

PRELIMINARY INVESTIGATION REPORT



ACCIDENT OF PIA FLIGHT PK8303 AIRBUS A320-214 REG NO AP-BLD CRASHED NEAR KARACHI AIRPORT ON 22-05-2020

Dated: 19 June 2020

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ABBREVIATIONS & CODES

Abbreviation / Code	Description
AAIB	Aircraft Accident Investigation Board
ACCREP	Accredited Representative
ADIRU	Air Data Inertial Reference Unit
AllAP	Allama Iqbal International Airport
AIP	Aeronautical Information Publication
APU	Auxiliary Power Unit
ATCO	Air Traffic Control Officer
BEA	Bureau of Enquiries and Analysis
CAA	Civil Aviation Authority
CARs	Civil Aviation Rules
CCTV	Close Circuit Television
CRM	Crew Resource Management
DAAR	Directorate of Airspace and Aerodrome Regulations
DEG	Degree
EASA	European Aviation Safety Agency
EGPWS	Enhanced Ground Proximity Warning System
FCDC	Flight Controls Data Concentrator
FCU	Flight Control Unit
FDM	Flight Data Monitoring
FDR	Flight Data Recorder
FIG	Figure

Abbreviation / Code	Description
FL	Flight Level
FO	First Officer
Ft	Feet
Hrs	Hours
HTP	Horizontal Tail Plane
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
JIAP	Jinnah International Airport
LH	Left Hand
LHS	Left Hand Side
MLG	Main Landing Gear
NLG	Nose Landing Gear
NM	Nautical Miles
NTSB	National Transport Safety Board
OPEN DES	Open Descent
PAX	Passengers
PIA	Pakistan International Airlines
PST	Pakistan Standard Time
QAR	Quick Access Recorder
RAT	Ram Air Turbine
RHS	Right Hand Side
SQMS	Safety and Quality Management System

Abbreviation / Code	Description
STAR	Standard Terminal Arrival Route
THS	Trimmable Horizontal Stabilizer
THSA	Trimmable Horizontal Stabilizer Actuator
USA	United States of America
VOR	Very High Frequency Omnidirectional Range
VTP	Vertical Tail Plane

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AAIB Pakistan acknowledges with profound gratitude the dedicated involvement of Bureau of Enquiries and Analysis (BEA) of France, National Transport Safety Board (NTSB) of USA, their respective advisors, ie EASA, Airbus SAS, Safran Engines, and General Electric, in the investigation process.

PRELIMINARY REPORT

ACCIDENT OF PIA FLIGHT PK8303 AIRBUS A320-214 REG NO AP-BLD NEAR KARACHI AIRPORT ON 22-05-2020

Brief Description

1. On 22 May 2020 at 13:05 hrs PST, the Pakistan International Airlines aircraft Airbus A320-214, registration number AP-BLD, took off from Lahore (Allama Iqbal International Airport – AllAP) Pakistan to perform a regular commercial passenger flight (PK8303) to Karachi (Jinnah International Airport – JIAP) Pakistan, with 8 crew members (01 Captain, 01 First Officer, and 06 flight attendants) and 91 passengers on board. At 14:35 hrs the aircraft performed an ILS approach for runway 25L and touched down without landing gears. Both engines scrubbed the runway at high speed. Flight crew initiated a go-around and informed “Karachi Approach” that they intend to make a second approach. About four minutes later, during downwind leg, at an altitude of around 2000 ft, flight crew declared an emergency and stated that both engines had failed. The aircraft started losing altitude. It crashed in a populated area, short of runway 25L by about 1340 meters (Lat: 24°54'42.07 Long: 67°11'18.99). An immediate subsequent post impact fire initiated. Out of 99 souls on-board, 97 were fatally injured and 02 passengers survived. On ground 04 persons were injured however 01 out of these reportedly expired later at a hospital.

Constitution / Composition of the Investigation Team

2. The investigation was notified by the Federal Government vide Notification No AT-13(1)/2020 dated 22 May 2020, under the provision of sub rule (1) Rule 273 of Civil Aviation Rules (CARs) 1994. As per this notification the investigation team comprises of following four members:-

- (a) Air Cdre Muhammad Usman Ghani, President AAIB (Investigator In-charge).
- (b) Gp Capt Toqeer Ahmad, Operations Investigator, PAF (Member).
- (c) Wg Cdr Malik Muhammad Imran, Additional Director Technical Investigation AAIB (Member).
- (d) Mr. Nasir Majeed, Additional Director ATS Investigation AAIB (Member).

