



**GOVERNMENT OF NEPAL
AIRCRAFT ACCIDENT INVESTIGATION COMMISSION 2015**

FINAL REPORT

**ON THE ACCIDENT INVESTIGATION OF 9NAJP AS350B3 ECUREUIL
HELICOPTER OPERATED BY MOUNTAIN HELICOPTERS AT ,
YAMUNADANDA V.D.C-8, SINDHUPALCHOK DISTRICT, NEPAL
ON 2nd JUNE 2015**

SUBMITTED BY

THE COMMISSION FOR THE ACCIDENT INVESTIGATION 2015

TO

**THE GOVERNMENT OF NEPAL
MINISTRY OF CULTURE, TOURISM AND CIVIL AVIATION**

February 2016 (Magh 2072 BS)

This report is prepared in accordance with the provisions of Civil Aviation (Accident Investigation) Regulation, 2071 B.S (2014 A.D.) for the purpose of preventing future aircraft accidents and incidents. It is not the function of the Commission and the investigations to assign blame or determine civil and criminal liability.

Foreword

This report on the accident of 9N-AJP, AS350**B3** Plus helicopter owned and operated by Mountain Helicopters (Pvt.) Ltd. Nepal, is based on the investigation carried out by the ‘Accident Investigation Commission’ constituted by the Government of Nepal on June 3, 2015. The responsibility of the Commission is to find out the cause of the accident and offer recommendations to prevent the recurrence of such kind of accident in the future so as to ensure a safer sky for all forms of aviation activities.

The Commission has collected, compiled and analyzed all the available resources including technical information about the helicopter, relevant documents, existing rules and regulations, crash site examination, weather information, and direct interviews with eye-witness, company officials and other personnel.

Composition of the Commission:

1. Joint Secretary, MoCTCA, Buddhi Sagar Lamichhane, **Chairman**
2. Engineer, Manang Air, JanakThapa, **Member**
3. Pilot, Simrik Air, Capt. Siddhartha Jung Gurung, **Member**
4. Under Secretary, MoCTCA, Pramod Nepal, **Member- Secretary**

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Abbreviations and Definitions

AD	Airworthiness Directives
AGL	Above Ground Level
AMSL	Above Mean Sea Level
AMT	Aircraft Maintenance Technician
ASB	Alert Service Bulletin
ATC	Air Traffic Controller
AUW	All up weight
B. S.	Bikram Sambat
C of A	Certificate of Airworthiness
CAAN	Civil Aviation Authority of Nepal
CAMMOE	Continue Airworthiness Management and Maintenance Organization Exposition.
CG	Center of Gravity
DI	Daily Inspection
FLI	Flight Limitation Indicator
FOR	Flight Operation Requirements
Ft/min	Feet per Minute
GPS	Global Positioning System
HF	High Frequency
IGE	In Ground Effect
INGO	International Non-governmental Organization
Kg	Kilogram
Kts	Knots
LST	Local Standard Time
MoCTCA	Ministry of Culture, Tourism and Civil Aviation

MSF	Medecins Sans Frontiers (Doctors Without Borders)
Mtrs	Meters
NG cycle	Gasgenerator cycle
NM	Nautical Mile
NP cycle	Power turbine cycle
Pax	Passengers
PF	Pre-Flight
PIC	Pilot in Command
POH	Pilot Operating Handbook
QNH	Pressure Setting to Indicate Elevation AMSL
SB	Service Bulletin
TUTH	Tribhuvan University Teaching Hospital
UTC	Universal Co-ordinated Time
VEMD	Vehicle and Engine Multifunction Display
VFR	Visual Flight Rules
VHF	Very High Frequency
WX	Weather

Synopsis

On the 2nd of June 2015, the ill-fated helicopter 9NAJP, AS350B3*Plus* helicopter owned and operated by Mountain Helicopters Pvt. Ltd. was operating charter flight for an INGO named MSF (Doctors without Borders) in eastern part of Nepal, Sindhupalchok District. The captain was the sole pilot for the mission on that day.

On the final segment of the schedule of the day, the helicopter departed from Tembathang to Kathmandu. The PIC took off with 3 pax and followed the river maintaining low altitude.

