FINAL INVESTIGATION REPORT OF ACCIDENT TO M/S DECCAN AVAITION (P) LTD BELL-206 L 3 HELICOPTER VT-DAK AT MYSORE ON 18th JANUARY 2008.

a) Helicopter

Type	: Bell 206
Nationality	: Indian
Registration	: VT-DAK
b) Owner/Operator	: M/s Deccan Aviation Pvt. Ltd
c) Pilot-in-Command	: Line Pilot – CHPL No. 795
Extent of Injuries	: Minor
d) Number of passenger on board	: Four including one technician
Extent of Injuries	: Seroius-2 : Minor- 2
g) Place of accident	: Lat. **12° 21' 52.9 "** North, Long. **76° 36' 19.5 "** East At Infosys helipad, Mysore.
h) Date & time of accident	: 18th January,2008; 1000 Hrs IST Approx.

(All timings in the report are in IST)

SUMMARY

M/s Deccan Aviation Pvt. Ltd Bell-206 B III helicopter VT-DAK while engaged in a Charter flight from Jakkur Aerodrome-Electronic city Mysore-Bangalore-Jakkur on 18.1.2008 was involved in an accident during landing at M/S Infosys Systems helipad. The helicopter was chartered to M/S Automative axles Ltd., Mysore. Line pilot was operating the helicopter and

there were 4 passengers, which included one technician of Deccan Aviation. The take-off from Jakkur aerodrome was normal at around 0915 hrs. No abnormality was reported for take-off and in cruise flight.

On reaching the helipad before the H marking at about 10 feet pilot reported abnormal yaw to the right. He immediately lowered the collective lever and applied the left rudder pedal, however helicopter continued to turn right till it contacted the ground by which time the engine throttle was closed. Soon, helicopter toppled to the left with its nose facing in westerly direction and skid separated. Helicopter was switched off and all the passengers came out from the helicopter with the help of ground crew. Three passengers and pilot received injuries during the accident. Helicopter sustained substantial damage. The accident occurred at time 1000 hrs i.e. 0430 UTC in the forenoon. The weather was fine. There was no fire.

1. FACTUAL INFORMATION

1.1 History of the flight :

Bell 206 L3 Helicopter VT-DAK belonging to M/S Deccan Aviation Pvt. Ltd was engaged in Charter flight from Jakkur Aerodrome-Electronic city Mysore- Bangalore-Jakkur Aerodrome on 18.1.2008. Line pilot was operating the flight and there were four passengers on board which included one company's technician. The passengers included Mr. Baba N. Kalyani, CMD and two directors of M/S Automotive axles, namely Mr. Rakesh Sachdev and Mr. Lori Dowers.

On 17.1.2008 the coordinates of the helipad were obtained by the pilot from the helipad directory. More so the flight plan was also filed at 1415 hrs to FIC Chennai and Bangalore ATC. As per the flight plan the cruise level was 4000 feet on QNH with cruising speed of 100 kts. The distance and bearing from Bangalore were 70 NM and 230 degree respectively for the destination helipad. The helicopter on 17.1.2008 was defuelled by 340 lbs for getting readied for 18.1.2008 planned charter flight to Electronic city, Mysore. The Daily inspection of the helicopter was carried out by appropriately licensed AME and helicopter was readied at 0700 hrs by AME. Helicopter was duly accepted by pilot at 0800 hrs. At the time of departure total fuel on board was 400 lbs.

As per the pilot report the start up and take-off from Jakkur aerodrome was normal at around 0915 hrs. No abnormality was reported for take-off and in

