FINAL INVESTIGATION REPORT OF ACCIDENT TO PAWAN HANS LTD. DAUPHIN AS 365 N3 HELICOPTER VT-PHZ AT HARSIL HELIPAD UTTRAKHAND ON 28/06/2013.

1. Helicopter Type	: Dauphin AS 365 N3
Nationality	: INDIAN
Registration	: VT - PHZ
2. Owner/ Operator	: Pawan Hans Ltd.
3. Pilot – in –Command	: Holder of ATPL (H)
Extent of injuries	: Nil
4. Co-Pilot	: Flying Under Rule 160
Extent of injuries	: Nil
5. Place of Accident	: Harsil Helipad, Uttarakhand
6. Co-ordinates of Accident Site	: $31^{o}2'18.26''$ N $78^{o}44'26.03''$ E
7. Last point of Departure	: Matli Helipad, Uttarakhand
8. Intended place of Landing	: Harsil Helipad, Uttarakhand
9. Date & Time of Accident	: 28th June, 2013; 05:25 UTC (Approx.)
10. Passengers on Board	: 01
Extent of Injuries	: NIL
11. Phase of Operation	: Landing
12. Type of Accident	: Crash landing

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SYNOPSIS:

Pawan Hans Ltd. (PHL) Dauphin AS 365 N3 Helicopter VT-PHZ, was engaged in services with state Government of Uttrakhand to carry out rescue of devotees and local people from the area affected by flash floods.

On 28/06/2013, PHL Helicopter VT-PHZ was positioned by the State Government to carry out rescue operation and evacuate people from Harsil Army Helipad located at 8200 feet. The helicopter was under the command of ATPL (H) holder on type with co-pilot (flying under Rule 160) and one passenger on board. Prior to this flight, the helicopter had landed twice at the Harsil helipad safely on same day. However, Pilot-in Command (PIC), carried out third landing at Harsil helipad under strong tail wind conditions.

The operation was carried out at 8200 feet altitude and the Landing Weight of the helicopter was close to its maximum permissible landing weight limit. During landing at short finals with maximum collective power, there was no power margin available with the PIC to arrest the rate of descent. The situation was further deteriorated due to presence of strong tail wind conditions, which eventually resulted helicopter entering into a probable vortex ring state at approximately 50 feet above Helipad. The helicopter became uncontrollable and crash landed resulting into substantial damage. All the occupants of the helicopter escaped safely. There was no injury to any person. There was no fire.

Ministry of Civil Aviation constituted a Committee of Inquiry to investigate the cause of the accident under Rule 11 of Aircraft (Investigation of Accidents and Incidents) Rules 2012 comprising of Shri B. S. Rai, Chairman along with Shri A. X. Joseph and Capt. Rakesh Kapoor as members.

1. FACTUAL INFORMATION.

1.1 History of the flight

Due to sudden flash flood conditions in Uttrakhand, devotees and local people got trapped in the hilly areas of Uttrakhand leading to disruption of roads. PHL had positioned two Dauphin AS 365 N3 helicopters with State Government of Uttrakhand for utilization.

Helicopter VT-PHZ was positioned at Dehradun, Uttrakhand from 23rd June 2013 to carry out rescue operation as detailed by State Government to evacuate devotees and people trapped in the hilly areas. Operations till 27.06.2013 were uneventful and helicopter made 29 rescue sorties. All these sorties were carried out at an altitude approximately 6000 feet and below.

On 28/06/2013, the State Government detailed Helicopter VT-PHZ to carry out rescue operation from Harsil Army Helipad located at 8200 feet altitude. Pre-flight inspections were carried out by AME and the helicopter was released for flight. The helicopter departed from Seheshtradhara Helipad, Dehradun at 0240 UTC for Harsil helipad under the command of ATPL (H) license holder with qualified co-pilot on type. The weather at Dehradun was clear sky with VFR conditions. The Helicopter landed at Harsil helipad safely and thereafter air lifted 05 passengers to Maneri helipad. The helicopter again landed at Harsil helipad and picked up 06 passengers for Darasu. After refueling at Darasu, the helicopter took off with 07 passengers and landed safely at Matli helipad. After disembarking 06 passengers at Matli helipad, the helicopter headed for Harsil helipad with 01 passenger on board.

While carrying out the third landing at Harsil helipad at approximately 05:25 UTC, the weather was turbulent due to strong gusty winds. During the previous two landings the winds were not very strong and also the pilot landed under head wind conditions. However during third landing, the pilot attempted to land at Harsil helipad under strong tail wind conditions. During short finals the pilot was not able to arrest the rate of descend and tried to go around by coming on collective however the rate of descent kept on increasing. Since the Landing Weight of the helicopter was close to the maximum permissible landing weight at 8200 feet altitude there was low power margin available with the pilot to come up on collective to arrest the rate of descent. The situation was further deteriorated due to presence of strong tail wind conditions gusting to 30 kts. The pilot decided to land, he came on maximum collective to arrest the rate of descent, however the low rotor rpm warning was activated and the helicopter became uncontrollable. During this process, the tail boom of the helicopter first hit the ground heavily and broke off, thereafter helicopter bounced turning nose to 180^0 in air before coming to final rest position and the helicopter was substantially damaged. All the occupants of the helicopter escaped safely. There was no fire.