The route followed by the aircraft was not normal for the helicopter heading towards Kathmandu. Because of the lack of factual evidence it became very difficult to find the reason for following the abnormal route from Tembathang.

The helicopter was damaged totally with the head on strike and severe burn. The pilot and three passengers were died on the spot.

The most probable cause of this accident was hitting neutral wire of high tension line of NEA by main rotor and tail rotor of the helicopter and loosing directional control; subsequently breakdown of dynamic components which resulted helicopter uncontrolled and hit on sloppy mountain terrain.

The contributing factors to the accident are identified as: Passenger distraction, Loss of situational awareness, Cumulative fatigue, Personality traits, Lack of wire avoidance training, Lack of obstacle maker on the high tension wire of NEA.

Pursuant to the Civil Aviation (Accident Investigation) Regulation, 2071 B.S. the Government of Nepal constituted a four-member Accident Investigation Commission on 3rd June 2015 to investigate the accident.

The investigation commission has madem safety recommendations for the enhancement of safety and to prevent such accidents in future. This report is submitted to the Government of Nepal, Ministry of Culture, Tourism and Civil Aviation on September, 2015.

1. FACTUAL INFORMATION

1.1 History of the Flight

The AS350 B3 plus helicopter with the registration mark: 9N-AJP, MSN: 4681, whose owner and operator is Mountain Helicopters Pvt. Ltd. was returning to Kathmandu from Tembathang, Sindhupalchowk district on 2nd June 2015. The aircraft crashed at 0930UTC (15:45Local time) with one crew and three passengers on board. The helicopter was said to be in a relief mission after the devastating earthquake in Nepal. The last reported position of helicopter was at 0847 UTC circuit area in Golche, Sindhupalchowk.

On 2nd June 2015, the helicopter departed from Kathmandu to drop the relief and medical team to Bulung and Bhirumi. The helicopter returned back to Kathmandu and did a second trip to Bolde-Bulung-Bhirumi-Nimlung and again returned back to Kathmandu. For the last departure from Kathmandu, the dispatcher did not check the passengers IDs and as a result, the passenger whose name was not mentioned in the passenger manifest was found onboard the helicopter. The helicopter did a third trip and had planned to pick up the medical team from Bolde, and go to Tembathang and then return back to Kathmandu. But unfortunately, the helicopter met with an accident on return flight from Tembathang.

Place of Accident	: Sanajhadi Forest, Yamuna Danda VDC-8, Sindhupalchowkdistrict
Location of Accident	: Latitude: 27 ⁰ 43' 67" N Longitude: 085 ⁰ 46' 50" E
Altitude of the Accident Site	: 2340ft AMSL

1.2 Injuries to Persons

Particulars	Crew	Passengers	Others
Fatal	1	3	-
Serious	-	-	-
Minored	-	-	-
Total	4	-	-

1.3 Damage to Aircraft

The helicopter first hit the neutral wire of high tension line of the 33 KVA supply of NEA and then being uncontrolled collided with terrain in a high speed. As a result, the aircraft is destroyed and most of the parts burnt. None of the parts of the aircrafts found reusable.

The engine recovered with heavily dented on various place with round dip scratch marks on inlet cone and axial compressor blades are bended against the direction of its rotation. The Engine Control Unit (EECU) was also burnt severely; So the commission could not be able to download recorded data which may be helpful to analyze the health of engine and aircraft before the accident.

1.4 Other Damages

No damage was caused to private property and other persons.

1.5 Personal Information

1.5.1 Pilot-in-Command (PIC)

Sex and Date of Birth	Male, 23 rd March, 1988
Nationality	Nepalese
Marital status	Unmarried (Single)
CAAN License No.	CPL 069 (H)
Validity of License	29 th February, 2016
Ratings	AS350 (Day VFR)
Total Flying Hours	1433.37 till May 31, 2015
Time flown in a period of one calendar month(May 2015)	124 Hours and 22 minutes
Time flown since last 7 days	22 Hours and 11 minutes
Last date of annual review/check-ride	21.12.2014
Proficiency Expiry	February 29, 2016
Rating on Types	AS350 (B2, B3+, B3e) VFR
Last date of annual review/Check Ride	November2014

The PIC had 1433.37 hrs of flying experience till May 31, 2015. As per his family members he had no complain about the company and was happy with his duty and working environment. He was honest for his Job. According to company and CAAN he had no record of past accident and Incident during his flying career.

