FINAL REPORT ON ACCIDENT TO PAWAN HANS HELICOPTER LTD. DAUPHIN 365 N3 VT-SOK AT CHANDIGARH AIRPORT ON 16/12/2010.

1. Helicopter Type	: Dauphin 365 N3
Nationality	: INDIAN
Registration	: VT - SOK
2. Owner/ Operator	: Pawan Hans Helicopter Ltd.
3. Pilot – in –Command	: Flying under rule 160
Extent of injuries	: Minor
4. Co-Pilot	: Holder of CPL (H)
Extent of injuries	: Minor
5. Place of Accident	: Chandigarh Airport
6. Last point of Departure	: Chandigarh Airport
7. Intended place of Landing	: Secretariat, Chandigarh
8. Date & Time of Accident	: 16th December, 2010; 04:30 UTC (Approx.)
9. Passengers on Board	: NIL
Extent of Injuries	: NIL
10. Phase of Operation	: Taxing
11. Type of Accident	: During Taxi the helicopter Toppled toward left side.

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SUMMARY:

On 16/12/2010 Pawan Hans Dauphin Helicopter AS 365 N3 VT-SOK, was operating a positioning flight from Chandigarh airport to Govt. Secretariat, Chandigarh to pick up a passenger and proceed to Mukerian in Hoshiarpur. After carrying out the refueling the AME released the helicopter for flight at around 04:25 UTC. The helicopter was fully serviceable as no defect was reported by the commander on the previous sector.

After obtaining ATC clearance the commander initiated taxi and immediately took a left turn to join the taxi line. After Taxiing for about 5-6 meters, the commander moved the cyclic stick to the left in order to give correction for the slope which was on the right. In the process the right wheel of the helicopter suddenly lifted up. The commander immediately came on collective, however the harsh and sudden movement of the controls coupled with the Auto Pilots "OFF" led to state of dynamic roll over, thus leading to an uncontrollable state in which the helicopter pitched forward and rearward and eventually resulted into an accident. Both the cockpit crew were rescued from the helicopter by the Pawan Hans staff. There was no fire.

1. FACTUAL INFORMATION.

1.1 History of the flight

On 16/12/2010 Pawan Hans Dauphin Helicopter AS 365 N3 VT-SOK, was operating a positioning flight from Chandigarh airport to Govt. Secretariat, Chandigarh to pick up a passenger and proceed to Mukerian in Hoshiarpur. The Pawan Hans Helicopter VT-SOK was leased to the Govt. of Punjab.

On 15/12/10 the helicopter made a night halt at Kalijharani. On 16/12/10 morning after carrying out the daily inspection schedule by the AME the

helicopter was brought back to Chandigarh at around 04:00 UTC after the flight of about half an hour and was parked in the civil dispersal area instead of its usual parking place which is in front of the Punjab Government hanger as one of Punjab Government fixed wing aircraft was parked in front of the hanger. The AME carried out refueling of 350 liters on the helicopter and released the helicopter for flight since it was scheduled to pick up a passenger from the secretariat and proceed to Mukerian in Hoshiarpur. The helicopter was fully serviceable as no defect was reported by the pilot on the previous sector.

At around 04:25 UTC after obtaining ATC clearance the commander initiated taxi and immediately took a left turn to join the taxi line. The apron area right of the yellow line marked on the apron was not leveled and had a slope. As the commander initiated taxi the right main wheel of the helicopter was on the slope and the left main wheel was on the flat surface. After Taxiing for about 5-6 meters, the commander moved the cyclic stick to the left in order to give correction for the slope which was on the right. In the process the right wheel of the helicopter suddenly lifted up. The commander thinking that the helicopter would roll over to the left he immediately came up on collective and the helicopter lifted up. However the harsh and sudden movement of the controls coupled with the Auto Pilots "OFF" led to state of dynamic roll over, thus leading to an uncontrollable state in which the helicopter pitched forward and rearward. To come out of the induced oscillations the commander in panic further came up on collective in order to gain height so as to recover the helicopter from the state of dynamic roll, this action further aggravated the situation and induced more oscillations and eventually resulted into an accident.

