FINAL REPORT ON ACCIDENT INVOLVING HAWKER 900XP, AIRCRAFT VT-LTA BELONGING TO TO M/s LARSEN AND TOUBRO AVIATION LTD AT CHENNAI ON 06/07/2016

Jasbir Singh Larhga
Chairman, Committee of Inquiry

Capt. Nitin Anand
Member, Committee of Inquiry

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 incidents 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 or incidents could lead to erroneous interpretations.

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FINAL REPORT ON ACCIDENT INVOLVING HAWKER 900XP, AIRCRAFT VT-LTA BELONGING TO TO M/s LARSEN AND TOUBRO AVIATION LTD AT CHENNAI ON 06/07/2016

1.	Aircraft Type	: Hawker 900XP
	Nationality	: INDIAN
	Registration	: VT – LTA
2.	Owner	: M/s Larsen and Toubro Aviation Ltd
3.	Operator	: M/s Larsen and Toubro Aviation Ltd.
4.	Pilot – in –Command	: ATPL holder
	Extent of injuries	: Nil
5.	First Officer	: CPL Holder on type
	Extent of injuries	: Nil
6.	Place of Accident	: Chennai Airport
7.	Date & Time of Accident	: 06th July 2016, 1436 UTC
8.	Last point of Departure	: Bangalore
9.	Point of intended landing	: Chennai
10.	Type of operation	: Non-Scheduled Operation
11.	Crew on Board	: 02
	Extent of injuries	: Nil
12.	Passengers on Board	: 04
	Extent of injuries	: Nil
13.	Phase of operation	: Landing
14.	Type of Accident	: Runway Excursion

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SUMMARY

M/s L&T Aviation Services Pvt Ltd Hawker 900XP VT-LTA was involved in an occurrence at Chennai on 06.07.2016 wherein nose landing gear collapsed after hard landing on Rwy 07 while operating Bangalore Chennai Sector. There were 04 passengers and 02 crew on board. There was no injury to the crew or passengers.

The aircraft carried out a hard landing and the left tyre of the aircraft went out of the runway. While the crew tried to bring the aircraft back into the runway, the nose landing gear collapsed. Thrust reverser and Brakes could not be applied thereon but aircraft came to halt after skidding for some distance. Passengers were evacuated on the runway. Runway was blocked from 1438 UTC to 1934 UTC. Runway blockage caused 05 International and 04 Domestic arrivals to be delayed. 02 International departures were also delayed.

The aircraft suffered substantial damage. Apart from the collapsed nose landing gear, both RH side wheel assembly tyres were blown. LH side wheel hub assembly was broken. The radome and lower area of nose section was completely damaged.

Occurrence was classified as accident by the Ministry of Civil Aviation and Committee of Inquiry was appointed with Sh Jasbir Singh Larhga, ADAS, AAIB as Chairman of COI and Capt Nitin Anand as Member. An Accrep was also appointed by NTSB, USA to assist in the investigation.

1. FACTUAL INFORMATION

1.1 History of the flight:

On 06th July 2016, M/s L&T Aviation aircraft, VT-LTA was scheduled to operate a non-schedule flight in sector VOMM-VOBG-VOBL-VOMM. The flight was to be operated by ATPL holder PIC and CPL holder Co-Pilot. The aircraft departed from Chennai at 0152 UTC for HAL airport Bangalore (VOBG) and landed at 0223 UTC. Thereafter aircraft took off at 0250 UTC for Kempegowda Airport, Bangalore (VOBL) and landed at VOBL at 0314 UTC. VOMM – VOBG –VOBL leg was completed uneventfully. The accident happened during the VOBL – VOMM leg of the flight.

The departure from VOBL was scheduled for 1330 UTC for VOMM and flight had 2 crew & 4 passengers. The chocks were off at 1355 UTC and the aircraft took off at 1405 UTC. The take-off, departure from VOBL, cruise and initial descent were uneventful. Crew took Chennai ATIS at 1400 UTC, Chennai Radar advised the flight to use the TEBAM 5 arrival STAR and expect radar vector for ILS 07.

During approach, at 1431 UTC, Chennai approach warned the flight crew that the preceding aircraft had reported wind shear on the finals. As per the flight crew they could see weather around the airfield on the weather radar during approach. After changing over to tower, crew reported position "08 miles final Rwy 07" to ATC at 1433UTC. The crew was advised of 16-18 Kt winds from direction 240°-250° and rain over airfield. The controls were handed over by the co-pilot to PIC thereafter. Aircraft was cleared to land at 1434 UTC. Thereafter, ATC also advised crew of heavy rain and change in QNH. As per the statement of crew, they saw intense weather all across ahead of them and there was progressive deterioration of weather. The PIC stated that he anticipated wind shear and maintained higher than normal speed. Crew observed increasing rain but not much of turbulence. The crew stated to have made visual contact with the approach lights well before minima and decided to land.

As the aircraft descended, Co-pilot warned PIC about aircraft being on the left of runway at about 200 feet altitude. Crew stated that, after flaring out and closing power, they experienced sudden blurring of the wind shield with very intense rain. Crew also felt that the float was also taking longer and thought they were experiencing unpredictable tail winds. Close to the touch-down, the Co-pilot again warned PIC of aircraft drifting to left. The first officer also called "**SIR, RUNWAY EDGE LIGHTS**"

The aircraft touched down on the left shoulder of Runway at about 1436 UTC and impacted the edge lights. The first edge light to be impacted was 1131 m from the threshold. The aircraft kept rolling and impacted 13 edge lights. The aircraft then veered off slightly left of the runway wherein the nose landing gear of the aircraft broke and fell in the soft ground. The NLG leg impacted the aircraft belly causing damage to aircraft control system. The crew could not operate TLC, Foot Brakes and Airbrakes. The aircraft had no directional control left.

Subsequently, the left MLG wheel got detached from the aircraft. The aircraft then again entered the Runway and continue to skid for 250 mts approx. and stopped at a distance of 2775 mts from the Rwy threshold, 5.5 mts right of the centre line.

The crew requested for emergency assistance at 1437 UTC and carried out evacuation of passengers. The right engine thrust lever and HP cock got jammed and crew had to overpower the resistance using their full weight and strength to cut off the engine. The emergency services took a long time to reach the aircraft. On arrival the Fire crew applied AFFF on the aircraft as a precaution as fuel was found leaking from aircraft and remained on standby. There was no fire. Runway blockage caused 10 flights to be diverted to alternate aerodromes. The runway was made operational at 1934 UTC.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil

1.3 Damage to Aircraft :

The aircraft suffered substantial damage in the accident. The Nose Radome was damaged due to hitting the edge lights. The Nose LG had sheared off. The nose fuselage under body was found damaged exposing various hydraulic oil lines. Avionics Bay was also damaged. There were several dents on the LH wing leading edge and bottom surface. Apart from that, LH wing tip light was also broken. The flap on the RH wing was also damaged. The LH Main Landing Gear wheel tyre was detached from wheel and found in pieces. MLG hub was completely exposed and damaged.