1.6 Aircraft Information

1.6.1 General

The Ecureuil AS 350B3 Plus single engine helicopter manufactured by Airbus France (airbus helicopters company) is designed for light utility work with good high altitude performance, equipped with three bladed main rotor and two bladed tail rotor, skid type landing gear, 6+1 seater seating capacity, right side control operated helicopter fitted with VEMD on cockpit for monitoring. The helicopter powered by Turbomeca, a France made Arriel 2B1 engine, is controlled by dual channel EECU. It has emergency backup control system (EBCAU) too.

The ill-fated AS 350-B3 +helicopter with the Serial No. 4681 was purchased by Mountain Helicopters Pvt. Ltd. on Dry Lease Agreement from Spin Helicopters SA, Spain signed on 3rd September 2010. The term of the lease was for a period of 2 years starting from 22nd September 2010. The ownership was transferred to the Mountain Helicopters Pvt. Ltd. on 31st October, 2015.

1.6.2 Aircraft

Manufacturer: - (Airbus helicopters company France)
Category of Aircraft:-Transport (Passenger)
Helicopter Type: - AS350 B3 Plus (Ecureuil)

A/C Serial NO:-4681
Date of Manufacture:-01/07/2009
Registration No:-9N-AJP
Owner/Operator:-Mountain Helicopters, Nepal
A/C total time:-3691.32 Hrs
A/C Landings:-10754 Landings
Last A/C weighing:-10 February 2014
A/C empty weight:- 1265 KG
Maximum Take-off Mass: - 2250 KG
Last C of A validity:-15/07/2015

Additional Information:

Helicopter arrived in Nepal on:- 26 October 2010
Flying Hours done before arrival in Nepal: - 485.06 hrs
Total hours flown with Mountain Helicopters:- 3206.26 till
02/06/2015

1.6.3 Engine

Engine details:-

Manufacturer:-Turbomeca France
Engine Type Arriel 2B1
Engine Serial No:-46249
Date of manufacture:- 2008
Hours done:- 3154.55 hours
Ng cycles :- 5258.00 cycles
NP cycles :- 2221.60 cycles

This helicopter was equipped with a VEMD. The VEMD displays the parameters and functions such as engine health control and cycle recording. Information about any failures and over limits during the last moments of engine operation can be retrieved from the VEMD. Unfortunately the VEMD was found burnt completely and could not be recovered any data.

1.6.4 Aircraft Maintenance History

The Helicopter was maintained as per the approved maintenance program in line with the NCAR Part M sub Part G 145 maintenance organization. All schedule inspections, service bulletin, alert service bulletin and airworthiness directives were found carried out and complied with in the specifies time limit by CAAN approved License holder certifying staffs.

The last major inspection A/F 600/1200/3600 hour/ and calendar 6M/12M/24M/4 Yrs/ inspection were carried out on 23 May, 2015 by certifying staff stamp no MH 176.

In the examination of aircraft and engine log book, list of SB'S, ASB,AD'S and maintenance status provided by Mountain Helicopters since 1st January 2015 to 1st June, 2015, no maintenance lapses and overdue as well as no any reported defect by captain and deferred defect were found. Airframe and engine component status reflect that the components fitted in the helicopter were within the recommended time limit provided by Manufactures Service life limit, Time between overhaul and Operating time limit.

1.6.5 Performance Data

The last engine performance check, which was carried out in flight on date 28 May, 2015 was recorded by satisfying staff MH 276. The readings were NG 96.4% NF 391 RPM T4 811° c Altitude 6870 Feet Torque 72 % OAT +20° c T4 margin -25° c Torque margin +2.1 % and the result obtained was “GOOD”.

1.6.6 Flight and Navigation Instruments

The aircraft was equipped with the standard AS350B3 base line flight and navigation instruments required for day VFR operation such as: VOR and GPS.

