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AIRCRAFT INCIDENT INVESTIGATION
REPORT

M/S LIBYAN ARAB AIRLINES

BOEING 707 A/C 5A-DJT

AT

KARACHI AIRPORT

WHILE OPERATING FLIGHT No. LN. 263

ON

6TH JANUARY, 1989

Original

REPORT ON INCIDENT TO M/S. LIBYAN ARAB AIRLINES
BOEING-707 AIRCRAFT 5A-DJT ON 6.1.90 AT KARACHI
AIRPORT WHILE TAKING OFF FOR KARACHI - TRIPOLI
FLIGHT NO. LN.263

1. SUMMARY OF INCIDENT

1.1. Libyan Arab Airlines Boeing 707 aircraft Registration 5A-DJI, took off from Karachi Airport (runway 25R) for schedule flight LN-263 on 6th January, 1989 at 0749 hrs local time. Take off was normal. During climb at about 900 feet a loud noise was heard by Cockpit crew. Cabin rate of climb indication on Flight Engineer pannel became unsteady, Turbo compressor (T/C) No.2 light came 'ON' and T/C was shut off automatically.

1.2. During climb power setting engine No.2 failed to responed, and it remained at 80% N1. At this stage Flight Engineer physically saw the No.2 engine and found its cowling missing. As such Captain decided to land back.

1.3. After dumping the excess fuel, the aircraft landed back safely at 0815 hrs LT. No.2 engine was shut down by pulling fire handle.

2. DAMAGE TO AIRCRAFT

2.1. No.2 engine main cowling (both sides) blown off.

2.2. No.1 engine oil tank ruptured by hitting of parts of the cowling of No.2 engine.

- 2.3. No.2 engine main cowl R/H Fwd hook sheared & remained in pylon hangar.
- 2.4. No.2 engine cowl aft. main hangar separated from pylon & found in wreckage, hangar supporting strip had tilted.
- 2.5. No.2 fuel heater valve wires broken at plug.
- 2.6. No.2 engine aft thrust reverser follow up cable broken from both sides & engines controls damages occurred beneath horizontal fire wall.
- 2.7. No.2 engine aft thrust reverser seleeve ruptured at about 5 O' clock postn. (10"x4" approx.).
- 2.8. No.2 engine L.P. start duct from starter S.O.V to starter, ruptured.
- 2.9. No.2 turbo compressor 16th stage supply duct near diffuser at clamped joint dislocated due clamp missing.
- 2.10. No.1 R/H main cowl damaged at two places.
- 2.11. L/H out-board flap had a hole on lower surface due to hitting of cowling pieces (hole radius approx.2").
- 2.12. L/H No.7 L.E. slat damaged 6"x2" approx. and gooseneck fairing missing.

3. OTHER DAMAGES

N I L

4. COWLING DESIGN FEATURES

4.1. Engine main cowlings are in two parts, left and right, detachable from the engine. At the top both the cowlings are hinged to the pylon independently. Left cowlings are held with 4 alignment hooks and 2 hinge brackets. Right hand cowlings are held with 3 alignment hooks and 2 hinge brackets. Alignment hooks and hinge brackets are held/locked in hangars installed on pylon. At the bottom both cowlings are latched together by 6 latches. Latch locks are in right hand cowlings and 'U' bolts, in which latch locks engage, are in left hand cowlings.

5. WRECKAGE & IMPACT INFORMATION

5.1. Pieces of No.2 cowlings and slats etc were found scattered at a distance of approximately 2 Kilometres from end of the runway, in the Central Ordnance Depot (C.O.D). Relative position of different pieces is shown in appendix 'A'. In spite of repeated attempts some of the parts could not be recovered as the area is full of bushes and an open, rain water drain also passes through the area especially the 16th stage H.P duct clamp. Ref Appendix 'H'.

