

NO.HQCAA/1901/237/SIB



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CIVIL AVIATION AUTHORITY

KARACHI PAKISTAN

INCIDENT RELATING TO PIAC FOKKER FRIENDSHIP F-27

PAKISTANI REGISTRATION NO AP-BCZ

OCCURRED ON 4TH JANUARY 1999

AT

TURBAT AIRPORT

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FINAL REPORT

INCIDENT RELATING TO PIAC FOKKER FRIENDSHIP F-27 PAKISTANI REGISTRATION NO AP-BCZ AT TURBAT ON 4TH JANUARY 1999.

SYNOPSIS

Incident information was transmitted by PIA Corporate Safety to CAA on telephone and then through Aircraft Occurrence Initial Report (Appendix 'A'). The investigation was carried out by the Air Commodore Hashim Yamin, Chief Pilot Investigator. This report is being released under the authority of DG CAA.

Brief Resume of the Circumstances Leading to the Incident. When engine power was reduced for the pre-landing descend, the right engine throttle could not be retarded below 12800 RPM. The Captain selected minimum permissible power on the left engine and made a landing. After landing, when the Captain switched off the right engine and selected ground fine on the left engine, the aircraft started to yaw towards the left side. Captain's actions to control this yaw proved futile. During this process the right side outer tyre got locked and gave way. The aircraft went off the runway towards the left side. However, after the aircraft had traveled a short distance, the Captain managed to bring it back on to the runway. (Please see Final Ground Path, Appendix 'B').

FACTUAL INFORMATION

1.1. History of the flight

1.1.1. PK-505, Passenger Flight from Karachi to Turbat, Take off time 0800 UTC. Incident took place at Turbat Airfield during day time at about 0915 UTC. Flight Planning is a non factor in this incident.

1.1.2. On 4th January, 1999, PIA's flight PK-505 Aircraft Registration AP-BCZ took off from Karachi for Turbat at 0800 UTC (1300 hours PST). Mr. M. Azhar Qureshi, P. No.47949, was the Captain while Mr Tariq Rabbani, P. No.54898, was the Co-pilot. The reported weather at Turbat was smoke haze with visibility 5 km and surface wind North - Easterly 25 Kts. Flight was uneventful upto 30 NM from Turbat. There, when engine power was reduced for the descend, the right engine throttle could not be retarded below 12800 RPM. The Captain elected to continue for landing. He announced the emergency, selected minimum permissible power on the left engine and made a landing near the beginning of the runway, slightly biased towards the right side. Soon after landing, when the Captain switched off the right engine and selected ground fine on the left engine, the mishap aircraft (MA) started to yaw towards the left side. Captain's actions to control this yaw proved futile. In fact, during this process the right side outer tyre got locked and gave way. The aircraft went off the runway towards the left side. However, after the aircraft had traveled a short distance, the Captain managed to bring it back on to the runway. (Please see Final Ground Path, Appendix 'B').

1.2. Injuries to Persons

1.2.1. Nil.

1.3. Damage to Aircraft

1.3.1. The only physical damage to the aircraft was the bursting of the right main wheel outer tyre. However, all main wheels were changed as part of preventive maintenance.

1.4. Other Damage

1.4.1. Two runway lights and one taxiway light were broken by the aircraft.

1.5. Personnel Information

- 1.5.1. The Captain of the aircraft, Mr. M. Azhar Qureshi, age 50 years, P No 47949, has a total of over 6300 flying hours of which over 2300 hours are on F-27s. He has been a Captain on F-27 since September, 1996 and has logged about 1350 hours since. He holds a valid ATP Licence No 779. He holds a current rating on F-27. He has accomplished relevant mandatory checks. His rest-duty schedule in the recent past has been satisfactory.
- 1.5.2. The Co-pilot of the aircraft, Mr. Tariq Rabbani, age 28 years, P No 54898, has a total of about 2040 flying hours of which over 760 hours are on F-27s. He holds a valid CPL No 1663. He holds a current rating on F-27. He has give accomplished relevant mandatory checks. His rest-duty schedule in the recent past has been satisfactory.
- 1.5.3. Mr Javed Ansari, age 52 years, AME No 1017, employed as Aircraft Engineer, Technical Services, since 1978.
- 1.5.4. Mr Amjad Nasir, age 40 years, AME No 1173, employed as Aircraft Engineer, Line Maintenance II, since 1978.
- 1.5.5. Mr Shahid Mehmood, age 44 years, AME No 1177, employed as Aircraft Engineer, Technical Services, since 1979.
- 1.5.6. Statements placed as Appendices 'S1' to 'S6'.