1.6.7 Aircraft Weight and Balance

The maximum take of weight of helicopter is 2250 KG. Similarly, the weight of passengers, crew, aircraft and fuel were 225 KG, 75 KG, 1265 KG and 256 KG respectively. Therefore, total weight mentioned in the weight and balance sheet of the helicopter was 1821KG.

1.7 Meteorological Information

As per the information given by eyewitness of the accident site, that day the weather was fair.

1.8 Aids to Navigation

The aircraft was equipped with a GPS navigation.

1.9 Communication

The aircraft was equipped with a VHF transceiver and Satellite phone on board but the Pilot didn't inform about the intention of flight towards Balefi area changing the prearranged flight schedule. When the helicopter needs to fly in the area where other means of communication like HF and VHF does not work properly SAT phone should be used and must communicate the important information regarding the flight status as early as possible. In this case even though the aircraft was equipped with SAT phone facility, the PIC did not use it to inform/communicate about the deviation from the scheduled programme. Due to lack of any kind of evidence, it became difficult to find the intention of PIC to fly towards the accident site.

1.10 Crash Site

The crash site is situated on geographical coordinates of N 27°43' 53.47" and E 85°46'53.9" at an altitude of 2340 ft AMSL in Yamunadanda VDC, east side of Bhotekoshi river Bank, Sindhupalchok District. The crash site is sloppy terrain covered with mountain forest trees.

1.11 Flight Recorder

The helicopter was equipped with VEMD, a form of data recorder but not the cockpit voice recorder. The VEMD was totally burnt and it was not possible to trace out any information from the VEMD.

The helicopter was not equipped with any flight data recorder or cockpit voice recorder.

1.12 Wreckage and Impact Information

The helicopter stroked into the NEA neutral power transmission line by main rotor and tail rotor system. Excessive vibration created due to sudden jerk on dynamic component during collision with wire and disturbance in rotation of dynamic component detached engine cowling engine air inlet duct, at the same point of strike below. TGB with broken tail rotor unit detached and fly away about 30 mtr from the strike point. Damage on upper and lower vertical fins with tail cone recovered on river bank about 90Mtr from strike point.

The main helicopter fuselage, canopy and tail boom with horizontal stabilizer were recovered about 170mtr away from the strike point with heavily impact on sloppy ground surrounded by trees. About 80% of fuselage and canopy including all instruments were destroyed with fire and not identifiable. The MGB and main rotor system with rotor shaft, starflex, and main rotor blade were found attachment sear during impact and detached from fuselage which was recovered about 20mtr away from the final impact. The two main rotor blades recovered with full length leading edge side and damaged with wire strike trailing age side with wire strike arc marks on full sized blades.

The full size engine with all module (Mo 01.....05) including full exhaust duct with heavily dented during impact on ground with round rubbed marks and axial compressor blades were bended against the direction of its rotation. It was recovered about 20mtr from final impact sloppy terrain.

Engine Electronic Control Unit (EECU) and VEMD found fully damaged with fire.

1.13 Medical and Pathological Information

As per the latest medical report PIC was medically fit for flight. He didn't have any physical, physiological and psychological problems and was not addicted to any illicit drugs. He was neither a smoker nor alcohol drinker. He was not under any medication. As per the pathological report prepared by TUTH, PIC was not influenced by any kind of substance that may affect physical or psychological performances of human body.

1.14 Fire

The evidence and eye witness statements show that there was no fire on helicopter before impact with terrain. After the impact with terrain the aircraft caught fire.

1.15 Survival Aspect

The accident was fatal. None of the persons onboard survive. One PIC and three passengers died instantly.

1.16 Tests and Research

A visual inspection of the crash site was done by the commission. Because of the condition of the wreckage there was no possibility of laboratory test of the wreckage. According to the eye-witness the helicopter was flying in a normal engine-run condition before the accident occurred, but in low altitude. Once the helicopter hit the neutral wire of NEA high transmission line then the helicopter became

unstable and uncontrolled, and hit the terrain with high speed and crashed with fire. The Commission has come to the conclusion that the power plant, control system and transmission system were operating normal at the time of the accident and any possibility of mechanical failure thus can be discounted.

