بسم الله الرحمن الرحيم

UNITED ARAB EMIRATES
GENERAL CIVIL AVIATION AUTHORITY
OFFICE OF THE DIRECTOR GENERAL

دولة الإمارات العربية المتحدة
الهيئة العامة للطيران المدني
مكتب المدير العام

AIRCRAFT INCIDENT 3/01

FINAL REPORT ON THE INCIDENT INVOLVING PAKISTAN INTERNATIONAL AIRLINES AIRBUS A300-B4, AP-BEY AT DUBAI INTERNATIONAL AIRPORT, UNITED ARAB EMIRATES ON 02 MARCH, 2003

أبوظبي : ص.ب : ٦٥٥٨، هاتف : ٤٤٤٧٦٦٦ (٢-٩٧١)، فاكس : ٤٠٥٤٤٨٥ (٢-٩٧١)*دبي : ص.ب : ٣٠٥٠٠، هاتف : ٢٨٢٨٢٧٠ (٤-٩٧١)، فاكس : ٢٨٢٦٢٣٣ (٤-٩٧١)، أ. ع. م.
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INTRODUCTION

1. The aircraft involved was an Airbus A300-B4, owned by the Pakistani national carrier Pakistan International Airlines, based in Karachi, Pakistan. Pakistan was the State of Registry and the State of the Operator and France was the State of Design and the State of Manufacture. On this particular flight, PK 213, AP-BEY, was operating a scheduled passenger flight from Karachi, Pakistan to Dubai, UAE, and was landing at night at Dubai International Airport on runway 12 L.

2. The aircraft was observed by the Dubai ATC Tower Controller to land normally and to taxi to its assigned parking area at B7 at the main passenger terminal (No 1). As the aircraft approached the parking area, a fire was observed in the right landing gear. The Captain was advised by ATC and the aircraft came to a stop prior to the gate. The fire was extinguished by the Airport Fire Services and all passengers and crew members were evacuated using the steps.

3. The cause of the fire was attributed to overheated brakes, which damaged the braking system and allowed hydraulic oil to leak onto the brakes.

4. The incident details are as follows;

Registered Owner	:	Pakistan International Airlines
Registered Operator	:	Pakistan International Airlines
Aircraft type & model	:	Airbus A300-B4
Nationality	:	Pakistani
Registration	:	AP-BEY
Place of Incident	:	Dubai International Airport, United Arab Emirates Latitude : 25° 15' 03" N Longitude : 055° 21' 40" E
Date & Time	:	02 March, 2003 2349 hours local UAE time 02 March, 2003 1949 hours UTC

Note: Unless otherwise stated, all times in this report are local UAE time, which is Coordinated Universal Time (UTC) plus 4 hours.

Injuries : Nil

5. The GCAA was notified shortly afterwards and an on-site investigation commenced. The occurrence was categorized as an incident. The following GCAA personnel were nominated to the Aircraft Incident Investigation Committee under a Ministerial Decree.

Eng. Ahmed Al Haddabi Director Flight Safety & Security	-	Investigator-in-charge
Eng. Mohammed Abu Baker Al Farea Chief of Airworthiness	-	Investigator on airworthiness matters
Captain Philip J. Smith Chief Flight Operations	-	Investigator on flight operational matters

6. An official from the Bureau Enquêtes-Accidents of Paris, France, representing the State of Design and State of Manufacturer, as well as an official from the Pakistani Civil Aviation Authority (CAA), were granted accredited representation. Technical advisers from the CAA, manufacturer and airline also assisted in the investigation and were granted observer status.

7. 5 safety recommendations have been made.

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 The aircraft was operating as a scheduled flight from Karachi, Pakistan to Dubai, UAE with the Captain as the pilot flying (PF). The crew reported nothing unusual for the take-off at Karachi and the aircraft operated to Dubai without event. The incident occurred after landing on Dubai runway 12L, when the aircraft was taxiing along taxiway "X" to the passenger terminal. The aircraft was operated in a dedicated passenger configuration as flight PK 213 and the radio call-sign was "Pakistan 213".

