GOVERNMENT OF INDIA
MINISTRY OF CIVIL AVIATION
AIRCRAFT ACCIDENT INVESTIGATION BUREAU
NEW DELHI INDIA

REPORT ON
ACCIDENT TO M/s PAWAN HANS
DAUPHIN N3 HELICOPTER VT-PHK
AT KHONSA
ON 04/08/2015

(Pradeep Srivastava)
Member
Committee of Inquiry

(R. S. Passi)
Chairman
Committee of Inquiry

REPORT ON
ACCIDENT TO DAUPHIN N3 HELICOPTER VT-PHK
NEAR KHONSA (ARUNACHAL PRADESH) ON 04/08/2015

1. Helicopter

Type	:	Dauphin
Model	:	N3
Nationality	:	INDIAN
Registration	:	VT-PHK

2.	Owner and Operator	:	Pawan Hans Limited
3.	Date of Accident	:	04.08.2015
4.	Time of Accident	:	0500 hrs. UTC
5.	Time of last contact with ATC	:	0457 hrs. UTC
6.	Last point of Departure	:	Khonsa
7.	Point of intended landing	:	Longding
8.	Geographical location of	:	26 53’48.3’’N
	Accident site (Lat. Long)	:	95 30’54.8’’E
9.	Type of operation	:	Non Scheduled, Passenger
10.	Phase of operation	:	Cruise
11.	Commander’s License	:	CHPL
12.	Extent of Injury	:	Fatal
13.	First Officer License	:	CHPL
14.	Extent of Injury	:	Fatal
15.	Passenger on board	:	One
16.	Extent of injury	:	Fatal
17.	Damage to helicopter	:	Destroyed

(All timings in this report are in UTC unless otherwise stated)

INDEX

1.0 Factual Information:

1.1 History of Flight:

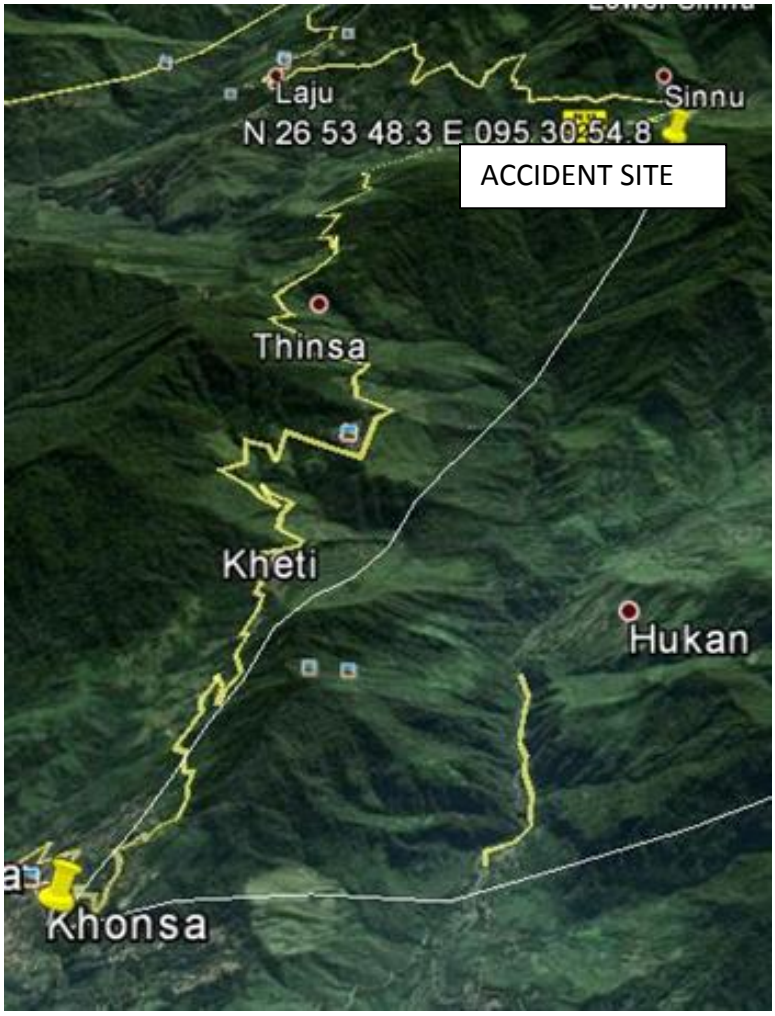
Pawan Hans Limited Dauphin helicopter VT-PHK was involved in an accident on 04.08.2015, while operating a passenger flight from Khonsa to Longding in Arunachal Pradesh. The accident occurred at approximately 6 nautical miles south of Khonsa Helipad. The helicopter was under command of a CHPL holder with another CHPL holder as First Officer. There was one passenger on board.

On the day of accident, the helicopter was planned to operate flight Itanagar- Dibrugarh- Khonsa- Longding- Changlang- Dibrugarh- Itanagar sectors. Pre flight inspection (first flight inspection) of the helicopter was carried out at Itanagar by an appropriately licensed Aircraft Maintenance Engineer and the helicopter was accepted by the Pilot-in-command for flying to Dibrugarh at 0330 UTC. The flight from Itanagar to Dibrugarh was normal.

The helicopter started up at 0421 UTC and took off from Dibrugarh at 0425 UTC for Khonsa under Special VFR conditions. After takeoff, the helicopter informed ATC Dibrugarh that their expected time of arrival at Khonsa is 0447 UTC. The helicopter changed over to Chabua ATC at 0429 UTC. It had maintained altitude of 3500 feet on direct route to Khonsa. At approximately 0441 UTC, the pilot reported to Chabua ATC that they were 5 miles inbound of Khonsa and would call ATC on getting airborne from Khonsa.

At 0457 UTC the pilot informed Chabua ATC that they had got airborne from Khonsa and were climbing to 4500 ft. Estimated time of landing at Longding was 0508 UTC. They also informed that the destination helipad was at 39 miles from Dibrugarh and at a radial of 156. At 0500 UTC pilot informed Chabua ATC that they were climbing to 5500 feet. Chabua ATC informed them to report on landing. Pilot replied in affirmative. At 0508 UTC Chabua ATC called up the helicopter but didn’t get any reply. Several unsuccessful attempts were made to contact the helicopter by Chabua ATC.

The helicopter was subsequently declared overdue and a MI-172 helicopter which was returning back from Vijaynagar to Dibrugarh via Miao was informed about the overdue helicopter. MI-172 helicopter flew over Changlang,



Khonsa and Longding helipads in order to locate the helicopter. The MI 172 was unable to locate the accident helicopter and landed back at Dibrugarh. Another IAF MI-17 helicopter was later sent for Search and Rescue operation from Dibrugarh airfield but the accident helicopter could not be located. There was no distress call to any ATC station by helicopter. Nor was any distress signal received from ELT installed on the helicopter.

Though inclement weather from time to time hampered search operations, however, continuous extensive search operation by IAF helicopters was carried

out the following days. Ground search operations by Assam Rifles were also undertaken from sunrise to sunset. Search parties comprising of officials of district administration and police personnel were also formed for combing the area.

A Control Room was set up at Dibrugarh with the help of the Airport Director, Airports Authority of India and a log of events was prepared on daily basis in the evening. All concerned were regularly updated on the developments at Dibrugarh. Station Commander, Air Force Station Mohanbari was the Task Force Commander for SAR operations.

The search continued on daily basis and on 10/08/2015 morning accident site of the helicopter was sighted. The accident site was located approximately 06 nm south of Khonsa helipad. Ground party of Assam Rifles at Khonsa informed that the main body of helicopter is burnt / damaged and is lying in deep gorge. Since the location was such (tough terrain) where helicopter could not land or hover to drop the men and material required for the process, it was decided to create a place on the close by ridge where a smaller helicopter can land and provide the necessary help/ equipment to the ground Assam Rifle party which may be available at crash site.

All the three occupants on board received fatal injuries. The helicopter was substantially damaged due impact and fire. On 12/08/2015 Morning, specialist troops from High Altitude Warfare School reached the site with the help of Assam Rifles personnel to recover the bodies. The bodies were recovered in the afternoon and brought to Dibrugarh Medical College.

The helicopter was equipped with Cockpit Voice and Data Recorders (Combo Unit). After recovery of the bodies, the specialist team has left as weather had further deteriorated due heavy rains. The State administration and the operator were appraised of the importance of the recorders and their necessity as essential evidence for investigation purposes.

1.2 Injuries to Persons:

Injuries	Crew	Passengers	Others
Fatal	2	1	0
Serious	0	0	0
Minor/None	0	0	0

1.3 Damage to helicopter:

The weather was very bad particularly heavy rains making the almost vertical hill side more slippery. Special personnel from high altitude warfare school have gone down to recover the bodies. These personnel were also provided with photographs of CVFDR unit so that the unit could be brought if traced. They were also instructed to take photographs of the wreckage. The CVFDR unit however has not been traced till the date of this report.

The following (on next page) are few photographs showing heavy damage to the helicopter. The whole wreckage barring the heavier parts like engine, MGB etc. were in bits and pieces as can be seen from some of the photographs. The light tertiary structure like portion of panels was found stuck in the bushes/ trees on the hill sides. Heavier parts have rolled down to the bottom of the gorge.

MGB SPLIT PANEL 	STARTER GENERATER 
VHF PANEL 	HYDRAULIC TANK 
LANDING LIGHT PANEL 	PASSENGER DOOR 
SLIDING DOOR PART 	HYDRAULIC TANK 

LANDING GEAR & ACTUATORS 	TGB MOUNTING & TAIL DRIVE SHAFT 
HYDRAULIC PUMP 	BROKEN PANELS & CONTROL RODS 
DAMAGED PARTS OF MGB 	DAMAGED BOTTOM STRUCTURE 

MGB MOUNT PARTS 	SIDE RAIL(STEP) 
FUSELAGE PORTION & CONTROL ROD 	PANELS WITH FIRE DAMAGE 
DAMAGED NOSE WHEEL 	STABILIZER 

UPHOLSTERY & CONTROL BELLCRANKS

TAIL SKID

ENGINE

PORTION OF DOOR

ENGINE

VHF PANEL

1.4 Other Damage

NIL

1.5 Personnel Information

The helicopter was under the command of CHPL holder with copilot who was also a CHPL holder. The PIC was a retired Indian Army officer and had joined PHL in September 2010. The PIC of the accident flight was earlier involved in a ground accident on a Dauphin N3 Helicopter, (though he was flying as copilot at that time), wherein the helicopter entered a dynamic roll over while taxiing. As per the recommendation of the investigation report, corrective training was imparted to both the pilots and they were cleared for flying duties. PHL was advised as a recommendation to include slope operations in their ground refresher training for the cockpit crew and also part of the syllabus for simulator training.

1.5.1 Pilot – in – Command

AGE	:	50Yrs
License	:	CHPL
Date of Issue	:	11.02.2015
Valid up to	:	10.02.2020
Category	:	Multi Engine
Date of Class I Medical Examination	:	14.03.2015
Class I Medical Valid up to	:	13.09.2015
Date of issue FRTOL License	:	11.02.2015
FRTO License valid up to	:	10.02.2020
Total flying experience	:	6000 Hrs
Total flying experience		
during last 6 Months	:	277:15 hrs.
during last 30 days	:	85:45 hrs.
during last 07 Days	:	16:50 hrs.

