

**FINAL REPORT ON INCIDENT TO M/s INDIGO AIRLINES AIRBUS A320**  
**AIRCRAFT VT-IEU AT KATHMANDU ON 08/03/2014**

- |                              |  |
|------------------------------|--|
| 1. Aircraft Type             | : Airbus A 320   |
| Nationality                  | : INDIAN   |
| Registration                 | : VT - IEU   |
| 2. Owner                     | : AWAS 5092 Ireland Limited, Ireland                       |
| 3. Operator                  | : Interglobe Aviation Ltd.                                 |
| 4. Pilot – in –Command       | : ATPL holder on type                                      |
| Extent of injuries           | : Nil  |
| 5. First Officer             | : ATPL Holder qualified on type                            |
| Extent of injuries           | : Nil  |
| 6. Place of Incident         | : Kathmandu international Airport                          |
| 7. Date & Time of Incident   | : 08 <sup>th</sup> April 2014 17:30 UTC                    |
| 8. Last point of Departure   | : IGI Airport, New Delhi                                   |
| 9. Point of intended landing | : Kathmandu  |
| 10. Type of operation        | : Schedule Operation                                       |
| 11. Crew on Board            | : 06   |
| Extent of injuries           | : Nil  |
| 12. Passengers on Board      | : 176 + 06 crew members                                    |
| Extent of injuries           | : Nil  |
| 13. Phase of operation       | : On arrival at bay  |
| 14. Type of incident         | : Emergency evacuation due fire on right main landing gear |

(ALL TIMINGS IN THE REPORT ARE IN UTC)

## **SUMMARY**

M/s IndiGo Airlines A320 aircraft VT-IEU operating scheduled flight 6E-031 Delhi to Kathmandu was involved in an incident of right main landing gear fire during parking on bay at Kathmandu on 08/04/2014. There were 182 persons on board the aircraft including six crew members.

The flight from Delhi to Kathmandu was uneventful. After landing at Kathmandu the aircraft taxied normally to the bay. After the aircraft was parked on the bay no.5 and the engines were switched off the Engineer on ground observed smoke from right main landing gear. The engineer on headset informed the pilot, about the smoke from right main landing gear and advised to evacuate. The pilot in command instructed the cabin crew in charge on Passenger announcement system to evacuate passengers from right.

The cabin crew in-charge followed the instructions of PIC and instructed evacuation from right. The right side main door cabin slides and left "over wing" slides were deployed by cabin crew. However the cabin crew could not manage the passengers and the Passenger's evacuated the aircraft along with their cabin hand baggage. Other than few superficial injuries which occurred during evacuation there was no injury to the passengers'.

The fire had occurred after the aircraft was parked on the bay as the hydraulic fluid from the RH main landing gear had leaked from the Quick Release Connectors (QAD) of No.4 wheel brake system under high pressure and came in contact with hot brakes which eventually resulted into fire.

The incident was reported by M/s IndiGo to DGCA immediately. DGCA ordered an Inquiry under Rule 13 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2012 to investigate into the cause of the incident.

## **1. FACTUAL INFORMATION**

### **1.1 History of the flight**

M/s IndiGo Airlines Airbus A320 aircraft VT-IEU operating scheduled flight 6E-031 (Delhi-Kathmandu) was involved in an incident at Kathmandu International Airport on 08/04/2014 due fire on right main landing gear. The flight was under the command of PIC holder of valid ATPL license with co-pilot both duly qualified on type. There were 182 persons including six crew members on board the aircraft.

This incident occurred on the first flight of the day. However the aircraft had operated Delhi-Kolkata-Bangkok-Kolkata-Delhi on the previous day. As per engineering records there was no snag/leakage reported on the aircraft hydraulic system on any of the previous sectors. No engineering maintenance sheet/off job sheet was raised for any work carried out on the landing gears or on the hydraulic systems. After the arrival from Kolkata, the AME at Delhi had carried out the daily inspection schedule at night and released the aircraft for Kathmandu flight on 08/04/2014. The departure fuel from Delhi was 9800 Kg. (Arrival fuel was 4700 kg and Uplifted fuel was 5100 kg)

The aircraft took off from Delhi at time 05:35 UTC. The weather at the time of departure from Delhi was fine and reported visibility as 6000 metres. The enroute flight was uneventful and the aircraft landed safely at Kathmandu International Airport at 17:30 UTC as per filed flight plan. After landing, the aircraft taxied normally and parked on the bay 5. As per M/s Indigo procedure the cabin doors/escape slides were disarmed during the aircraft taxi. As per DFDR the brake temperature was within the limits, however the brake temperature for #4 brakes was higher than all the brakes. After the aircraft was parked on the bay the parking brake were set and passenger seatbelts were switched off.

After the aircraft was parked on the bay, the cockpit crew observed commotion with the ground staffs and moving on the apron. Subsequently the engineer on ground came on head set and informed flight crew of the fire from #4 wheel and advised to evacuate. The Co-pilot requested ATC, Kathmandu for Fire services and in the meantime Captain instructed the cabin in-charge to

evacuate immediately and after a pause of few seconds PIC instructed evacuation from right side of the plane.

After the 'evacuate' instruction from the captain, the cabin crew In-charge (CCIC) initiated the unplanned emergency evacuation. Since all the escape slides were already disarmed, the cabin crew had to arm the doors slides again and then deploy the escape slides. Only the right side main door cabin slides were deployed. The left "over wing" slides were also deployed. Cabin crew gave command for the evacuation of the passengers, number of passengers evacuated with their cabin hand baggage's. Ground staff used the ground fire extinguishers to control the fires. Subsequently the fire tenders also came to the aircraft and the fire was brought under control. Few of the passengers were evacuated from the left over wing emergency exits. After the fire was brought under control the ladders were positioned on the L1 door and the remaining passengers disembarked from it. The flight crew and cabin crew in-charge also disembarked from the ladders positioned on L1 door of the aircraft.

