



**FINAL INVESTIGATION REPORT
OF
ACCIDENT TO SUPREME AIR
CESSNA 208B AIRCRAFT VT-UDN
AT LALGARH ON 07/08/2018**

**AIRCRAFT ACCIDENT INVESTIGATION BUREAU
MINISTRY OF CIVIL AVIATION
GOVERNMENT OF INDIA**

FOREWORD

This document has been prepared based upon the evidences collected during the investigation and opinion obtained from the experts. The investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under Rule 11 of Aircraft (Investigation of Accidents and Incidents), Rules 2017 of India. The investigation is conducted not to apportion blame or to assess individual or collective responsibility. The sole objective is to draw lessons from this accident which may help in preventing such incidents in future.

INDEX

1.0	FACTUAL INFORMATION	01
1.1	History of Flight	01
1.2	Injuries to Persons	02
1.3	Damage to Aircraft	02
1.4	Other damage	04
1.5	Personnel information	04
1.5.1	Pilot in Command (Pilot Flying)	04
1.5.2	Co-Pilot (Pilot Monitoring)	05
1.6	Aircraft information	06
1.7	Meteorological information	09
1.8	Aids to Navigation	09
1.9	Communication	09
1.10	Aerodrome information	09
1.11	Flight recorders	10
1.12	Wreckage and impact information	10
1.13	Medical and pathological Information	11
1.14	Fire	11
1.15	Survival aspects	11
1.16	Tests and research	11
1.17	Organizational and management information	11
1.18	Additional information	12
1.18.1	Maintenance of the Air Strip and its extension	12
1.18.2	Brake Assembly	13
1.18.3	Service Bulletin CAB-32-01	13
1.19	Useful or effective investigation Technique	14
2.0	ANALYSIS	15
2.1	General	15
2.2	Brake effectiveness and service bulletin	15
2.3	Airport and RESA	16
2.4	Circumstances leading to the incident	17
3.0	CONCLUSIONS	18
3.1	Findings	18
3.2	Cause	19
4.0	RECOMMENDATIONS	19

LIST OF ABBREVIATIONS

AGL	Above Ground Level
ASDA	Accelerated Stopped Distance Available
ATC	Air Traffic Control
BETA mode	The engine operational mode in which propeller blade pitch is controlled by the power lever.
CAR	Civil Aviation Requirements
CPL	Commercial Pilot License
FRTOL	Flight Radio Telephone Operators Licence
GPS	Global Position System
LDA	Landing Distance Available
MRO	Maintenance and Repair Organization
NSOP	Non Schedule Operators Permit
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
POH	Pilot Operating Handbook
PROP	Propeller
PWD	Public Works Department
RESA	Runway and Safety Area
RGB	Reduction Gear Box
RPM	Rotation per Minute
SB	Service Bulletin

FINAL INVESTIGATION REPORT OF ACCIDENT TO SUPREME AIR CESSNA 208B AIRCRAFT VT-UDN AT LALGARH ON 07/08/2018

1.0 FACTUAL INFORMATION

1.1 History of Flight

On 07/08/2018 Cessna 208B aircraft while operating flight from Jaipur to Lalgarh was involved in an accident during landing at Lalgarh. The flight was under the command of a CPL holder (PF) with another CPL holder acting as Pilot Monitoring (PM). There were 9 persons on board including two flight crew members. The aircraft after landing could not stop on the runway and hit the boundary wall at the end of the runway.

The flights from and to Lalgarh airstrip were being operated by an NSOP holder under the intrastate air services of the Rajasthan Government. On the day of accident both flight crew had reported for undertaking the flight and had undergone pre flight medical which was satisfactory. All the pre-flight checks including effectiveness of brakes during taxi at a speed of five to seven knots were found satisfactory. The aircraft was cleared direct to BUTOP, and thereafter direct to Lalgarh.

The aircraft took off from Jaipur and the flight till start of descent into Lalgarh was uneventful. The aircraft started descent when it was at a distance of about 45 nm from Lalgarh. As per the crew, at 7 nm from Lalgarh and at a height of 1500 ft AGL, the runway was visible to them. During descent, progressively flaps 10, 20 and 30 were selected at a distance of 6 nm, 5 nm and 3.5 nm from Lalgarh respectively.

