FINAL INVESTIGATION REPORT

SERIOUS INCIDENT OF PIAC FLIGHT PK-390 (KARACHI TO SUKKUR) ATR72-500 REG NO AP-BKY ENGINE SHUTDOWN ON LINE UP AT JIAP KARACHI ON 4 SEPTEMBER 2017

SCOPE

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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

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SERIOUS INCIDENT OF PIAC FLIGHT PK-390 (KARACHI TO SUKKUR) ATR72-500 REG NO AP-BKY ENGINE SHUTDOWN ON LINE UP AT JIAP KARACHI ON 4 SEPTEMBER 2017

Synopsis

On 4 September 2017, at JIAP, Karachi, M/s PIAC Flight PK-390 scheduled from Karachi to Sukkur returned to Ramp after taxi out due to No 2 Engine Electronic Control (EEC) and Propeller Electronic Control (PEC) single channel fault with dashes on torque indicator followed by engine flame out. This serious incident was reported to Safety Investigation Board (SIB) Pakistan by the operator through Mandatory Occurrence Report (MOR). The incident was notified in accordance with ICAO Annex-13. Aviation Division Government of Pakistan issued memorandum vide authorizing SIB Pakistan to investigate the incident and the investigation was conducted by SIB.

1. FACTUAL INFORMATION

1.1 **History of the Flight**. M/s PIAC ATR72-500 aircraft Reg No AP-BKY was scheduled for a routine flight PK-390 from Karachi to Sukkur on 4 September 2017. Aircraft returned to ramp after taxi out due right engine EEC and PEC single channel fault with dashes on torque indicator followed by engine flame out.

1.2 **Injuries to Persons**. There were no injuries to any person during the incident.

1.3 **Damage to Aircraft**. There was no damage to the aircraft.

1.4 **Other Damages**. None.

1.5 **Personnel information**. Not applicable.

1.6 **Aircraft and Engines Information**.

Aircraft Information	
Aircraft Registration	AP-BKY
Aircraft Make and Model	ATR72-500
Defective Component removed	No 2 Engine
Engine Information	
Type	PW-127M
Engine S No	ED1104
Date of Engine Manufacturing	May 2015
Time since New (TSN)	4336 hrs
Cycles since New	4059
Time since Installation on 01 July 2017	287 hrs
Cycles since Installation on 01 July 2017	216

1.6.1 The aircraft was being maintained in accordance with the approved maintenance schedule. It was a newer engine and had not gone through any overhaul / major un-scheduled inspection / maintenance.

1.7 **Meteorological Information.** Not applicable.

1.8 **Aids to Navigation**. Not applicable.

1.9 **Communications.** Not applicable.

1.10 **Aerodrome Information.** Not applicable.

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

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

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

1.14 **Fire**. Not applicable.

1.15 **Survival Aspects**. Not applicable.

1.16 **Test and Research**. The removed engine S No ED-1104 was sent to the OEM Pratt & Whitney Canada for a tear down examination.

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

1.18 **Additional Information.** Not applicable.