1.6. Aircraft Information

- 1.6.1. For General Aircraft Information please refer Appendix 'C' and for Engines' Information Appendices 'D' and 'E'. Aircraft had a history of No 2 Engine related problems since November, 1998 (Appendix 'F').
- 1.6.2. The mass and centre of gravity were within the prescribed limits.
- 1.6.3. Fuel used was Jet A-1.

1.7. Meteorological Information

- 1.7.1. The weather enroute from Karachi to Turbat, as observed by the Captain of MA, was cloudy with isolated live cells and with icing conditions prevailing. The reported and actual weather at Turbat was smoke haze with visibility 5 Km and clouds Nil (Appendix 'G'). The surface wind was high. It was reported as NE 25 Kts when M A was 30NM away from Turbat and 050 / 18 when MA was on short finals.

1.7.2. The meteorological information was available to the crew.

1.7.3. The incident took place in Sunlight condition.

1.8. **Aids to Navigation**

1.8.1. Not relevant to the incident.

1.9. **Communications**

1.9.1. Not relevant to the incident.

1.10. **Aerodrome Information**

1.10.1. Runway is 6000 feet long and 100 feet wide. Runway surface condition is satisfactory.

1.11. **Flight Recorders**

1.11.1. FDR was not readable. Preservation of CVR recording was not ensured by PIA's rectification team..

1.12. **Wreckage and Impact Information**

1.12.1. Refer Appendix 'B'.

1.13. **Medical and Pathological Information**

1.13.1. Not relevant.

1.14. **Fire**

1.14.1. Not relevant.

1.15. **Survival Aspects**

1.15.1. Not relevant.

1.16. **Tests and Research**

1.16.1. Nil.

1.17. **Organizational and Management Information**

1.17.1. Please refer analysis and conclusion.

1.18. Additional Information

1.18.1. Nil.

1.19. Useful or Effective Investigation Techniques

1.19.1. Nil.

ANALYSIS

2.1. The following aspects have been discussed :-

2.1.1. Technical Aspects.

- a) Cause of Throttle Sticking.
- b) Cause of Right Side Outer Wheel Locking.

2.1.2. Operational Aspects.

- a) Pilots' Fitness for the Flight.
- b) Captain's Role (Including Cause of Aircraft Departure from the Runway).

2.2. Other technical, operational and miscellaneous aspects have been covered directly in the findings.

2.3. No 2 Engine Throttle Stuck

2.3.1. On investigation, it was confirmed that No 2 engine throttle was stuck at 12800 RPM and throttle retarding was not possible. Actually No.2 Engine corrector motor bellcrank slipped over the retaining washer and nut because the washer had smaller outside diameter than the inner diameter of bellcrank bearing (Appendix 'H'). As such the washer could not hold in position the bellcrank, which got dislocated. The forward end of the bellcrank got stuck with the surrounding nacelle structure. This caused the RPM to get stuck. Engine history revealed that Engine RPM problem had been a trouble area on this aircraft since 28th November, 1998. The RPM problem was such that it would appear after every few flights and that too not in exactly the same fashion as before. This is partly due to the fact that all pilots are neither so observant nor so particular to record their observations. Anyway, MA's problem was known to PIA's senior engineering supervisors and quality control personnel.

