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HQ CAA/1901/173/81B



ORIGINAL

INVESTIGATION REPORT
ON
AIRCRAFT ACCIDENT TO PIAC
F-27 REG. MKS AP-ALN
AT
D.I. KHAN ON 5TH JULY 1994

CIVIL AVIATION AUTHORITY
KARACHI

AIRCRAFT ACCIDENT INVESTIGATION REPORT ON THE FORCE
LANDING ACCIDENT INVOLVING PAKISTAN INTERNATIONAL AIRLINES
AIRCRAFT F-27 REG- MK. AP-ALN ON 5TH JULY, 1994 NEAR
DERA.ISMAIL.KHAN AIRPORT

Authority:- Director General Civil Aviation Authority Memorandum
No.HQCAA/1901/173/SIB dated 5th July, 1994
(Appendix "A").

COMPOSITION OF INVESTIGATION TEAM

- | | |
|---|-----------------------|
| 1. Air Cdre (Retd) Rashid A. Bhatti
Actg. Chief Inspector and President
SIB. HQCAA. | Investigator-Incharge |
| 2. Engr. Shamimuddin,
Controller of Airworthiness (North) | Investigator |
| 3. Capt. Farooq Ahmed,
Chief Pilot F-27 (North) | Co-opted Member (PIA) |

1. **AIRCRAFT INFORMATION**

- | | |
|---|--|
| 1.1. Type of Aircraft | Fokker F-27 -219 |
| 1.2. Nationality & Registration Marks | AP-ALN |
| 1.3. Constructor's No. | 10164 |
| 1.4. Date of Construction | 1st Jan.1961 |
| 1.5. Airframe hrs since New | 66764 |
| 1.6. Total Landings since New | 83277 |
| 1.7. Date of CHK 'D' | 10.10.91 |
| 1.8. Date of CHK B3. | 13.6.94 |
| 1.9. Mod Status upto date | All Mandatory MODS
Embodied |
| 1.10. Certificate of Reg.No. | 266 (REV-1) valid |
| 1.11. Certificate of A/W No. | 242 |
| 1.12. Date of Validity C of A | 18.1.95 |
| 1.13. Certificate of Maint date of issue. | Validity 7.7.94 |
| 1.14. Loading CG position | 40560 Lbs (30.9%) at
Commencement of Flight
(PEW). |

1.15.	Left Engg Type Dart 532-7 S.No.	14209
1.15.1.	Hrs since New	41628
1.15.2.	Hrs since last O/H	2942
1.15.3.	Hrs since last check	170
1.16.	Right Engg type Dart 532-7 S.No.	13373
1.16.1.	Hrs since New	27713
1.16.2.	Hrs since Last O/H	4480
1.16.3.	Hrs since last check	1719
1.17.	Left Prop: S.No. DRG 42/65	
1.17.1.	Hrs since New	30493
1.17.2.	Since O/H	1812
1.18.	Right Prop S.No.DRG 193/58/35:	
1.18.1.	Hrs since New	42731
1.18.2.	Hrs since O/H	1684
1.19.	Defects discovered during investigation.	Nil
1.20.	Recent history of defects	See Appendix 'B'

2. **CREW INFORMATION**

2.1. **Pilot-in-Command.**

2.1.1.	Name	Capt Naimat ullah Khan
2.1.2.	Position in Cockpit	Left hand Seat
2.1.3.	Date of Birth	02.09.1952
2.1.4.	Type of Licence and No.	ATPL No.679
2.1.5.	Medical Date + Status	27.1.94 Fit
2.1.6.	<u>Rating</u>	
2.1.6.1.	Type(s) held.	Cessna-150/152, 180,31 PA 23, F-27, B-707, A-30
2.1.6.2.	Type Current	F-27
2.1.6.3.	Flt.Instructor Rating.	C-150/152,180 and 310
2.1.7.	<u>Flying Experience.</u>	
2.1.7.1.	Grand total	7342.10 Hrs
2.1.7.2.	Total-in-Command.	270.00 Hrs
2.1.7.3.	Total-in-Command of type accident occurred.	220.00 Hrs
2.1.8.	Where trained.	PIAC
2.1.9.	Date of joining the Org.	2.2.1986

2.2. **Co-Pilot**

2.2.1.	Name	F/o Ikram ullah
2.2.2.	Position in Cockpit	Right hand seat
2.2.3.	Date of Birth	17.3.1959

2.2.4.	Type of Licence and No.	CPL NO:1236
2.2.5.	Medical date with status.	15.2.94 flt
2.2.6.	<u>Rating</u>	
2.2.6.1.	Type(s) held	C-152, C-172
2.2.6.2.	Type Current	F-27
2.2.6.3.	Flt.InstRating	
2.2.7.	<u>Flying Experience.</u>	
2.2.7.1.	Grand Total	990.00 Hrs
2.2.7.2.	Total-in- Command.	-
2.2.7.3.	Total Co-Pilot on the type accident occurred.	576 Hrs
2.2.8.	Where Trained	PIAC
2.2.9.	Date of Joining Org.	17.3.1991.

3. **HISTORY OF ACCIDENT**

3.1. Captain Naimat ullah Khan P-45617 and First Officer Ikram ullah P-51749 of PIA were scheduled to operate PK 684 on 5th July, 1994 from Islamabad- Peshawar-D.I.Khan- Zhob-Multan Sector on F-27 aircraft Registration Marks AP-ALN. Islamabad - Peshawar sector flown by First Officer was normal and uneventful. Captain Niamat ullah Khan was the pilot flying on Peshawar - D.I. Khan Sector. AT 1013 hrs (L.T) PK 684 was given descent and landing clearance by the D.I. Khan Tower. At 1023 hrs the pilot called Long Final in landing Configuration and tower gave clearance for landing at Runway 12 with caution that Runway over run and F.W.S unserviceable due to rain on previous days. The pilot acknowledged the instructions passed by the ATCO and continued the approach for landing at RW 12. During the final approach Captain experienced some malfunction on No.1 Engine and initiated a go-around and asked for Flaps UP and Gears UP. After crossing the runway 12 threshold the aircraft veered off to the left and started losing height. As the aircraft height could not be maintained the Capain decided to make a crash landing in the fields. The aircraft hit two trees and Captain made a crash landing at about 1026 hrs. approximately 7000 feet North of D.I. Khan runway.

- 3.2. All 38 passengers and 4 crew on board the aircraft were safe. Due to impact forces the baggage/cargo had come out of the holding net and fell in the galley area, therefore, the front door was blocked. The First Officer opened the right cockpit window. The Captain, First Officer and one Airhostess jumped out of this window. The rear door was opened by other Airhostess and most of the passengers came out of the rear door and about 6 to 7 passengers went through the right emergency exit window.
- 3.3. The DATCO immediately despatched the crash tenders to the scene of accident and informed all the concerned agencies about the accident. The APM and PIA staff arrived at the scene of accident and three injured persons were despatched to Civil Hospital. The PAF helicopter along with flight surgeon also arrived at the scene of accident. Later on DC, D.S.P. and Local Army Commander also came and offered their services. The ASF and Local police were asked to cordon the aircraft and necessary measures were taken to safe guard the aircraft.

4. **INJURY TO PERSONS**

- 4.1. As a result of the accident three persons including one Airhostess were injured. Miss Humaira Chisti was hospitalized for dislocation of right shoulder. Mr. Falak Sher had fractured small bone of right foot and was hospitalized for three days. Mr. Rauf was given treatment and was discharged after 2 hours. (See Appendix 'C').

5. **DAMAGE TO AIRCRAFT**

- 5.1. The F.27 aircraft Registration Marks AP-ALN along with its engines and all ancillary equipment sustained substantial damage as a result of accident and has been assessed as totally destroyed. (See Appendix 'D' photographs of the wreckage and Appendix 'E' for details of damage to aircraft).

6. **OTHER DAMAGE**

- 6.1. As a result of crash landing in the fields the land owner Mr. Ahmed Khan Kamrani s/o Haji Tooti Khan resident of Zafarabad Colony, D.I. Khan has claimed damages worth Rs. 73,000/- (Rupees Seventy Three Thousand only (See Appendix 'F')).

7. **METEOROLOGICAL CONDITION**

- 7.1. The weather was fair. Visibility was good. Weather was not a factor in this accident. (See Appendix 'G').

8. **AIDS TO NAVIGATION**

- 8.1. NDB was serviceable at the time of accident. Navigation Aids were not a factor in this accident.

9. **COMMUNICATIONS**

- 9.1. Normal Communications were maintained between the aircraft and ATC through the landing approach. The last Communication from the aircraft was the acknowledgment of the landing clearance given by ATC at 1023 and 30 seconds. The copy of the extract of ATC log is placed at Appendix 'H'.

10. **AERODROME AND GROUND FACILITIES**

- 10.1. The D.I.Khan has one runway 12/30. The runway 12 was the runway in use at the time of accident. This runway is 5000 feet in length and 75 feet wide with an over-run of 900 feet on each end. The over run and F.W.S. were unserviceable due to rain on the previous days.