cruise flight. Pilot reported Magaddi hill (20 NM West of Bangalore) to Bangalore ATC and was told to maintain listening out and maintain 4000 feet on QNH 1018. On reaching overhead the helipad pilot carried out an aerial recee. When he first approached to the helipad, helicopter bearing was 232 degrees and was into tailwind of about 2-3 kts. Hence went over the helipad and took right turn from about 1 km for making landing on heading 050 degrees with winds of 230/2-3 kts. The rate of descend and all other parameters were reported to be normal. On reaching the helipad before the H marking at about 10 feet pilot reported abnormal yaw to the right. He immediately lowered the collective lever and applied the left rudder pedal, however helicopter continued to turn right by about 2 turns till it contacted the ground by which time the engine throttle was closed. Soon, helicopter toppled to left with its nose facing in westerly direction and skid separated. Helicopter was switched off and all the passengers came out from the helicopter with the help of ground crew. All the passengers and pilot were taken to the hospital for examination. Out of four persons, two persons received serious injury who were occupying LH seats in the helicopter and 2 received minor injury Helicopter sustained substantial damage to its structure. The accident occurred at time 0430 UTC i.e. 1000 hrs IST in the forenoon. Accident occurred during day light conditions in the infosys campus helipad, Mysore. Geographic location of the site are Lat 12 ° 21' 52.9" N and Long. 76 ° 36'19.5" E. The weather was fine. There was no fire.

1.2 Injuries to Persons :

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	NIL	NIL	NIL
SERIOUS	NIL	TWO	NIL
MINOR	ONE	ONE	NIL
NONE	ONE	NIL	NIL

1.3 Damage to aircraft : Helicopter sustained substantial damages during the accident.

1.4 Other damage : NIL

1.5 Personnel Information :

1.5.1 Pilot-in Command:

Line pilot
Date of Birth: 17.3.65.
Age: 43 years approx.

License: CHPL No. 795 (issued on 2.8.2007 and was valid up to 1.8.2012.)

FRTO No: 10384, Valid up to 1.8.2012.

Pilot in Command has retired from Indian Army Aviation on 20.6.2007 after 21 years of total service and Joined M/S Deccan Aviation on 1.7.2007.

He held PIC endorsements on his CHPL for Bell 206 L3 and Bell-407 type helicopters. He was last medically examined on 16.1.2008 wherein he was advised to reduce weight by 10 kgs.

Bell 206 L3 helicopter was endorsed on his license on 2.8.2007 after satisfactory completion of endorsement training in India. In November 2007 he was endorsed Bell-407 helicopter also. He had been regularly flying Bell 206 L3 helicopter since then. The pilot did not exceed the flight duty/flight time limitation prescribed by the DGCA. His flying records on type is as under:

During last 90 days:	62:25 hrs.
During last 30 days :	44:40 hrs.
During last 7 days:	00:45 hrs.
During last 24 hours:	00:45 hrs.

Total Hrs.

i) Total Flying Experience :	3700 hrs.
ii) Total Flying Exp. as PIC:	2145:15 hrs.
iii) Total Flying Exp on type Bell-206 L3	172:00 hrs
iv) Flying Exp as PIC on type	165:30 hrs.

There was no flight duty/flight time exceedance found for the pilot from the flying records.

1.6. Helicopter Information:

Bell 206 L3 Helicopter is a single engine American Bell Textron Company make for VFR flying with 2 main rotor blades and 2 tail rotor blades. Main rotor and tail rotor blades are made up of fiberglass with honeycomb core. Main rotor is 2 bladed semi-rigid, high kinetic energy type with pre coning and under slung capabilities to increase stability and provide smooth control response in all modes of flight. It has two-stage transmission reduction of 15.23: 1 between power plant and main rotor. Airframe consists of three sections (a) forward (b) intermediate (c) Tail boom section. Its maximum all up weight is 1882 Kg and maximum endurance of 2:45 hrs and VNE of 130 Kts.. The helicopter is having total seven seating capacity, which includes one Pilot.

As per Certificate of Airworthiness minimum crew required to fly the helicopter is one. Landing gear is skid type construction attached to the fuselage structure with forward and aft straps. Tail boom is basic monocoque construction. Tail boom supports the tail rotor drive shaft ,tail gear box, vertical fin and stabilizer elevator. The stabilizer is stationary while the elevator is moveable to maintain fuselage trim thru all air speed. Tail rotor blade consists of hub and two blades. The blades are mounted in the hub by spherical bearing which are mounted in the blades on the pitch change axis. The hub and blade assembly is mounted on the ninety degree gear box output shaft by means of a splined trunion, mounted in bearing in the hub to provide flapping. Tail rotor drive shaft is made up of forward short shaft, oil cooler blower shaft, aft short shaft and tail rotor drive shaft segments steel laminated flexible coupling requiring no lubrication are used for connection.