2.3.2. Talks with PIA's Director Engineering and Quality Control Engineers reveal that there exists a system whereby important and / or repeat entries are closely looked at. The irony of fate is that the engine problem of this aircraft was already an area of focus of supervisors. Not just that, the supervisors had nearly homed on to the problem. The previously installed washer, considered to be the culprit, was changed because it was considered to be too large and hence interfering with the free movement of the bellcrank. Implicitly, it was suspected that the washer was not of the right specification. Yet the new washer installed was also not of the right specification. That is why the engine problem repeated giving a false impression that washer was not causing the problem. Corrector motor was then replaced as suspect on 15th December, 1998 and the washer was forgotten.

2.3.3. There was a RPM related report on 24th December, 1998, 'Flight idle RPM of No 2 engine is 10500'. That was cleared by adjusting the RPM and subjecting the entry to further observation by the aircrew.

2.3.4 From 28th November, 1998 to 15th December, 1998, MA flew 91 sectors and logged 86 hours 45 minutes. From 15th December, 1998 to 24th December, 1998, it flew 57 sectors logging 49 hours 53 minutes. From 24th December, 1998 to 4th January, 1999, it flew 55 sectors and logged 54 hours 08 minutes.

2.3.5 It may be worthwhile noting that the Part Number of the washer is not given in the Illustrated Parts Catalogue (IPC) (Appendix 'J') which is normally referred to by the maintenance engineers. It was only during the post mishap investigation that it was discovered that the Part Number of the washer was given in the Overhaul Manual (Appendix 'K'). Post incident rectification details are given at. On the basis of the mishap aircraft investigation, an advisory note (Appendix 'L') has been issued by PIA's Chief Engineer, Quality Control.

2.4. Right Side Outer Wheel Locking

2.4.1. In order to determine the cause of right side outer wheel locking, the following wheel / brake components were tested in shop. The results of the tests are indicated against each component :-

- a) Main Wheel Assembly (Starboard, inner) - Serviceable (App.'M1')
- b) Main Wheel Assembly (Starboard, outer) - Serviceable (App.'M2')
- c) Main Wheel Assembly (Port, inner) - Serviceable (App.'M3')

- d) Main Wheel Assembly (Port, outer) - Serviceable (App.'M4')
- e) Nose Wheel Assembly - Serviceable (App.'M5')
- f) Brake Assembly (Starboard, inner) - Serviceable (App.'M6')
- g) Brake Assembly (Starboard, outer) - Serviceable (App.'M7')
- h) Maxaret Unit (Starboard, inner) - Serviceable (App.'M8')
- j) Maxaret Unit (Starboard, outer) - Unserviceable (App.'M9'&'M10')

The defective maxaret unit was found to have a clean history.

2.4.2. The results brought out that only the right outer maxaret unit was defective. Its run on time was 2.04 seconds (permitted range 2.8 to 4 seconds) and delay time 0.45 seconds (maximum permitted 0.3 seconds). The unit was stripped for further examination. It was found that Beam Assembly Pt No. ACO 41248 was sticky. That was also determined to be the cause of this maxaret malfunction and in turn of the right side outer wheel locking.

2.5. Pilots' Fitness for the Flight

2.5.1. As per the available evidence, both the pilots were physically, mentally and professionally fit to fly the mission.

2.6. Captain's Role

2.6.1. Initial Actions. The Captain did well to take over the controls, declare the emergency and apprise the Co-pilot of his intentions and of the actions he expected the Co-pilot to take during the emergency. The cabin crew were also informed of the possibility of passenger evacuation after landing.

2.6.2. Knowledge / Awareness of the Captain. As regards Captain's knowledge of single engine landing, he knew of the tendency of the aircraft to swing towards the good engine on selection of ground fine and that, according to the Flight Crew Operating Manual, this tendency can be easily corrected by use of rudder (Appendix 'N'). He did not know that in a previous similar incident a pilot had observed this tendency to be greater than expected. The Captain had personally not experienced such an emergency before. The regular six-monthly practice of single engine landing does not provide, for reasons of safety, practice of ground fine selection on one engine.