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

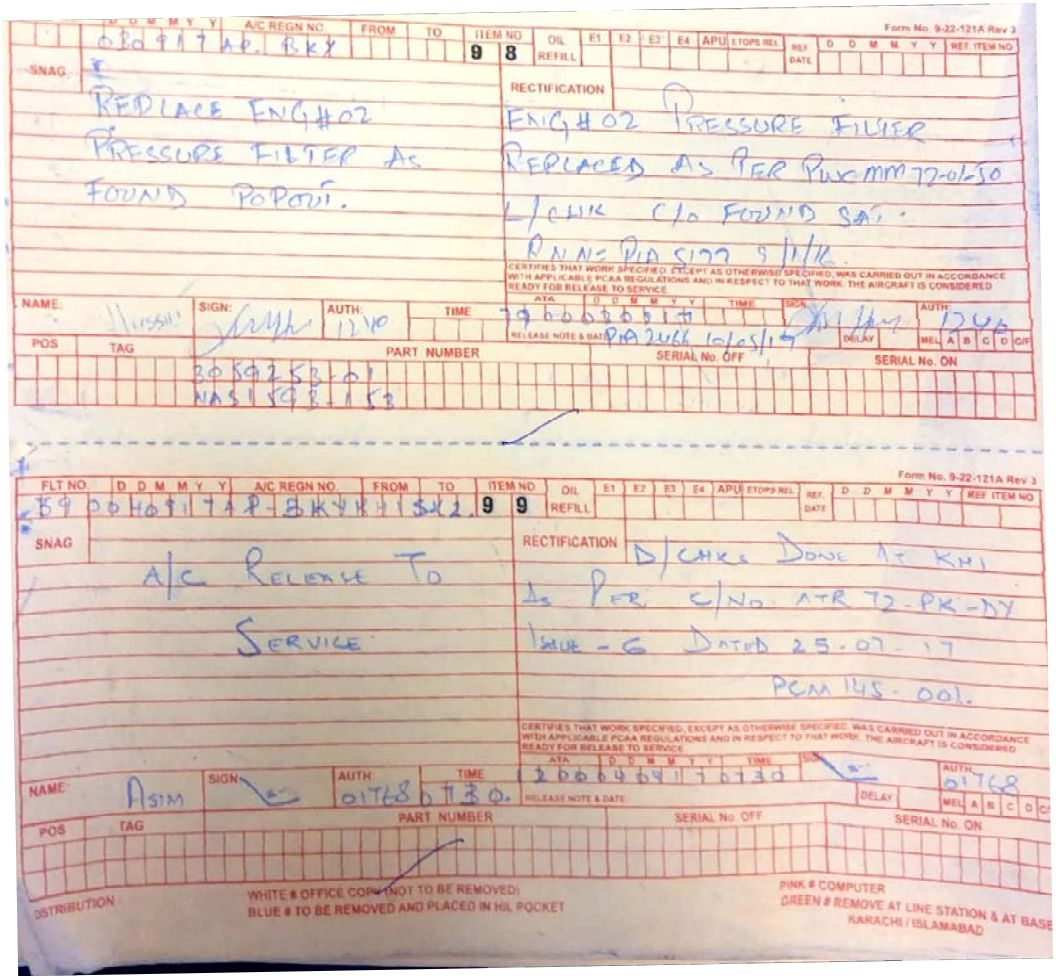
2. ANALYSIS

2.1 **Technical Analysis**

2.1.1 Post occurrence inspection of the engine inlet and exhaust areas revealed no abnormality except it was hard to rotate.

2.1.2 The Magnetic Chip Detector (MCD) of turbo-machinery was found with heavy metal particles.

2.1.3 The aircraft recent history revealed that on 03 September 2017 (on the night prior to this occurrence), a defect of *"Pressure Filter by-pass Indicator Popped Out"* was reported. This by-pass indicator is provided in the assembly of Oil filter and it pops out if the filter element gets clogged.



2.1.4 This previously reported defect of *"Pressure Filter by-pass Indicator Popped Out"* was cleared by replacing the filter element. In this maintenance activity, instructions given in the maintenance manual PW MM 72-0-05 fault isolation-2, Table-101, Fig-111 weren't adhered and missed out an essentially required activity of inspecting the Metal Chip Detector (MCD).

2.1.5 PIAC in its preliminary report acknowledged this omission.

2.1.6 The aircraft was released to service with the aforementioned un-safe airworthiness status. Consequently, the engine failed after taxi out.

2.1.7 The engine was relatively new as it was manufactured about two years ago and had flown ~4300 hours.

2.1.8 A review of the maintenance history revealed that except for the abovementioned omission, there was no other factor from the operator's maintenance which could have a contribution towards this occurrence.

