HQCAA/1901/315/SIB

سول ایوی ایشن اتھارٹی

PAKISTAN CIVIL AVIATION AUTHORITY
(SAFETY & INVESTIGATION BOARD)

SERIOUS INCIDENT TO M/S. PIAC, A-310 REG. NO. AP-BDZ ON 17 APRIL 2007 AT JINNAH INTERNATIONAL AIRPORT KARACHI

FINAL REPORT

SERIOUS INCIDENT TO M/S PIAC, A-310, MSN-585 REG. # AP-BDZ ON 17 APRIL 2007 AT JIAP, KARACHI

Authority: Director General Civil Aviation Authority Memorandum No. HQCAA/1901/315/SIB dated 19th April 2007. **(Appendix 'A')**

Synopsis

On 17th April 2007, a PIA Airbus, A-310 MSN 585 was on a scheduled flight from Jinnah International Airport Karachi. During take off roll, the aircrew observed that a number of strange failures were taking place, those included, tripping-off the auto throttles, auto pilot, yaw dampers and pitch trim; the failures were further accompanied by loss of speed references on Captain and First officer airspeed indicators. They were unable to engage both auto pilots. Hence the aircrew asked for a priority landing which was given by air traffic control. A few seconds latter the aircrew gave a "May Day, May Day" call on radio, which created concern at ground regarding the safety of aircraft and passengers on board. CAA and PIA activated all services to handle emergency to meet any eventuality. The aircraft initially touched down first on nose wheel; it then bounced up in the air and then landed on main wheels. It finally stopped on runway with three tyres deflated due to heavy load and emergency braking. Additionally during landing the nose wheel tread torn out and the rubber pieces of the tire damaged the structure with dents and rubber marks on the belly from the Nose landing gear till the bottom of aft cargo door. However luckily there were no injuries. Initial investigations disclosed that the aircraft had been on ground for last 25 days due some repair and rectifications; and had experienced, similar serious speed anomalies on 21st November 2006 and 8th January 2007. In the event of On 21st November, 2006, the aircraft, while on approach to Islamabad, had gone into a steep dive at an extra ordinary rate of descend that it crossed the maximum permissible vertical speed and "Mach Number". Due to crossing over limits the aircraft was subject to special inspections by Airbus, hence remained on ground for nearly two months for the repairs. As the Airbus and Goodrich (USA) were involved in the investigations of these occurrences and have attributed degradation of de- icing capability by the current detector at Captain's pitot probe (sensor for air speed measurement), as root cause of the speed anomalies; this occurrence shocked both the airbus and Goodrich (USA), the manufacturer of the air speed sensors installed at A 310. The DGCAA grounded the aircraft and ordered an investigation into the serious incident. The DGCAA further directed SIB to ensure that Airbus should conduct investigation and certify the airworthiness of the aircraft before its release to next flight. Airbus and Goodrich extended all out support, a special inspection program to detect and repair complete air speed indication system was conceived and executed at Karachi by Airbus experts; simultaneously a series of tests and research analysis was carried out on all the airspeed sensors of this aircraft at Goodrich, sensors and Integrated Systems,

Burnsville, MN, USA. However the findings of these time consuming and expensive investigations, once again revealed serious lapses on part of ground as well as aircrew of PIA. The causes indicated presence of a poor state of safety culture at PIA. The factors for which have been indicated time and again in previous investigations; but how will it improve, is a serious challenge for the national air carrier and for state "Safety Oversight Functionaries" as well.

1. Factual Information

1.1 History of the flight.

1.1.1 In the recent past, prior to this incident, this aircraft had been subject to a number of minor occurrences and one serious incident; all attributed to the "airspeed indication system"; and the sensors or probes being the most fundamental components of the aircraft airspeed detection and indication system were under scrutiny. Two significant occurrences of the series were reported on 21st Nov 2008 and the 8th Jan 2008, and Airbus and Goodrich were involved in the investigations.

