory is ensured.

■ **"PULL UP" – "TERRAIN TERRAIN PULL UP" – "TERRAIN AHEAD PULL UP"**
Simultaneously :
– AP ..... OFF
– PITCH ..... PULL UP
Pull to full backstick and maintain in that position.
– THRUST LEVERS ..... TOGA
– SPEED BRAKES LEVER ..... CHECK RETRACTED
– BANK ..... WINGS LEVEL or ADJUST

● **When flight path is safe and the warning stops :**
Decrease pitch attitude and accelerate.

● **When speed is above VLS, and vertical speed is positive :**
Clean up aircraft as required.

■ **"TERRAIN TERRAIN" – "TOO LOW TERRAIN" :**
Adjust the flight path or initiate a go-around.

■ **"TERRAIN AHEAD" :**
Adjust the flight path. Stop descent. Climb and/or turn, as necessary, based on analysis of all available instruments and information.

■ **"SINK RATE" "DON'T SINK" :**
Adjust pitch attitude and thrust to silence the alert.

■ **"TOO LOW GEAR" – "TOO LOW FLAPS" :**
Perform a go-around.

■ **"GLIDE SLOPE" :**
Establish the aircraft on the glideslope, or switch OFF the G/S mode pushbutton, if flight below the glideslope is intentional (non precision approach (NPA)).

5.5 Flight Recorders

5.5.1 The aircraft was equipped with two flight recorders. Both the flight recorders were located from the crash site, lying in the rear fuselage area having affected due to post impact fire. Flight recorders were identified and verified on the spot by SIB investigators, Airblue technical assistance team and the members of Airbus team. Details of each flight recorders are given below;

5.6 Flight Data Recorder

a. Make and model: Honeywell 4700
b. P/N: 980-4700-003
c. S/N: 9924
d. This model records at least 25 hours of flight data on a solid state memory.

5.7 Cockpit Voice Recorder

a. Make and model: Honeywell 6022
b. P/N: 980-6022-001
c. S/N: 61739
d. This model records at least 2 hours of flight on a solid state memory.

Note: Above information was provided by Airbus and Airblue, but it could not be confirmed on the Recorders themselves as the identification plates were missing from the flight recorders.

5.8 Post Crash Data Retrieval

5.8.1 Both the flight recorders were hand carried by SIB investigators to BEA facilities, France. These recorders were readout at the BEA between 9 and 13 August, 2010.

5.8.2 The opening and read-out operations were performed following BEA procedures and Honeywell's "*Reference Procedure for SSFDR Data Recovery after an Incident or Accident*" document.

5.8.3 For both recorders, the memory boards were extracted from the protected module, connected to a BEA chassis and downloaded using the manufacturer's read-out device. The read-out operations were successful. A 27 hour data file was downloaded from the FDR and the data downloaded from the CVR was decompressed into five audio files identified as follow:

1. Three files containing the last 30 minutes of recording of Captain, FO and Public Address, each one mixed with VHF communications,

2. 01 file containing a mix of the last two hours of recordings of the 3 tracks described above.
3. 01 file containing the last two hours of recording of the Cockpit Area Microphone.

5.8.4 The event was recorded on the CVR and on the FDR. The CVR was synchronized with the FDR using VHF KEING and A/P1 ENGAGED parameters.

5.8.5 **The Flight Recorders contained the complete flight data as well as cockpit voice recording for the entire flight duration from take off to crash.**

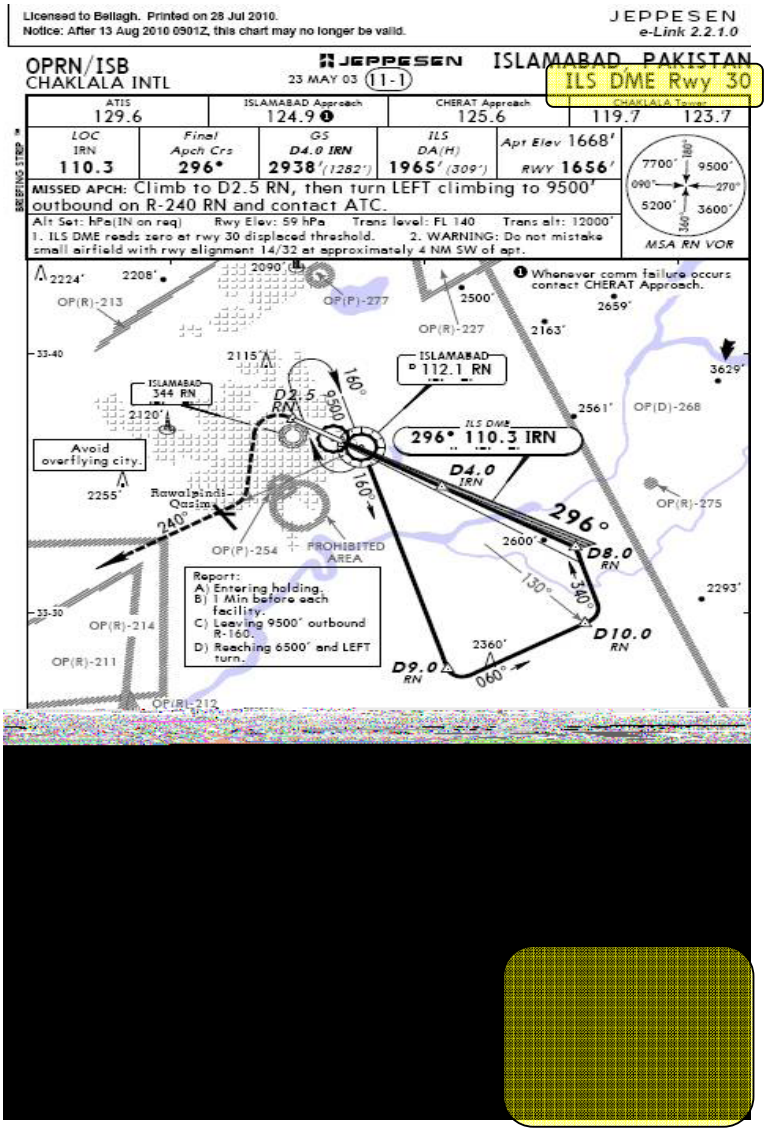
CHAPTER – 6 : AERODROME INFORMATION

6.1 General

6.1.1 A hilly area lay to the northeast of Benazir Bhutto International Airport (BBIAP), Islamabad. The city of Islamabad is to the North-west and Rawalpindi is to the South-west of the aerodrome. There are 2 prohibited areas in the vicinity of the airport: OP(P)-254 to the southwest and OP(P)-277 to the northeast