Bell 206 Helicopter is installed with one Allision 250-C30P engine. This is a turbo shaft engine with MCP of 370 SHP and take-off power of 456 SHP(increase power kit). The engine consists of single stage centrifugal flow compressor, a single combustion chamber, a two stage gas producer turbine and a two stage power turbine.

Bell 206 L3 helicopter, registration No. VT-DAK bearing constructor's serial No.51612 was manufactured in Year 1992 by M/S Bell Helicopter Textron, USA. It was brought to India by M/S Deccan Aviation Pvt. Ltd in August 1997. It was issued with C of R No 2905 on 29.8.1997 under Category 'B'. Its first Indian C of A No. 2322 was issued on 29.8.1997 under 'Normal' Category, subdivision 'Passenger/Aerial Aircraft'. The

Certificate of Airworthiness (C of A) was being re-validated on yearly basis and it was valid till 26.7.2009.

The helicopter was equipped with Allison 250C30 P turbo shaft engine S/no. 895684. The helicopter had done 6400 airframe hrs/16375 landings since new. The subject Engine on the helicopter had done 6317:39 hrs./7199 Cycles since new before the date of accident. As per log book entries all the mandatory modifications were recorded as complied with.

The helicopter was being maintained airworthy by periodically carrying out the approved maintenance schedule. Last 300 hrs inspection schedule was carried out on 4.1.2008 on the helicopter airframe at 6387:17 hrs and its engine at 6304:09 hrs7189 cycles. Certificate of release to service was issued on 4.1.2008 and was valid at the time of accident. The take-off weight of the helicopter was 1721 Kgs and landing weight at the helipad was 1643 Kgs and the Center of gravity was found well within limits. Total 250 lbs of fuel was observed on the fuel gauge after the accident.

1.7 Meteorological Information :

On 18th January 2008 helicopter had departed from Jakkur Aerodrome at around 0915 hrs IST. The weather report issued by Bangalore Airport Meterological Deptt. for time 0330 UTC indicated winds 090°/02 Kts, Visibility 2 Kms in mist and clouds scattered at 6000 feet and visibility becoming 5000 in Haze.

The accident occurred at around 1000 hrs at Infosys helipad, Mysore. There is no Met facility exists at the Infosys helipad, Mysore. Only wind sock was available for indicating the wind direction. As per the pilot report when entered into final approach to the helipad, winds were observed 050 degrees/2-3 Kts and temperature was about 22 degrees. Also the met information is obtained from Bangalore met office on phone before take-off. However as per the met office, Bangalore no briefing/documentation was provided to VT-DAK for its flight dated 18.1.2008.

1.8 Aids to Navigation :

The flight was conducted under Visual Flight Rules (VFR) rules for which no navigational aid was required. More over, no navigation facility was installed at the infosys helipad and aids to navigation are not considered as contributory factor in the accident.

1.9 Communications :

The helicopter was in contact with Bangalore ATC during the flight. The helicopter came in contact with Bangalore approach control at 0349 UTC after its take-off from Jakkur Aerodrome. The Bangalore Approach then asked the helicopter to route via Magadi, climb and maintain 4000 feet on QNH 1018 to which the helicopter replied affirmative. At 0357 UTC the helicopter replied ATC checking Magadi and resuming normal. The helicopter was asked to report ETA Mysore to which it replied 0426 UTC. ATC has asked the helicopter to keep a listening watch to which the helicopter replied affirmative. Thereafter no recordings of the flight with the Bangalore ATC found and pilot made no further transmissions with Bangalore ATC when made crash landing at Infosys helipad.