1.5.2 Co- Pilot

AGE	:	30Yrs
License	:	CHPL
Date of Issue	:	23.03.2010
Valid up to	:	22.03.2020
Category	:	Multi Engine
Date of Class I Med. Exam.	:	17.03.2015
Class I Medical Vaid up to	:	16.03.2016
Date of issue FRTOL License	:	23.03.2010
FRTO License valid up to	:	22.03.2020
Total flying experience	:	800 hours
Total flying experience		
during last 6 Months	:	135:20 hrs.
during last 30 days	:	04:50 hrs.
during last 07 Days	:	04:50 hrs.

1.6 Helicopter Information

1.6.1 General Description

Dauphin AS 365 N3 helicopter is certified in transport category, for day and night operation under VFR & IFR under FAR 29 amendment 16 category A & B. It is a twin engine helicopter fitted with Arriel 2C engines manufactured by Euro copter France. The maximum operating height under IFR is 15000 feet and maximum take-off weight is 4300 kg. The length, width and height of the helicopter is 13.684 meter, 3.285 meter and 3.808 meter respectively.

1.6.2 General Information (for the subject serial number)

The helicopter was operated under Non-scheduled operator's permit No. 02/1998 which is valid up to 15th March 2017.

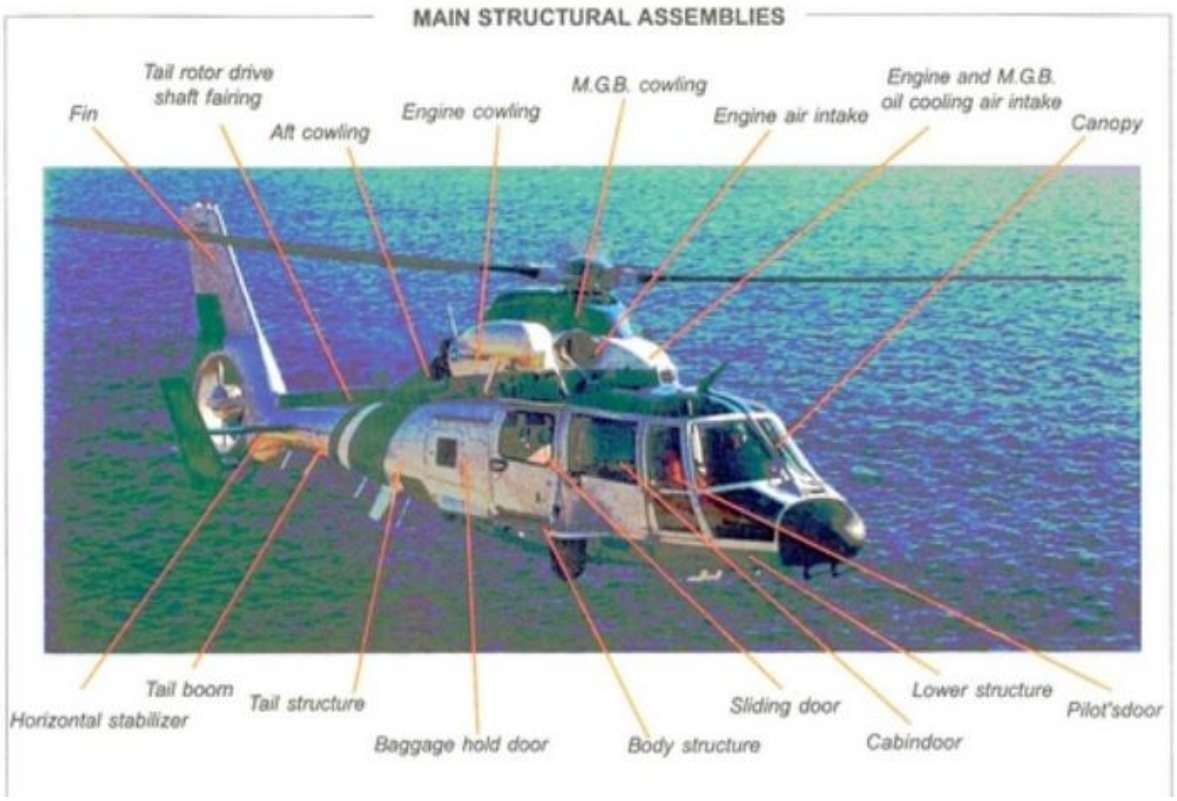
a)	Aircraft Model	:	DAUPHIN AS 365N3
b)	Aircraft S. No.	:	6631
c)	Year of Manufacturer	:	2002
d)	C of R	:	3103 issued on 08.01.2013
e)	C of A	:	2512
f)	C of A Validity	:	16.07.2016
g)	A R C issued on	:	17.07.2015
h)	ARC Valid up to	:	16.07.2016
i)	Engine Type LH	:	ARRIEL 2C
j)	Engine SI. No. LH	:	24347
k)	Engine Type RH	:	ARRIEL 2C
l)	Engine SI. No. RH	:	24203
m)	Aero mobile Licence No.	:	A-020/023-RLO(NR)
n)	Aircraft Empty Weight	:	2680.76 Kgs
o)	Maximum Take-off weight	:	4300 Kgs
p)	Date of weighment	:	24.11.2010
q)	Total Airframe Hours	:	8213:28
r)	Total Engine Hours LH	:	4206:50
s)	Total Engine Hours RH	:	5279:48

The last major inspection done was 600 hrs/02 year inspection at 8186:22 Airframe hours from 07.07.2015 to 17.07 .2015 at Guwahati. Subsequently all lower inspections, after last flight inspection and pre-flight checks were carried out as and when due before the accident.

The helicopter was last weighed on 24.11.2010 at Mumbai and the weight schedule prepared and duly approved by DGCA. As per the approved weight schedule the Empty weight in land configuration is 2680.76 kgs. Maximum usable fuel capacity is 896 kgs. Maximum permissible load with 2 pilots, fuel and

Oil tank full is 553.24 kgs. Empty weight CG is 4.190 meter aft of reference in land configuration. As there has not been any major modification affecting weight & balance since last weighing, hence the next weighing would have fallen due on 23.11.2015.

1.6.3 Construction:



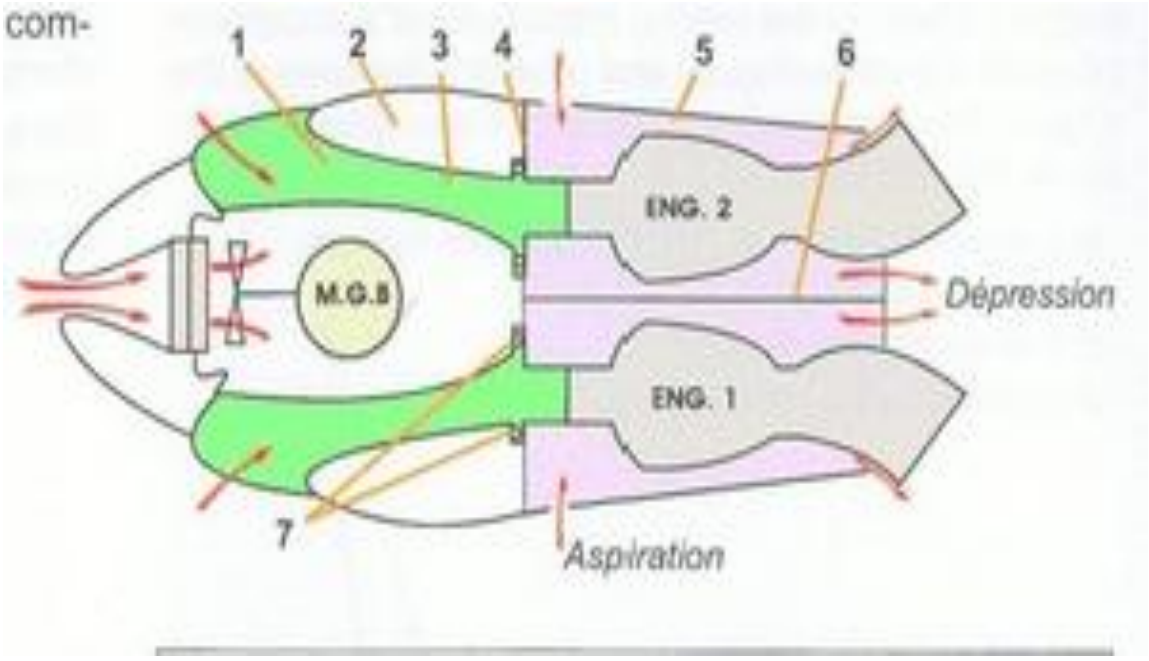
The structure of the helicopter is sandwich design stressed structure, with carbon fabric (Fenestron Fin and horizontal stabilizer), composite glass cloth (form of Nomex sandwich) and Kevlar cowling & faring.

Canopy and door includes frame work and 3 doors on each side. The primary structure includes transmission deck, engine check strong frames, forward, body and aft structures. The tail structure includes tail boom, horizontal stabilizer and side fins, fin and tail rotor guard. Secondary structure includes firewall, console, cabin floor, luggage hold doors, electric equipment racks and firewalls.

1.6.4 General information on engines (as on 03.08.2015)

The helicopter was fitted with two Turbo shaft Arriel 2C engines manufactured by Turbomeca, France. Each engine is mounted at 3 point on 1 coupling casing linking in a rigid way, i.e. by the engine to the MGB, and 2 elastomer damping pads, supported by the engine coupling tube. The fuel and oil pipes, the engine controls and fire detection electrical circuits are either fireproof or fire protected. Water, any fuel leakage is evacuated outside via drains located on the engine compartment floor.

The engines are installed in 2 insulated fireproof compartments. In forward flight the air intakes benefits from the ram air effect. The air is fed to the engines through ducts in the MGB cowlings. The engine compartments are ventilated by air drawn out by them by the negative pressure inducted by the exhaust gas.



1. Air intake, 2. MGB cowling, 3. Engine air intake duct,
4. Front firewall (titanium),
5. Fire proof engine cowling (NOMEX honeycomb)
6. Axial firewall (Titanium)
7. Inflatable seal

The main engine features include

- Free turbine engine with independent gas generator shaft and power turbine shaft.
- Electronic fuel flow governing system.
- Modular design individual module replacement without having to return the complete engine to the factory.
- Self- contained lubrication system.

The serial number of the LHS engine was 24347 and had logged 4206:50 Engine hours and 2133.08 FT cycles. The serial number of the RHS engine was 24203 and had logged 5279:48 Engine hours and 2639.27 FT cycles.

1.6.5 Emergency Locator Transmitter (ELT)

The helicopter was fitted with an ELT which gets activated at about 2.3 g and should always be kept 'ON'. The operating frequencies are 406 MHz, 121.5 MHz and 243 MHz. It transmits the latitude and the longitude of the helicopter on 406 MHz to a satellite system. The transmitter is identified by Serial Number of the aircraft. The transmitter on 406 MHz should operate for 24 hrs continuously before shutting down. The transmitter on 121.5/243 MHz should continue to operate till there is battery power (72 hours).

