REPORT ON
ACCIDENT TO HAL ROTARY WING ACADEMY CHETAK HELICOPTER VT-EIV AT HAL AIRPORT, BANGALORE ON 27TH AUGUST, 2010

GOVERNMENT OF INDIA
CIVIL AVIATION DEPARTMENT
O/o REGIONAL CONTEROLLER OF AIR SAFETY
SOUTHERN REGION, HYDERABAD AIRPORT
HYDERABAD-16

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General Information:

a. Helicopter	:	Type Chetak Helicopter Nationality Indian Registration VT-EIV Engine Type Artouste III B
b. Owner	:	HAL Rotary Wing Academy, Bangalore
c. Operator or Hirer	:	-do-
d. Pilot in Command	:	Flying Instructor
Extent of Injuries	:	Serious
e. Trainee Pilot	:	Student Pilot license
Extent of Injuries	:	Serious
f. No. of Passengers		Nil
Extent of Injuries	:	N/A
g. Date & Time of Accident	:	27th August, 2010. 0323 UTC Appx.
h. Last point of departure	:	HAL Airport, Bangalore
i. Point of intended landing	:	-do-
j. Geographical Location of Accident	:	Lat. 125707.8N Long.0773952.5E
k. Type of Operation	:	Training
l. Phase of Operation	:	Hover

(All timings in the report are in UTC)

SYNOPSIS:

HAL Rotary Wing Academy Chetak Helicopter SA 316B VT-EIV was engaged in local flying training at HAL Bangalore Airport on 27/08/2010. The trainee has obtained the weather report of 0300 UTC with visibility of 8 kilometers and the wind was 250/10 knots. The helicopter controls were with the Trainee Pilot and the Flying Instructor was following him on the controls. At 0314 UTC the trainee pilot requested ATC for taxi clearance and ATC gave the permission for taxi and lineup on main taxiway for runway 27 which was acknowledged by the trainee. The trainee pilot carried out the required checks, taxied on to the

main taxi way for runway 27. After carrying out required checks he carried out pick up and after hovering steadily for about 30 seconds helicopter became unsteady with pronounced left lateral cyclic movements. While the instructor started following on the cyclic then the helicopter suddenly pitched up. Due to pitch up and impact, tail rotor damaged and helicopter started rotating in anticlockwise direction. Finally, the helicopter collapsed on main taxiway opposite Runway 27 at 0323 UTC and got substantially damaged. Both the crew were immediately rushed to the HAL hospital as they received serious injuries. There was no fire.

The accident was immediately notified to the regulatory authority by HAL Rotary Wing Academy and same was investigated by Inspector of Accident under Rule 71 of Aircraft Rules, 1937.

The accident occurred due to sudden pitch up during hover, due to not proper handling of controls by the instructor which resulted in tail rotor hitting the ground and damage to the helicopter.

1. FACTUAL INFORMATION:

1.1 History of the Flight:

On 27.8.2010 Chetak Helicopter VT-EIV of HAL Rotary Wing Academy, Bangalore was engaged in local flying training at HAL Airport, Bangalore. The post flight and preflight inspection schedules were carried out by the AME and no abnormality/snag was observed by him. The Helicopter up lifted 30 liters of fuel in addition to 545 liters fuel which was already there in the tank and total fuel available at the time of first sortie of the day was 575 liters. The helicopter had operated the first sortie for 45 minutes duration with a different flying instructor and another trainee pilot. No abnormalities were noticed by the crew during the pre-flight checks and during the said sortie and all the parameters were within normal limits. On completion of the first sortie, the helicopter was

taken over by different Flying Instructor and another trainee pilot at the HAL RWA dispersal area.

The helicopter controls were with the Trainee Pilot and the Flying Instructor was following him on the controls. The trainee has obtained the weather report of 0300 UTC with visibility of 8 kilometers and the wind was 250/10 knots. At 0314 UTC the helicopter requested ATC for taxi clearance and ATC gave the permission for taxi and line up on main taxiway for runway 27 and the same was acknowledged by the trainee. Thereafter there was no response from the trainee to the ATC calls. The trainee pilot carried out the required checks, taxied on to the main taxi way for runway 27. After carrying out required checks he carried out pick up. As per instructor, the pickup was executed fairly steadily by the trainee pilot and the instructor followed him on the controls. They established a hover height of about 8 to 10 feet above the ground as this is a normal practice as per the instructor during training flights for trainee pilots in order to provide an element of safety. After hovering steadily for about 30 seconds the helicopter became unsteady with pronounced left lateral cyclic movements. The instructor was initially following the trainee pilot on the collective and prompting him to settle down. When the helicopter started more unsteady the instructor followed the trainee on cyclic during which the helicopter suddenly pitched up. The instructor immediately pushed the cyclic forward but the nose did not come down and the helicopter started yawing to the left. Full right rudder had no effect and the cyclic appeared ineffective in keeping the helicopter level. Since the helicopter was suddenly pitched up and instructor instinctively delayed lowering the collective until the helicopter nose came down and spinning, before impacting the ground in a slightly nose down attitude.

After impact of the helicopter with the ground, the engine was still running. The Flying Instructor switched off the engine with the fuel shut off cock and put off the battery and electrical switches. The trainee had come out of his own and the instructor was assisted out of the helicopter by other trainees and staff of RWA. Ambulance and Crash Fire Tender reached the accident site within 2 to

3 minutes. Both of them were rushed to HAL hospital as they had received serious injuries. The helicopter got substantially damaged with the main impact on the right side below the nose and right front bottom structure

1.2 Injuries to Persons:

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	2	-	-
Minor	-	-	-
None	-	-	-

1.3 Damage to Helicopter:

The helicopter substantially damaged.