2.6.3. Decision to Land at Turbat. F-27's crosswind limitation on a dry runway is 30 Kts. No change is specified on this limitation in case of asymmetric power. Also the Airline Policy does not demand a diversion in such cases; in fact, it leaves the decision with the aircraft Captain. The Captain had fuel to return to Karachi. He was also mindful of a possible problem after landing. That is why he had given a call to ATC to alert emergency services and had briefed the cabin crew of a possible passenger evacuation. He also had to apply somewhat unusual rudder and aileron inputs to keep the aircraft on the final approach flight path, owing to nine Kts left crosswind component and owing to asymmetric power, yet he decided to land at Turbat. According to the Captain, he had decided that in case his speed failed to decrease on final approach, he would overshoot and proceed to Karachi. His decision to land at Turbat was motivated by the following: close proximity to Turbat; other than wind, good weather at Turbat; not-so-good weather enroute; no Airline Policy against landing at Turbat in such conditions; perhaps, Airline economy and passenger comfort; confidence in personal ability; and perhaps, ego factor. It may be noted that major airports provide better ground emergency handling facilities. Also, Airline economy and passenger comfort can get reversed in case of mishap. Besides, Karachi also did not have strong crosswind during that period of time. However, since it is debatable whether it is worthwhile to travel on a long route with a sick engine, his decision is not being held against him.

2.6.4. Decision Not to Shut the Right Engine. One Engine RPM stuck at a particular value is not given in the F-27 emergency / abnormal procedures. The Captain had the option of shutting down the right engine and feathering it, and then making a single engine landing. He chose to keep the right engine at 12800 RPM (160 p.s.i. torque) and select minimum permissible power on the left (serviceable) engine. Perhaps, psychologically, he felt more secure with both engines available to him to cater for an unforeseen contingency. His option brought him on final approach with right rudder and right aileron inputs, weaker speed control (for speed reduction) and unfamiliar unpractised pattern of approach. Moreover, relying on a sick engine without knowing the exact nature of the sickness can be risky. In contrast with this option the single engine option would have required a fair amount of left rudder to cater for asymmetric power and for aircraft drift towards the right side due to wind. However, it would have had the advantage of being closer to what the pilots practice as an essential exercise on a regular basis. Speed control would also have been better. With the right engine feathered, the drag on the right side would have been minimum. Anyway, the flight was uneventful upto touchdown. After touchdown, when the good engine throttle was shut off, the situation in both options became similar with the chosen option having a slight advantage in that, since the right engine had been switched off and not feathered, the drag on the right was comparatively more, resisting the

left yaw. One thing that must, however, be borne in mind is that if a pilot decides to make an approach on two engines and then convert it to single engine landing after touch down, his mind may still be thinking 'two engines' even though the actions required are for single engine during the landing phase. This can lead to surprise, lack of anticipation and hence delayed reaction. All said and done, landing on single engine is considered better of the two options.

2.6.5. Performance of the Captain and the Cause of Aircraft Departure from the Runway.

The Captain maintained his cool and handled the emergency well upto touchdown. As per the evidence available, he landed at the correct speed in the beginning of the runway and cut off the right engine, as planned. Thereafter, he selected ground fine on the left engine. It would have been better if he had slowed down further, settled down more comfortably on the runway, and then, anticipating the left swing, selected the left throttle to ground fine. His not delaying use of ground fine could have been due to the fact that Turbat is a 6000 feet runway and is smaller than the normal 9000 feet or plus runways at major cities. However, though 6000 feet long, Turbat still cannot be considered a small runway keeping the landing distance of F-27 (about 2500 feet) in mind. The main cause of MA's departure from the runway was lack of anticipation by the Captain. The lack of anticipation was due to several other factors also which are given in detail in the findings. The Captain's actions to bring the aircraft back on to the runway, after the swing had developed, were satisfactory. After bringing the aircraft under control, the Captain attempted to take the aircraft on to the ramp. That was unnecessary.

