

FINAL INVESTIGATION REPORT ON
ACCIDENT TO SPICEJET LTD.
BOMBARDIER Q-400 AIRCRAFT VT-SUC
AT JABALPUR ON 04.12.2015

COMMITTEE OF INQUIRY VT-SUC

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Foreword

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2012, the sole objective of the investigation of an accident shall be the prevention of accidents and not apportion blame or liability.

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examination of various components. Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

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**INVESTIGATION REPORT ON ACCIDENT TO M/S SPICE JET
BOMBARDIER Q400 AIRCRAFT VT-SUC AT JABALPUR ON
04.12.2015.**

- | | |
|-------------------------------|---|
| 1. Aircraft | Bombardier |
| Type | Q-400 |
| Nationality | Indian |
| Registration | VT-SUC |
| 2. Owner | Maple Leaf Financing Limited |
| 3. Operator | Spice Jet Limited |
| 4. Pilot – in –Command | ATPL Holder |
| Extent of Injuries | None |
| 5. Co-pilot | ATPL Holder |
| Extent of Injuries | None |
| 6. No. of Passengers on board | 49 (Pax) + 02 (Cabin Crew) |
| Extent of Injuries | None |
| 7. Last point of Departure | Mumbai Airport |
| 8. Intended landing place | Jabalpur Airport |
| 9. Place of Accident | Jabalpur Airport
23° 10' 45" N , 80° 03' 14" E |
| 10. Date & Time of Accident | 04.12.2015: 1352 UTC |
| 11. Phase of operation | Landing Roll |
| 12. Type of accident | Wildlife Strike during landing roll |

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SYNOPSIS:

On 04.12.2015, M/s Spice Jet Ltd. Bombardier Q-400 aircraft VT-SUC operating a scheduled flight SG-1087, (Mumbai- Jabalpur) was involved in an accident due wild life strike during landing roll at Jabalpur. The aircraft was under the command of pilot holding ATPL and duly qualified on type along with First Officer also an ATPL holder and qualified on type. There were 49 passengers and 02 cabin crew on board the aircraft.

The aircraft VT-SUC took-off from Mumbai for Jabalpur at around 1200 UTC. The enroute flight was uneventful. ATC Jabalpur cleared the aircraft for landing on Runway 06. The aircraft landed on runway 06 and few seconds after touch down at around 1352 UTC the aircraft hit wild boars on the runway. One of the wild boars impacted the LH main landing gear due which the LH Main landing gear got collapsed and the aircraft started drifting towards left of the runway. Thereafter the aircraft exited the runway to its left side and entered into Soft Ground and stopped. All the passengers were evacuated safely from RH side. There was no injury to any of the occupants and there was no fire.

Ministry of Civil Aviation constituted a committee of inquiry to investigate into the cause of the accident under Rule 11 (1) of Aircraft (Investigation of Accidents and Accidents), Rules 2012 comprising of Sh. A. X. Joseph, Deputy Director, AAIB as Chairman with Capt. Nitin Anand and Sh. K Ramachandran, Air Safety Officer, AAIB as members vide order no. AV-15029/117/2015-DG.

1. FACTUAL INFORMATION.

1.1 History of the flight

Bombardier Q-400 aircraft VT-SUC belonging to M/s Spice jet Ltd. was involved in wild life strike accident during landing roll at Jabalpur while operating scheduled flight SG – 2458 from Mumbai to Jabalpur on 04.12.2015. The aircraft was under the command of pilot holding ATPL & duly qualified on type with First Officer also an ATPL holder and qualified on type. There were 49 passengers and 02 cabin crew on board the aircraft.

The aircraft VT-SUC took-off from Mumbai for Jabalpur at around 1200 UTC. The enroute flight was uneventful. The aircraft came in contact with ATC Jabalpur at around 1323 UTC. The ATC reported prevailing weather at Jabalpur as surface winds calm, visibility 5000 meters, weather Haze, non-significant clouds, and temp 24° C. At 1342 UTC the pilot requested ATC for visual approach runway 06. The ATC cleared VT-SUC for visual approach runway 06 and asked to confirm when runway in sight. At 1347 UTC the pilot confirmed the runway in sight and requested for landing clearance and the same was acknowledged by ATC. The aircraft landed on runway 06 and about 05 to 06 seconds after touch down at around 1350 UTC the aircraft hit wild boars on the runway. The pilot stated that as it was dawn they did not see the wild boars on runway during approach, and saw the wild boars only after touch down and when they were very close to them, also they did not had adequate time to react so as to take any evasive action. Hence, one of the wild boars on runway impacted with LH main landing gear due which the LH Main landing gear got collapsed and the aircraft started drifting towards left. Thereafter LH engine propeller blades came in contact with ground and got sheared off. The aircraft dragged on its belly for around 182 feet and in the process the nose landing gear also collapsed. The aircraft then veered to the left of the center line and subsequently exited the runway onto the left side and came to final halt position in Soft Ground. The pilot then confirmed with first officer about fire and once getting assured that there was no fire gave

evacuation call outs. The pilot then contacted ATC for assistance and informed that there were 10 to 11 pigs on the runway and the aircraft had hit the pig and gone off the runway. The Crash Fire Tender (CFT) team along with operational jeep reached the accident site. The pilot shut down the engines. All the passengers were then evacuated safely from the RH side. There was no injury to any of the occupants on board the aircraft and there was no fire.

1.2 Injuries to persons.

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR/None	02+02	49	

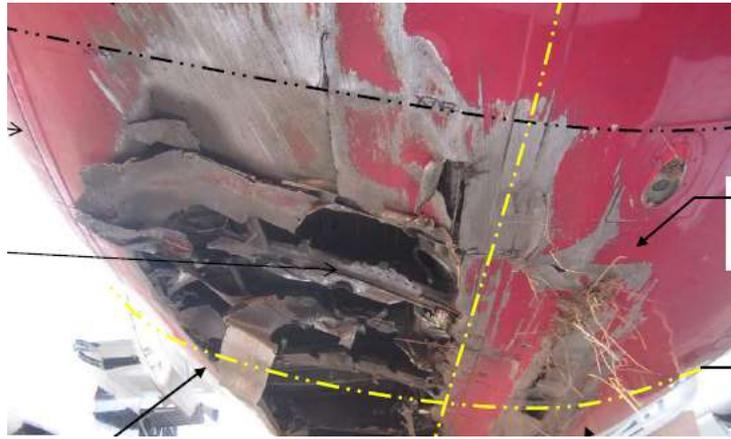
1.3 Damage to aircraft.

The aircraft sustained substantial damage. Few of the damages observed are listed below:

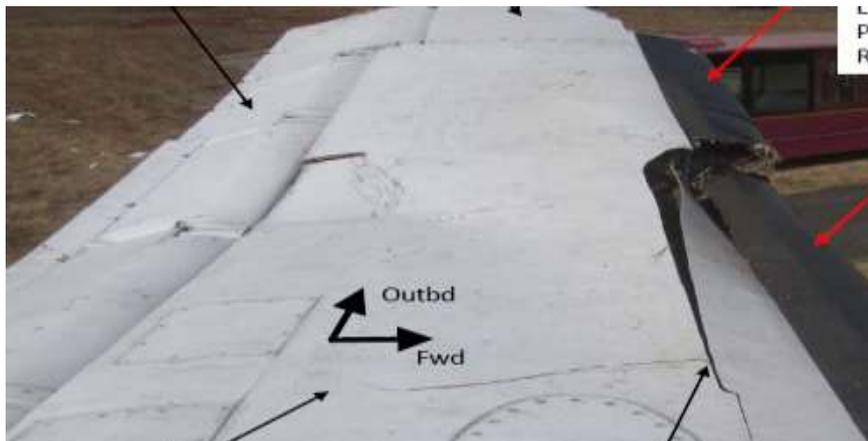
- Nose landing gear found collapsed.