1.4 Other Damage:

Nil

1.5 Personnel Information:

1.5.1. Flying Instructor

After serving in the IAF for 34 years the Flying instructor has joined the HAL Rotary Wing Academy in September 2008. He has a total of more than 8000 hours of flying experience. He was a qualified flying instructor certified by the IAF authorities.

The Ministry of Civil Aviation vide order no. AV.1103/01/2008-A dated 4th August 2008 had granted him exemption under rule 160 of Aircraft Rules 1937 from application of provisions of rule 6 read with rule 38(A) 2 and 6 in respect of operation of HAL Helicopter including Radio Telephony apparatus fitted there upon and to carryout instructional training with HAL RWA only subject to the below conditions that,

1. He will undergo training, to be approved by DGCA, for recency of flying experience, training checks for type rating on schweizer helicopter.
2. He shall pass DGCA examination and skill test on type of helicopter to be operated by him for imparting flying training.

Regarding the above conditions, the organization has informed that the instructor had passed the DGCA examination on Schweizer helicopter and had undergone training and checks. The organization has also informed that the instructor was granted clearance for imparting flying training on chetak helicopter under Rule 160 based on his experience and currency on type while he was a defence pilot with Indian Air Force. A skill test on Chetak was carried out on 24th September 2008 by a DGCA approved examiner and the performance of the pilot was found satisfactory. He had undergone his flying instructor's refresher course on 11th January 2010.

Pilot information		
Date of Birth	:	09th September, 1953
Age	:	57 years 7 months
Details of license (Helicopter)	:	Grant of exemption under rule 160
Issued on	:	04th August, 2008
Last Med. Exam.	:	31st March, 2010
Total Flying experience	:	8199:50 hrs.
Total flying experience as PIC	:	7020:35 hrs.
Total flying experience on Schweizer helicopter	:	324:15 hrs.
Total flying experience on Chetak helicopter	:	4206:20 hrs.
During last 90 days	:	204:20 hrs.
During last 30 days	:	49:45 hrs.
During last 7 days	:	14:00 hrs.
During last 24 hours	:	01:00 hrs.

1.5.2 Trainee Pilot:

The trainee pilot has 14:30 hours of dual flying experience on chetak helicopter.

Type of license	:	Student Pilot License
Date of Birth	:	20th April, 1983
Age	:	27 years 4 months

Details of license	:	SPL NO: RWA/205/2010
Issued on	:	02nd August, 2010
Last Med. Exam.	:	26th June, 2010

On 26.08.2010, i.e. the previous day of the accident, CFI had done progress check of the trainee pilot and warned him for slow progress in flying. The CFI mentioned that the trainee was very confident but did not know his checks before take off. Taxi was satisfactory but at times unnecessary application of parking brakes. The pickup was unsteady as not anticipating rudder requirement for raising of collective. The sortie conducted on 25.08.2010 with the involved instructor, the instructor comments of very large cyclic movements and some of the previous reports also states regarding unsteadiness in pickup. The trainee has been repeating these mistakes for the last few sorties and all the above comments have been duly reflected in his sortie reports.

1.6 Helicopter Information:

Chetak SA 316 B helicopter bearing Sl. No. AH-280 has a three–bladed Main rotor and an anti-torque tail rotor. It is powered by a Turbomeca “Artouste III B” turbine engine and is capable of carrying six passengers plus one pilot. It was manufactured by Hindustan Aeronautics Ltd., Helicopter Division, Bangalore in the year 1984. The helicopter was fitted with a tricycle landing gear consisting of a main gear unit and a nose gear unit provided with a centering cam, which acts for angles up to ± 45º relative to the centre line of the helicopter.

The helicopter is registered in India and was issued with Certificate of Registration No. 2252/3 in Cat. – 'A' on 03.01.2006 with owner and operator as HAL Rotary Wing Academy, Bangalore Certificate of Airworthiness No. 1777 was issued in NORMAL Category having subdivision 'PASSENGER'. The last revalidation of C of A was done on 28.08.2009 and the certificate was valid till the day of the accident. The helicopter had an Aero-mobile license no. A-75/44 which was valid till 31.12.2010. As per approved Weight Schedule, Empty Weight of the helicopter is 1251.5 Kgs. and its authorized Max. All Up Weight is 2200 Kgs.

The helicopter was maintained by Helicopter division of HAL, Bangalore who is also the manufacturer of the same helicopter. After carrying out Post flight and pre-flight inspections, the Certificate of Release to Service in respect of the helicopter and engine was issued on 27.08.2010. Last 100 hours inspection was carried out at 4440:55 airframe hours and helicopter had flown 4534:55 airframe hrs before the accident flight. The 800 hrs inspection was due at 4542:15 airframe hrs.

Before releasing the helicopter for the first sortie on 27th August 2010, the AME had carried out post flight as well as preflight inspection and did not observe any abnormalities. During post flight inspection as per approved maintenance schedule, the AME had checked tail boom and fairings, tail rotor gear box, tail rotor drive shaft and tail rotor guard and their conditions were satisfactory.

Prior to the accident flight, the helicopter flew one sortie for 45 minutes on circuits and landings at the HAL airport and the crew reported that all parameters were within operating limits and no abnormalities were observed during pre-flight checks and the sortie.