CONCLUSION

3.1. Findings

3.1.1. On 4th January, 1999, PIA's flight PK-505 Aircraft Registration AP-BCZ was scheduled to fly from Karachi to Turbat with Mr. Azhar Qureshi, P No 47949 as Captain and Mr. Tariq Rabbani P No.54898 as Co-pilot.

3.1.2. As per the available evidence, both, the Captain and the Co-pilot were physically, mentally and professionally fit to fly the mission.

3.1.3. The aircraft was declared serviceable for the mission. The aircraft had a history of No 2 Engine related problems since 28th November, 1998. However, since 25th December, 1998, the record was clean.

3.1.4. The aircraft took off at 0800 UTC. The estimated arrival time at Turbat was 0915 UTC.

- 3.1.5. The weather at Turbat was smoke haze with visibility 5 Km and wind NE 25 Kts.
- 3.1.6. The mission was uneventful upto about 30 NM from Turbat. There, when the throttles were retarded, right throttle failed to come below 12800 RPM.
- 3.1.7. The Captain took over the controls.
- 3.1.8. This particular emergency i.e. one throttle stuck at an RPM, is not given in the emergency / abnormal checklist.
- 3.1.9. The Co-pilot advised the Captain to feather No.2 (right side) Engine and make a single engine landing. The Captain decided to keep No 2 Engine at 12800 RPM and retard No.1 Engine throttle to minimum permissible power.
- 3.1.10. The Captain declared the emergency and also asked the ATC to alert the crash services. The cabin crew were also briefed regarding a possible emergency evacuation. The Captain briefed the Co-pilot on the actions to be taken by him.
- 3.1.11. The Captain's decision to land at Turbat as against diverting to Karachi is debatable. His decision to keep No.2 Engine at 12800 RPM and No 1 Engine at minimum permissible power as against switching off No 2 engine and making a single engine landing had more cons than pros.
- 3.1.12. The calculated bug speed was 95 Kts. The Captain observed the speed on short finals as 110 - 115 Kts. The Co-pilot observed 95 Kts on threshold.
- 3.1.13. The wind, reported to the pilots on finals, was 050 / 18 Kts. This would give a crosswind factor of about 9 Kts.
- 3.1.14. After touchdown in the beginning of the runway (4-500 feet), slightly biased towards the right side of the runway, the Captain shut down No 2 Engine, rolled for about 1000 feet and then selected ground fine on No 1 Engine. The Co-pilot called out "Six Lights and TGT below 550 degrees centigrade".
- 3.1.15. The aircraft veered left. Before the Captain put in corrective action, the aircraft had developed an angle of about 7 degrees towards the left. With this angle, at an average speed of about 80 Kts, the aircraft could stay on the runway for less than 3.6 seconds.
- 3.1.16. The Captain displayed lack of anticipation and did not take timely action. This lack of anticipation could be attributed to the following factors :-

- 12
- i) No previous experience of such an emergency (actual or simulated).
 - ii) The underplayed terminology "anticipate a swing which however can be easily corrected by use of rudder" used in the F-27 Flight Crew Operating Manual (Appendix 'N').
 - iii) No emphasis laid on the possibility of swing in PIA's single engine SOPs (Appendix 'O').
 - iv) Issuance of a circular and not a Operational Engineering Technical Bulletin (OETB) by PIA after a previous investigation into a similar incident (recommendations at Appendix 'P'), OETB being more permanent in effect.
 - v) Crosswind from the left (windvane effect).
 - vi) Captain's much preoccupation on final approach with unusual control inputs not allowing him time to think about post landing actions.
 - vii) Psychologically, coming on two engines all the way till touchdown, then converting the approach into a single engine landing after touchdown, could have distracted Captain's brain from clearly thinking about 'single engine' actions.
 - viii) Co-pilot's call "Six Lights and TGT below 550 degrees centigrade" led the Captain to believe that both engines had gone on ground fine, implying that there is no asymmetric thrust. This could have put him off guard against the oncoming swing.
 - ix) Use of ground fine not delayed sufficiently.
 - x) Right outer tyre failure causing right side braking efficiency to reduce.