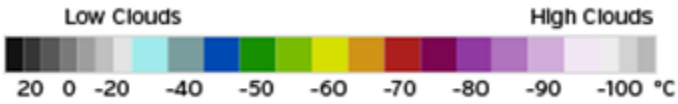
In the present accident, the ELT has not got activated.

1.7 Meteorological information

There is no meteorological observatory in Khonsa. The weather report issued at 1030 hours IST by the IAF (MET) department of Chabua which is in plain areas of Brahmputra valley indicated a total cloud count of 7 octa with temperature and dew point of 29.4° C and 25.6° C respectively. There were few, scattered and broken clouds at 450m (1500 feet), 750m (2500 feet) and 2.7 kms (9000 feet) of height respectively.

The cloud amount in the valleys and around ridges generally is greater than what is observed over plains and the weather changes very fast in the valley

particularly settling of clouds. There could also be scattered rain patches in the area.



The passenger on the previous sector i.e. flight to Khonsa, the eye witnesses and the officer on duty i.e. ASI (Food & Civil Supply Dept.), all have stated that due to bad weather the helicopter had hovered twice prior to finally landing at Khonsa indicating that the visibility was poor at the time the helicopter landed at Khonsa. Following have been stated by the eyewitnesses who were at the helipad.

> "…and finally the helicopter took off at around 10.20 hrs and vanished in thick clouds towards Longding side."

> "… the helicopter took off from the helipad and proceeded towards Longding side. The weather was cloudy and rainy at that time."

There were people working in the fields near the crash site. Following are the excerpts of their statement

> "I couldn't notice the helicopter properly as it was cloudy and foggy. On the next moment it went inside the thick cloud…. ."

"…and then the said helicopter vanished into the thick clouds."

ASI (Food & Civil Supply Dept.) who was on duty on 4/8/15 to receive and see off the helicopter has stated that,

"On 4/8/15, the chopper trying to land at the helipad ground, due to bad weather the chopper (made) round 2 (two) time at the sky and after few seconds it landed at ground between 1000 hrs to 1005hrs. One of the pilots have got down and moved towards the roadside with his mobile phone in hand. Later he talked to somebody.

After that, the pilot said that they will go first to Longding, changlang & then Dibrugarh;

The chopper take off in between 10.20 -10.25 hrs to Longding. During takeoff the weather was very bad & visibility was low.

Normally the chopper takes off toward south west direction but that day the chopper took off towards south east direction for Longding.

All the activities were done without stopping the rotor of the chopper, the rotor was not stopped."

1.8 Aids to navigation

The helicopter was fitted with the following equipments:

	Description	Part No.	Sl No.
1	VOR/ILS KNR 634 KING	066-01078-0010	14644, A16149
2.	ADF KDF 806	066-1077-01	7670
3.	RADIO ALTIMETER	9599 607 18503	2669
4.	DME KDM 706 KING	066-01066-0025	15480
5.	ELT CPI 503	503-16-25	2452
6.	TRANSPONDER MST 67A	066-01143-0601	4577
7.	GPS TNL 2101 TRIMBLE	81440-32-241	3500069

There was no snag or malfunction reported in working of these equipments.

1.9 Communications

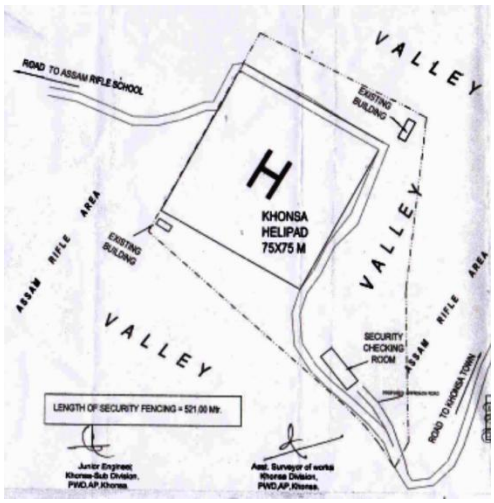
The helicopter was installed with following Communication/ Equipments as on 03.08.2015

	Description	Part No.	Serial No.
1.	Intercom 'TEAM' System	CP1976A1	5900,5837,1862
2.	HF 9100 Collins	622-8112-003	10183
3.	VHF/AM KTR 908 KING	064-1023-00	C12416,C12946

There was no snag or malfunction reported in working of these equipments.

1.10 Aerodrome information

Khonsa helipad from where the accident helicopter took off is owned and maintained by the Government of Arunachal Pradesh. Sketch of the helipad as maintained by the State is given below.



Khonsa is about 40 nautical miles south east of Dibrugarh. The area in which the helicopter went missing is a hilly area adjoining north Nagaland and Myanmar border. Longding is about 12 nautical miles south west of Khonsa. There are undulating hills in the area of average elevation of about 3000 to 4500 feet. The average elevation south and south east of Khonsa increases The

highest hill feature is of 6500 feet elevation which is in between khonsa and longding. There is another hill feature which is at elevation of 9120 feet close to Myanmar border .The area is very sparsely populated and the hills are covered with dense vegetation. There is also a road connecting Khonsa to Longding which passes from west of this highest feature. The helipad elevation at Khonsa and Longding is about 3000 feet.

1.11 Flight recorders

The helicopter was fitted with CVFDR, part number 980-6021-066 and serial number 12268. The CVFDR unit has not been recovered till the time this report was prepared.

1.12 Wreckage and impact information

The wreckage of the helicopter has gone into a deep gorge. The Committee was provided with the photographs of the wreckage which the rescue party has taken. The surrounding area around top of the gorge was combed for any parts/ portion of the helicopter. No part or portion of structure was found in the area. The whole wreckage barring the heavier parts like engine, MGB etc. were in bits and pieces. The portion of panels and other tertiary structure was found stuck in the bushes/ trees on the hill sides. Heavier parts have rolled down to the bottom of the gorge.

1.13 Medical and pathological Information

Both the flight crew had undergone pre-flight medical checks including the Breathanalyser test prior to the first take-off from Itanagar on the day of the accident. There was no abnormality observed and the crew was declared fit to fly.

1.14 Fire

As observed from the photographs of the crash site the wreckage has caught fire after impacting with the hills.

1.15 Survival aspects

The accident was not survivable. All the three occupants on board received fatal injuries after the helicopter impacted the hill and went down the gorge.

1.16 Tests and research

1.16.1 HUMS (Health and Usage Monitoring System)

While recovering the bodies of the deceased from the accident site, the UMS monitoring unit alongwith the HUMS flash card (Transcend 512 MB) was brought out from the gorge.

The HUMS system gathers following USAGE data which is stored in a PCMCIA card:

- Counters for accurate recordings:
  - Operating time, Flying time, Landing count;
  - Engine cycle count, NR cycle count, Torque cycle count.
- Continuous recordings of the rotors and engines over limits:
  - MGB over torque, engines exceedance (T4, NG, NF…);
  - NR exceedance defined for different flight configurations.
- Alarms and failures displayed on the dashboard (aircraft status)
- Alarms on Aircraft Recording and Monitoring systems (system status)

The flight starts when NG1 or NG2 increases over 11% and ends when NG1 and NG2 decrease below 11% and NR below 30%. If the flight is not closed properly, the data of the flight is not recorded in the HUMS card.

Though apparently it seemed that the card had not been damaged but as an abundant precaution, the card was provided to BEA France for downloading the data (Engineering parameters). Following are the excerpts of the BEA report.

“The HUMS card was in good condition. It was connected to a computer. 36 files of 1kB were recorded. There was usage data recorded on the card. As per the results, the last flight for which recording was available corresponded to

04th August 2015. The duration of the last flight was 32 min 17 s. This duration is not consistent with the duration of the flight of the event. No over-limit was detected.

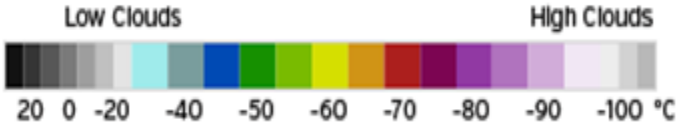
One “TRQCLA.1” alarm was detected on this flight. This failure corresponds to a failure in the torque calibration, in the Engine Control Unit. This failure has no impact on safety.”

So it was concluded that the flight (accident flight) was not recorded in the HUMS PCMCIA card. The last recording most probably corresponded to the flight which was prior to the accident flight. It is also opined that if the flight is not properly closed (completed), the data of the flight is not transferred and recorded in the HUMS card.

1.16.2 Flight track

Radar data of the accident flight was obtained though there was no audio provided in the recording. Various positions of the helicopter against time were taken and superimposed to have a track of the accident helicopter. The flight path of the helicopter from Khonsa to the crash site (15 different values based on the positions in the radar plot) was plotted as shown above.

The RADAR was not having the capability of giving weather picture. Against the plot in the picture below, is also shown the weather as available at the time of accident with color coding (variation) of the clouds.



1.17 Organizational and management information

1.17.1 Department of Civil Aviation, Government of Arunachal Pradesh

1.17.1.1 Organisational set-up

The Department of Civil Aviation, Government of Arunachal Pradesh is headed by Secretary (Civil Aviation) of Arunachal Pradesh. Government of Arunachal Pradesh is hiring helicopters on wet lease for passenger transportation.

There was no formal Organisation Chart available with the Directorate under the Secretary (Civil Aviation). In the Department there is a Director rank officer who is assisted by two Assistant Director Officers out of which one is on deputation (AD (ops.)) and other designated as AD (Tech.) who is working on permanent basis with the aviation. AD (ops.) is assisted by Aviation Officer(s). There is an administrative section assisting these officers.

All personnel are from non-aviation background. The Dept. of Supply and Transport was earlier coordinating the supply of rations to remote areas through IAF fixed wing and rotary wing aircraft. With the improvement in roads, the need of aircraft for transporting supplies has reduced. This Department then started coordinating the helicopter operations with operators.

A schedule is printed for helicopter operations connecting various places in Arunachal Pradesh. This schedule is for the five days of week with Saturday and Sunday as off days. The Government has entered into a wet lease contract agreement dated 7th November 2013 with PHL which was valid for two years. As per this wet lease agreement,

- PHL shall provide the helicopter instrumented for flights as required with current valid Certificate of Airworthiness from DGCA, India with necessary spare parts, equipments, crew and personnel for exclusive use by the Govt. of Arunachal Pardesh in the operations in India.

- The helicopter (s) should be available at Naharlagun helipad for inspection by the representatives of the State Govt. before the agreement is executed. The helicopters shall be taken on lease only after it is inspected and accepted by the State Govt. if so desired.
- The PHL shall prepare a Standard Operating Procedure (SOP) covering all required points as per Civil Aviation Requirement and get it approved by DGCA India and endorse a copy to the State Government. The SOP shall be strictly adhered to in letter and spirit and any deviation shall be only with prior approval of DGCA.
- There should be sufficient copies of Safety Manuals in flight for passengers.