1.2 Injuries to persons.

INJURIES	**CREW**	**PASSENGERS**	**OTHERS**
FATAL	Nil	Nil	Nil/20
SERIOUS	Nil	Nil	NIL
~~**MINOR**~~**/NONE**	02	01	----

1.3 Damage to Helicopter.

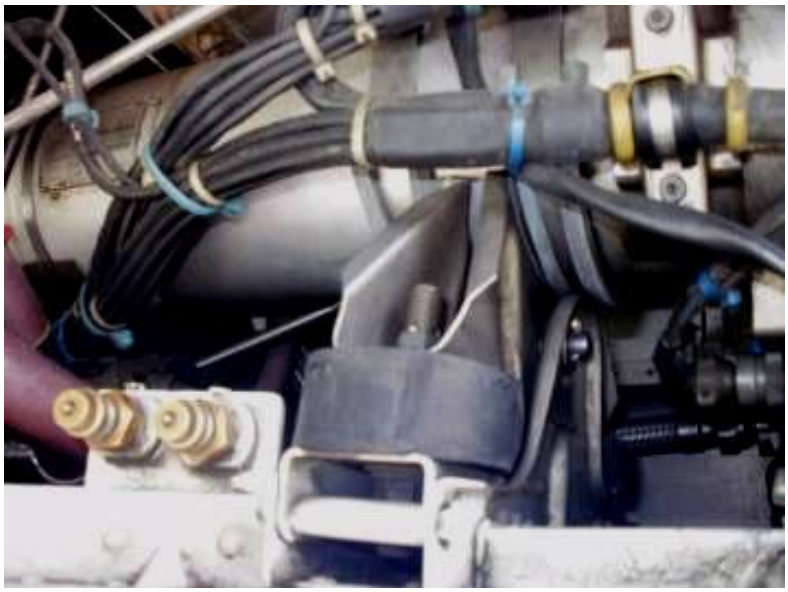
Aft structure of helicopter VT-PHZ was substantially damaged

The helicopter sustained damage mainly on the aft structure. Following damages were observed during inspection.

1. The tail boom had ruptured near stabilizer junction resulting in damage to Tail Boom, Tail rotor (fenestron) and fin. The Horizontal stabilizer on RH side had broken from tail boom attachment junction and also the fin was half broken from the lower end.

2. Internal wiring broken and hydraulic lines inside the horizontal stabilizer was found ruptured.

3. The top cowlings of both MGB and engine showed the tearing marks with exposed honeycomb indicating flapping of rotor head.



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4. The LH engine mounting cradle appeared with converged lips (compression), supporting the tube.

5. The fenestron blades had punctured the inner lip of the structure.

6. The Centre and aft Tail drive shaft were also snapped from the bearing housing on the tail boom and broken near the joint. The yaw control rod joining between tail rotor and tail boom had broken. The tail drive shaft fairing was broken along with the tail boom. Near the tail boom rupture line, the two flux valves were slightly damaged.

7. Along with the tail skid, the fenestron bottom area near to tail skid was broken. However, the skid plate showed no rubbing marks. The Beacon unit on the tail was in position, however, the fenestron skin was separated due to impact.

8. The HF antenna near tail boom junction from tubing was dislodged due to impact.

9. The landing gears did not show any evidence of breakage or leakage of fluid etc.. However the RH tyre had deflated and crumpled on rim with ground mud accumulated till centre of hub and this was not evident on LH wheel, which was found intact and without any mud accumulation.

RH- Main wheel deflated and damaged

1.4 Other damage:

Nil

1.5 Personnel information:

1.5.1 Pilot – in – Command:

AGE	: 48 years
Licence	: ATPL (H)
Date of Issue	: 09.04.1990
Valid up to	: 28.06.2017
Category	: Helicopter
Class	: Multi Engine Land
Endorsements as PIC	: Robinson R-22B, Dauphin AS 365 N3
Date of Med. Exam.	: 17/01/2013
Med. Exam valid upto	: 16/07/2013
FRTO Licence No.	: License Valid
Date of issue	: 17.06.2010
Valid up to	: Life time
Total flying experience	: 12709 hours (Approx)
Experience as PIC on type	: 6548 hours (Approx)

Last flown on type	:	28/06/2013
Total flying experience during last 180 days	:	386:38 Hrs. (Approx)
Total flying experience during last 90 days	:	187:08Hrs. (Approx)
Total flying experience during last 30 days	:	64:06Hrs. (Approx)
Total flying experience during last 07 Days	:	23:10Hrs. (Approx)
Total flying experience during last 24 Hours	:	05:05Hrs. (Approx)

The total hill flying experience as PIC was 220 hrs (Approx.), however PIC had no recency for hill flying in last 12 years. Prior to operations in Uttrakhand the PIC had not undergone the recurrent training for hill flying. The pilot had

undergone simulator and proficiency check recurrent training. All the other trainings were current (CRM, DGR, Monsoon, English Proficiency etc.).

1.5.2 Co-Pilot:

AGE	:	53 years
Licence	:	Flying under Aircraft Rule 160
Date of Issue	:	01/09/2008
Valid up to	:	N/A
Category	:	Helicopter
Class	:	Multi Engine Land
Endorsements as PIC	:	Dauphin 365 N3
Date of Med. Exam.	:	06/03/2013
Med. Exam valid upto	:	05/09/2013
FRTO Licence No.	:	Under Aircraft Rule 160
Date of issue	:	N/A
Valid up to	:	N/A

Total flying experience	:	5000:00 hours (Approx.)
Flying Experience on Other Helicopter	:	Cheetah, Chetak, MI-8

Last flown on type : 28/06/2013

Total flying experience during last 180 days	:	302:52Hrs.
Total flying experience during last 90 days	:	182:52Hrs.
Total flying experience during last 30 days	:	76:36Hrs.
Total flying experience during last 07 Days	:	23:10Hrs.
Total flying experience during last 24 Hours	:	05:05Hrs.