6.1.2 Islamabad Airport is a joint user airfield. Air Traffic Services (ATS) are provided by CAA and PAF in their respective areas of jurisdiction. Chaklala Tower is manned by PAF to provide aerodrome Control Services, whereas CAA Radar is providing radar vectoring services to arrival and departing aircraft in the designated airspace.

6.1.3 Airfield layout includes one main runway with no parallel or usable secondary surfaces. The following is the Jeppesen chart for the ILS DME RWY-30 approach. It also contains the circle-to-land minimums.



6.2 Runway Physical Characteristics:

OPRN AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	True bearing	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
12	122 (T) 120 (M)	3292 x 46	77/F/C/X/T Bitumen	333721.41N 0730508.49E	THR 506M / 1660 FT
30	302 (T) 300 (M)			333639.32N 0730642.38E	THR 505 M / 1657 FT

Designations RWY NR	Slope of RWY/SWY	SWY dimension (M)	CWY dimension (M)	Strip dimension (M)	Obstacle Free Zone
7	8	9	10	11	12
12	0.15% up till 1981 M from displaced THR	229	-	-	-
30	0.5% up till 762 M from displaced THR then .15%	213	-	-	-
Remarks: THR RWY 12 displaced 274 m. THR RWY 30 displaced 274 m. LCN 68 for 274 m (900') in the portion of runway before displaced THR RWY 12). Fair weather strip on both sides of RWY 12/30 not available due uneven level.					

OPRN AD 2.13 DECLARED DISTANCES (M)

Designations RWY NR	TORA	ASDA	TODA	LDA	Remarks
1	2	3	4	5	6
12	3017	3246	3246	3017	-
30	3292	3505	3505	2743	-

OPRN AD 2.14 APPROACH AND RUNWAY LIGHTS

Designations RWY NR	APCH LGT type LEN INTST	THR LGT colour WBAR	VASIS (MEH) PAPI	TDZM LGT LEN	RWY Centre line LGT Length, spacing, colour, INTST	RWY EDGE line LGT Length, spacing, colour, INTST	RWY End LGT spacing colour WBAR	SWY LGT LEN (M) colour	Remarks
1	2	3	4	5	6	7	8	9	10
12	SALS 518 M LIH	GREEN	PAPI Left/3°	-	2743 M 30 M WHITE LIL	2743 M 60 M WHITE LIL. Last 600 M yellow	RED	Additional Stand by RWY edge lights.	PAPI Max range 3 NM. Strobe LGT
30	PALS 900 M LIH	GREEN	PAPI Left/3°	-			RED	Sequence flasher	-

Strobe lights will be available when RWY 12 is in use or Bad WX or on request.

6.3 Communications

Following communication facilities were available and serviceable.

OPRN AD 2.18 ATS COMMUNICATION FACILITIES

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
APP	Islamabad APP	124.9 MHZ	H24	Primary frequency,
APP	Cherat APP	125.6 MHZ	H24	Primary frequency,
TWR	Chaklala Tower	123.7 MHZ	H24	Primary frequency,
	"	121.5 MHZ	H24	Emergency Frequency
	"	119.7MHZ	H24	Secondary Frequency ←
	Islamabad APP	125.5 MHZ	H24	Secondary Frequency
ATIS	ATIS	129.6 MHZ	H24	
BS	Radio Pakistan	1150 KHZ	HX	
G/A/G	Radio	5601 KHZ	H24	
G/A/G	Radio	2923 KHZ	H24	

6.4 Aids to Navigation:

Following navigation aids were available and serviceable.

OPRN AD 2.19 RADIO NAVIGATION AND LANDING AIDS

Type of aid. CAT of ILS (VAR VOR/ILS)	*ID*	*Frequency*	*Hours of operation*	*Site of transmitting antenna coordinates*	*Elevation of DME transmitting antenna*	*Remarks*
1	2	3	4	5	6	7
GP/DME 30	Dots/Dashes	335 MHZ / CH40X	H24	333639.92N 0730629.53E	-	
LLZ ILS CAT I	IRN	110.3 MHZ	H24	333728.90N 0730451.72E		
LLZ-TDME		CH-40X	H24	DITTO	513.09M	
VOR/DME	RN	112.1 MHZ / CH 58X	H24	333621.39N 0730733.37E	504.47M	
NDB	RN	344 KHZ	H24	3336.8N 07304.9E		Coverage 150NM

6.5 Landing Procedures at BBIAP, Islamabad

a. ILS Approach RWY-30
b. VOR Approach for RWY-30
c. Straight in Landing RWY 30
d. Circle to land RWY-12

6.6 Circling to Land RWY-12 Approach - Standard Operating Procedures

6.6.1 Air Blue's FCOM recommends that "for a circling approach, the flight crew should prepare the flight plan as follows:

Primary flight plan: introduce the instrument approach
Secondary flight plan: -copy the ACTIVE F-PLN
-revise the Landing runway

The aircraft should circle in CONF3 at F speed Upon reaching MDA:
-Push the V/S/FPA knob to level off
-Search for visual reference