1.10 Aerodrome Information:

The helipad on which the accident occurred belongs to M/S Infosys limited, Mysore. The same is a private helipad and made operational from February 2005. It is made of Reinforced Concrete Cement base. The elevation of helipad is about 3105 feet and geographical coordinates as N- 12°21'52.9" and E- 076°36'19.5. Helipad is suitable for VFR operations only. It has provision of windsock. Windsock was located in the north side of helipad but very near to the Boundary wall of Infosys campus. Outside the boundary wall there were 2 trees and thus the windsock was under the shadow region, which will not provide the proper wind speed/direction.

The marking on the helipad were also not proper. As per pilot he was familiar with the helipad during his conversions dual sorties in July 2007. More so he has also flown over the helipad few times on later dates but was making first time landing on the helipad.
The permission to land at the infosys helipad was obtained in advance by M/S Automotive axles Ltd, Mysore who has charted the helicopter.

1.11 Flight Recorders:

CVR/FDR were not installed on the helicopter and it was not mandatory for the type of helicopter.

1.12 Wreckage and Impact Information:

The accident occurred over the helipad the elevation of which is 3105 feet and coordinates of the site are Lat 12 ° 21' 52.9" N and Long. 76° 36 ' 19.5 " E. Wind sock is located on the north side of helipad. The surface of the helipad is made up of RCC.

Helicopter in its final rest position was facing westerly direction tilted to its left at the edge of the helipad. The skid of the helicopter was found separated and lying about 20 feet away from the main structure. Main rotor blades both found broken by more than half of its length but still attached with rotor hub. However main rotor blades debris were found strewn over and outside the helipad. The tail rotor blades (2) were broken at the tip but still attached with the tail rotor control shaft. ELT was found activated and same was switched off.

The above evidence indicates that the helicopter was under power conditions when impacted with the ground first with the skids and then the main rotor strikes with the helipad concrete cemented surface. More so the wreckage was found at one location indicating that there was no in-flight separation of the helicopter.

Immediately after the accident Cyclic, collective controls and tail rotor pedal controls found moving freely however the cyclic control response found till swash plate. Left rudder pedal/right rudder pedal forward response was not proper up to tail rotor blade location due to post accident damage (tail boom collapse). Later on straightening of tail boom both the rudder pedal movement was found satisfactory. Total 250 lbs of fuel was observed on the fuel gauge after the accident. Engine oil level observed near the oil filler port.

As per the statement of marshaller on duty when the helicopter was in between the edge and H marking of helipad, it stopped coming forward and there was slight movement of tail portion towards left and right. When the helicopter was about 30-40 feet above ground level it took one complete turn from right side. More so a Doctor on duty with ambulance has also stated that when the helicopter was coming near helipad the tail started moving very fast sideways and with in fraction of second it had hit the ground and fell to its left side. Incharge security who was also at the accident site has mentioned that when helicopter came for landing at about 20 feet height it

started wobbling and a second later it came down and crashed on its left side.

1.13 Medical and pathological information :

Total there were five persons on board the helicopter at the time of accident. Out of five persons, four persons received injuries and taken to Appolo BGS Hospital, Mysore. Out of four, two persons received serious injury who were occupying LH seats in the helicopter and 2 received minor injury as the helicopter in the final position toppled to the left.

1.14 Fire:

There was no fire in the accident at any stage.

1.15 Survival aspects:

At the helipad 3 portable fire extinguishers, a fire tender and an ambulance with doctor were positioned prior to arrival of helicopter. As the injury occurred to 4 persons they were taken to Appolo hospital for medical treatment. All the occupants were taken out from the Right door of the helicopter. Accident was survivable as the loss of tail rotor control experienced by pilot at only about 10 feet over the helipad. Pilot action of immediate lowering of collective lever down had saved the situation.

1.16 Tests and research:

Fuel, oil and Hydraulic samples drawn from the helicopter after the accident were tested in DGCA R & D Lab and the sample passed in the specification tests.

1.17. Organization and Management Information:

Organization i.e. M/S Deccan Aviation Limited, Bangalore was issued Non Schedule Operator permit (NSOP) on 12.9.1997 and VT-DAK was the first helicopter endorsed on it. NSOP was last validated till 11.9.2008. The helicopter was registered in Normal Passenger category and in year 2005 it was also endorsed for aerial work also in the NSOP permit. The company has various types of helicopter in their fleet and total aircraft are 13, which includes 3 fixed wing airplanes also. These all aircraft are being operated and maintained by the operator itself.