11. **FLIGHT RECORDERS**

- 11.1. At the time of accident F-27 AP-ALN was fitted with a Flight Data Recorder and Cockpit Voice Recorder. Both the recorders are the product of Sundstrand Data Control, Inc. These recorders were mounted on the rear fuselage of the aircraft near the empennage. Both the recorders were recovered from the aircraft.
- 11.2. **F.D.R.** The Flight Data Recorder Model No. FA.542 serial No.2015 was taken to the U.S.A. where laboratory facilities exist at the N.T.S.B. in Washington D.C., for the accurate read out of FDR records on all parameters i.e. Airspeed, vertical acceleration, Heading and Time. However, when Mr. Muhammad Ali Siddiqui Operations Investigator of CAA reached at N.T.S.B. Laboratory on 5th September, 1994 alongwith the FDR, he was told that due to major aircraft accident in U.S.A. the N.T.S.B. specialist are busy and will not be available for about 10 days or so. The officer had to wait in U.S.A. till the Specialist were available for the FDR read out. The officer again went to N.T.S.B. Laboratory on 21st

September, 1994 but the specialist were still busy and N.T.S.B. showed their inability to carry out the read out. FDR was brought back to Karachi for its read out at PIA instrument Overhaul Section. The FDR was opened in the presence of Investigator-in-charge and magazine was removed. The recording foil was in good condition and it was verified that the flight had been recorded. The FDR read out was received on 9th October, 1994. However, the recording was not available for the last two minutes of flight. The FDR read out is placed at Appendix 'J' and 'J2'.

- 11.3. **C.V.R.** The Cockpit voice Recorder Serial No. V557 was also taken to U.S.A. alongwith FDR to N.T.S.B. laboratory at Washington D.C. The magazine cassette was opened and unloaded by an expert of the N.T.S.B. in the presence of the Operations Investigator of CAA. The recording tape was in one piece. The tape was carefully transferred to a reel and was found on play back to contain only the radio transmissions made by the cockpit crew with the ground stations and other aircraft flying in the area. The Cockpit conversations was not picked up by the CVR. Using available equipment a clear copy of the tape was re-recorded on a cassette. The transcript of the tape could not be made at the N.T.S.B. laboratory due to the sickness of Mr. Muhammad Ali Siddiqui. The tape was brought back to Karachi alongwith the FDR. The transcript of the tape without the recording of cockpit conversation did not provide any useful information for the purpose of investigation. If the aircraft had been modified with hot wiring for boom microphone system the read out would have given cockpit conversation. A brief transcript of radio transmissions made after descend clearance till the aircraft impact sound is heard, is placed at Appendix 'K'.
12. **WRECKAGE** The wreckage of F.27 aircraft AP-ALN was located about 7000 feet North East of runway 12 of D.I.Khan Airport. The aircraft first hit the two trees at about 15 to 20 feet height with its left wing tip and bottom of fuselage and then impacted the ground with bottom of fuselage in almost level attitude with gears and flaps in UP position. The estimated speed at the time of impact with the ground was 100 to 110 kts. The freshly cut tree branches, VHF antenna, ADF antenna and broken pieces of anti collision light were found near the two trees hit by the aircraft. The left propeller contacted the ground immediately after the first impact. It made total of 13 slash marks on the ground and distance between the slash marks were measured for the purpose of calculation of Engine RPM at the time of first impact. The right wing hit a small tree and then aircraft crossed over the water channel about 3 feet wide. The right propeller slash marks were seen at distance of about 180

feet from first ground impact as the aircraft passed over the second water channel. The aircraft travelled another 250 feet when right out board wing broke after cutting a tree. The aircraft reached the final resting place after hitting a big tree with the right wing leading edge between fuselage and right engine. Some small portions of the undersurface of the fuselage were also located in the early stages of the wreckage trail after first impact.

12.1. No fire had occurred on any part of the wreckage. The fuel tanks had retained their integrity and there had been no severe leak at the time of the accident. When the wreckage had been cleared by the investigators, the fuel was drained out from the wing tanks (see sketch showing marks made by the aircraft, wreckage diagram and photographs placed at Appendix 'L' and 'D').

13. **FIRE**

13.1. No fire occurred during or after the accident.

14. **SURVIVAL ASPECTS**

14.1. The Captain made a controlled crash landing in an open and muddy field with gears and flaps up, therefore all passengers and crew survived miraculously. However, due to impact forces the fuselage belly skin panels/frame sections and stringers were completely ruptured and cabin floor boards moved up. The galley structure and its attachments sheared off causing structure to sink. As a result of this break up in the fuselage and cabin area only three persons received minor injuries. All the passengers came out of the aircraft from rear door and right emergency exit window. The front door could not be opened as it got blocked due to break up in the galley area.

15. **TEST AND RESEARCH**

15.1. Fuel sample obtained from the crashed aircraft was sent for laboratory analysis and was found to be clear of any foreign matters or other contaminants. The laboratory test report is placed at Appendix 'M'.

15.2. The urine samples of Captain Naimat and First Officer Ikram ullah were sent to Armed Forces Institute of Pathology Rawalpindi for Urine Opiates examination and Alcohol Test. Both results were negative. The test report is placed at Appendix 'N'.

15.3. Test were carried out on the Propeller Control Units, Pitch Locks and Fuel Control Units removed from the crashed F-27 aircraft AP-ALN. The details and results are placed at Appendix 'O'.

15.4. Flight Trials on F-27 aircraft were conducted on 10th November, 1994 at 10,000 feet AMSL with all up weight of 35000 Lbs to see the go around performance of the aircraft with the two/single engine with flaps selected at 40° position as per normal approach for landing. The trial results are placed at Appendix 'P'.

16. **OBSERVATIONS**

16.1. **F-27 Abnormal Checklist.**

The PIA Operations Management has issued a checklist for F-27 aircraft's Emergency/Abnormal checklist giving the procedures to be followed during inflight malfunctions. These procedures are categorised as "Memory Item" or "Checklist Action Item" keeping in view the nature of malfunction and phase of flight. "Excessive TGT (in Flight)" is categorised as a Checklist Action on page EAC-17 - JAN/91 and the procedure given is as follows:-

"EXCESSIVE TGT (IN FLIGHT)"

If over temperature limits of greater than 860°C but less than 960°C are exceeded for 5 sec.

AFFECTED ENGINE _____ FEATHER COMPLETE AFTER
FEATHERING CHECKS REFER CHECK LIST 4.

16.2. Since the Excessive TGT (in Flight) is not a memory item, therefore, the pilots are required to read the checklist and perform actions accordingly. During critical phase of flight like final approach, if a pilot is faced with high TGT problem, it may not be possible for him at that phase of the flight to ask for the read to do checklist actions. Under this situation the pilot may take wrong decision or in-appropriate actions to meet the emergency situation. Bearing the foregoing in mind the PIA Operations Management was requested to review the existing procedure for "Excessive TGT (in flight)" and it has now been categorised as "Memory Item" vide their letter DFO/CAA/94 dated 25th, October, 1994.

16.3. Under this observation it is recommended that PIA Operations Management should review the Emergency/Abnormal Checklist procedures for F-27 and all other types of aircraft flown by PIA and

categorise them as "Memory Item" or Checklist Item keeping in view the nature of failure and phase of flight.

16.4. F-27 Single Engine Go-Around Procedure

The Single Engine go-around procedure given in Flight Crew Operating Manual (FCOM) 1.3.22 page E.25 is as follows:-

- Select full power and use rudder to keep straight.
- Rotate to climb attitude while maintaining the approach speed.
- Call Flaps up, Gears up.
- Monitor heading .
- Accelerate VFC and Maximum Continuous Power.

Other than above procedure no other procedure is given in the FCOM or Flying Training Manual regarding "Single Engine Go-around", in case of go-around maneuver required after selection of Flaps 40 degree for landing. For example approach is made with both engines and Flaps 40 degree selected for landing and one engine fails due to any reason, there is no guide line/procedure available in the FCOM or Training Manual for this type of situation. Therefore, such exercise is not carried out during flight training on F-27 aircraft.

16.5 F-27 Flight Training Manual

Fokker F-27 Flight Training Manual (issue 4) dated 1st August, 1981 prepared and edited by Fokker B.V. Flight Department was received in the PIA Flight Operations Department in the 3rd week of March 1994 as informed by them vide letter No.DFO/CAA/94 dated 25th October, 1994. The Section 2 of this Manual Contained Limitations of power plant applicable to RR DA 536-7R engines while PIA fleet is equipped with 532-7 engines. This manual has still not been implemented by PIA.

16.6 Procedure for Engine Failure on Final.

As mentioned in para 16.4. above that F-27 FCOM or PIA Flying Training Manual does not give any guide line/procedure for one engine failure on final when Flaps have been selected to 40 degree for landing. However, F-27 Flight Training Manual (issue 4) as mentioned above has given a procedure under Operating Instructions on page 93 which is as follows:-

"ENGINE FAILURE ON FINAL"

If an engine failure occurs on final approach the propeller will not feather automatically as RPM is below 12,800. If engine failure is recognized (torque pressure zero) Immediately advance both power levers beyond 12,800 RPM. This action will increase power on the operative engine and the propeller of the failed engine will feather automatically.

Retract flaps to 16 degree and accelerate to VTHR+20. If the decision is made to continue the approach reset the speedbug of VTHR for 26 flap and maintain an approach Speed of VTHR 26 + 15. Adjust power to maintain glide slope and follow the Single Engine approach and landing procedure, select the HPC lever of the failed engine to FEATHER.