If the flight crew finds no visual reference: At MAP:
-initiate go-around

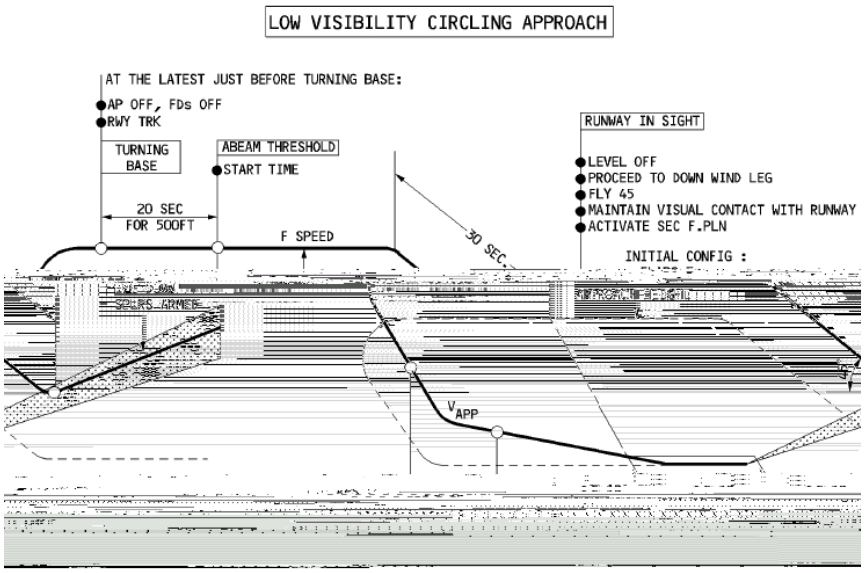
If the flight crew finds sufficient visual references:
-Select TRK for downwind
-Early on downwind activate SEC F-PLN

-Disengage autopilot before reaching the base leg
-Select both FDs OFF"

CAUTION:

The PNF should activate the SEC F-PLN
The PF should maintain visual contact during all the circling

6.6.2 Following diagram describes the recommended crew actions for a low visibility circling approach:



Recommended crew actions for circling approach

6.6.3 This diagram shows that a 45° track change is used to leave the final approach course to go and intercept the downwind leg. The time to execute this break-off leg should be 30 seconds, including turns. According to ICAO document 8168 (PANS-OPS), “the runway environment should be kept in sight while at minimum descent altitude/height (MDA/H) for circling. The runway environment includes features such as the runway threshold or approach lighting aids or other markings identifiable with the runway.”

6.6.4 According to this same document, the Airbus A321 is a category C aircraft. Its maximum speed for visual maneuvering (circling) is 180 kt. The groundspeed used for the determination of the visual maneuvering area is based on an ISA+15° temperature, an altitude 1,000 ft above the airport elevation and a 25 kt wind. These conditions for Islamabad airport and a category C aircraft give a maximum groundspeed of 220 kt for a circling approach. The maximum distance travelled in 30 seconds is therefore 1.85 NM.

6.6.5 As a consequence, the maximum distance between the runway centerline and the downwind leg is 1.3 NM, if the above recommended procedure is followed.

6.7 **Visual maneuvering area for Circle to land.**

The published circle-to-land MDA is 2,510 feet for category C aircraft. The corresponding visibility is 2,400 m. According to ICAO documentation (DOC 8168), the visual maneuvering area for a circling approach is determined by drawing arcs centered on each runway threshold and joining those arcs with tangent lines. The radius of the arcs is related to:

a. aircraft category (the Airbus A321 is a category C aircraft)
b. maximum speed for visual maneuvering (180 kt for category C aircraft);
c. wind speed: 25 kt throughout the turn;
d. bank angle: 20° average or 3° per second, whichever requires less bank.
e. temperature ISA+15°C
f. altitude 1,000 ft above the airport elevation, which is 1,668 ft at BBIAP, Islamabad

CHAPTER – 7 : METEOROLOGICAL INFORMATION

7.1 The weather observation reports (METAR) at BBIAP, Islamabad on 28 July 2010 at various hours is as follows:

Time in UTC	Weather Report
0200	Wind 050 degrees 16 knots; Surface Visibility 1500m; General Weather Rain; Clouds 2St. at 1500 ft, 1 TCu at 3000 ft, 4 Sc at 4000 ft, and 6 Ac at 10,000 ft. QNH 1005 hpa, 2970 inches, Temperature 24°C, Dew point 23°C. Weather Warning for TSR till 0400 hrs.
0300	Wind 050 degrees 16 knots; Surface Visibility 1500m; General Weather Rain; Clouds 2St. at 1500 ft, 1 TCu at 3000 ft, 4 Sc at 3000 ft, and 7 Ac As at 10,000 ft. QNH 1006 hpa, 2972 inches, Temperature 24°C, Dew point 23°C. Weather Warning for TSR till 0400 hrs.
0400	Wind 050 degrees 16 knots; Surface Visibility 3.5km; General Weather Rain; Clouds 3St. at 1500 ft, 1 TCu at 3000 ft, 4 Sc at 3000 ft, and 7 Ac As at 10,000 ft. QNH 1006 hpa, 2973 inches, Temperature 24°C, Dew point 23°C. Weather Warning for TSR till 0700 hrs.
0500	Wind 050 degrees 16 knots; Surface Visibility 3.5km; General Weather Rain; Clouds 3St. at 1000 ft, 1 TCu at 3000 ft, 4 Sc at 3000 ft, and 8 Ac As at 10,000 ft. QNH 1006 hpa, 2973 inches, Temperature 24°C, Dew point 23°C. Weather Warning for TSR till 0700 hrs.