The First Event of 21 Nov 2006

1.1.2 During this event the cabin crew members and one passenger reported some minor injuries as the aircraft went into sudden deep dive at 22, 000 feet. The aircraft encountered Certified Flight envelope excursion for:

- Maximum recorded Vertical Load factors: -0.33g / +2.59g (at 466kts) AMM chapter 05-51-17 flight maneuvering limit flaps down: -o g / +2g.
- Maximum recorded Computed Air speed: 471 kts – Mach 0.9, Maximum Operating Limit Speed VMO-MMO: 340 kt IAS-0.84.

1.1.3 The aircraft was then grounded for load analyses and special inspections recommended by Airbus due to crossing of maximum limits. The inspections as per AMM 30.31.00, page block 501 (probe ice protection check) did not reveal any defect. However the Captain's side pitot probe of aircraft airspeed indication system was dispatched to Goodrich, USA. The investigations attributed a defective de-icing system of the Captain's Pitot probe, as the root cause for erroneous air speed indications. This was detected after the 2nd event on 21st Nov by Goodrich, SIS-USA.

The Second Event of 8th Jan 2007

1.1.4 During this event the MSN 585 Air Data Computer of side 1 delivered erroneous speed / MACH parameter and the aircraft experienced a 2000kts abrupt sped drop. The Mach increased from 0.815 to 0.83, which was below the MMO warning 0.84. After the Maintenance actions conducted by Pakistan International and Pitot probe supplier BF – Goodrich, the aircraft was released to service:

- All pitots and AOA probe heating checks performed as per AMM and TSM and NO FAULT FOUND.
- Pitot probe maintenance checks performed and NO FAULT FOUND.
- Air Data Computer 1 and 2 checks performed and NO FAULT FOUND.
- Captain Pitot shop findings highlighted that the probe suffered an undetected degradation of the de-icing capability (by the current Detector).

1.1.5 Airbus reviewed the AMM 30.31.00 page 501 (probe ice protection – adjustment test) to assess the robustness of the test regarding the de-icing capability conditions. The AMM tasks have been improved and made available to the operator.

1.1.6 The Captain's Debrief on this occurrence is attached as **Appendix 'B'**.

1.2 Injuries to persons

There were no injuries during this event.

1.3 Damage to Aircraft

See Aircraft damage and recovery report by Airbus. **(Appendix 'C')**

- On fwd fuselage the structural damages have been limited to one small smooth dent of fuselage skin within allowable damage limits (SRM).
- A detailed (internal) inspection of Frame 17 has been performed with no findings.
- During landing, the nose wheel tread torn out and the rubber pieces of the tire damaged the structure with minor dents and with rubber marks on the belly from the Nose landing gear till the bottom of aft cargo door. In addition the wheels 2, 3 and 4 have been found deflated.
- The dent locations close to frames and stringers are evidence that damage is caused by tire tread impact and are not therefore due to high buckling loads resulting from the landing impact.

1.4 Other damages

N/A

1.5 Personnel information

Aircrew information and results of their medical examinations are attached as **Appendix 'D'** & **'E'** respectively.

1.6 Aircraft Information

A-310-308, MSN 0585
Engines: CF6-80
Total Flight Hours: 49570
Total Take offs: 16542

The aircraft "Defect History" after recovery from previous incidents is attached as **Appendix 'F'.**

1.7 **Aerodrome Information**

N/A

1.8 **Flight Recorders**

The aircraft was equipped with a CVR and DFDR. Airbus was provided with a copy of DFDR Raw data. The data has been reproduced in graphical and ad attached as **Appendix 'G'**. The CVR was downloaded in Pakistan and the transcript is not attached to meet the provisions of "Non Disclosure of information as per ICAO annexure 13. The investigation and analysis of aircrew performance is based on the information retrieved from CVR and DFDR.

1.9 **Air Traffic Control Radio Communication Tape Extracts.**

The transcriptions were decoded by ATS Karachi and are attached as **Appendix 'H'**. The communication provides a comprehensive picture of the emergency situation and its handling by various agencies at ground.

