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CIVIL AVIATION AUTHORITY
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AIRCRAFT INCIDENT INVESTIGATION REPORT
PAKISTAN INTERNATIONAL AIRLINES
AIRBUS-A310 AP-BGP
ON 31 MARCH 2005

AT

JINNAH INTERNATIONAL AIRPORT KARACHI

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FINAL REPORT

ACCIDENT TO PIAC's AIRBUS-310 AIRCRAFT REG # AP-BGP, PK-213 AT KARACHI AIRPORT ON 31-03-2005

Authority: Director General Civil Aviation Authority Memorandum HQCAA/1901/297/SIB dated 15th April 2005.

Synopsis: Airbus 310-, registration number AP-BGP was on its first scheduled flight on 31st March 2005 from Karachi to Dubai. The airbus had been on a major maintenance known as "Check C" for last 17 days in Base Maintenance, PIAC Engineering. Three engineers from Base Maintenance were on board to see aircraft behavior after the first flight. Aircrew observed few snags including burning smell during taxiing. Just after take off the "Electronic Centralized Aircraft Monitoring" (ECAM) system displayed a warning indicating presence of smoke in Avionics/Min Equipment Bay. (**See Appendix A)**

The cockpit crew aborted the flight as per their check list. On ground, the defect was not confirmed hence after technical checks, the aircraft was released for same flight after one hour. The Airbus was airborne again, but, soon landed back due to exactly the same defect. It caused lot of physical and mental agony to passengers who were on board since boarding for the flight first time. The aircraft was grounded by CAA Safety Investigation Board for detailed investigation and repair work.

1. Factual information

1.1 PK 213 was a schedule flight from Karachi to Dubai.

1.2 It landed back twice due to smoke warning on ECAM system.

1.2 **INJURY TO PERSONS:** Nil

1.3 **DAMAGE TO AIRCRAFT:** Nil

1.4 **OTHER DAMAGES** : Nil

1.5 AIRCRAFT INFORMATION

1.5.1 Aircraft was on its first flight after "C" Check. It had 53 smoke warnings on ECAM, 50 defects on Auxiliary Power Unit (APU) and 36 defects on Engine Fire Warning (Fault) reported by Pilots since it's induction in PIA however these defects were not properly rectified at any stage. These were recurring in different manners at various intervals. However, aircraft was airworthy from all other considerations.

1.6 METEOROLOGICAL INFORMATION

1.6.1 Weather was fit for flight and no NOTAMS were issued.

1.7 COMMUNICATION Non factor

1.8 AERODROME INFORMATION : Non factor

1.9 FLIGHT RECORDERS : N/A

2. TECHNICAL INVESTIGATION

2.1 The Defect and Aircrew Actions:

2.1.1 The defect for aborting the 1st flight was:
"A burning smell during Taxi. ECAM warning for Min Equipment Bay smoke/avionics smoke just after lift off".

2.1.2 During aircrew interview, it was found that burning smell was not enough to confirm any abnormality. The first officer did not respond to Captain's observation regarding burning smell. However the decision to discontinue the flight both times was due to ECAM warning for Min Equipment Bay/Avionics Bay smoke.

2.1.3 The aircrew actions to land as soon as possible as per A-310 smoke/loop aircrew action check list

(Appendix "B") have been criticized and challenged by ground crew **(See Appendix C-)**. The ground crew is of the opinion that aircrew should have confirmed the smoke through "Sniffer Fan" available in the cockpit and then, on confirmation, a smoke drill should have been carried out instead of landing back.

2.2 **Inadequate Rectification process after two aborts.**

2.2.1 During investigation, it was noted that the process of rectification of a chronic defect was not based on any careful analysis of the history of defect and taking help from previous experience of PIA and airbus industry. The chief engineer Base Maint was not aware of history of the defect even after two air aborts. "**It was simply replacement of contaminated coalscer bags(filters), APU and replacement of seven sensors in lavatories and cabins It did not cater for cleaning the entire air conditioning ducts which were contaminated due to APU oil leaks during last 13 months.**" The aircraft was released for a test flight after this rectification. **(See Appendix D)** The result was wastage of another flight costing Rs 3700 000(60,000 US$). The test flight was carried out by Captain Lateef Farooqui and was declared unsatisfactory due to exactly same defects which caused two aborts on 31st March, 2005.