7.2 **Islamabad Reported Weather at 0441 Hrs (time of crash)**

Visibility	3.5 Kms
Wind	050^0/ 16 Kts
Clouds	Scattered (3 octa) St at 1,000 feet; Few (1 octa) TCu at 3,000 feet; Scattered (04 octa) Sc at 3000 feet ; Broken (7 octa) AcAs at 10,000 feet.
General Weather	**Cloudy; Rain**
Temperature	24^0 C
Trend for next 2 Hrs	Similar weather was likely to persist
Forecast for the day	Hazy, cloudy with chances of thunderstorm rain. Clouds 1-2 octa TCU/CB, 1-3 ST, 2-4 ScCu, 4-6 AcAs. Wind NE/SE 10-20 kts gusting to 30 kts

7.3 **Weather Warning:**

7.3.1 Weather Warning, for thunderstorm/rain for OPRN and 50 miles around, valid up to 0700, and for wind SE/NE 20 kts to 40 kts, gusting up to 65 Kts or more. Surface Visibility may reduce to 1 km or less in precipitation. Moderate to severe turbulence may occur in 1-2 octa of CB at 3000 feet AGL.

7.4 Weather information to the crew:

7.4.1 Weather information to the flight crew was first provided through Airblue with the trim sheet (Dispatch Release Document). Later at 0350 hrs, the aircrew had listened to ATIS information and runway in use at BBIAP Islamabad (OPRN) as RWY-12. Natural Light condition at the time of accident was sunlight, covered with low clouds.

CHAPTER - 8 : SEQUENCE OF EVENTS (HISTORY OF FLIGHT)

8.1 ABQ-202 was scheduled to fly from Karachi to Islamabad. Start up, push back and taxi remained uneventful and the aircraft took-off from Karachi at 0241:21 UTC (0741:21 hrs -PST).

8.2 After takeoff at 0252:00, crew were served with tea and croissants by cabin crew.

8.3 During initial climb, the Captain tested the knowledge of FO and used harsh words and snobbish tone, contrary to the company procedures/norms.

8.4 The question / answer sessions, lecturing and advises by the mishap Captain continued with intervals for about one hour after takeoff.

8.5 After the intermittent humiliating sessions, the FO generally remained quiet, became under confident, submissive, and subsequently did not challenge the Captain for any of his errors, breaches and violations.

8.6 The mishap crew had listened to the Automatic Terminal Information Service (ATIS) information at about 0350 UTC and were informed that the runway in use at Islamabad airport (OPRN) was RWY-12. At that time, the aircraft was in cruise on a NE heading at FL330, 155 NM from Islamabad. According to DFDR information, the Captain was the Pilot Flying (PF).

8.7 About 2 minutes later at 0352 UTC, the crew discussed waypoints 5 NM to the SW of the runway, on a radial 206 from OPRN which is exactly 90° to the left of the approach course of the ILS procedure to RWY-30.

8.8 The Captain checked weather enroute, Islamabad, Peshawar and Lahore, through ATS and ATIS, and was fully aware about its gravity / intensity. The Captain sounded to be apprehensive about weather. The Captain was heard to be confusing BBIAP Islamabad with JIAP Karachi while planning FMS, and Khanpur Lake (Wah) with Kahuta area during holding pattern.

8.9 After learning that ABQ-202 would be required to execute a visual circling approach for RWY-12, in the reduced visibility and low clouds, Captain prepared himself to fly the visual circling approach on NAV mode.

8.10 Accordingly, the Captain asked the FO to feed **unauthorized 04** waypoints (PBD 8 to 11) in the FMS. FO did not challenge the Captain for his incorrect actions.

8.11 ***While planning for right hand downwind of visual approach RWY-12, at 0357:48 the Captain briefed First Officer (FO), "from abeam RWY-30, 3 to 5 miles abeam CF, then we go to abeam CF and then landing". This was contrary to established procedures for BBIAP, Islamabad.*** (Refer paragraph 5.2.5 for definition of CF).

8.12 In the pre descent brief, the Captain reaffirmed his stance to go to the end of D/W and then go abeam CF (5 miles) and then turn for landing.

8.13 ***During the descent, the Captain's request for a right hand D/W RWY-12 for a visual approach (the request being contrary to established procedures at BBIAP) was not agreed to by the Radar due to procedural limitations. The Captain became worried about bad weather and low clouds on the left hand downwind.***

8.14 At 03:58:17, aircraft started the descent.

8.15 At 0404:20, the Radar Controller informed ABQ-202 to "expect arrival to ILS RWY-30 circle to land RWY-12". ***The FO then requested a "right downwind RWY-12 for the approach"***. The controller responded that "right downwind RWY-12 is not available at the moment because of low clouds". ***Captain acknowledged "We understand right downwind is not available, it will be ILS down to minima and then left downwind ok"***.

8.16 At 0405:27, the crew discussed a waypoint (Place Bearing Distance (PBD) - 10) to the NE of the runway, on radial 026 from the threshold of OPRN RWY-12 and at a distance of "5 NM".

8.17 At 0406:35, there were other discussions about another waypoint, called PBD-11 on a 026° radial from "CF".

8.18 At 0433:55 at an altitude of 4,300 ft, the crew was cleared by radar controller to descend to 3,900 ft for ILS approach RWY- 30 followed by a circling approach to land RWY-12.

8.19 At 0435:44 at an altitude of 3,700 ft, the aircraft was established on the ILS with both autopilots engaged. The crew extended the landing gears.

8.20 At 0436:20, the crew again asked ATC Tower **"how's the weather right downwind"** The tower controller responded that the right downwind was not available and that only left downwind for RWY-12 was available.

8.21 ***At 0436:33 the Captain wanted to descend to 2,000 ft, but was reminded by FO of 2,500 ft (MDA), indicating possible intentions of Captain***.

8.22 At 0437:03, the crew leveled the aircraft at an altitude of 2,500 ft., autopilot 2 was disengaged and the crew flew the aircraft on a constant heading until the RN VOR with only autopilot 1 engaged.