Flying details of the helicopter and its engine are documented in different log books and the brief is as follows:

Airframe Hours:

I	Total Hours since new	4534:55 hrs.
II	Hours since last C of A renewal	785:55 hrs.
III	Hours since last100hrs/180 days Inspection.	94:00 hrs.
IV	Hours since last 25 hrs/15 days)	19:00 hrs.

Engine Hours:

I	Engine type	ARTOUSTE IIIB
II	Engine Serial No.	H55457
III	Hours since new	4601:55 hrs.
IV	Hours since last Complete overhaul	1481:50 hrs.

No snags were reported by the AME after the last 100 hrs inspection performed on the helicopter.

The helicopter was refueled with 30 liters of Jet A-1/Aviation Turbine fuel and total fuel available at the time of first sortie of the day was 575 liters at 0220 UTC.

As per Weight Schedule, the Authorized Maximum Takeoff Weight is 2200 Kgs and at the time of taxi from the HAL RWA dispersal the helicopter had an All Up Weight of 1820.94 kgs which was within the limits.

1.6.1 Tail Rotor

Tail rotor system for Chetak SA 316 B helicopter consists of tail rotor drive, tail gear box and tail rotor blades. The tail rotor drive system consists of the inclined drive shaft, the coupling shaft and the tail drive shaft, the latter being connected to the tail gearbox. The tail rotor gearbox changes the angle of drive by 95 degrees towards the tail rotor. The 1.912 m (6 feet 3.28 inch) diameter variable pitch tail rotor comprises three metal blades individually hinged in the flapping plane only.

1.6.2 Emergency Procedures – Tail Rotor Failure

Tail rotor failure is indicated by a sudden and uncontrollable turn towards the left. The rate of turn will be dependent on the amount of power that was applied and the weight of the helicopter at the time of the failure.

If tail rotor failure occurs close to the ground (e.g. blades damaged by hitting an obstacle) full low collective pitch must be applied, even if this is to cause a very hard landing, and the engine shut down by closing the fuel shut off cock, if possible before touching the ground.

1.6.3 Standard Take Off Procedure

1. Release the wheel brakes by turning the handles 90 degrees clockwise. Immediately close the handle to its initial position (parallel to aircraft center line). If necessary, roll forward about 1 meter (3 feet) (pitch 0.1 – 0.3) to center the front wheel.

2. Take off without hesitation and maintain hovering flight at 1 m (3 feet) above the ground. Check collective pitch and tail pipe temperature which should remain below 550 degree Celsius and be in accordance with the chart at the top of the instrument panel. Collective pitch should not exceed the graduation corresponding to local altitude.

3. Slowly establish forward flight by increasing collective pitch by 0.05 then apply the collective pitch value specified for climb. As soon as the transition speed (35 km/hr or 20 kt) has been exceeded, it is recommended to gain altitude progressively so that a power-off landing, if required can be accomplished in the best possible conditions. Make sure that the tail pipe temperature does not exceed 500 degree Celsius.

1.7 Meteorological Information*:*

The weather was good with 8 Km visibility and scattered clouds. Winds were westerly, wind speed 10 knots.

1.8 Aids to Navigation*:*

The flight was conducted under VFR rules. The accident occurred during hover and aids to navigation are not applicable.

1.9 Communications:

The helicopter was fitted with VHF COMM Transceiver equipments for two-way RT communication. The helicopter call sign RW 03 came into contact with the ATC at 0232 UTC for its first sortie. At 0310 UTC the helicopter completed the first sortie and returned back and changed over the call sign to RW 04. At 0314 UTC RW04 requested taxi clearance and ATC permitted the same & asked them to line up on main taxiway for runway 27. At 0315 UTC RW04 acknowledged the taxi clearance. At 0323 UTC ATC asked RW04 “confirm operations normal”. Thereafter there was no response from RW04.

1.10 Airport Information:

HAL Airport is the airport of Hindustan Aeronautics Limited (HAL) Bangalore, Karnataka. The Elevation of the airport above mean sea level is 2912 feet, Co-ordinates are Latitude 12º 57’ 0” N, Longitude 77º 40’ 06” E. The Airport has one runway 09/27 with runway length of 10,850 feet. There are 4 entry/exit taxiways, 2 on the east side called E2, E1 and 2 taxiways to the west side called W2, W1. The airport is equipped with VOR-DME and ILS navigation.

1.11 Flight Recorders:

Helicopter was neither required nor fitted with any of the recorders.

1.12 Wreckage and Impact Information:

The accident occurred over the main taxiway opposite to runway 27. The right side nose end bottom structure was damaged extensively. 3 plexi glass at the cabin bottom was found damaged. The left side bottom structure and canted bulkhead bottom side were also damaged. All the three main rotor blade tips

were found bent upward and damaged. The RH side shock strut was found broken from the top eye side. The fuel tank cable was found distorted and the fuel tank filler neck was found detached. The blade spacing cables attachments Y to R, Y to B were found separated. Nose landing gear was found broken and lying on the right side of the wreckage. The pilot entry door was found damaged and lying on the ground on the right side.

The tail rotor blades were found broken and lying on the right side. The tail rotor cable was found cut. The control pedestal was found damaged at the RH side bottom.TGB (tail rotor gear box) forward attachment was found sheared and rear attachment strut of TGB was found bent and cracked. Tail rotor guard was found extensively damaged and cut into pieces. The RH side stabilizer and fin was found damaged and the LH side stabilizer was found buckled. Tail boom was damaged extensively. The LH side cowling fairing was also found damaged.