16.7. Propeller System/Failures

The PIA F-27 Flight Training Manual under the section of Aircraft Systems Operation explains the functions of various propeller locks to obtain maximum propeller efficiency at various speeds and engine RPM. On page 11 it is mentioned that:-

"To safeguard against propeller hang up at the Flight Safety Lock, this lock should be manually with drawn at speed below 140 KIAS. During low speed flight, with low or idle power, i.e. during a stall or landing flare, the props will hang on the Flight Fine Lock and engine underspeed will occur. Increase in power at the same speed will result in normal engine RPM."

The Fokker F-27 Flight Training Manual (issue 4) on page 88 under the heading of "Propeller Failures" mentions that:-

"At low airspeeds the lock should be withdrawn to enable the propeller to decrease pitch compatible with the RPM required. Should this lock not be withdrawn at Low Speeds the prop will hang on the lock, causing a drop in RPM and AN INCREASE IN TGT, as FCU provide more fuel to keep up RPM. If an RPM drop is indicated below 11.000 on final approach, carefully increase power and airspeed (130 KIAS)."

16.8. The PIA F-27 Training Manual does not mention about INCREASE IN TGT alongwith drop in RPM when prop will hang on the Lock at slow air speeds.

16.9. Under these observations it is recommended that PIA Operations Management should expedite the implementation of F-27 Flight Training Manual (issue 4) printed by FOKKER company.

INVESTIGATION

17. Scene of Accident

- 17.1. Pakistan International Airlines Fokker F-27 aircraft REG. MK. AP.ALN which had taken off at 0935 hrs (L.T) from Peshawar Airport as scheduled passenger flight PK.684, while landing at D.I. Khan Airport Runway 12 made a crash landing at 1026 hrs (L.T) on 5th July, 1994 about 7000 feet North East of D.I.Khan runway. The aircraft touched down on a heading of 360° and the wreckage came to rest within a distance of 500 feet. The Investigators reached the scene of accident at about 1030 hrs on 6th July, 1994.
- 17.2. The examination at the scene of accident revealed no evidence that any part of the aircraft had detached in flight. The aircraft was complete at the time of initial impact. No. signs of pre-impact fire or bird strike damage were revealed by examination of the scene of accident, the airframe wreckage or the engines.
- 17.3. The aircraft had touched down in almost wings level attitude, on a muddy field. Just prior to touch down the port wing tip of the aircraft passed through the tops of 20 feet high tree breaking off the branches, and the bottom of the fuselage at the same place hit another tree at about 12 feet height from ground. The examination of the breaks on these trees indicated that the aircraft approached touch down at a shallow angle estimated to be 4 to 5 degrees. (See Appendices "DI" and "L"). This indicated that the aircraft was not in a stalled condition just prior to impact and was under control till touch down.
- 17.4. The ground marks at initial impact indicated that the bottom of aircraft fuselage made smooth contact with the ground at a distance of 150 feet from the two trees struck by the aircraft just before first impact. The port engine propeller contacted the ground at a distance of 60 feet from initial impact marks. The port propeller made about 13 slash marks. The distance between the first and second slash mark was 3 feet and 5 inches. This measurement was used to establish the approximate Engine RPM at the time of first impact. This will be discussed later in this report.
- 17.5. Shortly after the initial ground impact the starboard outer wing struck a tree which caused extensive damage to the starboard outer wing which eventually broke after hitting two trees and was thrown forward along the path of the aircraft and finally came to rest just short of a point where main aircraft wreckage came to a

stop. The Nose Landing Gear door piece was found about 150 feet from first impact point along the track made by aircraft fuselage belly. The right propeller slash marks were seen at a distance of about 180 feet from initial impact as the aircraft was passing over 3 feet wide water channel. The distance between the first and second slash mark was 3 feet and 9 inches. The aircraft moved forward on its belly almost on a straight line and hit a big tree with right wing leading edge between fuselage and right engine and completely cracked/ruptured the affected area of the aircraft. After hitting the tree the aircraft yawed to the right and reached a resting place on a heading of 035° at a distance of about 500 feet from initial ground impact. The track made by the aircraft indicated that the Main landing gears were in a raised position right up to point where the aircraft hit the last tree.

18. Examination of the Wreckage

- 18.1. The wreckage was examined at the site of the accident, and wreckage location and distribution diagrams were prepared. Photographs of the scene of accident and the wreckage were taken. Only those photographs considered relevant to this report have been included in the report (See Appendices "D" and "L").
- 18.2. At the final resting position of the aircraft both Main Landing Gear doors were found in fully open position and both main landing gears were resting on the ground giving an indication as if they had come out of their nacelles. The nose gear was also not in fully retracted position and half of the nose wheel was out of its wheel bay. The main landing gear UP LOCKS were examined to see if they had been forced open due to impact forces. They did not reveal any indication of forced opening of UP LOCKS. The examination of both main landing gear doors revealed that they had passed through branches of trees while they were still in the open position. Some of the freshly cut branches were stuck with the forward edge of the left landing gear door and inside of right landing gear door. The position of nose wheel also indicated that it was not in a fully retracted position. Had it been in retracted position the impact forces would have jammed the nose landing gear in UP position. It therefore, appears that the landing gears had not locked in UP position at the time of initial impact with the ground. (see Appendix "D7" to "D10").
- 18.3. The fuselage nose section had buckled and both the nose landing gear doors and operating linkages were damaged and detached from the structure. The cabin floor structure found in raised up position at crash beam attachments. The galley structure was

completely distorted and its attachments were sheared off causing structure to sink. All fittings and fixtures in the passenger cabin were badly damaged due to impact forces. The right outer wing section III detached from section II and right aileron departed alongwith wing leaving inboard aileron hinge and partial aileron segment and tab attached to the wing. Right hand side wing to fuselage fairing at wing leading edge was completely ruptured. The left wing was still attached to the fuselage.

- 18.4. Both the engines were complete with propellers still attached to the engines. All blades of port propeller were found in forward bending position near the tips in a manner suggesting that propeller had some power at the time it contacted the ground. All blades had twisted and were found at different pitch angles. The starboard propeller had hit a big tree before the aircraft had come to a stop. This caused uneven bending and twisting of blades in different directions. Both the engines were removed from the crashed F.27 aircraft and were sent to PIA Engine Overhaul Shop for strip examination of engines, Propeller Control Units, Pitch Locks and Fuel Control Units. The detailed reports are placed at Appendix "O".

18.5. **Position of Cockpit Control/Switches.**

The position of Cockpit Control and switches noted by the Investigators at the scene of the accident were as follows:-

1.	Gust Lock	Unlocked
2.	Landing gear handle	UP
3.	Nose Wheel Steering Valve	On
4.	Elevator Trim	1/8 NOSE DOWN
5.	Rudder Trim	0
6.	Flap handle	16.5'
7.	Port H.P. Cock	SHUT
8.	Starboard H.P. Cock.	SHUT
9.	Flap gauge	UP
10.	Aileron	0
11.	Throttles	IDLE
12.	Feathering buttons	NOT PRESSED
13.	Port RPM gauge	40
14.	Starboard RPM gauge	580
15.	Atimeter	600 (1002)
16.	Fuel quantity	2500/2700 Lbs
17.	Fuel Shut off Handle	WIRE LOCKED
18.	Fire Bottles SW	WIRE LOCKED
19.	Fuel Booster Pumps	OFF
20.	Anti Collision LT	ON

21. NAV. LT.	OFF
22. Fasten Seat Belt LT	ON
23. No Smoking	ON
24. Windshield Wiper	OFF
25. EXT Power SW	OFF
26. Emergency Power Supply	NORMAL
27. TAXI LT.	ON
28. Wing Icing	OFF
29. Landing Light	OFF
30. Blow out Master	SAFE
31. Starter SW	Starboard
32. Radio Master	OFF
33. Stall Warning	DWN/OFF
34. Test Switches both	OFF
35. Pitot Heater both SWs	OFF
36. CB LT White Dome LT	OFF
37. Inverter No.2	ON
38. Inverter No.1	OFF
39. Flight Safety Isolation	Normal
40. St. By Compass	035
41. Water Methanol SWS	OFF
42. Fuel Cross Feed	ON

18.6. Detailed Examination of Engines/Propellers.

The engines along with their propellers were removed for detailed examination at P.I.A.C. Engineering facility. After a briefing by the Investigators on the circumstances of accident the technical examination of the engines and propellers commenced in the PIA Engine Overhaul Shop (Q.C) in presence of Investigators. The examination revealed that the damage noticed on both the engines hardware was exclusively due to shock loading. Thorough examination of engines did not reveal any part failure or abnormality which could affect the performance of the engine. The turbine blades and vanes of both the engines were also found in good condition, with no indication of over temperature or burning. The examination of the Fuel Control Units revealed no malfunction of the FCUs and their performance on test bench was within acceptable limits. The examination of Port and Starboard Propeller Control Units and their Pitch Lock mechanism did not reveal any malfunction or system failure. Both the propeller systems were inspected to determine the blade angle at the time of first ground contact of the propellers. The depth of ground fine pitch stop from top of cylinder for port and starboard propeller was 3.358 inches and 3.089 inches respectively. These measurements correspond to blade pitch angle of 28.5 degree for port propeller and 21.75 degree

for Starboard propeller. This indicates that at the time of first contact of propeller blades with the ground both propellers were operating below the Flight Safety Locks and above Flight Fine Locks. Therefore, it can be concluded that the Flight Safety Pitch Locks of both the propellers were in LOCK OUT position during Landing approach.