The departure AME and the technician along with the Pawan Hans operation person immediately rushed toward the helicopter and broke the cockpit from the right side overhead plexi to take both the cockpit crew out of the helicopter. The fire vehicles also rushed to the site and sprayed the foam as the fuel was leaking from the fuel tank. Both the cockpit crew were immediately rushed to the

hospital as they sustained minor injuries. There was no fire. The accident occurred during morning hours at around 0430 UTC.

1.2 Injuries to persons.

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	NIL
MINOR	2	Nil	----

1.3 Damage to aircraft.

1. The Helicopter sustained substantial and irrepairable damage. Few of the damages are, after the helicopter impacted the ground, the tail boom got broken and separated from the main structure. The tail rotor head and the blades were completely damaged. The Tail Gear Box was completely destroyed. The left passenger door had impacted the ground and was completely deformed. Both the side fins were damaged. Both the horizontal stabilizers had also impacted the ground and were completely damaged. The tail skid were damaged and broken. All the four main rotor blades and rotor head had hit the ground and were completely damaged. After the aircraft hit the ground it toppled and skidded and in the process damaged both the engines and its cowling completely. The right main landing gear was also detached from structure. The Right side windshield also broken and the helicopter forward frame was deformed.

1.4 Other damage:

After the main rotor blades impacted the ground certain parts of the helicopter got scattered and hit the terminal building glass and damaged it. A portion of the main rotor blade was also found on the terrace of the terminal

building. There were helicopter rubbing marks and main rotor cut marks on the apron area.

1.5 Personnel information:

1.5.1 Pilot – in – Command:

Name	:	Flying under rule 160
AGE	:	45 years
Licence	:	Under Rule 160
Date of Issue	:	28/07/2008
Valid up to	:	N/A
Category	:	Helicopter
Class	:	Multi Engine Land
Endorsements as PIC	:	Flying under rule 160
Date of Med. Exam.	:	14/10/2010
Med. Exam valid upto	:	13/04/2011
FRTO Licence No.	:	Not required Under Rule 160
Date of issue	:	N/A
Valid up to	:	N/A
Total flying experience	:	3526:45 hours

Last flown on type	:	16/12/2010
Total flying experience during last 180 days	:	296:15Hrs.
Total flying experience during last 90 days	:	143:25Hrs.
Total flying experience during last 30 days	:	55:00Hrs.
Total flying experience during last 07 Days	:	21:50Hrs.
Total flying experience during last 24 Hours	:	04:05Hrs.

1.5.2 Co-Pilot:

Name	:	Holder of CPL (H) licence
AGE	:	47 years 05 months

Licence	:	CPL (H)
Date of Issue	:	28/07/2008
Valid up to	:	27/07/2013
Category	:	Helicopter
Class	:	Multi Engine Land
Endorsements as PIC	:	28/07/2008
Date of Med. Exam.	:	25/11/2010
Med. Exam valid upto	:	24/05/2011
FRTO Licence No.	:	11763
Date of issue	:	28/07/2008
Valid up to	:	27/07/2013
Total flying experience	:	3526:45 hours
Last flown on type	:	16/12/2010
Total flying experience during last 180 days	:	296:15Hrs.
Total flying experience during last 90 days	:	143:25Hrs.
Total flying experience during last 30 days	:	55:00Hrs.
Total flying experience during last 07 Days	:	21:50Hrs.
Total flying experience during last 24 Hours	:	04:05Hrs.

There was no record of any Flight Duty Time Limitation violation in respect of both operating crew. 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 is manufactured by Eurocopter, France. The helicopter is certified in transport category, for day and night operation under VFR & IFR. The maximum operating height under IFR of this helicopter is 15000 feet and maximum takeoff weight is 4300 kg. Helicopter length is 13.684 meter and width is 3.285 meter,

height of this helicopter is 3.808 meter. The helicopter is approved in the "Transport" category under FAR 29 amendment 16 category B & category A.