Detailed Inspection of Tail Boom

The Tail rotor blades (TRB) were found broken into pieces and lying at various locations

a) Red blade-broken at a distance of 6.25” from leading edge root end.
b) Yellow blade-broken at a distance of 7.5” from leading edge root end.
c) Blue blade-broken at a distance of 7.25” from leading edge root end.

The TRB Yellow blade cuff was found bent. The TRH (Tail Rotor Head) spider leg (Yellow blade) was found broken. The Pitch change links (Qty 3) were found bent. The TGB shaft was found bent. The TGB attachment bolts LH/RH at Tail boom frame 8 was found sheared. The TGB strut at frame 8 was found bent at top. The Tail rotor Guard attachment at tail boom top was found sheared and shifted inward 3.6”. The Attachment bolts were bent at centre.
The Tail rotor guard was found laminated with plastic tape and found broken into pieces.

1) Broken piece measures 38”
2) Broken piece measures 55”

3) Broken piece measures 5.5”

The tail rotor guard attachment clamp at rear end was found broken. The Tail rotor shaft was found broken at the Tail rotor guard/Tail boom attachment location, the broken end measured 34” from TGB coupling. The Tail rotor cable and Tail Light cable was found cut. The Tail boom top/bottom skin was found buckled. The LH stabilizer attachment was found damaged. The Spar tube was found shifted to LH side.

Wreckage distribution chart and photographs are given at appendix I & II respectively.

1.13 Medical and Pathological Information*:*

Due to impact of the helicopter with the ground both the crew received serious injuries and were rushed to HAL hospital.

The Flying instructor was bleeding from right eye and had a minimal superficial abrasion on right ala of nose and swelling in his right eye and face. There was a pain in the right knee. X-ray of right leg showed undisplaced fracture of lateral condyle of right TIBIA.

The trainee pilot was having pain in the lower back region and mild compression fracture of T12, L1, L2 and L3 Vertebral bodies was seen.

The breath alcohol analysis was negative for both Flying instructor and trainee pilot.

1.14 Fire:

There was no fire at any stage of the accident.

1.15 Survival Aspects:

The accident was survivable. After impact of the helicopter with the ground, the Flying Instructor switched off the engine with the fuel shut off cock and put

off the battery and electrical switches. The trainee had come out of the right side of the helicopter on his own and the instructor was assisted out of the helicopter by other trainees and staff of RWA. Ambulance and Crash Fire Tender reached the accident site within 2 to 3 minutes. Both of them were rushed to HAL hospital.

1.16 Tests & Research:

The samples of fuel & oil was drawn from the helicopter and sent to R&D Lab of DGCA and the samples were meeting the requirements.

The following failed parts were sent to R&D Lab of DGCA for investigation. These parts were examined in laboratory visually, macro examination and under scanning electron microscope (SEM).

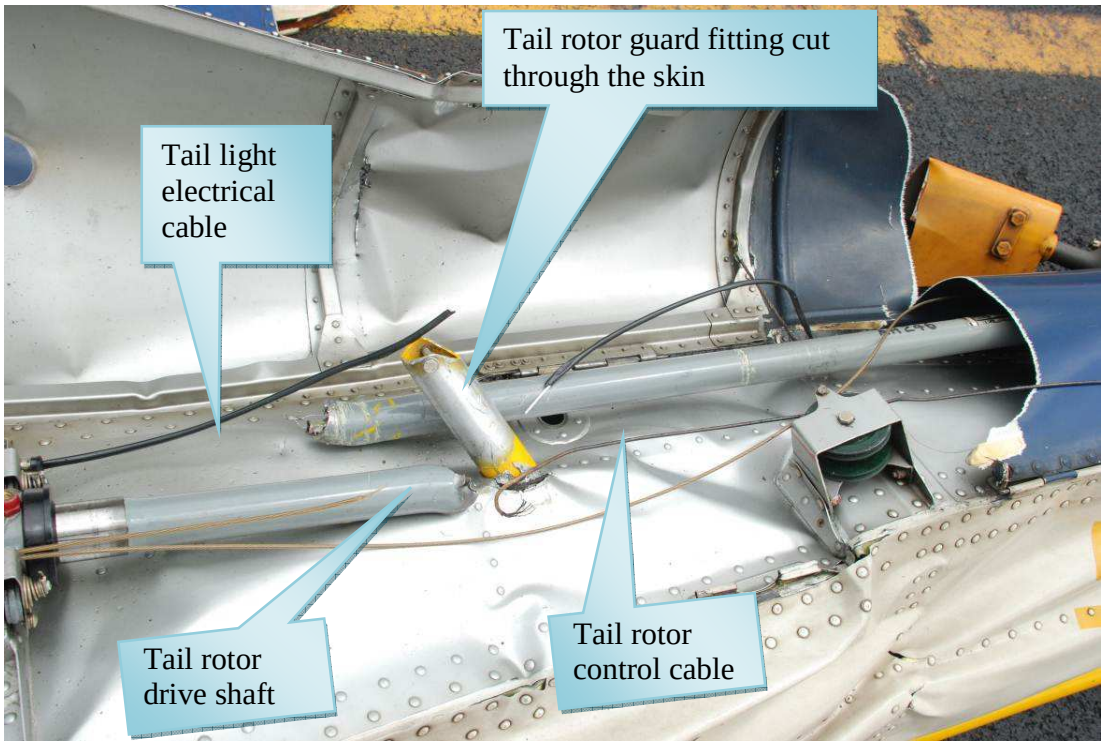
a. Tail rotor guard upper fitting on tail boom top skin.
b. Tail rotor drive shaft (TGB side).
c. Tail rotor drive shaft (MGB side).
d. Tail rotor control cable.
e. Tail light electrical cable.
f. TGB mounting bolts.