The total hill flying experience of co-pilot was 1500 hrs (Approx.), however he had last done hill flying in April 1999. The co-pilot after retiring from Air Force had joined Pawan Hans Ltd. in March 2009. Co-pilot had no recency for hill

flying. Prior to operation in Uttarakhand the co-pilot had not undergone any recurrent training for hill flying. The co-pilot had undergone simulator and proficiency check recurrent training. All the other trainings were current (CRM, DGR, Monsoon, English Proficiency etc.).

No Flight Duty Time Limitation violation was observed in respect of both the operating pilots. Also they were not involved in any Serious Incident/Accident previously.

1.6 Aircraft information:

Dauphin AS 365 N3 helicopter is a twin engine helicopter fitted with Arriel 2C engine and manufactured by Eurocopter, France. The helicopter is certified in transport category, for day and night operation under VFR & IFR. The maximum operating altitude of this helicopter is 15000 feet density altitude and maximum takeoff weight is 4300 kg. The helicopter is approved in the "Transport" category under FAR 29 amendment 16 category A & category B.

Construction:

The structure of the helicopter Dauphin is based on Modern Technology and makes wide use of new material : Sandwich design stressed structure, carbon fabric (Fenston Fin and horizontal stabilizer), composite (form of Nomex sandwich) glass cloth or Kevlar cowling and faring.

The primary structure includes transmission deck, engine deck strong frames, forward structure, body structure and aft structure. The new design structure stiffened plates replaced by NOMEX honeycomb panels with light alloy skin (lighter and more resistant material). The 3 main sections are forward structure, body structure, and aft structure. The main rotor shaft suspension bars are attached to two main strong frames.

The tail structure includes tail boom, horizontal stabilizer and side fins, Fin and tail rotor guard. The NOMEX honeycomb tail boom with light alloy skin, the tail boom, which may be disassembled, is bolted to the aft structure junction frame. It has high strength composite material fenestron fin. The stabilizer comprises of a one-piece carbon fabric, horizontal stabilizer which passes through the tail boom and two NOMEX sandwich structure side fins along with glass fiber tail rotor guard. The Secondary structure includes firewall, console, cabin floor, Luggage hold doors, Electric Equipment Racks and firewalls.

Dauphin AS 365 N3 helicopter VT-PHZ S/N 6923 was manufactured on 20th Oct. 2010. The helicopter is operated by Pawan Hans. Ltd. Certificate of Registration No. 4166, under Category 'A' was issued on 23/12/2010.

The certificate of Airworthiness Number 6275 was issued under normal category sub-division passenger issued by DGCA on 23/12/2010 and minimum operating crew as one. The C of A is valid upto 10th January 2016. ARC Ref No. PHZ/6275/ARC/1st /2011/005 and valid upto 11th January 2014. The maximum authorized all up weight is 4300 kgs. The aircraft was flown with Aeromobile Licence No. A-020/043-RLO (NR) and valid till 31st December 2013. Helicopter was operated under Non-scheduled operator's permit No. 02/1998 and is valid upto 15th March, 2015. The Dauphin AS 365 N3 helicopter has logged 2143:01 A/F Hrs as on 28th June 2013.

The AS 365 N3 helicopter and Engines are being maintained under continuous maintenance as per maintenance programme consisting of calendar period based maintenance and Flying Hours / Cycles based maintenance as per maintenance programme approved by Office of DDG, DGCA, Mumbai.

Accordingly the last major inspection 600 Hrs / 02 Year inspection was carried out at 1796:55 A/F Hrs on 09/03/2013. Subsequently all lower inspections, after last flight inspection and preflight checks were carried out as and when due before the accident.

The helicopter was last weighed on 14/10/2010 at Eurocopter, France and the weight schedule was recomputed on 24/12/2010 and duly approved by DAW, DGCA, Mumbai. As per the approved weight schedule the Empty weight is 2668.77 kgs. Maximum Fuel capacity is 896 kgs. Maximum permissible load with 2 Pilots, Fuel and Oil tank full is 565.23 kgs. Empty weight CG is 4.171 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 was due on 14/10/2015. Prior to landing at Harsil, the landing weight of the helicopter as reflected in the Load & Trim Sheet, was within limits.

All the concerned Airworthiness Directive, Service Bulletins, DGCA Mandatory Modification on this helicopter and its engine have been complied with as & when due.

Turn Around Inspections are carried out by PHL as per approved Turn Around Inspection schedules and all the higher inspection includes checks/inspection as per the manufacturer's guidelines as specified in "PRE" (Maintenance Programme) and are approved by the CAM (WR).

The last fuel microbiological test was carried out on 07/11/2012 at DGCA approved facility and the colony count was within acceptable limits.

ENGINES

The Dauphin AS 365 N3 helicopter is fitted with two Turboshaft Arriel 2C engines manufactured by Turbomeca, France. Helicopter was fitted with LH Engine S/N 24537 had logged 2143:01 Hrs, 3725.00 Ng cycles and 1154.00 FT cycles respectively. The RH Engine installed with S/N 24536 had logged 2143:01 Hrs, 3707.8 Ng cycles and 1144.77 FT cycles respectively.