6. FINDINGS/OBSERVATIONS

6.1. Scrutiny of the Aircraft Tech log book revealed that the aircraft had experienced loss of utility hydraulic system on the preceding flight (No.LN-262, Tripoli to Karachi dated 4th January, 1989). The defect was rectified by

PIAC and detail of the work performed by PIAC Engineering staff is attached as appendix 'B'.

- 6.2. Turbo compressor duct which supplies engine's 16th stage air (at about 185 PSI) to No.2 turbo compressor was found separated from its joint. Two parts of the duct are held together by a clamp which was missing.
- 6.3. Collar at the matting face of one of the two parts of 16th stage duct was found chipped off at two places (Ref photograph at appendix 'C'). The missing portions are 2 cm apart and are of dimensions 1.5 x 0.4 cm.
- 6.4. Cowling of corresponding engine on R.H.S was checked and a considered gap was found between duct clamp and the cowling in closed position. Moreover there were no signs of any part hitting the 16th stage duct.
- 6.5. Condition of latches as found as recovered parts of the cowling indicates that they were properly locked before departure of the aircraft. Complete details pertaining to condition of the latches are given in appendix 'D'.
- 6.6. Forward hinge hook is riveted to a channel of the cowling. This channel had sustained structural damage in the past also and was found repaired by a doubler. (Ref. photograph at appendix 'E'). The rivets of the repaired area were found sheared which resulted in separation of hook from the cowling.

6.7. Thrust reversor follow up cable was found broken just aft of its turn buckle. From inspection of the cable it appears that the cowling had been hanging on this cable before falling down.

6.8. Power lever operating cam (roller) was found broken and entangled with the thrust reversor cam. This happened due to pull on the cable.

6.9. After return of the aircraft, No.2 engine power lever was found stuck in forward position. When the T.R follow up cam was moved away from power lever cam, with the help of a screw driver, the power lever cam became free and throttle could easily be moved back.

7. EVIDENCES

Statement of the following personnel are enclosed as appendix 'F'.

7.1. Mr.R.Salama (Flight Engineer).

7.2. Mr.S.R.Hussain (Aircraft Maintenance Engineer)

7.3. Mr.Shafiq Khan (Officer Engineer LM-I).

7.4. Mr.Sadat (Sr.Technician).

7.5. Mr.Wazir Ali (Engine Technician).

8. INVESTIGATION

8.1. Breakage of clamp, holding two parts of 16th stage air duct, caused sudden application of 185 PSI on the cowling. This pressure multiplied by projected area of the cowling created a huge force which resulted in failure of the

/cowling

cowling hook, which had already been weakened by a previous repair. After failure of first hook its load was also distributed on remaining members which also gave away due to over stress. To confirm this reasoning the matter was referred to Boeing company and they have confirmed that loss of cowling due to broken 16th stage duct clamp was previously also reported to them. Copy of Boeing report is enclosed as appendix 'G'.

- 8.2. Condition of the latches with reference to their locking mechanism confirms that the same were properly locked before departure of the aircraft, statements of maintenance staff also confirmed that the latches were properly locked before departure of above flight Ex-Karachi Airport.
- 8.3. During discussion, Captain and Flight Engineer of the aircraft confirmed that No.2 turbo compressor was 'ON' during take off which is in conformity with normal procedure, and turbo compressor low pressure light was off. The turbo compressor low pressure light came 'ON' when aircraft reached 900 feet. This confirms that 16th stage duct clamp was intact at the time of departure. However, it broke when aircraft was at 900 feet. As a result 16th stage air expelled into the cowling. This created a low pressure condition on the turbo compressor and its low pressure light came 'ON', after a sudden thudding noise heard by crew also.

8.4. Matting face at the collar of one half of the 16th stage duct was found chipped off at two places. It appears that at the time of installation of the clamp the two parts of the duct were not properly aligned and the clamp was installed by pushing one half of the duct face with a screw driver. This caused chipping of the matting face and also in this way the clamp was continuously under stress.