Fig: 1 Aircraft after Removal from Runway

The detailed description of the damage to aircraft is as below:-

- Minor scratches were seen on the outside skin of the cabin entry door
- Minor scratches were seen on bottom side skin between Frame 8 to 12.
- There was a minor dent between Frame 4 and 8, on the bottom side skin

- The lower belly fairing running from Frame #04 to 12 was badly damaged. The metal tubing inside were exposed and damaged. Traces of Hydraulic Fluid leak were observed in the area. The attachment point on the adjacent structure was also damaged.

Fig: 2 Damage to radome and nose section

- The LH & RH side door attachment structure also damaged.
- The radome was punctured by impact with the runway edge lights causing a big opening on the right side.
- There were some dent and minor scratches on the bottom side skin between Frame 3 & 4.There was deep penetration between Frame 6 & 8 on lower skin.

Fig: 3 Damage to nose section lower portion

- RH Marker Antenna and adjacent mounting structure were badly damaged.
- The area between Frames 9B to 10A on the bottom structure was badly damaged and there was deep penetration.
- TAT probe was damaged

Fig:4 Damage to TAT probe

- Nose Landing Gear assembly and lower drag brace were damaged beyond repair. Both LH & RH Side Door and Rear Door were damaged beyond repair.

Fig:5 Damage to NLG and NLG door

- LH Main Landing Gear inboard and outboard doors were damaged. Outboard door spring strut was broken.
- Both wheel hub of LH landing gear were damaged beyond repair. Tyres were missing. The outboard brake and brake tubing were damaged. The forward Support Bracket had cracked and forward support structure near the actuator attach point was damaged.

Fig:6 Damage to RH MLG and wing tip

- The LH Flap Drive shaft from Flap Actuator to Wheel well was broken, Flap Actuator Fairing was also damaged.
- LH Wing Trailing Edge Lower Fairing between Spoiler and Flap Actuator was deformed and damage. The LH winglet static wicks were missing and Wing tip Light assembly and lense was broken.

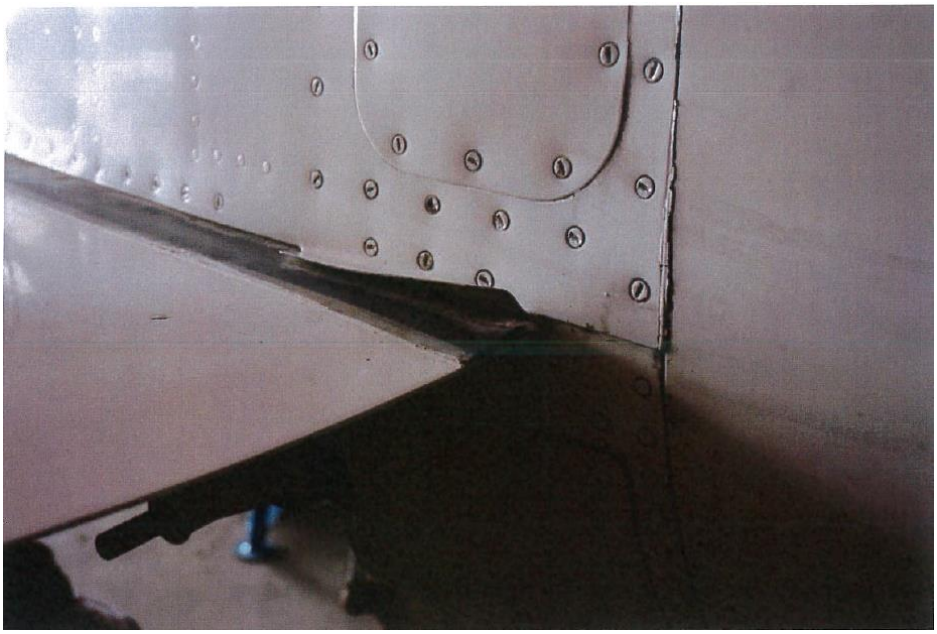


Fig:7 Damage to LH wing

- The inboard section of LH Flap Actuator had dents and a hole was observed on lower skin outboard of Flap Actuator section.

- LH Wing outer most manhole panel had got deep dent and chipped. Aft of this manhole, wing lower skin had got chipped. There were 6 minor chips in the lower skin of between Ribs 3 and 4 and 1 chip between Rib 4 and 5.

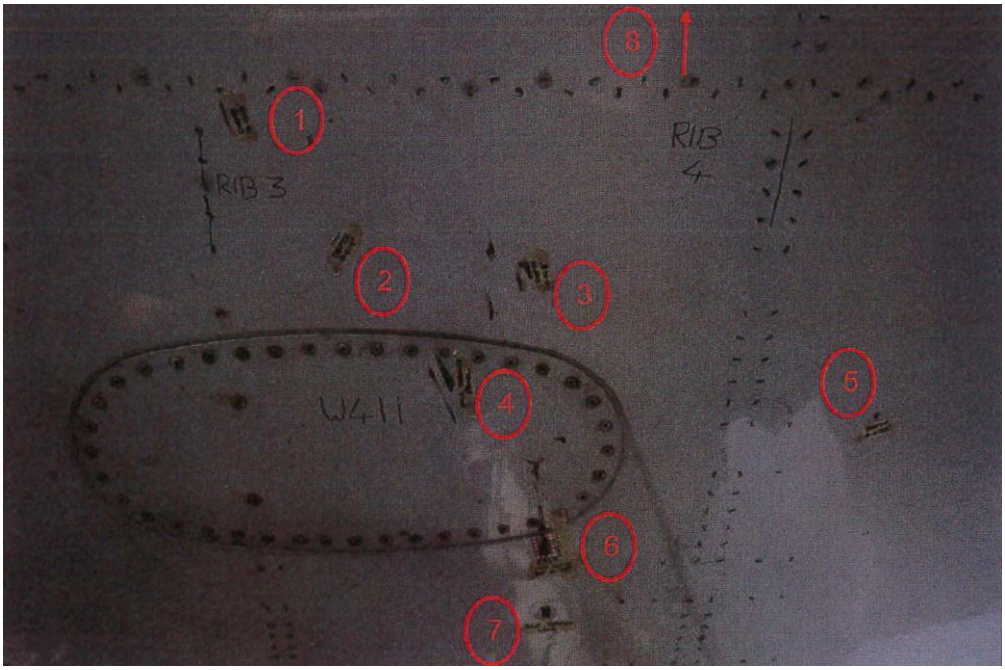


Fig:8 Damages on LH wing

- LH Wing inner most TKS Panel had deep dent and there were many scratches and dents on the top and bottom surface of the leading edge.