The evacuation was completed in approximately 81 seconds. Other than small cuts and bruises there was no injury to any of the occupants.



**Slides deployed for evacuation**

## 1.2 Injuries to persons

<b>INJURIES</b>	<b>CREW</b>	<b>PASSENGERS</b>	<b>OTHERS</b>
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR/ None	06	176	

## 1.3 Damage to Aircraft : Minor

The aircraft sustained the following damages.

1. Both RH main wheel # 3 & # 4 were found damaged/ deflated, however the brake assembly were found satisfactory.
2. The hydraulic hoses for #3 and #4 had fire marks.

## 1.4 Other damage: NIL

## 1.5 Personnel information

### 1.5.1 Pilot – in – Command

AGE : 40 years 4 months 6 days

License : ATPL Holder

Category : Aeroplane

Class : Single/Multi engine land

Endorsements as PIC : C152A/C172/PA 34- 200/ Boeing 737-200/  
Boeing 737-700/800/ Airbus 320

Date of Med. Exam. : 30<sup>th</sup> October 2013

Med. Exam valid upto : 29<sup>th</sup> April 2014

Total flying experience : 12670:40 hours

Experience on type : 2789:26 hours

Experience as PIC on type : 2572:36 hours  
Total flying experience during last 180 days : 417:03 hours  
Total flying experience during last 90 days : 230:16 hours  
Total flying experience during last 30 days : 83:02 hours  
Total flying experience during last 07 Days : 18:34 hours  
Total flying experience during last 24 Hours : Nil

### **1.5.2 Co-Pilot**

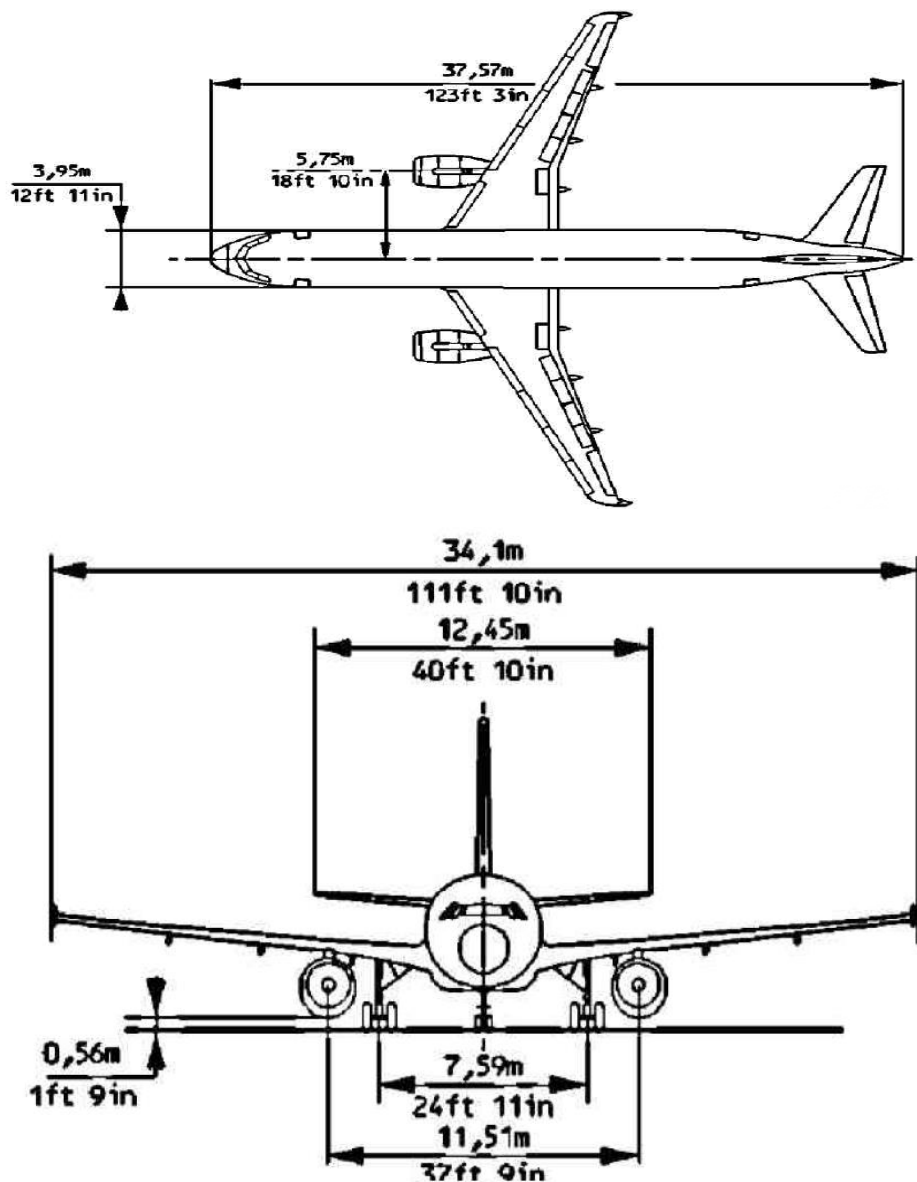
AGE : 59 yrs 4 months and 8 days  
License : ATPL Holder  
Category : Aeroplane  
Class : Single engine and Multi engine  
Endorsements as PIC : Cessna-152 and PA-34  
Endorsements as F/O : A320 Aircraft  
Date of Med. Exam : 20<sup>th</sup> November 2013  
Med. Exam valid upto : 19<sup>th</sup> May 2014  
Total flying experience : 4770:17 hours  
Experience on type : 1640:10 hours  
Experience as PIC on type : Nil  
Total flying experience during last 180 days : 482:16 hours  
Total flying experience during last 90 days : 247:04 hours  
Total flying experience during last 30 days : 72:13 hours  
Total flying experience during last 07 Days : 23:12 hours  
Total flying experience during last 24 Hours : 05:00 hours

Both the operating crew were not involved in any serious incident/ accident in past. Both the operating crew were current in all training and had adequate rest

as per the Flight Duty Time Limitations (FDTL) requirement prior to operating the incident flight.

