



مسول ایوی ایشن اتھارٹی

PAKISTAN CIVIL AVIATION AUTHORITY
(SAFETY & INVESTIGATION BOARD)



AIRCRAFT INCIDENT INVESTIGATION REPORT
(DIS-ORIENTATION)

M/S. AIR BLUE, AIRBUS – 320 FLIGHT NO. ED-405
REG. NO. AP-BGV ON 10 AUGUST 2007
AT
JINNAH INTERNATIONAL AIRPORT
KARACHI

FINAL REPORT

INCIDENT ON AIR BLUE A-320-231 (MSN-0443) AP-BGV FLIGHT NO. ED 405 ON 10th AUGUST 2007 AT JIAP, KARACHI (DIS-ORIENTATION)

AUTHORITY: Director General Civil Aviation Authority Memorandum No. HQCAA/1901/319/SIB dated 04 September 2007 (**Appendix 'A'**).

SYNOPSIS

On 10th of August 2007 an Airblue Flight No. ED 405 from Lahore to Karachi at 1443 UTC experienced "Map Shift" during approach while it was 3 to 5 NMS from the runway. It was reported by ATS that aircraft after being cleared for ILS approach to runway 25L, was observed on Radar maintaining the south westerly heading. Corrective measures were taken by ATC and aircraft was vectored for radar surveillance approach runway 25R. Aircraft reported field insight at 4.5 miles and landed at 1450 hrs on runway 25R. After landing pilot reported that flight monitoring and guidance control system was giving problems.

1. FACTUAL INFORMATION:

- 1.1. **Type of Aircraft:** Airbus-320-231
- 1.2. **A/C Registration:** AP-BGV
- 1.3. **Flight Number:** ED-405. LHR - KHI
- 1.4. **Crew Information:**
 - (a) Capt. Zafar Mehmood, Pilot-In-Command
 - (b) Capt Iftikhar J Usami, Captain under training
 - (c) Capt Shahryar Bin Aman Mufti, First Officer
- 1.5. **Date of Occurrence:** 10th August 2007
- 1.6. **Air Traffic Services:** ILS/NDB/VOR/DME
- 1.7. **ATC Tape Extracts:** Attached as Appendix 'B'
- 1.8. **DFDR:** Data transferred to Airbus for analysis.
- 1.9. **CVR:** N / A
- 1.10. **Injuries to Persons:** Nil
- 1.11. **Damage to Aircraft:** Nil

1.12. **Meteorological Information:** As per Met report the weather at the time of incident was low clouds at 800 feet with visibility less than 04 KM. The rain had stopped 30 minutes earlier. There was thundering activity around point Marvi.

1.13. **Fire:** Nil

2. TECHNICAL INVESTIGATION

2.1 The incident of map shift was broken down into two technical areas to determine whether airborne equipment or ground-based navigational aids contributed to the incident. The areas identified were:

- a) Navigation Aids at JIAP, Karachi
- b) Airborne Nav Aids

2.2 Information collected from following sources enhanced and supported the analysis based on factual data:

2.2.1 ATC tape extracts (**Appendix 'B'**)

2.2.2 DFDR data analyzed by Airbus (**Appendix 'C'**)

2.2.3 Radar recording of the incident (**Appendix 'D'**)

2.3 Navigation Aids at JIAP, Karachi

2.3.1 JIAP, Karachi has 02 parallel runways. This airport has all the navigation and landing aids for a CAT1 approaches. On runway 25L and 25R, ILS facilities are available.



(Figure - A)



(Figure - B)

(Glide Slope 25L Hut/ Room)

2.3.2 The Glide Slope Room is equipped with Terminal Distance Measuring (TDM) equipment and DME (Model: Glide Slope Mark II Wilox USA installed since 1993), with 03 air conditioners (window type) to maintain the room temperature. Maintenance checks (including daily checks) are logged in the diary book (Communication Center/ transmitting station/ maintenance dairy book).



(Figure- C)



(Figure- D)

(Glide Slope 25L Hut/ Room)

2.4 Scrutiny of NAV AID record:

Scrutiny of the log book/ daily diary revealed the following entries on or around the incident date:

a) **Log Book Entry on 08th August 2007:**

"The quarterly scheduled maintenance carried out of glide slope TDME on 08.09.2007".

b) **Log Book Entry on 09th August 2007:**

"On 09.08.2007 ECR reported glide slope off the air, reached checked and made it normal".

c) **Log Book Entry on 10th August 2007:**

"Glide slope reported off the air 1020 LT, reached and found its modulation lobe. Adjusted limits and wave shape observed on oscilloscope found OK, technically glide slope OK at 11:40 E but due to non availability of aircraft tower declared it serviceable at 12:06 LT".