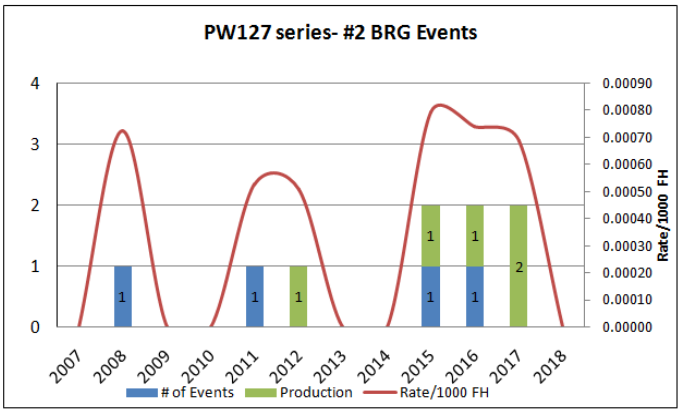
2.1.9 The engine, the filter element (replaced previous night) and the contaminant were sent to the OEM for tear down examination and further investigation**.**

2.1.10 Pratt & Whitney and Transport Safety Board Canada conducted the activity of tear down examination in the presence of SIB's representative. A detailed technical analysis report was rendered by the OEM. Salient findings are as mentioned below:-

2.1.10.1 *"The event was the result of the deterioration of the No 2 roller bearing. The rubbing wear and fracture of the No 2 bearing air seal as well as the inter-shaft rubbing damages were all secondary. The flame-out was the result of continued operation of the engine until inter-shaft rubbing resulted in significant component distress in the inner compressor case and subsequent loss of HP bevel gear contact with the tower shaft to drive the oil pump and fuel pump. Due to the advanced state of distress and damages to the No 2 bearing components the cause for the primary distress could not be established conclusively"*.

2.1.10.2 The industry data reveals that between 2007 and 2018, the event rate for No 2 bearing distress has been found to be 1 event per 2.58 million hours. The damaged condition of the bearings in the events to date has been such that root cause of the bearings distress has yet to be formally identified.

PW127 series #2 bearing events



Event rate for 2007-2018 period 1 per 2.58MHRS

*include ED1104

Extensive damage to the bearing is preventing P&WC to formerly identify root case of the bearing distress

P&WC currently monitoring the fleet

Event rate set at 1 per 2.58MHRS

2.1.11 During the process of disassembly for tear down examination, the engine was found to be beyond economical repair due to extensive damage as a consequence of inter-shaft rubbing.

2.1.12 Failure of No 2 bearing (as witnessed in this case) can be a consequence of any or combination of the following factors :-

2.1.12.1 Design deficiency of No 2 bearing

2.1.12.2 Some deficiency induced during the manufacturing process

2.1.12.3 Design deficiency in the interface between No 2 bearing and its housing

3. CONCLUSIONS

3.1 Findings

3.1.1 The Magnetic Chip Detector (MCD) of Turbo-machinery was found with heavy metal particles once checked after the incident.

3.1.2 The aircraft recent maintenance history revealed that on 03 September 2017 (on the night prior to this occurrence), a defect of *"Pressure Filter by-pass Indicator Popped Out"* was reported.

3.1.3 After reporting of the defect PIAC Engineering replaced the filter element without checking the MCD of Turbo-machinery contrary to the instructions given in the maintenance manual.

3.1.4 The aircraft was released to service with the aforementioned un-safe airworthiness status. Consequently, the engine failed after taxi out.

3.1.5 A review of the maintenance history revealed that except for the abovementioned omission, there was no other factor from the operator's maintenance which could have a contribution towards this occurrence.

3.1.6 The tear down examination and investigation at the OEM premises revealed that the engine shut down process was initiated due to failure of No 2 bearing owing to its intrinsic reason(s).

3.1.7 The failure of No 2 bearing are being reported / recorded by the OEM since 2007, however, the exact cause of No bearing failure have yet not been established which needs due attention at the OEM level considering its severity and consequences.

3.2 **Cause(s) of the Occurrence.** The occurrence was caused due to :-

3.2.1 Design inadequacies of the No 2 bearing; and

3.2.2 Continued operation after the bearing failure by not investigating the matter during filter change by PIAC.

4. SAFETY RECOMMENDATIONS

4.1 The OEM (Pratt & Whitney, Canada) is recommended to accelerate their efforts for identifying the intrinsic reason(s) leading to failure of No 2 bearing and make required improvement(s) with an aim to improve the engine reliability / safety.

4.2 PIAC is required to carry out refresher training of its maintenance engineers and technicians with a special emphasis on adequate troubleshooting of the reported defects as per guidelines given in the maintenance manuals.