3. As per rule 273 of CARs 1994 the investigator in-charge is empowered to include co-opted members, and as per para 5.18 of the ICAO Annex 13 and rule 278 CARs 1994 the investigation team is supported by the Accredited Representatives (ACCREPs), along with their advisors from aircraft and engine design and manufacture, and one Advisor from EASA. After addition of co-opted members and ACCREPs the Investigation team now comprises of a total of 12 members, which includes following: -

- (a) **04 AAIB** Pakistan investigators
- (b) **02 BEA** France investigators and **01 NTSB** USA investigator (ACCREPs)
- (c) **05 co-opted** members (02 A320 pilots, 01 doctor, 01 aviation psychologist, and 01 A320 engineer)

Scope / Purpose of Investigation

4. This safety investigation by AAIB is conducted in accordance with Annex-13 to the ICAO Convention, and CARs 1994. The sole objective of this safety investigation is the prevention of accidents and incidents of similar nature. It is not the purpose of this safety investigation to apportion blame or liability. Accordingly, it is inappropriate to use AAIB investigation report (or any preliminary / interim report / statement by AAIB) to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

5. This information is published to inform the aviation industry (states of manufacture and design, and ICAO etc) and the public about the general circumstances of this event. It is in line with ICAO Annex 13 para 7.1 and 7.5, and para 2 of the Notification by the Federal Government Ref AT-13(1)/2020 dated 22 May 2020. Extracts of this preliminary report may be published without specific permission, provided that the source is duly acknowledged, and the material is reproduced accurately, in its original context.

6. This is a preliminary report and it contains facts which have been determined up to the time of publication. It provides brief overview of the investigation process (tasks accomplished so far), summary of a few of the important findings, and an overview of the remaining investigation process.

Custody of Records of Aircrew, ATCOs and Aircraft

7. Aircrew records related to their medical fitness and licensing etc were taken into immediate custody from relevant directorates of CAA. Similarly their training records and personal documents were collected from PIA. All these documents are in the custody of AAIB. Additionally, information about crew scheduling / rest periods during last one month and during last 72 hours was collected from PIA.

8. Air Traffic Control Officers (ATCOs) records related to licensing, training, medical fitness and categorization were taken into immediate custody from relevant directorates of CAA. Duty rosters and records related to scheduling were also collected.

9. Aircraft technical documents, records, log books (ie Aircraft, Engine, Auxiliary Power Unit (APU) and Technical log books, Check A-1, Check A-3, Daily Check Sheets, Weekly Check Sheets and Check-C records, and Cabin Log book etc) were collected from PIA, and are kept in the custody in AAIB. Salient aspects / data about aircraft and its engines is appended below: -

Manufacturer	Airbus S.A.S.
Type	A320-214
Serial number	2274
Registration	AP-BLD
Entry into service	2004
Engine manufacturer	CFM International
Engine type	CFM56-5B4/P
Engine 1 serial number	577534
Engine 2 serial number	697502
Total flight hours	47124
Total flight cycles	25866

Crash Site

10. The crash site is located in a residential area northeast of JIAP. The wreckage lies approximately 1340 m from the runway 25L threshold close to the extended runway centerline. The aircraft parts were spread out over 75 m in a single street, with some parts on the roof tops of adjoining houses. Figure 1 hereunder describes the location of the crash site with reference to the JIAP on a Google Earth image. Figure 2 shows an aerial view of the crash site.



Fig 1: Google Earth crash site location (direction of flight from right to left)