Fig:9 Damage to TKS panel of LH wing

- Both the tyres on RH Main Landing Gear (MLG) were damaged and had cut marks. The brake lines were damaged and leaking. There was a minor scratch on the outboard Main Landing Gear door.

Fig:10 Damage to the RH MLG tyres

- RH Wing attach fairing leading edges had minor dents with scratches. Dent was also observed on the inboard of innermost TKS panel. Top winglet static wick was missing along with the base.

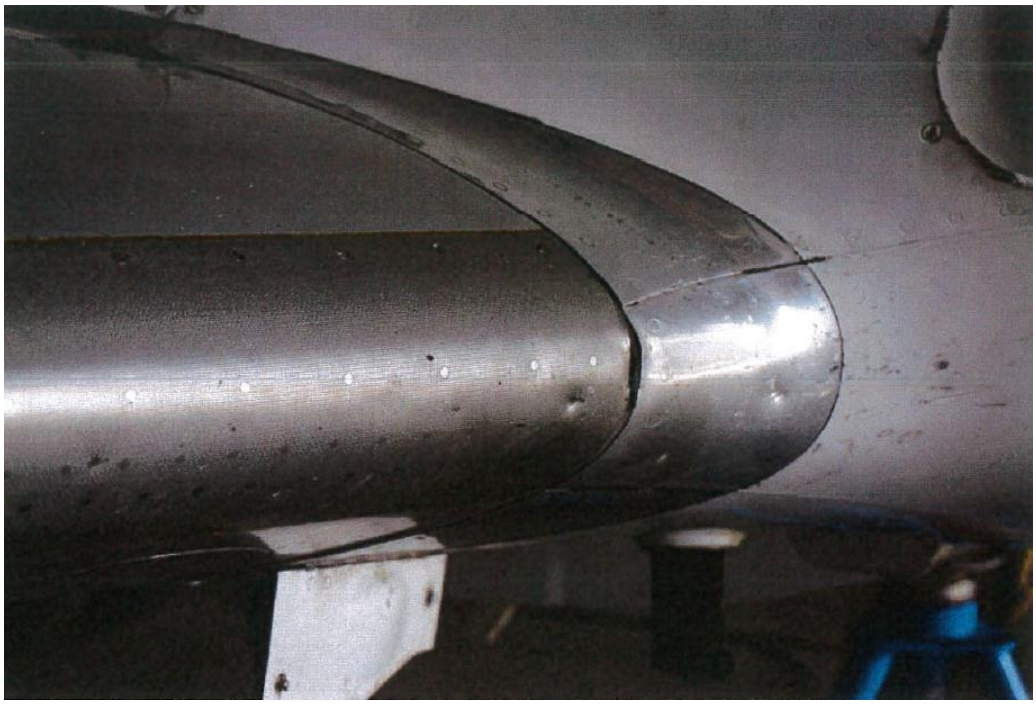


Fig:11 Damage to TKS panel of RH wing

- Inboard section of RH Flap (I/B of Flap Actuator) had hole through the top and bottom skin. Also the trailing edge has got dent and minor crack

Fig:12 Damage to RH flap

- Minor nick marks were seen on fan rotor blades of LH Engine.
- The fan rotor blades of RH Engine had got minor nicks and 04 blades were bent at the tip.
- Acoustic Liner of the Fan Rotor Blade has got minor damage and traces of Oil were found on the inner fan duct.

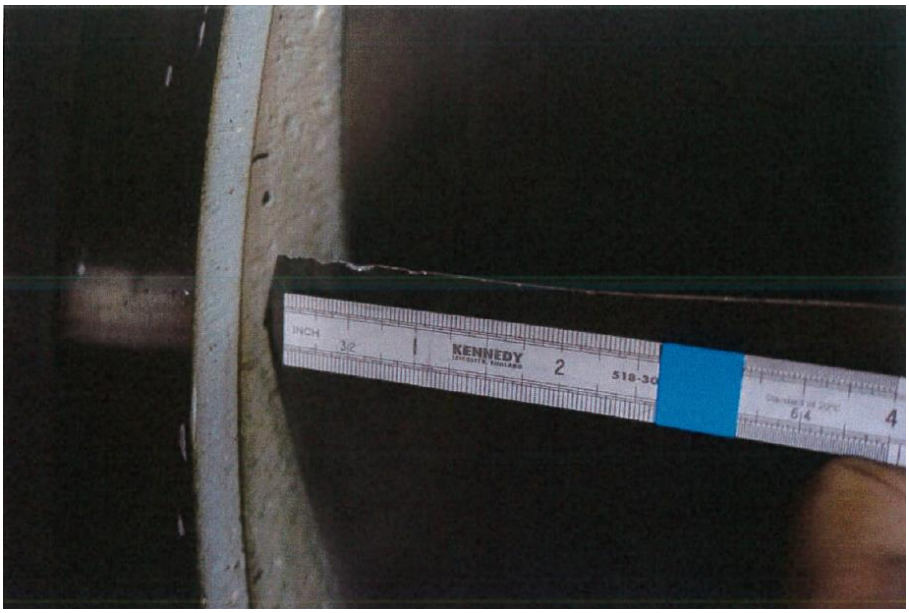


Fig:13 Damage to the RH engine blades

- In the cockpit, the control column lock was not engaging. Rudder and Aileron trim wheel and LH engine LP lever were jammed.
- The elevator trim wheel and both throttles were free due to broken cables.

1.4 Other damage:

Apart from the damage caused to the aircraft, 13 runway edge lights were broken due to impact with the aircraft.

Fig:14 Broken edge lights and junction box

Runway widening work was in progress and aircraft went over surface which was still under construction. Aircraft tyres went over electrical conduits and junction box causing them to get damaged and also causing the tyres to get cut and burst.