During investigation following observations were made;

1. Airframe hours as laid down in airframe log book and aircraft flight/tech log are not matching.
2. Training records of crew not maintained.
3. Cruise performance parameters in Tech log are not being recorded number of times by the flight crew.
4. Passenger manifest is not signed by the Pilot in Command in the instant case.
5. Load and trim sheet was not carried on board the flight.
6. The insurance certificate on board the helicopter had expired for VT-DAK at the time of accident.
7. The Engg.Deptt is not reflecting stores items used on the helicopter in the aircraft documents.

1.18 Additional information :

Loss of tail rotor effectiveness (LTE) :

As per the FAA LTE has been identified as a contributory factor in several helicopter accidents involving loss of control. The phenomena of LTE is described below:

Loss of tail rotor effectiveness (LTE) is a critical low speed aerodynamic flight characteristic which can result in an uncommented rapid yaw rate which does not subside of its own and, if not corrected, can result in the loss of aircraft control. LTE is not related to a maintenance malfunction and may occur in varying degrees in all single main rotor helicopters at airspeeds less than 30 kts. LTE is not necessarily the result of a control margin deficiency. Flight operations at low altitude and low airspeed in which the pilot is distracted from the dynamic conditions affecting control of the helicopter are particularly susceptible to this phenomena.

In case of American helicopters main rotor turning anticlockwise (view from top). The torque produced by main rotor causes the fuselage to rotate in opposite direction (Nose right). The anti-torque is produced by the tail rotor. So in case of tail rotor system failure the helicopter will tend to yaw to right. Tail rotor thrust is the result of the application of anti-torque pedal by the pilot. If the tail rotor generates more thrust then required to counter the main rotor torque then helicopter will yaw or turn to the left. If less tail rotor

thrust is generated then helicopter will yaw to right. By varying the thrust generated by tail rotor the pilot controls the heading when hovering.

In no wind condition, for a given main rotor torque setting, there is an exact amount of tail rotor thrust required to prevent the helicopter from yawing either left or right. This is known as tail rotor trim thrust. In order to maintain a constant heading while hovering, the pilot should maintain tail rotor thrust equal to trim thrust.

The environment in which helicopters fly, however is not controlled. Helicopters are subjected to constantly changing wind direction and velocity. The required tail rotor thrust in actual flight is modified by the effects of the wind. If an uncommanded right yaw occurs in flight, it may be because the wind reduced the tail rotor effective thrust. The wind can also add to the anti-torque system thrust. In this case, the helicopter will react with uncommanded left yaw. The wind can and will cause anti-torque system thrust variations to occur. Certain relative wind directions are more likely to cause tail rotor thrust variations than others. These relative wind directions or regions form an LTE conducive environment.

Any maneuver which requires the pilot to operate in a high power, low airspeed environment with a left cross wind or tail wind creates an environment where unanticipated right yaw may occur.

There is greater susceptibility for LTE in right turns. This is especially true during flight at low airspeed, since the pilot may not be able to stop rotation. The helicopter will attempt to yaw to right. Correct and timely pilot response to an uncommanded right yaw is critical. The yaw is usually correctable if additional left pedal is applied immediately. If the response is incorrect or slow, the yaw rate may rapidly increase to a point where recovery is not possible. Caution should be exercised when executing right turns under conditions conducive to LTE.

Training of pilots on LTE:

On being queried with the pilot whether any simulator training was imparted for tail rotor failure during induction he has mentioned that no training on simulator was provided.

Helicopter pilots should be aware of LTE and should avoid entering into the flight phases where LTE could occur. The specific wind directions and

speeds may vary with helicopter types and in some cases the danger arcs indeed overlap so detection may not be easy. As on date there is no training provided to the helicopter pilots about the phenomena of LTE affecting all single engine helicopters using conventional tail rotor. It is advised that helicopter operators should consider imparting training to the pilots and it should be a regular feature by including it in the recurrent training where critical emergencies are supposed to be revised on simulators.