As per the above contract between both these parties the PHL is responsible to follow all rules and regulations as per ICAO & DGCA. State Government is responsible for ticketing of passengers, security checks and loading of the luggage. In case of night halts outside of their designated base, the State Government would also provide accommodation and other admin facilities. The PHL is required to adhere to the schedule given and position helicopters at base.

The State Government had hardly any communication with the DGCA on matters concerning aviation.

1.17.1.2 Helipad Management

As per the existing Standard Operating Procedures (SOP) for Itanagar operations with Dauphin SA 365N helicopter, prepared by PHL Northern Region,

> "In order to ensure safety of helicopter and passengers, a helipad safety and operations cell will be established by the Govt. Arunachal Pradesh Authorities."

The details of the duties and responsibilities are as follows:

1. Helipad safety & operations cell

   The Officer In- charge Helipad will ensure the following.

   a) Safety: The Officer In-Charge will ensure safety of helicopter and passengers. The Officer In-charge Helipad will at all time have communication facilities between Itanagar and the helipad.
   b) Fire Fighting Facilities: Adequate fire fighting facilities as laid down are available. Trained personnel are available at the helipad to operate the equipment in case of emergency.
   c) Refueling: For schedule operations refueling is being carried out at IOC outlets only.
   d) Helipad Inspection: Officer In-charge will inspect the helipad and safety services everyday and declare the helipad fit for operation. He will also ensure that landing area and surroundings are clean and clear of loose articles/ materials, which are likely to be picked up due to down wash of helicopter. He will further ensure periodic maintenance of helipad i.e. markings, repairs and windsock.
   e) Take off, Landing And Emergency Procedure : Take off, landing and emergency procedures are to be strictly followed as laid down in the Flight Manual and CAR section 4 series B part V dated 4th August 2011.

2. Duties of Helipad Management Personnel

   ----

3. Fire Fighting Equipment

   a) ---------

      ----

4. Duties Officer I/C Helipad

   a) OI/C is to carry out daily inspection of helipad and equipment.
   b) Helipad is to be swept periodically.
   c) Any loose article/materials which is likely to be picked up due to rotor down wash is to be removed.
   d) He must inform the pilot about general weather conditions at the destination helipad on landline/mobile phone.
   e) Any deterioration in weather is to be communicated immediately.
   f) He must ensure that helipad is clear before clearing the helicopter.

1.17.2 Pawan Hans Limited (PHL)

1.17.2.1 Organisational set up

PHL was incorporated in October, 1985. It is a non-scheduled air transport operator with valid NSOP and is engaged in Helicopter charter operations. It gives support to petroleum sector mainly ONGC, connecting difficult areas in the North and North East, travel tourism and intra city transportation. The company carries out operations and maintenance contract of helicopters across the country. The Board of Directors is the apex body for PHL. Its normal operations are overseen by the CMD. The Accountable Manager of PHL as per the various Manuals and documents is a person with finance background.

As per the operator,

1. The procedure for obtaining met information followed for flights originating from Itanagar-Mohanbari-khonsa-Longding-Changlang-Mohanbari sector:-

   a) The pilot of his own checks the satellite picture on the internet in the morning before the flight. The Dibrugarh weather is obtained by the base assistant on mobile and recorded in the Register.
   b) The ADST (agency responsible for the movement of passengers from various helipads) representative while giving the details of load and passengers also provides the preliminary weather at that helipad.

c) After refueling at Dibrugarh, before the subsequent flight the PIC checks and gets the latest weather from the Officer In Charge of the helipad (not trained in the task) on the mobile by asking some laymen details to get some insight of the weather. Rest is on his experience and interpretation.

2. The requirements and the procedures laid down for carrying out preflight briefing including met briefing:

   As there are only two crew available, the pre-flight briefing is carried out by the PIC and recorded in the “Pre Flight Register” kept there. Met Briefing is also obtained from the Base Assistant for Dibrugarh and recorded in the “Met Briefing Register” kept there. For subsequent flights from Dibrugarh, the method explained above is followed.

3. Operational control structure of PHL at Guwahati:

   Eastern Region (ER) with Head Quarters at Guwahati is in the process of being fully established and during this process PHL is only posting one pilot on rotation basis at ER to coordinate operation related issues at Guwahati. He also assists the GM (ER) in operational issues of Guwahati and the other Bases under ER. The process of posting a permanent operations HOD at Guwahati is under process at PHL. However, the Operations at ER are controlled by JGM level appointee along with his team at NR which includes formulation of SOP, De-tailing of pilots their training requirements and correspondence with DGCA and air safety aspects. Further, Dauphin N3 deployments at ER are controlled by Western Region (WR) as the entire N3 resources; both machines and human are based at WR. The future plan for ER is to be an independent Region like other existing two regions of PHL. ER is in its formative stages and gradually PHL is placing its resources both human and other at Guwahati.

4. Chief pilot:

   In order to understand the aspect of the approval of the appointment of chief pilot in PHL, it is essential to understand the organization of PHL. PHL, being

a large organization, is working with three Regions namely western Region (WR, Juhu), Northern Region (NR, Safdarjung Airport) and Eastern Region (ER, Guwahati). In the approved organization of WR and NR, (ER is under raising), there is a JGM (joint General Manager) level appointee who is a senior (Supervisor) Pilot of at least one of the helicopters of the fleet and performs all the duties of HOD (operations). He is responsible for the overall operations related aspects of the Region. He is assisted by other Managerial level pilots who are appointed for training, safety, planning and Co-ordinations etc. The HOD Operations of the Region is looking after all the aspects that are looked after by the Chief pilot.

1.17.2.2 Standard Operating Procedure (SOP) for Itanagar

PHL has prepared a standard Operating Procedure for Itanagar with Dauphin SA 365 N Helicopters. The SOP was approved from operational aspects by DGCA on 18th march 2014 with an advice to incorporate the same in their Operations Manual and update the SOP periodically under intimation to DGCA.

As per this SOP,

- Under sub part **H Performance** it is given that the Dauphin helicopter is cleared for VFR & IFR operations. Normally VFR/ Spl VFR day operations are being carried out. However under special circumstances, IFR operations can be carried out with qualified crew.
- Under sub part **M- Operational structure & team for activity.**
  - Pilots: Senior most pilot will be responsible for Operational Planning and conduct of Flying Operations. Rotation and detailing of Pilots will be done by DGM (OPS) NR.
  - AME: The AME will be responsible for maintenance and rectification. He will be detailed by DGM (ENGG) NR.
- Under Sub part **O Maintenance.**
  - Itanagar helicopter base is well equipped to carry out all maintenance activity and inspection on Dauphin up to and including 50 hrs inspections.

All routine inspection pertaining to Air frame, Engine and other related systems, snag rectification, replacement of components etc will be done at the base under the direct supervision of Base Manger (AME) to keep the helicopter airworthy at all times.

- Under Sub part **P Contingency Plan: SAR**
  - Base In charge, in consultation with Ops department NR will coordinate the SAR activities. All possible help from other agencies is also to be sought and coordinated.
- Under Sub part **R: Helipad Management**
  - 1. **Helipad Safety & operations Cell**

    In order to ensure safety of helicopter and passengers, a helipad safety and operations cell will be established by the Govt. Arunachal Pradesh Authorities.

  - 4. **Duties Officer I /C Helipad**

    ---

    d) He must inform the pilot about general weather conditions at the destination helipad on landing /mobile phone.

    e) Any deterioration in weather is to be communicated immediately.

The SOP has also got an AIRAC AIP Supplement number 18/2013 dated 13th June 2013, which are the guidelines and helicopter routings for day VFR helicopter in Arunachal Pradesh as attachment. As per the Supplement,

- Since the area of sector lies in mountainous terrain, all Pilots are required to be thoroughly proficient in hill Operation. Therefore, it is essential that all Pilots follow the instructions as laid down in the relevant CAR and other instructions on the subject in order to ensure that flight safety is not compromised and the task accomplishment is enhanced.

  In view of the past experience of flying carried out in the hilly sectors, the operator must have their standard operating procedures for each helipad, duly revised periodically.

- **Flight Planning**: Meticulous flight planning will be done by the Dispatch sections and pilots keeping in mind:
  - Route- In and Route-Out.
  - No Diversion in terms of Route, Altitude and Timings from the Flight plan once accepted by concerned ATC.
  - Knowledge of other helicopters flying in the valley/over the helipads intended to fly.
  - Contingency plan when encountering bad/marginal weather.
  - Flights will be approved ONLY for VFR conditions and under no circumstances will the helicopters enter IMC conditions.
- **RT Calls**: Pilots will give RT calls at the entry/exit point of the valley and all prominent points en-route. In addition, RT calls will also be made when:
  - On Take-off from helipad along with intentions.
  - Any weather phenomenon is observed.
- **Sortie Monitoring**: Irrespective of time of the year or season, all sorties into valleys will be monitored by responsible personnel from Company's management till its completion.

Perusal of the Appendix 'B' to the SOP reveals that Longding helipad has not been shown nor are there any routings for the inter hill helipads given.

1.17.2.3 Training Manual

PHL (WR) has provided a copy of the training Manual (volume 4 of the operations Manual, old format) which was not having any date of issue and as per PHL the Manual was approved by the DGCA in as it is condition. This was the only version available with them. It was also informed that there were no amendments made to the Manual but a revised Operations Manual (part IV – Training Manual) in the new format has been submitted to DGCA for approval. Northern and Western region had training captains but there was no training captain appointed for Eastern Region.

As per the existing training manual on the date of accident, the DGM (trg) / DGM (ops) of WR & NR respectively would be responsible for their respective type training. As a general instruction to the training personnel it is mentioned that they must,

"Ensure that where weakness is identified these are concentrated upon. The purpose is not to fail a candidate but to teach and correct him, avoiding over criticism and the undermining his self confidence. However where serious weaknesses are revealed and the candidate's ability is in doubt, then there must be no hesitation in recording a fail. "

1.17.2.4 Training Records

PHL pilots undergo recurrent training at HATSOFF Training (P) Limited as per the service agreement dated July 2014. The training records of the Flight crew as available with PHL and HATSOFF were scrutinized. The following is the gist of the trainings carried out by the co-pilot.

Type rating training (Dauphin N3)	14.6.2014 to 26.6.2014	Ground training, 9 sessions of simulator training for Dauphin N3 with every SIM session having different exercises.
Initial SVFR test	1.2.2015	VEGT-VEGT
Skill test	2.2.2015	VEGT-VEAC
Initial hill release check	2.2.2015	VEAC-VEGT
Initial IR test	10.7.2015	On Dauphin FTD at HATSOFF Bangalore

The last pilot proficiency check/ skill test by day for the co-pilot was carried out on 28th June 2015 by a DGCA approved examiner. Earlier to that the same check was carried out on 6th Jan 2015, wherein though the overall performance was satisfactory but in the remarks it was stated, "an average sortie; Needs to put in lot of effort".