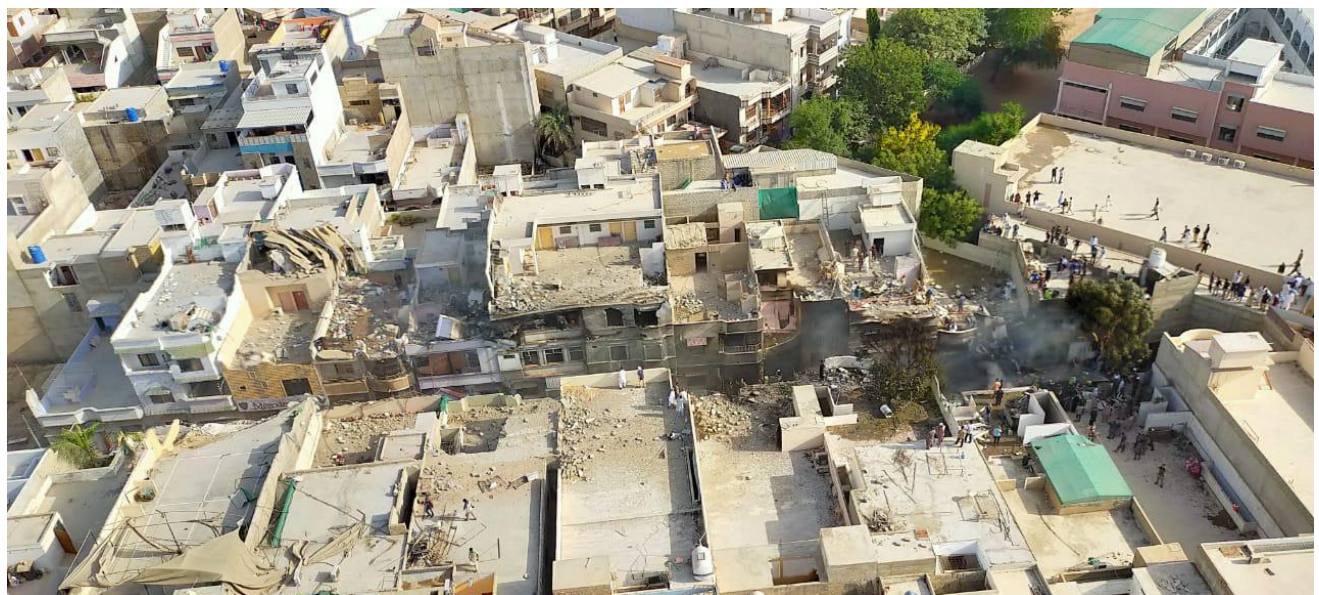


Fig 2: Aerial view of the crash site street (direction of flight from left to right)

Mapping and Identification of Aircraft Parts

11. Most of the aircraft parts were located on the southern side of the street. The building heights are between 9 m and 11 m. The following image presents an overview of the layout of the various aircraft parts found in the street by the investigation team. Parts identified in

green were located on the roofs of the buildings adjacent to the street. Parts identified in orange were located on the ground. Most of the parts however were moved during the search and rescue operations.

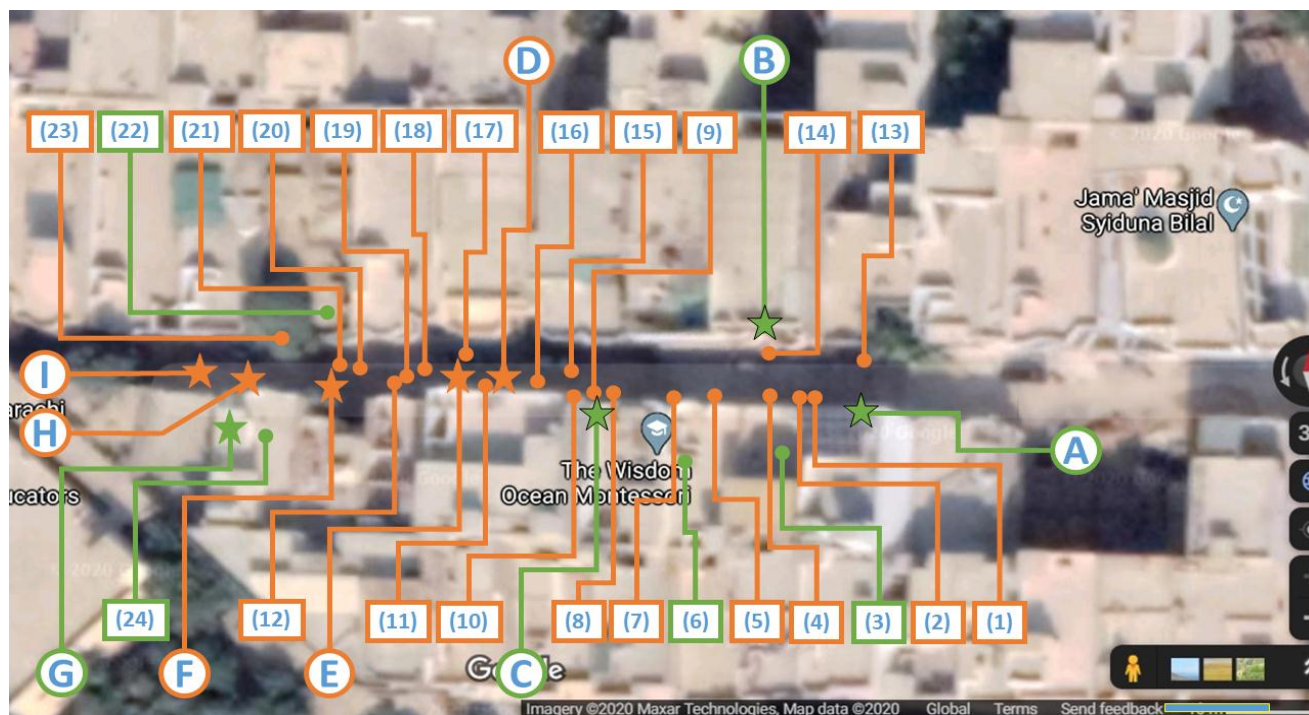


Fig 3 : Wreckage mapping (Google Maps)