8.5. To investigate into the clamp failure, the work performed by PIAC prior to departure of this flight was thoroughly reviewed and it was confirmed from the documents and interrogation of the concerned personnel, that PIA did not perform any work causing disturbance of the clamp. Maintenance of this aircraft is performed by PIAC only when it is in transit at Karachi. Rest of the maintenance is performed by Libyan Arab Airlines or other organization. As such it was not possible for the investigation team to determine how the duct face was chipped off and in the absence of the broken clamp pieces it was not possible to determine if it was properly installed/torqued.

NOTE: Libyan Arab Airline's team visited Karachi after the incident. Details of the findings were explained to the team. They were informed that above incident happened due failure of the 16th stage duct clamp which is located on L.H. side of the engine. And PIAC carried out hydraulic

failure work on R.H. of engine. During all above work, Libyan Arab Airlines Engineer was available watching work being performed by the PIA Maint. However, during the discussion they insisted on the recovery of missing clamp to determine the causes of its failure specially the possibility of its mishandling by PIA maintenance staff. As such repeated attempts were made, by Army personnel of C.O.D and Civil Aviation teams lead by Technical Investigator to recover the clamp or its pieces but due to the bushes and open water drain in respective area the clamp pieces could not be recovered. Since C.O.D area is a restricted area, the investigation team was not allowed to visit inside C.O.D area where all broken parts of slat and cowlings were found. However the commanding officer confirmed they will carry out regular search from time to time as it is very big area to cover. Thus, how this report is submitted late due clamp search has been called off by C.O.D personnel in Dec 89. The missing clamp which was a vital source of evidence of above incident could not be located. Ref Appendix 'H'.

- 8.6. Scattering of the cowling parts on the ground indicates that both parts of the cowling had separated from each other in the air. Right hand cowling fell slightly after the L.H cowling, indicating that the R.H cowling had

been hanging on the thrust reversor follow up cable, which eventually gave in due high air velocity of aircraft forward speed.

8.7. Close inspection of the failure pattern of thrust reversor follow up cable indicates that the cowling had been hanging on it before falling on ground. This pull on the cable moved the aft thrust reversor cam in a direction as it does on application of thrust reversor. Due to over movement of the follow up cam, it hit the power lever roller and broke the same. This caused binding in power lever cam, as a result of which the throttle of No.2 engine could not be moved back. However, on releasing the power lever cam with the help of a screw driver, after return of the aircraft, the No.2 throttle became free. Thus jamming of No.2 throttle was a result of secondary damage caused by cowling failure.

8.8. Damage to other parts of the aircraft, oil tank, fuel heater, No.2 engine aft thrust reversor cable & sleeve, No.2 engine low pressure start duct, L/H outboard flap and L/H No.7 leading edge slat, was caused by hitting of cowling parts.

8.9. The damaged parts were specially inspected for the possibility of any explosion but no signs of that nature could be observed.

9. CONCLUSION

- 9.1. No.2 engine cowling was damaged and separated from the aircraft due to huge sudden force applied on it by air pressure caused by failure of clamp joining two parts of 16th stage duct supplying Air to No.2 Turbo compressor.
- 9.2. The clamp was intact at the time of departure and failed when the aircraft was at 900 ft.
- 9.3. It is suspected that the clamp was not properly fitted during last installation as revealed by damage to the duct collar. However, as clamp pieces could not be recovered, its detailed analysis could not be performed to determine if it had failed due to fatigue or due to over torquing etc. No work was performed in this area prior to the flight at Karachi. Aircraft records do not reveal when the clamp was installed last time, and maintenance of this aircraft is mainly performed by different agencies outside Pakistan, hence the responsibility can not be pinpointed.
- 9.4. The cowling was properly locked/latched before departure of the Aircraft.
- 9.5 Jamming of No.2 engine throttle was a result of secondary damaged caused by breakage of the cowling, Other damage to the aircraft was caused by penetration of cowling pieces.

10. **RECOMMENDATION**

10.1. The incident was caused due to non adherence to proper maintenance practices. As such the same should be strictly followed while performing any work on the aircraft.

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