### 1.6 Aircraft Information:

The A320 is a subsonic, medium-range, civil transport aircraft. The aircraft has two high bypass turbofan engines manufactured by M/S International Aero Engines. The aircraft is designed for operation with two pilots and has passenger seating capacity of 180.



The aircraft is certified in Normal (Passenger) category, for day and night operation under VFR & IFR. The maximum operating altitude is 39,100 feet and

maximum take-off weight is 73500 Kg. The Maximum Landing weight is 64500 Kg. The Aircraft length is 37.57 meters, wingspan is 34.1 meters and height of this aircraft is 12.14 meters. The distance between main wheel centres is 7.59 meters. The distance between engines is 11.51 meters and Engine Ground Clearance is 0.56 meters. Airbus A320 aircraft VT-IEU (MSN 5092) had been manufactured in year 2012. The aircraft was registered with DGCA under the ownership of M/S AWAS 5092 IRELAND Limited. The aircraft is registered under Category 'A' with the Certificate of registration No. 4315.

The Certificate of Airworthiness Number 6424 under "Normal category" subdivision Passenger / Mail / Goods was issued by DGCA on 28 Mar 2012. The specified minimum operating crew is two and the maximum all up weight is 77000 Kg. At the time of incident the Certificate of Airworthiness was current and was valid up to 27 March 2017.

The Aircraft was holding a valid Aero Mobile License No A-002/059-RLO (NR) at the time of incident. This Aircraft was operated under Scheduled Operator's Permit No S-19 which was valid up to 2<sup>nd</sup> August 2017. As on 8<sup>th</sup> Mar 2014 the aircraft had logged 7595.25 Airframe Hours and 3778 cycles.

The Airbus A320 aircraft and its Engines are being maintained as per the maintenance program consisting of calendar period/ flying Hours or Cycles based maintenance as per maintenance program approved by Regional Airworthiness office, Delhi.

Accordingly, the last major inspection 2250FH/ 360 DAYS check carried out at 3018 cycles on 22<sup>nd</sup> Oct 2013. Subsequently all lower inspections (Preflight checks, Service Checks, Weekly Checks) were carried out as and when due before the incident.

The aircraft was last weighed on 22 March 2012 at Hamburg and the weight schedule was prepared and duly approved by the office of Director of Airworthiness, DGCA, Delhi. As per the approved weight schedule the Empty weight of the aircraft is 38036.455 Kg. Maximum Usable fuel Quantity is 18730.000



Kg. Maximum payload with fuel tanks full is 16600.735 Kg. Empty weight CG is 18.825 meters aft of datum. As there has not been any major modification affecting weight & balance since last weighing, hence the next weighing is due on 21st March 2017. Prior to the departure from Delhi, as per the Load & Trim sheet, the aircraft weight and balance was well within the operating limits. The landing weight of aircraft was also well within the operational limit.

All the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine has been complied with as on date of event.

Transit Inspections are carried out as per approved Transit Inspection schedules and all the higher inspection schedules include checks 1 inspection as per the manufacturer's guidelines as specified in Maintenance Program and are approved by the Continuing Airworthiness Manager (Post Holder for Continuous Airworthiness).

The last fuel microbiological test was done on 22 Feb 2014 at 7438/3700 and the colony count was within acceptable limits.

The left Engine S/N 16171 had logged 7595.25 Hrs and 3778 cycles and the right Engine S/N 16179 had logged 7595.25 Hrs. and 3778 cycles. There was no defect reported on the engines on the previous flight.

The defect record of the aircraft were scrutinised for a period of one month from the date of occurrence of the incident. There was no defect recorded on the landing gear hydraulic system. The brakes were last replaced on #3 and #4 wheels on 13<sup>th</sup> December 2013 and 14<sup>th</sup> November 2013 respectively. Thereafter there was no maintenance carried out on the involved system. Both #3 and #4 brakes were sent to the shop for defect investigation and found to be satisfactory.

Prior to departure 08 days inspection and pre-flight check prior to departure was carried out at Delhi. As per the inspection task card there is only visual inspections for brakes/ hoses /nuts for hydraulic leakage on the landing gear

system. During scrutiny of the maintenance records, there was no hydraulic leak observed by the AME on the landing gear system while carrying out 08 days inspection and pre-flight check prior to departure of flight on 08/03/2014. Further, as per records, there was no upliftment of Hydraulic fluid or engine oil prior to departure of flight from Delhi.

### **1.6.1 Hydraulic Brake System:**

The components that control the supply of hydraulic power to the system are installed on a manifold that is located in the hydraulics compartment. These components are:

- selector valve
- high pressure filter
- pressure transducer

A manifold installed on each MLG includes the necessary components to control the hydraulic pressure at its related brakes. The selector valve attached to the GREEN PTU manifold. The selector valve is solenoid operated and controls the supply and release of the Green hydraulic pressure in the brake system. When the valve is de-energized it connects the system to the Green LP manifold to release the pressure in the system. The BSCU energizes the selector valve to connect the Green hydraulic pressure to the system when:

- the brake pedals move more than a specified limit
- the conditions necessary for an automatic braking program are available
- the landing gear is set to UP (retraction braking). The selector valve stays energized for 3 seconds or until the NLG is not down-locked.
- it does a test of the normal braking system (this occurs before each landing or when a specified BITE test

The high pressure filter and pressure transducer are installed downstream of the selector valve. The filter prevents contamination of the braking system components. The transducer measures the hydraulic pressure in the system and supplies the data to the BSCU and to the ABCU (to give the condition of the selector valve). The hydraulic line divides to supply the two Normal Brake Servo-valve

Manifold assemblies installed on the MLG. The manifold assemblies are the same. They have an inlet port that includes a filter, a return port and two outlet ports that each supply a related brake. At the filter outlet, the hydraulic supply divides equally to supply two sets of components that are attached to the manifold (one set for each brake). Each set of components includes a servo-valve, a safety valve and a pressure transducer. Each servo-valve has an electrically operated solenoid. The active channel of the BSCU supplies the servo-valve control current to the related coil to:

- get the correct quantity of pressure in the brake line
- Connect the brake line to return to release the pressure.