1.1.2 At 2349 hours local time, an Airport Safety Patrol member (Mobile 5) saw smoke and then a fire on the right landing gear of PK 213 and he immediately advised both the ATC Tower and the fire services. The marshaller at parking bay B7 blocked the area and also advised the fire services. The fire services arrived within 90 seconds and extinguished the fire.

1.1.3 Upon notification from ATC, the Captain shut down the engines. He was advised that the fire had been extinguished so he did not evacuate the passengers. Once mobile steps had been positioned next to the aircraft, the passengers left the aircraft without incident

1.2 Injuries to persons

There were no injuries

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	0	0	0
Minor	0	0	0
None	12	239	0

1.3 Damage to aircraft

1.3.1 General.

The number 8 wheel on the right landing gear was internally damaged and the corresponding tyre had deflated. The adjacent green and yellow hydraulic system lines were fire damaged. Number 7 and 8 brake fans and temperature sensors had short-circuited. The adjacent landing gear bogie beam housing cover was burnt and there were signs of fire damage to the right landing gear door.

1.4 Other damage

There was no other damage.

1.5 Personnel information

1.5.1 General.

The required flight crew complement for the Airbus A300-B4 was a Captain, First Officer and Flight Engineer.

1.5.2 Captain : Pakistani National
Male aged 50 years

Licence : ATP Licence valid until April 2003
A300 command type rating

Medical Certificate : Valid until 30 April, 2003

Flying experience :

Total all types	-	13066.29	hours
Total on A300	-	1683.04	hours
Last 30 days on A300	-	67.00	hours
Last 24 hours on A300	-	2.37	hours

Duty Times :

Last 30 days	-	89.00	hours
Last 7 days	-	26.29	hours
Last 24 hours	-	3.46	hours

Training :

A300 type rating	-	16 March, 2000
Line Check	-	20 September, 2002
Pilot Proficiency Check	-	09 October, 2002

1.5.3 First Officer : Pakistani National
Male aged 42 years

Licence : ATP Licence valid until November, 2003
A300 co-pilot type rating

Medical Certificate : Valid until 31 May, 2001

Flying experience :

Total all types	-	5100.00	hours
Total on A300	-	2000.00	hours
Last 30 days on A300	-	54.00	hours
Last 24 hours on A300	-	2.37	hours

Duty Times :

Last 30 days	-	70	hours
Last 7 days	-	30	hours
Last 24 hours	-	3.46	hours

Training :

A300 type rating	-	November, 1998
Pilot Proficiency Check	-	November, 2002

1.5.4 Flight Engineer : Pakistani National
Male aged 47 years

Licence : F/E Licence valid until January, 2004
A300 type rating

Medical Certificate : Valid until 31 July, 2003

Flying experience :

Total all types	-	13229	hours
Total on A300	-	9820.50	hours
Last 30 days on A300	-	65.00	hours
Last 24 hours on A300	-	2.25	hours

Duty Times :

Last 30 days	-	99.0	hours
Last 7 days	-	223.0	hours
Last 24 hours	-	4.75	hours

1.6 Aircraft Information

1.6.1 Aircraft Details

Type	:	Airbus A300-B4
Serial No.	:	146 manufactured in May, 1981
Engines	:	General Electric CF6-50 C2
Certification of Registration	:	Registered in Pakistan as AP-BEY
Certificate of Airworthiness	:	Issued 20 September, 2002;
	:	Valid to 19 September, 2003
Operator in-service date	:	May, 1993
Total airframe hours	:	57592 hours
Total cycles	:	24816 cycles
Fuel on board on arrival	:	19.6 tonne
Actual TOW on departure	:	142.9 tonne
Actual landing weight on arrival	:	130.0 tonne

1.6.2 Maintenance Details.

Maintenance performed in accordance with the manufacturer's Maintenance Schedule for Airbus A300-B4.