During final approach and landing, when the aircraft was at a height of 200 ft, tailwind of 4 knots was observed as seen on GPS installed in the aircraft. As per the flight crew, when the aircraft was at the short finals, all of a sudden they saw a flock of birds crossing the runway. The flight crew therefore stopped descent and maintained the altitude which in turn delayed the touchdown. The aircraft touched down at around 2300 ft from the beginning of the runway leaving around

1900 ft of runway for landing roll till final stop. The crew could not stop the aircraft on runway. It overshot and hit the perimeter wall just at the end of runway resulting in substantial damages.

The crew stated that after touchdown they have applied brakes but found them sluggish. As the brakes were not effective they tried to take a U turn in order to avoid hitting the wall. There was no fire during or after the accident. There was no injury to any of the occupants.

1.2 Injuries to Persons

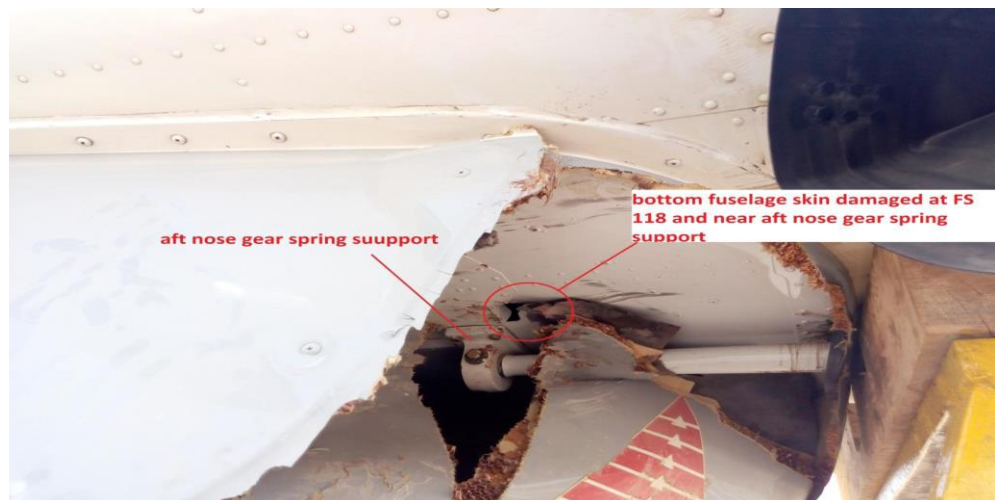
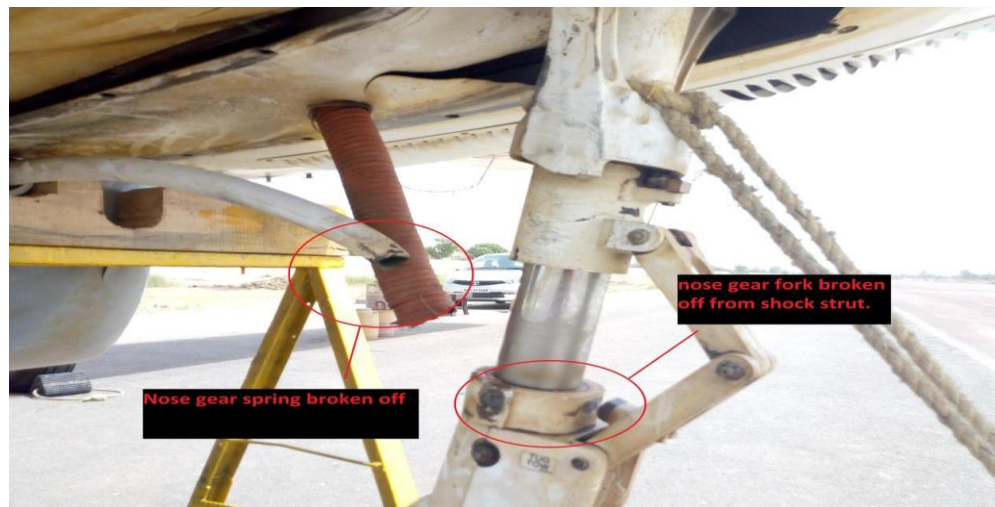
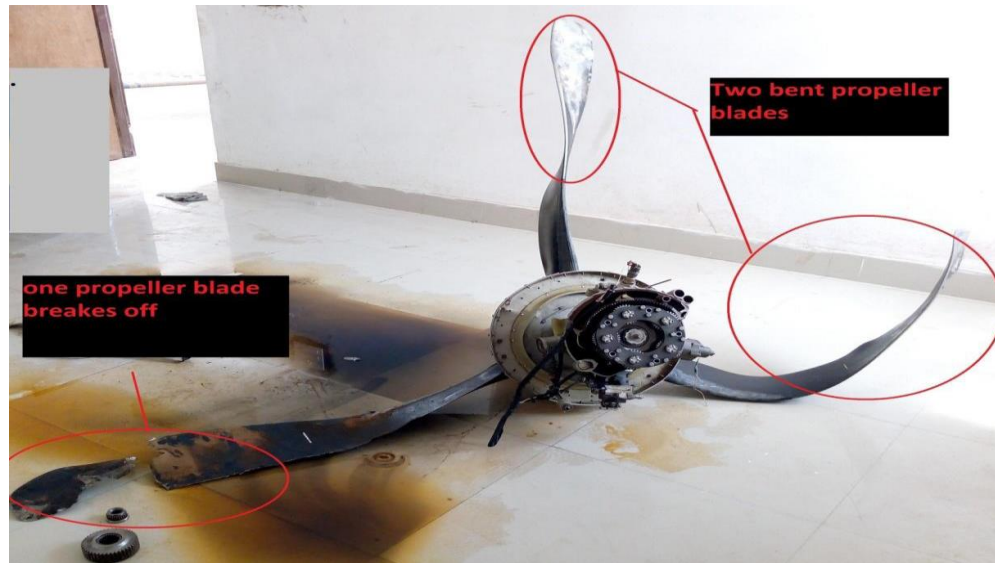
INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR / NONE	Nil / 02	Nil / 07	Nil