1.10 **Wreckage and impact information**

Minor rubber pieces were recovered from the runway and it was cleaned appropriately for further use.

1.11 **Fire**

N/A

1.12 **Survival aspects.**

N/A

1.13 **Special investigation techniques**

Goodrich Investigation reports on Captain's and Standby Probes and on angle of attack sensor S/N 01373.

2. Analysis

The analysis are based on factual information retrieved from DFDR, CVR, ATC communication, Goodrich report, Airbus Requirements and test Report and FCOM procedures.

2.1 Flight Recorders analysis

The plots of various parameters especially the altitude, speeds, accelerations and landing gears micro switch position indicators from the FDR are provided in **Appendix 'H'**. It may be noted that the computed air speed (CAS), angle of attack (AOA) and Auto Flight System (Yaw Damper parameters) which are recorded in the DFDR are only the ones from Air Data Computer 1, Auto Flight System 1 and Yaw Damper 1 and not from ADC 2. The analysis for various flight phases is as follows:

2.1.1 Take Off phase

Take off conditions:

a. The Aircraft was in Conf 2 with a Magnetic heading at 254°

b. At 01.51.00 UTC, both throttles levers are pushed above max climb thrust. Both N1 therefore reached 97%.

c. At 01.51.17, Computed Air Speed – CAS from Air Data Computer 1-ADC1 became valid with a 31kt value.

d. Note: below 30 kts, CAS is sent as Non Computed Data by the ADC and is therefore not usable by the systems users.

e. At 01.51.28, the Nose Landing Gear was lifted off with CAS from ADC1 at 37.5kt.

f. The aircraft lift off is recorded at 01.51.31, with a recorded CAS from ADC 1 at 43 kt and a pitch at 15°.

g. Few seconds later CAS (recorded) reached 62 kt and then remained around 60 kt.

2.1.2 Climb phase

a. At 01.52.03, reaching 1000 ft Radio Altitude, the crew engaged the AP1.

b. Seconds later a right turn was recorded.

c. At 01.52.14, the AP1 is disengaged. THS deflection decreased and crew ordered a pitch down order.

d. Seconds later pitch decreased to 4.4° and CAS1 reduced from 54 kt to 44 kt in 1 second followed by a jumped back to 63 kt in 2 seconds. Right Hand bank angle increased up to 28° and then remained around 25°.

e. At 01.52.30, Conf 1 was set.

f. At 01.52.33, AOA1 became valid at 3.54°.

g. Crew reduced throttles levers (Throttle Resolver Angle – TRA down to 62°.)

h. Then, 2 seconds later, AOA 1 value increased up to about 5° and both throttles were progressively pushed to max climb thrust position.

i. AOA1 value then began to decrease down to 1.96° (At 01.53.19).

j. At 01.52.47, slight lateral load factor oscillations began to be recorded (+/- 0.04, with a period of 1.3second). From 01.53.08, the amplitude of these oscillations increased up to about +/- 0.12g. Rudder deflections were also recorded with about the same frequency (0/+3°, rudder deflected to the right when lat g < 0 (CG acceleration to be the right)).

k. At 01.53.28, as Conf 2 was set while crew reduced Right Hand bank angle, AOA 1 jumped from 2.54° to -0.46° upon a pitch down order. AOA1 value then froze at -0.46°as CAS rapidly decreased under 60kts.

l. At 01.53.40, throttle was pushed to TOGA position whereas aircraft was leveling off at about 4000 ft RA (4150ft STD).

m. Below 60kts, the last AOA value is seen at the last valid value and sent as Non Computed Data by the ADC.

2.1.3 Approach phase

a. At 01.53.50, crew reduced throttles to about 50° and aircraft was progressively set in descent.

b. AT 01.53.55, VFE warning triggered and Oscillating lateral load factor reached a value of -0.19g.

c. At 01.53.58, as CAS1 increased above 60 kts, AOA 1 changed from its frozen value to -1.7°.

d. At 01.54.04, the vertical load factor reached a value of 1.74g.

e. At 01.54.07, VFE warning stopped following pitch up order and a short subsequent level off.

f. During descent, altitude rate reached -4500ft/min (at about 2000 ft RA) and lateral oscillations linked with rudder movements lasted till landing.

g. Conf3 then conf full was set for landing.

