FINAL INVESTIGATION REPORT

SERIOUS INCIDENT OF PIA FLIGHT PK-311 (QUETTA TO KARACHI) ATR 42-500 REG NO AP-BHM NO 1 ENGINE IN-FLIGHT SHUT DOWN DURING FINAL APPROACH AT JIAP KARACHI ON 09-06-2017

SCOPE

Safety Investigation Board (SIB), Pakistan investigations are conducted in accordance with Annex-13 to the ICAO Convention on International Civil Aviation and Civil Aviation Authority (CAA), Pakistan Rules 1994 (CARs 94).

The sole objective of the investigation of an accident or incident under above stated regulations is the prevention of future accidents and incidents of similar nature. It is not the purpose of such an investigation to apportion blame or liability. Accordingly, it is inappropriate that SIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

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THE SIB PAKISTAN ICAO ANNEX 13 SAFETY INVESTIGATION BOARD TEAM

Sr No	Name	Designation
1.	Air Commodore M Usman Ghani	President SIB Investigation In-charge
2.	Group Captain Mian Tahir Aftab	Additional Director Tech Investigator SIB

FINAL REPORT

SERIOUS INCIDENT OF M/S. PIAC FLIGHT PK-311 (SECTOR UET – KHI) ATR42-500 REG NO AP-BHM AT JIAP KARACHI ON 09-06-2017

Synopsis

On 09 June 2017, AP-BHM ATR-42-500 aircraft operated by Pakistan International Airlines was on a flight from Quetta to Karachi Jinnah International Airport. While on final approach for Runway 25L at Karachi, an un-commanded in-flight shutdown of the number 1 engine occurred. The aircraft landed safely out of same approach.

This serious incident was reported to Safety Investigation Board (SIB) Pakistan by the operator through Mandatory Occurrence Report. The incident was notified in accordance with ICAO Annex-13. Aviation Division Government of Pakistan issued memorandum vide letter No HQCAA/1901/396/SIB dated 15June, 2017 authorizing SIB Pakistan to investigate the incident.

1. FACTUAL INFORMATION

1.1 **History of the Flight**. On 09 June 2017, PIAC aircraft AP-BHM ATR-42-500 took off from Quetta for Karachi. The weather was fit to undertake the flight. The aircraft followed standard route. After establishing localizer for the final approach the first officer (Pilot Flying) felt a dissymmetry in the flight conditions. The Captain took over the controls. Master caution light along with EEC light and subsequently PEC light of No 1 Engine came on. Followed by unwinding of all parameters / un-commanded in-flight shutdown of No 1 Engine. Checklist actions were taken and the aircraft landed safely out of same approach. There were 41 passengers and 04 crew members on board. The aircraft landed safely with no injuries.

1.2 **Injuries to Persons**. Nil.

1.3 **Damage to Aircraft**. Nil.

1.4 **Other Damages**. None.

1.5 **Personnel information**. The aircraft was flown by Captain Furrukh Azam Chohan and First Officer Uzair Ansari. Both the pilots were qualified, held valid licences and were adequately experienced to undertake the said flight.

1.6 **Aircraft and Engine Information**.

AIRCRAFT INFORMATION	
Aircraft Make & Model	ATR42-500
Registration Marking	AP-BHM
Manufacturer Serial No	659
Year of Manufacture	March 2007
Daily inspection prior to 09-06-2017 occurrence (date, location)	09-06-17 (KHI)
Total Aircraft hours / cycles / landings	22049:13 / 21799 / 21945

NO 1 ENGINE INFORMATION		
Part No		PW127E
S No		EB0284
Manufacturer's Details		Pratt & Whitney Canada
Time Since New (TSN) / CSN		14346/13242
Time Since Installed		1772 Hrs
Next Overhaul Due at TSN / CSN		25262 /18058
Details of recent scheduled / un-scheduled maintenance performed on this engine		
S No	**Date / Location**	**Details of Sch / Un-sch maintenance**
1	03/06/17(KHI)	HP vane damage BSI
2	28/05/17(KHI)	Handling bleed Valve filter cleaning
3	18/04/17(ISB)	HPT NGVs inspection

1.7 The aircraft was being maintained in accordance with the approved maintenance schedule. Recent maintenance record for the past over two years (March, 2015 ~ June, 2017) of the engine S No EB0284 was reviewed from it's Log book which revealed that :

1.7.1 This engine has flown 2337 hours in last 28 months and 1772 hour since installation on this aircraft AP-BHM.

1.7.2 The engine has not gone thru any maintenance which could have a direct impact towards this occurrence.

1.8 **Meteorological Information.**Weather was fit to undertake said flight.