a. Tail rotor guard upper fitting on tail boom top skin:

The failed part was examined under the stereo microscope upto a magnification of 50x. the failed tail rotor guard upper fitting on the tail boom top skin is just below the tail drive transmission shaft and welded to the body of the helicopter with aluminum alloy fitting have two holes for fitment of steel bolt. The steel bolt was also found slightly bent having smooth marks. The upper fitting also shows some metal flow on its top circumference and crack. This fitting is a double walled tube. The failed sample was prepared for SEM (scanning electron microscope) examination after washing with acetone. The SEM factographs shows shear dimples which indicate shear overload fracture.

b. Tail rotor drive shaft (TGB side and MGB side):

The fracture of both the ends suggests that torsional fracture having slant fracture and marks of gauging (peeling) of protective coating of the shaft. These marks are in the folds of torsional fracture. This suggests that these marks were there on circumference of shaft before torsion occurred. The SEM factographs having shear dimples on fracture surface of tail drive shaft mating end (MGB side) indicates shear overload.



c. Tail rotor control cable:

The control cable was found sheared off. The smaller end MGB side with plastic coating clearly shows shearing whereas longer end(TGB side)was found curved having strands unraveled and without plastic coating. The SEM factographs shows shear dimples which indicate shear overload fracture.

d. Tail light electrical cable:

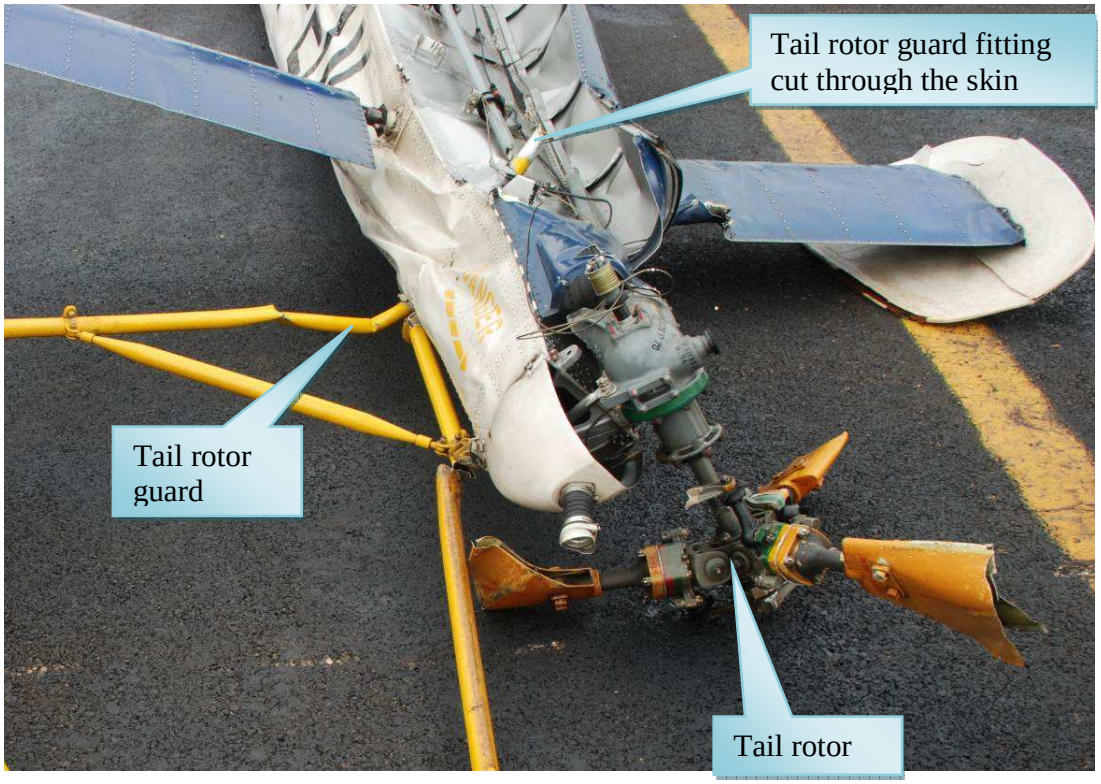
The tail light electrical cable was found sheared off. Here also, the smaller MGB side end shows shearing with small coating missing and

longer TGB side end shows shearing with larger area of its coating missing and having cut marks. Core wire seems to be of softer alloy. The SEM factographs shows shear mode failure of strands at low magnification.

e. TGB mounting bolts:

Two out of three mounting bolts were found sheared off. The RH side TGB mounting bolt indicates shearing pattern with metal flow and fracture surface indicating half moon crescent shaped mark indicating failure in shear mode. LH side TGB mounting bolt indicates similar features as observed on RH side. The SEM factographs shows shear dimples which indicate failure by shear force.

The failure of tail rotor guard upper fitting on tail boom top skin suggests that it was pushed upwardly elongating and failing both the bolt holes, cracking the top skin and probably hitting the tail drive shaft, thereby making circular marks on the protective coating of shaft. Bending of the bolt of tail rotor rod and smooth marks on its bend suggests that it is touching the rotor shaft. Top edge of the tube containing tail rotor guard also shows metal flow. The torsional force (produced by tail rotor upon hitting the ground) might have failed the shaft and buckling it torsionally.