1.17 **Useful or effective investigation techniques:** Nil

2. ANALYSIS

The circumstances that could have led the Pilot after experiencing the controllable yaw to the right are discussed below.

2.1 Malfunctioning of the helicopter and/or its engine.

Prior to the flight the helicopter had undergone Daily inspection by the AME and fuel available for the flight was 400 lbs. The duplicate controls on co-pilot side i.e. on LH side were found removed for which there was no log entry made by the attending AME. Helicopter was made available for flying at 0700 hrs. Pilot later accepted the helicopter at 0800 hrs.

There was no snag reported/recorded before the accident on the said helicopter. After the accident, pilot reported that when helicopter came to hover at about 10 feet high over the helipad helicopter uncontrollably yawed to the right, which could not be arrested by applying the left rudder pedal in the cockpit.

Helicopter had also undergone 300 hrs schedule inspection on 4.1.2008 and had flown only 14 hrs since then and Certificate of release to service was issued. During 300 hrs inspection tail rotor drive shaft hangar bearings (Qty-7) were lubricated with grease and also tail rotor drive shaft sliding adapter splines (Qty-4) were lubricated. Tail gearbox oil was also changed during that 300 hrs inspection.

Further more on 3.11.2007 Tail gear box S/no. 2767 was removed from the helicopter to service another helicopter VT-DAL and TGB S/No. 3338 after overhaul was fitted on VT-DAK on 7.11.2007. Overhaul of the TGB was done at the operator's facility. The said gearbox was installed at 5590 hrs since new and was of year 1992 make. The said gearbox in its life had

undergone 2 times overhaul and one time duplex bearing change. Tail gear box had done 79 hours on the said helicopter till the time of accident.

Records of the helicopter reveals that the said Helicopter was on ground from 9.1.2008 till 17.1.2008 for 9 days and was inside the Deccan aviation hangar at Jakkur Aerodrome. The last component change on the helicopter before the accident was carried out on 4.1.2008 of starter generator S/no. 5892 which was due for overhaul and was replaced with S/no. 3619.

Immediately after the accident Cyclic, collective controls and tail rotor pedal controls were checked and found moving freely however the cyclic control response found till swash plate. Left rudder pedal/right rudder pedal forward response was not proper up to tail rotor blade location due to post accident damage (tail boom collapse). Later on straightening of tail boom both the rudder pedal movement was found satisfactory.

Subsequent to the accident tail rotor hub assembly along with blades and Tail gear box were sent to M/S Bell helicopters, USA for laboratory examination. As per the Lab report tail rotor blades were fractured and had overload features on the fracture surfaces from impact with the ground. A tail rotor blade feathering bearing roll staking lip fractured in overload and contact damage on the opposite blade surface were both from impact. More so no visual discrepancies found in TGB and hub assemblies.

2.2 Pilot factor conducting the flight.

Pilot was detailed on 17.1.2008 to undertake flight on 18.1.2008 for sector Jakkur-Mysore Infosys helipad-Bangalore-Jakkur on VT-DAK with 3 passengers. He prepared for the flight by obtaining coordinates of Helipad and flight plan was faxed to Chennai ATC and Bangalore on 17.1.2008 at 1415 hrs. He also briefed technician to have fuel 400 lbs on gauge. On 18.1.2008 he obtained ADC and FIC numbers for all the three legs and obtained weather from party at helipad. The weather reported was 6-8 Kms visibility with blue skies and winds 2-3 kts. Departure from Jakkur was delayed due fog at Jakkur and Bangalore. AME handed over the helicopter to pilot at around 0700 hrs after completion of Daily inspection. Subsequently Pilot carried out external and internal checks, which was reported satisfactory. All the three passengers arrived at 0800 hrs. At 0900 hrs clearance from Bangalore ATC was obtained and was told to proceed via Maghadi Hill.