Date of last inspection	:	"A" Check conducted 29 July, 2002
Next maintenance review	:	57958.20 hours

1.6.3 Technical Considerations.

The aircraft maintenance documents indicated that the aircraft had been undergoing maintenance on the right landing gear and brake numbers 3 and 7 from 25 February, 2003 to 02 March, 2003 and that this was the first flight since that date. There were numerous items such as brake sensors and indicator panel/control boxes checked during this work but no work was recorded on wheel number 8. The aircraft was serviceable at the initial departure aerodrome of Karachi and no defects were noticed during the flight.

1.7 Meteorological Information

1.7.1 General.

There was a general forecast of a weakening high pressure gradient covering the lower Arabian Gulf.. The actual weather at the time of the incident was fine and slightly hazy with light and variable winds.

1.7.2 Weather Conditions.

Dubai Weather Report (Actual). The weather conditions recorded at 1950 hours UTC (at the time of the incident);

1950 hours UTC

Wind	:	Variable 1 kt
Visibility	:	> 10000 m
Cloud	:	nil
Temperature	:	18° C; Dewpoint 09° C
QNH	:	1021 hPa
Warnings	:	Nil

1.8 Aids to Navigation.

The navigation aids at Dubai are NDB, VOR/DME as well as an ILS for each runway. They conform to, and are in compliance with, Annex 10, Volume 1, Radio Navigation Aids.

1.9 Communications.

All transmissions to the aircraft, as well as inter-agency telephone conversations, made by UAE ATC were clear, in the English language, and recorded. Transcripts were made of all communications involving PK 213 and the initial emergency response. There were no transmissions made by PK 213 indicating a problem and all conversation was given in a clear and unhurried manner. The co-pilot was subsequently determined to have made all communications to ATC from PK 213, and during those transmissions, no aircraft warning noises were heard. The UTC timing on the tapes was determined to be correct UTC time. (Refer to Attachment 1 for transcript). As all instructions issued by ATC were correctly acknowledged, radio communications between ATC and PK 213 were not considered a factor in this incident. There were no communications between the Fire Services and the aircraft.

1.10 Aerodrome Information.

1.10.1 Air Traffic Control.

Dubai International Airport is a UAE international airport with two parallel runways. Runway 12L is aligned at 122° M and dimensions are 4000 m x 60 m with full facilities. At the time of the incident the control tower was manned by correctly licensed and validated personnel.

1.10.2 Fire Services.

Dubai Airport Fire Services are categorised as Rescue and Fire Fighting (RFF) Category 9. The RFF facility was determined to be operating to RFF Category 9 at the time of the incident. From the transcripts of the communications, the time from the initial activation of the crash alarm to the extinguishing of the fire was determined to be less than 2 minutes 30 seconds.

1.11 Flight recorders

1.11.1 Recovery.

The Cockpit Voice Recorder, a Sundstrand Model V-557, S/N: 2199, and the Digital Flight Data Recorder (DFDR), a Sundstrand Model 6009, S/N 2193 were retrieved from the aircraft and presented to the Bureau Enquetes-Accidents in Le Bourget, France on 24 March, 2003 for extraction of the DFDR data and CVR transcription.

1.11.2 Cockpit Voice Recorder.

The CVR replay was of extremely poor quality and it was determined to be from an earlier flight and not applicable to this incident. The CVR was therefore inoperative.

1.11.3 Digital Flight Data Recorder.

A satisfactory extraction of the data was obtained. The DFDR did not have parameters indicating brake temperatures and all other parameters indicated that a normal approach and landing was made. There was no indication of undue brake action after landing.

1.12 Wreckage And Impact Information

Parts of molten brake pads and metal screens were later found on taxiways "Mike" and "Kilo". An initial inspection of the No. 8 brake assembly indicated that a disk(s) was broken and there was evidence of fire damage to wiring.

1.13 Medical Information

Investigation of the crewmembers' medical history confirmed that they met the CAA and ICAO Annex 1 medical standards for the licences held. There were no indications of any disorder that could have had a bearing on this incident.