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 check 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 as following: forward structure, body structure, and aft structure. The main rotor shaft suspension bars is attached to two strong frames of the body structure.

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-SOK S/N 6536 has been manufactured on 27th Oct. 1998. The helicopter was initially procured by Govt. of Kartnataka and was maintained by PHHL. However, on 13.02.2007 the Helicopter VT-SOK was registered under the ownership of PHHL, Certificate of registration No. 2983/2, under category 'A'.

The certificate of airworthiness Number 2392 under "normal category" sub-division passenger was issued by DGCA on 01.02.1999 and specified minimum operating crew as one. The maximum authorized all up weight is 4300 kgs. The C of A is valid up to 31st December 2011. The Helicopter was flown with Aero Mobile Licence No. A-020/003-RLO (NR) and is valid up till 31st December 2011. This helicopter was operated under Non scheduled operator's permit No. 02/1998 and was valid up to 15th March 2012. This Dauphin AS 365 N3 helicopter VT-SOK has logged 2815:10 A/F Hrs as on 15th December 2010.

The AS 365 N helicopter and its Engines are being maintained as per the maintenance program consisting of calendar period based maintenance and flying Hours/ Cycles based maintenance as per maintenance program approved by Regional Airworthiness office, New Delhi.

Accordingly, the last major inspection done is 1200 Hrs/02 year inspection at 2289:13 A/F Hrs on 31.12.2009. Subsequently all lower inspections, after last flight inspection and pre flight checks were carried out as and when due before the incident.

The helicopter was last weighed on 29.12.2009 at Chandigarh and the weight schedule was prepared and duly approved by DAW, New Delhi. As per the approved weight schedule the Empty weight is 2751 kgs. Maximum fuel capacity is 915 kgs. Maximum permissible load with 2 pilots, fuel and Oil tank full is 483 kgs. Empty weight CG is 4.2277 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 28.12.2014. Prior to the accident flight the weight and balance of the helicopter was well within the operating limits.

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

when due. All the spares kept at Chandigarh detachment for Dauphin AS 365 N3 helicopter were accompanied with proper documents along with inspection tag issued by the approved stores Inspector.

Turn Around Inspections are carried out 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 Program) and are approved by the Quality Manager (WR).

The last fuel microbiological test was done on 23.07.2010 at DGCA approved facility and the colony count was within acceptable limits.

The Dauphin AS 365 N3 helicopter is fitted with two Turboshaft Arriel 2C engines manufactured by Turbomeca, France. VT-SOK was fitted with LH Engine S/N 24202 and had logged with 3673:44 Engine Hrs, 59396 Ng cycles and 1955.1 FT cycles respectively. The RH Engine installed is S/N 24345 and had logged 1696:01 Hrs with 3073.9 Ng cycles and 954.2 FT cycles.

The AS 365 N3 helicopter VT-SOK is fitted with 4 Main Rotor Blades having a SLL of 20000 Hrs. Details are as below:-

The Main Rotor Blade

S/N	PART NO.	SERIAL NO.	COMPONENT HRS
1.	365A11-0050-07	6587	13462:50
2.	365A11-0050-07	6779	13903:38
3.	365A11-0050-08	9789	3008:25
4.	365A11-0050-08	8659	3946:27

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

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

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

Prior to accident flight there was no pending/repetitive defect entered on the Pilot Defect Report/Technical Logbook of the helicopter. The certificate of Flight Release was valid prior to the accident flight.

1.7 Meteorological information:

The weather at departure from Chandigarh was fine with visibility 5 km and clear skies. The enroute weather and the weather at Mukerian in Hoshiarpur was reported to be fine.

1.8 Aids to navigation:

Chandigarh has a single runway 11/29 in operation. The VOR/DME approaches are available on either side of the runway. However the ILS landing facility is available for runway 11 only. The PAPI is available for the runway 11/27.

1.9 Communications:

There was always two way communications between the helicopter and the ATC.