Fig:15 Damage to underconstruction pavements and wire conduits

1.5 Personnel information

1.5.1 Pilot – in – Command

Age	:	61
License	:	ATPL
Category	:	Aeroplane
Validity	:	11.07.2020
Endorsements as PIC	:	C152, HS 125-850 XP, HS 125-800 XP, HS125-900 XP, Open rating for aircraft with AUW<5700Kg
Date of Med. Exam.	:	13.04.2016
Med. Exam valid upto	:	12.10.2016
FRTO License Validity	:	08.04.2018
Total flying experience	:	5505 Hrs
Experience on Type	:	1005 Hrs
Total flying experience during last 90 days	:	90:40 Hrs
Total flying experience during last 30 days	:	30:40 Hrs
Total flying experience during last 07 Days	:	02:10 Hrs
Total flying experience during last 24 Hours	:	01:25 Hrs

1.5.2 Co-Pilot

Age	:	31 Years
License	:	CPL Holder
Category	:	Aeroplane
Validity	:	28.10.2020
Endorsements as PIC	:	Cessna 152 A, Duchess 76 as PIC.
Endorsements as F/O	:	HS125 850XP/900XP as P2
Date of Med. Exam	:	29.06.2016

Med. Exam valid upto	:	28.06.2016
Total flying experience	:	1695 Hrs
Experience on Type	:	1414 Hrs
Total flying experience during last 90 days	:	119 Hrs
Total flying experience during last 30 days	:	39:42 Hrs
Total flying experience during last 07 Days	:	7:42 Hrs
Total flying experience during last 24 Hours	:	02:10 Hrs

Both operating crew have not been involved in any serious incident/ accident in the 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 accident flight.

1.6 Aircraft Information:

Hawker 900XP aircraft is a twin engine aircraft fitted with Honeywell TFE731-50R-1H tail mounted engines manufactured by Beechcraft Corporation USA. The airplane is certified in transport category for day and night operation under VFR and IFR, by FAA and EASA. FAA Type Certificate Number is A3EU. The maximum operating height of this aircraft is 41000 (12500 mts) feet and maximum all up(AUW) weight authorised is 12701 kgs.

The Hawker 900 XP is a twin turbo fan, low wing monoplane aircraft with winglets. It is all metal construction. The engines are tail mounted. It has tri cycle landing gears with each gear having two wheels. The general dimensions are: Overall length of 15.59 mts, height of 5.31 mts, and wingspan of 16.55 mts. The landing gears are retractable type, hydraulic pressure is used to retract and extend the gears. The gears can also be extended manually in emergency/standby.

The nose landing gear assembly is a self centering type and incorporates an oleo-pneumatic shock absorber strut, the base of which carries a twin live axel.

The leg is mounted in bearings attached to fittings on each side of the nose gear bay and is stabilized in the down position by a drag stay assembly which folds

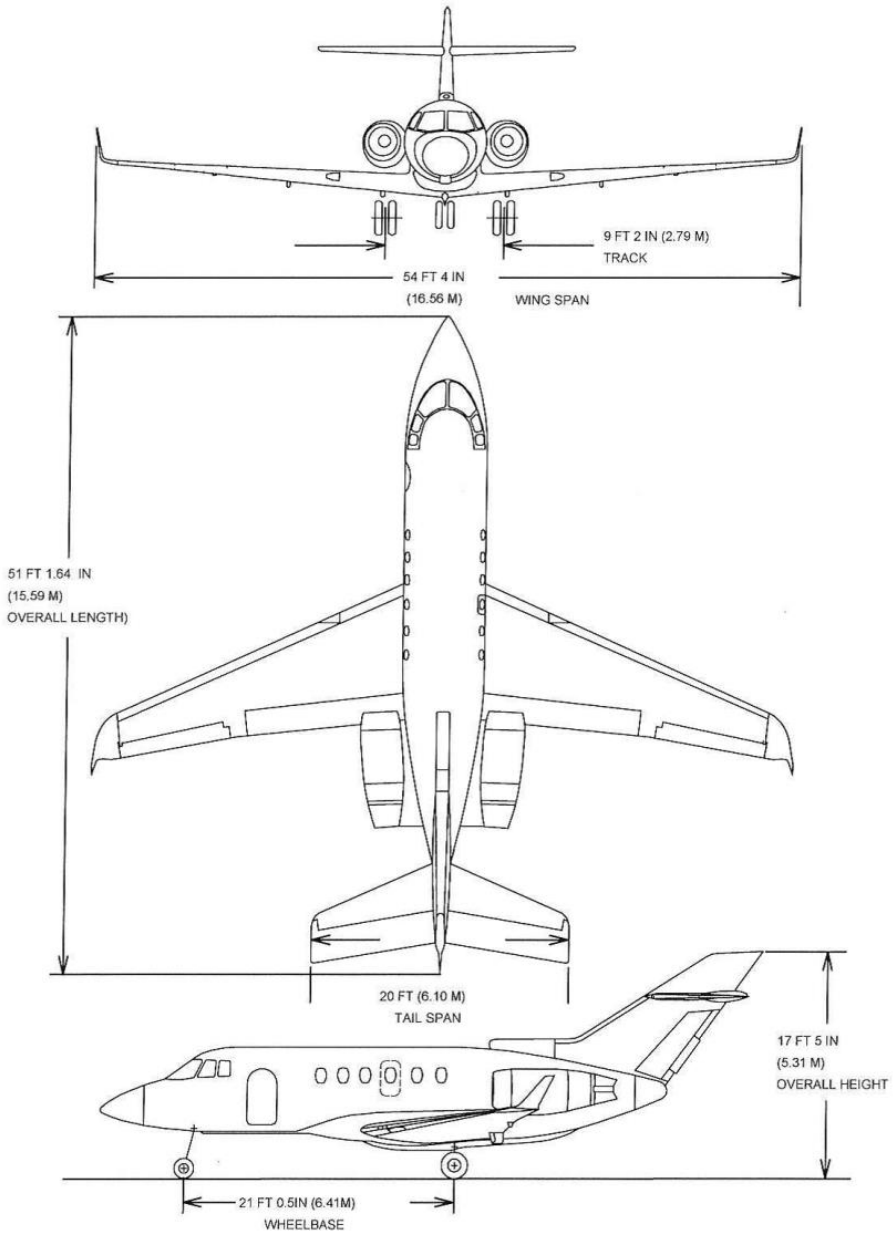


Fig:16 Aircraft Layout

during retraction and forms the main locking component in both the extended and retracted position. Two hinged doors linked mechanically to the drag stay and the leg are normally closed and open only momentarily during retraction and extension of the gear.

Manual opening of the doors is affected by operation of a lever attached to the door operating mechanism. A fairing attached to the leg assembly completes the enclosure of the gear when locked up. The nose landing gear retracts forward

in the nose landing gear bay. The nose gear is steerable and used to steer the aircraft.