2.1.4 Landing phase

a. From 01.56.44 to 01.56.49, both throttles were progressively reduced.

b. At 122ft Radio Altitude and pitch oscillated around -4.5°.

c. Slight crew pitches up orders were recorded during final landing phase.

d. At 01.56.55, a first touch down was recorded on nose landing gear with a vertical load factor, which reached +1.81g.

e. One second later crew ordered pitch down order of 7° whereas aircraft was bouncing on runway (vertical load factor reached 0.39g).

f. Less than 1 second later touch down on main landing gears was recorded with a vertical load factor, which reached 1.59g and Lateral load factor, which reached +0.24g.

g. Full reverse was then set on both engines; ground spoilers deployed and crew applied full manual braking.

2.2 Aircraft airspeed system's trouble shooting by Airbus experts at Karachi

The Airbus experts monitored a series of tests, conducted by PIA engineers on the airspeed sensing and indication system of the aircraft at PIA engineering and maintenance facilities at Karachi, under an Airbus special investigation and repair scheme. These tests included system checks on **"Auto Flight System, Air Data and Probe Heating System and Brakes and Wheel Steering**. Tests highlighted **important leaks** in the Air Data Systems and presence of a number of defective valves and pipes in the system. The Captain's probe PN 0851HV (S NO 227916) and Standby pitot probe PN 0851Hv (S/N 21974) were removed before these tests as the same were required by Goodrich Corporation, USA fro detailed analysis. The tests results with replaced probes can be seen at Airbus Test Report attached as **Appendix 'J'.**

2.3 Effect of air leaks on the Captain and Stand-By Static circuits:

a. The purpose of the Static Circuit is to measure the external atmospheric pressure. The leak was between the Static circuit and the interior of the fuselage.

b. So the pressure that was physically present inside the Static Circuit was a mix between the internal cabin pressure and the external cabin pressure.

c. In case of very significant leak, the effect could be similar to a disconnection of the Static Circuit. The pressure that is physically present inside the Static circuit could be therefore close the internal cabin pressure.

d. As a consequence the Captain ADC and the Stand-By airspeed indicator were computing erroneous Altitude and Airspeed values.

2.4 Goodrich Report on 085 1HV pitot probes

2.4.1 The Goodrich Sensors and integrated Systems (SIS) were involved in investigating the cause of two the earlier events of this aircraft first on 21st Nov 2006 and second on 8th January 2007. The root cause was not detected during investigation of first event. However after event of 8th Jan 2007, Goodrich identified a unique defect in the

electrical heating system of a sensor where the defect was not detectable during maintenance checks yet the electrical system was unable to de-ice the sensor probe. Consequently Airbus reviewed the AMM 30.31.00 page 501 (probe ice protection-adjustment test) to assess the robustness of the test regarding the de-icing capability (by the current detector). With this background when this incident was reported the Goodrich expressed it reaction as follows:

"We are of course mortified to read such a report. I will make sure we watch closely for the arrival of the pitot probes. I will give the matter full and immediate attention and will investigate the root cause. The urgency is obvious". Refer **Appendix 'K'** for details.

2.4.2 The Goodrich immediately formed a composite team of experts and carried out analyses of the Captain's side (S/N 227916) and stand by (S/N 212974) probes. The analyses included electrical tests, nondestructive tests, thermal and chemical reprocessing and taking of photographs. The report is attached as **Appendix 'L'.** The salient findings from the reports prepared by Jon Dixon, who was instrumental and provided all out support to CAA Pakistan, are reproduced here. (Refer to **Appendix 'L'** for high resolution photographs to appreciate the root cause of the incident and also the consequences of poor maintenance culture in aviation.