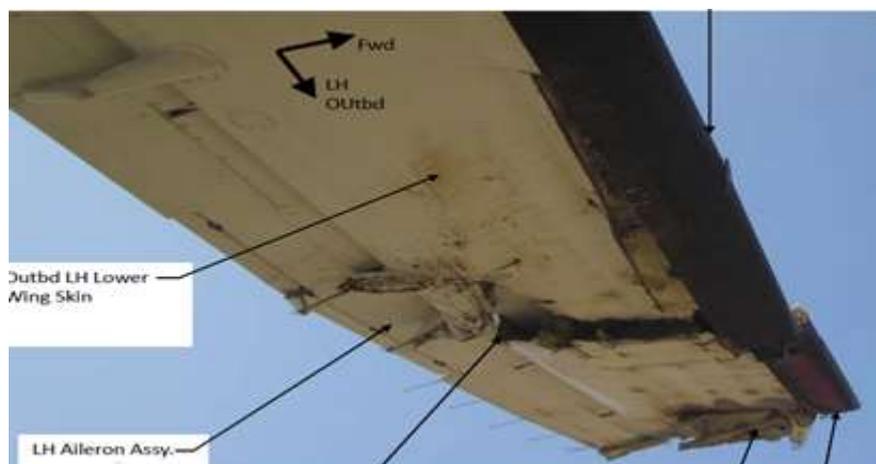
- Forward unpresurized compartment severely punctured and portion sheared off.



- Hydraulic hoses around nose landing gear found sheared off and fluid found leaking.
- Nose landing gear lock found protruded.
- Nose landing gear trunnion frame found sheared from fuselage frame.
- Forward right emergency exit lower cabin facing decorative panel found torn off.
- Left No#2 flap from inboard fairing found sheared off.



- Left wing tip found sheared.



- Left aileron found bent and cracked including tab.
- Left side wing from extreme outboard upper access panel found bent.
- Left extreme outboard leading edge found cracked.
- Front wing spar (left wing) found cracked and bent.
- Left engine all six propeller blades found sheared off completely till the root and left main landing gear was collapsed into the engine nacelle. The lower portion of the nacelle found sheared off.



- Dome portion of left spinner found missing.
- Sealant of mating portion of left wing with outboard nacelle face found cracked.
- Found loose and torn portion of left alternate main landing gear door on aft side of nacelle.
- Left fuselage strake found cracked and loose from fuselage.
- Rivets from aft outboard skin of nacelle found popped out.
- On opening of cabin floor boards found fuselage skin sheared with mud/debris inside.
- Nose fuselage front pressurized compartment floor found broken.

1.4 Other damage:

Four runway edge lights were damaged.

1.5 Personnel information:

Pilot- in- Command:

AGE	:	48 years.
Licence	:	ATPL holder.
Date of issue	:	17-05-2006.
Valid up to	:	06-04-2017.
Category	:	ATPL- Multi Engine Land.
Class	:	AEROPLANES.
Endorsements as PIC	:	Aircraft Type-DHC-408.
Date of Med. Exam.	:	06/07/2016.
Med. Exam valid up to	:	05/01/2016.
FRTTO Licence No.	:	Valid
Date of issue	:	29/10/2013.
Valid up to	:	26/10/2018.
Total flying experience	:	7748 hrs.
Experience on type	:	2148 hrs.
Experience as PIC on type	:	1968 hrs.
Last flown on type	:	04/12/2015.
Total flying experience during last 180days	:	469:02 Hrs.
Total flying experience during last 90 days	:	205:10 Hrs.
Total flying experience during last 30 days	:	72:49 Hrs.
Total flying experience during last 07 days	:	13:44 Hrs.
Total flying experience during last 24 Hours	:	05:48 Hrs.

Co- Pilot:

AGE	: 55 years.
Licence	: ATPL holder.
Date of issue	: 26/03/2012.
Valid up to	: 25/03/2021.
Category	: ATPL Multi Engine Land.
Class	: AEROPLANES.
Endorsements as PIC	: B1900D, C-90. P68C.
Date of Med. Exam.	: 06/01/2015.
Med. Exam valid up to	: 05 /04 /2016.
FRTTO Licence No.	: Valid
Date of issue	: 26/03/2012.
Valid up to	: 25/03/2017.
Total flying experience	: 7804 Hrs.
Experience on type	: 137 Hrs.
Experience as PIC on type	: NIL.
Last flown on type	: 04/12/2015.
Total flying experience during last 180days	: 137 Hrs.
Total flying experience during last 90 days	: 137 Hrs.
Total flying experience during last 30 days	: 79 Hrs.
Total flying experience during last 07 days	: 13 Hrs. 18 Min.
Total flying experience during last 24 Hours	: 05 Hrs. 49 Min.

Both the operating crew was not involved in any serious incident/ accident in the past. Both the crew had adequate rest prior to roster for the accident flight and were current in all trainings.

1.6 Aircraft information:

Aircraft VT-SUC (MSN 4377) had been manufactured in year 2011. The aircraft was registered with DGCA under the ownership of M/s MAPLE LEAF FINANCING LIMITED. The aircraft is registered under category 'A' and the certificate of registration No. 4247.

The Certificate of Airworthiness Number 6356 under "Normal category" subdivision Passenger / Mail / Goods was issued by DGCA on 02/09/2011. The specified minimum operating crew is two and the maximum all up weight is 29257 Kgs. At the time of accident, the Certificate of Airworthiness was valid.

The Aircraft was holding a valid Aero Mobile License No. A-010/035-RLO(NR) at the time of accident. This Aircraft was operated under Scheduled Operator's Permit No S-16 which was valid up to 16/05/2018. As on 4/12/2015 the aircraft had logged 11928:05 Airframe hours and 11214 cycles.

The Bombardier DHC-8-402 aircraft and its Engines are being maintained as per the maintenance programme consisting of calendar period / flying Hours or Cycles based maintenance as per maintenance programme approved by Regional Airworthiness Office, Delhi.

Accordingly, the last major inspection Base check-2 (12000 FH check) carried out at 11084 cycles on 12/9/2015. Subsequently all lower inspection (Preflight checks, 600 FH Inspections) were carried out as and due before the accident.

The aircraft was last weighed on 27/7/2011 at Canada 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 17550.81 Kgs. Maximum pay load with fuel tanks full

is 5783.10 Kgs. Empty weight CG is 10.01 meters aft of datum. There was not any major modification affecting weight & balance since last weighing, hence the next weighing was due on 20/07/2016. Prior to the accident flight the weight and balance of the aircraft was well within the operating limits.

