GOVERNMENT OF NEPAL
AIRCRAFT ACCIDENT INVESTIGATION COMMISSION, 2014

FINAL REPORT ON THE ACCIDENT INVESTIGATION OF 9N-ABB TWIN OTTER (DHC6/300) AIRCRAFT OWNED AND OPERATED BY--NEPAL AIRLINES CORPORATION AT DIHIDANDA, MASINALEK ARGHAKHANCHI DISTRICT, NEPAL ON 16 FEBRUARY 2014

[FINAL REPORT]

SUBMITTED BY
Commission For The Accident Investigation

To
The Government of Nepal
Ministry of Culture, Tourism and Civil Aviation
25/08/2014 (2071/05/09 B.S.)

FOREWORD

This Final Report on the accident (on 16 February 2014, at Dihidanda, Masinalek, Arghakhanchi District of Nepal) of the Scheduled Flight of Nepal Airlines Corporation 9N-ABB, Twin Otter (DHC6/300) aircraft has been prepared by the Aircraft Accident Investigation Commission constituted by the Government of Nepal, Ministry of Culture, Tourism and Civil Aviation (on 17 February 2014), in accordance with Annex 13 to the Convention on International Civil Aviation and Civil Aviation (Accident Investigation) Rules, 2024 B.S. to identify the probable cause of the accident and suggest remedial measures so as to prevent the recurrence of such accidents in future.

The Commission carried out thorough investigation and extensive analysis of the available information and evidences, statements and interviews with concerned persons, study of reports, records and documents etc.

The Commission had submitted an interim safety recommendation as immediate remedial measure. The Commission in its final report presented safety recommendations to be implemented by the Ministry of Culture, Tourism and Civil Aviation, Civil Aviation Authority of Nepal and Nepal Airlines Corporation respectively.

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Former Director General
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Singh Durbar, Kathmandu

Expert to the Commission

1. Dr. Khagenda Shresth, Aeromedical Expert
2. Mr. Suman Kumar Regmi, Senior Divisional Meteorologist, Department of Hydrology & Meteorology

Date: 2014/08/25 (2071/05/09)

Abbreviations used in this report are as follows:

AFIS : Aerodrome Flight Information Service
AIP : Aeronautical Information Publication
AMSL : Above Mean Sea Level
ARP : Aerodrome Reference Point
ATC : Air Traffic Controller
ATSO : Air Traffic Service Officer
CAAN : Civil Aviation Authority of Nepal
C of A : Certificate of Airworthiness
COM : Communication
CRM : Crew Resource Management
CVR : Cockpit Voice Recorder
DME : Distance Measuring Equipment
DHC-6/300: De Havilland Twin Otter 300 Series
ENR : En-route
ETA : Estimated Time of Arrival
ETD : Estimated Time of Departure
F/O : First Officer
FOR : Flight Operation Requirements
HF : High Frequency
ICAO : International Civil Aviation Organization
IFR : Instrument Flight Rules
KM : Kilometer
LH : Left Hand
LMC : Last Minute Change
LT : Local Time
NM : Nautical Mile
NAC : Nepal Airlines Corporation
OAT : Outside Air Temperature
PIC : Pilot-in-Command
PIREP : Pilot Report
PROP : Propeller
QNH : Pressure Setting to Indicate Elevation above Mean Sea Level
RH : Right Hand
RWY : Runway
SOP : Standard Operating Procedures
STOL : Short Take Off and Landing
UTC : Universal Coordinated Time
VFR : Visual Flight Rules
VHF : Very High Frequency
VMC : Visual Meteorological Conditions
VNPK/PKR: Pokhara Airport
VNJS/JMO : Jomsom Airport
VOR : Very High Frequency Omni directional Radio Range

TABLE OF CONTENTS

APPENDICES

FINAL REPORT ON THE ACCIDENT OF NEPAL AIRLINES CORPORATION'S 9N-ABB (DHC6/300) TWIN OTTER AIRCRAFT AT DIHI DANDA, ARGHAKHANCHI DISTRICT ON 16 FEBRUARY 2014

SYNOPSIS

On 16 Feb. 2014 (2070-11-4 B.S.) The Twin Otter aircraft (DHC-6/300), 9N-ABB, owned and operated by Nepal Airlines Corporation (NAC) was on scheduled flight from Kathmandu to Jumla. The flight was scheduled for technical landing i.e. for refueling purpose at Pokhara Airport. After refueling, the aircraft departed Pokhara at 0658 UTC (12:43 LT) for destination Jumla airport. Since few days back weather over the country was deteriorated due to western disturbance. Jumla weather though not favorable in the morning, later in the afternoon it was improved and reported VFR.

Upon leaving Pokhara Control Zone, PIC realized that the direct track was not possible due weather and decided to proceed via South. During the flight pilots were experiencing uncomfortable flying environment due to unfavorable weather condition. In course of avoiding weather pilots had to fly up and down and changing the heading. Finally being unable to penetrate the weather ahead PIC decided to divert to Bhairahawa, the nearest airport. During this endeavor to come out of the weather and in an attempt to divert to Bhairahawa, the PIC did not take into consideration the surrounding terrain and continued descent turning right. The aircraft initially slashed a small tree and finally hit the sloppy ridge with the huge impact. Due to the heavy impact the left wing was first disintegrated and then the front part of the aircraft toppled over beyond the ridge with several subsequent impacts.