2.4.3 The Captain's pitot probe (SN 227916) was visually examined and a complete blockage was found at the water dam location (approximately 1.5 inches inside the probe inlet). The blockage appeared to be dried mud. The blockage was first observed with an otoscope and examined in more detail using a borescope. A sample of the blockage materials was removed and analyzed using optical microscopy, SEM (scanning electron microscopy), and EDX (Energy – Dispersive X-ray analysis). Optical microscopy showed that the blockage consisted of small particles of sand/soil. The EDX analysis showed that the composition of the blockage consisted of silicon, aluminum, magnesium, calcium, potassium, iron and oxygen. The primary component of the blockage was silicon oxide (likely quartz). The elements detected were consistent with elements commonly found in soil samples.

2.4.4 Further SEM and EDX analysis also revealed the presence of charred insect remains from within SN 227916. The blockage observed in SN 227916 was consistent with mud dauber nests that have been observed in other pitot probes returned from the field. There have been several documented cases where mud dauber nests in probes have been the cause of aborted take offs.

2.4.5 The heater in SN 227916 was electrically tested and had continuity. Infinite insulation resistance was measured using a hand-held multi-meter indicating the heater was in good condition.

2.4.6 The standby probe (SN 212974) was visually examined to look for evidence of blockage. Sand particles were observed inside the air fitting on the probe. Borescope inspection revealed a charred insect at the second water dame opening. The opening in the first water dam appeared to be free of mud/sand blockage, however, some sand particles were found inside the cap placed on the nose of the probe. EDX analysis of the particles removed from the air fitting and cap showed the same composition as the mud/sand particles removed from the captain's probe (SN 227916). Charred insect parts were removed from this probe by back flowing compressed air though the probe.

2.4.7 A continuity test of the heater in SN 212974 was performed and the probe resistance measured a nominal 2.1 ohms. The insulation resistance was measured at 5 MΩ indicating that the heater sheath was no longer hermetically sealed. A cross section through the heater in the nose showed high temperature corrosion product that had attacked the heather sheath. The cause of the low insulation resistance was the high temperature oxidation which penetrated through the heater sheath allowing moisture to enter the heater. The low insulation resistance was a sign of heater degradation that eventually would have led to heather failure.

2.4.8 Use of the PIA emergency.

2.5 **Effect of Captain and Stand-By Pitots obstruction:**

2.5.1 The Pitot 1 (Captain) was totally obstructed and the Pitot 3 (Stand-By) was partially obstructed, so the total pressure measured by the 2 Pitots were under-estimated.

2.5.2 As a consequence, the Captain ADC and the Stand-By Airspeed indicator were computing under-estimated Airspeed values.

2.5.3 The aircraft took off with an aircraft speed (From ADC 1) recorded at 43 Kts, speed displayed on Captain PFD side. Reaching 1000 ft Radio Altitude the crew engaged Auto Pilot 1.

2.5.4 This is confirmed with the DFDR recorded data, as ADC1 airspeed never exceeded 70kts during the whole flight and was sometime below 30kts – NCD (the airspeed is not computed by the ADC below 30 kts).

2.6 **Goodrich Report on First Officer Pitot Probe Model 0851Hv (S/N 228577 and Angler of Attack Sensor Model 0861CAE1 (S/N 01373).**

2.6.1 The examination and analysis on these two probes is attached as **Appendix 'M'**. Earlier these components were not sent to Goodrich SIS because the F/O indication was apparently found correct during the occurrence as well as during leak checks by Airbus experts in Karachi. However after the examination of Captain's and standby probes at Goodrich, where horrifying evidence was found, it was decided to investigate remaining sensors to have the complete picture of PIA maintenance culture and poor house keeping. Hence the remaining two sensors were sent to

Goodrich. The investigation did not reveal any defect which could have contributed to the April 17 event but there were number of maintenance malpractices observed. These are discussed in detail at Goodrich SIS memo attached as **Appendix 'M'.**

2.6.2 A summary is reproduced here along with photographs

Model 0851HV FO Pitot Probe S/N 228577

The Model 0851HV FO Pitot probe S/N 228577 is suitable for return to service with no changes, modifications or repairs. Under normal return circumstances this unit would be considered a no-fault found (NFF). There were no indications that anything was wrong with this unit, and GSIS suggests it played no part in erroneous airspeed readings aboard MSN 0585. This particular probe was, in fact associated with the one airspeed indication aboard MSN 0585 that appeared accurate.