2.3 **Rectification after Failure of First Test Flight**

2.3.1 At this stage the investigation team directed maintenance personnel to remove and clean all contaminated parts which had been contaminated in last 13 months due to oil

leak and were causing illumination of smoke warning lights again and again. After the colossal work of cleaning the entire system, aircraft was again subjected to a test flight and it was satisfactory. (See **Appendix "E"** for details of rectification and pilot's expression of thanks after second test flight on 6th April, 2005.

2.4 **History of the smoke/fire warning defect:**

2.4.1 Investigation of aircraft documents revealed that a defect of internal oil leak from auxiliary power unit had been nourished to cause contamination of the entire air conditioning ducts, components, sensors, thermostats and cabin since the induction of this aircraft in PIAC in March 2004. The defects summary of this aircraft revealed that the "Fire Protection" system of the aircraft had registered 53 such defects since 1st March 2004. This number was compared with other 8 aircraft of the fleet and it was found to be the highest. Similar defects on other aircraft as per **Appendix "F"** are shown here:

A/c Reg.	BDZ	BEB	BEC	BEG	BEQ	BEU	BGO	BGN	BGP
Defects	9	11	5	6	4	18	27	11	53

2.4.1.2 The indication of defects/ warnings in fire protection system, as many as 53 times, was alarming enough at every stage of maintenance. Its history was traced from aircraft documents since its induction in PIAC. The examination and scrutiny revealed weaknesses of Defect Monitoring by PIAC Engineering.

2.5 **Tracking of the History of Defect since its Acceptance by PIA – CAA Team**

2.5.1 The defect was even reported by the acceptance team during "Test Flight" at Brussels on 28 January 2004. The defects at serial numbers 51,52 and 53 are reproduced here to make reader feel that "Fire Protection System" is indicating presence of some fluid leak in the air-conditioning system of this Airbus since the first test flight during acceptance by a team of 13 members from PIA including on CAA inspector **(See Appendix "J")**

(a) During the taxi, climb and descend Burning smell comes from air-conditioning packs.

(b) Smoke warning for toilet 'A' came ON and remained on.

(C) Min Equipment Bay Smoke warning came ON for some time during climb & went off.

2.6 **Analysis of Pilot Reported Defects for last 13 Months**

2.6.1 The software used by PIAC engineering is known as PAMMIS provides defect analysis in many useful forms. It shows that there had been smoke warning on ECAM 31 times during last 13 months (See **Appendix "H"**). It also shows that "APU" tripped off during operation 49 times (See Appendix "J) The frequency of these two simultaneous defects was enough to react and rectify the root cause. The analysis of PAMMIS software for pilot reported defect history reveals that there exist an efficient computerized system to observe and monitor the defect trends but ironically neither aircrew nor the ground crew interviewed during investigation were aware of such a **useful "Database for Monitoring**

Defect Trends". As another example of inadequate utility of the system, Airbus AP-BGO was found with 26 defects on Fire Protection system" but no corrective action has been taken through this information.

2.6.2 A critical Analysis revealed another very interesting fact that aircrew had been accepting these defects for last one year despite of its recurrence again and again. The question arises whether aircrew was taking a **safety risk** during last one year or this time flight was aborted due to some other reason. What ever may be the reason for Captain Nayyar Nazir to abort the aircraft twice on the night between 31st March and 1st April 2005 with passengers continuously on board; it was blessing for PIA that due to media reporting Safety Investigation Board CAA undertook the investigation. The investigation brought out a number of amazing, astonishing and surprising facts for improving aviation safety in PIAC.

2.7 Investigation Report by Chief Engineer (Quality Systems)

2.7.1 Interestingly, the Chief Engineer (Quality Systems), in his investigation report blames cockpit crew procedure and behavior for these aborts. Chief Engineer (Quality System)'s remarks are reproduced here from Appendix "Q"

2.8 **Cockpit Crew Procedure/Behavior:**

2.8.1 **Except the reporting on 31st March, 2005, whenever the Minimum Equipment Bay/Avionics smoke warning came ON and that too were during take –off the Crew performed the Sniff check and after confirming No-Smoke the flight was continued. This is as per procedure as given in their check-list.**

On this particular occasion the Cockpit Crew neither observed the Check-list nor utilized their skills/airman ship. Had they performed the Sniff check? The situation would have been cleared to them, that actual smoke did not exist.