1.14 Fire

The fire commenced whilst the aircraft taxied along taxiway "X" and started from the wheel bogie. It burnt for at least 2 minutes and was extinguished using water spray from the attending fire trucks.

1.15 Survival Aspects

The prompt action by the ground staff and then the ATC Tower controller to activate the crash alarms as well as the immediate response by the fire fighting and rescue services would have greatly contributed to the survivability of the passengers and crew had the fire spread.

1.16 Statements

1.16.1 Captain's Statement.

The Captain stated that he was occupying the left seat and was the pilot flying (PF). He stated that the aircraft was duly certified as serviceable for the flight from Karachi to Dubai and that the flight was uneventful. He recalled that there was nothing unusual regarding the departure from Karachi and there were no indications of brake binding or any abnormal brake temperatures. After landing on runway 12L, he used auto brake on "minimum" setting and then used gentle braking to bring the aircraft to a safe taxi speed. He exited the runway at M7, which was the high speed taxiway. As he vacated the runway, the Flight Engineer announced that the number 8 wheel brake temperature was high and increasing. Shortly after this the Flight Engineer announced that the temperature was decreasing and then fluctuating. The Captain stated that he decided to stop the aircraft on taxiway "K" and call ATC for assistance. As he was stopping the aircraft, the Flight Engineer announced that the temperature had dropped and the light was off. The number 8 brake temperature was 160° and all other brake temperatures were normal and close to this figure. The Captain therefore continued to taxi to the parking bay and assumed that the brake indicating system was giving a spurious indication.

Whilst continuing to taxi along taxiways "K", "J2" and "X", he stated that there was no indication of brake binding, vibration or reduced braking effectiveness. Whilst taxiing along "X", and just prior to the turn into the parking bay B7, the ATC Tower advised the aircraft to stop as there was a fire in the right landing gear. He immediately stopped the aircraft, shut down the engines and ordered the cabin crew to station. He stated that the fire services were very quickly on the scene and extinguished the fire. The First Officer opened his side window and confirmed that there was no longer any fire. The Fire Supervisor came on the intercommunication from the nose gear area and advised that everything was under control. Steps were arranged and passengers disembarked normally.

1.16.2 Flight Engineer's Statement.

The Flight Engineer stated that he thoroughly checked the technical log book before departure at Karachi and noted all of the maintenance that had been conducted on the right landing gear. He was satisfied that the aircraft was fully serviceable for the flight and there were no defects noted during the flight to Dubai. He recalled that the approach and landing at Dubai was normal and that minimum auto brake setting was used. While clearing the runway, he switched on the brake fans, then noticed that number 8 brake temperature was rising very fast and reached 700° with in a few seconds. The accompanying warning light illuminated. He then stated that the indicator started fluctuating, went down to 600° and finally dropped to 160° with the warning light out.

The Captain taxied to the terminal and there was no change to number 8 brake temperature or any indications of brake binding. His version of events then were identical to the Captain, although he did recall looking at number 8 wheel after leaving the aircraft and noted that there were no flat spots or other indications of brake binding.

1.16.3 ATC Tower Controller's Statement.

The ATC Ground Controller, who was on duty in the tower located approximately half way along the runway, reported that he had instructed the aircraft to taxi to Bay B7 via taxiways "K", "J" and "X". He received a radio call from Safety Mobile 4 stating that the PIA aircraft had a wheel fire. He immediately activated the crash alarm. He then contacted the aircraft and reported that the right wheels were on fire; that fire services were on the way, to hold position; and shut down the number 2 engine. He later advised the crew that the fire was under control and discussed passenger disembarkation matters with the crew.

1.16.4 Safety Officer's Statement.

A Dubai Airport Safety Officer was conducting a random patrol in the vicinity of parking bay B7, when he saw the fire break out on AP-BEY. He immediately tried to notify the Fire Services on 121.775 MHz but other communications were in progress so he contacted ATC on 121.65 MHz and informed them of the situation and the need to stop the aircraft and to shut down the engines. He went with other personnel to the fire extinguishers nearby and was in the process of moving towards the aircraft when the Fire Services arrived.