Model 0861CAE1-0001 Angle of Attach sensor S/N 01373

Model 0861CAE1-0001 AOA sensor S/N 01373 has provided a very long service, life and promises to provide even more life if the unit is requested to be returned to service. The overall field returns rate for this model is very low, being only 0.05% in the last rolling six months for the entire fleet of approximately 1,920 sensors.

The vane damage, gear contamination, resolver calibration, vane angle accuracy, aerodynamic alignment and sensitivity are not sufficiently out of tolerances to have caused errors detectable onboard the aircraft, and were within CMM specification tolerances. GSIS would, for return to service, recalibrate the unit to new product standards which are much more stringent than those in the CMM.

The units damages, contamination and out of tolerance measurements noted in this report would in no way have contributed to the unfortunate flight emergency of April 17 on board PIA MSN 0585.

2.6.3 GSIS submits that neither of these two sensors contributed to the emergency nature of PIA Flight PK-340 the morning of April 17, 2007. Both sensors are suitable for recalibration and return to service.

2.7 Conclusions

2.7.1 The foregoing investigations prove that the aircrew took off despite a greatly underestimated calibrated air speed on Captain's PDF (CAS1) while the F/O airspeed indicator was reading different. They failed to apply the A 310 Standard Operating Procedures of speeds crosscheck at 100kts. (Refer FCOM 2.03.12) attached as **Appendix "N"**. It makes it mandatory for the PNF to announce "One hundred knots" when speed is 100kts. The pilot flying at this stage crosschecks speed on his PDF and announces "Check". This crucial speed crosscheck was not carried out. As they failed to detect that there is speed indication problem, they further failed to control the speed with unreliable airspeed indication (Refer FCOM Abnormal Procedures at Chapter 2.05.80- Page 6 at **Appendix 'O').** Their failure to detect presence of unreliable airspeed indication and not following the important

speed cross check procedure resulted in complicating the emergency in a unique manner where, Captain was advancing the throttle and First officer was retarding it, without realizing that Captain's speed indicator is under reading. The Captain should not have taken off with this speed which never went beyond 43 kts.

2.7.2 The reason for Captain's highly under estimated air speed indication was complete blockage of its sensor probe by insects and mud. The standby speed sensor was also partially blocked due to insects nesting and presence foreign objects causing it to under read. The trouble shooting at aircraft system also indicated that Captain's and standby probes were obstructed by insect nests. This indicates that pitot probes were not covered during last 25 days of parking in hanger as per AMM 10.11.00 and AMM12.21.11.

2.8 **Importance Unreliable Airspeed Indication Detection**

2.8.1 Airspeed is such critical parameter in the aircraft operation, that the system design and indicators use 3 independent airspeeds as inputs to the pilot's displays as well as to the standby indicator. In- Service experience feedbacks have revealed that the most common cause for unreliable airspeed information is an incorrect maintenance of the probes. It is also noticed that take-offs are sometimes pursued disrespecting one or two unreliable airspeed indications. This has been reviewed in a "Performance and Operations Conference held in Puerto-Vallarta in 2007. It discusses the event of PIA which occurred on 21st November 2006, without mentioning the organization and country, and provide lesson to the entire aviation community, however the PIA fails to learn any lesson from this article. (Attached as **Appendix 'P'**).