(Figure- E)

(Figure- F)

1. (VOR/ DME Hut/ Room)

2.5 VOR/ DME Room is equipped with VOR (Model Wilcox 585B) and DME (Model Wilcox 956B), the unit is installed since 1983. On top of the room the antenna is installed. This antenna is built in single unit shape, transmitting both the systems frequencies. VOR antenna is covered with a radome.

2.6 Scrutiny of 'The Daily Log Book' reveals the following entries:

a) Log Book Entry on 09th August 2007

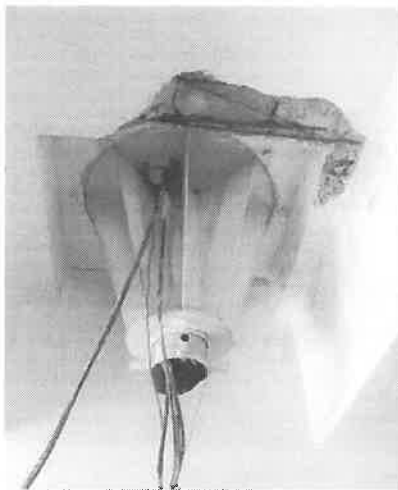
"VOR off the air due to phase alarm" on dated 09.08.2007"

b) Log Book Entry on 10th August 2007

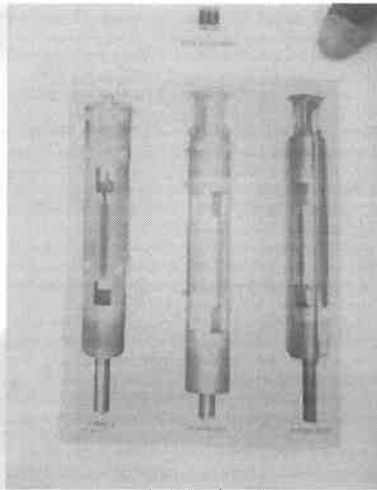
"There are two 02 entries are made on the same date the first entry states that "checked VOR/ DME aid found working normal. The second entry states "checked VOR/ DME found phase alarm, now working normal" (21:00 LT - 21:45 LT) ECR reported for phase alarm on 20:30 LT."

c) Log Book Entries on 12th August 2007

"(10:00LT to 18:00 LT) 'Visited VOR/ DME open the antenna system observed water in side and also checked both sides band cables found normal. However reflected power on green side band approximately 0.8 watt and forwarded 01.4 watt than put 02 bulbs on the antenna system and observed slow improvement".



(Figure-G)



(Figure-H)



(Figure-I)

(VOR/ DME Antenna Installation - ceiling view)

"12.08.2007 (10:30 pm) at 2230 visited VOR found improvement and reflected power is 0.6 watt."

"13.08.2007 (1000 LT) reached VOR and found that reflected power at side band one became zero and VOR is operating normal ground checks of both transmitters carried out and found satisfactory informed sr. manager Nav Aids".



(Figure-J)



(Figure-K)

(VOR/ DME Equipments and Antenna Installation)

"11.08.2007 ECR reported that VOR is not getting by aircraft. Checked and found that VOR is working normal".

"12.08.2007 the matter became serious in nature.
By 13.08.07 the system became normal".

"ILS 25 L Calibrations was last carried out on 07th Feb 2007; however flight ability check of Both ILS (Right and Left) was

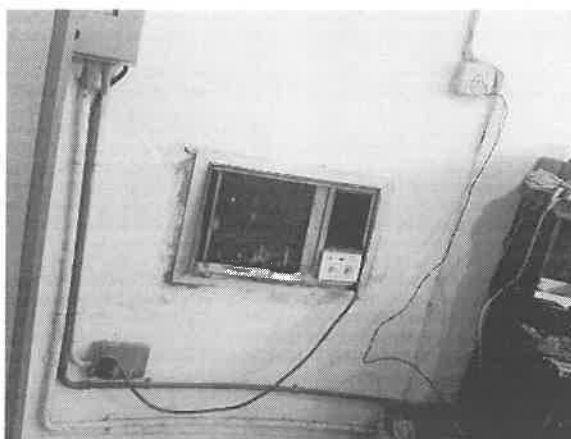
carried out on 09th May 2007 by Capt Khalid, on aircraft hired from M/s Schon.