Legend		
A- Impact Point	B- MLG wheels RHS	C- ENG1 & LHS Wing
D- VTP	E- APU Cone	F- ENG2
G- Cockpit	H- RHS Wing	I- Avionics
(1) Pax door	(2) APU inlet	(3) Flap fairings
(4) HTP panels	(5) LH Wing	(6) LH wing tip
(7) HTP panels	(8) LH HTP	(9) Pax door
(10) MLG Fitting LH	(11) Slat LH	(12) Fuselage panels
(13) MLG LH	(14) MLG LH Tire	(15) APU tail cone
(16) RHS Wing	(17) NLG uplock	(18) THS Screw
(19) NLG main strut	(20) Cargo door & aft fuselage	(21) RH MLG upper part
(22) Wing tip	(23) RAT	(24) NLG

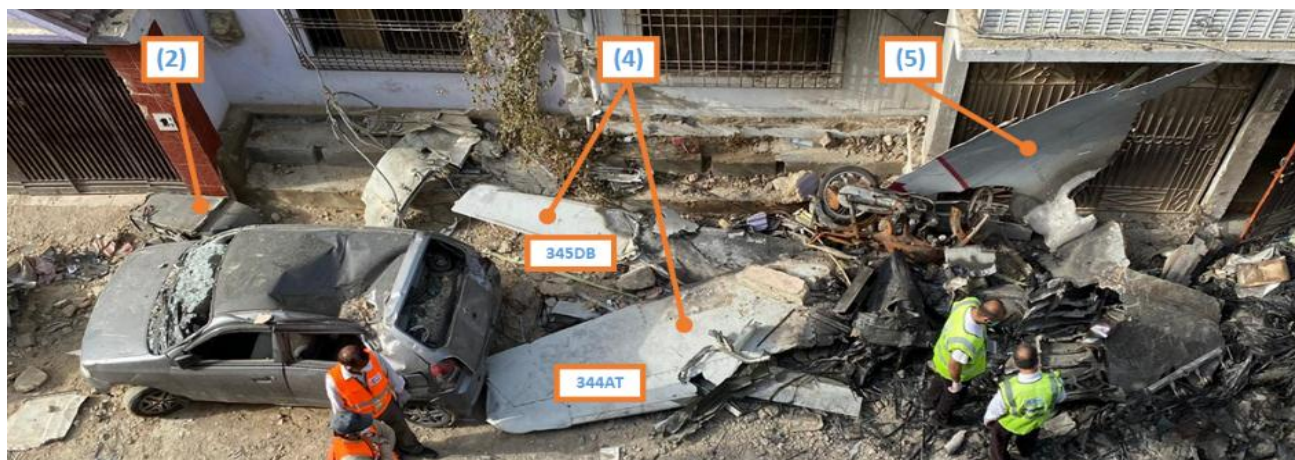


Fig 4 : View of the eastern side of the street



Fig 5 : View of the middle of the street looking towards the western end of the street