Finalization

Primary – I

Human Factor Ground Crew - Avoidable

Failure to Follow Aircraft Maintenance Manual Procedures to safeguard probes from foreign objects

Primary – II

Human Factor Aircrew

Failure to follow SOPs – Avoidable

3. Observations

3.1 PIA engineering needs to improve safety culture.

3.2 The aircraft was not given due attention, in relation to cleaning, while awaiting investigation team of foreign experts from Boeing.

3.3 It was found in extremely dirty conditions when visited by SIB prior to Airbus experts visit.

3.4 The cockpit was fully covered with dust, the interior was full of pigeon manure and it was evident that birds have been eating and living in the aircraft.

3.5 The aircraft doors remained opened, since the event till the arrival of Airbus experts, to allow dust, pigeons and other birds.

3.6 On first day of investigation work by Airbus and SIB the aircraft battery was found exhausted and preparations for technical work were not made despite of verbal and written cautions for good preparation and housekeeping.

3.7 The foreign experts expressed their concern over the poor state of technical preparedness by maintenance crew.

3.8 In the light of ban on certain PIA aircraft in Europe, the poor house keeping, further confirmed to airbus experts that PIA is really weak in housekeeping.

3.9 While the investigation was still in progress and Goodrich was cooperating with all out support to CAA and PIA; an article appeared in the Air Safety Week, which pointed fingers to Goodrich. The Goodrich management pointed out the matter to SIB. On local investigations, it was quiet obvious that the information from Airbus and Goodrich reports, which received at PIA, was leaked out and was basis of this article. Though it was not possible to identify as to how it reached in the press but it did point out our organizational and cultural weaknesses to safe guard information. **Appendix 'Q'.**

3.10 Information contained in a research paper by Ohio State University, USA on "Mud Daubers & Nests" be brought into the knowledge of maintenance personnel. Refer **Appendix 'R'**.

3.11 This aircraft (AP-BDZ) had experienced a number of defects of similar nature in the past; hence, though the technical investigation report on air speed indication system components and aircraft system by Goodrich and Airbus were received by June 2008, the aircraft was kept under observation to monitor the performance of ASI system for next six months. During this period, the performance of the aircraft has been observed as satisfactory; hence the inquiry is being closed and submitted.

4. Findings

4.1 The Occurrence:

4.1.1 The airbus 310 registration number AP-BDZ was on ground due maintenance for the last 25 days. This eventful flight on 17 April 2007 was its first flight after prolonged parking.

4.1.2 The aircrews immediately after take off announced that due to some technical problem they are turning back.

4.1.3 The aircrew then gave a "May Day" call.

4.1.4 Landing was done on several steps with a first touch down on nose landing gear followed by some bouncing and then application of the full reverse and max braking till stop.

4.1.5 The aircraft landed in emergency with full load which resulted in deflating of three main and one nose tyres due to brakes application.

4.1.6 The aircrew stated that during the take off roll both auto pilots tripped off and hence take off power was set manually.

4.1.7 The aircrew further stated that the air speed indication cross checks for 100 kts was normal (a critical cross check during take off).

4.1.8 The aircrew in it's debrief recorded the following events leading to "May Day" call:

(a) During take off V1 & VR were normal
(b) At 1000 altitude auto pilot 1 was engaged. But it could not.
(c) All speed references were lost i.e. all three Air speed Indicators were indicating different speeds. (Captain's 70to 80 kts, First officer's 240 kts and stand by 180 kts)
(d) Both Yaw Dampers and Pitch Trims were tripped off.
(e) The aircraft landed safely without any injuries to any passengers.

4.1.9 After landing the aircrew communicated to ATC tower that the reason for return was that there was "Flight Control problem after Take off"

Aircrew Actions

4.2 The DFDR analysis indicated that during take off:

a. The aircraft was in configuration 2 with a magnetic heading 254.

b. At 01.51.00 UTC, both throttles levers are pushed above max climb thrust, with both N1 reaching 97%.

c. At 01.51.17, computed air speed (CAS) from Air Data Computer (ADC) became valid with a 31 kts value. (Below 30 kts CAS is sent as a Non Computed data (NCD) by the ADC and therefore is not useable by the system users.

d. At 01.51.28, the Nose landing gear lifted off with CAS from ADC1 at 37.5 kts.

e. At 01.51.31, the aircraft lift off is recorded with a recorded CAS from ADC1 at 43 kts and a pitch of 15°.

f. Few seconds later CAS reached 62 kts and then remained around 60kts.