1.3 Damage to Aircraft

The aircraft suffered substantial damages as given below:

- ✚ Aircraft propeller and reduction gearbox section sheared off from the engine at reduction gearbox area along with all the RGB mounted accessories (propeller governor, over speed governor, torque limiter, RGB chip detector etc...).
- ✚ Secondary exhaust duct assembly was damaged due to collision with tree stem.
- ✚ All engine drains at bottom lower cowls were damaged.
- ✚ LH and RH lower cowl panels were damaged.
- ✚ Two Propeller blades got bent and one had broken due impact with the wall structure.
- ✚ RH nose cap assembly was damaged.
- ✚ Nose gear spring broke off from the middle. Nose gear fork broke off from the shock strut.

- ✚ Front cargo pod area was damaged due to collision with tree stem.
- ✚ Bottom fuselage skin was damaged at FS118 near aft nose gear support.



1.4 Other damage

Boundary wall of the airport was broken.



1.5 Personnel Information

1.5.1 Pilot-in-Command (Pilot Flying)

Age	33 years
License	CPL
Date of Issue	29.05.2008
Valid up to	05.12.2018
Class	Land
Category	Aeroplane, Multi engine
Endorsement as PIC	C172, C 208B
Date of Med. Exam	25.02.2018
Med. Exam valid upto	08.03.2019
Instrument Rating	Valid
Date of FRTOL Issue and Validity	29.05.2008, valid
Total flying experience	1444 hrs.
Total Experience on Type	1205 hrs.
Experience as PIC on type	676:15 hrs.

Last flown on Type	06.08.2018
Total flying experience during last 180 days	525:20 hrs.
Total flying experience during last 90 days	239:55 hrs.
Total flying experience during last 30 days	55:50 hrs.
Total flying experience during last 07 Days	12:40 hrs.
Rest period before the flight	02:10 hrs.

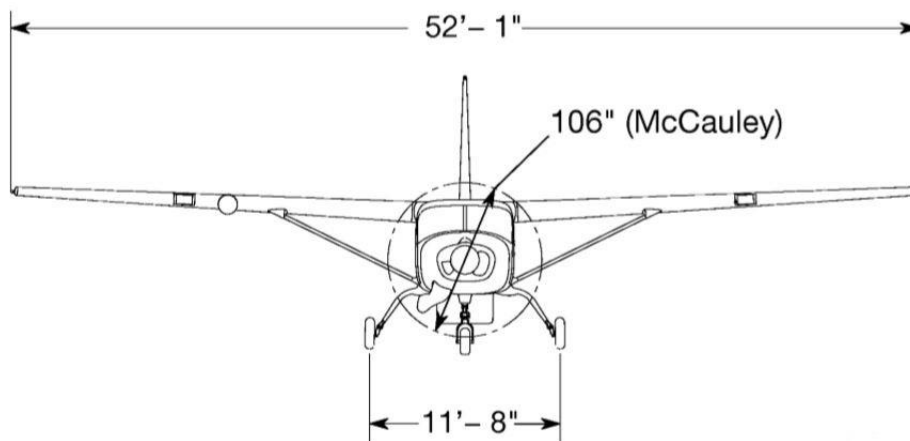
1.5.2 Co-Pilot (Pilot Monitoring)