1.17 Organizational & Management Information:

HAL Rotary Wing Academy, Bangalore was approved for imparting helicopter pilot training vide DGCA approval no. 03/2001 valid till 12.02.2011. The helicopter was maintained by Helicopter division of HAL, Bangalore who is also the manufacturer of the same helicopter. The academy has different type of helicopters in their fleet namely Schweizer 300 C, Schweizer 330 SP and Chetak for imparting flying training to pilots.

1.17.1 The DGCA approved examiner has carried out skill test of the instructor on Chetak helicopter based on the proforma applicable for proficiency check as given in CAR section 7 series B part XIV. As per the proforma used by the examiner following checks were not done.

a. Hover
   1. 3-5 ft. hover over spot. 360 turns (L & R).
   2. 3-5 ft. hover forward – backward – sideways.

b. Departure

1. Normal take-off (clear heliport).
2. Restricted Area Take off (Steep angle, Max take-off power).
3. Vertical take-off (Max. take-off power).

c. Climb
   1. Best climb speed or best angle of climb.
   2. Power adjustment during climb.

d. Air Work
   1. Quick stops from cruising speed to hover.

e. Approach
   1. Normal.
   2. Steep.
   3. Shallow.

The proforma used by the examiner for the skill test/proficiency check of the involved instructor on 24/09/2008 was not standard. There is no separate skill test proforma available in the regulatory authority documents.

1.17.2 The academy does not have an approved training and procedures manual.

1.18 Additional Information:

As per Rule 160 of Aircraft Rules 1937 “The Central Government may, by general or special order in writing, exempt any aircraft or class of aircraft or any person or class of persons from the operation of these rules, either wholly or partially, subject to such conditions, if any, as may be specified in such order.” The Ministry of Civil Aviation vide order no. AV.1103/01/2008-A dated 4th August 2008 had granted the instructor exemption under rule 160 of Aircraft Rules 1937 from application of provisions of rule 6 read with rule 38(A) 2 and 6 in respect of operation of HAL Helicopter including Radio Telephony apparatus fitted there upon and to carryout instructional training with M/s. HAL RWA only subject to the following conditions that,

1. He will undergo training, to be approved by DGCA, for recency of flying experience, training checks for type rating on schweizer helicopter.

2. He shall pass DGCA examination and skill test on type of helicopter to be operated by him for imparting flying training.

On compliance of such conditions the instructor/pilot will be able to fly without any restrictions as there is no system with the regulatory authority to renew and conduct other required checks for the instructor/pilot holding this kind of an authorization though the operators do carry out medical and other required checks periodically for their pilots/instructors holding such authorization.

1.19 Useful or effective investigation techniques:

Nil.

2. ANALYSIS

2.1 Helicopter

The helicopter had valid Certificate of Airworthiness and was maintained as per the approved Maintenance Schedules. The Certificate of Release to Service in respect of the helicopter and engine was issued by appropriately licensed helicopter maintenance engineer. The All Up Weight and Centre of Gravity of the helicopter were within the specified and approved limits.

The helicopter had completed 4534:55 airframe hours since new. The last revalidation of C of A was done on 28.08.2009 and the certificate was valid till the date of accident and has done 785:55 airframe hours since last C of A renewal. Last 100 hours inspection was carried out at 4440:55 airframe hrs and Helicopter had flown 4534:55 airframe hrs before the accident flight. The 800 hrs inspection was due at 4542:15 airframe hrs.

Before releasing the helicopter for the first sortie on 27th August 2010, the AME had carried out post flight and preflight inspection and did not observe any abnormalities.

The helicopter had earlier operated the first sortie for 45 minutes by a different set of flying instructor and trainee. No abnormalities were observed during the sortie and all the parameters were within normal limits.

In view of the above, the maintenance and serviceability of the helicopter cannot be considered as a contributory factor to the accident.

Failure of Tail Rotor

The failure of tail rotor guard upper fitting on tail boom top skin suggests that it was pushed upwardly elongating and failing both the bolt holes, cracking the top skin and probably hitting the tail drive shaft, thereby making circular marks on the protective coating of shaft. Bending of the bolt of tail rotor rod and smooth marks on its bend suggests that it is touching the rotor shaft. Top edge of the tube containing tail rotor guard also shows metal flow. The torsional force (produced by tail rotor upon hitting the ground) might have failed the shaft and buckling it torsionally.

Due to steep pitch up, the tail rotor guard had hit the ground, cracking the top skin and hitting the tail rotor driveshaft causing tail rotor failure and subsequent uncontrolled yaw to the left. The tail rotor guard had also cut the tail rotor cable making the rudder pedals in effective.

2.2 Human Factors

2.2.1 Flying Instructor:

The flying instructor joined HAL Rotary wing academy in September 2008 after serving for 34 years in the IAF. He has a total of more than 8000 hours of flying experience. He was a qualified flying instructor certified by the IAF authorities. He was granted exemption under rule 160 of Aircraft Rules 1937 from application of provisions of rule 6 read with rule 38(A) 2 and 6 in respect of operation of M/s HAL Helicopter including Radio Telephony apparatus fitted there upon and to carryout instructional training with M/s HAL RWA only.

The instructor and student established a hover height of about 8 to 10 feet above the ground against the hovering height of 3 feet as laid down in the Flight Manual and is a part of the proficiency check/skill test proforma as laid down in CAR section 7 series XIV part I as this is a normal practice as per the instructor during training flights for trainee pilots in order to provide an element of safety. In view of the above it can be inferred that the instructor has not maintained the hover height as laid down in the Flight Manual. From the proforma of skill test conducted by DGCA approved examiner for the instructor, it is evident that the hover check at 3-5 ft. was not carried out. There is no approved Training and Procedures Manual in the academy which defines the hover height during training flights for trainee pilots in order to provide an element of safety.