MAIN ROTOR BLADES

Dauphin AS 365 N3 helicopter is fitted with 4 Main Rotor Blades having a SLL (Service Life Limit) of 20000 Hrs. Details are as below:

The Main Rotor Blade

S/N	PART NO.	SERIAL NO.	COMPONENT HRS
1.	365A11-0050-07	6806	14810:30
2.	365A11-0050-07	6279	12586.07
3.	365A11-0050-07	5631	16409:21
4.	365A11-0050-07	6339	14595:01

The status of all Airworthiness Directives as issued by DGCA through mandatory modification for helicopter including Main Rotor blades also were checked and found satisfactory.

There is no special maintenances programme applicable to Main Rotor Blades as it is covered with the helicopter maintenance programme.

BRAKES

There are parking brake and pedal brakes installed for helicopter operation. Main Rotor Brake is installed for stopping of the Main Rotor Blades at a predetermined operation during shutting down of both engines.

1.7 Meteorological information:

Harsil helipad is an uncontrolled army helipad and there is no meteorological information available. However the local weather in and around the area is only available from Meteorological Department located in Dehradun.

As per the PIC statement, the weather at Harsil Helipad was clear for VFR flying conditions. However, there were strong gusty winds during day-time.

1.8 Aids to navigation:

Harsil Helipad is a temporary Army Helipad, other than the windsock there is no navigational aid available.

1.9 Communications:

There is no two way communication available at Harsil helipad, Uttrakhand.

1.10 Aerodrome information:

Harsil helipad, at Uttrakhand is an Army helipad located at an altitude of 8200 feet (approx.) above mean sea level and its co-ordinates are $31^0$2'18.26" N and $78^0$44'26.03" E. The operations at the helipad are controlled by Army. There is no Air Traffic Services available at this helipad. It has a concrete cemented platform which can accommodate one middle category helicopters at

any given time. In addition to the concrete platform there is also landing space available on the soft ground which is cleared from all obstructions and can accommodate one helicopter. Other than the wind sock there is no other facility available at this helipad.

1.11 Flight recorders:

The CVFDR installed on the helicopter was manufactured by M/s. Honeywell. The Part No. of the unit was 9806021066 and Sl. No. was ARCOMBI-12302.

CVR:

CVR readout was carried out and following observations were made.

1. The crew was aware of helicopter limitation at high altitude due load prior to landing at Harsil helipad. There is discussion in the cockpit about fuel 520 Kgs and cargo 200 kgs and helicopter weight being more.
2. The Co-pilot caution the pilot about winds and asked him to carry out full procedure for landing. The pilot replied that he was aware of it.
3. There is no call out for operating the 365 switch which is mandatory prior to landing above 2000 feet Mean sea level.
4. Pre Landing Checklist was not carried out.
5. The Co-pilot has cautioned pilot of high turbulence and high rate of descent 1000 feet/minute.
6. Just prior to touch down the low rotor RPM horn is heard and subsequently the helicopter made a crash landing. There is no recording thereafter.

DFDR:

DFDR analysis was carried out and following observations were made:

1. The approach was in strong tail wind conditions. Winds gusting to 30 Kts.
2. At short finals the Indicated Air Speed (IAS) was low (below 20 Kts).

3. At short finals the pilot attempted to control the high Rate of Descent (ROD) by increasing Torque, but the helicopter was uncontrollable at full engine power.
4. The helicopter experienced a free fall from approx 50 feet height and crash landed at Harsil helipad with vertical acceleration of 3.38g.

1.12 Wreckage and impact information.

During examination of the Helicopter at accident site, it was observed that Helicopter was resting on the ground on its landing gears with the nose facing west. The landing was carried out on a soft ground, hence the damage was limited to the helicopter only and there was no external damage.

Inspection on site revealed that the damages were mainly on the aft structure. The helicopter made a crash landing in pitch up position as a result the tail boom impacted the ground first and ruptured from the main airframe near stabilizer junction. Due to the impact the Tail rotor fin, fenestron and horizontal stabilizer along with its internal wiring and hydraulic lines ruptured. The centre and aft Tail drive shaft was snapped from the bearing housing and broken near the joint. The yaw control rod joining between tail rotor and on tail boom was also broken.

The Tail skid under the fenestron had broken during landing however the skid plate had no rubbing marks. Due heavy impact the tail rotor blades had punctured the upper and lower fenestron skin and also had rubbing marks.
The tail drive shaft fairing was broken and the hydraulic fluid has drained out from the tail servo system lines after breakage of pipes.

On the top cowlings of both MGB and engine cowling there is an evidence of tearing marks by exposed honeycomb which had occurred due to flapping of rotor head. Due to heavy impact, the left engine mounting cradle had converged lips supporting the tube.

The helicopter made a heavy touchdown as was evident from the wheel marks on the ground. Though the landing gears did not show any evidence of breakage or leakage of fluid etc., the RH tyre had deflated and crumpled on rim and bogged down in mud up to its centre. However, the LH wheel was intact and without mud.

1.13 Medical and pathological Information:

The preflight medical was carried out prior to the first flight of the day at Dehradun on 28th June, 2013 and was satisfactory. However no medical check was carried out post-accident.

1.14 Fire:

There was no fire post-accident

1.15 Survival aspects:

The accident was survivable.