1.9 **Aids to Navigation**. All onboard aircraft & ground navigation aids and related equipment were serviceable.

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

1.11 **Aerodrome Information.** Detailed aerodrome data of Jinnah International Airport, Karachi is appended below:-

1.12 **Flight Recorders**. The Flight Data Recorder (FDR) andCockpit Voice Recorder (CVR) were successfully downloaded and utilized for the purpose of investigation.

1.13 **Wreckage and Impact Information**. Not applicable.

1.14 **Medical and Pathological Information**. Not applicable.

1.15 **Fire**. There was no evidence of fire available after the occurrence.

1.16 **Survival Aspects**. Not applicable.

1.17 **Test and Research**.The No 1 engine S No EB-0284 was sent to the OEM Pratt & Whitney Canada for a tear down examination.

1.18 **Organisational and Management Information**.Not applicable**.**

1.19 **Additional Information.** Not applicable.

1.20 **Use of Effective Investigation Techniques**. Standard investigation procedure and techniques were used.

2. ANALYSIS

2.1 The aircraft followed standard route to Karachi. After establishing localizer for the final approach the first officer (Pilot Flying) felt a dissymmetry in the flight condition.

2.2 The captain took over the controls. Master caution light along with EEC light and subsequently PEC light of No 1 Engine came on. Followed by unwinding of all parameters / un-commanded in-flight shutdown of No 1 Engine.

2.3 Checklist actions were taken and the aircraft landed safely out of same approach.

2.4 Immediatelyafter the reported incident, SIB's team arrived Karachi and the initial investigation was conducted in the presence of representatives from ATR France & Pratt & Whitney Canada (who were incidentally available at PIAC Karachi on that day).

2.5 Engine No1 Inlet and exhaust were checked, found no abnormality.

2.6 The Magnetic Chip Detector (MCD) of Turbo-machinery was found with metal particles as shown below:

2.7 Abnormal sound and irregular movement of the Accessory Gear Box (AGB) was observed in Engine No 1. In order to avoid any damage to the evidence, the initial investigation at Karachi was stopped and the engine was sent to the OEM for a detailed tear down examination and investigation**.**

2.8 Pratt & Whitney Canada conducted the tear down examination in the presence of representatives from SIB Pakistan and Transport Safety Board Canada.

2.9 During tear down examination of the engine, it was established that the event was a result of failure of No. 30 bearingwhich is installed on tower shaft of Accessory Gear Box (AGB). Owing to this failure, drive from the engine was lost which lead to IFSD due stopping of all driven components (Oil & Fuel Pumps etc).

2.10 The failed No 30 bearing was sent to the Engineering Lab of TSB for a failure mode analysis which concluded that :

"The bearing failed due to bearing cage cracking. The mode of failure of the cage could not be determined due to the extensive rubbing damage observed on the fracture surfaces and the rivets"

2.11 A review of the engine maintenance history of past over two years revealed that no maintenance was performed by the operator (M/s PIAC) in the area of tower shaft or its bearings.

2.12 Industry data on failure rate of No 29 / 30 bearings and Tower Shaft (on which these two bearings are installed) was sought from the OEM which is as given below :

2.13 The above data for the period 2007 ~ 2017 reveals that there have been failure cases related to tower shaft and its two bearings (No 29 & No 30 bearings). There's overall a decreasing trend of such failures on the entire fleet. Based on the above failures, the OEM (Pratt & Whitney Canada) is already working on re-designing / modification of the tower shaft and bearing No 29. These modifications