The skill test performed by the examiner on Chetak helicopter based on the proficiency check test proforma. The examiner used the non-standard proforma which was not containing requisite checks as per the requirements. There is no separate proforma exists in the regulatory authority documents for carrying out skill test of helicopter pilots.

While the instructor started following the trainee on the cyclic, the helicopter suddenly pitched up. The pitch up was due to not properly handling the controls by the instructor.

As per Flight Manual If tail rotor failure occurs close to the ground (e.g. blades damaged by hitting an obstacle) full low collective pitch must be applied, even if this is to cause a very hard landing, and the engine shut down by closing the fuel shut off cock, if possible before touching the ground.

Since the helicopter was suddenly pitched up the instructor instinctively delayed lowering the collective until the helicopter nose came down. In view of the above it can be inferred that the instructor had not properly handled the controls and delayed the corrective action and did not follow the emergency procedures as laid down in the Flight Manual

2.2.2 Trainee Pilot:

The trainee pilot has done only 14:30 hours of dual flying on Chetak helicopter and was not well versed in handling the controls.

2.3 Weather:

The weather was good with 8 Km visibility and scattered clouds. Winds were westerly, wind speed 10 knots. The time of accident was 0323 UTC i.e. in day time. The weather was not a contributory factor to the accident.

2.4 Organization and Management:

While examining the compliance of the conditions stipulated by Ministry of Civil Aviation vide order no. AV.1103/01/2008-A dated 4th August 2008, the organization informed that the instructor had passed the DGCA examination on Schweizer helicopter and had undergone training and checks. The organization has also informed that the instructor was granted clearance for imparting flying training on Chetak helicopter under Rule 160 based on his experience and currency on type since he was a defence pilot from Indian Air Force.

The skill test performed by the examiner on Chetak helicopter based on the proficiency check test proforma. The organization didnot keep the standard proforma for carrying out the skill test/proficiency checks of their pilots.

There is no approved Training and Procedures Manual in the academy which defines the hover height during training flights for trainee pilots in order to provide an element of safety.

2.5 Exemption under Rule 160 of Aircraft Rules 1937

The Ministry of Civil Aviation vide order no. AV.1103/01/2008-A dated 4th August 2008 had granted the instructor exemption under Rule 160 of Aircraft

Rules 1937 for imparting flying training subject to conditions. On compliance of such conditions the instructor/pilot will be able to fly without any restrictions. It will not be necessary for instructor/pilot to do any recurrent training, medical examinations etc. Once such an exemption is granted by Ministry of Civil Aviation, it remains valid for life time and there is no system with the regulatory authority to renew and conduct other required checks the instructor/pilot holding this kind of an authorization.

2.6 Circumstances Leading to the Accident

After hovering steadily for about 30 seconds the helicopter became unsteady with pronounced left lateral cyclic movements. While the instructor started following the trainee on the cyclic then the helicopter suddenly pitched up. The sudden pitch up was due to not properly handling of controls by the instructor. Due to steep pitch up, the tail rotor guard had hit the ground, cracking the top skin and hitting the tail rotor driveshaft and tail rotor cable causing tail rotor failure and subsequent uncontrolled yaw to the left. The helicopter started rotating in anticlockwise direction and impacted the ground in a slightly nose down attitude and got substantially damaged.

3. CONCLUSIONS:

3.1 Findings:

3.1.1 The helicopter had valid Certificate of Airworthiness and it was being maintained airworthy as per approved maintenance schedules.

3.1.2 The Certificate of Release to Service in respect of the helicopter and engine was issued by appropriately licensed helicopter maintenance engineer.

3.1.3 The All-up-weight and Centre of Gravity of the helicopter were within the specified and approved limits.

3.1.4 The AME had carried out post flight and preflight inspection and did not observe any abnormalities.

3.1.5 The helicopter had flown one sortie earlier without any abnormalities.

3.1.6 The trainee pilot has done only 14:30 hours of dual flying on Chetak helicopter and was not well versed in handling the controls.

3.1.7 The instructor had 4206:20 hours of flying experience on Chetak helicopter

3.1.8 The skill test performed by the examiner on the involved instructor was not adequate as the proforma used was nonstandard as it was not containing requisite checks for all phases of the flight.

3.1.9 There is no separate proforma for skill test of helicopter pilots in the regulatory documents.

3.1.10 While the instructor started following the pupil on the cyclic, the helicopter suddenly pitched up.

3.1.11 The sudden pitch up during hover was due to not properly handling of controls by the instructor.

3.1.12 The instructor had followed his instincts and did not follow the emergency procedures as laid down in the Flight Manual thereby delaying the corrective action.

3.1.13 Due to steep pitch up, the tail rotor guard had hit the ground, cracking the top skin and hitting the tail rotor driveshaft causing tail rotor failure and subsequent uncontrolled yaw to the left.

3.1.14 The tail rotor guard had cut the tail rotor cable making the rudder pedals in effective.

3.1.15 There is no proper system with the regulatory authority for monitoring of pilots holding authorization under Rule 160, to check their medicals, renewals and other required checks.

3.1.16 The academy does not have an approved Training and Procedures Manual which defines the hover height during training flights for trainee pilots in order to provide an element of safety.