1.16 Tests and research: NIL

1.17 Organizational and management information:

M/s Pawan Hans Limited (PHL) operates under Non Schedule Operator's Permit No. 02/1998 valid up to 15/3/2015. It has the biggest operation of helicopters to the off shore for oil rig platforms. PHL also holds the largest number of helicopters under NSOP. The fleet consists of Helicopters like Dauphin, Bell 407, Bell 206 and MI 172. M/s PHL is also engaged in contracts with number of state governments for providing helicopter services. PHL provides helicopter service at high altitudes for the pilgrims visiting Amarnath Ji caves in Srinagar, Mata Vaishno Devi shrine at Katra, Jammu & Kashmir, Kedarnath & Badrinath in Uttrakhand etc.

Due to cloud burst, which resulted in flash floods and disruption of roads in Uttrakhand, devotees and local people got trapped in the hilly areas. For rescue mission, PHL had positioned two Dauphin 365 N3 helicopters with State Government. Helicopters were utilized by the State Government, as per requirement for rescue and relief purpose at different locations of state. Out of the two helicopters positioned, one of the helicopter VT-PHZ met with an accident at Harsil helipad on 28th June 2013.

1.18 Additional information:

1.18.1 High Altitude Operation:

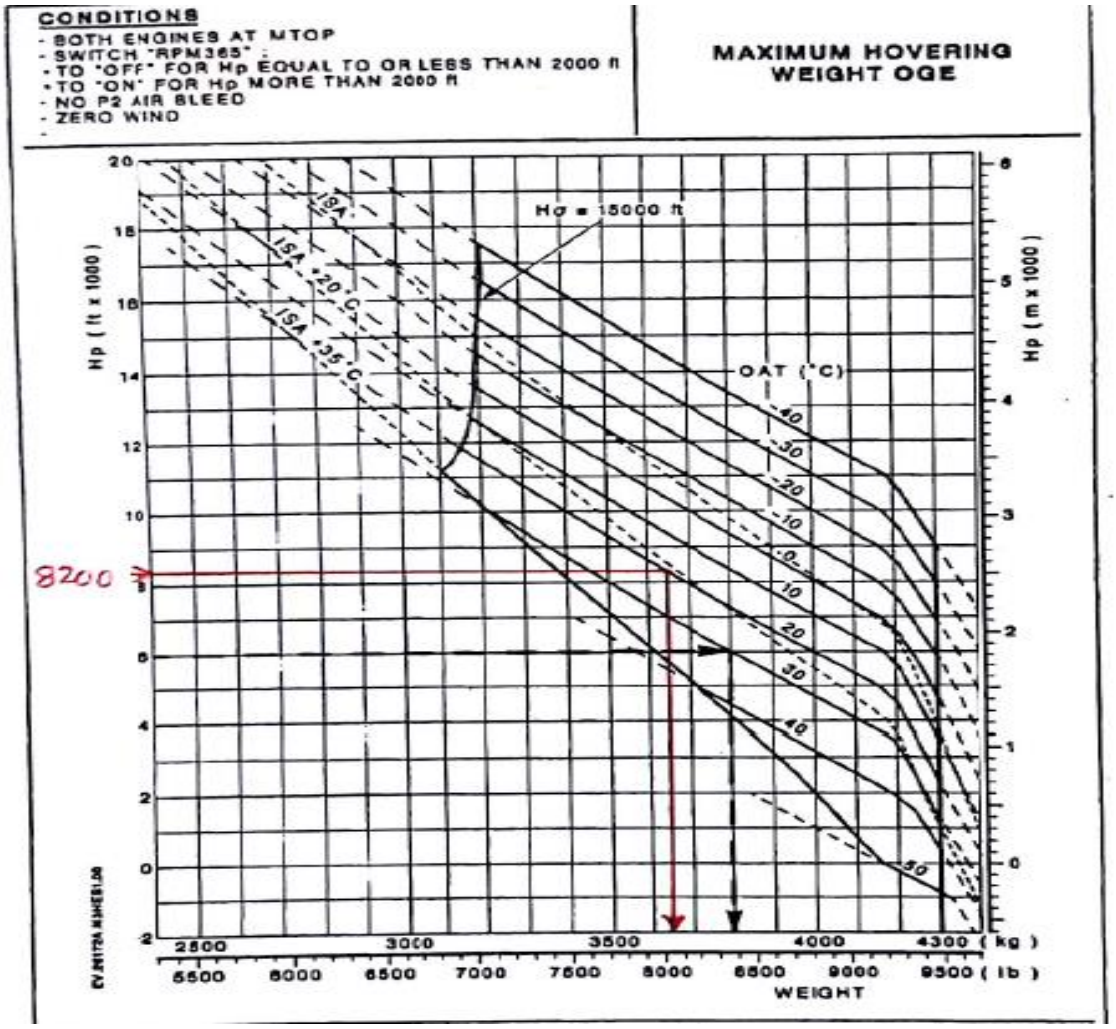
Helicopter operations in hilly/mountainous terrain need cautious and a great deal of Pilot Handling Skills. This is primarily due to the following major reasons

(a) Operations in rarefied atmosphere/decreased air density conditions.
(b) Effects of decreased air density on engine and airframe performance.
(c) Handling characteristics of helicopter change with altitude.
(d) Control effect decreases because of rarified atmosphere at high altitude and a marked difference is apparent compared with the handling at Sea Level.
(e) Power Margins (Reserve of Power) are lesser due to high density altitude.
(f) Turbulent weather conditions and other Meteorological peculiarities.