1.10 Aerodrome information:

Chandigarh airfield is a Defence airfield and the operations are controlled by Indian Air Force. The ATC is controlled by the Indian Air Force and the Civil apron is controlled by Airports Authority of India. Since the Civil Apron was under Airport Authority of India it was resurfaced recently and the level was raised. However the area in front of the Govt. of Punjab Hanger remained at a lower level which resulted into a slope. The field elevation of Chandigarh is 1030 feet or 314 meters. It has one single runway 11/29 in operation. The airfield is equipped to provide VOR/DME approach on either side of the runway. Runway 11 is equipped for making ILS approach and landing. The PAPI is also available for the runway 11/29.

1.11 Flight recorders:

CVR:

CVR readout was carried out and following observations were made.

1. The helicopter requested ATC for start up to secretariat helipad Chandigarh, 500 feet AGL with only 2 crews on board.
2. Both the crew did the pre-flight inspection/checks.
3. P1 did mention to P2 that the helicopter was not parked properly during the previous switch off.
4. P2 mention to P1 that they will make correction for that.
5. Immediately after that P2 screaming voice is heard followed by warning sounds.

DFDR:

DFDR analysis was carried out and following observations were made:

1. Both the engines started normally with no significant changes in parameters.

2. Since, the helicopter was parked on a slope with right main gear on the slope the cockpit crew gave a correction towards the left on the cyclic to counter the slope.
3. In the process the helicopter went into pitching mode with values fluctuating from 77.75% to as low as 25.08% accompanied with a yaw from 70.53% to 33.06%. At this time the NR was 100%.
4. The tail pitch also started fluctuating simultaneously from -4.86 to 48.42 degrees at 100% NR.
5. During the pitching of the helicopter accompanied with yaw the main rotor hit the ground and the NR dropped from 109.97% to 72.17% accompanied with warnings in the cockpit. Thereafter the helicopter rolled over towards the left.

1.12 Wreckage and impact information.

During examination of the Helicopter at site, it was observed that Helicopter was resting on the ground in an upside down position about 20 Mts in front of the arrival building at Chandigarh airport. The RH main landing gear had broken and detached from the helicopter structure. The LH Main Landing Gear attachment was also broken. The tail rotor shaft had broken and the structure sheared off and detached from the helicopter main structure and was lying next to the RH main landing gear. All the four main rotor blades had broken from the root into small pieces and were lying all over the apron area. A portion of the main rotor blade was also found on the terrace of the Chandigarh arrival terminal building. The glass of the main arrival building was also broken due to impact with the pieces of the main rotor blades. The fenstrom had also detached along with the tail rotor shaft and was lying next to the helicopter. Both the horizontal stabilizer had broken and detached from the main structure. The RH door was deformed and broken. Both the cockpit crew were rescued by breaking the top RH side plexi. The left side door and structure was also damaged. The final rest position of the helicopter was on the right side, which was completely

damaged. The nose portion containing all the avionics equipment was also damaged.

After examining the apron area it was observed the helicopter was parked on the apron with its nose gear on to the slope area. After the engine start up the helicopter rolled forward for few feet and then took a left turn as a result the RH main gear came to the slope area. Thereafter tail boom composite pieces were observed on the apron area and the main rotor hitting marks on the apron surface were observed in continuous pattern. Once the main rotors impacted the apron surface the composite structure disintegrated into small pieces and scattered all over the apron area as shown in the pictures. Thereafter the helicopter rolled over on to its left side and then skidded on its right side before coming to final rest position about 20 mts from the terminal building.

Picture: Helicopter rubbing marks and debris scattered on the apron

Picture: Side view showing damage on Right Side

In the cockpit, the fuel levers were found in off positions and the rotor blades were ON. The helicopter batteries were found in off position. Since both the doors were damaged the RH overhead plexi was broken and both the pilots were rescued from the helicopter.

1.13 Medical and pathological Information:

There was no preflight medical carried out prior to the accident flight at Chandigarh. However both the cockpit crew were subjected to medical examination after the accident and was found satisfactory.