2.8.2 Engineering personnel have based their analysis of aircrew actions on the following factors:

2.8.2.1 The defect related to smoke warning in various areas has continuously been reported on this aircraft since its induction in PIA fleet.

2.8.2.2 The first reporting was on 28th March, 2004 pertaining to Minimum Equipment Bay area. (I.e. just 18 days after its induction in PIAC).

2.8.2.3 There are total 21 pilot reports regarding smoke warning in which 13 reports are related to Minimum Equipment Bay/Avionics Bay area.

2.8.2.4 Total six times the above defects were reported along with the pungent smell in cabin and cockpit.

2.8.2.5 At no time the smoke has been confirmed by cockpit crew after using the sniffer fan as per procedure.

2.9 **Analysis of Aircrew Decision**

2.9.1 Critical scrutiny of Flight Crew Operating Manual clearly indicates that if there is an "ECAM Warning for Smoke/Min Equipment Bay or Avionics Bay then; Instruction to Land as Soon As possible overrides all other actions/drills. However, why aircrew did not act in similar manner during at least 5

earlier exactly similar situations is to be answered by operations.

2.10 **Handling/Treatment of a "Chronic Smoke Warning Defect" by Line Maintenance – PIA Engineering**

2.10.1 Investigation revealed that Line Maintenance engineers, technicians, supervisors and Manager were well aware of this defect as it was repeating again and again for last one year. They were purposely delaying its rectification as that would require grounding of the aircraft for a longer period say two to three days. As a matter of fact, according to minimum aviation safety standards; line maintenance should have grounded the aircraft and rectified the defect at a very early stage, earliest in June 2004. By June 2004 APU had registered 20 defects and ECAM "Smoke Warning" had been for 10 times. Any defect trend analysis for first three months would have shown that a faulty APU is causing "Smoke Warning Light to activate ECAM".

2.10.2 The apathy is that line maintenance personnel neither corrected the situation during last one year and nor demanded the same in **"discrete"** technical language from base maintenance personnel; while handing over the aircraft for a major check 'C' on 16th March 2005 to Base Maintenance. It may be noted that Manager Engineering (Planning Line Maintenance) informed Manager Engineering planning (Base Maintenance), in a **vague** manner regarding these defects. The higher management was unaware of the situation, the LM written for defects other than C checks actions says **(See Appendix "K")**

"Aircraft AP-BGP is grounded for major check in Base Maintenance, following defects may please be attended on this grounding as require longer ground time."

(a) APU trips at times during operation

(b) Fumes in cabin reported after take off."

2.10.3 This was not an appropriate technical procedure to address a safety Issue related to a chronic defect. In fact it was an effort to avoid accountability at any latter stage, i.e. why it was not reported and also why it was not rectified at line maintenance. When a defect or situation is reported in this manner i.e. "Shirking Responsibility" and the result or reaction is likely to be similar. **Engineers and Chief Engineer at Base Maintenance blame this casual reporting as a "cause for not rectifying the defect during C check"**

2.11 **The Base Maintenance – Unaware of the situation**

2.11.1 The aircraft remained grounded w.e.f. 16th to 31st March i.e. 16 DAYS for a major Maintenance check 'C'. This was an ideal opportunity for maintenance personnel to investigate and rectify the chronic defects of "APU" tripping out during operation (49 pilot reported defects) and smoke warnings on ECAM (31 times). Similar to earlier response to these defects by line maint, technical services and operations engineering at PIA; the base maintenance also remained inactive to the situation, an engineer of maintenance planning simply raised AROs in response to LM for AP-BGP Defects in a very routine manner as if a **the defect had just appeared without any history. (See Appendix "L"). It says**

"Fumes in cabin reported after take off PL rectify" signed by AME 786 Q 340 – 1047.