If a leak of hydraulic fluid occurs downstream of the safety valve, the valve automatically closes to prevent loss of fluid in the related brake line. The pressure transducer measures the hydraulic pressure in the related brake line and supplies an input to the BSCU. The input is in proportion to the pressure. Each manifold assembly has a return line with a check valve. The return line from each MLG manifold connects the related manifold to the Green LP Manifold. The check valves isolate the related manifold from the other return pressures. Half couplings connect the brake line to half couplings in the brake. The two half couplings seal automatically if disconnected from each other to prevent a decrease of system fluid and fluid contamination. Each MLG axle has a multi-disc brake. The brake has two sets of hydraulic pistons. One set of pistons connects to the normal braking system and the other connects to the alternate braking system

## **A. Normal Braking :**

The Normal braking system is electrohydraulic and includes a computer, which is the Braking / Steering Control Unit (BSCU). The BSCU controls the operation of the electrohydraulic valves in the system to decrease the speed of the aircraft. The hydraulic pressure that operates the brake pistons is supplied from the Green Main Hydraulic Power system.

The system has two modes of operation, manual and automatic, and gives automatic anti-skid protection in each mode. Each brake unit gets separate pressure control to supply the anti-skid protection. The WHEEL page shows when the anti-skid function operates. A switch (A/SKID) in the cockpit lets you cancel the system. If the switch is set to OFF, brake operation will go to the Alternate Braking without Anti-Skid system.

During manual braking, the input signals to the computer come from the two pairs of brake pedals (through the related transmitter unit) in the flight deck. Thus the quantity of hydraulic pressure that goes to the brake units is in proportion to the travel of each related brake pedal. Each pedal independently controls braking to the related MLG.

Three pushbutton switches in the cockpit set the auto braking to be used during a landing. There are three deceleration modes (LOW, MEDIUM & MAXIMUM). MAX mode is selected before Take-off.

If a brake pedal supplies an input signal which is more than the set auto value it cancels the automatic braking program. If specified failures occur in the system, control automatically changes to the Alternate Braking system.

## **B. Alternate Braking with Anti-Skid :**

The Alternate braking system with anti-skid is the secondary, electrohydraulic braking system. It automatically becomes available if:

- specified failures occur in the Normal braking system
- The pressure of the Green main hydraulic power supply is less than a specified value.

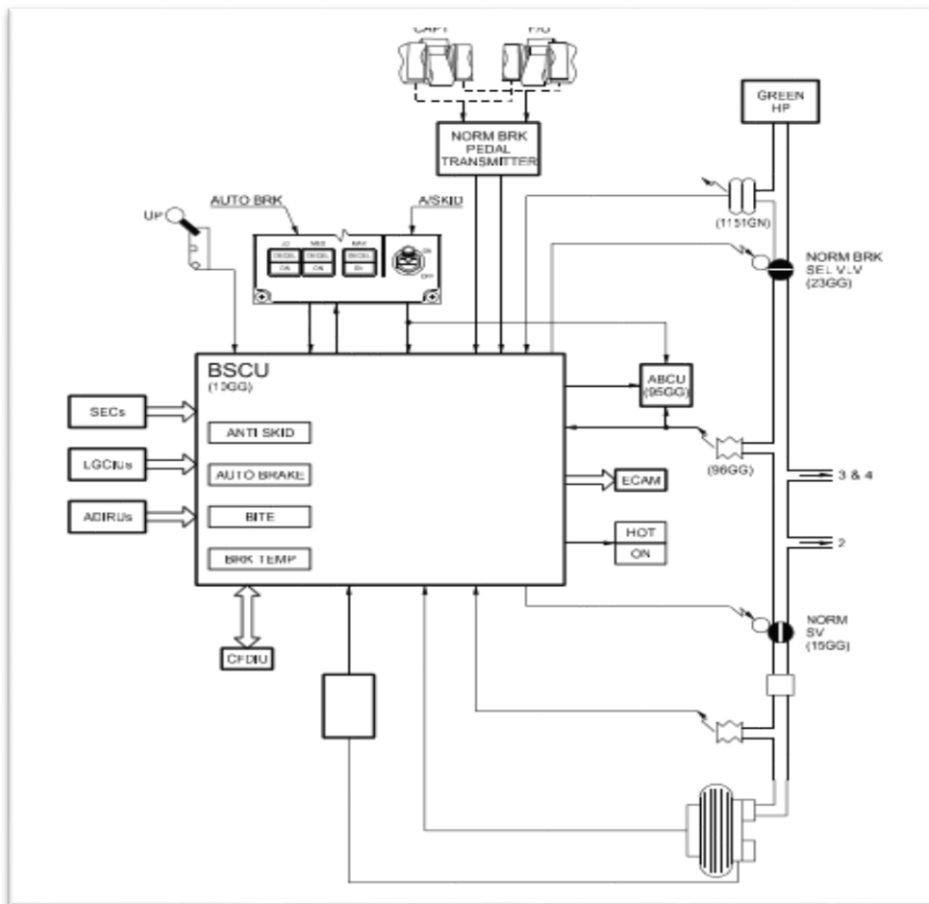
An analog computer ABCU (Alternate Braking Control Unit) controls the operation of the alternate braking system. Braking inputs can only be made at the brake pedals and the BSCU provides the anti-skid control. The hydraulic pressure that goes to the second set of pistons in the brakes is supplied from the Yellow Main Hydraulic Power supply. The quantity of hydraulic pressure that goes to the brake units is in proportion to the travel of each related brake pedal. Each pair of brake units (on the same gear) get separate pressure control to supply the anti-skid function.