The Main Landing Gear assembly incorporates an oleo-pneumatic shock absorber strut at the base of which are mounted, the two off set axel tubes. The complete leg assembly is supported in trunion bearings on a fitting extending aft from the wing rear spar and stabilized when in the down position by a side stay between the leg and the wing structure.

The side stay folds during retraction and forms the main locking component when the gear is in the extended and retracted position. The gear leg is faired in the up position by a fairing which is hinged to the lower wing skin and linked to the leg by a short strut.

The aircraft has a hydro mechanical brake anti-skid system with no control from the cockpit and no indication to the crew of its functioning. The system basically consists of 4 maxaret units one for each main wheel. The maxaret unit is mounted within each wheel axle and is connected into the brake line. The unit consist of a valve arrangement regulated by a flywheel which is rotated by the aircraft main wheel. The unit is sensitive to angular deceleration consistent with an approaching skid of the wheel. The unit is rotated by a drive assembly which is bolted over the hub of the aircraft wheel and engages the splined input shaft. The shaft engages a drive ring which imparts a positive drive to the flywheel through the medium of a drive spring with a one way clutch. Normally with the wheel turning, the splined input shaft and the flywheel rotate at the same speed. When a skid develops the wheel stops but the flywheel driven by the one way clutch continues to spin. When the relative angle between the input shaft and the flywheel reached 30 degrees, the flywheel action moves a valve mechanism which releases the hydraulic pressure to the brake and the brake is released. The fail safe philosophy of the maxaret unit is to allow full hydraulic pressure to go to the brakes in case of maxaret failure.

Aircraft VT-LTA (MSN HA-0165) was manufactured in the year 2010. The aircraft was registered with DGCA under the ownership of L & T Aviation

Services Pvt. Ltd. The aircraft is registered under Category 'A' and Certificate of Registration No. 4135/3.

The Certificate of Airworthiness Number 6244 under "Normal category" subdivision “Passenger” was issued by DGCA on 20.09.2010. The specified minimum operating crew is two and the maximum AUW is 12701 Kgs.

Certificate of Airworthiness was valid subject to validity of Annual Review Certificate (ARC). The last ARC was issued on 18.09.2015 and was valid upto 19.09.2016.

This Aircraft was operated under Non Scheduled Air Operator's Permit No 06/2010 which was valid up to 02.11.2016. As on the day of accident, the aircraft had logged 1865:38 Airframe Hours and 1154 cycles.

The aircraft and engines were being maintained by M/s. Indamar Aviation Pvt Ltd as per DGCA Approved maintenance programme. It consisted of calendar period based maintenance and flying hours/ cycles based maintenance as per the maintenance programme approved by Regional Airworthiness Office, DGCA, Mumbai.

Accordingly, the last Major Inspection carried out on the aircraft was F Check (24 months) which was carried out on 25.04.2016 at 1766:16 Hrs / 1095 Cycles. Subsequently, all Lower Inspections (Pre-flight checks, Service Checks, Weekly Checks) were carried out as and when due.

The last Periodic Inspection was carried out on aircraft at Chennai before departure to Bangalore on 06.07.2016; this was followed by pre-flight inspection by the PIC.

The aircraft was last weighed on 02.07.2015 at Mumbai. Weight Schedule was approved by the Regional Airworthiness Office, Mumbai prepared on the basis of weighing. As per approved weight schedule, the Empty weight is 7619 kg. Maximum Fuel capacity is 4421 Kgs. Maximum commercial load with oil and fuel tanks full is 661 Kgs. Empty weight C.G in % of Standard Mean Chord (SMC) is 31.57 %. As there has not been any major modification affecting weight

& balance since last weighing, hence the next weighing would have fallen due on 01.07.2020.

The Hawker 900XP aircraft is fitted with two HONEYWELL manufactured Engine Model TFE 731-50R-1H. The aircraft was fitted with Engine Sl. No.122379 on left side. The Engine had logged 1865 Hrs 38 mins Time Since New (TSN) and 1159 Cycles Since New (CSN). The RH Engine installed was Sl. No. 122380. It had logged 1865 Hrs 38 mins. TSN and 1159 cycles CSN.

All the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine had been complied with as on date of event. Scrutiny of the snag register did not reveal any snag relevant to the accident. The last CRS (Certificate of Release to Service) was issued on 2 July 2016 and valid till 16 July 2016. Engineering document scrutiny did not reveal any carried forward snag. Last Transit check (pre-flight check) was carried out on 6 July 2016 at Bangalore and Pilot confirmed Nil defects on the aircraft and the aircraft released to service from Bangalore to Chennai. After departure from Bangalore the aircraft landed at Chennai.

1.7 Meteorological Information

The accident took place during night time at around 1436 UTC. There was Moderate/Heavy rain over the airfield. Metrological data from the time 1400 UTC to 1505 UTC obtained from Chennai aerodrome and Met data from the BUG Card recording the 1406 UTC ATIS weather is tabulated below:-

Sr. No	MET Report
1	**1400 UTC** 150/07 6 KMS FEW 2000 FEW CB 2500 31/26 1003 TREND NOSIG CB (NW & SW)
2	**1406 UTC** 150/07 6KMS FEW 2000 31 1003 NOSIG
3	**1430 UTC** 160/08 6KMS FEW 2000 FEW CB 2500 31/26 1004 TREND NOSIG CB (NW & SW)
4	**1500 UTC** 150/08 6KMS FEW 2000 FEW CB 2500 26/24 1005 TEMPO 4000 -TSRA CB (NW & SW & OH)
5	**1505 UTC** 150/08 6KMS FBL TSRA FEW 2000 FEW 2500 BKN 10000 26/24 1005 TREND NOSIG CB (NW & SW & OH)

Crew were also briefed about weather by the ATC at 1433 UTC and 1434UTC. They were informed about winds of 16-18 Kt direction 240°-250° and heavy rain over the airfield with QNH 1004.

1.8 Aids to Navigation

Following are the details of navigation and landing aids available at Chennai airport.

Type of aid CAT of ILS/MLS (For VOR/ILS/MLS, give VAR)	ID	Frequency	Hours of operation	Site of transmitting antenna	ELEV of DME transmitting antenna
LLZ 07	IMAS	110.3 MHz	H24	125950.3 N 0801115.2 E	---
GP 07	-	335.0 MHz	H24	125910.9 N 0800917.7 E	---
OM07	---	75.0 MHz	H24	125720.1 N 0800429.6 E	---
LO	MA	228.0 kHz	H24	125720.1 N 0800429.6 E	---
LM	AS	211.0 kHz	H24	125851.1 N 0800837.5 E	---
DVOR/DME	MMV	1159/1096MHz	H24	125936.1N 0801014.5E	44FT
DME(ILS)	IMAS	1001/1064MHz	H24	125910.9N 0800917.7E	44FT
DVOR	MMV	112.5 MHz	H24	125936.1N 0801014.5E	---

1.9 Communications

Aircraft maintained positive communication with the ATC throughout the flight and after accident.