Helicopter start up and take-off was normal at 0915 hrs. One passenger was seated on the left seat in the cockpit. In flight all the operations were normal. Pilot reported Magadhi hill to Bangalore ATC and was told to maintain listening watch & maintain 4000 feet on QNH 1018. At 0955 hrs he came over the helipad and did an aerial recce. Helicopter bearing at this time was 232 degrees and helipad was found activated with safety services i.e. fire extinguishers and ambulance, wind sock in place. Pilot made visual contact with marshaller on ground. At this time helicopter was in tail winds. He crossed over the helipad and afterwards initiated right turn to roll out for final approach on the helipad. On final approach the bearing of the helicopter was 050 degrees and winds were 230/2-3 Kts. Pilot initiated approach with rate of descend of about 400-500 feet /Minute and all the operations were reported normal and speed was about 60 kts. On short finals the rate of descend was about 200-300 feet /Minute. On entering the helipad at about 5-10 feet, helicopter yawed uncontrollably to right. He immediately lowered the collective and applied left rudder but helicopter continued turning right and contacted ground at the time of closing of engine throttle. Helicopter toppled to left and pilot switched off the helicopter. He supervised the passengers exit from helicopter. One of the passenger had bruises on his left cheek and all passengers were taken to Appolo hospital for medical examination.

During initial investigation pilot stated that on final helicopter bearing was 050 degrees with winds as mentioned 230/2-3 Kts. With this condition it will become tail winds for landing direction. Later on he replied that the winds were 050 degrees/2-3 kts and not 230/2-3 kts and it was erroneously mentioned in his earlier statement.

He has stated that prior to entry into helipad there was no abnormal noise from engine and no vibrations felt from helicopter. The helicopter took one complete turn to right(360 degrees) in air followed by about half turn (180 degrees) after hitting the ground. He has last flown on this helicopter on 8.1.2008 from Vishakapatnam and subsequent flight was the accident sortie of day 18.1.2008.

As per the statement of marshaller on duty when the helicopter was in between the edge and H marking of helipad, it stopped coming forward and there was slight movement of tail portion towards left and right. When the helicopter was about 30-40 feet above ground level it took one complete turn from right side. More so a Doctor on duty with ambulance has also stated that when the helicopter was coming near helipad the tail started moving

very fast sideways and with in fraction of second it had hit the ground and fell to its left side. Incharge security who was also at the accident site has mentioned that when helicopter came for landing at about 20 feet height it started wobbling and a second later it came down and crashed on its left side.

Pilot records reveals that Bell-206 L3 was endorsed on his license on 2.8.2007 and started flying as copilot from 5.8.2007 at Katra. He started flying in Southern region with other pilot from November 2007 and was flying independently from 1.12.2007. He was also familiar with the place of landing during his conversion dual flying and more so flew past few times over the helipad later on. However he was making landing on the helipad first time. On being asked about the tail rotor failure training he has replied that the emergencies of tail rotor have been revised regularly during the classroom discussions.

On being queried about use of left rudder in flight on the day of accident, pilot replied that the response of left rudder pedal was reported normal during take-off. Pilot did not inform Bangalore ATC about the accident but ATC was informed by the operator. The helicopter took complete one turn (Right) in air and 180 degrees on ground after hitting the rotor blades. He has also stated that initial 10-30 degrees yaw was gradual and after 30 degrees the yaw was rapid. Weight of the helicopter at the time of landing was 1643 kgs. Pilot has not undergone any training about the phenomena of loss of tail rotor effectiveness on helicopters. More so no training is provided to helicopter pilots about the loss of tail rotor effectiveness.

2.3 Position of Wind sock:

At the infosys helipad which is a private helipad, windsock of white with orange stripes of standard configuration was installed in the North side of helipad close to the boundary wall of infosys campus. Just outside the boundary wall there are 2 trees which forms obstruction to the wind sock for free flow of air and thus the windsock was under the shadow region, which will not give the proper wind speed/direction. Hence the winds speed/direction expected by pilot was different than the actual wind conditions.

Operator has not made any survey of the helipad before accident about proper facility at the helipad e.g. markings, location of windsock etc.