3.1.17. The aircraft started to veer left around 1620 feet down the runway (Photographs at Appendix 'Q'). Right outer wheel got locked around 1950 feet down, left tyre entered Katcha around 2100 feet down, left tyre got back on prepared surface around 2430 feet down and aircraft got under control around 2500 feet down the runway. During the process, aircraft remained on Katcha for about 330 feet and its left tyre went furthest away by about 33 feet from the runway edge.

3.1.18. Two runway lights and one taxiway light were broken by the aircraft.

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- 3.1.19. Aircraft came back on to runway due to Captain's actions and minutely due to the right turn resulting due to right wheel hitting and breaking the second runway light.
 - 3.1.20. The only physical damage to the aircraft was the bursting of the right main wheel outer tyre. However, all main wheels were changed as part of preventive maintenance..
 - 3.1.21. After the aircraft got under control, the Captain made a vain attempt to taxi back to the ramp (Appendix 'B'). Since only left engine power could be used, turning towards the left was difficult. Finally, the Captain switched off at point 'O' and disembarked the passengers. Captain's attempt to taxi back to the ramp was unnecessary.
 - 3.1.22. The cause for throttle sticking was installation of washer of incorrect specification on the corrector motor bellcrank, which forms part of the throttle linkage system. This led to the dislocation of the bellcrank and permitted its forward end to get entangled with the nacelle panel. The specification of the washer is not given in Illustrated Parts Catalogue, which is used as a reference guide, during line maintenance.
 - 3.1.23. The cause of right outer wheel locking was malfunction of maxaret unit, due to sticking beam assembly. As per the shop record, maxaret unit reliability is very high.
 - 3.1.24. A one time check of the washer on the other aircraft revealed no discrepancy on the other aircraft.
 - 3.1.25. Actions taken by Co-pilot and AATCO are considered satisfactory.
 - 3.1.26. FDR was not readable. Preservation of CVR recording was not ensured by PIA's rectification team..
 - 3.1.27. Blood sample of the Captain, as per a requirement stipulated in CAA/F1-41, was not taken at Turbat.

3.2. Causes

- 3.2.1. The aircraft No.2 Engine power control got stuck due to installation of an incorrect specification washer on the corrector motor bellcrank, causing the bellcrank to get dislocated and permitting its forward end to get entangled with the nacelle panel.
- 3.2.2. The right side outer tyre got locked and gave way due to maxaret malfunction, which in turn was due to sticking beam assembly.

3.2.3. The aircraft went off the runway due to lack of preparedness / anticipation on the part of the Captain and this was due to several factors, not necessarily attributable to Captain's aircraft handling ability.

SAFETY RECOMMENDATIONS

- 4.1. Operational Engineering Technical Bulletin be issued on the subject of :-
- a) Aircraft handling during single engine landing, especially in case of crosswind from the same side as the serviceable engine.
 - b) Procedure in case of power stuck at a particular value.
- 4.2. In F-27 SOPs on single engine (Appendix 'O'), a note to the following effect may be added after para 5(d) "On selection of ground fine, caution for swing towards good engine".
- 4.3. Technical Notice may be issued by PIA's Development Engineering on the shortcomings which have come to light during the incident and the proposed measures to overcome them..
- 4.4. PIA's Engineering may consider formation of a team to study the Illustrated Parts Catalogue to review if important Part Numbers (including that of the culprit washer) need to be included in it.
- 4.5. During F-27's Dart 528/532 Engine Maintenance Course and other relevant courses, PIA's training should stress on the engineers the importance of installing proper specification washers, nuts, bolts, split pins etc, and the risk involved in not doing so. This incident may be quoted as an example.
- 4.6. PIA may consider providing guidelines to the Flight Crew on factors to be borne in mind when deciding whether or not to divert in such cases.
- 4.7. Initial rectification team should ensure that all suspect items, which are removed, are kept in safe custody for further review (e g washer) and items aiding future investigation are preserved (e g CVR).
-