1.18.2 Weight & CG Calculations:

On 28th June, 2013, the helicopter carried out two successful sorties at Harsil Helipad. The helicopter VT-PHZ after refueling at Darasu, took off with 07 passengers and landed at Matli helipad. After disembarking 06 passengers at Matli helipad, the helicopter headed for Harsil helipad for the third sortie with 01 passenger on board. As per the load and trim sheet, the maximum all up weight at the time of take-off from Matli was 3564 Kgs approximately including 150 kgs of cargo weight. As per the CVR readout prior to descend, there was a discussion in the cockpit of cargo weight around 200 kgs and considering the cargo weight of 200 Kgs the maximum All up Weight of the helicopter was 3614

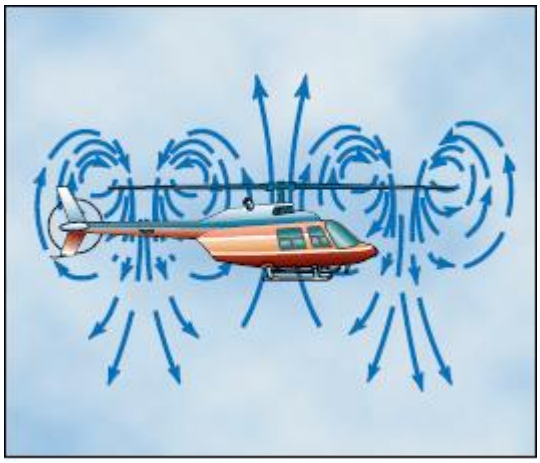
Kgs. The Harsil helipad is at an elevation of 8200 ft and the outside air temperature (OAT) at the time of landing was around 20^0C. As per the graph given in the helicopter flight manual the maximum permissible hovering weight at an elevation of 8200 ft. with OAT of 20^0C is approximately 3640kgs. Helicopter at the time of landing at Harsil, was very close to its maximum operating weight, as a result, there was less power margin available to the pilots to come up on collective to control the rate of descent.

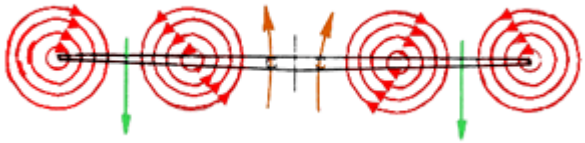


Graph showing the maximum permissible hovering weight with altitude.

1.18.3 Formation of Vortex Ring

The vortex ring state, also known as "settling with power", is a dangerous condition that may arise in helicopter flight, when a vortex ring system engulfs the rotor causing severe loss of lift. Essentially, the helicopter descends into its own downwash. When the condition arises, increasing the rotor power merely feeds the vortex motion without generating additional lift.





In forward flight, there is no upward flow (upflow) of air in the hub area. As forward airspeed decreases and vertical descent rates increase, an upflow begins because there are no airfoil surfaces in the mast and blade grip area. As volume of upflow increases, the induced flow (air pulled or "induced" down through the rotor system) of the inner blade sections is overcome and the blades begin to stall near the hub. As the inner blade sections stall, a second set of vortices, similar to the rotor tip vortices, form in the center of the rotor system. The inner set of vortices decreases the amount of lift being produced and causes an increase in sink rate. In an accelerated condition, the inner and outer vortices begin to feed each other to the point where any increase in rotor

blade pitch angle increases the interaction between the vortices and increases the rate of descent. In this state, the helicopter is operating in its own downwash, descending through descending air. The failure of a helicopter pilot to recognize and react to the condition can lead to high descent rates and excessive height loss.

A helicopter normally encounters this condition when attempting to hover out of ground effect above the hovering ceiling for the aircraft, hovering out of ground effect without maintaining precise altitude control, and while making downwind (tail wind) or steep (high Rate of Descent), powered approaches when the airspeed drops to nearly zero.

The signs of settling with power are a vibration in the main rotor system followed by an increasing sink rate and possibly a decrease of cyclic authority.

The vortex ring state can be corrected by moving the cyclic control forward, which controls the pitch angle of the rotor blade, slightly pitching nose down, and establishing forward flight. The helicopter will fly into "clean air", and will be able to regain lift.

1.18.4 Suitability of Helicopter for High Altitude Operations

The design parameters of a helicopter provide its optimum performance and suitable area of operations. Certain helicopters are most suited for low altitude operations, while some others may be suitable for high altitude operations. This assessment has to be conducted by helicopter operator.

Prior to deploying the helicopters for rescue operation at Uttarakhand, PHL has not conducted any in-house study/exercise to determine suitability of Dauphin AS365N3 for High Altitude operations.

1.19 Useful or effective investigation techniques: NIL

2. ANALYSIS

2.1 Serviceability of the Helicopter:

2.1.1 Dauphin AS 365 N3 helicopter VT-PHZ S/N 6923 was manufactured by M/s Eurocopter France in October 2010. The helicopter was operated by PHL, having Certificate of Registration No. 4166, under category' A' issued on 23.12.2010.

The helicopter was issued a certificate of airworthiness Number 6275 under normal category sub-division passenger by DGCA on 23.12.2010 and was valid upto 10th Jan 2016. The helicopter had a valid Aeromobile Licence No. A-020/043-RLO (NR) valid till 31st December 2013. The helicopter was operated under Non scheduled operator's permit No. 02/1998 and was valid till 15th March 2015. Prior to flight, Helicopter was holding a valid Certificate of Flight Release.