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

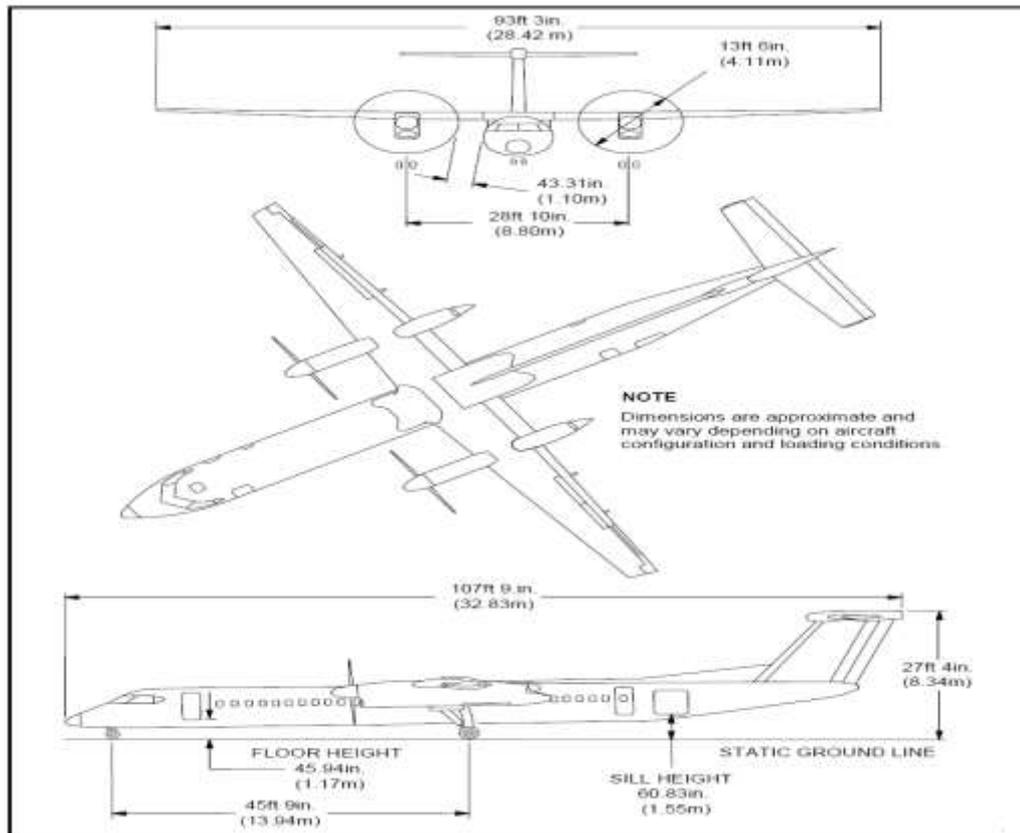
Transit Inspections are carried out as per approved Transit Inspection schedules and all the higher inspection schedules include checks 1 inspection as per the manufacturer's guidelines as specified in Maintenance Program and are approved by the Continuous Airworthiness Manager (Post Holder for Continuous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

The last fuel microbiological test was done through Fuel stat test kit on 29/6/2015 at Hyderabad by Spicejet and the microbiological growth was negligible.

The left Engine S/N PCE-FA0890 had logged 8883:55 Hrs and 8468 cycles and the right Engine S/N PCE-FA807 had logged 8009:21 Hrs and 7558 cycles.

Construction

The aircraft is a metal high wing monoplane with fully cantilever wings and horizontal stabilizer surfaces, a semi-monocoque fuselage and a fully retractable tricycle landing gear. A large portion of the skin panels are bonded assemblies consisting of a skin, stringers and doublers, or skin sandwich with a honeycomb core.



The two nacelles, one on each side of the fuselage, mounted below the wing, house the power plants, accommodate the landing gears and some additional equipment. The nacelle comprises of following three main areas of structure i.e. Forward, Centre and Aft. The center nacelle structure which is located between nacelle stations 121.230 and 210.000 houses A-Frame which attaches to MLG drag-strut and side-braces. The A-Frame is machined from a solid aluminum alloy billet.

LANDING GEAR CONSTRUCTION

The landing gear is electrically controlled and hydraulically operated. The tricycle gear is a retractable dual wheel installation. The main gears retract aft into the nacelles and the nose gear retracts forward into the nose section. Doors completely enclose the landing gear when it is retracted and partially enclose the gear when it is down.

Main Landing Gear:

The Main Landing Gear includes the following components:

- Yoke
- Shock Strut
- Stabilizer Brace
- Drag Strut
- Up lock Assembly
- Down lock Release Actuator
- Retraction Actuator
- Auxiliary Extension Actuator

Each MLG assembly is installed on the airframe structure in the wheel well of the related engine nacelle. Each MLG has two wheel and tire assemblies and retracts rearwards into the aft section of the wheel well.

A retraction actuator is attached to the yoke and to the shock strut to extend and retract the MLG. A lock actuator on the stabilizer brace locks the MLG in the down position. An auxiliary extension actuator is attached to the airframe structure in the aft section of the wheel well and to the arm of the yoke. The auxiliary extension actuator extends the MLG during an alternate extension sequence. An uplock assembly is attached to the top of the aft section of the wheel well and locks the MLG in the retracted position.

The yoke is attached to the top of the aft section of the wheel well. The shock strut is attached to the bottom of the yoke. A stabilizer brace keeps the yoke in position in the wheel well. The stabilizer brace is attached to the front of the yoke and to the forward frame of the forward section of the wheel well. The shock strut is held in position, in the wheel well, by the drag strut. The drag strut is attached to the bottom of the shock strut cylinder and to the forward frame of the forward section of the wheel well. The shock strut has provision for the wheels, brake units, and anti-skid devices to attach to the axles.

Landing gear system description and operation:

The landing gear selector lever and the proximity sensor electronic unit (PSEU) control the operation of the landing gear. The number 2 hydraulic system supplies the power to the landing gear. Hydraulic retraction or extension starts when the landing gear selector lever is moved to the desired position. The PSEU checks the status of the MLG and the MLG doors, and compares it with the command selected. The PSEU verifies the "down and locked" status of the gear through signals sent to it by 2 proximity sensors on each main gear, as well as an uplock sensor and a door sensor. When these sensors and targets are close together (read by the PSEU as "NEAR"¹¹), this indicates that the gear is down and in a locked condition. When the gear is not locked down or is in transition, the proximity sensors are read by the PSEU as being in a "FAR"¹² condition. The PSEU also controls the hydraulic sequences to either fully extend or fully retract the landing gear.

The status of the landing gear and the landing gear doors is shown in the cockpit by the indicator lights on the landing gear control panel. A "landing gear inoperative" (LDG GEAR INOP) caution light on the Caution and Warning panel indicates a fault in the landing gear retraction and extension system.

- The landing gear starts to extend when the landing gear selector lever is unlocked and moved to the down (DN) position.
- The down solenoid of the selector valve receives electrical power.
- The selector valve supplies aircraft hydraulic system pressure and flow into the extend side of the landing gear hydraulic system.
- Main landing gear extension

When the landing gear selector lever is moved to the down position, the 2 MLG solenoid sequence valves (SSVs) remain de-energized. At the start of the normal MLG extend sequence, these de-energized SSVs supply hydraulic pressure to the retract side of the MLG aft doors actuators, opening the MLG aft doors. When the MLG aft doors are approximately 93% open, the MLG aft doors linkage operates the mechanical sequence valve. The valve supplies hydraulic pressure to the uplock release actuators and to the down side of the

MLG retraction actuators. The MLG then starts to travel to the down and locked position.

Three proximity sensors are used to monitor the MLG extension sequence. Each MLG has 2 down-and-locked sensors and 1 MLG aft-doors-closed sensor. When the PSEU receives input signals that the MLG is down and locked, the PSEU energizes the SSVs.