2.11.2 Here at Base Maintenance not only that the defects were not given any serious consideration, rather the rectification column was cleared without any work. The rectification is recorded as follows:

"APU duct and air-conditioning ducting sys cleaned. No Fumes observed during pack operations (man-hours Consumed 6 Hrs)".

2.11.3 The above write-up for rectification amounts for negligence and disregard to aviation safety by P-55733, AME 1396 Q340–2076. In simple words an A/C engineer is writing with signature what is not actually carried out.

2.12 **Facts from witness statements and media reporting**

2.12.1 A number of engineers and pilots were interviewed. The analysis of evidence revealed the following:-

2.12.1.1 Newspapers report was based on the only first air abort on 31st March, 2005. They were not aware of the second abort. Had they known the second abort, the reporting in news media would have been more critical.

2.12.1.2 Engineer Farhan Hameed, who rectified the defect after first abort did not find anything abnormal in various compartments, hence he cleared the aircraft. This was not a professional approach for defect rectification.

2.12.1.3 Engineer Abdul Muneeb Sheikh, who was on board to monitor the aircraft behavior after "C" Check was unaware of the history of defect.

2.12.1.4 AME Syed Meraj-ud-Din inspected this aircraft at Brussels in January, 2004 and pointed out this defect. He was aware of the fact that smoke warning light on ECAM appears quite frequently. However, he is also not familiar with any "Defect Trend Analysis". He states that no defect analysis was received either from corporate safety or from defect monitoring cell.

2.12.1.5 Captain Nayer Nazir and First Officer Ather Haroon are not familiar with "Pilot Reported Defect Summary" and "Safety Management System Manual".

2.12.1.6 Managers Technical Services have a totally different definition of "Repeated Defects" shown in **Appendix "R",** according to which a defect is considered a repeat defect if it repeats within ten days of last reporting.

2.12.1.7 Manager Technical Services could not provide a satisfactory answer to the fact that this defect was not monitored and communicated to other departments as it should have been as per EMPM Volume-VII procedure for reporting of defect and EMPM Volume-I (1-6-02-02 para-09 to 11 defect control procedure) attached as **Appendix "S".**

2.12.1.8 Chief Engineer (Base Maint.) Mr. Yousuf Jamil Zaidi was not aware of the history of 53 defects when the aircraft was under "C" Checks under his supervision. They even did not come to know the history when it was prepared for a Test Flight after two air aborts on 31st March, 2005.

2.13 **Root cause of Failure:**

2.13.1 PIA's Engineering and Maintenance Procedures Manual (EMPM) Vol 7 for Quality Control Division, amply, with no ambiguity exposes the root cause of failure. (See **Appendix "M"**) The purpose of investigation and reporting of defects given on page 7-4-00-13 is reproduced below:-

"PURPOSE"

2.13.2 **Any defect however minor it may be and whether or not it caused any delay to a scheduled service, once reported by pilot or found during inspection, requires proper investigation, rectification and recording as it has significant impact on airworthiness of aircraft. Proper investigation will ensure that the defect does not repeat or becomes a Safety Hazard.**

2.13.3 While allocating the responsibilities and procedure for investigation and reporting of defect; it states:-

"PROCEDURE"

2.13.4 Normally it is the responsibility of the respective Quality Control Division to properly investigate and rectify the defects found during inspections or whenever reported by pilot to prevent its repetition but it is also essential that proper recording of these defects is carried out and monitored by Technical Services Section of Quality Control Division as a means of Quality assurance.

2.13.5 The procedure as per paragraph C of EMPM Vol 7 page 7-4-00-13 requires that:

2.13.5.1 Technical Services to record all pilot reported defect with ATA chapter wise codes on computer.

2.13.5.2 Technical Services to "Monitor and Review" defects on each system such as "Fire Protection" on daily basis.

2.13.5.3 If a defect appears third time (R3) then Manager Engineering Technical Services will start active participation on the rectification effort through verbal advice or issue of Technical Services Requirement (TSR) specially asking the Maintenance division to carry out specific Tests, follow a specific procedures change of component and /or to follow a trouble shooting procedure as laid down in the Maintenance Manual and as recommended by the Technical Services (trade/system) who after reviewing the previous rectification using **computer data base** will recommend an action plan basing his recommendation and trouble shooting charts of Maint. Manual and backdrop of industry and PIA experience.