Both the cockpit crews were rescued from the helicopter after the accident and were immediately rushed to the hospital for medical assistance. Both the crew sustained minor injuries.

Picture : The Cockpit Crew was rescued after breaking the Plexi

1.14 Fire:

There was no fire after the accident. However, since the helicopter had toppled and skidded the fuel tank got damaged and the fuel started leaking after the accident. The fire vehicles sprayed foam all around the helicopters as a precautionary measure to prevent accidental fire.

Picture: As a precaution fire vehicles sprayed foam since fuel was leaking

1.15 Survival aspects:

The accident was survivable.

1.16 Tests and research: NIL

1.17 Organizational and management information:

M/s Pawan Hans Helicopters operates under Non Schedule Operator's Permit No. 02/1998 valid up to 15th March 2012. It has the biggest operation on the off shore oil rig platforms. PHHL holds the largest number of helicopters under NSOP. M/s PHHL also hold contracts with number of state governments and provide helicopter services to them, Govt. of Punjab was one of them. The contract between the PHHL and Government of Punjab was valid till October 2011.

1.18 Additional information:

Both the pilots were retired army officials and were re-employed with Pawan Hans. The commander of the helicopter was flying under the privileges of rule 160 however the copilot was holding a valid DGCA license on type at the time of accident.

1.18.1 Dynamic Rollover:

A helicopter is susceptible to a lateral rolling tendency when lifting off the surface, this could occur if some factor causes the helicopter to roll, pivot around a skid or landing gear wheel, until its critical rollover angle is reached. This is the angle to which we tilt an object to bring the C.G directly over the roll point. If the object is tilted beyond this angle it will fall over (C.G beyond the pivot point). The roll will only stop if the C.G is kept before the pivot point, beyond this point main rotor thrust continues the roll and recovery is impossible even if the full cyclic control corrections are applied. This phenomenon is called Dynamic rollover.

Dynamic rollover may occur for various reasons i.e failure to remove a tie down or skid securing device, or if the skid or wheel contacts a fixed object or if the landing gear is stuck in ice, soft asphalt or mud. Dynamic rollover may also occur if the pilot does not use the proper landing or take off technique while **performing slope operations**. Dynamic rollover cannot be stopped once initiated by application of opposite cycle control alone i.e. if the right skid contacts an object and becomes pivot point while the helicopter starts rolling to the right even with full left cyclic applied, the main rotor thrust vector and its moment is such that the helicopter will continue to roll towards the right (critical angle is reached) and it will fall over to right.

This phenomenon was experienced by the Dauphin N3 helicopter, VT-SOK at Chandigarh airport on 16/12/11 at 4:30 UTC (approx.). The pilot was performing slope operation and did not use the proper corrective techniques. Since the slope was towards the right the pilot gave a cyclic correction towards the left as a result the right wheel came off the ground. The pilot realizing this immediately came up on collective to do the hover taxi and in the process of picking up, the critical angle was reached and the helicopter started to roll over towards the left side since the cyclic was towards the left and in doing so helicopter went into an oscillation and the fenstrom got damaged and the main rotor thrust vector and its moment was such that the helicopter toppled over in the direction of rotation of the main rotor blades towards the left side.

If the helicopter is engaged in slope operation then lateral cyclic must be applied into the slope, this input is relative to the degree of the slope or quickly applying down collective which is the most effective way to stop dynamic roll over. The captain of VT-SOK did not apply any of these techniques to control the oscillations and this finally resulted into the accident.

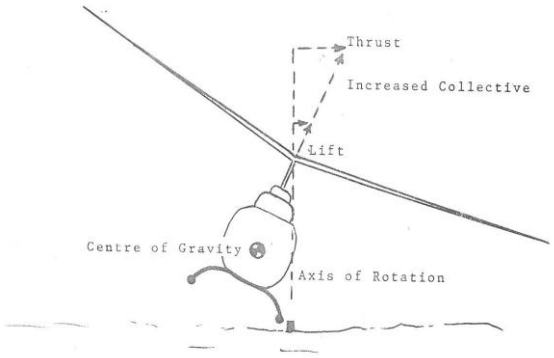

Fig. Dynamic Roll

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-SOK S/N 6536 was manufactured by M/s Eurocopter France in 1998. The helicopter operated by PHHL, Certificate of registration No. 2983/2, under category' A' was issued on 13.02.2007.