Age	25 years
License	CPL holder
Date of Issue	31.08.2016
Valid up to	30.08.2021
Class	Single Engine Land
Date of Med. Exam	21-11-2017
Med. Exam valid upto	20-11-2018
Instrument Rating	C – 208B 28/03/18
Date of RTR Issue and Valid upto	01/01/2016, valid
Date of FRTOL Issue and Validity	10/05/2016, valid
FRTOL License.	Valid
Total flying experience	309 hrs
Total Experience on Type	28 hrs
Last flown on Type	03/08/2018
Total flying experience during last 01 year	38 hrs
Total flying experience during last 180 days	38 hrs
Total flying experience during last 90 days	28 hrs
Total flying experience during last 30 days	10 hrs
Total flying experience during last 07 Days	3 hrs

1.6 Aircraft Information

The aircraft is all-metal, high-wing, single-engine aircraft equipped with tricycle landing gear. The construction of the fuselage is a conventional form with sheet metal bulkhead, stringer, and semi monocoque skin design. Major items of structure are the front and rear carry-through spars to which the wings are attached, a bulkhead and forgings for main landing gear attachment and a bulkhead with attaching plates at its base for the strut-to-fuselage attachment of the wing struts.

The flight control system consists of conventional aileron, elevator and rudder control surfaces and a pair of spoilers mounted above the outboard ends of the flaps. The control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons, spoilers and elevator and rudder/ brake pedals for the rudder. The major dimensions are as follows:

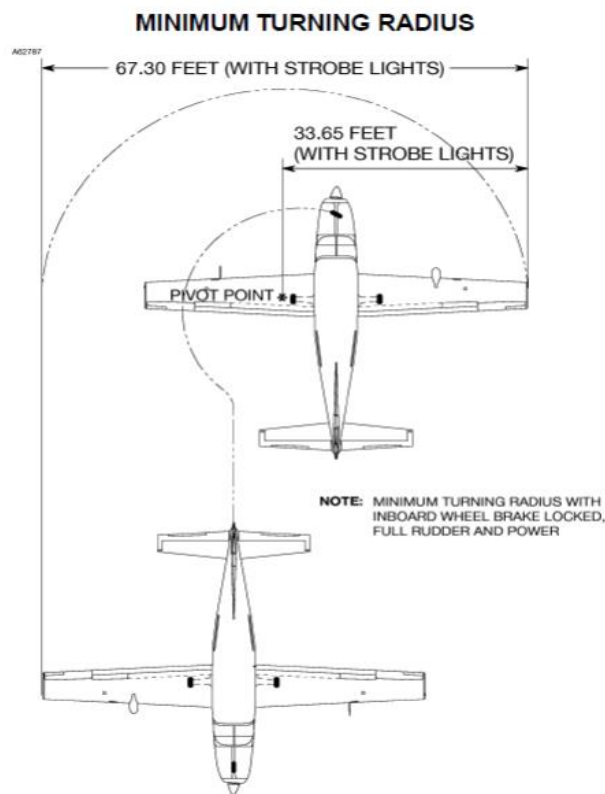


Brake System

The aircraft has a single-disc, hydraulically-actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (copilot's) set of rudder pedals, which are interconnected.

Some of the symptoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, bring the pedals up and then re-apply the brakes with heavy pressure.

The minimum turning radius with inboard wheel locked applying full rudder and power is as given below:



The aircraft MSN is 208B 2420. Four days prior to the accident i.e on 5.8.2018, schedule maintenance was carried out. No snag was reported thereafter either by engineering or by any of the flight crew.

NORMAL PROCEDURES (Aircraft Operation)

As a normal practice, the flight crew should carry out complete pre flight planning to minimise possible emergencies which may occur during the flight. Further he

should also be aware of hazardous conditions existing at the destination, in addition to the capabilities and limitations of the aircraft.

As per the Pilot's Operating Handbook (POH) of the aircraft, normal landing approaches can be made with power-on or idle power with any flap setting desired and the PROP RPM Lever set at 1900. Use of FULL flaps is normally preferred to minimize touchdown speed. For a given flap setting, surface winds and turbulence are usually the primary factors in determining the most comfortable approach speed.