2.13.5.4 Technical Services will continue to participate until the defects is finally rectified.

2.13.5.5 It may be noted that the entire procedure reproduced above was not followed at all. Had it been followed by any supervisor the occurrence could have been avoided.

2.14 **Failure of Quality System**

2.14.1 Manager Technical Services failed to monitor and review the repeated defect; thereby no verbal advice or Technical Services requirement was issued during line operations. Base Maint Quality, too, failed in a similar manner. Analysis of defects shows another defect regarding "Illumination of engine # 2 Loop A warning light" thirty times since 8th April 2004 to 29th July 2004. Aircrew kept writing the chronic defect after each flight but, no action was taken by any component of Quality Systems to monitor and review the defect.

3. Conclusion:

3.1 A serious airworthiness hazardous situation was communicated to Aircrew and Engineers for one year-, through "Fire Protection System's warning (ECAM). It was recorded and entered in computer system for daily review and corrective action; but, no corrective action was taken either by Quality Systems, Flight Operations or Line/Base Maintenance Engineering. Ultimately on 31st March due to two aborts and media reporting all the weaknesses were exposed through investigation by SIB. The occurrence has further tarnished the already existing inadequate flight safety standards in PIA and caused approximately a loss of 0.8 Million US $.

OBSERVATIONS

3.1.2 There is lack of coordination between line maintenance, base maintenance and Quality System as far as reporting and investigation of defects in concerned.

3.1.3 There is no coordination between Operations and Engineering for monitoring the repeated defects.

3.1.4 The definition of "Repeat Defect" communicated to operations by Technical Services needs to be modified for avoiding such situations.

3.1.5 Operations Engineering should be assertive in getting the defects rectified by Engineering.

FINDINGS

Occurrence and aircrew actions

3.2.1 AP-BGP A-310 PK 213 aborted twice for Dubai after take off on 31st March 2005 on ECAM Warning for smoke in Minimum Equipment Bay /Avionics smoke.

3.2.2 Cockpit crew actions to abort were timely and correct as per Smoke Min Equip Smoke/Avionics smoke check list Rev 31 Page 5.04.

3.2.3 Ground crew perception of "Sniffer Fan operation/Smoke Drill on "ECAM WX for Smoke is incorrect.

3.2.4 Different set of Cockpit Crew did not take checklist action earlier on similar Warnings on ECAM for smoke during take off at least five times in the past.

Quality of Rectification:

3.2.5 The rectification at line maintenance for 53 times during last 13 months was simply to replace or/and clean sensors instead of finding and removing cause.

3.2.6 During "C" Check when aircraft was on ground for 16 days, again the air conditioning components were cleaned. There was no fault diagnosis based on defect history for removal of the cause.

3.2.7 The rectification process after two aborts on 31st March and for test flight on 3rd April was without procedural approach and was not based on defect trend analysis.

3.2.8 The rectification before 2nd flight was guided and monitored by Manager Engineering Base Quality according to procedures.

3.2.9 The rectification included removal of defective APU and cleaning of entire Air-conditioning system by removal and washing.

Defect History of Airbus AP-BGP

3.2.10 The Pilot Reported Defect Summary shows 53 defects in last thirteen months on Fire Protection System-2600.

3.2.11 There were 49 defects on APU and 30 on ECAM for smoke Warnings for Min Equip Bay/ Avionics Smoke.

3.2.12 The APU caused burning smell and smoke warnings on ECAM/Min Equipment Bay Smoke during take off while acceptance flight was undertaken at Brussels on 28-01-04.

Failures of Engineering Management

3.2.13 The ECAM Warnings for smoke were not taken seriously by Line Maintenance.

3.2.14 Technical Services did not follow the procedure given in EMPM Vol 7 for Investigation and Defect Reporting for repeated defects. No R1, R2 or R3 was raised for repeat defects. There is no active participation by Technical Services in the form of Technical Service Requirement (TSR) specially asking the maintenance division to carry out specific tasks, follow a specific procedures change of component and / or to follow a trouble shooting procedure as laid down in the Maintenance Manual.