### **C. Alternate Braking without Anti-Skid:**

The alternate braking without anti-skid system is the secondary mode of operation of the alternate braking with anti-skid system. The system is automatically available when the antiskid function is not available. This occurs when:

- A/SKID switch is set to OFF
- Yellow Main Hydraulic Power supply is not available.
- Anti-skid function of the BSCU is faulty.

The system uses the same hydro-mechanical components as the alternate braking with anti-skid system. If the Yellow Hydraulic Power supply is lost, the accumulator (filled from the Yellow HP) gives sufficient power for at least seven full brake application. A triple pressure indicator in the cockpit shows the braking accumulator pressure and the pressure at the brakes.



***Normal braking System***

## **1.7 Meteorological information**

At the time of landing, the following weather was reported by ATC.

Wind	:	250 <sup>0</sup> /04 knots
Visibility	:	7000 m
Weather	:	Fair
Clouds	:	Few 2000 FT
Temperature	:	20 <sup>0</sup> C
Dew pt	:	04 <sup>0</sup> C
QNH	:	1020 hPa
Trend	:	No significant Weather Change

## 1.8 Aids to navigation

There is one single runway available at Tribhuvan International Airport in Kathmandu, Nepal which has the orientation 02/20. The NDB and DVOR is available for both the approaches for runway 02/20. PAPI is available for both sides of the runway. There is no ILS available at Tribhuvan International Airport in Kathmandu. A320 aircraft is equipped with all latest navigational instruments which are compatible with the ground equipment.

## 1.9 Communications

There was always two ways communication between the ATC and the aircraft.

## 1.10 Aerodrome information

### **Tribhuvan International Airport in Kathmandu, Nepal**

#### **ICAO :VNKT**

#### Co-ordinates

ARP : N 27 41.8°  
E 085 21.5°  
Elevation : 4390 Ft.

#### Runway Orientation and dimension

Orientation- 02/20 Dimension 3050 x 46 (M)

R/W & Taxi Tracks Markings Standard as per Annex- 14

Approach and Runway Lighting:

RWY.	HIALS (APCH LGT)	THR LGT	PAPI	Rwy Centre Line LGT	HIRL (RWY edge LGT)
02	CAT-I	Yes	Yes (3 degrees)	No	Yes

### Met Services

MET services are available at the airport. TAF, Trend Forecast and Briefing is available. Weather forecast is available at an interval of every half an hour.

### Navigation and Landing Aids

NDB, DVOR

### ATS Communication Facilities

Kathmandu Radar	127.0 MHZ
Kathmandu Approach	120.6/125.1 MHZ
Kathmandu Tower	118.1 MHZ
Kathmandu Ground	121.9 MHZ

RFSS (Rescue & Fire fighting Services) Category 8



Figure: Location of aircraft (red) in the parking bay no. 5

**1.11 Flight recorders:** The Cockpit Voice Recorder (CVR) and the Digital Flight Data Recorder (DFDR) was downloaded for investigation.

**CVR:** Make: Honeywell, Part No. 9806022-001, S/N: CVR120-15742

1. After uneventful landing, aircraft vacated the runway through taxiway B to stand number 5.



2. After completion of 'After Landing Checklist', PIC instructed to disarm the slides.
3. The ground AME contacted PIC about the Fire in right tyre.
4. AME also confirmed about the fire on #3 and #4 brakes and requested to evacuate immediately.
5. PIC announced 'Evacuate Evacuate Evacuate' command and in addition also announced to evacuate from right side of the aircraft.

**DFDR:** Make: Honeywell, Part No. 980-4700-042, S/N: SSFDR 19198

The DFDR was downloaded and following observation were made:

1. The aircraft carried out full configuration landing (Flap 04).
  2. Manual Braking was applied 12 seconds after touchdown with speeds around 102 kts.
  3. Average deceleration rate was 1.93 m/s. normal braking was applied by the pilot.
  4. The maximum brake temperature for
    - a. Brake 1 was 195 degrees
    - b. Brake 2 was 156 degrees
    - c. Brake 3 was 189 degrees
    - d. Brake 4 was 272 degrees.
- Brake No.4 temperature was higher than all other three brakes but was well within the limit which is 300 degrees when the warning is triggered.
5. Aircraft speed while exiting Rwy was 5-6 kts.
  6. Aircraft speed while entering into bay was 5-6 kts.
  7. The vertical acceleration during landing was 1.39.
  8. The incident occurred after the engines were shut down.

### **1.12 Wreckage and impact information**

There was no major damage to the aircraft, however following observations were made:

1. Both RH main wheel # 3 & # 4 were found damaged/ deflated, however the brake assembly were found satisfactory.
2. The hydraulic hoses for #3 and #4 had fire marks.

3. The creep mark on the QAD No.4 and No.3 main landing gear wheel hydraulic system was found drift from their position.



**Other than the hydraulic hoses there was no damage on brakes and wheels**



**Fire soot marks on the hydraulic hoses.**

### **1.13 Medical and pathological Information**

Both the cockpit crew and all four cabin crew had undergone Breath analyser check during the pre-flight medical check prior to the flight at Delhi and were found negative.

### **1.14 Fire**

After landing there was hydraulic leak from #3 and #4 main wheel hydraulic hoses connector plugs. The hydraulic fluid when came in contact with the hot brakes it caused dense smoke and eventually fire. The fire extinguisher bottle which was positioned near the aircraft was deployed by the ground personnel's for fire fighting and to control the fire. The fire was controlled even before the airport fire services vehicles arrived at the aircraft.

### **1.15 Survival aspects**

The incident was survivable.

### **1.16 Tests and research**

During ground inspection, leakage of hydraulic fluid was seen from the QAD the alternate brake system. Both the hoses (Part no. 201042275 and 201042274) along with quick release coupling were send for detailed examination and investigation to ascertain the cause of leakage at Aircraft Engineering Directorate, DGCA.