1.10 Aerodrome information

Fig: 17Aerodrome Layout

Chennai International Airport is located at Meenambakkam, Chennai. ICAO nomenclature for the airport is VOMM and IATA nomenclature is MAA. The airport is maintained managed by Airport Authority of India. The details of the airport are as below.

Co-ordinates

ARP : 12°58′56″ N 80°9′49″ E

Elevation : 16 M/ 52 Feet.

Runway Orientation and dimension

Orientation: 07/25 and 12/30

Dimension: 3658M x 45M and 2085M x 45M

The details of runway and declared distances are as below.

RWY designator	TORA (M)	TODA (M)	ASDA (M)	LDA (M)	Remarks
12	2085	2235	2085	1942	RESA 90 X 90 M
30	2085	2235	2085	1755	RESA 90 X 90 M
7	3658	3811	3708	3658	RESA 240 X 90 M
25	3658	3863	3718	3658	RESA 90 X 90 M

1.11 Flight Recorders:

Aircraft was equipped with L3 Communication DFDR, model no. FA2100. Part number of the DFDR was 2100-4043-00 and Serial No. was 000511431. The DFDR was downloaded and raw data was sent to NTSB for conversion into engineering parameters.

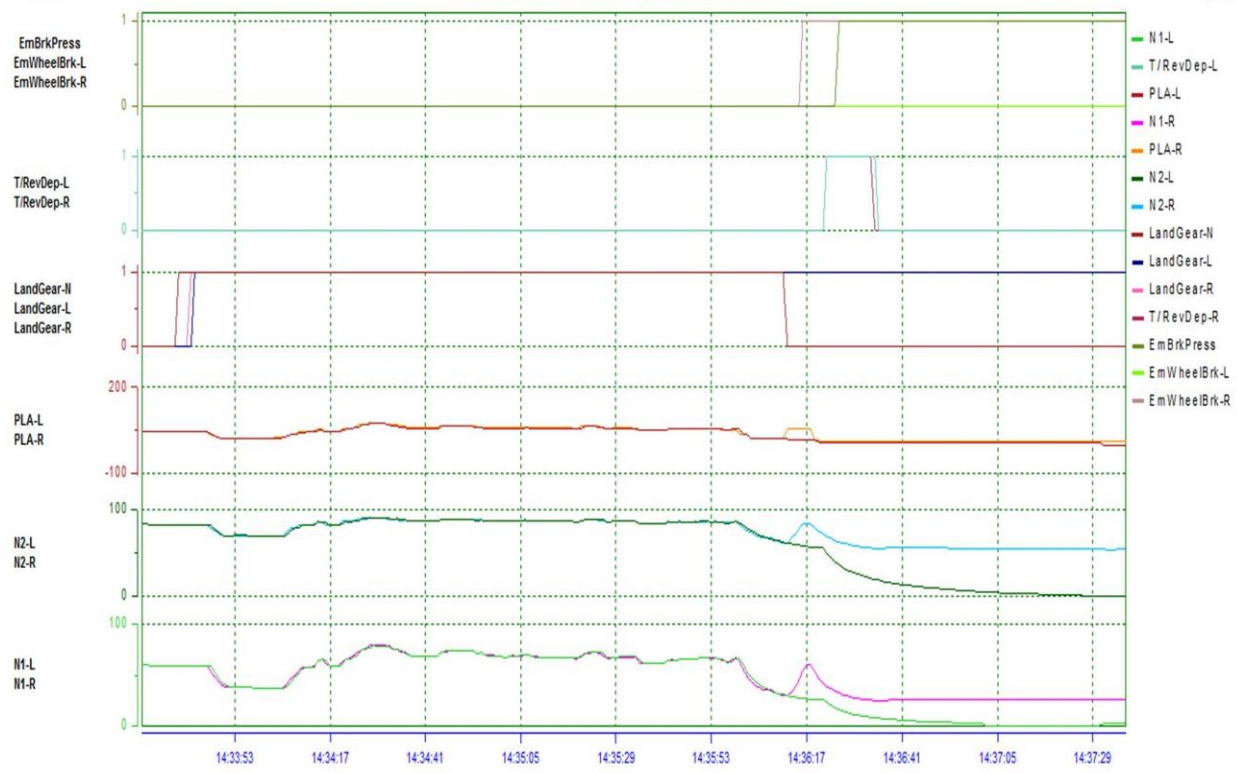


Fig:18 Plotting of DFDR data

Aircraft was also equipped with L3 Communication CVR, Model no A200S. The part number of CVR was S200-0012-00 and the serial number was 02200. The CVR was downloaded at DGCA approved facility and was used to co-relate the findings.

1.12 Wreckage and Impact Information

The aircraft touched down left of the centre line on the RWY shoulder. The Aircraft after touchdown impacted the RWY edge lights on the left edge of the runway.

The first edge light which broke due to Aircraft impact was at a distance of 1131m from the threshold of runway 07. The Aircraft kept rolling over the edge lights of the runway and its left wheel veered off the runway. Subsequently Nose

Landing gear got detached and was found at 1557m from threshold and at a distance of 18.3m from the edge line.

Further the Main Landing Gear Wheels (Left) got detached from the Aircraft was found at 2000m (approximately) on the RWY shoulder. The aircraft turned right and re-entered the runway at 2085 m from threshold and crossed the runway centreline at 2505m from threshold. The aircraft halted at 2775m from threshold on right side of centreline at a distance of 5.5 m from the centreline.

1.13 Medical and Pathological Information:

The crew had undergone the Pre-Flight Medical at Chennai at 0700 IST on 06.07.2016 as per the CAR requirement and the test was satisfactory. The crew and passenger were provided Post Flight Medical Assistance by the Chennai Airport.

1.14 Fire:

There was fuel leakage on the runway, however, no fire was observed.

1.15 Survival aspects:

All crew and passengers survived this accident, without any injuries.

1.16 Tests and Research: NIL

1.17 Organizational and Management Information:

L&T Aviation Services Pvt. Ltd is a subsidiary company of Larsen & Toubro Limited. "L&T Aviation Services Pvt. Ltd" is a separate company to operate Non-scheduled Air Transport Service. The company had two Hawker 900XP aircrafts operating under NSOP no. 06/2010 which was valid upto 02.11.2016 as on date of accident.