Actual touchdown should be made with idle power and on the main wheels first, just slightly above stall speed. The nose wheel is then gently lowered on to the runway, the POWER Lever repositioned to the BETA range, and brakes applied as required.

Beta Range, in a turboprop engine, is the range of power lever positions between flight idle and maximum reverse. It is used for ground operations inclusive of slowing the aircraft after landing. Below flight idle, the power levers control the blade pitch directly. With the power lever(s) in the ground idle position, the blade pitch is such that the propeller produces its minimum level of thrust. By moving the power lever from the ground idle position towards maximum reverse, the propeller blades go into reverse pitch which directs the airflow from the propeller forward. The landing and approach speeds as per POH are as follows:

APPROACH	
Normal Approach (Flaps Up)	100-115 knots
Normal Approach (Flaps Full)	75-85 knots
NORMAL LANDING	
Wing Flaps Handle	Full
Airspeed	75 – 85 knots
Touch down	Main Wheels First
Power Lever	Beta Range after Touchdown
Brakes	Apply

During landing use of Reverse Thrust reduces the landing roll by 10 %.

1.7 Meteorological Information

There is no Meteorological observatory or Met office at the airport. The flight crew themselves take the weather from the internet and reassess the same prior to approach and landing at the airport. On the day of accident, the weather was fine with tailwinds of 4 knots at the time of landing.

1.8 Aids to Navigation

There are no ground aids available at landing airport.

1.9 Communications

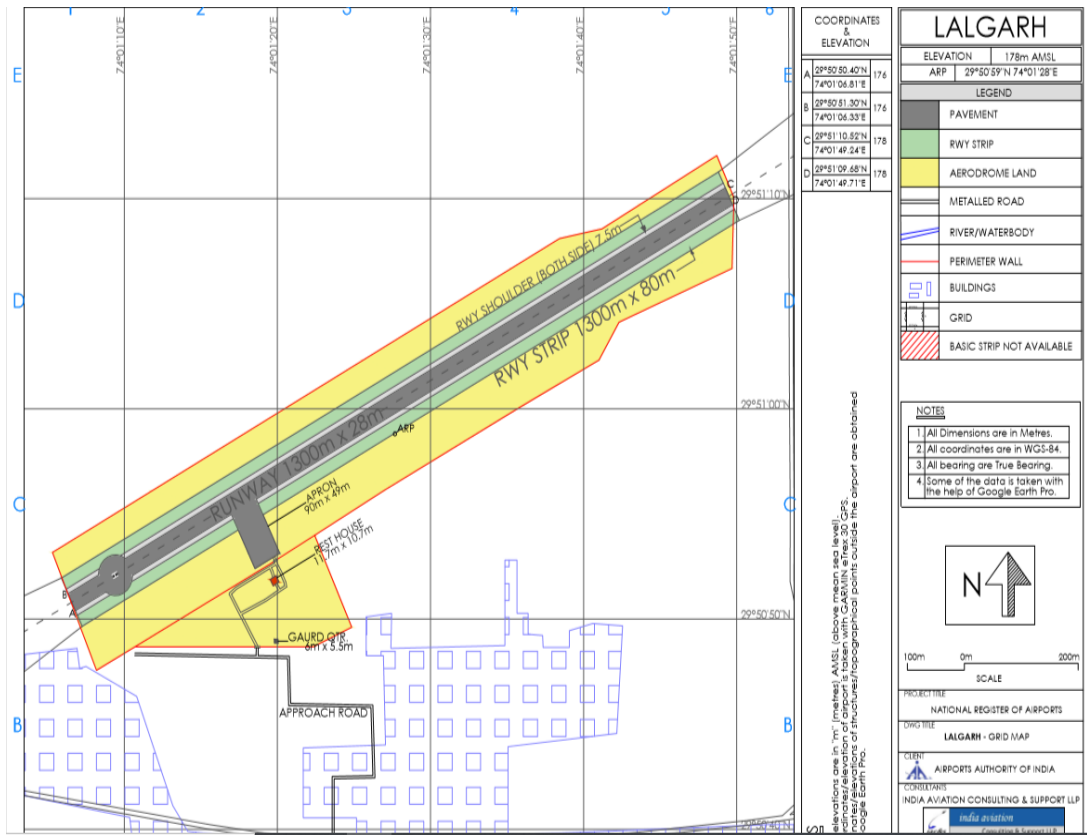
There was two way communications whenever the aircraft was in contact with the ATC/ ground.