4.3 The captain's recorded speed did not go above 43 kts, and the Captain's speed was different from First officer airspeed but crew continued to take off; hence their decision to take off was professionally a hazard for the safety of aircraft and passengers.

4.4 The throttle manipulation by aircrew also indicated total lack of situational awareness as Captain is increasing the power and F/O is decreasing it.

4.5 The landing was also at high speed with first touch down on nose landing gear followed by some bouncing and then application of the full reverse and max braking till final stop.

4.6 The aircrew miss-stated few facts in debrief and in their statements for no reasons.

Maintenance and Technical Failures

4.7 The investigations by the Airbus experts discovered following defects in pitot static system:

4.7.1 Air Data Systems were found with important leaks.
4.7.2 Captain's pitot drain was leaking.
4.7.3 Drain valve was found defective.
4.7.4 Standby static system had such heavy leak that first leak test was impossible due to a defective tube connector and standby drain valve.
4.7.5 The defective tube connector, which makes connection to cabin pressure controller, identified the cabin pressure issue noted in the log book for several legs.
4.7.6 Wiring checks indicated defects incorrect signals at two pins.

Maintenance of Pitot Sensors

4.8 Captain's pitot probe was found completely blocked due to existence of sand/mud at the water dam.

4.9 The standby pitot probe was also found with similar sand mud material but was partially blocked.

4.10 Insect's remains were found in both pitot probes suggesting that the blockage and foreign material were result of insects and foreign objects.

4.11 This type of blockage was consistent with mud dauber nests that have been returned from field service

4.12 The blockage and foreign material inside the probes was the cause of the anomalous airspeed indication.

4.13 The aircraft pitot static sensors were not properly covered during aircraft parking in hanger for 25 days.

4.14 It was season for mud gaubers for nesting.

5. Safety Recommendations

5.1 PIA must ensure that aviation personnel, in general, and aircrew, cabin crew, flight engineers and AME holders in particular are aware of the contents of CAR Rule 275 explaining the "Conduct of witnesses" in aircraft accident investigation

5.2 PIA corporate safety is to issue a Standard Operating Procedure, for aircraft under investigation either by airline or by CAA, to ensure that necessary cleaning; towing, Parking, storage and inspections by operator/manufacturer are carried out in time in coordination with investigating body till the aircraft is released for routine maintenance operations.

5.3 PIA engineering should identify all places in hangers where pigeons can have homes and take measures to avoid their nesting.

5.4 PIA Quality control to ensure that aircraft and critical airspeed indication components are properly covered and guarded against ingress of foreign material such as insects, Mud-Dauber Wasps, cleaner wax etc(Refer AMM 10.11.00 and 12.21.11)

5.5 PIA Flight Operations and Corporate Safety should ensure that aircrew is well aware of the Standard Operating Procedures during take off in A310 FCOM (2.03.12), quote When speed is 100kts on PDF:

- PNF announce "One hundred knots"
- PF crosscheck speed reading on own PDF
- PF Announce "Check"

5.6 PIA Flight Operations and Corporate Safety should ensure that aircrew is well aware of the expanded awareness information and guidance material in Abnormal Procedures of a 310 FCOM (2.05.80) with reference to "Recognition and Speed Control with Unreliable airspeed".

5.7 Operators of Airbus to ensure that relevant information from "Performance and Operations Conferences" are brought in the knowledge of aircrew as soon as possible. (Refer article on "Unreliable airspeed indication detection presentation in Puerto Vallarta 2007).

5.8 Our observations in Chapter 3 need attention to arrest the falling maintenance standards in PIAC.

5.9 In initial and recurrent simulators more emphasis to be given to unreliable airspeed exercises.