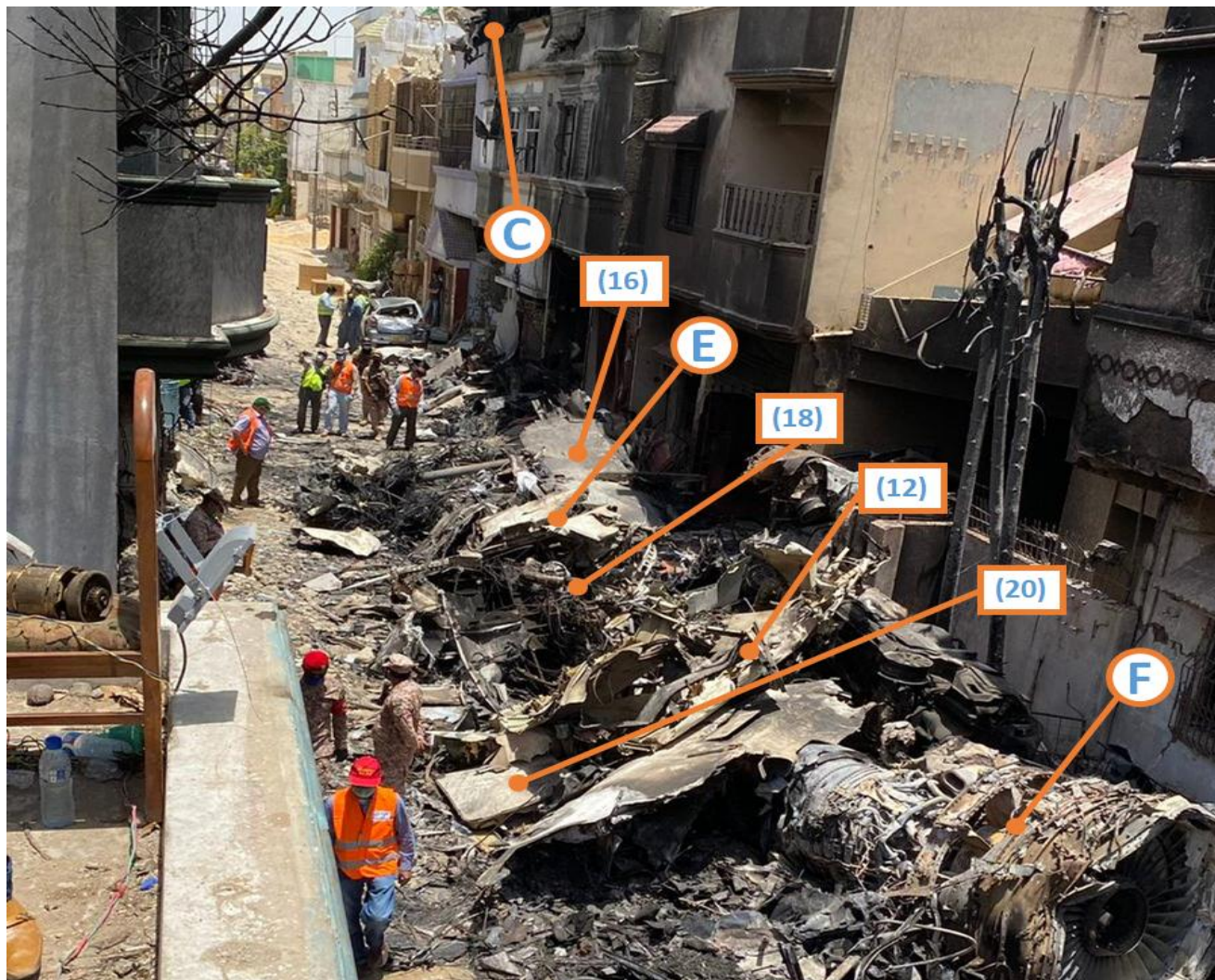


Fig 6 : View from western end of the street looking towards eastern side

12. The layout of the aircraft parts on the accident site is consistent with the aircraft impacting buildings on both sides of the street at low speed. The THSA position before the impact was determined to be 2.8 deg nose up. According to the Rudder Travel Limiting Unit, the aircraft speed before impact was below 150 knots IAS. Several findings indicate an extended landing gear configuration at the time of impact. The free fall mechanism for lowering of landing gears was not used. The slat / flap configuration was determined to be in position slat 1 (ie 18 deg), flaps fully retracted (0 deg). The RAT was seen deployed on CCTV screen shots prior impact.

13. Left engine showed evidence of external fire. Visible fan blades condition was consistent with the engine being at low rotational speed at the time of impact, most likely not producing any thrust. Right engine showed evidence of external fire. Fan blades were in good condition being consistent with the engine at low rotational speed at the impact, most likely not producing any thrust at time of impact.

14. Transfer gearbox and drain mast reservoir, located at the engine lower part showed marks of friction with hard flat surface, material displacement and loss of material. It was consistent with the CCTV footages showing the lower part of the engine scrubbing the runway during the first landing attempt. The APU air intake flap actuator was not in the "retracted" position, consistent with the APU not being used at the time of impact, ie not

supplying electric power and bleed air pressure.

15. Some parts recovered from the runway 25L were identified as CFM56-5B engine and A320 nacelle parts, consistent with the CCTV videos of the airport showing the lower part of the nacelle and engines impacting the runway during the first landing attempt.

Wreckage Removal and Collection of Vital Evidences

16. Various aircraft components were identified and removed from the crash site. Few of the components were considered as vital for the analysis and were preserved. Flight Data Recorder (FDR), Cockpit Voice Recorder (CVR), Enhanced Ground Proximity Warning System (EGPWS) computer, Quick Access Recorder (QAR) computer, Flight Controls Data Concentrator (FCDC) computer, Air Data Inertial Reference Unit (ADIRU) computer were collected from the wreckage and were earmarked for advanced analysis, at BEA. Figures hereunder show wreckage at the crash site: -



Fig 7 : Left wing being lifted from roof top



Fig 8 : Right wing



Fig 9 : Left engine being lifted from roof top



Fig 10 : Right engine



Fig 11 : Left main landing gear



Fig 12 : Right main landing gear

17. Some electronic components / vital parts (that may be required for advanced analysis during later stage of investigation) were preserved and placed at AAIB Camp office at Karachi. Other major parts including both Engines were placed at the wreckage storage site at a disused tarmac at JIAP, close to Shaheen Hangar. Figures hereunder show AAIB Camp Office and the wreckage storage site at the tarmac area.