The maximum all up weight of the helicopter is 4300 kgs. The helicopter was last weighed on 14.10.2010 at Eurocopters, France. The maximum fuel capacity is 896 kgs. Maximum permissible load with 2 pilots, fuel and Oil tank full is 565.23 kgs. Empty weight CG is 4.171 meter aft of reference in land configuration. There was no major modification carried out affecting weight & balance. The next weighing was due on 14.10.2015.

The helicopter has logged 2143 A/F Hrs as on 28th June 2013. The AS 365 N helicopter and Engines were being maintained under continuous maintenance programme consisting of calendar period based maintenance and flying Hours/

Cycles based maintenance approved by Regional Airworthiness office, Mumbai. The last major inspection 600 Hrs/02 year inspection was carried out at 1796:55 Airframe Hours on 09.03.2013. Subsequently all lower inspections, till the last flight prior to accident was carried out as per the maintenance programme.

All the Airworthiness Directive, Service Bulletins, DGCA Mandatory modifications on this helicopter and its engine were found complied. Turn Around Inspections were carried out as per approve Turn Around Inspection schedules and all the higher inspection including checks/inspection as per the manufacturer's guidelines as specified in "PRE" (Maintenance Programme) were complied with and same were found approved by the Quality Manager (WR).

The last fuel microbiological test was done on 07.11.2012 at DGCA approved facility and the colony counts were within acceptable limits.

2.1.2 Examination of the helicopter wreckage at the site revealed that it was confined around its final resting position. There was no in-flight disintegration of any part of the helicopter. After the helicopter impacted the ground, the tail boom broke off from the helicopter main airframe structure. The damage sustained by the helicopter was all post impact.

In view of the above, it is inferred that the serviceability of the helicopter was not a factor to the accident.

2.2 Weather:

The weather at the time of departure from Dehradun was clear and visibility under VFR conditions. There is no MET facility available in that region other than Dehradun. As per the pilot report, the weather at Harsil helipad was clear with visibility under VFR conditions. However, there were strong gusting winds during the day.

2.3 Pilot handling of the Helicopter:

Pawan Hans Ltd (PHL) had positioned 02 Dauphin AS 365 N3 helicopter for Rescue and Relief (R&R) Operations in Uttrakhand with effect from 23rd June, 2013.

On 28/06/13, while conducting R&R Operations, helicopter VT-PHZ had taken off on a planned route from Dehradun to Matli and thereafter to Harsil. Prior to this flight, the same operating crew had landed the helicopter at Harsil helipad twice and both the sorties were uneventful.

During investigation it was established that both the earlier landings were carried out into prevailing head wind conditions. This was as per the company Standard Operating Procedure required when landing on high altitude and in mountainous terrain. However, during the third landing the pilot did not monitor or judge accurately the wind conditions. Though the pilot stated that the winds were from right side, however this do not correlate with the DFDR data analysis. As per DFDR analysis the descent and approach was made in strong tail wind conditions. CVR analysis revealed that the PIC was advised by Co-pilot to exercise caution due to strong winds prevailing during approach. The Co-pilot also cautioned PIC for high Rate of Descend (ROD) 1000 feet per minute (fpm) was maintained on final approach. Both DFDR and CVR indicated that landing was carried out in strong tail wind conditions, gusting to 30 Kts.

While carrying out the third landing at Harsil helipad the PIC did not carry out reconnaissance over the helipad prior to landing and did not position the helicopter into winds on final. On final approach, at around 500 feet above ground level (AGL) the PIC did not ascertain accurately the prevailing wind conditions at the helipad with the help of wind sock and from the Co-pilot advise. Further, due to high altitude operation with low Power Margin, PIC could not control the rate of descent of the helicopter even with full collective input.

The winds were incorrectly judged and the approach was continued onto the helipad in adverse wind conditions.

As per Flight Manual, the Rate of Descend at high altitudes should normally be maintained at low rates below 500 feet/minute. However, in this particular case the PIC maintained high ROD of around 1000 fpm for the current altitude and existing AUW conditions. The PIC tried to arrest the high ROD on final by coming up on full collective. With low Power Margin, the PIC was not able to arrest high ROD and the helicopter entered into Vortex Ring State.The helicopter dropped and impacted the ground from approx 50 feet height in an uncontrolled way. The extensive damage was sustained by the helicopter post impact. There were no injuries to any of the occupants on board the helicopter.

PHL has not conducted any in-house study/exercise to determine suitability of Dauphin AS 365 N3 for deployment in High Altitude operations in Uttarakhand for rescue and relief purpose. As per the Flight Manual of AS 365 N3 helicopter, the manufacturer certifies the flight, landing, take off envelope upto 15000 feet density altitude. However, it is evident that due to lack of recent hill flying training/experience, the PIC could not handle the controls correctly at high altitude which eventually resulted into the crash landing. It is opined that the pilot handling of the helicopter is a factor to the accident.

2.4 Pilot Training for Hill Flying:

DGCA Civil Aviation Requirement Section 7, Flight Crew Standards Training and Licensing Series B Part XII clearly stipulate requirements for pilots to undergo Hill flying training/route check prior to their release for Hill Flying Operations.

Helicopter operations in hilly/mountainous terrain need cautious and a great deal of Pilot Handling Skills. This is primarily due to the following major reasons.