1.10 Aerodrome Information

The airport is owned and operated by Government of Rajasthan. Following information was taken from National Register of Airports. The airport reference points are 29°50'59" N, 74°01'28" E and an altitude of 178 m. There is no Air Traffic Control. For the purposes of rescue and fire fighting City Fire Service are used.

S.No.	Runway	Dimensions
1.	Runway Orientation	062°/ 242°
2.	Runway Designation /Dimension	06 / 24 1300 M X 28 M
3.	Runway Slope	0.15%
4.	Runway Shoulders	7.5 M Available On Both Sides
5.	Location Of Threshold	Threshold Marked At Both Ends
6.	Stop way / Blast Pad	Not Available
7.	Turn Pads	Available Only On Runway 06
8.	RESA	Not Available

S. No.	Runway	TORA	TODA	ASDA	LDA
1.	RWY 06	1300 m	1300 m	1300 m	1300 m
2.	RWY 24	1300 m	1300 m	1300 m	1300 m



1.11 Flight Recorders

Neither fitted nor required.

1.12 Wreckage and Impact Information



*Tyres marks were not continuous throughout the path followed by the aircraft.

Photo taken from Goggle Maps

Insert
 Actual rest position of the aircraft

The aircraft during landing overshot the runway. As there is no RESA available, the nose portion of the aircraft hit the boundary wall of the aerodrome. The ground marks indicate that flight crew at the very last moment had tried to turn the aircraft.

1.13 Medical and Pathological Information

The crew was subjected to pre-flight medical examination before the flight at Jaipur. The medical report including breath analyzer test was satisfactory.

1.14 Fire

There was no fire after or during the accident.

1.15 Survival Aspects

The accident was survivable.

1.16 Tests and Research

NIL

1.17 Organizational and Management Information

The operator held a valid Non Schedule Operators Permit with the accident aircraft endorsed. The registered office of the operator was in Mumbai.

Maintenance of the aircraft was carried out by a Maintenance & Repair Organization (MRO) approved under CAR 145 by the DGCA.

The aircraft was operating Intra State Operations as approved by the Government of Rajasthan. The Lalgarh airport is owned and maintained by the State Government (Public Works Department (PWD)). Discussions were held with the authorities of PWD and it was given to understand that they do not have any experience or knowledge about the requirements of construction or maintenance of the Runway. Before according approval for flights under Intra

State operations, the State Government had requested the operator to intimate if any short comings are there at Lalgarh airport.

The operator carried out trial flights and had intimated to the State Government that

- a) Real time weather information, especially wind shear, cloud ceiling, visibility, rain are not available, which will hamper operations.
- b) Altimeter settings are not available which become quite risky for everyday operations.
- c) Aircraft has to be based overnight for most optimum operations, hence runway lights for night operations along with a navigation aid would be mandatory.

As per the letter of 11th July 2018, approval was given to ply Intra State Air Services after completing all necessary formalities and establishing required facilities.

1.18 Additional Information

1.18.1 Maintenance of the Air Strip and its Extension.

Discussion with the State authorities who were maintaining the airport including airstrip/ runway revealed that there was no expertise available with them as far as runway requirements are concerned. However, it was informed that runway extension work was planned by the State as shown below:



The authorities (PWD) supposed to be carrying out the above extension work were not aware of any safety requirements to be made available at the airport or around the airstrips. There was a water body on one side of the airstrip attracting bird activity.

1.18.2 Brake Assembly

The brakes are hydraulically operated and MIL- H-5606 hydraulic fluid is used. The brake system consists of a magnesium housing containing four pistons, an inlet port, bleeder port, torque plate, back plates, pressure plate, shims and anchor bolt. The brake assembly is held together with bolts, washers, and nuts.

Two brake master cylinders are installed, one for each brake. Master cylinders are located forward of the pilot's rudder pedals. Each brake master cylinder consists of a piston, ring, packing, spring and cylinder.

The brake assemblies were removed for bench check. Visual inspection was satisfactory. For the investigation purposes, both brakes were tested on bench under hydraulic pressure and were found to be working as designed.

1.18.3 Service Bulletin CAB-32-01

Cessna has issued Service Bulletin CAB-32-01 Revision 1 dated 14.03.2014 for the aircraft which was applicable for the accidented aircraft also. As per this SB, a brake return spring was to be installed to give additional brake return force.