Fig 13 : Parts / components stored at AAIB Camp Office



Fig 14 : Wreckage layout at the wreckage storage site

FDR / CVR Readout Activity at BEA France

18. FDR, CVR, EGPWS, QAR, FCDC, and ADIRU were transported to BEA under the personal custody of the investigator in-charge, on a special flight on 01 June 2020. Opening of the FDR and CVR, electrical checks and related technical jobs were undertaken on 02 June 2020 in the presence of investigator in-charge. CVR was damaged during post impact fire; therefore, its connecting cable (ie flex cable) and connector were burnt. It required opening of the protected module and removal of the circuit boards, visual microscopic examination, electric checks and then readout on a “golden chassis”. FDR was in a good state, therefore its opening and readout were comparatively simple. A recording of the entire activity was saved as per the recommended practices. After readout and validation of data, initial discussions and preliminary analysis were undertaken at BEA during 02 to 05 June 2020. Advanced analysis is in progress at BEA, and detailed reports shall be furnished accordingly. Figures hereunder show the CVR and FDR opening and readout process.



Fig 15 : FDR as recovered from wreckage



Fig 16 : CVR as recovered from wreckage



Fig 17 : FDR opening for data recovery



Fig 18 : CVR opening for data recovery



Fig 19 : FDR protected module on a golden chassis for readout



Fig 20 : CVR circuit boards on a golden chassis for readout

19. The CVR recording was found to be of good quality and covered complete flight. However, FDR included the data of the entire flight except after the time when electric power was not available for the FDR. This is as per its designed limitation.

Preliminary Findings

20. The investigation so far into the available evidences, ie FDR / CVR readouts (preliminary assessment), footages from CCTV / Security Cameras at JIAP, and “Karachi Approach” radar data etc, following has been revealed and validated as the preliminary findings: -

- (a) The reported weather at origin, en-route and at destination airfields was fit to undertake the flight.
- (b) On 22 May 2020 PIA flight PK8303 took off from AllAP Lahore at 13:05 hrs (as per the Lahore ATC recording / transcript). Departure from Lahore and cruising flight were uneventful. The crew did not follow standard callouts and did not observe CRM aspects during most parts of flight.
- (c) “Area Control Karachi East” cleared PK8303 for “Nawabshah 2A” arrival procedure (STAR - Standard Terminal Arrival Route as published in AIP and JEPPESEN), and advised to expect ILS approach for runway 25L. The flight was later cleared at pilot’s discretion to report direct MAKLI (a waypoint 15 nautical miles at a radial of 075 from Karachi VOR) and descend to FL100, and later re-cleared for FL50.

The aircraft changed over to “Karachi Approach” and was cleared to descend down further to 3000 ft, by the time it reaches MAKLI.

(d) The aircraft ended up higher than the required descend profile. At MAKLI the aircraft was at 9780 ft and at about 245 knots IAS. In order to manage the descent and lose the additional height, “OPEN DES” mode was selected via the FCU, both autopilots were disengaged and speed brakes were extended.

(e) “Karachi Approach” inquired “confirm track mile comfortable for descend” and later advised to take an orbit, so that the aircraft can be adjusted on the required descend profile. No orbit was executed and the effort to intercept the glide slope and localizer (of ILS) was continued. The FDR indicated action of lowering of the landing gears at 7221 ft at around 10.5 Nautical Miles from Runway 25L.

(f) “Karachi Approach” advised repeatedly (twice to discontinue the approach and once cautioned) about excessive height. Landing approach was not discontinued. However, FDR shows action of raising of the landing gears at 1740 ft followed by retraction of the speed brakes (at a distance slightly less than 05 nautical miles from the runway 25L). At this time, the aircraft had intercepted the localizer as well as the glide slope. Flaps 1 were selected at 243 knots IAS, the landing gears and speed brakes were retracted. Over-speed and EGPWS warnings were then triggered.

(g) Figure hereunder depicts a few parameters of FDR data and the first approach profile of the aircraft in comparison with the required approach profile.