18.7. Estimation of Engine RPM at Impact.

The major features of an aircraft structure such as wing tips, landing gears and propellers can all produce characteristic marks when they hit the ground. The assessment of engine power at the time of impact can be made from the propeller slash marks on the ground. From these slashes the relationship between ground speed and propeller rotational speed can be established. If the ground speed of the aircraft at impact is known (or can be estimated) the propeller rotational speed in RPM can be determined by using the measurements between consecutive blade slash marks. Then Engine RPM can be obtained by inversely applying the reduction gear ratio to the propeller speed. The calculation of estimated Engine RPM of Port and Starboard engine at Impact is placed at Appendix "Q".

- 18.8. The port propeller blade made contact with ground immediately after initial impact of the aircraft. The distance between the first and second slash mark was 3 feet 5 inches. the aircraft had impacted the ground at an estimated ground speed of at least 100-110 knots. This estimation is based on the fact that the aircraft had not impacted the ground in a stalled condition. The stalling speed of F.27 aircraft with 0 degree flap and 39000 lbs weight is 91 knots and Threshold speed with 0 degree flap for same weight configuration is 120 kts. The aircraft was skidding on its belly in a muddy field and travelled 500 feet. The aircraft had hit a big tree at fairly high speed before it came to a final stop. The Captain stated that he closed No.2 Engine when aircraft hit the two trees just before initial ground impact. At this moment the aircraft was in the process of go around and speed should be around 120 Kts minimum. The aircraft impacted the ground in less than one second after No.2 Engine throttle was closed. Therefore, the speed at initial impact is estimated to be around 110 Kts. As per calculations placed at Appendix "Q" the No.1 Engine RPM is 8784 at the time of impact. No.2 Engine propeller contacted the ground about one second after No.1 Engine propeller contacted the ground. Therefore, the speed of aircraft had also reduced to below 100 Kts or so. The slash marks of No.2 Engine propeller were not very

clear as compared to No.1 Engine propeller as the aircraft was passing over the water channel when No.2 Engine propeller contacted the ground. By now the RPM had further dropped. The No.2 Engine RPM at this stage was around 7300 or so. It is estimated that both Engine were at same RPM at the time of initial impact of aircraft with ground.

19. **WITNESS.**

The following relevant information was obtained from the captain and First Officer of F.27 aircraft, from eye witnesses to the accident, Cabin crew and passengers travelling on board the crashed aircraft:-

- 19.1. PIA F-27 aircraft on schedule flight from Peshawar (PK.684) established contact with D.I. Khan Tower at 1000 Hrs (L.T). Aircraft reported final for Runway 12 at 1023 Hrs and landing clearance was given with caution that F.W.S. and over run unserviceable due rain. The aircraft approached for landing and crossed 1000 foot marker board from RW 12 threshold and was approximately 20-25 feet above ground. The aircraft increased power and pulled up then immediately turned left. I saw the landing gear retracting when the aircraft had crossed the airport fencing (312 feet from Runway center line). I could see the aircraft upto a distance of approximately 2500 feet flying 25 to 30 feet above the trees and then lost height and hit the ground. (Statement of DATCO Appendix R1 and R2).
- 19.2. PK.684 approached for landing at Runway 12. when aircraft crossed 1000 foot marker board it turned to left and retracted the gears at low altitude. (Statement of AFF D.I. Khan Appendix "S").
- 19.3. The aircraft was coming to land at D.I. Khan and I observed that the aircraft is perfectly lined up for final approach. I could also see the runway underneath the aircraft. As the aircraft was about to touch down on the runway, I suddenly felt that the aircraft power was increasing and it started to climb and at same time turning to the left. The aircraft then levelled off and was not maintaining height and made crash landing in an open field after hitting 2 to 3 trees. (statement of ASF Guard on board the aircraft Appendix "T".)
- 19.4. I felt that plane had aligned itself on to the strip, but before touch down it appeared as if plane is trying to gain height and it did so by few feet. I looked through the window and realized we were just above tree top height and off from runway. Also the speed was

more than normally is at the time of landing. After few seconds plane hit the ground. (statement of passenger on board the aircraft Appendix "U")

- 19.5. The Captain, while on approach to land at D.I. Khan Runway 12, noticed that the TGT of No.1 Engine rising rapidly and going above 800°C when the aircraft was at about 500/600 AGL and approximately 3/4 to 1 mile from Runway 12 threshold. The fuel trimmer was brought to almost zero position and left throttle (No.1) brought to idle position but TGT kept increasing and went beyond 900°C and No.1 Engine RPM was dropping below 7500. At this stage I was at about 400/500 AGL and approximately 2500 feet from threshold Runway 12. Now the approach was destabilised, so I immediately opened full power on No.2 Engine and asked for Flaps UP and Gears UP. The aircraft was losing height and I must have come almost parallel to the runway and height may be around 150/200 AGL and the aircraft was heading towards built up area and swollen river in front. I reduced the rudder pressure to veer off to the left side. By this time I sensed that the aircraft will not hold height and I have to put it down. From my peripheral view I saw an open space and decided to make crash landing. After I hit the first tree I closed No.2 Engine and made a crash landing. (Statement of Captain Appendix "V1", and V2")
- 19.6. When we were approaching to land for Runway 12 in landing configuration I saw Captain's hand moving from throttle to fuel trimmer. When we were approximately 500 feet AGL I saw his hand on the right hand power lever and moving all the way to full power and he asked me for flaps UP and Gears UP. I instantly checked the TGT on No.1 Engine and observed that it was rising to 900°C.. As the aircraft drastically swung towards left, Captain and my self applied full right rudder to keep the aircraft aligned with the runway. The aircraft kept veering off to the left and losing height. Roughly 200 feet abeam the runway the aircraft turned left. Captain selected a marshy field and made forced landing. (Statement of First Officer Appendix "W", and W2").
- 19.7. The Airport Manager has stated that in the month of June, 1994 on two occasions Captain Anjum Karim got the passengers baggage weighed after landing at D.I. Khan Airport. It was discovered that on both the occasions the baggage was 200 to 300 Kgs in excess of that mentioned in Trim Sheet (See Appendix "X").

- 19.8. Air hostess Humaira Chisti was assigned the galley duty on this flight. After finishing the service, she occupied the jump seat during landing. On final approach hearing abnormal noises she got up from seat and went to the cockpit out of curiosity and started looking from cockpit wind Shield. She saw the aircraft flying over the trees at a very low altitude and then made a crash landing. (See Appendix "Y"). To a question concerning the design of the galley and jump seat position the Airhostess stated: "I know of two cabin crews of F.27 aircraft who were injured because of loose container or articles falling off from the galley during landing roll or take off run. Every Cabin crew is scared of sitting on jump seat located in the galley area" (See Appendix "Y2").
- 19.9. Air hostess Shazia Manzoor was assigned the Cabin duty. After the service she sat down on her jump seat. On final approach she saw the landing gears were down and suddenly the aircraft turned to left side and went up and was shaking up and down. The aircraft made crash landing. To a question concerning the cabin crew training she stated: "during one month of training three types of aircraft were covered and it was not complete training (See Appendix "Z2").

20. **DOCUMENTS**

The following relevant information was obtained from PIA aircraft AP-ALN Technical Log regarding High TGT during flight:-

- 20.1. On 23.6.94 Captain made an entry that "No.1 Engine (Left) TGT in cruise with fuel Trimmer at Zero stays at 730°C. On final approach fuel Trimmer at DATUM 55% at 12000 RPM No.1 Engine TGT was 880°C and No.2 Engine 700°C.

Rectification. No.1 TGT indicator was changed. Oil filters, Oil level and Oil leak checked and found SAT. No.1 combustion Chamber removed and H.P. Turbine checked for signs of over temperature or burning-found SAT. All engine parameters checked and found SAT.

- 20.2. After the above entry the aircraft flew for 9 days without any entry regarding TGT problem. On 3.7.94 Captain made an entry that No.1 Engine at 11000 RPM, Torque 120, TGT suddenly rose beyond 800°C on approach path. Power lever brought back to bring TGT within limit. TGT normal after landing.

Rectification No.1 propeller static checks carried out as per Maintenance Manual and found normal. No.1 Engine inlet and exhaust checked for contamination and found clean. High rotation check normal and considered SAT.

20.3. On 4.7.94 AP-ALN aircraft flew 9 missions without any High TGT problem. This confirms that the fault reported on 3.7.94 was not repeated, although no rectification work had been carried out, as nothing was found during inspection and functional checks of the No.1 Engine as per Maintenance Manual. The Captain himself flew on Islamabad-Peshawar Sector on 5.7.94 (The day of accident) and did not report any defect regarding High TGT on final approach.