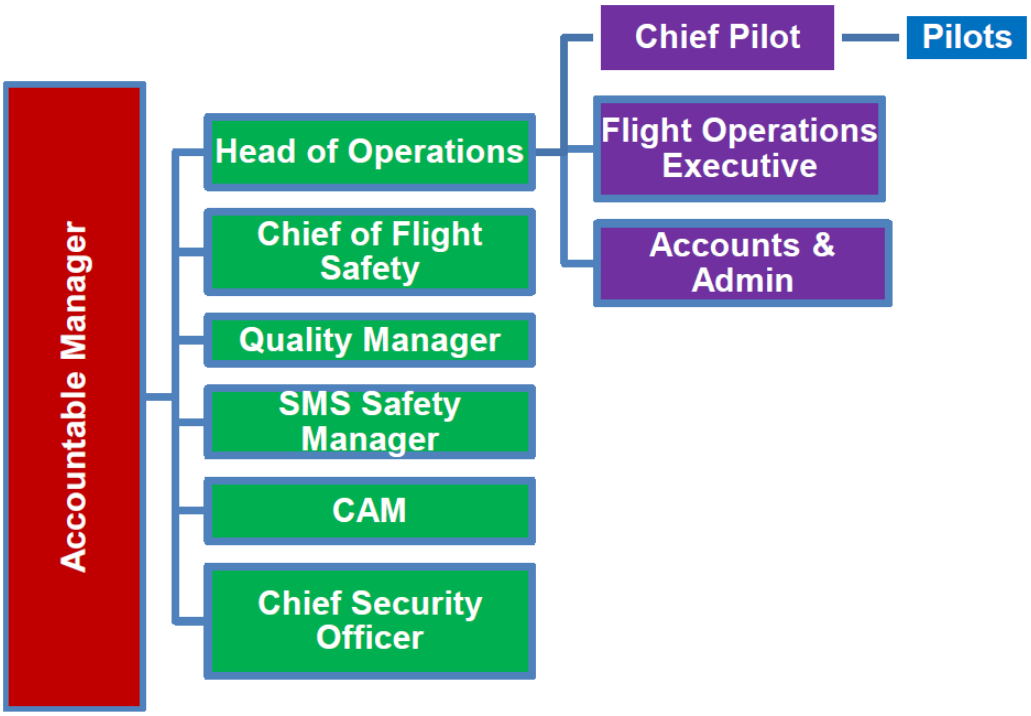


Fig:19 Organisation Chart

The operator is mainly based at Mumbai and has its head office at Mumbai. The management of the organisation is looked after by an Accountable Manager who was assisted by a team of Head of Operations, Chief of Flight Safety, Quality Manager, SMS Safety Manager, CAM and a Chief Security Officer. The organisation chart of the operator's depicting the organisation is given in figure above.

As per the approved Operations Manual of the company, it is responsibility of PIC to ensure that weather and runway conditions are safe for landing. The extract from Para 7.8 of Operations Manual is given below:-

"7.8 Approach and landing conditions:

Before commencing an approach to land, the PIC must satisfy himself/herself that, according to the information available to him/her, the weather at the aerodrome and the condition of the runway intended to be used should not prevent a safe approach, landing or missed approach."

Further, as per the Para 7.15 of Operations Manual which is quoted below, the PIC has discretion to delay take-off or landing if the weather has deteriorated or is likely to deteriorate.

"7.15 PIC Responsibility

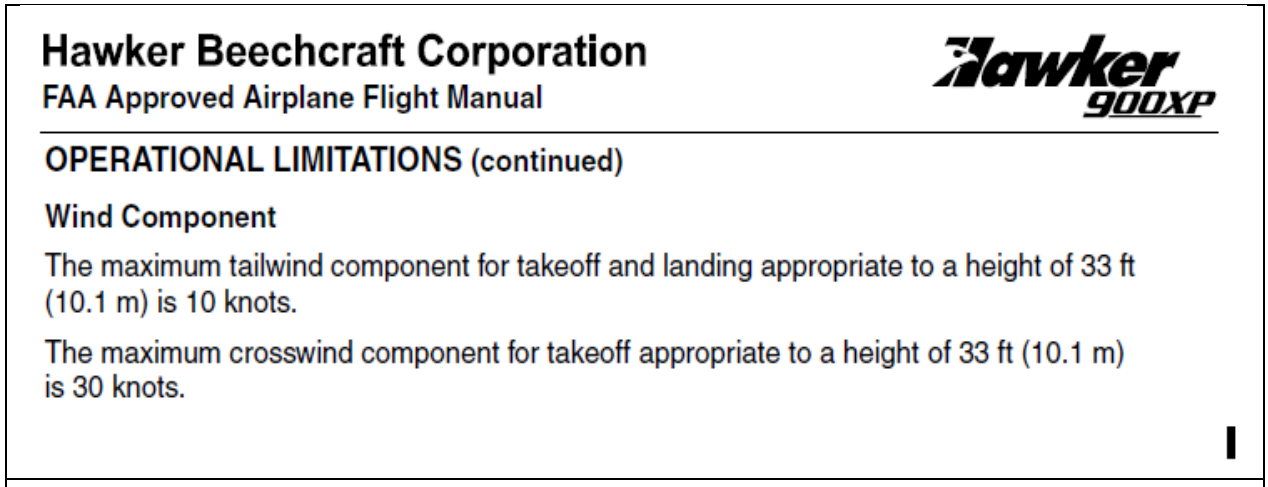
It is the Commander's responsibility to evaluate through his own observations that the actual conditions at the time of take-off/ landing are at least equal to or better than the filed minima even though, the reported visibility is above minima and ATC has given him clearance. Even if MET conditions meet the minima required the Commander may use his discretion to delay a take-off or a landing if the weather has deteriorated or is likely to deteriorate."

The company's policy laid in Para 34.1.3 states that *"Pilots should not hesitate to go around in case of unstabilized approach or hold for improvement of weather."*

1.18 Additional Information

1.18.1 Aircraft Performance Limitations:

As per the Airplane Flight Manual, the tailwind limitation for the aircraft while Landing and Take-off is 10 Kt. The extract from the AFM is given below.



Hawker Beechcraft Corporation
FAA Approved Airplane Flight Manual

Hawker 900XP

OPERATIONAL LIMITATIONS (continued)

Wind Component

The maximum tailwind component for takeoff and landing appropriate to a height of 33 ft (10.1 m) is 10 knots.