1.16.5 Marshaller's Statement.

The Marshaller was in position at parking bay B7, when he saw smoke and then fire. He notified the Fire Services Watch room and then closed the parking area off. He then saw the fire trucks arrive very quickly and extinguish the fire.

1.16.6 Duty Fire Officer's Statement

The Duty Fire Officer stated that, upon activation of the crash alarm, he immediately boarded Fire truck 1 and preceded to the PIA aircraft. He stated that the wheels were well alight. He was joined by Fire trucks 3,4,5 and 10 and he instructed the crews to use foam to extinguish the flames. The fire was quickly extinguished and He stated that he listened out on 121.6 MHz expecting to be able to communicate with the crew but he could not make contact and did not hear any calls.

1.17 Tests and Research

1.17.1 General.

The preliminary investigation of the brake assembly indicated that a failure had occurred. In order to complete the examination, the BE-A was authorized to send these items to the French Ministry of Defence CEAT laboratories for further analysis.

1.17.2 History of Brake Assembly.

The manufacturer of the landing gear and hinge arm was Messier-Dowty, previously known as Messier-Hispano-Bugatti. The brake assembly, serial number U245, was delivered as a new component for the initial delivery of aircraft MSN 146. The documented history of the brake assembly was;

(a) Initial delivery on MSN 146 aircraft on 15 June, 1993.

(b) Since new, there were;

(i) 14995 hr 08 min flight hours;

(ii) 17535 hr 21 min block hours;

(iii) 7879 cycles;

(iv) 7847 landings;

(c) On 08 February, 2002 the brake assembly was overhauled at the PIA Engineering facility at Karachi.

(d) On 10 February, 2003, the brake assembly was fitted to AP-BEY.

(e) Since overhaul, there were;

(i) 108 hr 57 min flight hours.

(ii) 127 hr 03 min block hours;

(iii) 53 cycles;

(iv) 53 landings.

1.17.3 Laboratory Tests on Brake Assembly.

1.17.3.1 Before Disassembly

With reference to Attachment 2, the examination of the wheel showed:

(a) The tire was burnt over a section of 200° on the rear of the brake assembly (illustration 8).

(b) The pressure plate was highly distorted and pushed back piston n°13 while piston n°12 was pushed out significantly (illustration 12).

(c) The two wear indicators showed abnormal wear (illustrations 10 and 11).

(d) The even number pistons (illustration 9) were in contact with the pressure plate.

A test under hydraulic pressure showed that the odd hydraulic system was working correctly. The even hydraulic system leaked as a pressure of 10 bars was reached.

1.17.3.2 During Disassembly

The heat pack looked like a compact welded block (illustration 19). The first stator had disappeared (illustrations 17 and d18). The teardown of the heat pack showed it had been subject to huge energy, which induced a large temperature increase.

1.17.3.3 After Disassembly

After disassembly, all the elements of the wheel/brake assembly were observed. The most relevant observations are as follows.

(a) Thermocouple (illustrations 20 and 21)

The crew saw the temperature indicator rising to 750°C before decreasing to 160°C. This information indicates the thermocouple was working correctly at first. Then, the first stator and the hot welding of the thermocouple having disappeared, the electrical continuity was due to the contact with the first rotor.

(b) Hydraulic crown (illustrations 25)

The seal of piston n°12 was removed from its normal position. The leak observed during the hydraulic test was located on this piston.

(c) Pistons (illustrations 27, 28 and 32)

The even number pistons were beyond their limit stroke because of the disappearance of stator n°1. Moreover the pressure plate, which was in contact with rotor n°1, was distorted and drove piston n°12. Analysis of the deposit found at the bottom of piston n°8 shows that the hydraulic fluid of the even system was severely damaged due to long exposure to hot temperatures.

The odd number pistons were in normal position compared to the pressure plate. Nevertheless, the position of the spiral friction spring indicates a significant wear rate on the heat pack. Analysis of the piston n°9 hydraulic fluid showed no damage compared to new fluid. This indicates the odd hydraulic system wasn't operated during braking and afterwards.