20.4. The read out of FDR is placed at Appendix "J" to this report. Relevant details from the FDR read out are as follows:-

20.4.1 The aircraft was approaching on a heading of $120^{\circ} \pm 10^{\circ}$ for landing at Runway 12 at D.I. Khan . Five miles from Runway Threshold the aircraft was on a heading of 110° , flying speed 120 Kts at about 1900' AMSL (1100 AGL). The aircraft started drifting to the right and when three miles away from runway 12 threshold the aircraft was on a heading of 150° , flying speed 110 Kts at 900 AGL. From this point onward the FDR read out was not available due to some fault in the system which could not be identified. The power supply to the FDR was available right upto the time of impact. The FDR test, carried out at the Instrument Shop of PIAC, functioned satisfactorily.

20.5. Flight Trials on Fokker F.27 aircraft were conducted at 10,000 feet AMSL with all up weight of 35000 feet to see the go around performance of the aircraft with Both/single engine, after selection of flaps 40 degree for landing has been made. The trial results are as follows:-

20.5.1 When go around was initiated with both engines by raising flaps UP. in One go followed by gears up the height lost was 200 feet before rate of descent was arrested. During second attempt the height loss was 50 feet before climb was established.

20.5.2. When go around was initiated with single engine and flaps raised to UP position followed by gears UP the height lost was 250 feet within 25 seconds. Aircraft levelled off briefly before continuing to lose height gradually at a very slow rate.

- When left engine was feathered, the rate of descent was arrested and very gentle climb was established.
- 20.5.3. Go around initiated on one Engine Flaps raised to 16 degree and gears up initial height loss was 250 feet before a gentle climb was established. After feathering the dead engine, climb rate improved marginally.
- 20.5.4 **Conclusion.** If flaps are raised in one go from 40 degree to full up, even in a go around with both the engines, upto 200 feet height loss can be expected. Single engine go around with flaps going up in one go without feathering of the failed engine is not possible. However, if failed engine is feathered and flaps are raised in stages, the go around is possible from 250-300 feet AGL.

DISCUSSION AND ANALYSIS

21. The sequence of events leading to accident as described by the Captain of F.27 aircraft could not be corroborated with any other source of evidence i.e. the statement of eye witnesses, wreckage examination at the scene of accident, the FDR read out and detailed technical examination of engines and propellers at the P.I.A.C. Engineering facility at Karachi. It is therefore, considered pertinent to analyse the statement of the Captain in the light of evidences obtained from other sources of evidence before any discussion is carried out on the cause/causes of accident.
- 21.1. **Statement of Captain.** The Captain stated that while on approach to land at D.I.K. at about 500/600 AGL and one mile from runway 12 Threshold he noticed the TGT of No.1 engine rising rapidly and going above 800°C. He used the fuel trimmer to reduce the TGT while continuing the approach but TGT kept increasing. He reduced the throttle to idle and fuel trimmer to almost zero but TGT kept increasing and went beyond 900°C at the same time he looked at No.1 Engine RPM gauge and saw RPM dropping below 7500. Now the approach was destabilized so he immediately opened full power on the No.2 engine (right) and asked the First Officer for flaps UP and gears UP. He was concentrating on flying the aircraft and keeping it straight with the help of rudder. The go around was initiated from about 400/500 AGL when approximately 2500 feet from Runway 12 Threshold. The aircraft was meanwhile losing height despite full power on No.2 Engine. By now the aircraft was almost parallel to the runway around 150/200 AGL probably abeam ATC (1000 feet down the runway). By this time he sensed that the aircraft will not hold height and he has to put it down. So he reduced the right rudder pressure to veer off to the left side

towards an open space which he saw from his peripheral view. After he hit the first tree he closed No.2 Engine and made a crash landing.

- 21.2. **Analysis of Captain's Statement.** The Captain initiated a go around with full power on No.2 engine from 400/500 AGL and approximately 2500 feet from Runway 12 threshold. The height of the aircraft at 1000 feet down the runway was 150/200 feet AGL. During this process the aircraft travelled 3500 feet and Lost about 300 feet of height thus giving a rate of descent of 830 feet per min. If the aircraft was losing height at this rate than it should have impacted the ground after about 12 seconds or so. However, when the Captain reduced the right rudder pressure to veer off to the left towards an open field which he saw from his peripheral view, the aircraft flew for about 36 second and covered a distance of 6500 feet before aircraft impacted the ground at about 100-110 Kts. Therefore, it is not understood as to how an aircraft which is losing height at the rate of 830'/M before it was veered off to the left for crash landing could fly for another 36 seconds upto a distance of 6500 feet. (See Appendix "AA" and "AA2" for calculation of Time, distance and Rate of descent).
- 21.3. **Landing Gears UP Selection.** The Captain stated that he asked for flaps UP and Gears UP when he initiated a go around from 400/500 AGL and when approximately 2500 feet from Runway 12 threshold. The DATCO of D.I.Khan Airport has mentioned in his statement placed at Appendix "R", and "R2" that PK 684 approached for landing with gears down\ and crossed 1000 feet from runway 12 Threshold at approximately 20-25 feet height. The aircraft increased power, pulled up and turned left immediately and lost height. He saw the gears retracting after aircraft had crossed the Airport fencing. The fencing is 312 feet from the runway center line. At the scene of accident the examination of main landing gear up lock, main and nose gear position, and main landing gears doors revealed that the landing gears had not fully retracted at the time of initial impact with the ground (See Appendix "D7" to "D10").
- 21.4. **Examination of Engines.** Thorough examination of engines did not reveal any part failure or abnormality which could affect the performance of the engine. The turbine blades gave no indication of over temperature or burning. The fuel Control Unit's performance during functional check on test bench was within limits.

- 21.5. **Examination of Propeller Control Units.** The examination of both PCUs and their pitch lock mechanism did not reveal any malfunction or system failure. At the time of impact the blade pitch angle for port and starboard propeller were found to be at 28.5 degree and 21.75 degree respectively. This indicates that both propellers were operating below the Flight Safety Locks.
- 21.6. **Engine RPM at Impact.** The assessment of engine RPM at the time of impact was made by measuring the distance between the first and second propeller slash marks on the ground. As per calculations placed at Appendix "Q" the No.1 Engine RPM at the time of initial impact of the aircraft was 8784. Since No.2 Engine propeller did not make contact immediately after aircraft touch down, therefore, its exact RPM at the time of initial impact could not be obtained. In any case the main interest was in finding out the RPM of No.1 Engine which according to Captain had dropped to below 7500 during final approach.
- 21.7. **History of High TGT F.27 AP-ALN.** There were two entries regarding high TGT during flight. On 23.6.94 Captain reported that No.1 Engine TGT was 880°C and No.2 Engine TGT 700°C on final approach and Captain made satisfactory landing without any problem. No.1 TGT indicator was changed and investigation revealed no signs of overheat or burning of H.P. Turbine. The aircraft flew for nine days without any entry regarding TGT problem. On 3.7.94 another entry was made that TGT suddenly rose beyond 800°C on approach path. During investigation no abnormality was discovered and aircraft was cleared for flying. The aircraft flew 9 satisfactory mission on 4.7.94 and one mission on 5.7.94 (Islamabad-Peshawar Sector) by Captain Naimat himself and did not report any problem regarding high TGT on final approach.
- 21.8. The statement of Captain is pointing towards possible failure of the Flight Safety Pitch lock to withdraw. Therefore, it is considered appropriate to include a brief description of the propeller system for the benefit of reviewing authority.
- 21.9. **Propeller System.** The propeller assembly consists of a hub which accommodates four blades, a back plate for attachment of the Spinner, and a variable pitch mechanism secured to the front of the hub. The variable pitch mechanism primarily consists of a hydraulically operated piston moving in a cylinder, which is secured to the front of the hub. Forward movement of the piston rotates the blades towards fine pitch, while rearward movement

results in pitch coarsening. Two fixed stops limit the ground fine pitch angle to 'O' degree and the feather pitch angle to 87 degree.

21.10. In addition to two fixed stops, there are two hydraulically releasable pitch locks. One for the Flight Safety Pitch angle at 32 degree, and the other for the Flight Fine Pitch angle at 20 degree.

21.11. **Flight Safety Pitch Lock.** The Flight safety stop is a design feature of the R-193 propeller to ensure that a defective power plant or propeller will neither exceed its limiting over speed nor develop an unacceptable wind milling drag at high forward speed. The angle of this stop is chosen such that it will engage just before the aircraft reaches the critical forward speed for such condition. The stop is designed to be removed automatically using Solenoid and mechanical valves actuated by duplicated hub contact switches of one propeller in series with duplicated hub contact switches of the other propeller and with two relay coils. These hub contact switches are set to close a nominal 2 degrees above the Flight Safety Stop.

21.12. During the normal process of reducing airspeed the propellers move fine and the hub switch of both propellers will close to energize the relay coils. Any continuing decrease of airspeed will firstly cause the propellers to move on to their Flight Safety Stops, and then result in an increasing engine underspeed. This underspeeding will induce an increasing fine pitch oil pressure, which operates a staging valve to introduce high pressure oil into the lock withdrawal mechanism of the pitch lock assembly. This in turn, withdraw the Flight Safety Stop and allow further finning off of the blades upto the Flight Fine angle.