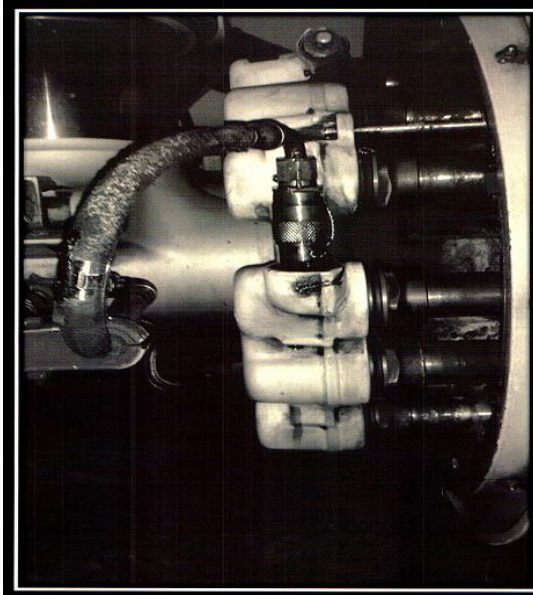


Figure 1: shows the location of Leakage

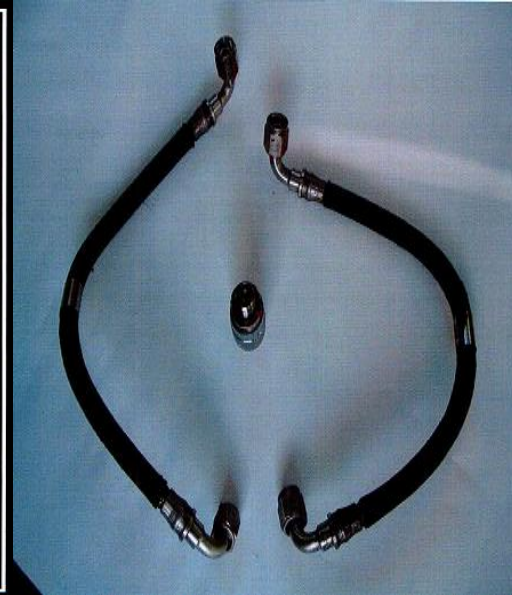


Figure 2: shows the hoses removed from the aircraft

### Visual and Macro Examination

Both the hose pipes along with quick release coupling were examined under the stereo microscope up to a magnification of 50X. On both the hoses common marks were observed which were;

1. Some rubbing marks were observed on the 1A end as shown in Fig. 3a, which appears to be due to rubbing of some external object during service.

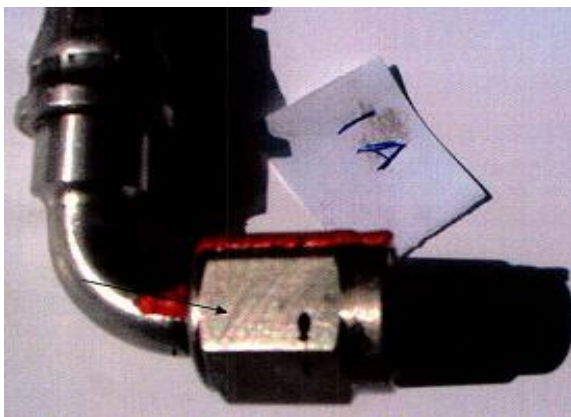


Figure 3a: Shows the rubbing marks on end 1A due to the rubbing of some external object during service



Figure 3b: Shows deep marking on the face of ferrule in the hose pipe

2. On the end 1B as shown in Fig. 3b, deep marking on the face of ferrule was observed in the hose pipe. It seems to be due to the over tightening of the nut. However, there is no abnormality found on the other end.

3. While examination of the Quick release coupling, in the bore (inner diameter) of the coupling, scratches/metal gauging marks were observed. Two dent marks are also noticed on the outer surface of the coupling.



Fig. 4 shows quick release coupling with internal scratches/ metal gauging



Fig. 5 External Dent marks indicating striking of hard material

## **Discussion**

The bore of the quick release coupling holds the outer diameter of the ferrule for hoses pipe. Metal gauging in the Inner diameter of sleeve has occurred due to extra torque (over tightening) of hose pipe.

Dent marks appears to have occurred due to striking of hard material which is a non-standard maintenance practice in aviation.

### **The visual and macro examination of hose pipe and quick release coupling revealed that:**

Leakage of hydraulic fluid has probably occurred due to scratches/metal Gauging marks in the sleeve. Scratches/metal gauging marks occurred in the sleeve have occurred due to over torque.

### **1.17 Organizational and management information:**

M/s IndiGo is a scheduled airline with a current fleet of 78 Airbus A-320 aircraft operating flights on domestic and international sectors. The company is in operation from last 07 years. The Company is headed by CEO assisted by a leadership team of professional of various departments. The flight operation is headed by V.P. Flight Ops who holds current license on Airbus A-320. The Flight Safety Department is headed by Chief of Flight Safety approved by DGCA who is a pilot with a current license of Airbus A-320. The Chief of Safety reports directly to the CEO. The Engineering Department headed by VP-Engineering who also holds AME license on Airbus 320 Aircraft. He heads the line maintenance and the Quality Control department of the organization.

### **1.18 Additional information**

#### **1.18.1 Disarming of the cabin door during taxi**

As per cabin safety manual of M/s Indigo Airlines, the cabin doors are disarmed by the cabin crew when the aircraft is still in taxi phase and not parked on the bay. This procedure is not in line with the manufacturer recommended procedure

as per their Wise Circular Eng-Ops-15425 dated 01.10.2014 which stipulates that the cabin crew should disarm the slides when aircraft reaches the final parking position. Also, this procedure is not in line with the industry practice within the country.