3.2 Probable Cause:

The probable cause of the accident is the sudden pitch up during hover, due to not proper handling of controls by the instructor which resulted in tail rotor hitting the ground and damage to the helicopter.

4. SAFETY RECOMMENDATIONS

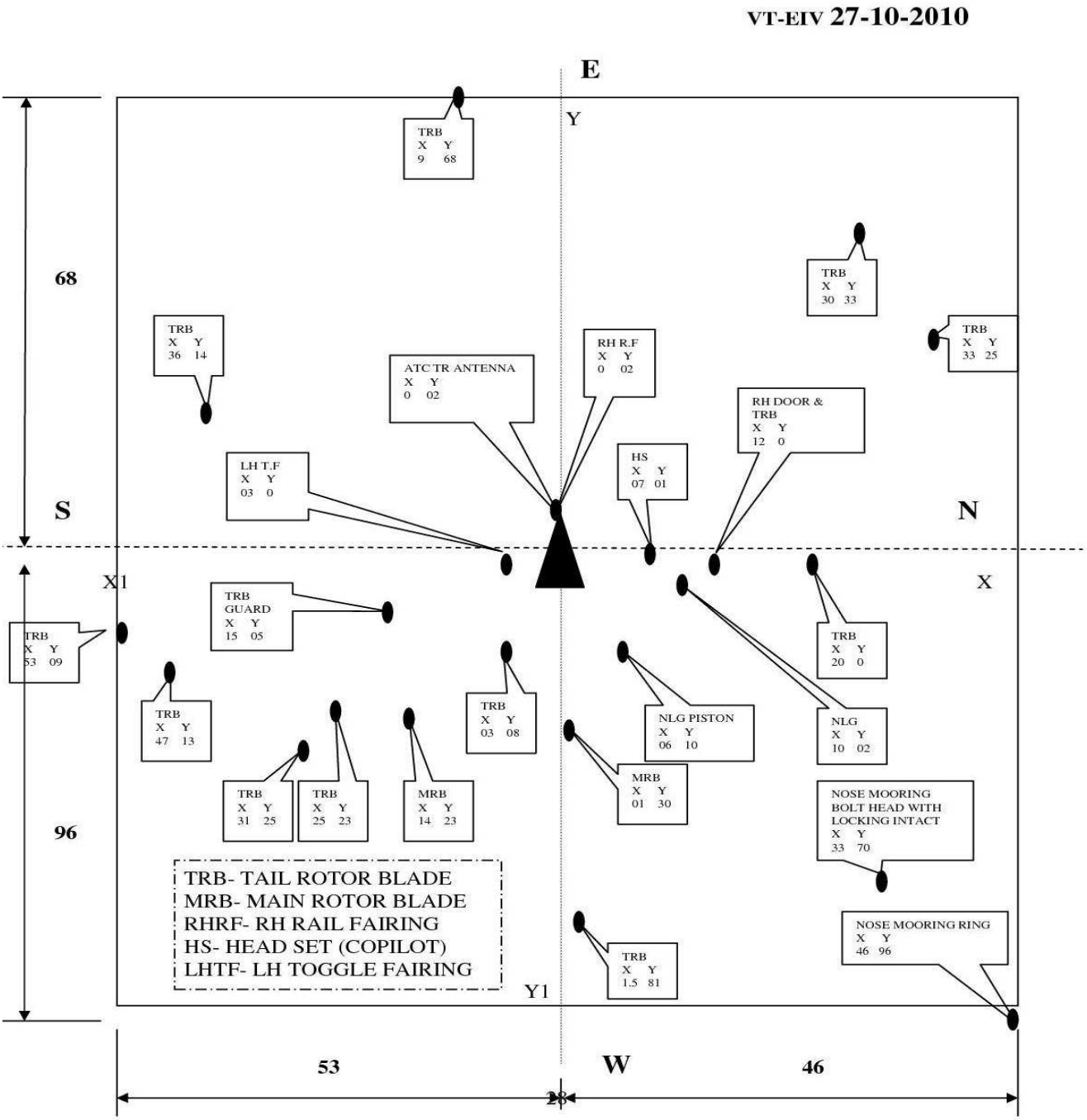
1. The involved instructor should be subjected to skill test on Chetak Helicopter.
2. Action as deemed fit may be taken against the flying instructor for not taking timely appropriate action and not following proper emergency procedures.
3. Action as deemed fit may be taken against the organization for not having an approved Training and Procedures manual for imparting flying training to the students and not keeping the required proforma for carrying out the skill test/proficiency checks of their pilots.
4. All the DGCA examiners should be familiar with the latest requirements of regulatory authority while conducting the Skill Test/ Proficiency Check.
5. DGCA should provide the skill test proforma in the regulatory documents for carrying out the skill test of helicopter pilots.
6. A system should be evolved by the regulatory authority for monitoring of pilots/instructors those holding authorization under Rule 160, to monitor their medicals, renewals and other periodical checks.

(K.L. Meena)
Regional Controller of Air Safety
Inspector of Accident (VT-EIV)

Date: 01-08-2011
Place: Hyderabad

APPENDIX I

WRECKAGE DISTRIBUTION CHART



APPENDIX II

WRECKAGE PHOTOGRAPHS

Helicopter resting on its belly in tilted condition

Right side view of the cockpit with right cockpit door separated

Left side view of the cockpit with left cockpit door open

Helicopter with the foam spread on the tarmac

Damage to the tail rotor guard and tail rotor blades with tail boom buckled

Ground marks of tail rotor guard and tail rotor blades