The helicopter was holding a valid certificate of airworthiness Number 2392 issued under normal category sub-division passenger by DGCA on 01.02.1999 and was valid upto 31st December 2011. The helicopter had a valid Aeromobile Licence No. A-020/003-RLO (NR) valid till 31st December 2011. This helicopter was operated under Non scheduled operator's permit No. 02/1998 and was valid till 15th March 2012. Prior to flight the 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 29.12.2009 at Chandigarh. The maximum fuel capacity is 915 kgs. Maximum permissible load with 2 pilots, fuel and Oil tank full is 483 kgs. Empty weight CG is 4.2277 meter aft of reference in land configuration. There was no major modification carried out affecting weight & balance. The next weighing was due on 28.12.2014.

This helicopter VT-SOK has logged 2815:10 A/F Hrs as on 15th December 2010. The AS 365 N helicopter and Engines were being maintained under continuous maintenance as per maintenance program consisting of calendar period based maintenance and flying Hours/ Cycles based maintenance as per maintenance program approved by Regional Airworthiness office, New Delhi. The last major inspection 1200 Hrs/02 year inspection was carried out at 2289:13 Airframe Hours on 31.12.2009. Subsequently all lower inspections, till the last flight prior to accident was carried out as per the maintenance programme.

All the concerned Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications on this helicopter and its engine were found complied with. 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 Program) were complied with and same were found approved by the Quality Manager (WR).

The last fuel microbiological test was done on 23.07.2010 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 rest position. There was no in-flight disintegration of any part of the helicopter. After the helicopter impacted the ground the LH Main Landing Gear attachment and the tail rotor drive shaft broke and the structure sheared off and detached from the helicopter main structure and was lying next to the RH main landing gear. Examination of all four main rotor blades revealed that it had broken from the root into small pieces due to impact with the ground as evident from the cut marks on apron area and also the debris spread over the apron area. Both the horizontal stabilizer had broken and detached from the main structure. (The RH door was deformed and broken due which both the cockpit crew were taken out from the helicopter after breaking the RH overhead Plexi)

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

2.2 Weather:

The weather at departure from Chandigarh was fine with visibility 5 km and clear skies. The en-route weather and at destination at Mukerian in Hoshiarpur was reported to be fine.

2.3 Pilot handling of the aircraft:

The helicopter VT-SOK had returned to Chandigarh airfield on 16/12/2010 at around 0400 UTC after a night halt at kalijharani, Punjab the previous day. The weather at Chandigarh was reported to be fine with visibility 5 kilometers with clear skies. The helicopter was parked on the resurfaced raised civil dispersal which was at ninety degrees to the usual place of parking in front of the Punjab government hangar. The helicopter was parked on the civil dispersal near the terminal building without any coordination with AAI. After refueling, the helicopter was scheduled for departure at 0430 UTC to Secretariat helipad to pick up a passenger for their onward flight to Hoshiarpur. Both the cockpit crew were aware prior to flight that the helicopter was not parked properly since it was on the raised platform and nose facing towards the slope. The commander after obtaining the ATC and MET clearance started engines and requested ATC for taxi. The helicopter after taxing straight for a few meters took a gradual left turn to avoid the obstacles on the right and in the process the right wheel of the helicopter went into a slope however the left wheel remained on the leveled ground.