8.23 At 0437:26, the confirmation by the Tower for the safe landing of PK-356 (aircraft of a competitive airline) in the same weather conditions put the Captain under further pressure to ensure a landing at Islamabad under any circumstances.

8.24 At 0437:27, the break-off to the right, after the ILS approach was delayed due to late visual with the airfield caused by poor visibility. ATC also called visual with AB-202 and asked AB-202 to report established left D/W RWY-12.

8.25 At 0437:32 as the aircraft was flying over the RN VOR, the crew commanded a right turn through the autopilot. ***A few seconds later, the selected altitude was***

lowered to 2,300 ft and the aircraft started to descend to selected altitude, thus violating the height minima of 2,510 MDA.

8.26 At 0437:36, the Captain asked FO to activate secondary flight plan, which was activated in the FMS.

8.27 ***After break-off from ILS approach, the Captain ignored the tower controller's suggestion (at 0437:54) to fly a bad weather circuit by saying "let him say whatever he wants to say". The CVR recording and flight simulation show that the Captain probably decided to fly a managed approach on pre selected PBDs unbeknown to the ATS.***

8.28 At time 0438:01, although Captain said that he was going for NAV, yet the aircraft kept on flying on HDG mode. ***FO reminded "Okay Sir, but are you visual?" The Captain said "Visual Hein! OK".***

8.29 At 0438:47, the Captain while preparing for intended approach pattern, said to FO "passing (waypoint) "PBD11" they would take flaps 3 and Flaps full".

8.30 At 0439:32 as the aircraft was more than 3.5 NM from the runway centerline; abeam the threshold of RWY-12 with a heading of 352°, the crew commanded a left turn to 300° through the autopilot.

8.31 At 0439:43, lateral mode was changed to NAV (which continued till 0440:28 hrs.)

8.32 At 0439:46 as the aircraft was 01 NM to the south of prohibited area OP (P) - 277, the air traffic controller instructed the crew to turn left in order to avoid a No-Fly Zone (NFZ).

8.33 ***At 0439:58, the aircraft was 5 NM to the north of the aerodrome and the first EGPWS predictive "TERRAIN AHEAD" caution was recorded on the CVR. FO told the captain "this Sir higher ground has reached, Sir there is a terrain ahead, sir turn left".***

8.34 By now the Captain had become very jittery in his verbal communication and displayed frustration, confusion and anxiety resulting in further deterioration in his behaviour.

8.35 ***At 0440:10, tower controller asked the crew if they were visual with the airfield. The crew did not respond to the question, whereas, FO asked the Captain (on cockpit Mic) "Kia batauon Sir ?" (What should I tell him Sir?)***

8.36 Immediately at **0440:16** on the insistence of Radar Controller, the Tower Controller asked the crew if they were visual with the ground. Captain and the FO responded to the controller ***"Airblue 202 visual with the ground".*** FO again asked Captain ***"Sir terrain ahead is coming". The Captain replied "Han ji, we are turning left" (Yes, we are turning left). Whereas aircraft was not turning, only the HDG bug was being rotated towards left.*** At the same time, two EGPWS predictive **"TERRAIN AHEAD"** cautions were recorded on the CVR.

8.37 The pilots were unsure of their geographical position and did not seek Radar help. The consequent loss of situational awareness caused the aircraft to go astray.

8.38 ***In an attempt to turn the aircraft to the left, the Captain was setting the heading bug on reduced headings, but not pulling the HDG knob. Since the aircraft was in the NAV mode, the Captain was not performing the appropriate actions to turn the aircraft to the left.***

8.39 ***At 0440:28, lateral mode was changed from NAV to HDG, 40 Seconds before the impact. At this stage, current heading of aircraft was 307 degrees, whereas selected heading had been reduced to 086 degrees, due to which the aircraft started to turn the shortest way to the right towards Margalla hills by default***. From that time onward, several EGPWS predictive **"TERRAIN AHEAD PULL UP"** warnings were recorded on the CVR until the end of the flight.

8.40 The aircraft had ended up in a dangerous situation because of most unprofessional handling by the Captain. Since the desired initiative of FO had been curbed and a communication barrier had already been created by the Captain, the FO failed to intervene, take over the controls to pull the aircraft out of danger and display required CRM skills.

8.41 ***At 0440:30, FO asked the Captain twice in succession "Sir turn left, Pull Up Sir. Sir pull Up".***

8.42 At 0440:33, the thrust levers were moved forward to the MCT/FLX detent (instead of TOGA position) and the auto-thrust (A/THR) disengaged.

8.43 At 0440:35, the selected altitude was changed to 3,700 ft and the aircraft started to climb. The aircraft was still turning right.

8.44 ***At 0440:39 (within 06 seconds), the thrust levers were moved back to the CLB detent and the A/THR re-engaged in climb mode. The selected altitude was reduced to 3100 ft.***

8.45 ***At 0440:41,*** FO asked the Captain yet another time ***"Sir Pull Up Sir"***.

8.46 At 0440:46, autopilot 1 was disconnected. The roll angle was 25° to the right. The captain applied full left side stick along with a 6° left rudder pedal input and the aircraft started to turn left. The altitude was 2,770 ft and increasing.

8.47 During the last few seconds, the aircraft did climb to 3,090 feet. The Captain put in 52 degrees of bank to turn the aircraft, and also made some nose down inputs. Therefore, the aircraft pitched down, speed increased and auto thrust commanded the engines to spooled down to keep airspeed on the target speed. The aircraft started again to descend at a high rate.

8.48 ***Unfortunately in his panic, until 0440:46 the Captain continued to move the***

CHAPTER - 9 : POST CRASH INFORMATION

9.1 Wreckage and impact information

9.1.1 Consequent to the accident, Technical Assistance Team of Airblue alongwith Capital City Administration managed to visit the crash site within half an hour of the accident. As all the scheduled flights were either diverted from or cancelled to BBIAP, Islamabad, therefore SIB team reached Islamabad in the evening on mishap day. Subsequently, IAE and Airbus representatives also arrived on crash scene on 30 July 2010 and provided on-site assistance to the investigation team members.