The maximum crosswind component for takeoff appropriate to a height of 33 ft (10.1 m) is 30 knots.

Fig:20 Extract from AFM

1.19 Useful or effective investigation techniques: NIL

2. ANALYSIS

2.1 Serviceability of the aircraft

The scrutiny of aircraft documents and maintenance record reveals that the aircraft held a valid Certificate of Airworthiness Number on the date of accident. As on the day of accident the aircraft had logged 1865:38 Airframe Hours and 1154 cycles.

The aircraft and engines were being maintained by M/s. Indamar Aviation Pvt Ltd as per DGCA Approved maintenance programme. The last major inspection carried out on the aircraft was F check (24 months) which was carried out on 25.04.2016 at 1766:16 Hrs / 1095 Cycles. Subsequently all lower inspections (Pre-flight checks, Service Checks, Weekly Checks) were carried out as and when due before the accident.

The last periodic inspection was carried out on aircraft at Chennai before departure to Bangalore on 06.07.2016; this was followed by pre-flight inspection by the PIC. There was no pending snag on the aircraft and the aircraft was airworthy and capable of performing the last flight. Serviceability of aircraft is not a factor that could have caused the accident.

2.2 Weather

As per the MET reports, and ATC, there was moderate to heavy rain over the airfield at the time of accident. From the CVR recording as well as the ATC transcript, it is evident that the crew were adequately briefed about weather by the ATC at 1433 UTC and 1434UTC. The crew was also advised about winds from direction 240°-250° at 16-18 Kt and heavy rain over the airfield with QNH 1004.

The weather was not conducive of a safe landing due to rain and tail winds, which were beyond the performance limitation of the aircraft. The weather was a contributory factor in the accident.

2.3 Pilot Handling

The CVR recording hints at an inadequate approach briefing by the crew. The Missed Approach Procedure should have been included in the approach briefing and would have clarified the captain's intended actions in the event of unstablized approach or loss of visual clues during landing.

The crew was also warned of heavy rain over the airfield and go-around due to wind shear carried out by the preceding aircraft but the crew continued with the landing. The crew was also informed of tail wind from direction 240 to 250 at 16-18 Kt, which was beyond the performance limitation of the aircraft.

The PIC decided to land after having made visual contact with the approach lights well before minima and continued to land in spite of marginal conditions. The aircraft touched down on the left shoulder of Runway at about 1436 UTC and impacted the edge lights. The aircraft kept rolling and impacted 13 edge lights. The left MLG wheel got detached and aircraft broke its nose landing gear before skidding approximately 250 m towards the runway centreline.

Due to damage to the aircraft, the crew could not operate TLC, Foot Brakes and Airbrakes; and the aircraft was left with no directional control. Aircraft stopped at a distance of 2775 mts from the Rwy threshold, 5.5 mts right of the centre line. The crew requested for emergency assistance at 1437 UTC and carried out evacuation of passengers.

There was lack of effective CRM in the cockpit as well. It is evident from CVR recording that, the Co-pilot was aware of the lateral deviation of the airplane flight path and warned the PIC of aircraft being on the left of runway at about 200 feet altitude. The co-pilot also warned PIC of aircraft drifting to the left close to touchdown as well as the runway edge lights.

2.4 Sequence of Events

Sr. No	Time(UTC)	Event
1	1424	Aircraft comes in contact of Chennai approach
2	1431	Crew is advised about preceding aircraft reporting wind shear.
3	1433	Crew report position "8miles final Rwy 07" to Chennai Tower Co-pilot gives controls to PIC ATC informs of rain over airfield and winds from direction 240 at 18 kts. Crew continues with approach.
4	1434	Crew is again advised of heavy rain and change in QNH.
5	1436	Aircraft touches down on the runway shoulder.
6	1437	Crew request assistance

3 CONCLUSIONS

3.1 Findings

3.1.1 Aircraft had a valid Certificate of Airworthiness and there were no pending snags on the date of accident.

3.1.2 Crew had the necessary qualifications to operate the flight and were current on the date of accident.

3.1.3 There was moderate to heavy rain over the airfield at the time of accident, and crew was advised of the same by the ATC. The reported winds were from direction 240° to 250° at 16-18 kts.

3.1.4 Tailwind limitation for landing as per AFM is 10 Kt.

3.1.5 Crew used some non-standard call outs during the approach and landing.

3.1.6 Crew continued with approach in spite of warning by ATC of rain, change in QNH and winds; and attempted landing at higher speed anticipating wind shear.

3.1.7 Co-pilot was aware of lateral deviation of the aircraft and warned the PIC at 200 feet and close to touchdown but adequate CRM was lacking.

3.1.8 The PIC did not carry out an approach briefing which should have included missed approach procedures and would have clarified the captain's intended actions in the event of unstablized approach or loss of visual clues during landing

3.1.9 Aircraft landed on the left shoulder of Rwy 07 and impacted the runway edge lights while rolling. The aircraft impacted and broke a total of 13 edge lights.

3.1.10 Nose Landing gear of the aircraft broke and caused the nose section to impact the ground. The impact resulted in structural damage due to which crew was left with no control over TLC, Airbrakes, rudder etc.

3.1.11 The MLG wheel also got detached from the aircraft and aircraft continued to skid before coming to halt at distance of 2775 m from threshold 5.5 m right of centreline .

3.1.12 Crew requested for assistance and helped the passengers in evacuation.

3.1.13 No injury was reported to any of the occupants.

3.2 Probable Cause of the Accident:

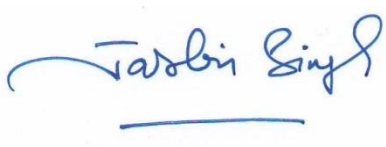
The accident was caused by failure of crew to actively monitor deteriorating weather environment of the airfield and trying to land in high tail wind, which caused the runway excursion.

Inadequate approach briefing, CRM were the contributory factors.

4 Safety Recommendations

4.1 Air Operator must enhance Crew Resource Management (CRM) in both initial and recurrent training program to improve decision making, maximize communication and coordination; and minimize the chance for errors.

4.2 Operations Department of M/s L&T Aviation should issue circular to crew reiterating standard call outs during approach and landing especially during marginal weather conditions and educate crew about DGCA's non reprisal policy on GO AROUND and DIVERSION laid in CAR Section 8 Series C Part 1.



Jasbir Singh Larhga
Chairman, Committee of Inquiry

Capt Nitin Anand
Member, Committee of Inquiry

Date: 05.11.2018

Place: New Delhi