Pressure is then supplied to the MLG aft doors actuators to close the MLG aft doors. At approximately 7% reverse travel of the MLG doors, the mechanical sequence valves close. This action isolates the MLG retraction actuator from the rest of the hydraulic system. In-line restrictors keep the down side of MLG retraction actuators pressurized to 3000 pounds per square inch (psi) at the end of the extension sequence.

When the landing gear is down and locked, the SSVs and the down solenoid of the selector valve are kept in an energized condition. This condition maintains hydraulic pressure on the down side of the retraction actuators and the down side of the MLG unlock actuators, which helps keep the over-centre lock links in a position that locks the stabilizer brace.

Landing gear control Panel:

The landing gear is controlled and monitored from the landing gear control panel, located on the right side of the engine display on the forward instrument panel in the flight deck. The panel has a landing gear selector lever, a lock-release selector lever, landing gear and landing gear door advisory lights, and a landing gear warning horn/mute test switch. The landing gear is commanded to the up or down position with the landing gear selector lever. An amber light in the landing gear selector lever is illuminated when the landing gear position does not agree with the landing gear selector handle position or when any of the landing gear doors are not closed.

Landing gear selector valve:

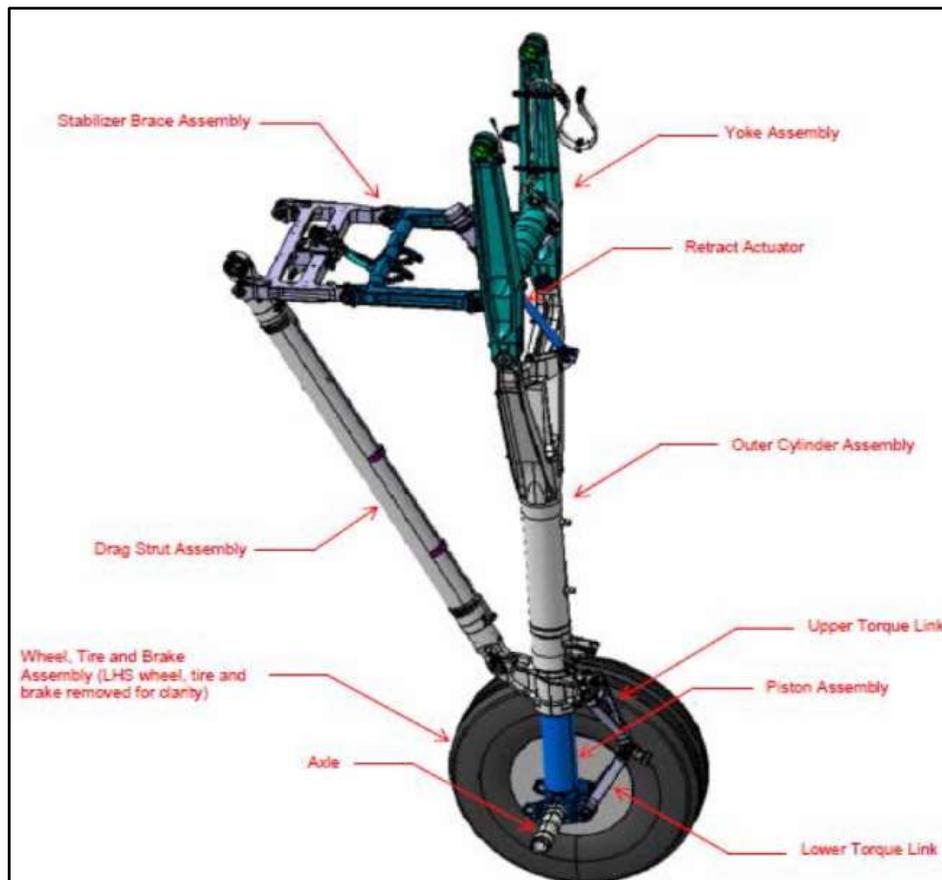
The landing gear selector valve is a self-contained assembly with 2 solenoid valves. It controls hydraulic pressure to position a directional control valve that is spring-centred. The position of the valve controls the supply of

hydraulic pressure to either the up or down hydraulic circuits of the landing gear system. The landing gear system can be configured for either normal retraction or extension.

Main landing gear unlock actuator

The MLG unlock actuator has 2 ports, to which hydraulic lines are attached and sealed with O-rings. The MLG unlock actuator is attached to the MLG stabilizer brace assembly. The unlock actuator's primary function is to unlock the stabilizer brace. When the MLG is down and locked, this actuator also provides down-force, helping the lock links to stay in an over-centre position.

The retraction actuator is designed to move the landing gear up when the aircraft get airborne.



1.7 Meteorological information:

The following is the Met report of Jabalpur on the date of accident between 1315 Hrs. UTC to 1420 Hrs. UTC.

Time (UTC)	Winds (°/Knots)	Visibility (Meters)	Weather	Clouds	QNH (HPA)	Temp (°C)	Dew Point (°C)
1315	000/00	5000	HAZE	No Significant Cloud (NSC)	1015	24	10
1345	000/00	5000	HAZE	NSC	1015	23	11
1400	000/00	5000	HAZE	NSC	1016	22	11
1410	000/00	5000	HAZE	NSC	1016	22	10
1420	000/00	5000	HAZE	NSC	1016	22	10

1.8 Aids to navigation:

There is one single runway available at Jabalpur which has the orientation 06/24. For landing runway 06/24 VOR/DME approach is available. PAPI is available for both sides of the runway. NDB is also available at Jabalpur for approach and landing.

1.9 Communications:

There was always two-way communication between the ATC and the aircraft.

1.10 Aerodrome information:

The Jabalpur airfield and ATC are controlled by Airports Authority of India. It has single runway with orientation 06/24 and dimensions 1988 meters (length) x 45 meters (width). The aerodrome elevation is about 495 meters (1622 feet). The airfield is equipped to provide VOR/DME approach on either side of the runway. The PAPI and NDB are also available for the runway 06/24. The aerodrome is licensed.

Few of the observations/findings made during the onsite investigation after the accident are listed below:

Perimeter Wall

1. There were around 20 breaches found in the perimeter wall of the aerodrome which includes several 18 inch (diameter) open circular drainage pipes and 18"x 18" square opening in the perimeter wall. There were several openings at the bottom of the perimeter walls of 15x20 inch. They were adequate for the wild life animals to enter the aerodrome premises at any time of the day.



2. At certain places the height of the perimeter wall was found to be 5 feet 6 inches.



3. In some places the boundary wall was found to be broken from top.
4. The overhung fence is missing at most of the places.
5. The perimeter road was not available.
6. There are no perimeter lights available.