The aircraft was imported into India. At the time of import, it had operated for approximately 1000 hours and had done 600 landings. The engine had done 500 cycles. The Indian operator was provided with the documents at that time and it is mentioned in the maintenance transaction record for the export of the aircraft dated. 16th May 2017 that,

“Completed Aircraft Records research. Verified all airworthiness directives are currently in compliance up through Bi-weekly 2017-10. All required inspections and life limited components researched and found to be current and in compliance. All modifications found to be properly documented in aircraft records.”

The above SB was to be accomplished within 18 months of issue and as such by the above statement in maintenance transaction record it is indicated that the modification was complied with. During investigation, it was found that the spring was not available on the aircraft, as shown in the photographs below:



1.19 Useful or Effective Investigation Techniques

NIL

2. Analysis

2.1 General

- ✚ Both operating crew were appropriately licensed and qualified to operate the flight. Their Medicals were valid. They had undergone all refresher trainings and nothing was wanting as per the requirements.
- ✚ The aircraft had a valid Certificate of Airworthiness at the time of accident. The aircraft held valid Certificate of Release to Service. The aircraft was having a valid Aero Mobile License. Inspection schedules including checks/inspection as per the manufacturer's guidelines were carried out.
- ✚ The weather at the airport at the time of accident was fine and is not a contributory factor to the accident.

2.2 Brakes Effectiveness & Service Bulletin CAB-32-01 – Installation of Brake Return Spring

SB CAB-32-01 was issued by manufacturer to improve upon the operation of brake system by installing a brake return spring which gave primarily additional return force to pedals. The modification was not for improving the braking, but to assist in operation.

The flight crew had stated that they started giving intermittent brakes after landing. The brakes were found sluggish and not effective. After the accident, it has been reported that the brake fluid had leaked out of the system due to damages. The brake assemblies were removed for bench check. Visual inspection was satisfactory. For the investigation purposes both brakes were tested on bench under requisite hydraulic pressure and were found to be operating as designed.

The runway marks of the aircraft tyres indicated that the touchdown was not firm as these marks were not continuous in the beginning. The aircraft was afloat for certain distance.

After the accident during discussions, the crew informed that they had verbally reported intermittent brake issues earlier, but there was no record indicating that

these defects were reported by any of the flight crew. During the pre flight checks by the flight crew prior to take-off from Jaipur, the brakes were checked by them and found to be working as desired. It can therefore be concluded that the brakes were effective when the wheels were touching the ground with weight on wheels as there were continuous marks during the later portion of landing roll. Further, non-availability of the spring in the brake system has not contributed towards the accident.

2.3 Airport and RESA

The airport is owned & operated by Government of Rajasthan. The airport data including that of runway is contained in the National Register of Airports. As per this data, the runway strip dimension is 4265 feet x 92 feet, with threshold marked at both ends. However, there is no RESA available and as such ASDA & LDA are the same. The landing distance required to stop the aircraft is 900 feet. No risk analysis or risk mitigation was carried out for non-availability of RESA. During earlier landings on this runway, the crew used to touch down at a distance of 700 to 1000 feet from 24 end of runway. The normal procedure followed by crew for landing was, "After a landing roll of 200 ft or so, initial brakes were applied followed by gradual increase. If required, reversers were deployed after a landing roll of 400 ft or so. With this procedure normally the aircraft will stop in a distance of 900 ft approximately".

PF has mentioned that the touchdown on the day of accident was at 2378 feet from 24 end of the runway. So still a distance of more than 1900 feet was available for the aircraft to stop on the runway, which is more than double the distance required to stop the aircraft in normal circumstances. Even with the late touchdown, crew should have been able to stop the aircraft on the runway. It is pertinent to note that had RESA or some other ground maneuvering area was available before the perimeter wall; the aircraft damages could have been avoided or reduced.

The operator had carried out trial flights prior to commencement of operations to the airport and requested the State Government for provision of certain facilities

from safety point of view but have not mentioned about the existence of seasonal water body in the area around the airstrip. Directorate of Civil Aviation of the State Government while conveying the approval for start of operations to the airport have mentioned about the establishment of facilities but not of any safety precautions or risk mitigation.