Examination of engine accessories

1. Engine accessory Gearbox Mechanical magnetic plug:-
Checked; no accumulated magnetic particle accumulated on probe.
2. Engine Reduction Gearbox Mechanical magnetic plug :-
Checked; no accumulated magnetic particle accumulated on probe.
3. Engine scavenge oil outlet Electrical Chip detector:-
Checked; no accumulated magnetic partical on probe.
4. Engine oil filter inspected:-
Found some carbon deposited on it. No other object detected.

Examination of transmission system Chip detectors

1. Main Gear box Magnetic chip detector:-
Checked; no accumulated magnetic particle onprobe.
2. Tail Gear box Magnetic chip detector:-
Checked; no accumulated magnetic particle on probe.
3. Main Rotor shaft Magnetic chip detector:-
Checked; no accumulated magnetic particle on probe.

1.17 Organization and Management Information

1.17.1 Mountain Helicopters

Mountain Helicopters Pvt. Ltd is Kathmandu based helicopter company of Nepal and has been operating since 2009.

Mountain Helicopters operates with a well equipped fleet of aircrafts of the Ecureuil family, namely AS350 B2 (2003 model), AS350 B3+ (2009 model) and AS350 B3e (2012 model) manufactured by Eurocopter, France.

The company had no any record of accident and serious incident till this accident. As per the latest safety audit report (done by CAAN), the safety record of the helicopter company is also good.

The company has maintained a standard safety record and has implemented SMS in principle. It has maintained a group of expert professionals in its operation and maintenance team.

1.18 Additional Information

1.18.1 Prior flights and Events

The pilot was scheduled to carry out three flights to the Sindupalchok area on that day, all flights originated from T.I.A. and for the same client. They were operating flights for an INGO, MSF (Doctors without Borders) working for the post earthquake relief. As many of the earthquake affected areas were inaccessible by road, helicopters were being used by the different agencies for the relief work.

After the earthquake, Mountain Helicopters like the other helicopter operators were heavily involved with the rescue, recovery and relief efforts. Almost six week after the earthquake the relief efforts were coming to an end. That day was the last flight for the INGO in that area as they were closing down there post earthquake operations.

The initial two flights were carried out normally. The last report made by the PIC was circuit area Golche at 0847 UTC.

1.18.2 Accident Sequence

The helicopter departed from Tembathang (7,200 feet) around 1530 LT. around 1545 the helicopter crashed at Yamuna Dada on the East bank of BhoteKoshi opposite Balefi Bazar.

As the crash site is not on the flight path back to Kathmmandu, it is clear that the helicopter had deviated from its normal route. According to the flight plan the helicopter was supposed to return to Kathmandu but no any information of deviation was reported by the pilot or the INGO's staff neither to civil aviation system nor to local government agencies or company. Locals at Tembathang reported that the helicopter was planning to go to Barhabise just 7 NM upriver from the crash site but this report cannot be verified with data.

Locals near the accident site reported that the helicopter was flying very low. But the different persons who themselves claimed as eye-witness has different statement about the helicopters flying, sound and maneuvers, so it is extremely difficult to take into account the eyewitness statement as a good reference during investigation.

First the helicopter strike with NEA high tension line and then crashed on the steep terrain opposite to Balefi Bazaar. The area was engulfed with fire and the dead burnt bodies were found 10 meters below the spot where the fuselage was scattered in many pieces.

2. ANALYSIS

2.1 Introduction

Analysis of the event was done with the details available on fact-based information and psychological, physiological, operational as well as mechanical factors. Several discussions were held among the members and experts, especially on the possibility of the human factors, violation of regulations, conditions of crash site, aerodynamics and other technical aspects.

It is found that the PIC was properly certified and qualified under the CAAN regulations and training requirements. No evidence was found to indicate any pre-existing medical condition that might have adversely impaired the pilot's performance during the flight. The helicopter's weight and balance were within the limits for the duration of flight. The aircraft was flying on VMC all the time on that day. Because of the location and nature of the crash site as well as condition of the wreckages it was not possible for the Commission to study all wreckages and the extension of the wreckages after the crash.