The co-pilot had also attended recurrent training on simulator form 22 Jul 2015 to 23 Jul 2015 covering the following:

- Critical Emergencies 2:30 hrs
- IF Training 2:30 hrs

He was given attendance certificate for the same. As per the test report of the training following comments were made:

22.07.2015 (0830 – 0945 hrs) Critical emergencies - 1	Pilot Briefed for the sortie. Carried out Checks as per check list. Practiced emergencies by day. His actions conformed to SOP. However there is lot of scope for improvement. For is experience check excessive movement/ cyclic.
22.07.2015 (1330 – 1445 hrs) IF- 1	Pilot briefed for the sortie. Practiced IMC Flying. Needs more practice and exposure keeping his experience in view. Knowledge of charts and practical precision approach – VEGT. Scope for improvement. Should concentrate more and brush on procedures.
23.07.2015 (0840 – 0955 hrs) Critical emergencies-2	Pilot's knowledge is not being put in practical use. Needs to improve his concentration in the helicopter.
23.07.2015 (1430 – 1545 hrs) IF-2	Over all flying in IMC conditions needs to improve. Drifts away from his aim. Lacks concentration in bad weather.

1.17.2.5 Flight Safety Department & Safety Management System

The Flight Safety Manual and the Safety Management System Manuals have been prepared as per the DGCA requirements. The SMS Manual has been accepted by DGCA in October 2014. The Safety Policy has been signed and issued by the Accountable Manager.

The SMS manual has not been revised since initial issue in 2014, inspite of the fact that various changes in organisation setup have taken place. Neither there was any Risk Assessment carried out for any of these changes. Safety Communication through meetings, seminars and bulletin etc along with Safety Training has been stated as a major way to achieve the goal of Safety Promotion. No safety circular or bulletin has however been issued during last 2 years.

Safety training is required to be provided to all staff with refresher each year, but it was found that even initial training has not been completed for all the employees as mentioned in the Manual. As an example, no safety training undergone by Joint GM eastern region acting as Dy. Chief of flight safety eastern region till August 2016.

Pawan Hans has defined 18 key performance indicators as part of Safety Assurance, though no values were indicated for any year to assess the level of safety. Data pertaining to Safety Performance Parameters are also required to be communicated to all concerned, but in absence of any monitoring system, no such data is shared. There is no record to indicate that consultation with all personnel regarding changes in work environment, procedures, practices etc. is being carried out.

The safety duties are defined in the SMS Manual for a Base Manager of the detachment but in practice the acting base manager(s) were not aware of the function. The Manual further requires that the Flight Safety Document system shall be reviewed at least once a year but it was not carried out even once.

It was informed that for a period of almost a year prior to the accident, actions such as review of Flight Safety Manual, Safety Management System Manual and record keeping on key performance indicators, training of PHL executives, pilots, AMEs and other staff were not conducted though it was required as per regulations.

1.17.2.6 Attrition of flight crew

In one of the regulatory audits, it has been noted that there has been an attrition of 46 pilots since 1st January 2014 in PHL. This is over 30% of the average strength of pilots in the company. As on 21.12.2015, the company also has a shortfall of 34 pilots as per their internal planning parameters of the company with a shortfall of 21 pilots in the western region alone. (Dauphin N3 along with its flight crew is deputed to Itanagar from western region). The operations management staff at both the Northern & Western regions has also undergone major turnover in the period.

During discussions, it was informed that probable cause for attrition of pilots is better opportunities/ emoluments being offered by other Operators. In order to curtail attrition and bench-mark emoluments with industry, several measures are being introduced. These cover proposed increase in the license related allowances, narrowing the gap in emoluments between regular and contract Pilots through regularisation of contract Pilots after completion of 5 years with overall good performance, proposed increase in the minimum assured flying to cater to pilots with lower flying hours task, review of the promotion policy of pilots, increased insurance coverage and review of the overall emoluments structure comprising of fixed salary and variable allowances.

1.17.3 Directorate General of Civil Aviation (DGCA)

The DGCA is entrusted with regulatory functions for safe operations of civil aviation aircraft in India including the obligations contained in ICAO Annexes as a signatory to the Chicago Convention which include formulation of standards of airworthiness for civil aircraft registered in India and grant of certificates of

airworthiness to such aircraft; Licensing of pilots and aircraft maintenance engineers; conducting examinations and checks for that purpose; maintaining a check on the proficiency of flight crew and of other operational personnel such as flight dispatchers and cabin crew; supervision of the institutes/ clubs/ schools engaged in flying training including simulator training.

The DGCA is the single regulatory body for Civil Aviation in India.

1.17.3.1 Flight Inspection Directorate of DGCA

Flight Inspectors are responsible for carrying out checks on the proficiency of the flight crew. The pilots also carry out surveillance checks and are part of the Regulatory audit teams of the DGCA. The Directorate is also responsible for approving SOPs and assists in approval of CAP 3100 of the organisations.

1.17.3.2 Licensing and Inspection of Helipads

The Central Govt. Rules for the licensing of aerodromes are contained in Part XI of the Aircraft Rules 1937. Rule 78 requires that no aerodrome shall be used as a regular place for landing and departure by a scheduled air transport service or for a series of landing and departures by any aircraft carrying passengers or cargo for hire or reward unless it has been licensed.

This pertains not only to the licensing of the aerodrome but also include heliports for Public use (CAR Section 4 Series F Part I). As per Regulations, it is the responsibility of the operator to ensure that they land at a licensed aerodrome.

In Arunachal Pradesh, there are around 120 helipads and the State Government provides helicopter services for day to day transportation and emergency requirements. Heliports are not required to be licensed unless they are to be used by a schedule transport service and/ or for public transportation involving series of landing and/ or hire and reward. Practically speaking therefore, all the helipads being used for operation should have been licensed unless otherwise exempted.

1.18 Additional information

1.18.1 Search & Rescue

The Search and Rescue Services in India is organized by the Airports Authority of India in collaboration with the Ministry of Defence. Airports Authority of India has prepared a manual for search and rescue operation.

On receipt of information of the overdue helicopter, search and rescue (SAR) team was constituted by the Airports Authority of India (AAI) office at Guwahati for coordinating the SAR operation of the helicopter and issue situation report (SITREP). The SITREPs were issued on daily basis based on the communication received or transmitted concerning the search operation starting 4.8.2015.

All the Search operation was carried out by IAF helicopters alongwith ground search operations by Assam Rifles till the wreckage was finally spotted on 10.08.2015. The recovery of bodies was carried out with the help of IAF high altitude mountaineering personnel on 12.8.2015 and bodies were shifted to Dibrugarh on 13.8.2015 thereby the SAR operation was called off by all the concerned agencies. Though messages were sent by the DGCA officials through

AAI SAR team at Guwahati for retrieving of the wreckage but it could not be done probably due to inclement weather at that time.

The Committee later on took up the matter from time to time with PHL, Arunachal Pradesh State Government even through Ministry of Civil Aviation for retrieval of the wreckage particularly Cockpit Voice Flight Data Recorder (CVFDR) which is a very vital and major piece of evidence for the investigation. However the wreckage or the CVFDR was not available.

1.18.2 Hill flying accidents – a review

The helicopters ability to transit through or maneuver in a hilly or mountainous terrain is one of the most demanding aspects of helicopter operations and has resulted in a number of helicopter accidents. The Committee went through the investigation reports of the accidents and it was observed that the issues of planning, preparation, weather, flying techniques etc. came into play in these accidents. It was also observed that there was a very high percentage of commonality of factors in these accidents. Following is the gist of these aspects:

1.18.2.1 Planning & preparation vis-à-vis weather

Operating in hilly terrain requires extra planning considerations particularly to the weather. As the helipads are mostly away from an airfield (with the associated met facilities), the pilots are required to interpolate the information provided in the synoptic charts, TAFs and METARs. Further hills can create their own micro climates in which the weather may deteriorate rapidly. Clouds can form quickly on both hill tops & valley bottoms and pilots must learn to recognize the clues to weather given by cloud formations such as lenticular and rotor clouds. Cumulonimbus clouds and other clouds of vertical development typically produce heavy rain and thunderstorms, especially when the air is forced up due to orographic lifting. The cumulonimbus convection currents produce strong and unpredictable winds particularly up-draughts and down-draughts which are

extremely dangerous and aircraft should avoid flying in the vicinity of a cumulonimbus cloud.

Radio communication in mountainous terrain is difficult and/or intermittent and therefore consideration should be given to establishing a flight following system. In hilly terrain, the pilot may encounter negative physiological and psychological effects particularly hypoxia, visual illusions, apprehension, spatial disorientation etc.

Reduced visibility conditions or combining VMC & IMC also greatly increase the risk of spatial disorientation. Spatial disorientation occurs when a pilot develops an incorrect perception of aircraft attitude, altitude or motion relative to the Earth's surface. It results when a pilot's normal visual cues to aircraft attitude are inaccurate, unavailable or inadequately monitored and the pilot, instead, relies on other cues to aircraft attitude that may be misleading.

These cues are provided by the motion-sensing vestibular organs in each inner ear. The sensory organs of the inner ear detect angular accelerations in the pitch, yaw and roll axes, as well as gravity and linear accelerations. The vestibular system provides useful sensory information under conditions of self-locomotion on the ground but provides misleading sensations in the flight environment. Vestibular sensations are easily ignored when pilots have a clear view of the horizon, but they become compelling illusions when external visual references are not available.

Even experienced, instrument-rated pilots can experience episodes of spatial disorientation in reduced visibility conditions. Situational risk factors for spatial disorientation include false surface planes created by sloping clouds or terrain, transitions between VMC and IMC that require the shifting of visual attention between external visual references and cockpit flight instruments, sustained turns and high workload. Spatially disoriented pilots are at risk of making inappropriate control inputs that can result in loss of aircraft control.

1.18.2.2 Flying techniques (EHEST (European Helicopter Safety Team) analysis))

- Speed Management

  Maintaining an appropriate airspeed can be very challenging in mountain terrain. Pilots need to be aware of the speed limitations especially in relation to turbulence speed and VNE. It is advisable to maintain Vy whenever possible, thereby allowing maximum power margin for maneuvering.

- Attitude Management

  When operating in hills or mountains the “real” horizon can be difficult to identify from the slopes of the surrounding terrain. When this happens, vertical and horizontal references can be lost and it is difficult to establish whether the aircraft is climbing, descending or is in straight and level flight. Frequent reference to the aircraft altimeter, ASI, VSI and attitude indicator should be made.

- Height Management

  If the aircraft encounters a wind –shear or a severe down-draught and it is not possible to maintain height using power, the pilot should turn towards a clear area, adopt wings level, set maximum power and the pitch attitude for Vy in order to maintain or achieve a safe flight condition.

- Transit Flying

  When flying through hilly or mountains terrain, the route should be planned taking the local meteorological conditions into account avoiding adverse weather. When crossing mountains, especially in strong winds, one should clear the top of the mountain by at least 500 ft. if one is unable to achieve a safe clearance, consideration for an alternative route or a diversion may be given.

  When crossing a range of hills or mountains with cloud on the top, it is better to approach parallel to the top of the range in order to see the extent of the

clouds. If the cloud cover appears to be extensive beyond the high ground, consider an alternative route or a diversion.