9.1.2 The investigation team, during on site wreckage study, established the following facts.

a. The fuselage was found broken between frame 29 and frame 34 upon impact as indicated by the location of aircraft debris:

   i. On top of the cliff, the forward part of fuselage structure up to frame 29,
   ii. At the bottom of the cliff, the remaining fuselage section from frame 34 to aft, with the wings and tail section.

b. Systems debris observation made it possible to determine that the landing gear was extended at time of impact.
c. Due to the impact damage, the slats and flaps configuration could not be determined.
d. The horizontal stabilizer actuator position before the impact was determined to be 3.5 degrees nose up.
e. Engine debris observation suggested that engine power was available and was not at full power.
f. No evidence of uncontained engine failure or engine fire prior to impact was identified on either engine.
g. Neither of the 2 FMGCs was recovered.

9.2 Medical and Pathological Information

9.2.1 It was not possible to carry out detailed autopsy / post mortem examination of the body of Captain because of the severely charred condition. However, Post-Mortem of the body of FO could not be conducted as the body was collected by Airblue management prior to arrival of investigation team on site and handed over to his father for burial.

9.3 Fire

9.3.1 The ground fire was caused due to post impact fuel and oil spillage. Due to difficult terrain, access of firefighting equipment to crash site was not possible, however, the nonstop rain helped to extinguish the fire.

9.4 Survival Aspects

9.4.1 Contrary to the general public perception regarding survivors, due to the force of impact unfortunately, all souls on board sustained fatal injuries on the initial impact. There were no survivors. Search & Rescue operations were conducted by National Disaster Management Authority, (NDMA) Islamabad with the assistance of various agencies located at ICT Islamabad.

9.5 **Injuries to person**

Injuries	Crew	Passengers	Others	Total
Fatal	06	146	--	152
Serious	--	--	--	--
Minor/None	--	--	--	--

9.6 **Damage to aircraft**

9.6.1 Aircraft A321, Registration number AP-BJB was completely destroyed (written off) by the force of the impact.

9.7 **Other Damage**

9.7.1 There were no other damages except damage caused to some portion of hill, greenery / forest.

9.8 **Tests and Research**

9.8.1 Few aircraft and engine components were placed into quarantine for future analysis but later on, BEA and NTSB declined to undertake any further examinations due to required verification sought through DFDR and CVR decoding. Hence no aircraft and engine part was required to be sent to BEA, Airbus and NTSB. Both the DFDR and CVR were read out at BEA. Analysis of DFDR was conducted with the help of BEA and NTSB.

9.9 **Organizational and Management Information.**

9.9.1 Consequent to the accident, Investigation Team of Safety Investigation Board, Pakistan CAA reached Islamabad.. Soon after the arrival, a crises management cum coordination meeting was conducted. Secretary Defence, MoD, chaired the meeting and the participants included Additional Secy-I, Director General CAA, Joint Secy-6 (Avn), President SIB, Investigation team, Reps from HQ CAA, Airport Management and Airblue Reps. A numbers of important decisions were taken and various responsibilities were allocated.

9.9.2 The arrangements including flight recorders analysis at BEA France and wreckage shifting from crash site to BBIAP Islamabad were looked after by Airblue. Airblue also chartered a heavy lift Helicopter from outside the country to airlift heavy parts of wreckage from Margalla hills to BBIAP, Islamabad. Airblue Technical Assistance team remained actively involved in handling and repositioning of wreckage with Technical Investigators.

CHAPTER - 10 : FINDINGS

10.1 The mishap Captain and the FO possessed the requisite qualifications/ratings and were medically fit to undertake this flight.

10.2 Though the Captain was scheduled for this flight only a night before, yet the aircrew were well rested and the “prescribed rest period (FDTL)” violation did not take place.

10.3 It was conclusively established that neither the Captain, nor the FO, were fasting during or 12 hours before the flight.

10.4 The weather conditions especially at the destination were marginal and these deteriorated weather conditions were found to be a factor in the causation of this accident.

10.5 The Captain’s behaviour towards the FO was harsh, snobbish and contrary to establish norms. This undesired activity of the Captain curbed the initiative of the FO, created a tense and undesirable environment, and a very conspicuous communication barrier in the cockpit, portraying a classic CRM failure.

10.6 Contrary to ATS briefing and established procedures of “Circle to Land RWY-12”, the Captain opted to fly approach on Nav mode and asked the FO to feed 04 way points (PBD 8-11 on FMS). **FO did not challenge the captain for his incorrect actions**.

10.7 This intention of Captain to fly PBD based approach was not known to the ATS at any stage of flight. Due to this violation of established procedure, the FMS created positions (PBD 8 to 11) were way out of the protected airspace lying into Margalla hills. ***Unfortunately, PBD-11 happened to be in the near vicinity of the crash point.***

10.8 The Captain had a very strong fixation for landing through RH D/W for RWY-12. This despite the fact that with his vast experience of flying, he knew RH D/W for RWY-12 is not allowed by procedures; and this time even low clouds were reported in the area.

10.9 The Captain showed signs of anxiety, preoccupation, confusion and geographical disorientation in various phases of flight especially after commencement of descent.

10.10 The Captain had prior knowledge of the decision by two Captains flying ahead of him. While the Captain of PK-356 managed to land (in the third attempt), the Captain of China Southern decided to divert back to Urumchi (China). The Captain of Mishap flight opted to follow PK-356 but with non-standard approach procedure.

10.11 During the descent, the Captain's request for RH D/W for RWY-12 for a visual approach (the request being contrary to established procedures at BBIAP, Islamabad) was not agreed to by Radar

10.12 During ILS approach, the Captain's second request for RH D/W for RWY-12 was also declined by ATC Tower due to procedural limitations (RH D/W for RWY-12 is not allowed).