During the course of investigation the commission analyzed all the possible factors that may relate to the accident categorically. After the detail and extensive analysis the commission has reached to the conclusion accordingly and forwarded safety recommendations accordingly.

2.2 Methodology

The following were the methods followed by the Commission during the investigation to reach the conclusion on the probable causes of the accident.

- a) Detailed interviews with the witnesses, officials of the Mountain Helicopters, CAAN officials, family members of the PIC and other individuals who carried any information related to the accident;
- b) Visual examination and assessment of wreckage. Photographs and videos were collected for detailed study;
- c) Study of the prevailing weather information received from the locals at the crash site;
- d) Study of technical documents related to the maintenance and operational history of the aircraft;
- e) Study of personal files and information about the PIC;
- f) Study of aerodynamics, human factors, aviation medicine, human psychology, human physiology;
- g) Review of the CAAN regulations/requirements regarding helicopter operations.

2.3 Visits to the Crash Site

The Commission members visited the crash site on 3rd and 7th June 2015 to study and collect the evidences and first hand information related to the accident available on the accident site. The onsite visits were very supportive to the commission.

2.4 Mechanical Factors

No evidence of maintenance lapses was found. The Commission examined the maintenance history of the helicopter and found that all the airworthiness directives and service bulletins had been complied as per the maintenance requirements within the prescribed time frame. The technical logs and log books show that the maintenance works, major inspection works and modifications were carried out as per the approved maintenance program and bulletins. No technical defect was found prior to the flight.

There was no evidence of engine failure until the impact of the helicopter. There was no evidence of any system failure either. Hence, the failure of the helicopter systems e.g. hydraulic, flight control, transmission system and other major components can be ruled out.

On the basis of the available evidence and documents analysis, any technical or mechanical reason has been ruled out as the factor of accident.

2.5 Weather Factor

There was no any recorded weather reports but as per the eye witness weather was fair. So weather could be ruled out as the factor of accident.

2.6 Flight Analysis

The helicopter landed at Tembathang, enroute from Bolde. The locals recalls the Dutch doctor mentioning that this was their last day as they were closing down their operations; So they are there to meet them before leaving the village completing their task.

Weather wise the visibility was good with only few clouds around. As this was their last spot, according to the programme of the charter party the helicopter was supposed to return to Kathmandu from tembathang.

According to the Flight Operations Requirements (FOR) Helicopter 5th EDITION July 2013, SEC 2 CHAP 7-5, Para 7.6, Sub-Para 7.6.3.2.1 clause (b) ***“In a particular instance when the pilot’s flight duty period exceeds 7 hours but does not exceed 8 hours, he shall be removed from all flight duties the following day regardless of the number of previous days that he has flown.”***

After examining the Aircraft Technical Logbook, the PIC was found violating the above requirement multiple of times. At one instance it was also found that the Operation Director of the Mountain Helicopters had issued an internal circular with a strict warning to the Captain for having flown for 9 hours and 45 minutes on 03 May 2015 but didn’t bother to inform the PIC who was scheduled to fly the next day. The airline is known to have no shortage of flight crew. Despite the warning, the PIC continued to fly the aircraft the following day without having rest as required by FOR (H).

The following findings were noted which explains the flight duty time violations by the Captain:-

- i) Aircraft Registration Mark: 9N-AJP
Aircraft Log Date: 01 May 2015
Total Flight Time: 7 Hours and 50 minutes
- ii) Aircraft Registration Mark: 9N-AJP
Aircraft Log Date: 02 May 2015
Total Flight Time: 7 Hours and 30 minutes
- iii) Aircraft Registration Mark: 9N-AJP
Aircraft Log Date: 03 May 2015
Total Flight Time: 9 Hours and 45 minutes
- iv) Aircraft Registration Mark: 9N-AJP
Aircraft Log Date: 04 May 2015
Total Flight Time: 6 Hours and 45 minutes
- v) Aircraft Registration Mark: 9N-AKB
Aircraft Log Date: 16 May 2015
Total Flight Time: 8 Hours and 01 minute
- vi) Aircraft Registration Mark: 9N-AKB
Aircraft Log Date: 17 May 2015
Total Flight Time: 6 Hours and 41 minutes

Based on the above data and analysis, it can be assumed that the pilot's performance may be affected by the cumulative fatigue produced by the excessive duties.