The escape route when flying along a valley is normally to perform a 180^0 turn. Therefore if continued flight alone the valley is deemed inappropriate, e.g. due to low clouds, DVE or obstacles, an early decision to turn back is essential to ensure a successful turn.

- Approach to a Ridge or Pinnacle

The escape route for an approach to a ridge or a pinnacle should be a planned turn away from the feature, which should not require abrupt or excessive maneuvering, into an obstacle free area previously identified during the recee phase.

1.18.2.3 Common Factors in hill accidents

The investigation reports of the accidents wherein helicopters have entered the bad weather concluded to have the following common factors in majority of the cases:

- The helicopters were capable of negotiating through weather since these were IFR certified and had weather radar.
- Pilots were experienced
- Flights were VFR/ Special VFR flights
- At the time of take off, enroute weather was bad
- Accidents occurred in flight while negotiating weather
- Loss of visual reference was evident in these cases
- Pilots had the option to either abort their flights or return back ASAP.

1.19 Useful or effective investigation techniques

Nil

2.0 ANALYSIS

2.1 Airworthiness of Helicopter

The Helicopter had flown for 8213:28 airframe hrs. before the date of accident flight. The last Airworthiness Review Certificate (ARC) was issued on 17.07.2015 at 8186:34 airframe hrs and was valid up to 16.07.2016. The helicopter had flown for 26:54 hrs since issue of last ARC. The Certificate of Airworthiness of helicopter remains valid until or unless it is suspended/ cancelled subject to valid ARC. The helicopter's Aeromobile license was valid till 31st Dec 2016.

The helicopter is equipped with two Turboshaft Arriel 2C engines manufactured by Turbomeca, France. The last major inspection done on helicopter was 600 Hrs/ 02 year inspection at 8186:22 Airframe Hours from 07.07.2015 to 16.07.2015 at Guwahati. The last 25 hours inspection was carried out at 8210:16 airframe hours on 01.08.2015. Subsequently all lower inspections, after last flight inspection and pre-flight checks were carried out as and when due before the accident. Last 10 hours inspection was carried out at 8201:04 airframe hours on 28.07.2015.

Approved Pre-flight (Before Flight Inspection) schedule was duly carried out by an approved AME on 04.08.2015 with 6:48 hrs available before next 10 hrs inspection. The pilot had completed the load and trim sheet before undertaking the flight for the sector Itanagar-Dibrugarh. The helicopter was loaded within the limit and C.G was within approved range.

All modifications and Service Bulletins were complied with before undertaking the flight. No snag was pending for rectification before the accident flight.

Analysis of PDR reveals that apart from the snag related to CVFDR light that was reported on 22.07.2015, there was no snag reported by pilots since 600Hrs/ 02Yrs inspection. Prior to 600hrs/02Yrs inspection, helicopter was

involved in an incidence wherein helicopter returned back to bay after taxiing due Engine 1 failure on 20.06.2015. The snag rectification for the same was carried out by 24.06.2015 and helicopter did not report any snag till the time of 600Hrs Inspection.

Itanagar base was approved for carrying out 100Hrs/ 03Months inspection of AS350 B3 helicopter and its engines. Pawan Hans had sought enhancement of scope of approval for Itanagar detachment to carry out 300Hrs/ 01Yrs inspection at Itanagar and was in process of obtaining the approval. However, at the time of accident, all major maintenance of Dauphin helicopter operating in North East India was being carried out at Pawan Hans Base in Guwahati which had necessary approvals for the same.

Technical emergencies:

The Committee deliberated on the various technical emergencies, one of which could have occurred such as engine failure (both), MGB failure, rotor failures, hydraulic failures etc. Failure of one of the engine would not result into any grave emergency as the helicopter with the given loading would continue the flight without any problems. Failure of both engines is highly improbable.

From the photographs of the wreckage made available to the Committee, the wreckage distribution indicates that the whole wreckage after impact with the hill has gone into gorge and there are no indications of in flight fire or disintegration of any part of the helicopter. So, failure of MGB, main rotor, main rotor blades, tail rotor or in-flight fire including that to engine seems impossible.

Though failure of tail rotor in bad weather may pose difficulties to control the helicopter and the helicopter may hit the hills but there is no other corroborating evidence of tail failure.

It can be concluded that the helicopter was maintained properly and it was airworthy to take the flight. Maintenance aspects of the helicopter have not contributed as cause of the accident.

2.2 Crew qualifications

Both the crew held valid licenses and were qualified on type. Their ratings were current. The PIC had a total flying experience of 6000 hrs and the co-pilot had a total flying experience of around 800 hrs. Both had valid class I medical and have undergone proficiency checks as per the requirements. The crew has undergone pre flight medical including breath-analyser test at Itanagar before taking off for the first flight of the day and they were not under influence of alcohol.

2.3 Training of flight crew

In any operational organisation training records are very vital and is supposed to provide the health of operations. With sound review procedures of the training records, a strong roistering methodology can be devised so that the risks are minimized particularly for crew pairing and for special operations. Earlier investigation reports have emphasized on the issue and gave recommendations not only on the conduct of training but also on upkeep of documentation.

The training of Dauphin N3 pilots is under the head of training, western region under the overall control of GM (WR). From last one and a half year, an officer (Capt.) is holding the post of both head of training as well as the head of operations. Simulator training to fulfill the requirements of relevant CARs is being imparted at HATSOFF Bangaluru under a service agreement. A pilot is deputed for carrying out the requisite training on simulator as per CAR for fixed number of hours and for fixed exercises. Though there are no failures during the simulator training but the SFI puts his observation in the comments column.

The co-pilot in the present case has undergone his type training and recurrent training at HATSOFF as per the CAR requirements but the comments in the SIM exercises report(s) invariably required that the pilot should be monitored on various weak aspects. Further the documents also revealed that his skill test and initial hill release check was conducted at Guwahati and Shillong, which, it is felt should have been on hilly helipads.

Review of the files of the individual and particularly of the crew of subject flight revealed that there is no system of review of the training report/ record received for the pilot and nor is there any procedure through which the progress of the pilot on any weak areas indicated in the simulator training can be monitored. It is more of a dumping the records in a file with index.

2.4 Operations in Arunachal Pradesh

Government of Arunachal Pradesh is hiring helicopters on wet lease for passenger transportation under Department of Civil Aviation, Government of Arunachal Pradesh.

As per the wet lease agreement, PHL was required to prepare a Standard Operating Procedure (SOP) covering all required points as per Civil Aviation Requirement and get it approved by DGCA India and endorse a copy to the State Government. It is pertinent to note that none of the person in the Aviation Department is from aviation background. Though it was required that SOP shall be strictly adhered to in letter and spirit and any deviation shall be only with prior approval of DGCA but the Department was not provided a copy of the SOP. State Government had hardly any communication with the DGCA on matters concerning aviation.

As per the existing Standard Operating Procedures (SOP) for Itanagar operations prepared by PHL Northern Region,

> "In order to ensure safety of helicopter and passengers, a helipad safety and operations cell will be established by the Govt. of Arunachal Pradesh Authorities."

Officer In-charge of the helipad was required to inspect the helipad and safety services everyday and declare the helipad fit for operation. He will further ensure periodic maintenance of helipad i.e. markings, repairs and windsock. The above was carried out only for Naharlagun helipad and not for other helipads.

The State Government may establish helipad safety and operations cell that can carry out periodic inspections for all the helipads.

The ground personnel handling the helicopter arrivals and take-offs at hill helipads should be given minimum training concerning relevant safety aspects of operations, provide rough assessment of weather, etc. Standard safety forms (Formats) under Safety Management System can be prepared, which should be filled in by the helipad personnel and used for safety management and risk analysis.

2.5 Safety Management System

The SMS Manual of PHL has been accepted by DGCA in October 2014. The Safety Policy has been signed and issued by the Accountable Manager. A detailed review of the manual gives a good account of “to do list” of certain activities. At times there are ‘sermons’ regarding what should be done by an operator reproducing the contents of ICAO document 9859.

‘How to do’ is totally missing from the Manual. Further taking into account that the training of individuals on SMS across the whole organisation has not been carried out as per the requirement, the Manual just remains a document without performance of functions at working level.

For a period of almost a year prior to the accident, actions such as review of Flight Safety Manual, Safety Management System Manual and record keeping on key performance indicators, training of PHL executives, pilots, AMEs and other staff were not conducted though it was required as per regulations.

Earlier Committees of Inquiry have recommended “establishment of strong safety department” but it was observed that the operator has not established the safety department in true letter and spirit. It is still continuing on ad-hoc basis and full fledged department is yet to be established.

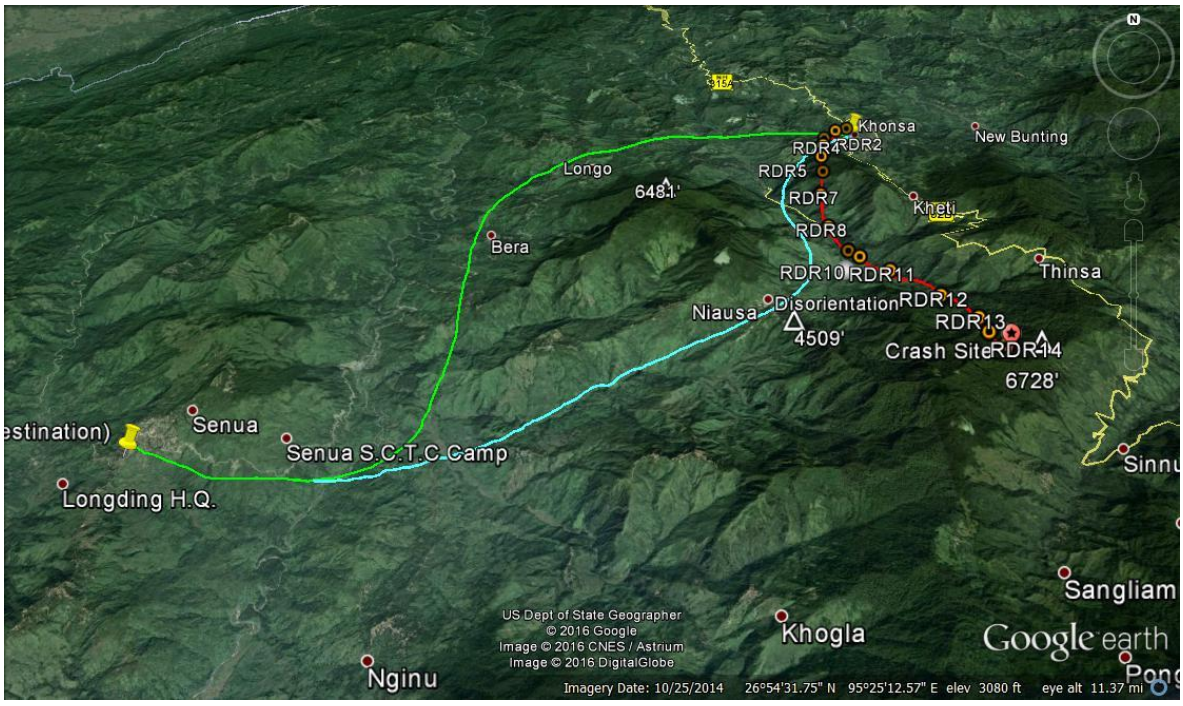
PHL should immediately undertake the implementation of safety management system across the whole organisation by completion of training,

reviewing the manual by including the procedures for the actions to be carried out under SMS, appointing key safety personnel at all regions and Corporate Office, establishing values of the safety indicators, etc.