2.4 Circumstances leading to the accident

In addition to runway markings/ damage to the aircraft, the only evidence available with the investigation was the statements of flight crew. As per these evidences, the aircraft took off from Jaipur and the flight till start of descent into Lalgarh was uneventful. The aircraft started descent when it was at a distance of about 45 nm from Lalgarh. At 7 nm from Lalgarh and at a height of 1500 ft AGL, the runway was visible to the flight crew. Flaps 10, 20 and 30 (maximum) were selected at a distance of 6 nm, 5 nm and 3.5 nm from Lalgarh respectively.

When the aircraft was at the short finals, all of a sudden the flight crew saw flock of birds flying across the runway. The flight crew therefore stopped descent and maintained the altitude. The touchdown was therefore delayed. On seeing the birds crossing the runway, the crew were having an alternate to “Go Around” instead of continuing the flight to land, which the PF had not opted for.

The aircraft touched down at around 2300 ft from beginning of the runway leaving around 1900 ft of runway for landing roll till final stop. The crew could not stop the aircraft on runway. It overshoot and hit the perimeter wall just at the end of runway resulting in damages. The damages to the aircraft indicate that the speed of the aircraft at the time it hit the wall was considerably reduced.

Final descent and touchdown scenario was analysed with the help of crew statements, runway marks and the damages to aircraft. In view of the delayed/ steeper descent and aircraft not stopping in 1900 feet, following operational aspects were considered:

- ✚ There was a possibility of incorrect flaring coupled with higher touchdown speed. The crew have maintained that the speed at the time of touchdown was 90 knots.
- ✚ Touchdown not firm resulting in floating of aircraft for some time (Weight not on Wheels).
- ✚ Late application of thrust reverser.
- ✚ Delayed decision to turn the aircraft i.e. beyond the turning pad.

The crew stated that after touchdown they had applied brakes but found them sluggish. Brakes were checked in shop and were found to be working satisfactorily.

Reversers as per the PF were applied after a landing roll of about 400 feet and tried to initiate a turn between 900 to 1100 feet of landing roll. The runway marks however clearly indicate that the touchdown was little left of centreline and the aircraft drifted towards right during landing roll. There were no turning marks till almost near threshold. There was infirm touchdown at higher speed requiring longer landing roll distance.

3.0 CONCLUSION

3.1 Findings

- 3.1.1 Both operating crew were appropriately licensed and qualified to operate the flight. Their Medicals were valid.
- 3.1.2 The aircraft had a valid Certificate of Airworthiness and Certificate of Release to Service at the time of accident. Inspection schedules including checks/ inspection were carried out.
- 3.1.3 The weather at the airport at the time of accident was fine.
- 3.1.4 The aircraft was on a flight from Jaipur to Lalgarh under Intra State Operations approved by the State Government.
- 3.1.5 Before take-off from Jaipur, the flight crew had carried out pre-flight checks including brake checks and were found working satisfactorily.

- 3.1.6 When at the short finals, PF stopped further descent as he observed birds flying across the runway.
- 3.1.7 The touchdown was at around 2300 feet from beginning of the runway.
- 3.1.8 Due to steep descent, there was incorrect flaring and higher speed at touchdown.
- 3.1.9 The aircraft floated for some time resulting in ineffective braking.
- 3.1.10 The aircraft turn was initiated beyond the turning pad, available before the runway end.
- 3.1.11 The aircraft hit the boundary wall at the end of the runway resulting in damages to aircraft.
- 3.1.12 RESA is not available on either end of the runway which is a safety concern.
- 3.1.13 Safety conditions at Lalgarh airport were not as per the laid down requirements.
- 3.1.14 "Safety Risk Analysis" and "Risk Mitigation" of the safety concerns was not carried out at the time of according approval for operations.


3.2 Probable cause of the accident

The crew delayed the aircraft descent instead of going around as birds were seen crossing the runway resulting in infirm touchdown at higher speed requiring longer landing roll distance due to which the aircraft hit the boundary wall existing at the end of runway strip causing damages to the aircraft.

4.0 Recommendations

- 4.1 DGCA should ensure that whenever regular Intra State passenger flights are undertaken by the State Governments or by an NSOP with the approval of State Government, thorough "Safety Risk Analysis" and "Risk Mitigation" is carried out.
- 4.2 State Governments should get periodic surveillance carried out by competent aviation personnel including that by 3rd party, of the operators who are carrying out Intra State flight operation approved by them.


(Shilpy Satiya)
Investigator


(R.S. Passi)
Investigator-In-Charge

Date: 20/11/2019
Place: Delhi