2.7 Pilots Familiarity with the area

Based on the data and information available it was established that the pilot was familiar with the area as he had carried out many flights from Dhulikhel to Tatopani during the big landslide operation of August 2014, and many more flights afterwards. At times during the landslide operation of 2014 the cloud ceilings were low and he was aware of the transmission lines around Balefi while following the BhoteKoshi upriver to Tatopani.

While coming downriver from Balefi Khola it is very difficult to spot the transmission towers and wires even if one is aware of the hazards around Balefi. It is very difficult to spot the hazards until the last moment and if the helicopter is flying low and fast this could be potentially fatal. Furthermore, coming from Tembathang side the line runs perpendicular to the flight path which if not spotted quickly can be a potential trap. So even being familiar with the area PIC did not take care of the fact of presence of high tension wire at that area. As a flier it can be said that due negligence from the side of PIC may be a contributing factor of accident.

2.8 Wire Strike

Initially there were reports that the helicopter 9N-AJP had struck the wire of the high tension transmission line of NEA before crashing. Various accounts stated various wires they had stuck before crashing

and some even claimed they had not even made contact with the wire at all.

As all the transmission lines were intact even the wire strike theory seemed improbable. But, after consulting with credible witnesses, consultation with the NEA technicians formally and studying the helicopter's debris location the commission reached to the conclusion of wire strike. Upon careful observation of the top most neutral wire of the main transmission line, slashing (rubbing) marks of roughly one meter in length were found.

The clear mark of wire is also seen on the main rotor blade, tail rotor pitch change rod and spider assembly. This corresponds with the eye witness accounts.

The helicopter had flown underneath the neutral wire and the blades had made contact with the wire thus the marks of wire seen on the blades likewise rubbing mark also seen on the wire. The blade which made contact with the wire flapped down and took out the whole engine cowling. Thereafter the tail gear box including the tail rotor separated and the fuselage was carried forward by the momentum to the other side of the river where it crashed and burned.

Based on the facts and evidences it can be easily determined that the helicopter strike with the neutral wire of the high tension line of the NEA and ultimately crashed hitting the mountain terrain.

2.9 Situational awareness

The sky of Balefi area was crowded by wires of different capacities of electricity transmission lines. While observing the area it was found that there was no any signage of distinct identity on high tension line and information signal regarding the danger of crossing wires for flying. Presence of such kind of crossing wires always brings the threat of wire strike because of the illusion to the PIC. As the PIC was familiar to the site and flown many times to that area. In this respect it can be assumed that the PIC should be aware of the possible wire strike while flying towards that area.

As this was the last flight of the mission, pilot could have been flying low as a treat to the familiar passengers.

In this background it can be determined that the PIC lost situational awareness while flying towards the familiar area as he was flying at low altitude i.e below 500ft AGL.

2.10 Human Factors

2.10.1 passenger Distraction

As the pilot was young and unmarried and there was a woman in the front seat. Usually on a single pilot helicopter pilots can communicate with the passengers via the intercom system sitting on the front seat. As the passenger had already flown many times with the same pilot there might have developed some kind of familiarity between them and they might have engaged in communication which might have distracted the pilot in the crucial moments.

2.10.2 Pilot's personality traits

There are many different pilot personality traits. His own characterized traits might have made him to fly low on that particular day, but this is difficult to verify.

2.10.3 Cumulative Fatigue

The pilot didn't fly the previous day but it doesn't mean he was properly rested. As he had flown a lot of hours on the previous month and had made some violations of the flight duty time, cumulative fatigue could be a major factor in the decision making process.

2.12 Obstacle Markings

Even though ICAO's requirements clearly say that the power lines shall be marked when crossing the river, valley or major highway with marker spheres, NEA has not put such mark in high tension line. Moreover, such obstacle information is not mentioned in CAAN's documents. Owing to this, high tension lines have become hazardous for flight.