Runway condition

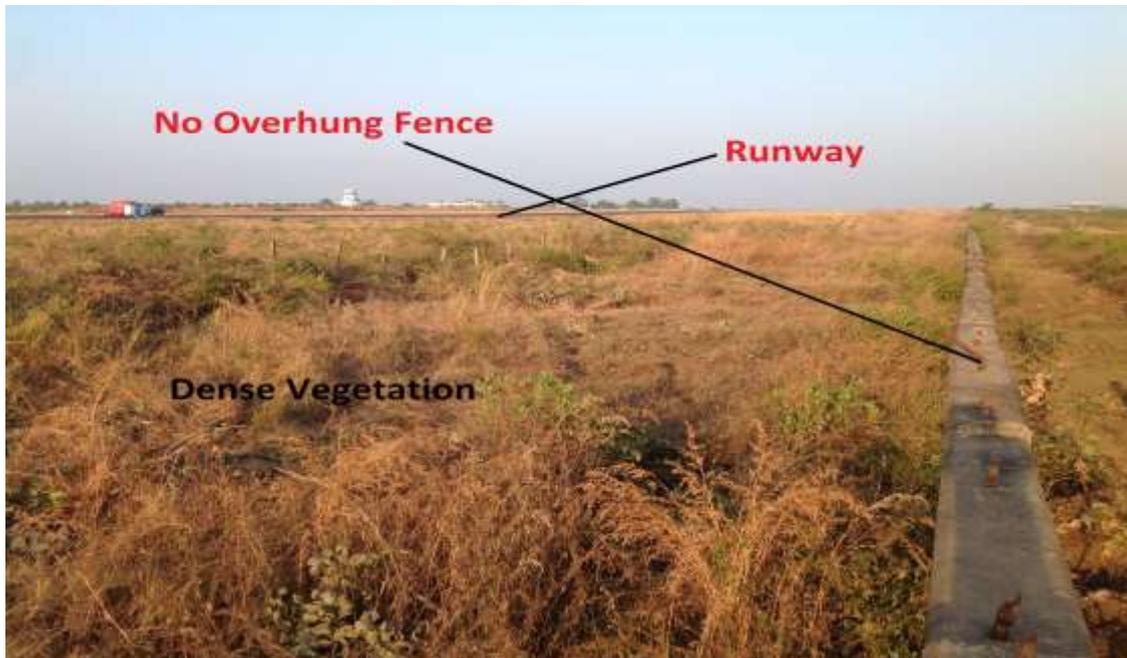
1. The runway surface condition was very poor with visible patches and uneven pavement. Loose gravel/ Foreign objects on the runway and taxiway.



2. The runway is not visible from the ATC tower during night operations due to presence of heavy vegetation.

Vegetation

1. Dense vegetation/shrubs/tall grass were observed between the runway and the perimeter wall.



No perimeter road available on either side of the airport boundary wall

2. Dense vegetation/shrubs/tall grass was also observed outside the perimeter wall and of approximately 12 feet high at certain places.

While carrying out onsite investigation jackals and dogs were found moving around the operational area.



1.11 Flight recorders:

The Cockpit Voice Recorder (CVR) and the Digital Flight Data Recorder (DFDR) were downloaded and the following information were obtained.

CVR:

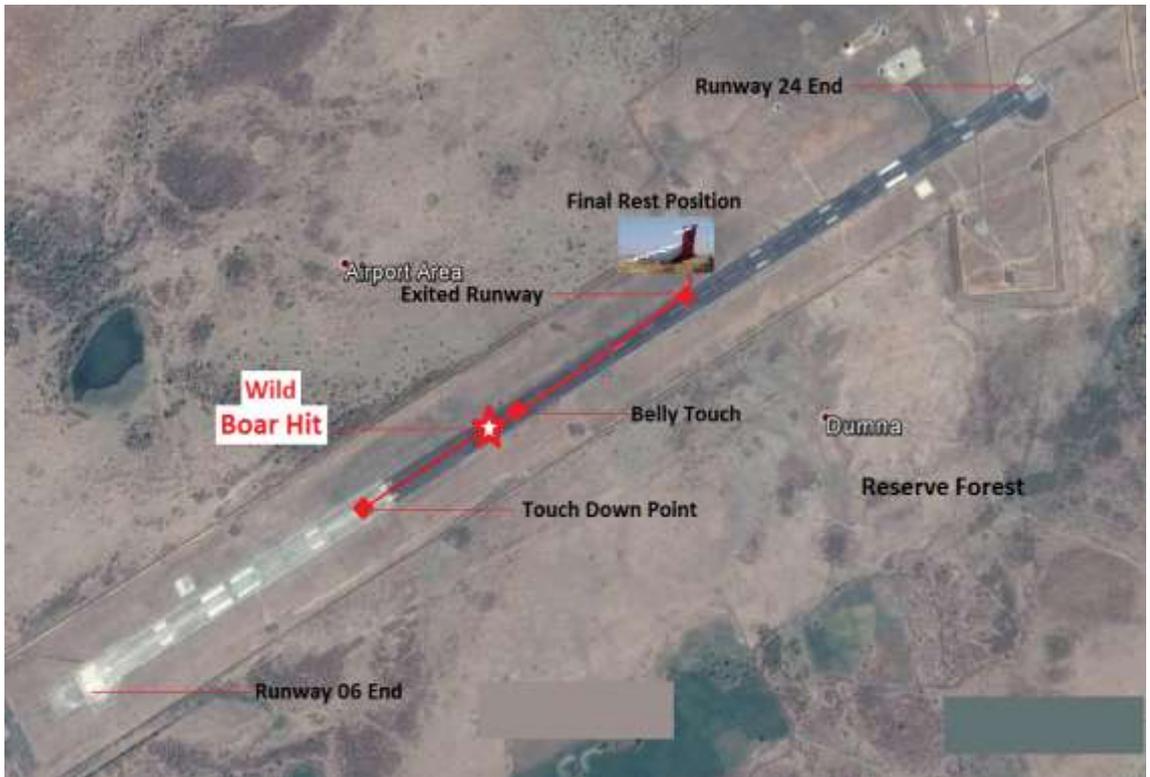
- The cockpit crew were not wearing the headsets.
- On short finals, the ATC cleared VT –SUC for landing.
- 4-5 seconds after touchdown, the loud thud sound was heard.
- After the aircraft came to final halt, the PIC confirmed with F/O for fire.
- Non- Standard evacuation call outs were given by the cockpit crew.
- The PIC called ATC for assistance and informed that there were 10-11 pigs on the runway and we hit the pigs, gone off the runway and have problems with the landing gear.

DFDR:

- The aircraft made a touch down at a speed of 126 knots heading 58° at 135045 UTC.
- At 135050 the roll attitude of the aircraft suddenly changes from 0.4° left to 6.6° left.
- At 135051 the roll attitude reaches a maximum value of 16° and subsequently Master caution "Prop RPM drop Engine L" comes ON.
- At 135059 the magnetic heading suddenly starts changing from 54° and reaches 6.6° in 07 seconds.
- At 135107 the aircraft stops with heading 6.6°.
- At 135112 the engines were shut down.

1.12 Wreckage and impact information.

During examination of the wreckage at the accident site, it was observed that the aircraft had sustained substantial damage after the accident. The aircraft exited the runway on the left and was resting on the soft ground in a banked condition on its belly and left wing tip.



As per the evidences collected at the accident site, the aircraft made touch down at a distance of 595 meters from the runway 06 end. After about 254 meters of landing roll the left main landing gear of the aircraft hit the wild boars on runway. Due impact with the boars the left main landing gear collapsed. Continuous marks of propeller blade strike were observed on the

runway surface at about 300 meters from touch down point. The damaged left main landing gear tyre was found on the runway.



Subsequently the aircraft belly came in contact with the runway surface and belly scraping marks were observed on runway for about 168 meters. All the five propeller blades were sheared off from the root attachment. The damaged propeller blades were found on runway and on the basic strip.