21.13. This arrangement ensures that in the event of one propeller reducing pitch as a result of a malfunction then the facts that the other propeller is functioning normally at a higher angle will prevent the solenoid valves becoming energized and the Flight Safety Stop being withdrawn. Thereby holding the malfunctioning propeller blade angle at the 32 degree stop.

21.14. In addition to the automatic lock withdrawal system a manually operated mechanical override has been provided in the propeller Control Unit actuated by the selection of the H.P. Fuel Cock lever to the "LOCK OUT" position. This action moves the aforementioned selector valve and by passes high pressure oil around the solenoids to directly clamp down the pressure relief valve. With this selection, the Blue Flight Safety Unlocked lights will illuminate.

- 21.15. **Flight Safety Pitch Lock Failure.** Failure of the Flight Safety pitch Lock to withdraw, will be indicated by a reduction of RPM below the selected value, and a rise in TGT as the airspeed is reduced. If it is an electrical failure it is possible for both propellers to be affected, but the failure may be by passed by moving the H.P.C. lever to "LOCK OUT" position.
- 21.16. **Manual Selection of H.P.C. to LOCK OUT.** For low speed flight such as is encountered during approach and landing , the propeller Flight Safety Stops are removed manually, prior to landing, by moving the H.P.C. levers to LOCK OUT. However, if the crew should forget and fail to do this, there is a back up electrical system which will remove these stops automatically, If however, the crew have failed to select 'LOCK OUT" manually. AND THE ELECTRICAL LOCK REMOVAL SYSTEM OF EITHER PROPELLER FAILS TO OPERATE FOR ANY REASON THEN BOTH THE PROPELLER WILL BE RETAINED ON THE FLIGHT SAFETY STOPS.
- 21.17. **Operation of Manual/Automatic Selection of Flight Safety Stop withdrawal.** The examination and physical Checks Confirmed that the linkages between the engine control boxes and P.C.U.'s was correctly interconnected on both the engines. Tests of both the propellers pitch lock assemblies and P.C.U.'s established their satisfactory operation, particularly regarding the Flight Safety Stop withdrawal function. The fact that the port and Starboard propeller blades were found between Flight Safety and Flight Fine Pitch position after the accident clearly demonstrates that satisfactory operation of its Flight Safety Stop withdrawal mechanisms was achieved. Therefore, it can be concluded that the mechanical, electrical and hydraulic performance of the port and starboard P.C.U.'s and propeller pitch Lock assemblies was satisfactory and would not have inhibited Flight Safety Stop withdrawal.
- 21.18. **Possible Cause of High TGT.** From the above mentioned satisfactory operation of automatic and manual withdrawal of Flight Safety Pitch Stop during tests carried out at Engineering Facility it is quite evident that P.C.U.'s and Propeller Pitch Lock assemblies were serviceable at the time of accident. Therefore, the cause of high TGT (as reported by the Captain) due to technical reasons can be ruled out. Besides this Captain flew a mission on Islamabad - Peshawar Sector on the day of accident and did not report any defect. On Peshawar - D.I.K. Sector, it is clear that during start up, taxi out, take off, climb, cruise and descent to low

altitude for landing at D.I.K. Airport , there was no problem with the engines. Therefore, there could be an operational factor which may have caused momentarily high TGT during final approach.

21.19. The F.27 Flight Training Manual mentions that "during low speed flight, with low or idle power, i.e. "during a stall or landing flare, the props will hang on the Flight Fine Lock and engine underspeed will occur. Increase in power will result in normal engine RPM". The manual also mentions that "normal power changes should be done slowly to obtain quiet operation". It is quite possible that on final approach the aircraft speed may have dropped to below 110 Kts and to regain the speed the Captain may have opened the throttles rapidly. During this process it is quite likely that high transient turbine temperatures might have been attained. The FDR read out also confirms that when the aircraft was at distance of 4 miles from Runway 12 threshold the speed had reduced from 120 Kts to 110 Kts and the rate of descent also reduced from 700 feet/Min to 200 feet/MIN. The speed may have reduced to below 110 Kts which of course is not recorded on the FDR as it stopped functioning at this stage of the flight. The heading of the aircraft also changed from 110 degree to 140-150 degree.

21.20. It appears that when the aircraft was about 4 to 5 miles from the runway threshold the Captain asked for flaps 40 degree. During this process the aircraft speed reduced to below 110 Kts and Captain did not advance throttle slowly to regain the speed. This may have resulted in rise in TGT of No.1 Engine. (The throttle movement of No.1 engine may have been faster than No.2 Engine).

21.21. The Sequence of Events Leading to Accident As Analysed By the Investigation Board.

The sequence of events as described by the Captain could not be corroborated with any other factual sources of evidence. May be due to intense emotional experience the Captain is not able to recall the details of the sequence of events in any logical manner. It could be an immature reaction to stress which is called "Rationalization".

" A person rationalizes when he attempts to give a reasonable excuse for some failure on his part. He explains himself in such a way as to avoid loss of social status. In the extreme case, the individual is never able to face up to his problems and always has an excuse by which he attempts to escape the blame for his failure".

**From:- EMOTIONS
CH 9-8
AVIATION PSYCHOLOGY
BY
NEIL D. WARREN.**

21.22. In the opinion of the Investigation Board the likely sequence of events leading to crash landing of F.27 AP.ALN aircraft is as follows:-

- On Final approach when the aircraft was at a distance of about 5 miles from Runway 12 threshold, the Captain asked for 40 degree flaps selection. As the flaps came down to 40 position the aircraft speed reduced to below 110 Kts. As per FDR read out the rate of descent also reduced from 700 feet/Min to 200 feet/Min.
- The Captain advanced the throttles at the rate faster than normal which resulted in high transient turbine temperatures as noticed by the Captain. While Captain was busy in controlling the high TGT of No.1 Engine with the help of Fuel trimmer, the aircraft started drifting to the right and change in heading from 120 degree to 140-150 degree was not noticed by the Captain.
- No.1 Engine throttle was also reduced to Idle position to control the TGT.
- The Captain continued the approach by keeping the No.1 Engine throttle at Idle RPM (11000- zero Torque) and used No.2 Engine throttle to adjust his approach and landing.
- With No.1 Engine at Idle RPM the Captain had to keep No.2 Engine at higher RPM and application of right rudder to control the aircraft speed, height and direction, because of excessive wind milling drag generated by No.1 Engine at flight Idle.

With flaps at 40 degree and No.1 Engine at Idle RPM (zero torque) the Captain required more power on the No.2 Engine to control his touch down point. As he advanced the right throttle the directional control could not be maintained and decision was made to go around when the aircraft was over/past the runway 12 threshold at about 100 AGL.

- As the full power with water methanol came on No.2 Engine while No.1 Engine was at idle the aircraft veered off to the left

when it was about 1500 feet down the runway at about 100-150 feet AGL.

- The Captain asked for flaps UP and gears UP and used full right rudder to maintain the directional control.
- With flaps selected from 40 to UP position the aircraft could not maintain the height with one engine at idle position.
- The aircraft hit two trees (25-30 feet high) in almost level attitude. The Captain closed No.2 Engine and made crash landing on a muddy field which was right in front of the trees.
- At the time of impact the main landing gears and nose gear had not gone up in fully retracted position. This indicates that the landing gears were selected UP just a few seconds before the aircraft hit the trees. Late retraction of landing gear further aggravated the problem during go around.

21.23. The following evidences also indicate that the Captain may have advanced the No.1 Engine throttle at full power, after aircraft veered off to the left, to improve the go around capability of the aircraft but still the height could not be maintained due to high sink rate caused because of retraction of flaps from 40 position to UP position.

- After aircraft had veered off to the left from the D.I. Khan runway the aircraft flew almost in level attitude flying over the trees and impacted the ground at a distance of 6500 feet from the runway. Had the No.1 Engine been at flight idle (11000 RPM- zero torque) and No.2 Engine at full power with water methanol ON, the aircraft would have continued turning to the left despite full right rudder pressure and aircraft controllability would have been lost soon after go around was initiated. Therefore, it is quite evident that No.1 Engine throttle was also advanced after the aircraft had veered off to the left (Reference PIA Ops Engg Tech Bulletin placed at Appendix "AC").
- When the throttles are closed rapidly from maximum RPM and fuel flow is reduced from 1400 LB/Hrs to 352.8 LB/Hrs in one second time, then the position of blade pitch angle and RPM reduction rate would be as shown in the graph placed at Appendix "AD". This graph indicates that 1.5" seconds after the throttle closures the engine RPM would be around 9000 and blade pitch angle will be at about 28 degree. The No.1 Engine RPM calculation

obtained from the propeller slash marks at the time of initial contact with the ground was 8784. The blade pitch angle of No.1 propeller at the time of impact was 28.5. degree. (See Appendix "O" and "Q"). The aircraft impacted the ground about one second after it hit the trees. The Captain realizing that the aircraft would not be able to clear the trees he closed the throttles rapidly to make crash landing. Therefore, the assessment of No.1 Engine RPM and blade angle at the time of impact as obtained by the investigators, is very close to the graph placed at Appendix "AD".

- From the above mentioned factual information it is quite evident that the Captain had also advanced the No.1 Engine throttle in an effort to make a successful go around.