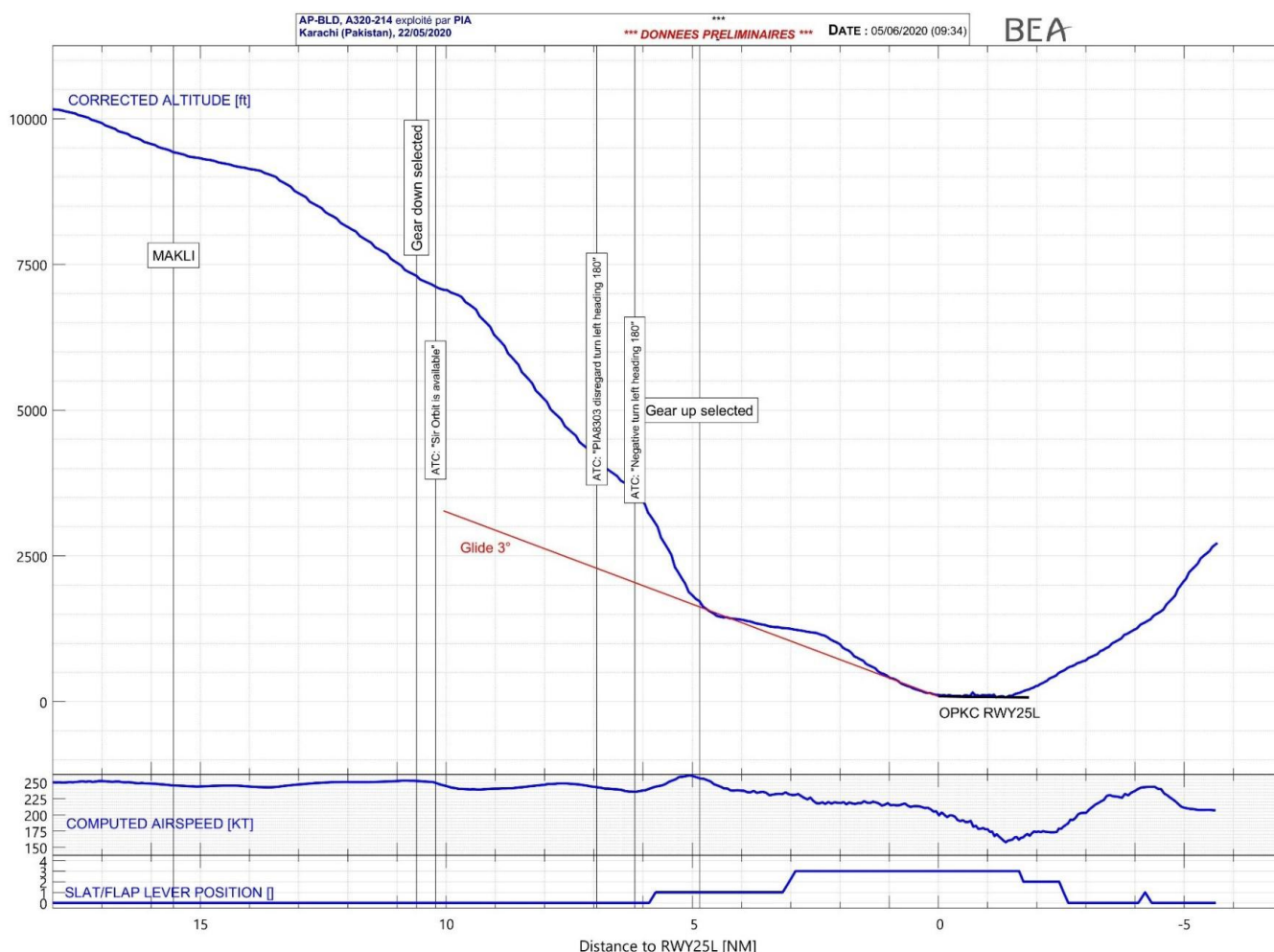


Fig 21 : Selected FDR parameters during last part of the first approach

Note : For the descent path, the altitude has been shifted to start from 84 ft in order to match the altitude of the runway at ground impact.

(h) Since the approach to land was continued, “Karachi Approach” instead of changing over the aircraft to “Aerodrome Control”, sought telephonic landing clearance from the “Aerodrome Control”. The “Aerodrome Control” conveyed a landing clearance of the aircraft (without observing the abnormality that the landing gears were not extended) to “Karachi Approach”. Subsequently “Karachi Approach” cleared the aircraft to land.

(i) At 500 ft, the FDR indicates: landing gear retracted, slat/flap configuration 3, airspeed 220 knots IAS, descent rate 2000 ft/min. According to the FDR and CVR recordings several warnings and alerts such as over-speed, landing gear not down and ground proximity alerts were disregarded. The landing was undertaken with landing gears retracted. The aircraft touched the runway surface on its engines. Flight crew applied reverse engine power and initiated a braking action. Both engines scrubbed the runway at various locations causing damage to both of them. Figures hereunder show selected screenshots of security / CCTV cameras footages of the aircraft engines touching the runway and showing sparks due to scrubbing, along with marks on the runway.



Fig 22 : Screenshots of security / CCTV cameras footages, and marks on runway

(j) The “Aerodrome Control” observed the scrubbing of engines with the runway but did not convey this abnormality to the aircraft. It was conveyed to the “Karachi Approach” on telephone. Subsequently “Karachi Approach” also did not relay this abnormality to the aircraft.