Damaged Propeller on the runway and shoulder area



Left Main Tyre

Thereafter the nose landing gear of the aircraft collapsed and the aircraft nose hit the runway surface at about 320 meters from touch down point. Engine spinner cowling was found at 960 meters from runway 06 end and 16 meters left of runway centerline. The engine spinner cover was found at 971 meters from runway 06 end and 10.36 meters left of runway centerline. Marks of left Wing tip hitting the runway surface were observed at 1063 meters from

runway 06 end. The aircraft thereafter overrun the runway edge lights and veered to the left on the soft ground and stopped just beside the runway edge. All the damaged aircraft parts were either recovered from the runway or were confined to the main wreckage. There was no disintegration of any part of the aircraft in air.

1.13 Medical and pathological Information:

Both the pilots had undergone preflight medical check prior to the first flight and the same was negative.

1.14 Fire:

There was no fire after the accident.

1.15 Survival aspects:

The accident was survivable.

1.16 Tests and research:

Nil

1.17 Organizational and management information:

1.17.1 Spice Jet

M/s Spice jet Ltd. is a scheduled airline with a fleet of 29 Boeing 737-800 and 06 B737-900 (ER) aircraft and 17 Bombardier Q-400 aircraft operating flights on domestic and international sectors. The Airlines Head Quarter is located at New Delhi. The Air operator permit of the Airlines is valid till 30/06/2018. The Company is headed by Chief Executive Officer assisted by a team of professional of various departments. The Flight Safety Department is headed by Chief of Flight Safety approved by DGCA. The Chief of Safety is senior management official who reports directly to the CEO.

M/s Spice jet has a full established Operations training facility for the pilots. The training facility for both Boeing pilots and Q-400 pilots is setup at Delhi. The training facilities are headed by the senior vice president Operations who reports to Chairman directly. The Engineering training facility is established at Delhi for B737 aircraft and Hyderabad for Q-400 aircrafts.

1.17.2 Airports Authority of India

The Government of India passed the international Airport Authority Act in 1971, which created the International Airports Authority of India which acted as, in charge for planning, managing, and developing India's four international airports. Another authority, the National Airport Authority was created in 1986 to take over the management of India's domestic airports, and develop and operate them on corporate principles. The National Airports Authority and the International Airports Authority of India were merged in 1995 under the single Airports Authority of India (AAI). The function of AAI are managing and developing civil aviation infrastructure, managing Indian airspace, and providing en route navigation facilities to aircraft flying in Indian airspace including

1. Design, Development, Operation and Maintenance of international and domestic airports and civil enclaves.
2. Control and management of the Indian airspace extending beyond the territorial limits of the country, as accepted by ICAO.
3. Construction, and Modification and Management of passenger terminals.
4. Development and management of cargo terminals at international and domestic airports.
5. Provision of passenger facilities and information system at the passenger terminals at airports.
6. Expansion and strengthening of operation area, viz. Runways, Aprons, Taxiway etc.
7. Provision of visual aids.
8. Provision of Communication and Navigation aids viz. ILS, DVOR, DME, and Radar etc.

Safety oversight is a function through which effective implementation of the safety- related Standards and Recommended Practices (SARPs) contained in the Annexes to the Convention on International Civil Aviation and related ICAO documents is ensured. The goal is to ensure that operators and service providers maintain an acceptable level of safety in their operations. In order to fulfill the above requirement and those of the SMS, in AAI, each licensed aerodrome and aerodrome applying for Aerodrome license are required to develop their Safety Management System (SMS) Manual. This Manual is also required to include all local practice to improve and enhance Safety that are being practiced at aerodrome/location.

AAI has got a Directorate of Aviation Safety as a custodian of SMS and its function include the following:

- Detect the weaknesses in the function and the practices in the activities of all department of AAI which may affect the safety of the system(s).
- Implement effective safety programs in all areas of operations and passenger facilities with a view to provide safe environment for aircraft operations and passengers at all AAI airports.
- Carry out annual audit of all AAI airports, civil enclaves and other facilities with the objective of identifying operational and system deficiencies, hazards and trends at ground level.

1.18 Additional Information:

1.18.1 ICAO Annexure 14 Volume 1 chapter 9 (Wild Life)

The relevant extract regarding the presence of wildlife from the above Annex in the aerodrome vicinity and actions required are as follows:

Note: The presence of wildlife (birds and animals) on and in the aerodrome vicinity poses a serious threat to aircraft operational safety.

- Para 9.4.1
The wildlife strike hazard on, or in the vicinity of, an aerodrome shall be assessed through:
 - a) The establishment of a national procedure for recording and reporting wildlife strikes to aircraft;
 - b) The collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operation; and
 - c) An ongoing evaluation of the wildlife hazard by competent personnel.

- Para 9.4.2
Wildlife strike reports shall be collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

- Para 9.4.3
Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

- Para 9.4.4
The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

- Para 9.4.5
Recommendation- States should give due consideration to aviation safety concerns related to land developing in the vicinity of the aerodrome that may attract wildlife.

1.18.2 ICAO Annexure 14 Volume 1 chapter 9- (fencing)

- Para 9.10.1

A fence or other suitable barrier shall be provided on an aerodrome to prevent the entrance to the movement area of animals large enough to be a hazard to aircraft.

- Para 9.10.2

A fence or other suitable barrier shall be provided on an aerodrome to deter the inadvertent or premeditated access of an unauthorized person onto a non-public area of the aerodrome.

Note 1: This is intended to include the barring of sewers, ducts, tunnels, etc., where necessary to prevent access.

Note 2: Special measures may be required to prevent the access of an unauthorized person to runways or taxiways which overpass public roads.

- Para 9.10.3

Suitable means of protection shall be provided to deter the inadvertent or premeditated access of unauthorized persons into ground installations and facilities essential for the safety of civil aviation located off the aerodrome.

Note: The requirement of ICAO Annexure 14 Volume 1 are incorporated verbatim in Civil Aviation Requirement Section 4 Series 'B' Part 1.

1.18.3 ATC Procedures for Inspections.

As per the procedures laid down in the AAI Ops Circular No. 05 of 2011, inspection of Runway, Taxiways, Aprons and fencing etc. has to be a regular affair. As per Para 4.5 which states that the general inspection of operational area should be carried out every day and attention shall be paid to following points (Only salient point are mentioned):

- Operational wall/ fencing, if any breach is observed it must be repaired forthwith.

- Vegetation check- If excessive growth is obscuring lights, signs, markers etc. the same should be urgently removed by the engineering staff- Civil Wing.
- Obstacles which are authorized should be checked for proper marking and lightings and unauthorized obstacles must be reported to the in-charge of the Aerodrome for prompt action.

Few of the salient procedures for reporting of unserviceability laid down in the circular are:

- All the un-service-abilities noticed during an inspection shall be reported to the control tower. The tower Officer in turn shall bring the same to the notice of the in-charge of the aerodrome for appropriate action.
- Inspection of entire operational area should be carried by the duty officer-tower/In-charge of the aerodrome along with JE/AE at mutually agreed time.
- Routine runway inspection of the operational area may be carried out a Metro Airports by the GFS official and at non-metro airports, runway inspection may be carried out by Tower Officials/ Aerodrome Assistants/ Fire Foreman i.e. the trained manpower for airside management is provided.