21.24. Actions Taken by the Captain.

When an inflight emergency or abnormal situation occurs, the pilot is faced with three sequential tasks. Firstly he must be aware of the abnormal situation and recognize its cause. Secondly, he must decide on the actions required to meet the emergency. Thirdly, he must perform the actions decided upon. An accident may result from failure to perform any of these tasks. On the other hand if the tasks are successfully accomplished in a correct sequence, the emergency may be resolved without an accident occurring.

When Captain noticed that the TGT of No.1 Engine rising above 800°C, instead of asking for Check List, he followed a Non Standard procedure by bringing the No.1 Engine throttle to Idle position and continued the approach. As the approach was destabilized and go around was initiated by opening full power with Water Methanol on the aircraft veered off to the left. This sudden veering off to the left was perceived by the Captain and the First Officer as a Single Engine Failure (No.1). The Captain asked for flaps UP and gears UP as per single engine go-around procedure given in FCOM. The Captain did not realize that this single engine go-around procedure is to be followed when pilot is making a single Engine approach with flaps selected at 16 degree position for landing. Therefore, keeping in view the F.27 aircraft performance characteristics, the approach and threshold speeds with different flaps positions and good airmanship demanded that Captain should have asked for flap 16 position instead of UP position to arrest high sink rate during go-around and No.1 Engine should have been feathered as per check list action.

CONCLUSIONS

22. FINDINGS

From the foregoing investigation and analysis the Investigators find that:-

- 22.1. P.I.A. aircraft Fokker F.27 Reg. Mk. AP-ALN operating scheduled domestic flight PK-684 from Peshawar to D.I. Khan on 5th July, 1994 while on final approach to Runway 12 of D.I.Khan Airport initiated a go-around and made crash landing at 1026 hours at a place 7000 feet North of D.I.Khan runway.
- 22.2. All 38 passengers and 4 crew on board the aircraft were safe. Only three persons received minor injuries.
- 22.3. Fokker F.27 aircraft AP-ALN alongwith its engines, propellers and ancillary equipment sustained substantial damage as a result of the accident and has been assessed as totally destroyed.
- 22.4. The aircraft was fully certificated and had been maintained to the laid down standards. The aircraft Centre of Gravity was within limits at the time of accident.
- 22.5. The pilots were properly certificated and authorised for the flight. Captain Naimat Ullah Khan P-45617 holding valid ALTP No. 679 was the Pilot-in-Command and First Officer Ikram Ullah P-51749 holding valid CPL No.1236 was the Co-Pilot.
- 22.6. The flight PK-684 was uneventful till about one mile from D.I. Khan Runway 12 threshold at 500/600 AGL, when Captain noticed the No.1 Engine TGT rising rapidly and going above 800°C. Captain reduced the fuel trimmer to almost zero and brought No.1 Engine throttle to Idle.
- 22.7. The Captain stated that No.1 Engine TGT went beyond 900°C and RPM dropped below 7500.
- 22.8. The approach was destabilized and when aircraft was at 400/500 AGL and 2500 feet from Runway 12 threshold the Captain initiated a go-around and asked for flaps UP and gears UP. The aircraft was losing height and going to the left. When abeam ATC at 150/200 AGL the Captain stated that he reduced the right rudder pressure to veer off to the left with a view to put the aircraft down in an open area and made crash landing at a distance of 7000 feet towards North of D.I.Khan Runway.
- 22.9. The sequence of events leading to accident as stated by the Captain could not be corroborated with any other source of

evidence i.e. the eye witnesses, wreckage examination at the scene of accident, the FDR readout and detailed technical examination of engines and propellers.

- 22.10. The landing gears had not fully retracted at the time of initial impact of aircraft with the ground.
- 22.11. The turbine blades gave no indication of overtemperature or burning. The fuel Control Units performance during functional check was within limits. The propeller Control Units and their pitch Lock mechanism did not reveal any malfunction or system failure.
- 22.12. Both propellers were operating below Flight Safety Lock (32 degree) at the time of initial contact of propellers with the ground.
- 22.13. The Engine RPM of No.1 Engine at the time of impact was approximately 8784 RPM.
- 22.14. The operation of Automatic and Manual selection of Flight Safety Stop withdrawl system was satisfactory.
- 22.15. On final approach when the aircraft was at a distance of 4 miles from Runway 12 threshold, the speed reduced from 120 kts to 110 kts and the rate of descent reduced from 700 feet/min to 200 feet/min.
- 22.16. The technical cause of high TGT on No.1 Engine as noticed by the Captain could not be determined. High transient TGT may have been caused due to rapid opening of throttles at low speeds.
- 22.17. While Captain was busy in controlling the high TGT on No.1 Engine with the help of fuel trimmer, the aircraft started drifting to the right. The change in heading from 120 degree to 140-150 degree went un-noticed by the Captain.
- 22.18. The Captain brought the No.1 Engine throttle to Idle position to control the TGT.
- 22.19. The Captain did not ask for excessive TGT (in flight) check list actions. Instead he followed a non standard procedure by bringing No.1 Engine throttle to Idle position instead of feathering the affected engine.

- 22.20. During the final approach, with No.1 engine at Idle (11000 RPM and Zero Torque) with flaps selected at 40 position, more power was required on No.2 engine to control the touch down point.
- 22.21. When Captain advanced the right (No.2 Engine) throttle the directional Control could not be maintained due to high asymmetric drag generated by No.1 Engine (left) at flight Idle and decision was made to go-around when the aircraft was over-past the runway 12 threshold at about 100 feet AGL.
- 22.22. As the full power with Water Methanol came on No.2 Engine, while No.1 Engine was at flight Idle (zero torque) the aircraft turned to the left when it was about 1500 feet down the runway 12 at about 100-150 feet AGL.
- 22.23. The sudden veering off to the left was perceived by the Captain as a single engine failure (No.1). Therefore, Captain asked for flaps UP and gears UP as per single engine go-around procedure given in FCOM.
- 22.24. The Captain did not realize that this single Engine go-around procedure is followed when Pilot is making a single Engine approach with flaps selected at 16 degree position for landing.
- 22.25. With flaps selected from 40 position to UP position during go-around, the excessive sink rate could not be arrested and aircraft hit the tree in almost level attitude and Captain closed the throttle and made a crash landing in an open muddy field.
- 22.26. The PIA Operations Management has issued a checklist for F.27 aircraft. "Excessive TGT (in flight)" is categorised as a checklist Action i.e. AFFECTED ENGINE FEATHER Since Excessive TGT (in flight) is not "Memory Item", therefore, during the critical phase of flight it may not be possible for a pilot to ask for check list and in-appropriate actions may be taken to handle the situation.
- 22.27. The PIA F.27 Aircraft Flight Training Manual does not provide any guide line/procedure regarding "Single Engine Go-around" in case of go-around maneuver required after selection of flaps 40 degree for landing.
- 22.28. Fokker F.27 Flight Training Manual (issue 4) dated 1st August 1981 prepared by Fokker B.V. flight Department was received by PIA Flight Operations Department and has not be implemented by PIA. This Flight Training Manual (issue 4) has given a procedure for "Engine Failure on Final" and recommends that flaps to be retracted to 16 degree and accelerate to VTHR + 20 during go-around.

- 22.29. The FDR read out was not available for the last two minutes of the flight as such the final flight path of the aircraft just before impact could not be determined from the FDR.
- 22.30. The Cockpit Voice Recorder contained only the radio transmissions made by the cockpit crew with the ground stations. The Cockpit conversations were not picked up by the area microphone.
- 22.31. The Captain of the F.27 aircraft did not give any call regarding any malfunction or abnormal situation during flight.
- 22.32. The Airhostess Humaira Chishti was assigned the galley duty on this flight and during crash landing the loose containers and other articles from the galley structure fell on her and was hospitalized for dislocation of right shoulder.
- 22.33. During training adequate emphasis is not placed on cockpit crew coordination and communication during emergency situation.
- 22.34. As a result of crash landing in the fields, the land owner has claimed damages worth Rs.73,000/- (Rupees Seventy Three thousand only).
- 22.35. Meteorological conditions and Airport facilities were not a causal factor in the accident.

23. **CAUSE OF THE ACCIDENT.**

- 23.1. From the analysis of the available evidence the Investigators are of the opinion that the cause of the accident to PIA F.27 aircraft Reg. Mk. AP-ALN Operating PK.684 on 5h July, 1994 was due to the failure of Captain Naimat Ullah Khan P-45617 Pilot-in-Command to follow the appropriate procedures when he noticed the TGT of No.1 Engine rising above 800°C. In that he, instead of asking for checklist actions, which required Feathering of Affected Engine, he followed a non-standard procedure by bringing No.1 Engine Throttle to idle position (zero torque) which resulted in destabilized approach and generated excessive wind milling asymmetric drag during go-around from final approach. He asked for flaps UP from 40 degree position in one go, therefore, high sink rate of aircraft could not be arrested which resulted in crash landing in an open field.
- 23.2. Contributing factor to the cause of accident is the non availability of any guide line/procedure in the Flight Crew Operating Manual or Flight Training Manual of F.27 aircraft for Single Engine go-around after flaps have been selected to 40 degree for landing.

24. RECOMMENDATIONS

The Investigators make the following recommendations based on their observations and findings.