2.4 Circumstances lead to the accident:

From the analysis it is clear that there was no problem existing on the tail rotor control system before the accident as the tail rotor hub assembly along with blades and Tail gear box were sent to M/S Bell helicopters, USA for laboratory examination. As per the Lab report tail rotor blades were fractured and had overload features on the fracture surfaces from impact with the ground. A tail rotor blade feathering bearing roll staking lip fractured in overload and contact damage on the opposite blade surface were both from impact. More so no visual discrepancies found in TGB and hub assemblies. Also there was no snag recorded in the helicopter flight report prior to accident sortie.

When the helicopter came near to ground in hover was in hover IGE conditions i.e. 10 feet above ground. Pilot experienced loss of tail rotor effectiveness with a yaw to right and on application of left rudder no effect was felt by the crew and helicopter continued turning to right. The winds at the helipad might not be 050/2-3 kts as mentioned by pilot due wrong indication of the wind speed/direction by the incorrectly installed wind sock. As per the eye witness on the ground there was abnormal movement of tail boom in air before landing on helipad which might be due to change in wind direction/speed. The helicopter thus made approach from 050 degrees thereby making landing in changing wind conditions on the helipad and causing loss of control of helicopter with consequential substantial damage.

3. CONCLUSION

3.1 Findings :

1. The helicopter had a valid Certificate of Airworthiness and Certificate of release to service on the day of accident.
2. Pilot had appropriate license and qualified to undertake the flight.
3. There was no snag reported/recorded in the aircraft records prior to the date of accident.
4. Pilot was making first time landing on the helipad on which the accident occurred though he was familiar with the helipad prior to accident.
5. Dual controls on the left seat in the cockpit was though removed but no entries in the helicopter airframe log book made by the attending AME.

6. The infosys helipad is a private helipad and markings on the helipad were not proper.
7. Operator has not made any survey of the helipad before operations about facilities existing at the helipad.
8. No briefing/documentation was provided to VT-DAK 18.1.2008 by the Met officer Bangalore.
9. Take off and enroute flight was normal and no snag was reported by the pilot on the helicopter.
10. During final approach the bearing of the helicopter was 050 degrees and winds reported by pilot were 050/2-3 Kts.
11. Wind sock was not properly positioned on the helipad due obstructions near it.
12. Winds indicated by the wind sock were not correct as observed by the pilot.
13. On entering the helipad at about 5-10 feet, helicopter yawed uncontrollably to right. Pilot immediately lowered the collective and applied left rudder but helicopter continued turning right and contacted ground by the time of closing of engine throttle.
14. Helicopter entered into loss of tail rotor effectiveness phenomenon at about 10 feet above ground.
15. The helicopter took complete one turn (Right) in air and 180 degrees on ground after hitting the rotor blades.
16. No defect was found on the tail rotor control system after the accident and damage to the system was attributed due to post impact.
17. Pilot self did not inform to ATC Bangalore about the accident but information to ATC was informed by company.
18. Two persons received serious injuries that were occupying LH seats in the helicopter as the helicopter toppled to its left side.
19. Pilot made landing in changing wind conditions on the helipad thereby inducing phenomenon of loss of tail rotor effectiveness and loss of control.
20. There is no training provided to the helicopter pilots about the phenomena of LTE.
21. As per the eye witness on the ground there was abnormal movement of tail boom in air before landing on helipad.

3.2 Probable Cause of the accident:

During landing pilot experienced loss of tail rotor effectiveness at hover and entered in to right yaw due changing wind conditions which resulted in loss of control and crash landing of helicopter.

Wrong location of the windsock at the helipad was the contributory factor to the accident.

4. RECOMMENDATION

1) Action as deemed appropriate be taken against pilot for the lapses indicated in the findings.

2) All helicopter operators should include the topic of loss of tail rotor effectiveness during recurrent ground training of their flight crew.

3) Operators to survey the helipad before operations for the existence of proper facilities like markings, wind sock etc.

(M.J. Singh)
Inspector of Accidents
VT-DAK

New Delhi
28.11.2008

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