2.7 Schedule Maintenance of VOR

Last quarterly scheduled maintenance of Karachi VOR was carried out on 14th July 2007. As per practice in vogue, antenna system is not opened during the course of scheduled maintenance, unless certain technical / system parameters lead to check the performance of antenna system. The manuals of Nav Aids i.e. ILS Localizer, VOR also does not reflect specifically for any time barred inspections on antennas therefore the inspections on antenna are not being carried out, until any abnormality is reported. However the routine inspections and maintenance on navigation equipments is being followed properly:

2.7.1 Environments of NAV Aids: Following flaws in the vicinity of Nav Aids were also noted:

- a) Improper electrical installations and loose connection which may lead in arcing of electric or cause fire hazard situation (Refer **Figure 'L' and 'M'**).
- b) Improper Installation of Room Air conditioners (Window Type), several gaps/ openings in AC slot were noted and cause dust, pests and lizards etc in side the room, this may also effect for damaging of equipments.



(Figure-L)



(Figure-M)

(VOR/ DME Antenna Installation - ceiling view)

2.7.2 The analysis of NAV AIDS maintenance procedures especially the defect reported and corrective actions taken, did point out significant evidence which could have contributed to erroneous signal in space.

2.8 ANALYSIS OF DIGITAL FLIGHT DATA BY AIR BUS

2.8.1 Airbus analysis confirm that before the engagement of LOC, the navigation mode was either in 3IRS / VOR / DME using VOR / DME KC for radio updating or in 3IRS / VOR / DME using VOR / DME KC and DME IQA for radio updating. In both cases, VOR / DME KC were used by the FMS to compute the position with IRS. But this Nav aid sent corrupted signal which led to an erroneous FMS position (the pilots were not aware of this description). As soon as the LOC was engaged, the FMS used the LOC information received to update the current position computed with 3IRS / VOR / DME or 3IRS / DME / DME. The localizer updating led to the MAP shift observed as the previous position shifted. Once the LOC is disengaged by the crew (GMT 12.50.37, 15s after having engaged LOC), the LOC update is stopped and position computation re-switched to 3IRS / VOR / DME or 3IRS / DME / DME, using corrupted VOR DME KC. Usually when a LOC is available at arrival, the FMS updates its position using the LOC reference coming from the FMS Nav Data base. The erroneous data could be either incorrect coordinates or incorrect magnetic declinations. So, normally, a MAP shift is rarely due to aircraft misbehavior. If VOR / DME KC was unserviceable at the time of event that means that navigation mode before LOC capture was 3IRS only. Then it is suspected that this pure IRS position had drifted and was not correct when the LOC capture engaged and began to update.

2.9 **CONCLUSION:** The analysis of Nav Aids maintenance records and inspections of physical installations that maintenance of VOR / DME antenna installations needs attention specifically with relation to corrosion control and effect of rain. ~~The flight data analysis by Air-Bus did not reveal any defect of aircraft airborne navigational system which contributed to the incident.~~ However, the erroneous data could be either incorrect coordinates or incorrect magnetic declinations.

3. OPS INVESTIGATION AND ANALYSIS

3.1 Operation analysis is based on information obtained from ATC Tape extracts, crew interviews, operations procedure to update coordinates on FMGCs and Airbus analysis of Digital Flight Data Recorder. The eventful

flight was being flown by Capt Usmani who was an under training captain (training for P-1); Capt Zafar, Chief Pilot Training who is also a designated check pilot was occupying the right seat as co-pilot. The First Officer Shehryar Bin Aman Mufti was occupying the observer's seat as per the company policy.

3.2 It is important to note that the weather at Karachi was cloud base 800' broken, visibility less than 4.0 KM. Thunder activity was reported by ED-405 around point MARVI. The rain had stopped about 30' prior to the arrival of the said aircraft. Under these conditions, at time 1248 UTC the aircraft was cleared to descend to 1,600' and to establish ILS at 7 NM due weather. The aircraft was radar vectored to point 8 NM from the touch down of Runway 25L. The approach controller handed over the aircraft to the tower controller when he saw the aircraft establish finals at 7 NM. Due to low visibility, the aircraft was not visible to the Tower controller. The Approach controller observed the aircraft drifting to the south and descending to 800'.