Frequency of Inspection

Few of the salient points as per the circular are as follows:

- Inspection of Movement area should be regular and as frequent as possible.
- For runways where ATC watch hours are from dawn to dusk or H-24, at least four inspections as given below shall be carried out.
 - a) Dawn
 - b) Morning
 - c) Afternoon and
 - d) Dusk.

1.18.4 AERODROME INSPECTION

PURPOSE

The aim of these procedures is to insure that the movement area, related facilities and the obstacle limitation surfaces (OLS) or regularly inspected to ensure DGCA standards are maintained.

RESPONSIBILITIES.

- a) The airport Director has over all responsibilities for ensuring that procedures are established and resources are provided for airport inspection in order to ensure that DGCA standards are met.
- b) IN CHARGE (ATC) is responsible for carrying out monthly inspection of Airport facilities and OLS for the purpose of quality control. He is also responsible that annual safety inspection is coordinated and action taken report is submitted to Director of Air Safety, Mumbai/ DGCA New Delhi.
- c) Duty officer Control Tower has responsibilities for ensuring that daily serviceability inspections are carried out satisfactorily and as a result of these inspections that appropriate action / reporting take place. At Jabalpur inspection are carried out as laid down DARA circulars 01/1991. Records are maintained with IN CHARGE (ATC). He also responsible for initiating NOTAM action when required.
- d) OIC (Engineering Civil) is responsible for all civil engineering works and projects as well as maintenance. He shall ensure that arrangements exist for urgent civil repairs work to the operational facilities round the clock. He is also responsible for normal repair and maintenance of pavements, marking of runway, taxi ways, apron etc., He is also responsible to join the joint inspections of operational area to assist ATC operations and attend the immediate civil urgencies reported like gates, boundary wall clearing of bushes, fence, drainage roads are damaged to pavements and carry out preventive maintenance as required after monthly technical inspection.
- e) OIC (Engineering Elect) has the responsibilities towards all electrical works, their inspection and maintenance. He is responsible for ensuring that inspections of airport lighting are carried out in accordance with inspection schedules detailed in Section 4.6 (Visual aids – electrical system and aerodrome lighting) of this manual. He is to ensure that joint inspections are also carried out along with ATC officers. He is required to ensure essential power supply for runway/ taxi way, lights, PAPI, Apron and floods lights, ATS units, aerodrome beacon, security arrangements, minimum lighting in the terminal building.

NOTE: Standby power supply is available for all essential airport lighting at Jabalpur Airport. The switch over time as laid down in AIP India is less than 15 seconds.

LEGISLATION, STANDARD AND TECHNICAL REFERENCES.

- a) Aircraft manual India Part I & II requires the Airport Director Jabalpur Airport to maintain airport facilities in a safe physical condition and to monitor OLS for the presence of obstacles.
- b) The relevant DGCA standards are sent out in AIC No. 05/1989 and 04/2000. Runway inspection frequencies are laid down in DARA circular No. 01/1991.
- c) The equivalent international standards are recommended practices are to be found in ICAO Annex 14.

SERVICEABILITY INSPECTION.

Inspection officers are engaged during watch hours of aerodrome to ensure continuous monitoring of airport serviceability. The following officers are delegated for this purpose.

- a) Duty officer control tower.
- b) In charge (ATC)
- c) Terminal Manager
- d) Fire staff

LOG BOOK AND CHECK LISTS

In addition to important records of ATC operation of concerned units the inspection and sufficient occurrences are recorded by unit duty officers. For example: a) tower officer's log book. b) Terminal managers log book. c) Fire station log book, etc.

INSPECTION PROCEDURE AND FREQUENCY

- a) Detailed movement area inspections are carried out two times in a day. First at the time of opening watch, seconds at the time of closing watch. Detailed movement area inspection are also carried after earthquake, heavy rainfall,

strong winds, thunder storms or other significant phenomena which are expected to affect the serviceability of the airport facilities.

- b) Movement area inspections are also carried out when requested by ATC, after reported bird strike on the runway and at the request of pilots or airline representatives.
- c) Quick runway inspection will be carried out when required. The person carrying out quick runway inspection gives a report on walkie talkie to control tower. In respect of inspection carried out by fire staff, check list will be maintained in the fire station. In respect of inspection carried out by ATC officers check lists are maintained in Control Tower. An entry will be made in the runway inspection register kept in control tower whenever a runway inspection is made.

REPORTING OF UNSERVICEABILITIES.

Inspecting officers who detect unserviceability on the movement area will take the following action in sequence:

- a) Inspect the facility
- b) Report the unserviceability to control tower or to the other appropriate personnel such as OIC (Civil), OIC (Elect) or OIC (CNS).
- c) Mark the unserviceable portion of the pavement or area in accordance with the standard Annex 14 Chapter VII. Allowance shall be made for the effect of jet blast, RESA and obstacles clearance in displaced threshold calculation consideration.
- d) Make arrangement if it is possible to get it repaired immediately. As laid down in Part 4.7 of the manual.
- e) Review and report to the ATC of the result so achieved.

1.19 Useful or effective investigation techniques:

NIL

2. ANALYSIS

2.1 Serviceability of the aircraft:

Aircraft VT-SUC (MSN 4377) had been manufactured in year 2011. The aircraft was registered with DGCA under the ownership of M/s Maple Leaf Financing Ltd. The aircraft is registered under category 'A' and the certificate of registration No. 4247. On the day of accident, the aircraft VT – SUC had logged 11928.05 Airframe hours and 11214 cycles.

The Certificate of Airworthiness Number 6356 under "Normal category" subdivision Passenger / Mail / Goods was issued by DGCA on 02/09/2011. The specified minimum operating crew is TWO and the maximum all up weight is 29257 Kgs. At the time of accident the Certificate of Airworthiness was valid.

The Aircraft was holding a valid Aero Mobile License No. A-010/035-RLO (NR) at the time of accident. This Aircraft was operated under Scheduled Operator's Permit No S-16 which was valid up to 16/05/2018 as on 4/12/2015 the aircraft had logged 11928:05 Airframe hours and 11214 cycles.

The Bombardier DHC – 8 - 402 aircraft and Engines are being maintained under continuous maintenance as per maintenance programme consisting of calendar period based maintenance and Flying Hours / Cycles based maintenance as per maintenance programme approved by Regional Airworthiness office, Delhi.

Accordingly, the last major inspection Base check-2 (12000 FH check) carried out at 11084 cycles on 12/9/2015. Subsequently all lower inspection (Preflight checks, 600 FH Inspections) were carried out as and due before the accident.

The aircraft was last weighed on 27/7/2011 at Canada 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 17550.81 Kgs. Maximum payload with fuel tanks full is 5783.10 Kgs. Empty weight CG is 10.01 meters aft of datum. There has not been any major modification affecting weight & balance since last weighing,

hence the next weighing was due on 20/07/2016. Prior to the accident flight the weight and balance of the aircraft was well within the operating limits.

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

From the above it is inferred that the serviceability of the aircraft is not a factor to the accident.

2.2 Weather:

Prior to take off from Mumbai, the weather was fine. The aircraft took off from Mumbai at around 1200 UTC and weather reported for Jabalpur was within the crew operating minima. The weather reported at Jabalpur was fine and visibility reported was 5000 meters with haze.

From the foregoing, it is inferred that though the weather conditions were within the operating minima of the PIC and is not the contributory factor to the accident.