(k) The landing was discontinued and a go-around was executed. FDR recording indicates a brief action of selection of landing gear lever to down position, which was immediately followed by its movement to up position. Intention to undertake another ILS approach for landing on runway 25L was conveyed, however shortly after the go-around both engines failed one by one. Ram Air Turbine (RAT) was deployed to power the essential systems. FDR data recording stopped during this timeframe (as per the designed limitation). The aircraft was unable to maintain required height. The aircrew declared the emergency situation that both engines were lost, and transmitted a “Mayday Call”. Evidences from the wreckage indicate reasons for right engine failure, however left engine requires further examination, and landing gear in extended position did not demonstrate any malfunction of the landing gear system.

(l) The aircraft crashed about 1340 meters short from runway 25L. It was a slow speed impact with high angle of attack, with aircraft configuration indicating landing gears extended, slats at step / position 1, and flaps retracted. The said configuration was ascertained and documented from the wreckage at the crash site (as the FDR data recording had stopped earlier).

(m) The aircraft was reportedly serviceable for the said flight; necessary scrutiny of the aircraft maintenance records / documents is under way. Captain and First Officer were adequately qualified and experienced to undertake the said flight; necessary scrutiny of the aircrew records / documents is under way.

Way Forward

21. Further course of investigation process may include (but not limited to) advance analysis of FDR and CVR, related advanced technical analysis of aircraft / engine components, exploration for reasons and causes of the anomalies discovered so far, and also of any further shortcomings that may be revealed during later part of the investigation. This may encompass conduct of various activities at AAIB, and deep interaction / visits to relevant organizations to ascertain possible causes and identify proportionate safety recommendations. Overview of planned activities (envisaged so far) related to the remaining investigation process are as follows :-

(a) Scrutiny and analysis of aircrew records related to their medical fitness, licensing, training records and personal documents, and information about crew scheduling / rest periods during last one month and during last 72 hours. Similarly ATCOs records related to licensing, training, medical fitness and categorization, duty rosters and scheduling records are under scrutiny and analysis at AAIB.

(b) Aircraft documents (ie Engine, APU and Technical log books, Check A-1, Check A-3, Daily Check Sheets, Weekly Check Sheets and Check-C records, Cabin Log book etc) are also under scrutiny and analysis at AAIB.

(c) Layout and analysis of aircraft wreckage is under process for any advance analysis of technical nature for respective failure pattern of aircraft components and / or engines. Components of vital significance have been preserved. The decision of

requirement of such advanced analysis will depend upon the detailed FDR and CVR analysis.

(d) The aircraft remained on ground for 46 days (from 22 March to 06 May 2020) during Covid 19 quarantine, due to restrictions on flying operations. Scrutiny of the maintenance records before the release of the aircraft for normal flying is under process by AAIB, to evaluate the adequacy of the maintenance actions.

(e) Critical analysis of actions / decisions by ATCOs at “Karachi Approach” and “Aerodrome Control”, will be undertaken in light of the relevant ICAO Standards and Recommended Practices, the procedures adopted by Operations Directorate of CAA, and oversight of important aspects by Directorate of Airspace and Aerodrome Regulations (DAAR) of CAA.

(f) Critical analysis of monitoring of performance of the pilots by PIA for stabilized approaches, use of FDM analysis tools, CRM training mechanism, and supervision of simulator sessions etc and related regulatory oversight by the Directorate of Flight Standards (DFS) of CAA, will be undertaken and shall require detailed visits of relevant departments of PIA and CAA.

(g) Assessment of Safety Management System of PIA and State Safety Programme (SSP) of CAA for the safety oversight of operators, and evaluation of Safety and Quality Management System (SQMS) for the safety oversight of Directorate of Operations of CAA, will be undertaken by AAIB.

(h) Assessment of preflight medical actions, and post-crash initial response by CAA, is also underway at AAIB.

22. The way forward shall also include collaboration with ACCREPs from BEA and NTSB. The envisaged activities include analysis / reconstruction of the flight profile of the aircraft after the time the FDR data is not available, discussion on the actions and decisions during various stages of the entire flight, and detailed FDR and CVR reports etc.

Summary

23. This Preliminary Report is issued in accordance with ICAO Annex 13 para 7.1 and 7.5, and para 2 of Notification No Ref AT-13(1)/2020 dated 22 May 2020 by the Federal Government. This report provides facts which have been determined up to the time of publication. It includes brief overview of the investigation process (tasks accomplished so far), summary of a few of the important findings, and an overview of the remaining investigation process. It will be followed by advanced analysis into the root causes and a draft final report shall be compiled, which would be further disseminated to the ACCREPs in accordance with the relevant provisions of the ICAO Annex 13. After the comments by the ACCREPs the Final Report shall be submitted to the Aviation Division, for approval and dissemination.