In case of any unplanned emergency evacuation the cabin crew has to first arm the slides first and then deploy the slide chutes for passenger evacuation, this would certainly delay the evacuation procedures. This exactly happened in this particular case wherein some precious time was lost by the cabin crew in first arming the slides and then deploying the escape chutes for passenger evacuation.

### **1.18.2 Evacuation command by PIC**

As per Airbus procedures in case of evacuation the cockpit crew announces "Evacuate" and thereafter the cabin crew in-charge takes over the situation. The cabin crew after assessing the external conditions deploys the escape slides for evacuation of the passengers.

In this case, after the "Evacuate" command was given by the PIC after a gap of few seconds also announced to evacuate for the right. The fire was also on the right main landing gear. The PIC announcement to evacuate from the right influenced the cabin crew decision and the cabin crew deployed the right side escape slides for evacuation.

### **1.18.3 Crowd Control**

Flight with critical emergencies could be potentially critical or life threatening is termed as un-planned emergencies or un-anticipated emergencies. Thus it is imperative for cabin attendants to perform their 30 seconds review while seated on their jump-seats for take-off and landing. The cabin attendant must use positive verbal commands and physical gestures in order to efficiently direct passengers towards the exit and directing to leave everything including cabin luggage. Also it is extremely important for cabin crew to remain out of the passenger way during evacuation in order to expedite the process.

Since this was an unplanned evacuation there was very little time available with cabin crew members to coordinate and prepare for passengers evacuation. After the incident video clips were available on the internet which indicated that the passengers were evacuating from the escape slides which were next to the fire along with the cabin hand baggage's.

**1.19 Useful or effective investigation techniques: NIL**

**2. ANALYSIS**

**2.1 Serviceability of the aircraft**

Airbus A320 aircraft VT-IEU (MSN 5092) was manufactured by M/s Airbus, France in year 2012. The aircraft is registered under the ownership of M/s AWAS 5092 Ireland Limited, Ireland. The Certificate of Registration No. 4315, under category 'A' was issued on 28 Mar 2012. On the day of incident the aircraft VT-IEU had logged 7595.25 Airframe Hours and 3778 cycles.

The aircraft was holding a valid Certificate of Airworthiness Number 6424 issued under "Normal category" sub-division Passenger / Mail / Goods by DGCA on 28 Mar 2012 and was valid up till 27 Mar 2017. This aircraft was operated under Scheduled Operator's Permit No. S-19 and which was valid till 02 Aug 2017. Prior to flight, the aircraft was holding a valid Certificate of Flight Release.

The aircraft was last weighed on 22 Mar 2012 at Hamburg. There was no major modification carried out on the aircraft affecting weight & balance. The aircraft and Engines were being maintained under continuous maintenance as per maintenance program consisting of calendar period based maintenance and flying Hours/ Cycles based maintenance as per maintenance program approved by Regional Airworthiness office, New Delhi. The last major inspection 2250FH/ 360 DAYS check carried out at 3018 cycles on 22 Oct 2013. Subsequently all lower inspections/schedules, till the last flight prior to incident was carried out as per the maintenance programme.



All the concerned Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine were found complied with. Transit Inspections are carried out as per approved Transit Inspection schedules and all the higher inspection schedules include checks 1 inspection as per the manufacturer's guidelines as specified in Maintenance Program and are approved by the Continuing Airworthiness Manager (Post Holder for Continuous Airworthiness).

Following Engineering facts were established during investigation:

- a) Prior to the incident flight the aircraft had operated flight Delhi-Kolkata-Bangkok-Kolkata-Delhi on the previous day and no snag was reported on the aircraft.
- b) There was no defect recorded on the landing gear hydraulic system for the previous sector.
- c) The brakes were last replaced on #3 and #4 wheels on 13<sup>th</sup> December 2013 and 14<sup>th</sup> November 2013 respectively. Thereafter there was no maintenance carried out on the involved system.
- d) Prior to departure 08 days inspection and pre-flight check prior to departure was carried out at Delhi. As per the inspection task card there is only visual inspections for brakes/ hoses /nuts for hydraulic leakage on the landing gear system and no leakage was observed by the departure engineer.
- e) There was no upliftment of hydraulic fluid on the aircraft at Delhi prior to the incident flight.
- f) After the incident both #3 and #4 brakes were sent to the shop for defect investigation and found to be satisfactory.
- g) There was no in-flight disintegration of any part of the aircraft.
- h) The affected hoses were sent to the laboratory for investigation and it was observed that the bore of the quick release coupling which holds the outer diameter of the ferrule of hoses pipe had metal gauging in the inner diameter of sleeve. There were also evidences of Dent marks on the connector outer surface which appears to have occurred due to striking with hard material.

- i) During maintenance/servicing ie. opening and re-torturing of the connectors with the application of extra torque (over -tightening) the outer diameter of the ferrule of hoses pipe had developed metal gauging in the inner diameter of sleeve which over the period of time had deteriorated and gave way to the hydraulic fluid under high pressure.

From the above it is inferred that, as the operating hydraulic pressure in the system is very high ie. 3000 pound square inch the scratches/metal Gauging marks on the quick Attach/Detach connector/sleeve gave way to the hydraulic fluid under pressure. Once the leaked hydraulic fluid came in contact with the hot brakes dense smoke was generated and subsequently fire.

## **2.2 Weather**

At departure from Delhi, the weather was fine with clear skies and visibility 6000 M. The aircraft took off for Delhi at around 11:05 UTC. As per the METAR at the time of landing, the reported weather was 20° fair, wind 250/04 knots and visibility was 7000m with no significant change in weather.

## **2.3 Handling of Evacuation procedures**

After the aircraft was parked on the bay and the engines were shut down. The AME on the ground came on headset and inform the cockpit crew that there was fire on #4 wheel. The AME also advised the PIC to evacuate the aircraft. The PIC immediately announced "Evacuate" on the Public address system. After a gap of few seconds the PIC announced "Evacuate from the right". This was not in accordance with the evacuation procedures laid down by the manufacturer M/s Airbus and also with the procedures approved by DGCA in company Operation manual.