2.3 Aerodrome:

Jabalpur Aerodrome is the licensed aerodrome and license was renewed on 4th July 2015 which was valid till 3rd July 2017. The accident occurred on 4th December 2015 wherein a wild boar hit the main landing gear of an aircraft during landing roll. The investigating team in addition to the wreckage investigation also carried out the aerodrome inspection. During aerodrome inspection it was observed that number of breaches in the perimeter wall were observed all throughout the periphery. There were several breaches of 18 inch (diameter) open circular drainage pipes and 18"x 18" square opening in the perimeter wall. There were several openings at the bottom of the perimeter walls of 15x20 inch. The openings were sufficient for the wild animals to enter the aerodrome area at any time of the day. Further the height of the perimeter wall was found to be as low as 5 feet at certain places. This is also a hazard from a security point of view to the aerodrome.

There was no perimeter road available to carry out the perimeter wall inspection on the regular basis. The Perimeter wall was highly inaccessible due to thick and heavy vegetation. The aerodrome operator had not undertaken any measures to remove this heavy vegetation so that the inspection of the perimeter wall could be carried out as per laid down procedure. The conditions were ideal for wild animals to enter the aerodrome premises through the breaches and hide in the thick vegetation.

The aerodrome operator did not supervise the operation at Jabalpur aerodrome on following accounts:

1. The airport Director did not ensure that the established procedures and resources required for airport inspection of Jabalpur in accordance to DGCA standards.
2. The inspections carried out by the ATC IN CHARGE for the runway and the perimeter road were not in accordance with laid down procedures.
3. Perfunctory inspections carried out by the ATC in charge and the OIC (civil) has no serious observations recorded in their documents which are contradicting to the investigation committee findings.
4. OIC (Engineering Civil) did not carry out preventive maintenance as required after monthly technical inspection which includes immediate civil urgencies like gates, boundary wall, clearing of bushes, fence drainage roads are damaged to pavements.
5. The runway is not visible from the ATC tower at nights due to dense vegetation/shrubs/tall grass between the runway and the perimeter wall.

From the above it is inferred that non-standard practices and non-adherence to the standard procedures adopted by the aerodrome operator is the factor to the accident.

2.4 Circumstances leading to the Accident :

Spice jet flight SG – 1087 was cleared to land by ATC at Jabalpur at around 1347 UTC. The aircraft touched down at 1352 UTC. Immediately after touchdown the PIC noticed number of wild boars on the center of the runway. Before the PIC could react after touched down the left landing gear hit one of the wild boars. The aircraft felt a big jolt and thereafter the left landing gear collapsed. The pilot tried to maintain the directional control, keeping the aircraft on the runway. Thereafter the propellers came into contact with ground and got broken. The aircraft dragged on its belly for around 182 feet and during the process, the nose landing gear also collapsed. As the aircraft speed reduced the aircraft became uncontrollable, started veering to the left of the center line. The aircraft subsequently exited the runway onto the left side and came to the final halt position.

3. CONCLUSIONS:

3.1 Findings:

- a) The Certificate of Airworthiness and the Certificate of Registration of the aircraft was valid on the date of accident.
- b) The certificate of flight release was valid on the day of accident.
- 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) There was no snag reported prior to the accident flight.
- f) The aircraft took off from Mumbai at around 1200 UTC and the visibility reported for Jabalpur was 5 km.
- g) The aircraft came in contact with Jabalpur ATC and was cleared to land.
- h) The aircraft made a touched down at a speed of 126 knots with magnetic heading 58 degree.
- i) During landing roll, after about 5 to 6 seconds of touchdown the LH main landing gear hit wild boars on runway and subsequently the LH main landing gear collapsed.

- j) After the left landing gear collapsed the left propeller blades hit the runway surface and sheared off from the root attachment.
- k) The nose wheel tyre failed under over load conditions and the nose landing gear collapsed and the aircraft belly came in contact with the runway surface.
- l) Aircraft veered toward the left side of the runway and in the process overrun the runway edge light.
- m) The aircraft exited the runway on the left side on Soft Ground and came to the final stop.
- n) The cockpit crew switched off the engines and the electrical power supply and cockpit door.
- o) The cockpit crew gave non-standard evacuation call outs.
- p) The ATC had alerted the fire services and the fire vehicles reached the aircraft after it came to final halt position.
- q) There was no injury to any of the occupants on board the aircraft.
- r) There was no post-accident fire.
- s) The cockpit crew did not wear headsets during the flight.
- t) During, aerodrome inspection there were several breaches of 18 inch (diameter) open circular drainage pipes and 18"x 18" square opening in the perimeter wall.
- u) There were several openings of 15x20 inch at the bottom of the perimeter walls.
- v) Further the height of the perimeter wall was found to be as low as 5 feet at certain places.
- w) There was no perimeter road available to carry out the perimeter wall inspection on the regular basis. The Perimeter wall was inaccessible due to thick and heavy vegetation.

3.2 Probable cause of the accident:

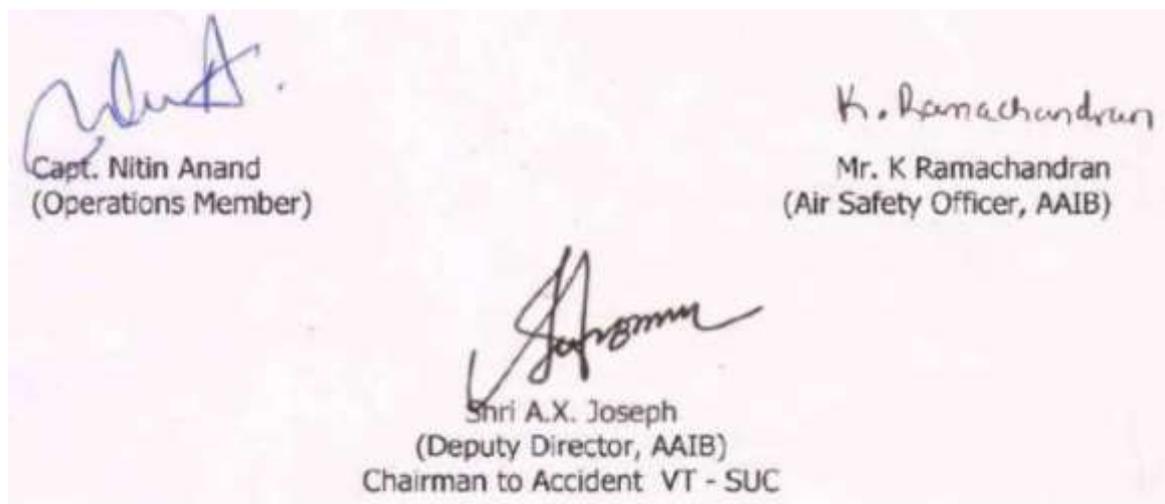
The aircraft during its landing roll had a wild life (Wild Boars) strike on the runway, resulting in collapse of left main landing gear and subsequently the aircraft veered to the left of the runway.

Contributory factor

The presence of wild life in the operational area and the runway was due to several breaches in the boundary wall.

4. SAFETY RECOMMENDATIONS

1. DGCA may reiterate instructions to all aerodrome operators for strict compliance of CAR section 4 Series B Part I at the time of issue/ renewal of aerodrome license.



Capt. Nitin Anand
(Operations Member)

Mr. K Ramachandran
(Air Safety Officer, AAIB)

Shri A.X. Joseph
(Deputy Director, AAIB)
Chairman to Accident VT - SUC

Date: 27.07.2017

Place: New Delhi