- 24.1. PIA Management should review the Emergency and Abnormal Checklist procedures for F.27 aircraft and all other types of aircraft flown by PIA and Categorise them as Memory Item or Checklist Item keeping in view the nature of failure and phase of flight.
- 24.2. PIA Management should expedite the implementation of F.27 Flight Training Manual (issue 4) prepared by Fokker Company.
- 24.3. The PIA F.27 Training Manual be suitably amended to adequately emphasise the requirement of selecting the flaps to 16 degree if engine failure occurs on final approach when flaps have been selected to 40 degree for landing.
- 24.4. It should be ensured during training of F.27 pilots that adequate emphasis is placed on following the certified procedures when handling inflight emergency/ abnormal situation.
- 24.5. During Crew Resource Management Courses adequate stress be laid on Cockpit crew Coordination during normal flying and in emergency situation.
- 24.6. The Flight Data Recorder Model No.FA 542 fitted on F.27 aircraft be replaced with modern type of FDR.
- 24.7. The F.27 aircraft be provided with hot wiring for boom microphone system for CVR recording.
- 24.8. The jump seat for airhostess on F.27 galley duty be removed from its present location and a seat should be provided in the passenger Cabin area for galley duty airhostess.
- 24.9. The PIA Operations Management should brief all the pilots to declare the inflight emergency or abnormal situation before landing at the Airport.
- 24.10. Rs.73,000/- (rupees Seventy Three Thousand only) be paid to Mr. Ahmed Khan Kamrani for the damages claimed by him as a result of crash landing in the field.

24.11. Captain Naimat Ullah Khan's P-1 Rating for F.27 aircraft on his ALTP No. 679 be withdrawn for a period of 6 months for violation of rule 155 of Civil Aviation Rules 1978.

APP.

D-1



AIRCRAFT HIT TWO TREES BEFORE CRASH LANDING

APP.

D-2



AIRCRAFT CAME TO FINAL RESTING PLACE

APP. D-3



SIDE VIEW OF AIRCRAFT AT FINAL STOP

APP. D-4



AERIAL VIEW OF AIRCRAFT CRASH LANDING SITE

APP.

D-5



FRONT VIEW OF AIRCRAFT AT FINAL STOP

APP.

D-6



STARBOARD WING ROOT L.E. DAMAGED BY TREE

APP.

D-7



NOSE WHEEL NOT FULLY RETRACTED

APP. D-8



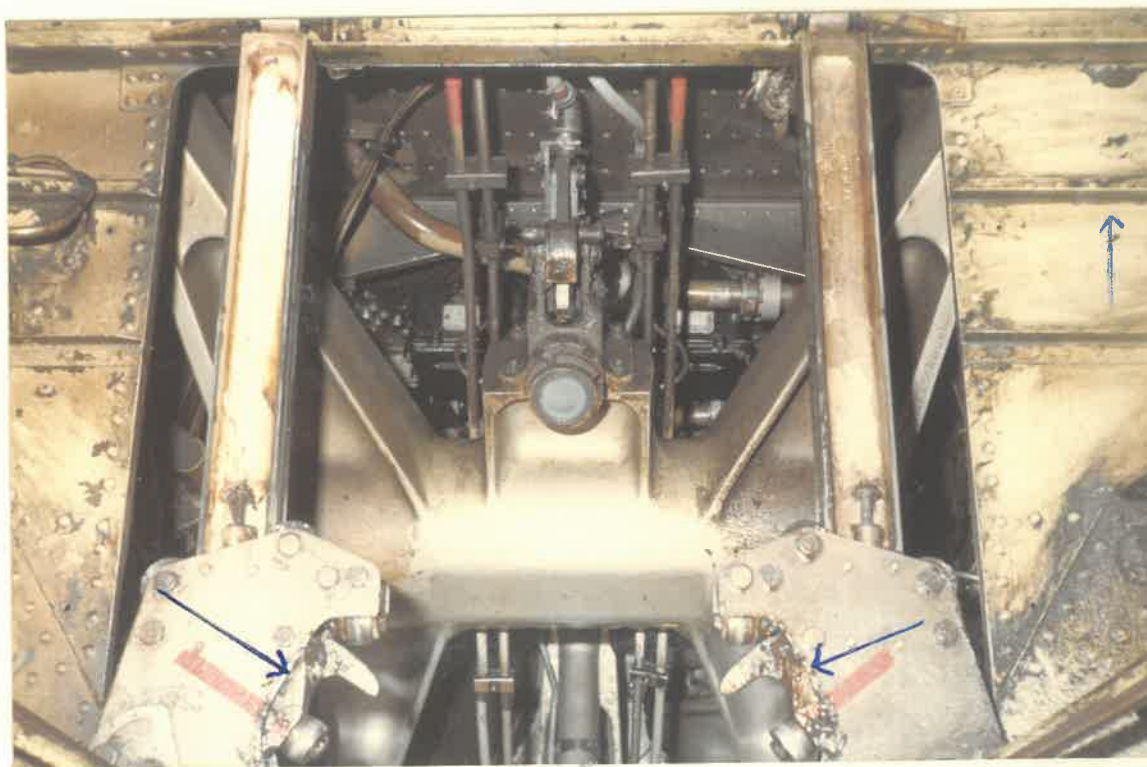
TREE BRANCHES STUCK IN LEFT MAIN GEAR DOOR

APP. D-9



RIGHT MAIN GEAR UP LOCKS IN OPEN POSITION
AND TREE BRANCHES STUCK INSIDE THE DOOR

APP.
D-10



LEFT MAIN GEAR UP LOCKS IN OPEN POSITION

APP.

D-11



RIGHT WING BROKEN FROM MID SECTION

APP. D-12



RIGHT OUT BOARD WING PORTION

APP.

D-13



LEFT OUTER WING L.E. HIT TREES BEFORE CRASH LANDING

APP. D-14



AIRCRAFT NOSE SECTION AREA DAMAGED

APP. D-15



PASSENGER CABIN AND SEATS DAMAGED

APP. D-16



AIRCRAFT GALLEY AND LUGGAGE AREA

APP.

D-17



PORT ENGINE PROPELLER TIPS SHOWING FORWARD BENDING

APP. D-18



SLASH MARK MADE BY PORT PROP
AT INITIAL IMPACT OF AIRCRAFT

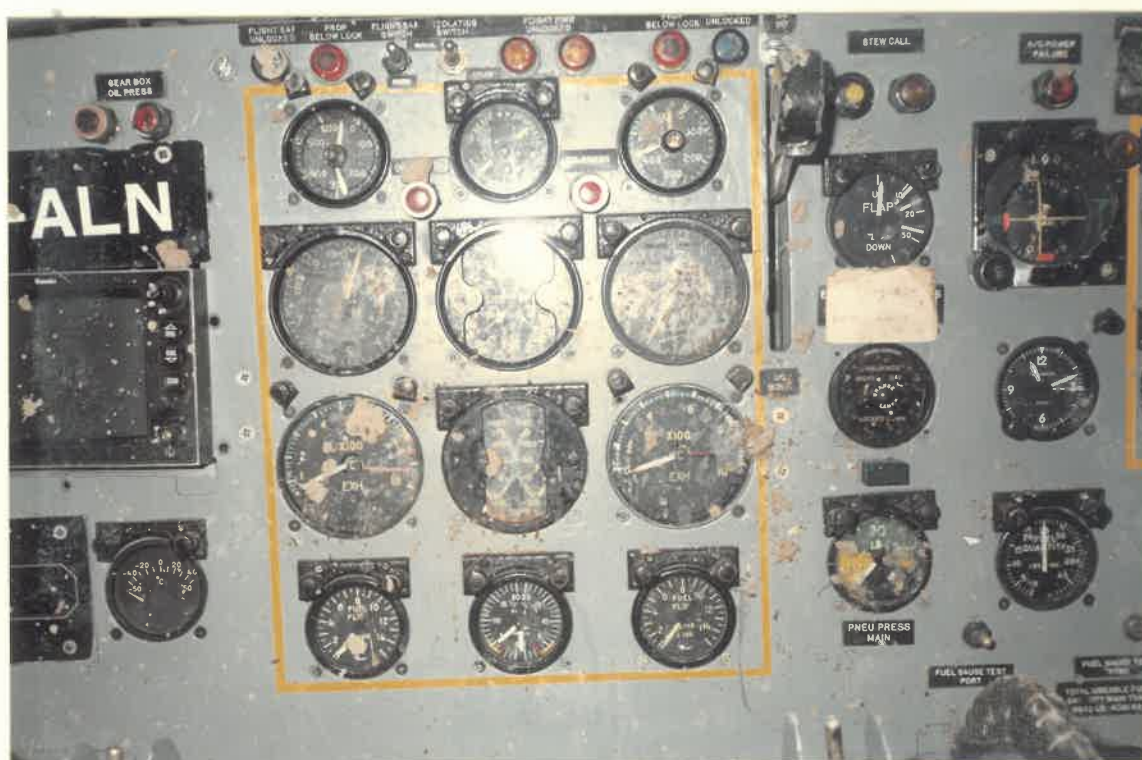
APP.

D-19



COCKPIT CONTROL LEVERS POSITION

APP. D-26



FLAP INDICATOR SHOWING "UP"