2.6 Weather & circumstances leading to the accident

2.6.1 Pictorial Analysis of Flight Path

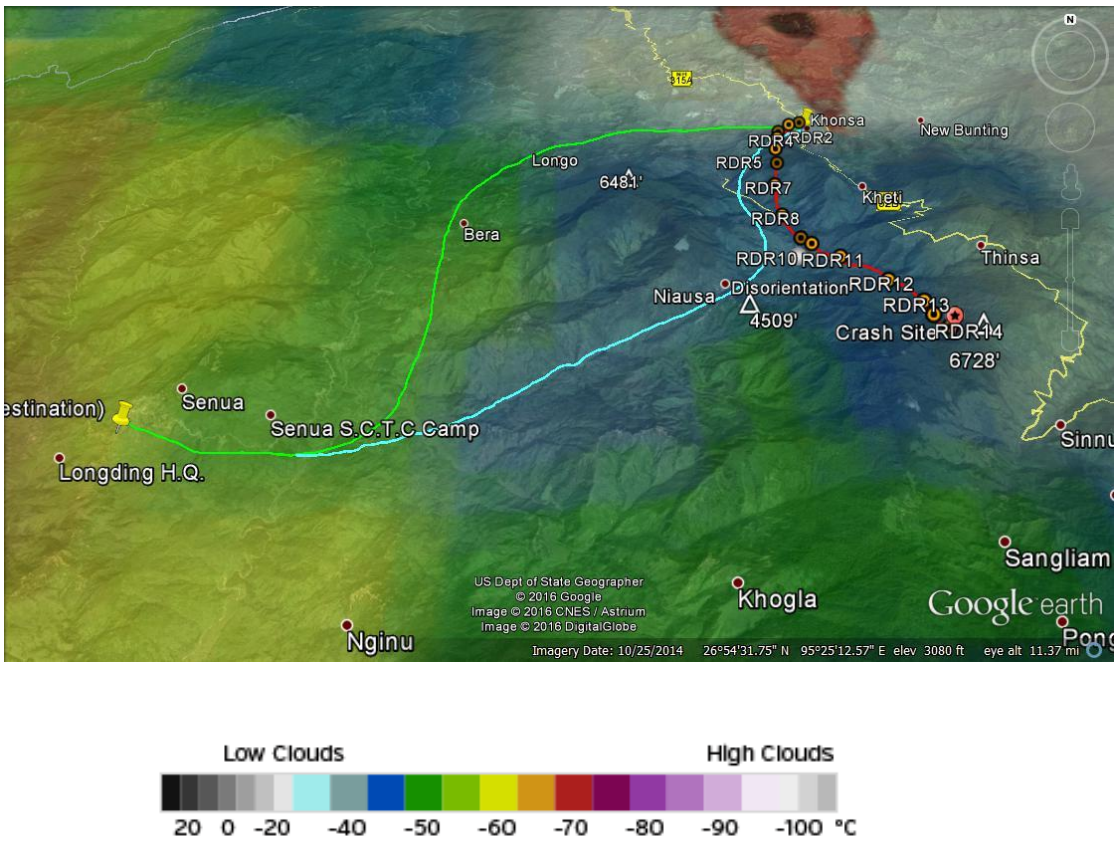
It has been discussed earlier that CVFDR recording was not available. The evidences available with the Committee i.e. RADAR report, Flight Plan weather picture of the area at that time especially clouding and statements of individuals at Khonsa helipad were analysed and integrated to have the probable path followed by the helicopter vis-à-vis weather conditions and hill topography. It is amply clear from the weather synoptic that the clouds were thick and low and visibility was poor at the time of flight. The SOP for the Itanagar operation does not give the routing (radial and heights which should be followed for the sortie between Khonsa and Longding.



The above picture gives out the terrain very clearly and attempt has been made to depict the planned, alternate and actual flight paths taking into account

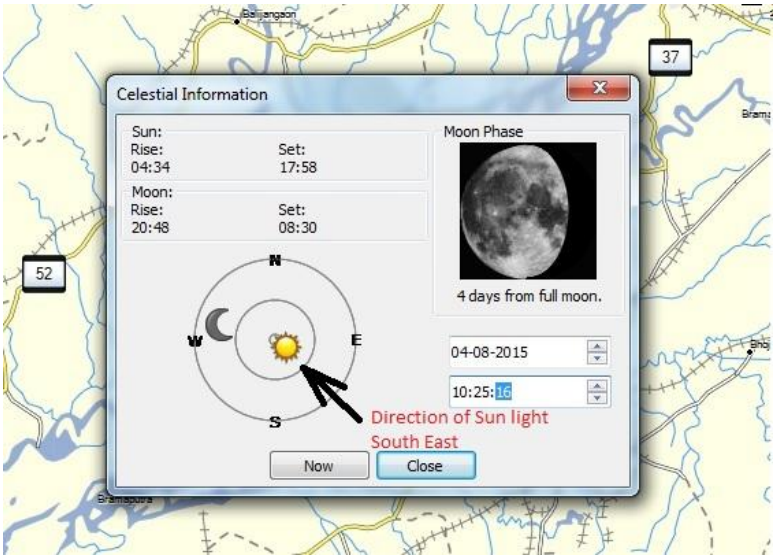
the data available from Radar plots, Flight plans, terrain study and Radio Calls given by the Pilot. The green path is for the probable planned route, blue path is probable alternate path which the PIC tried to follow due weather on the planned path and Red is the actual path followed by the helicopter.

As per flight Plan the level filed for the sector 3500 ft, which based on the average heights of the hills in the area implies that the planned route was that after take-off from Khonsa fly West towards Luthong, up till Longo and then turn Southerly towards Bera up till Senua where the PIC would have once again turned west and landed at Longding. The highest point in this route is approx 2400 feet, so with 1000 feet clearance, he had planned to fly at 3500 feet level (as given in filed flight plan by the flight crew). No other routing has terrain less than 2500 feet.



Flight Paths with Cloud Picture overlay

Cloud picture overlay of Satellite imagery, clearly gives out that there was widely spread low cloud cover and same is corroborated by weather reports and statements of people on ground. The clouds were thick and dark as per the statements of people on ground. As in the present case the weather was very bad in the area of planned routing, alternate routing available was via Niausa, for which initially the helicopter should fly south after take-off uptill Niausa and climb to 5500 feet, as altitude of Niausa is 4500 feet, there after turn right (west) and fly towards Senua and continue descending to land at Longding.



Sun Position

One more reason for pilot not taking the planned route and trying out alternate route comes out from the direction of sun (light) during the flight. Position of Sun was in South East direction. When sky is completely covered with thick clouds, in the direction of Sun, because of strong sun rays, the clouds seem to be lighter and give a feeling of less cloud thickness and reciprocal direction looks darker. This phenomenon, makes the pilot feel that it's better to fly in the direction where clouds are less and might get a clear area very soon and in the present case the direction was SE. This could had been the reason for Pilot to fly on the alternate route. The last radio call given by the pilot was of "Climbing to 5500 feet" which indicates that he was following the route via Niausa, and was

aware of Minimum Safe Altitude of this route (4500 + 1000) and clearly gave out his intentions of Climbing to 5500 feet.

The destination was approx. 15 NM of flight and the helicopter would have reached abeam Niausa, where he was supposed to turn right and climb within 3 to 4 minutes of flight. As the helicopter took off facing SE direction, he had thick clouds in front, and the Sun rays coming from front. These rays striking the clouds scatter light all around, and reducing the visibility when flying into sun during day time. Pilot it appears had lost all ground contact and got disoriented. Not able to have contact with ground and disoriented, pilot did not turn right and continued straight, not realizing that there was a hill in front at an altitude of 6500 feet. The actual flight path is clearly depicted by the Radar plots, i.e. red flight path in the pictures above.

The above probability is based on the corroboration of existing evidences. Committee has simulated and assimilated the reasons for take-off in bad weather, on alternate route and turning right in the absence of CVFDR readout of the helicopter which could not be recovered.

2.6.2 Other possibilities:

- Had there been any emergency which appears to be a remote possibility such as engine failure (both), MGB failure, rotor failures, hydraulic failures etc.; the crew would have given distress call. Though no distress call was received by Dibrugarh or any other station but because of the terrain it is very difficult to have continuous RT contact with Dibrugarh. The CVFDR readout could have put conclusive light on the subject.
- The Committee could not find any compelling reason due which the pilot had taken the flight in such inclement life threatening weather?
- There was a huge difference in the hill flying experience of the two flight crew members, but in the absence of CVR readout, Committee is not in a position to comment on the CRM aspect as a contributory factor to the accident.

3.0 Conclusion

In the previous two sections the Committee has put forward the factual state of affairs as existing in PHL on the date of accident and tried to analyse the same particularly for the actions or inactions which could have acted as precursor to the accident.

In the following section an attempt has been made to give systematically the identified active and latent failures within the functioning of various departments which, it is felt culminated into the accident. The approach is based on Human Factors Analysis and Classification System (HFACS) which is a broad human error framework to investigate and analyse human factors aspects. It is based upon James Reason's swiss cheese model. The aim is not at all to attribute blame but is to understand the underlying causal factors that lead to this accident.

As will be seen there were avoidable inadvertent errors which continued due total lack of supervision/ oversight in addition to certain genuine errors. Certain probabilities are also discussed in the end as the corroboratory evidences for these were not available.

3.1 Findings

1. General

- The operator was carrying out operation of helicopter under NSOP and the maintenance of helicopter under CAR 145.
- The Certificate of Airworthiness, Certificate of Registration and Certificate of Release to Service of the helicopter was valid on the date of the accident.
- The defect records were scrutinized and there was no defect pending on the helicopter prior to the flight which could have contributed to the accident.
-

- The PIC & the co-pilot were holding a valid license on the type of helicopter. Both the crew members held valid medical certificates as per the requirement.
- The crew had undergone pre-flight medical examination and nothing abnormal was observed. The BA test was negative.
- All major modifications and Service Bulletins were complied with. There was no snag pending for rectification before the accident flight.
- The quantum of training as required by the relevant regulations on the subject was imparted to both the flight crew members.
- There was no abnormality reported on the navigational or communication equipments prior to the accident. It appears that during flight also these equipments were working satisfactorily.