(a) Operations in rarefied atmosphere/decreased air density conditions.
(b) Effects of decreased air density on engine and airframe.
(c) Handling characteristics of helicopter change with altitude.
(d) Control effect decreases because of rarified atmosphere at high altitude and a marked difference is apparent compared with the handling at Sea Level.
(e) Power Margins (Reserve of Power) are lesser due to high density altitude.
(f) Turbulent weather conditions and other Meteorological peculiarities.

The PIC has stated in his statement that he has carried out Hill Flying Operations earlier in his flying career. During investigation it was known that before Uttarakhand rescue and relief operations, the PIC had not done any hill flying for last 12 years and also not undergone any hill flying training/route check for the same period. The PIC was aware of the provisions of PHL Operations Manual, Chapter 34, pertaining to Mountain & High Altitude Flying, and the training required operating in hills. However the same was not complied with by the operations department of PHL before deputing the crew for operations in Uttrakhand.

From the foregoing, it is evident that deployment of the crew by the PHL Operations Department to operate in hilly/mountainous terrain without requisite training is a contributory factor to the accident.

2.5 Crew Resource Management (CRM) :

In a Multi Crew cockpit environment, CRM assumes great significance. This is more so important for conduct of Flight-Checks, Procedures and safety of operations. Prior to landing, there is no record of mandatory checks and procedures, viz. high/low reconnaissance of helipad area to identify prevailing wind conditions carried out by the crew.

As per Rotorcraft Flight Manual of AS365N3 Dauphin helicopter, "RPM 365" is mandatory to be used when operating above 2000 ft altitude. There was a contradiction in the statements of PIC and Co-pilot regarding usage of "RPM 365".

The Navigation Log for the flight was not prepared and mandatory records of the same were not maintained. No actual calculation for the load and trim for this particular flight were done by the crew. Even though the co-pilot had cautioned the PIC for the strong winds and high rate of descent, there was not much reaction from the PIC for the same.

From the forgoing, it is opined that the conduct of Flight-CRM was not properly followed.

2.6 Circumstances Leading to the Accident:

The crew detailed, to operate for the rescue and relief operation in hilly terrain of Uttarakhand were not trained for operations in hilly/mountainous terrain in accordance with PHL Operations Manual and CAR. The handling characteristics of helicopter changes distinctly in higher altitudes especially during takeoff, landing and hover operations.

The crew while carrying out the operations in hilly terrains should have given more significance to adequate check lists and procedures. Monitoring of winds is an essential part of checks and procedures. Helicopter Limitations are necessarily to be complied in terms of side and tail wind envelope. Approach and landing in strong tail wind conditions should have been avoided.

Prior to the accident flight the PIC did not ensure adequate power margins are available with him so that reserve of power is available to make an approach and landing. The PIC continued the approach with high ROD under strong tail wind conditions. During finals the PIC came up on full collective to control the rate of descent. Since the reserve power was not available with full collective, the rate of descend could not be controlled and helicopter entered into vortex ring state and subsequently became uncontrollable. This situation eventually resulted into the accident.

3. CONCLUSIONS:

3.1 Findings:

a) The Certificate of Airworthiness and the Certificate of Registration of the helicopter was valid on the date of accident.

b) The certificate of flight release was valid at the time of accident.

c) Both the Pilots were in the regular employment of PHL.

d) The Co-Pilot of the helicopter was flying under the authorization by DGCA under rule 160 of Aircraft Rules 1937.

e) PHL Operations Manual, Chapter 34, pertaining to Mountain & High Altitude Flying, requires Ground and Flight training as essential requirement before earmarking pilots for hill operations, the same was not complied by PHL operations Department.

f) Both the pilots deputed by PHL operations to Uttarakhand for rescue operations had not flown in the hilly terrain for more than 10 years.

g) The commander had accepted the helicopter for flight after the daily inspection schedule was carried out on the helicopter by the AME.

h) Prior to the accident flight the same operating crew had landed the helicopter at Harsil helipad twice into the wind conditions (head wind) as per the standard operating procedures and both the sorties were uneventful.

i) During the third landing the pilot did not monitor or judge accurately the wind conditions and made approach and landing under strong tail wind conditions which was also confirmed from DFDR read-out, with winds gusting to 30 Kts.

j) Performance of helicopters deteriorates at high altitudes. The PIC did not ensure adequate power margins are available with him to make an approach and landing.

k) The PIC maintained high ROD under strong tail wind conditions during approach and landing. The PIC came up on full collective to arrest the

rate of descend, however with low power margin available, the helicopter entered into vortex ring state and became uncontrollable which resulted into the crash landing.

3.2 Probable cause of the Accident:

PIC while carrying out approach and landing under strong tail wind conditions, could not control the high rate of descend with the available reserve power (Max collective power). The helicopter entering into vortex ring state, becoming uncontrollable which eventually resulted into the heavy landing accident.

Deployment of cockpit crew to operate in hilly/mountainous terrain by PHL operations without requisite hill flying training/recurrent training is a contributory factor to the accident.

4. SAFETY RECOMMENDATIONS:

1. DGCA may reiterate necessary instructions to all the helicopter operators to ensure that the crew are not deployed for operations in the hilly terrains without the requisite training and checks.

2. DGCA may advise all the helicopter operators to assess the capability / suitability of the machines viz a viz the operational requirements before deployment of the helicopter for operations.

3. DGCA may reiterate instructions regarding the importance of following the Standard Operating Procedures (SOP) and Crew Resource Management (CRM).

4. DGCA may issue instructions emphasising the requirements of refreshers / checks in simulators for all operations.

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