(d) Pressure plate and wear indicators (illustration 36)

The even number pistons pushed the pressure plate, thus proving they were under pressure during braking. The two slide indexes of the wear indicators had disappeared, which could have happened during the event.

(e) Heat pack (illustrations 45 and 46)

The stators and rotors were welded. At the circumference of the block there were some molten pieces of stator n°1. Measurement of stators + rotors indicates that the wear of the pack without the first stator was within the permissible limits (measured wear between 23 and 25 mm for a permissible wear of 28 mm).

(f) Torque tube (illustration 51)

The torque tube shows traces of burning products and indications of rapid cooling. The locking spins of stators were torn. So the torque tube did not fix the heat pack. The wheel was free to turn.

(g) First rotor

Chemical analysis, micrographic analysis and hardness measurements show that:

(i) the material of rotor n°1 was heated above its transformation points, that is to say over 880°C, then cooled rapidly.

(ii) the percentage of silicon (1.8 %) was above the manufacturer's limits (1.5 %).

(h) Last stator

The last stator was the only element in the heat pack which was intact. The materials were in accordance with manufacturer's specifications.

(i) Tyre (illustrations 69 and 70)

The external tyre wall was intact. There was a burnt section on the internal wall, which seems to indicate the flames were pushed towards the back or that the tyre turned after the fire.

(j) Rim (illustration 79)

On the side near the heat pack, the tyre appeared to be unstuck and left melted rubber marks. Inside the rim, near the heat pack, there were burn marks and from combustion products, particularly located near the burnt area of the tyre. The metal appeared burnt.

1.17.3.4 Analysis.

Observations and analysis lead to a scenario in four phases. In each phase, several events occurred but it is impossible to classify these events chronologically. Here, the order of description is arbitrary.

(a) During braking and taxiing (after braking).The heat pack underwent a rapid and very high temperature rise (indication: 750°C). The first stator broke then partly melted due to friction and heat.

(b) The thermocouple broke, the tyre deflated (it could then turn on the rim). Pistons from the even hydraulic system went past their limit stroke, because of the disappearance of stator n°1.

(c) Piston n°12 seal was removed from its housing and caused hydraulic leakage on a section of the wheel. The hydraulic fluid caught fire in contact with the hot brake and the air. Most of the locking pins, which link the stators to the torque tube, broke.

(d) When the aircraft stopped.
- Fire was rapidly under control.
- The hot rim was stuck to the tyre at the bottom of the assembly.
- The rapid cooling caused the first rotor quenching.

1.17.3.5 Analysis Conclusion

Visual inspections and metallurgical analysis of the parts of the wheel/brake assembly did not show incorrect operation capable of explaining the event. For an unknown reason, the brake assembly absorbed very high energy leading to a rapid and large temperature rise in the assembly. Then a hydraulic leak on to the hot brake caused the fire. It was determined that the metal from the first rotor contains 1.8 % of silicon for 1.5 % permitted by the manufacturer. This has some bearing on the microstructure but it did not seem to be the cause of the problem.

According to the information obtained and the analysis done, the cause of the event cannot be identified. Nevertheless, some hypotheses can be drawn:

(a) Premature damage to the first stator, which could have caused the overheating of the heat pack.

(b) Incorrect operation of the braking system upstream from the wheel (for example: hydraulic regulation problem, incorrect operation of other brake assemblies).

(c) An external event such as emergency braking on a previous flight.

In summary, the cause of the fire was attributed to overheated brakes, which damaged the braking system and allowed hydraulic oil to leak onto the brakes. The cause of the brake overheating could not be ascertained.

1.18 Organizational And Management Aspects

1.18.1 Operator

An inspection of the operator's procedures for brake overheat warning was conducted. It was noted that the PIA and Airbus procedures were identical. The PIA Airbus met the requirements of all applicable Airworthiness Directives and Service Bulletins.