After Taxiing for about 5-6 meters, the commander moved the cyclic stick to the left in order to give correction for the slope which was on the right. In the process the right wheel of the helicopter suddenly lifted up. The commander thinking that the helicopter would roll over to the left he immediately came up on collective and the helicopter lifted up. However the harsh and sudden movement of the controls coupled with the Auto Pilots "OFF" led to state of dynamic roll over, thus leading to an uncontrollable state in which the helicopter pitched forward and rearward. To counter the same an excessive rearward cyclic movement was given by the commander which led to hitting of the fenstrom and thus leading to a tail rotor efficiency loss. To come out of the induced oscillations the commander in panic further came up on collective in order to gain height so as to recover the helicopter from the state of dynamic roll, this

action further aggravated the situation and induced more oscillations and eventually resulted into an accident.

As per the commander statement in this entire process the helicopter gained about 40-50 feet of height before crashing. The commander further stated that immediately on crashing, he had put the fuel shut off levers OFF and the rotor brakes ON while the other pilot switched the batteries OFF.

From the foregoing, it is evident that both the cockpit crew were aware that the helicopter was not parked properly after the previous landing and was on the slope. The commander gave a cyclic input to left to compensate for the slope which resulted into a dynamic roll. This dynamic roll further aggravated by the fact that the commander came further on collective in order to gain height to control the helicopter and eventually resulted into the helicopter toppling onto the left side and resulting into the accident. Hence commander handling of the helicopter is the contributory factor to the accident.

2.5 Circumstances leading to the Accident :

Since the regular parking area of the helicopter which is in front of the Punjab Govt. hanger area was not available, the helicopter was parked on the civil apron closed to the slope area with nose of the helicopter facing towards the slope leading to the Punjab government hanger. As the helicopter taxied out it took a left turn as a result the right wheel went on to a slope area and the left wheel remained on the flat apron area. This caused the helicopter to tilt slightly right. The commander in order to provide the correction for the slope moved the cyclic towards the left as a result the right wheel of the helicopter came up in air. The commander thinking that the helicopter might topple over towards the left immediately came up on collective and the helicopter lifted up. However the harsh and sudden movement led to state of dynamic roll over, thus leading to an uncontrollable state in which the helicopter pitched forward and rearward. This

dynamic roll was further aggravated by the fact that the commander came further on collective in order to gain height to control the helicopter, not realizing that in order to come out of the dynamic roll he should have put the collective down and landed back. Commander action of coming up on collective further aggravated the dynamic roll which 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 retired Army officials and were re-employed with Pawan Hans Helicopter Ltd.
d) The commander of the helicopter was flying under the authorization of rule 160.
e) The commander had accepted the helicopter for flight after the daily inspection schedule was carried out on the helicopter by the AME.
f) Prior to flight both the cockpit crew were aware that the helicopter was not parked properly after the previous switch off.
g) The commander mentions to the other pilot that he will take care of the slope.
h) As the commander initiated taxi it took a left turn and the right main gear came on to the slope area. The commander gave a left cyclic correction to counter the slope, however the correction was harsh and sudden and the right wheel went up in air and this resulted into a dynamic roll.
i) The commander immediately came on collective to lift off from the ground by doing this the oscillations increased further and it became uncontrollable.

j) During pitching the fenstrom of the helicopter hit the ground which reduce the tail efficiency and further destabilize the helicopter.

k) As the power was high with fenstrom damage the helicopter toppled on to its left resulting into an accident.

l) Both the crew had shut off the fuel lever, applied the rotor brakes and switched off the batteries after the helicopter toppled.

m) Both the cockpit crew were rescued from the helicopter by breaking the RH side top plexi by the company officials.

n) Both the crew sustained minor injuries.

o) Weather was fine and is not a factor to the accident.

3.2 Probable cause of the Accident:

Mishandling of controls on the slope area during taxing resulted into the Helicopter entering into a dynamic roll thereby impacting heavily with ground causing substantial damage to Helicopter. The slope on the apron area was the contributing factor to the accident.

4. SAFETY RECOMMENDATIONS:

1. PHHL to include slope operations in their ground refresher training for the cockpit crew and also part of the syllabus for simulator training.

2. Hqrs may take appropriate action in the matter.

Place: New Delhi
Date: 04.07.2011

(A.X.Joseph)
Senior Air Safety Officer (E)
Inspector of Accidents VT-SOK