3.3 At this point (aircraft was about 3 to 4 NM south of the track and at 800' and still drifting away, the Approach Controller asked the Tower controller to hand over the aircraft to him (Approach controller) and ask the aircraft to initiate climb to 2000'. The aircraft changed over to the Approach controller and was radar vectored for runway 25R till the pilots were positively in visual contact of the runway. The aircraft landed safely at 1301 UTC. It is clear that a proactive approach by air traffic controller mitigated the situation from converting into a serious incident or accident.

3.4 To look into any causal factors, FMGC was evaluated in actual flight environment.

3.5 **RESEARCH FLIGHT FOR OBSERVING THE PERFORMANCE OF AIRBORNE EQUIPMENT (FMGSS):**

3.5.1 During the flight flown for the investigation, FMGC and ILS were tested before flight. During Flight, aircraft was manually tuned for VOR, ILS frequency and CRS. No drift was observed. Auto pilot was able to follow tuning commands and CRS+HDG displays were accurate. During approach at Runway 25L, no drift of ILS CRS observed. At the leg end PFR was also checked for any failures related to VOR/ ILS/ DME and AFS system, none reported. Avionics status checked for class 3 failures, none reported.

3.5.2 On 12th August 2007 during flight ED 403 sector (Karachi-Lahore) before Nawab Shah. Karachi tower informed about un-serviceability of ground VOR. Pilot and accompanying engineer decided to go for FMS approach procedure to check integrity of AFS. Aircraft aligned ILS CRS and LOC at auto tuning. All displays were accurate. MAP vector was also accurate and no drift was observed while landing at Karachi on runway 25R.

3.5.3 Subsequently, in order to collect additional data on FMGC system, all Air Blue aircraft were inspected for serviceability and performance.

3.6 DATA OF MISSED APPROACHES DUE TO ILS PERFORMANCE:

3.6.1 It was determined that ILS has been sending erroneous signals at different times (See Appendix E).

3.7 On 10th August 2007:

- i. B-777 SVA 10 1015 LT. Missed APPR for 25L ILS due to malfunction.
- ii. PIA 341 B-737 carried out VOR DME at 25L due ILS 25L Malfunctioning.
- iii. PIA 305 missed APR 10 1952 LT due ILS 25L.

3.8 On 11th August 2007:

- i) ABQ 405 AP-BGV 12 1947 Failed LOC.

3.9 In order to determine the contribution of operational procedures which could have contributed towards the incident, aircrew interviews were analyzed. It was revealed that PF was following the IFR rules; whereas the PNF – PIC was visual. The transcript also revealed that the pilots still believed that they were on the glide slope and had intercepted the glide path (PIC reported that he was visual with the runway on to his left; whereas the Karachi Airport was on to the right). Both pilots failed to note that final heading was not 254°.

3.10 CONCLUSION

As analyzed by M/s. Airbus, Map shift occurred either due to the incorrect coordinates or incorrect magnetic declinations of the FMS Nav data base. Aircrew observed this and continued to follow the erroneous FMGC indications, thus drifting away from the approach path. Failure of the pilots to monitor the LOC properly for failure indications led them to follow the erroneous indications; which is weakness of CRM. Poor condition of VOR / DME of Karachi Airport may have resulted in erroneous signal in space.

3.11 FINALIZATION

Primary Cause

- (i) Lack of situational awareness
- (ii) Air Crew – Avoidable

Secondary Cause

- (i) Operational Procedures for feeding FMGC
- (ii) Suspected Navigation Aids performance at Karachi Airport.

4. FINDINGS

4.1 Ground based Navigational Aids and weather did contribute to the incident.

4.2 As per Airbus industry FDR analysis:

4.2.1 The erroneous data could either be incorrect coordinates or incorrect magnetic declinations.

4.2.2 It is suspected that pure IRS position had drifted and was not correct when the LOC capture engaged and began to update.

4.3 Poor Crew Resource Management (CRM) led to misinterpretation of cockpit indications; procedures followed by pilots failed to detect aircraft shift during approach.

4.4 Air Traffic Controller's timely action mitigated the hazardous situation from converting into a serious incident or accident.

5. RECOMMENDATIONS

5.1 Additional checks are to be introduced to visually inspect the Nav aids located at Karachi Airport to monitor their condition during rain / bad weather.

5.2 Appropriate NOTAM actions should be taken for erratic behavior of the Nav Aids to warn the operators in case water is observed to have seeped into the system.

5.3 M/s Airblue to improve training of its pilots for identifying the ground Nav aid failure coupled with Map shift.

5.4 All data base of FMS in aircraft of M/s Air blue be checked for correct coordinates and magnetic declinations.