1.18.2 Aircraft Manufacturer Procedures

The operator used a Flight Crew Operating Manual, which was produced by the aircraft manufacturer. It was noticed there was insufficient guidance material contained in the manufacturer's documentation in respect to crew actions after experiencing a brake overheat after landing. The following is the extract of the procedures for "brakes hot" after landing:

> "....If BRAKE TEMP indication exceeds 500° maintenance personnel must remove brakes for inspection"

1.19 Useful Or Effective Investigation Techniques

The use of the BE-A and CEAT laboratory facilities and metallurgic expertise was most effective and their analysis was very much appreciated in understanding the problem.

2. ANALYSIS

2.1 Reconstruction of Events

The aircraft was duly certified as serviceable for the flight from Karachi to Dubai and that the flight was uneventful. There were no indications of brake binding or any abnormal brake temperatures on departure. The Captain was the pilot flying (PF) and he conducted a normal approach and landing on runway 12L, using auto brake on "minimum" setting and gentle braking to bring the aircraft to a safe taxi speed. As the aircraft exited the runway on the high speed taxiway, the Flight Engineer announced that the number 8 wheel brake temperature was high and increasing. Shortly after this the Flight Engineer announced that the temperature was decreasing and then fluctuating. The Captain stated that he decided to stop the aircraft on taxiway "K" and call ATC for assistance but as he was stopping the aircraft, the Flight Engineer announced that the temperature had dropped and the light was off. The Captain therefore continued to taxi to the parking bay and assumed that the brake indicating system was giving a spurious indication. However the brakes had overheated and hydraulic fluid leaked onto the hot brakes and ignited. There was no internal indication of brake fire and ground personnel were able to alert the crew through radio communications to the ATC Tower.

The absence of any CVR data meant that the crew actions and decisions could not be collaborated.

2.2 Technical analysis

2.2.1 Brake Overheating. The most likely causes were;

(a) Premature damage to the first stator, which could have caused the overheating of the heat pack.

(b) Damage to the brake pistons, which allowed hydraulic fluid to leak over the overheated brakes.

(c) Incorrect operation of the braking system upstream from the wheel (for example: hydraulic regulation problem, incorrect operation of other brake assemblies).

(d) An external event such as emergency braking on a previous flight.

2.2.2 Overheat Warning. The initial indication in the cockpit was correct although the analysis indicated that the temperature reached 880°. However, as the thermocouple melted the electrical continuity was affected and the indicator decreased to a nominal value comparable with the other brake values instead of zero.

2.2.3 Cockpit Voice Recorder.

No technical analysis was conducted on the reasons for the inoperative CVR and the extremely poor quality of the recording. PIA procedures for CVR periodic inspection and recorder quality control was not carried out.

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2.3 Human Factor Considerations

2.3.1 Guidance Documentation.

In the opinion of the Investigation Committee, there was insufficient guidance material contained in the manufacturer's documentation in respect to crew actions after experiencing a brake overheat after landing. There was also an absence of information regarding the behaviour of a brake indicator should the thermocouple melt and effect the electrical continuity.

This was identified as an organizational latent failure, the implications of which was not immediately apparent and lay dormant for a considerable time.

2.3.2 Crew Procedures.

2.3.2.1 Training. The crew's decision to accept the sudden changes in brake temperatures indicated a fault analysis training issue may be involved.

This was identified as a local factor, which can affect the occurrence of active failures. Local factors are task, situational or environmental factors which affect task performance and the occurrence of errors or violations. This local factor was considered to have had a direct influence on the decision of the Captain to continue to taxi into the Terminal.

2.3.2.2 Risk Management. The decision for the pilot in command to continue to taxi the aircraft into a crowded Terminal having experienced an extremely high brake temperature indication and warning light without stopping for an external inspection of the brakes by the Fire Services, or even the consideration of a tow to a proper area, may have compromised the safety of PIA, and other, aircraft and passengers.