10.13 After delayed break-off from ILS at minima due to poor visibility, the Captain turned right to about 352 degrees and then contrary to the published procedure, did not turn left to parallel the course of the runway.

10.14 While flying the northerly heading, abeam downwind, the Captain descended below the MDA (2,510ft) to 2,300ft. FO remained reliant on the Captain's actions and did not challenge the deviation from procedures.

10.15 The Captain failed to maintain visual contact with the airfield, in violation of the published procedures.

10.16 While aircraft was flying in the general direction of 352 degrees, it went very close to the NFZ (01 km) in the North.

10.17 When the ATC Controller did not find the aircraft on Downwind / final approach, he sought Radar help on landline. The aircraft was re-identified by the Radar close to NFZ. As advised by Radar controller, ATC instructed ABQ-202 to turn left to avoid No Flying Zone. However, the Captain had already initiated the left turn onto 300 degrees using HDG mode.

10.18 **At 0439:58 hrs (70 seconds before the impact), the first EGPWS warning of "terrain ahead" started sounding** meaning that the EGPWS worked exactly in the manner for which it was designed.

10.19 ABQ-202 was asked by ATS if they had contact with the airfield. No reply was given by either of aircrew, but FO asked the Captain in the cockpit ***"Kia batauon Sir" (what should I tell him Sir), indicating possible loss of visual contact with airfield as well as geographical disorientation.***

10.20 The protected circling airspace to fly at MDA was available till 4.3 NM. Contrary to the recommended procedures, the mishap aircrew took the aircraft out of the protected area to 7.3 NM from RWY-12 threshold.

10.21 In the ensuing self created emergency situation, the Captain unknowingly failed to do even the simple things such as engaging the HDG knob by pulling it to activate the desired mode.

10.22 **During last 70 seconds from crash, despite calls from ATS and the EGPWS sounding 21 times as Terrain ahead including 15 times for pull up (extract of sound and alarms chronology is attached at Appendix-C), the Captain continued to take the aircraft on its fatal journey**. The FO also informed the Captain **4 times** about the terrain / Terrain Warning and asked him **at least 3 times to pull up**. But the Captain did not pull up, nor did he apply the TOGA (Take Off Go Around) thrust, contrary to the established SOPs.

10.23 FO kept watching the Captain's failures, and unsafe actions such as inducing steep banks; and continuous flight into hilly terrain at low altitude in poor visibility; and failure to apply power and pull up. Unfortunately, FO remained impassive and failed to assert himself due to non congenial environment in the cockpit.

10.24 While the FO sensing imminent and acute danger did shout twice in the most disappointed / frustrated manner to inform the Captain that the aircraft was going down, but unfortunately still failed to takeover / override.

10.25 The aircraft was fully airworthy and its power plants, control surfaces, Enhanced Ground Proximity Warning System (EGPWS) and associated systems were functioning normal till its impact with the hill.

10.26 No evidence was found for any internal or external sabotage, incapacitation of the aircraft systems, in-flight fire, bird strike or structural fatigue.

10.27 BBIAP Islamabad being a busy international airport of the country, instrument approach procedure was not established for RWY-12, because of which Circle to land on RWY-12 was in use.

CHAPTER - 11 : CONCLUSION

11.1 ABQ-202, the mishap aircraft was airworthy to undertake the flight on 28 July 2010. Both the aircrew had valid medical and aircrew rating for the type of aircraft. Air Navigation and Aerodrome facilities were serviceable and as per AIP.

11.2 Weather conditions indicated rain, poor visibility and low clouds in and around the airport. The information regarding prevalent weather and the required type of approach on arrival was in the knowledge of aircrew.

11.3 Though aircrew Captain was fit to undertake the flight on the mishap day, yet his portrayed behavior and efficiency was observed to have deteriorated with the inclement weather at BBIAP Islamabad.

11.4 The chain of events leading to the accident in fact started with the commencement of flight, where Captain was heard to be confusing BBIAP Islamabad with JIAP Karachi while planning FMS, and Khanpur Lake (Wah) with Kahuta area during holding pattern. This state continued when Captain of the mishap flight violated the prescribed Circling Approach procedure for RWY-12; by descending below MDA (i.e 2,300 ft instead of maintaining 2,510 ft), losing visual contact with the airfield and instead resorting to fly the non-standard self created PBD based approach, thus transgressing out of protected airspace of maximum of 4.3 NM into Margallas and finally collided with the hills.

11.5 Aircrew Captain not only clearly violated the prescribed procedures for circling approach but also did not at all adhere to FCOM procedures of displaying reaction / response to timely and continuous **terrain** and **pull up** warnings (21 times in 70 seconds) – despite these very loud, continuous and executive commands, the Captain failed to register the urgency of the situation and did not respond in kind (break off / pull off).

11.6 FO simply remained a passive bystander in the cockpit and did not participate as an effective team member failing to supplement / compliment or to correct the errors of his captain assertively in line with the teachings of CRM due to Captain's behavior in the flight.

11.7 At the crucial juncture both the ATC and the Radar controllers were preoccupied with bad weather and the traffic; the air traffic controller having lost visual contact with the aircraft got worried and sought Radar help on the land line (the ATC does not have a Radar scope); the radar controller having cleared aircraft to change frequency to ATC, got busy with the following traffic. Having been alerted by the ATC, the Radar controller shifted focus to the mishap aircraft – seeing the aircraft very close to NFZ he asked the ATCO (on land line) to ask the aircraft to immediately turn left, which was transmitted. Sensing the gravity of the situation and on seeing the aircraft still heading towards the hills, the Radar controller asked the ATCO on land line "Confirm he has visual contact with the ground. If not, then ask him to immediately climb, and make him execute missed approach". The ATCO in quick succession asked the Captain if he had contact with the airfield – on receiving no reply from aircrew the ATCO on Radars prompting

asked if he had contact with the ground. Aircrew announced visual contact with the ground which put ATS at ease.