2. Organizational influences

- There was no officer / official with aviation background in the civil aviation department of Arunachal Pradesh. The terms and conditions of the wet lease agreement and the effective implementation of the standard operating procedures for Itanagar operations though required that there should be trained personnel on aviation aspects. There was no communication between the state Govt. and DGCA on matters concerning aviation.
- No DGCA approved SOP for Dauphin N3 was produced by PHL. Old SOP of Dauphin N helicopter was produced (also by Government of Arunachal Pradesh) which in itself had certain anomalies vis-a-vis laid down guidelines of DGCA.
- The SOP (Dauphin N) for Itanagar operations required that there should be a helipad safety and operations cell established by Govt. of Arunachal Pradesh for carrying out ground safety and ground operations functions including provision of information to the pilot about general weather conditions at the destination helipad. In addition the officer incharge

helipad was required to ensure that takeoff, landing and emergency procedure are strictly followed as laid down in CAR Section IV, Series B Part V dated 04.08.2011.

- PHL (ER) with hqrs at Guwahati is in the process of being fully established which also includes posting of a permanent head of operations.
- Though the Dauphin N3 helicopters are under control of WR including its flight crew but the operations at ER are controlled from NR.
- There was lot of contradictions/ anomalies in the implementation of SOP for Itanagar. One being that the pilots and AMEs will be detailed by NR. However these were being detailed by WR. Longding helipad and routing from Khonsa to Longding was not shown in the map of the valley appended to the SOP.
- The training manual available with the WR was not having any date of issue though it was approved by the DGCA in as it is condition.
- In WR the same flight crew personnel (DGM Level) was holding the posts of DGM Training and DGM Ops.
- The SMS manual though accepted by DGCA does not contain 'How to do' the various functions mentioned therein. The Manual just remains a document without performance of any function at working level.
- There is ambiguity about the 'Base Manager' in the organisation. Even the persons acting as base manager at detachments were not aware about their functions, duties and responsibilities as these are at variance in different documents.
- Earlier Committees of Inquiry have recommended "establishment of strong safety department" but it was observed that the operator has not established the safety department in true letter and spirit. It is still continuing on ad-hoc basis and full fledged department is yet to be established.
- There is a shortage of pilots and situation is aggravated due higher attrition rate of flight crew.

3. Unsafe supervision

- The pilots flying on Itanagar-Mohanbari-Khonsa-Longding-Changlang-Mohanbari of his own checks the satellite pictures in the morning before the flight; obtains preliminary weather from the personnel at helipad along with the details of load and passengers; gets latest weather from the officer incharge of the helipad. Further the things are left on the experience and personnel interpretation of the flight crew.
- The decision to undertake the flight rested with the pilot after ascertaining weather. There was no monitoring/ supervision to check if unsafe decisions were not taken.
- The SOP for Itanagar also requires that irrespective of time of the year or season, all sorties in to valleys will be monitored by responsible person from company's management till its completion.
- The training records of the flight crew is just a record keeping exercise without any system or procedure in place to review the observation of the instructor / examiner for monitoring the progress of the flight crew. There is no system to identify the observations made by the SFIs in their reports and depute the crew members accordingly for the various special operations being conducted by PHL.
- As per SOP, if a pilot observes any weather phenomenon, he should give R/T calls. There was no system of monitoring this aspect and it appears that procedure was not followed.

4. Preconditions for unsafe acts

- The standard operating procedure for Itanagar though approved by DGCA was not showing the location of Longding on the 'N' valley map nor was any routing shown between Khonsa and Longding or other helipads in the 'N' valley.
- None of the hill helipads including Khonsa in Arunachal Pradesh has been licensed by the DGCA whereas rule 78 and CAR Section IV Series F, Part

I requires that it has to be so if it is being used for a series of landing and departures or for hire and reward. Even as per PHL operations manual all helipads were to be approved by PHL operations, no documents were produced to show that Khonsa was approved by PHL operations.

- Many recommendations made by the earlier courts / committees of inquiry having operational safety implications are yet to be implemented by PHL in true spirit. Even the actions taken on the recommendations have withered away with passage of time due complacency and non supervision.
- The duty officer Incharge of the helipad was supposed to provide general weather conditions at the destination helipad including any deterioration in weather. However, the above procedure was not followed and no competent person was made available for carrying out the above function.
- As per the analysis of evidences available, the accident is most probably a case of CFIT in extremely bad weather. There was no Operational supervision on the pilot on day to day flying by PHL at any level and the accident took place due to one wrong decision by the PIC. Since no active supervision was being exercised, so it might have become a norm with the PIC to do things on his own without any cross checking by the Operations supervisors.
- Due to non availability of senior level operational personnel and adhocism, there is no supervision of operational activity.
- The SOP for Itanagar was issued in March 2014 and it was explicitly mentioned that it should be updated periodically under intimation to DGCA. Though there were major changes which require SOP to be updated but no action was taken in this regard.

5. The accident sequence

- The clouds at the time of flight in and around the Khonsa helipad were thick and low. The visibility was poor and the previous landing by the helicopter was carried out in third attempt at Khonsa helipad.

- The helicopter took off from Khonsa in bad weather with low thick clouds and after takeoff turned to South East direction.
- In the absence of any flight path given in the SOP, the probable planned flight path based on the average height of the hills and filled flight plan appears to be after takeoff from Khonsa fly west towards Luthong, up till Longo and then turn southerly towards Bera up till Senua again turned west and land at Longding.
- There was no distress call from helicopter to any ATC unit nor was any distress signal received from ELT installed on the helicopter.
- The helicopter after getting airborne climbed to 4500 feet and thereafter informed that it was climbing to 5500 feet. Taking in to consideration this fact, the takeoff of the helicopter in SE direction and the height of hills (4500 ft max), probably the crew tried to fly on an alternate route via Naiusa, climbed to 5500 feet turn right fly towards Senua and continue descending to Longding. The position of the sun (light) at the time might also be one of the reasons for taking the above alternate route.
- As per the above alternate route, the destination was approx. 15 NM of flight and the helicopter would have reached abeam Niausa, where he was supposed to turn right and climb within 3 to 4 minutes of flight.
- After getting airborne, the helicopter was facing SE direction and had thick clouds in front with Sun rays coming from front. These rays striking the clouds scattered light all around reducing the visibility when flying into sun during day time. Pilot it appears had lost all ground contact and got disoriented. Not able to have contact with ground and disoriented, pilot did not turn right and continued straight, not realizing the there was a hill in front at an altitude of 6500 feet.
- The helicopter hit the hill approximately at a height of 6000 feet causing fatal injuries to its occupants. The helicopter also was totally destroyed and the wreckage fell in to a deep gorge.
- Though aerial & ground search operations were immediately pressed into, the wreckage was spotted on 6th day from the day of accident.

6. Probabilities

- Emergency situation arising out of any type of technical malfunction/ failure such as engine failure (both), MGB failure and rotor failures etc. is ruled out.
- Any in-flight breakage of the helicopter structure prior to its impact with the hills is also ruled out.
- After the accident, the team wanted to inspect the wreckage but could not reach the site of accident nor was the wreckage retrieved and provided for inspection. So no report could be made available to the Committee. Perusal of the photographs of the damaged structure provided to the Committee, do not indicate any signatures of involvement of unlawful activity. However it can be conclusively ruled out as no evidence to the contrary has come to the notice of the Committee.
- With the available evidences, the possibility of incapacitation of the flight crew appears extremely improbable.
- From the documentation available on training, experience & operational aspects, the issue of CRM is also relevant in this case.

3.2 Probable Cause

- The helicopter after taking off in bad weather and while trying to negotiate weather flew on alternate route getting disoriented resultantly hitting hill in the area.
- Non familiarity with the topography around alternate route, in the absence of route maps and charts, contributed to the accident.
- Lack of supervision & absence of flight follow up in the organisation as required by SOP contributed to the accident.

4.0 Safety Recommendations

- For Government of Arunachal Pradesh

1. The Department of Civil Aviation, Government of Arunachal Pradesh may implement all the recommendations given by earlier accident investigations Committees particularly to have an officer / official with aviation background who should devise a methodology to ensure the fulfillment of the requirements of SOP. He should also be monitoring the day to day activities and should regularly communicate with DGCA on matters concerning aviation.
2. A training capsule be prepared for helipad safety and operations cell personnel at the helipads so that they can carry out ground safety and ground operations functions including provision of information to the pilot about general weather conditions at the destination helipad. It should also be ensured that the trained personnel are always available /retained at helipad postings.

- For Pawan Hans Limited

The actions being recommended in following paragraphs has been earlier also recommended in accident reports in one way or other. PHL should implement these recommendations not in isolation from each other as a paperwork exercise only but take holistic view of the whole situation in the organisation and implement the recommendations with a long term view. Systems and procedures should also be devised to avoid any onset of complacency in future whereby the unsafe situations again creep in.

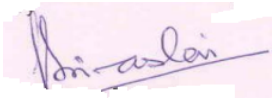
1. Immediate action be taken to have appropriate level of operational personnel who should review the existing systems thereby adopting changes to ensure monitoring and supervision of the whole operational activities.
2. Ambiguity about the duties and responsibilities of base manager should be removed and only those persons should be appointed who can carry out all the stipulated functions.

3. Documentation is a weak area throughout the organisation be it operations or safety including SMS. The importance of timely updation of documents and the dissemination of information needs no emphasis. As one time exercise all the Manuals, procedures, processes be reviewed and amended to have cohesion of content. System of periodic review should be put in place and strictly followed.
4. For hill flying:
    - Competent person should supervise flight planning taking into consideration route, Operational Flight plan, weather and its analysis, loading of helicopter and helipad conditions on daily basis for every flight, especially in case of detachments.
    - System may be developed for providing real time weather information by operations person to pilot by closely monitoring the weather from various sources (Weather Charts, Satellite and Doppler picture) and the pilot in turn should keep all operations supervisors informed of the intended path of flight.
    - System of detailed debrief of flights in written format should be provided by the pilots on daily basis. Similarly written briefing for flights be given to pilots on detachments by operational supervisors.
5. PHL should immediately undertake the implementation of safety management system across the whole organisation by completion of training, reviewing the manual by including the procedures for the actions to be carried out under SMS, appointing key safety personnel at all regions and Corporate Office, establishing values of the safety indicators, etc.
6. During the simulator and flying training, it should be ensured that where weakness is identified these are concentrated upon. Whenever serious weaknesses are revealed and the candidate's ability is in doubt, then there must be a system of recording the same and documented follow up action be taken to monitor the improvement.
7. In order to curtail higher rate of attrition of pilots, PHL must introduce some long term effective remedial measures and must ensure that the pilot should

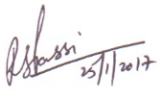
not have any type of allurement to fly more number of hours, which at times may be at the cost of safety.

- For DGCA

1. As it is neither feasible nor practically required to licence all the helipads in the North Eastern Region as is stipulated in the present CAR on the subject, DGCA may formulate some intermediate not so stringent requirements within the existing Rules for the helipads in the region whereby safety of the operations is ensured legally. The requirements should cover helipad conditions, ground personnel, their training etc. in addition to the flight crew requirements.
2. In view of the observation that similar findings have been made in the regulatory audits, surveillance, investigation reports repeatedly, DGCA may for certain period, carry out constant monitoring on the effectiveness of actions taken by PHL on these findings.



(Pradeep Srivastava)
Member
Committee of Inquiry



(R. S. Passi)
Chairman
Committee of Inquiry

DATED: 25.1.2017