This was identified as an active failure, which is an error or violation and had an immediate adverse effect. Active failures are or may result in unsafe acts, which most generally involve the actions of operational personnel. Such failures can be divided into two distinct groups; errors and violations.

2.3.3 Summary

For the purposes of this summary, the GCAA Investigation Committee used the methodology researched and developed by Professor James Reason of the University of Manchester. The Reason accident causation model is an industry standard, and has been recommended by ICAO for use in investigating the role of management policies and procedures in aircraft accidents and incidents. The methodology has been amplified by italics above and is summarized below.

The defences in place proved to be inadequate and did not protect adequate protection arising from the combination of active, latent and local factors.

3. CONCLUSIONS

3.1 Findings

(a) The operator was correctly authorised by the Pakistan CAA to operate Airbus A300 B4 aircraft on scheduled international commercial operations.

(b) The aircraft was correctly registered, insured, and held a valid Certificate of Airworthiness.

(c) The aircraft was within the centre of gravity limitations and carried sufficient flight fuel, plus reserves. The load-sheet was determined to be correct for the manifested passengers, freight and fuel.

(e) The crew were correctly licensed, rated, and met the recent experience and proficiency requirements for the Airbus A300.

(f) Each crewmember held a valid and appropriate medical certificate and neither suffered from a known medical condition or injury.

(g) The aircraft was serviceable on departure from Karachi with no known mechanical defects for the arrival at Dubai.

(h) The CVR was found to be inoperative for the entire flight. The quality of the recording of the previous flight was extremely poor.

(i) After landing the No. 8 brake temperature indicated over 700° with an accompanying warning light whilst analysis indicated the brake temperature achieved a figure of 880°.

(j) The overheating of the heat pack may have been initiated by premature damage to the first stator, coupled with the incorrect operation of the braking system upstream from the wheel (such as a hydraulic regulation problem, incorrect operation of other brake assemblies) and possibly exacerbated by an external event such as emergency braking on a previous flight.

(k) A fire ignited in the right landing gear and was attributed to overheated No. 8 brakes, which damaged the braking system and allowed hydraulic oil to leak onto the brakes.

(l) As the pilot in command was in the process of coming to a stop on the taxiway, the indication suddenly dropped to 160° and the warning light went out. The pilot in command elected to continue to the assigned parking position at the terminal.

(m) The decision for the pilot in command to continue to taxi the aircraft into a crowded terminal having experienced an extremely high brake temperature indication and warning light without stopping for an external inspection of the brakes by the Fire Services, or even the consideration of a tow to a proper area, may have compromised the safety of PIA, and other, aircraft and passengers.

(n) The reaction of the duty ground staff, ATC and fire services was timely and appropriate.

3.2 Cause

The cause of the fire was attributed to an overheated No. 8 brake, which damaged the braking system and allowed hydraulic oil to leak onto the brakes. There was no obvious cause for the brake overheat, although it may have been initiated by premature damage to the first stator, coupled with the incorrect operation of the braking system upstream from the wheel (such as a hydraulic regulation problem, incorrect operation of other brake assemblies) and possibly exacerbated by an external event such as emergency braking on a previous flight.

4. RECOMMENDATIONS

4.1 PIA is recommended to create a quality assurance and control system in respect to the operation of the CVR and of the recording quality.

4.2 PIA is recommended to examine the human factor and training considerations regarding this incident and revise, formalise and document their procedures accordingly. In particular, the need to stop the aircraft once a high brake temperature has been experienced and the requirement for the pilot in command to arrange either an external inspection of the brakes by the Fire Services, or even the consideration of a tow to a proper area.

4.3 PIA is recommended to investigate the spare parts acquisition programme in respect to the first rotor, as it was determined that the percentage of silicon (1.8 %) was above the manufacturer's limits (1.5 %).

4.4 The French DGAC, in consultation with the aircraft and brake manufacturer, is recommended to determine the adequacy of the FCOM guidance in respect to high brake temperature after landing.

4.5 The Pakistan CAA is recommended to note the circumstances of this incident and recommendations 4.1; 4.2 and 4.3 above.