11.8 Ensuing discussion and mutual situational update (on land line) continued and, in fact, the ATC call “message from Radar immediately turn left” was though transmitted, but by the time the call got transmitted, the aircraft had crashed at the same time.

11.9 The accident was primarily caused by the aircrew who violated all established procedures for a visual approach for RWY-12 and ignored several calls by ATS Controllers and EGPWS system warnings (21) related to approaching rising terrain and PULL UP.

CHAPTER – 12 : FINALIZATION

Air blue crash has been finalized as a case of **Controlled Flight into Terrain (CFIT),** in which aircrew failed to display superior judgment and professional skills in a self created unsafe environment. In their pursuit to land in inclement weather, they committed serious violations of procedures and breaches of flying discipline, which put the aircraft in an unsafe condition over dangerous terrain at low altitude.

CHAPTER - 13 : SAFETY RECOMMENDATIONS

13.1 All aircrew be re-briefed on CFIT avoidance and Circling Approach procedures and a strict implementation of this procedure be ensured through an intensive monitoring system.

13.2 Aircrew scheduling and pairing being a critical subject be preferably handled / supervised by Flight Operations.

13.3 The implementation of an effective CRM program be ensured and the syllabus of CRM training be reviewed in line with international standards.

13.4 Existing aircrew training methodology be catered for standardization and harmonization of procedures.

13.5 Human factor / personality profiling program for aircrew be introduced to predict their behaviour under crises.

13.6 Instrument landing procedure for RWY-12 be established, if possible.

13.7 Safety Management System be implemented in ATS as per the spirit of the ICAO document (doc. 4444).

13.8 New Islamabad International Airport (NIIA) be completed and made functional on priority

13.9 Visual augment system (Approach Radar Scope) be installed in control tower to monitor the positions and progress of aircraft flying in the circuit.

13.10 Review of the existing Regulations for the compensation and their expeditious award to the legal heirs of the victims be ensured.

13.11 Adequacy of SIB resources comprising qualified human resource and equipment be reviewed.

13.12 Information to public on the progress of the investigation process through the media by trained / qualified investigators of SIB be ensured on regular intervals.

13.13 NDMA be tasked to acquire in-country airlift capability for removal of wreckage from difficult terrain like Margalla etc. As an interim arrangement, some foreign sources be earmarked for making such an arrangements on as and when required basis.

13.14 Civil Police Department be tasked to work out and ensure effective cordoning and onsite security arrangements of crashed aircraft wreckage at all the places specially remote / difficult hilly locations.

13.15 Environment Control Department be directed to recover the ill effects of deterioration / damages caused to Marghalla hill due to the crash.

Appendix – A

COMPOSITION OF INVESTIGATION TEAM

Team Members

1) Investigation In Charge (IIC), Safety Investigation Board, PCAA
2) Ops Member, PCAA
3) Tech Member, Safety Investigation Board, PCAA
4) Medical Member, PCAA
5) ATS Member, PCAA
6) Airworthiness Member, PCAA
7) Airblue Acc Member
8) PAF Acc Member

Appendix – B

LIST OF INTERNATIONAL ACCREDITED REPRESENTATIVES

BEA France Accredited Representative -

-

a. **Technical Advisor to BEA France Acc Rep**

U.S. Accredited Representative -

-

-

a. **Technical Advisors to US Acc Rep**

b. **US Federal Aviation Administration.**

Accredited Representative -

Appendix – C

EXTRACT OF SOUND AND ALARMS CHRONOLOGY

The CVR recording started at 02:36:08. The following table is the chronology of significant sound and alarms heard on the CVR files from 04:35:00 till the end of the recording.

	UTC Time	Sound and alarms (SV : Synthetic Voice)
1	04h 35mn 43s	Sound of gear extension
2	04h 36mn 54s	SV *« One thousand »*
3	04h 37mn 05s	Triple click
4	04h 39mn 58s	EGPWS caution / SV *« Terrain ahead »*
5	04h 40mn 00s	EGPWS caution / SV *« Terrain ahead »*
6	04h 40mn 16s	EGPWS caution / SV *« Terrain ahead »*
7	04h 40mn 18s	EGPWS caution / SV *« Terrain ahead »*
8	04h 40mn 26s	EGPWS caution / SV *« Terrain ahead »*
9	04h 40mn 28s	EGPWS warning / SV *« Terrain ahead pull up »*
10	04h 40mn 31s	EGPWS warning / SV *« Terrain ahead pull up »*
11	04h 40mn 34s	EGPWS warning / SV *« Terrain ahead pull up »*
12	04h 40mn 37s	EGPWS warning / SV *« Terrain ahead pull up »*
13	04h 40mn 39s	EGPWS warning / SV *« Terrain ahead pull up »*
14	04h 40mn 42s	EGPWS warning / SV *« Terrain ahead pull up »*
15	04h 40mn 45s	EGPWS warning / SV *« Terrain ahead pull up »*
16	04h 40mn 47s	Pilot disconnect / Cavalry charge “Auto”
17	04h 40mn 48s	EGPWS warning / SV *« Terrain ahead pull up »*
18	04h 40mn 50s	EGPWS warning / SV *« Terrain ahead pull up »*
19	04h 40mn 53s	EGPWS warning / SV *« Terrain ahead pull up »*
20	04h 40mn 56s	EGPWS warning / SV *« Terrain ahead pull up »*
21	04h 40mn 59s	EGPWS warning / SV *« Terrain ahead pull up »*
22	04h 41mn 01s	EGPWS warning / SV *« Terrain Terrain »*
23	04h 41mn 03s	EGPWS warning / SV *« Terrain ahead pull up »*
24	04h 41mn 05s	EGPWS warning / SV *« Pull up »*
25	04h 41mn 07s	EGPWS warning / SV *« Pull up »*
		--END--