As per M/s Indigo Cabin Safety Training manual the escape slides are disarmed during taxi and not after the aircraft is completely parked on the bay. As the escape slides were already disarmed during the taxi, the cabin in-charge advised all the crew members to first arm the door and then deploy the right side slides. This

procedure is not in line with the manufacturer recommended procedure as per their Wise Circular Eng-Ops-15425 dated 01.10.2014 which stipulates that the cabin crew should disarm the slides when aircraft reaches the final parking position.

It was observed from the videos released after the incident that the passengers had evacuated from the right side where the fire had occurred and also were seen evacuating on escape slides with the cabin luggage's.

For the above it is inferred that the cabin crew action reflected poor assessment of situation as their actions were not in accordance with their approved cabin safety manual. The cabin crew deployed escape slides where the fire had occurred as their decision was influenced by the PIC. Further the cabin crew were not able to handle the passengers during the evacuation as number of passengers evacuated with the cabin luggage.

## **2.4 Circumstances leading to the Incident**

The flight from Delhi for Kathmandu was uneventful. As per DFDR the aircraft landed safely and normal brakes application were observed. However the brake temperature for #4 brake was recorded higher than all the other three brakes but was within limits. After the aircraft was parked on the bay and engines were shut down. As the operating hydraulic pressure in the system is very high ie. 3000 pound square inch the scratches/metal Gauging marks on the quick Attach/Detach connector/sleeve gave way to the hydraulic fluid under pressure. Once the leaked hydraulic fluid came in contact with the hot brakes dense smoke was generated and subsequently fire.

## **3 CONCLUSIONS**

### **3.1 Findings**

- a) The Certificate of Airworthiness and the Certificate of Registration of the aircraft was current/valid on the date of incident.
- b) The certificate of flight release was valid on the day of incident.

- c) Both the pilots were appropriately qualified to operate the flight.
- d) All the concerned Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine were found complied with.
- e) Prior to the incident flight the aircraft had operated Delhi-Kolkata-Bangkok-Kolkata-Delhi on the previous day and there was no snag reported on the aircraft.
- f) The AME had carried out daily inspection schedule prior to incident flight at night and released the aircraft for flight.
- g) This incident occurred on the first flight of the day.
- h) The enroute flight was uneventful and the aircraft landed safely at Kathmandu as per filed flight plan. After landing, the aircraft taxied normally and parked on the bay.
- i) The engineer on ground observed smoke from #4 wheel and immediately informed flight crew of the fire from #4 wheel and advised them to evacuate.
- j) Initially the Captain instructed cabin in-charge to evacuate immediately and thereafter instructed evacuation from right side of the plane. This was not as per Airbus/company approved operating procedures.
- k) As per M/s Indigo existing procedure the door slides are disarmed during taxi and not after the aircraft is parked on the bay. Hence after the PIC made the evacuation command the cabin crew had to arm all the doors again and then deploy the escape slides for evacuation. This practice also is not as per the recommended manufacturer procedures for disarming the doors.
- l) The cabin crew followed the PIC instructions and without assessing the external conditions deployed the escape slides on the same side where the fire had actually occurred.
- m) The cabin crew were not able to handle the passengers effectively as number of passengers were observed sliding downs the escape slides with their cabin baggage's, which is not as per the company evacuation procedure.

- n) The evacuation was completed in approximately 81 seconds. Other than small cuts and bruises there was no injury to any of the occupants.
- o) The brakes were last replaced on #3 and #4 wheels on 13<sup>th</sup> December 2013 and 14<sup>th</sup> November 2013 respectively. Thereafter there was no maintenance carried out on the involved system.
- p) Prior to departure 08 days inspection and pre-flight check prior to departure was carried out at Delhi. As per the inspection task card there is only visual inspections for brakes/ hoses /nuts for hydraulic leakage on the landing gear system and no leakage was observed by the departure engineer.
- q) There was no upliftment of hydraulic fluid on the aircraft at Delhi prior to the incident flight.
- r) After the incident both #3 and #4 brakes were sent to the shop for defect investigation and found to be satisfactory.
- s) Hydraulic leak was observed from the #3 and #4 main wheel hydraulic lines connector plugs/sleeves.
- t) The hoses were sent to DGCA laboratory for defect investigation. Scratches/metal gauging marks on the internal diameter of the QAD were observed which had probably occurred due to over torque of the QAD during maintenance/servicing.
- u) The hydraulic fluid under high pressure of 3000 p.s.i Leaked from the scratches/metal Gauging in the QAD connector and after it came in contact with the hot brakes and caused fire.
- v) The weather at the time of landing at Kathmandu was fine and is not a contributory factor.

### **3.2 Probable cause of the Incident:**

As the operating hydraulic pressure is very high, the scratches/metal Gauging marks in the connector plug/sleeve gave way to the hydraulic fluid. After the hydraulic fluid came in contact with hot brakes smoke was generated and subsequently fire.

The scratches/metal Gauging marks in the inter diameter of QAD connector had probably occurred due over torque during maintenance.

#### 4 SAFETY RECOMMENDATIONS:

1. M/s Indigo should ensure that the pilots (PIC) adheres to standard operating procedure in case of emergency evacuation and not to influence the cabin crew during evacuation process.
2. M/s Indigo procedures for arming/disarming the doors to be inline with the Airbus/aviation operators within the country.
3. M/s Indigo to ensure that during cabin crew training emphasise are made on the importance of handling crowd control during emergency evacuation and also to strictly adhere the standard operating procedures for assessing the external conditions before commencing evacuation.
4. Engineering Department to issue internal circular highlighting the incident and advising precautions while handling QAD during servicing/maintenance on the aircraft.

Place: New Delhi

Date: 24.07.2015



A X Joseph  
Deputy Director-Air Safety  
Inquiry Officer-VT-IEU