2.13 Servo Transparency

According to Eurocopter service letter no. 1648-29-03, the servo transparency phenomena also known as servo reversibility or jack, stall can be encountered during abrupt maneuvering of any single hydraulic system equipped helicopter particularly at high speed. The phenomenon marks a flight envelope boundary. The factors that affect servo transparency are airspeed, collective pitch input, gross weight, g-loads and density altitude.

During investigation, the commission came to know that the helicopter was flying low and fast. This could have led the situation of servo transparency which might have made him impossible to avoid the wire.

2.14 Training

He has not taken specific training regarding the Wire Strike Avoidance. CAAN has not developed wire strike avoidance training requirement for helicopter pilots yet.

4. CONCLUSION

4.1 Findings

1. The Pilot was qualified and certified in accordance with the rules and the regulations of Civil Aviation Authority of Nepal. The Pilot's proficiency check was carried out on November 21, 2014 and the PIC is rated for AS 350 (B2, B3+, B3e) .
2. The aircraft was operating within the performance limitation as per its Flight Manual. The weight and centre of gravity were within the prescribed limits prior to the take-off from Kathmandu.
3. The helicopter was airworthy and fit to fly.
4. The aircraft was maintained as per the requirements. All maintenance work was found satisfactory and all maintenance records had been maintained properly.
5. Maintenance was carried out on NCAR Part M subpart G 145 approved maintenance organization (CAMMOE) by CAAN.
6. All Manufacturer recommended maintenance task (SB, ASB), and Airworthiness Directives complied on time.
7. There was no evidence of failure of the flight controls, any aircraft's systems, structure, or power-plant prior to the wire strike.
8. The helicopter stroked with the neutral wire of NEA high tension line and subsequently detached its parts.

9. There was no evidence of any medical condition adversely affecting the PIC's performance and judgment during the flight.
10. The weather condition at the accident site was fair at the time of the accident.
11. The helicopter had been collapsed totally with severe burn on the body part. The engine was severely dented and partially burnt.

3.2 Contributing Factors

The contributing factors to the accident could be defined as:

1. Passenger distraction
2. Loss of situational awareness
3. Cumulative fatigue
4. Personality traits
5. Lack of wire avoidance training
6. Lack of obstacle maker at crash site

3.3 Probable Cause

At the end of the investigation the Commission reached to the conclusion that *the most probable cause of this accident was hitting neutral wire of high tension line of NEA by main rotor and tail rotor of the helicopter and losing directional control; subsequently breakdown of dynamic components which resulted helicopter became uncontrolled and hit on sloppy mountain terrain.*

4. Safety Recommendations

The Accident Investigation Commission recommends the following safety recommendations to help prevent similar accidents in the future.

4.1 Mountain Helicopters

1. The operators should develop a system so that all the operation of the helicopter is under the surveillance of company's operation department.
2. The operator should ensure all the captains shall properly remain in communication with the aircraft operation department by other means of communication while operating outside the VHF range.
3. The operator should install tracker device on all helicopters.
4. The operator shall ensure the proper briefing to crews before flight particularly when flying towards the area which is more hazardous and weather is critical.
5. The Operator shall conduct Wire Strike Avoidance Training to all crews to fly safely in the wire and obstruction environment.
6. Helicopter company shall ensure that all the passengers are positively identified and verified by any kind of IDs before boarding and the proper passengers are onboard.

4.2 CAAN

1. CAAN shall ensure helicopters are maintaining 500ft. AGL during flight. Low flying should be discouraged/ restricted.
2. CAAN shall monitor strictly the implementation of flying hour limitation as per requirements.
3. CAAN shall introduce personality traits test (psychological profiling) to all crews as a part of routine medical checkup.
4. CAAN shall develop a requirement for wire strike avoidance training.
5. As the servo transparency phenomenon occurs particularly to AS350 series helicopter, CAAN should issue awareness information to concerned operators and pilots.
6. CAAN should coordinate with NEA to install marking in high tension wire as per ICAO Annex 14, Chapter 6.

4.3 NEA

- 1 As per ICAO Annex 14, Chapter 6, NEA should install markers on high tension lines at intervals and warning lights on any sufficiently high transmission towers.
- 2 NEA should make available all the data/ information/ coordinates of High tension lines to CAAN, whenever these lines cross the river, valleys and major highways.