3.2.15 Line Maintenance mentioned these defects in a vague manner to Base Maintenance.

3.2.16 Base Maintenance did not rectify the defects during 16 days in hanger for Major Check "C"; rather the defect referred vaguely by Line maintenance was cleared without following the procedures.

3.2.17 The rectification at Base Maintenance was recorded as follows "APU duct and air-conditioning systems cleaned. No fumes observed during air cooling machine operations". This write-up for rectification amounts for negligence and disregard to aviation safety by Base maintenance.

3.2.18 No attention was given towards chronic repeated defects by Line, Base and Technical Services for other defects such as Engine Fire Warning "Fault light for Engine # 2 loop A" which repeated 30 times.

3.2.19 The APU was dispatched for Repair to vender without any Investigation into its failure.

3.2.20 The Defect Control system in PIAC is not monitored at higher level of management i.e. Manger Engineering, Chief Engineers and director engineering.

Airworthiness (CAA)

3.2.18 Monitoring of defects by Airworthiness Directorate is absent, no advice was ever issued on this chronic defect which was existing since its induction in PIAC.

Operations Engineering PIAC

3.2.19 Chief Pilot Technical and operation engineers did not play any role to correct the situation by issuing any Operational Engineering Information Bulletin.

Lack of coordination between Corporate Safety and Quality System.

3.2.20 The defect was not identified as Chronic or repeat defect for 13 months either by Corporate Safety or by Quality System.

Cost of Occurrence

3.2.21 The Occurrence has caused at least 0.8 million US $ loss by a very conservative estimates.

(MUHAMMAD ALI AFTAB)
Manager Engineering (Quality System)
Base Maint. PIAC
24 May, 2005

(NASEEM AHMED)
Wg Cdr (Retd)
Investigator In-charge
24 May, 2005

Finalization:

3.2.21 The occurrence is finalized as

Primary

3.2.22 Human Factor – Avoidable

Manager Engineering Technical Services. Failure to follow Investigation and Reporting of Defect procedure as per Engineering Maintenance Procedures Manual – Vol 7.

3.2.23. Manager Engineering Base Maintenance. Clearing a defect only on papers without any rectification in accordance with aircraft maintenance manual.

Contributory

3.2.24 Human Factor - Avoidable

3.2.24.1 Line Maintenance Manager Engineering's failure to clearly identify the problem to Base Maintenance.

Supervisory Lapses

3.2.25 Manager Engineering Base Maintenance. Failure to supervise work on AROs during "C" Check and provide supervisory guidance to remove chronic defects.

3.2.26 Chief Engineer (Quality System) Failure to analyze defect trend and take corrective actions through base quality/technical services.

RECOMMENDATIONS

4.1 PIAC to initiate a study for integration of Quality System and Corporate Safety under one executive who reports directly to Chief Executive to avoid such failures.

4.2 Director Engineering PIAC is to ensure that procedures for defect control and reporting and investigation of defect given in EMPM Volume-1 (1.6.2.02) and EMPM Volume-VII (7.4.00.13) respectively are followed by Line Maint, Base Maint and Quality System.

4.3 Director Engineering is to identify the management causes responsible at Line Maintenance, Base Maintenance and Quality System for failure to react to pilot reported defects.

4.4 Director Engineering is to identify engineers and supervisors responsible for clearing only on paper the "fumes in cabin after take off" defect during "C" Check; and take administrative action.

4.5 Director Engineering, in coordination with Airworthiness Directorate(PCA), is to define the term "Repeat Defect" in such a manner that if an aircraft system is showing defects repeatedly; it is given a alert level status. The new definition be inserted in the maintenance exposition manual.

4.5. Director Airworthiness (CAA) is to ensure that Airworthiness Inspectors/Surveyors have a standard procedure to point out to PIAC Engineering regarding failure of Quality Systems to monitor such chronic defects.

4.6 Director Flight Operations is to standardize the handling and reporting of serious incident/accidents by pilots.

4.7 Director Flight Operation is to ensure that Operation Engineering analyze pilot reported defects and communicate the summary to all concerned.