Search and Rescue was not possible on that day due to bad weather. Crashed aircraft was located next day. All 18 persons on board were found dead. Aircraft was completely damaged and wreckages were scattered around 2 kilometers over and beyond the hill.

The Government of Nepal, Ministry of Culture, Tourism and Civil Aviation formed a four member Aircraft Accident Investigation Commission on 17 February 2014 to probe into the circumstances and probable cause of the accident for the purpose of preventing reoccurrence of similar accident in future and enhancing flight safety.

The Commission carried out thorough investigation and extensive analysis. The methodologies adopted were site visits, interviews with concerned persons, study of reports, records and documents etc. CVR readout provided a vivid picture of the flying environment encountered by the pilots and the actual circumstances before the crash.

After detailed investigation and thorough analysis of the circumstances and evidences, the Commission has determined that the most probable causes of the accident is the

"Losing situational awareness on the part of PIC while flying into instrument meteorological weather condition to the extent of collision with terrain."

The contributing factors to the occurrence are;

- Deteriorated weather associated with western disturbance, unstable in nature and embedded CB.

- Inappropriate and insufficient crew coordination while changing course of action,

The Commission after evaluating the accident scenario, analysis of available primary information and discussion with Director General, Civil Aviation Authority of Nepal and Managing Director Nepal Airlines issued an interim safety recommendation as an immediate remedial measure.

The Commission in its draft final report presented safety recommendations to be implemented by the Ministry of Culture, Tourism and Civil Aviation, the Department of Hydrology and Meteorology, the Civil Aviation Authority of Nepal and the Nepal Airlines Corporation respectively.

The Commission acquired the services of Dr. Khagendra Bahadur Shrestha, Aero medical expert for the Medical and Human Factors aspects and Mr. Suman Kumar Regmi, Divisional Meteorologist, Department of Hydrology and Meteorology for the meteorological aspects. The Commission also acquired information regarding the characteristic weather pattern over and along the flight path followed by the crashed aircraft from the National Atmospheric Resource And Environmental Research Laboratory (NARERL), Central Department of Physics, Tribhuvan University.

In course of the investigation the Commission was in contact with Mr. Earl Chapmann, the accredited representative of Canada as a State of Manufacturer for the aircraft and Engine, according to ICAO Annex 13, Section 5.2.4.

Similarly, the Commission also consulted with the experts from Air Accident Investigation Bureau, London during their visit to Kathmandu.

1. Factual Information

1.1 History of the Flight

On 16 February 2014, the Twin Otter (DHC6/300) aircraft with registration number 9N-ABB, owned and operated by Nepal Airlines Corporation (NAC), departed Kathmandu at 0610 UTC (1155 LT) on its schedule flight to Jumla carrying 18 persons on board including 3 crews. Detailed sectors to be covered by the flight No. RA 183/718 was Kathmandu–Pokhara–Jumla-Nepalganj (Night stop). Flight from Kathmandu to Pokhara completed in normal condition. After 17 minutes on ground at Pokhara airport and refueling 9N-ABB departed Pokhara at 0658 for Jumla. The details of the unfortunate flight as submitted to the Pokhara Civil Aviation Office, was as follows:

Aerodrome of Departure: Pokhara	**EOBT:** 0645 UTC	**Destination Aerodrome:** Jumla
Altitude: 10500ft	**Total Estimated Elapse Time:** 0100 hour	**1st Alternate Aerodrome:** Nepalgunj
2nd Alternate: Surkhet	**Endurance**: 02:30 HRS	**PIC**: Capt. Shankar Shrestha
Equipments: SD/N	**POB**: TBN	**Flight Rule:** VFR

After Jumla flight, the aircraft was scheduled to Night stop at Nepalgunj. Next day it was to do a series of shuttle flights from Nepalgunj.

Prevailing westerly weather had a severe impact on most of the domestic flights since last two days. A.M.E. of Engineering Department of NAC who had performed D.I. of 9N ABB had mentioned in his written report to the Commission that he had reminded the diversion of Bhojpur flight of NAC due weather and asked the Captain whether he had weather briefing of the Western Nepal or not. In response to the AME's query the Captain had replied casually that- "weather is moving from west to east and now west is improving".

Pilots behavior was reported normal by the ground staffs of Kathmandu and Pokhara airports prior to the commencement of flight on that day. All the pre and post departure procedure of the flight were completed in normal manner. Before departure to Jumla from Pokhara, Pilots obtained Jumla and Bhairahawa weather and seems to be encouraged with VFR Weather at both stations. However, they were unable to make proper assessment of en route weather.

PIC decided to remain south of track to avoid the terrain and weather. CVR read out revealed that pilots were aware and concerned about the icing conditions due to low outside air temperature.

After around 25 minutes, probably maneuvering to avoid weather, the PIC instructed the co-pilot to plan a route further south of their position, to fly through the Dang valley. The copilot selected Dang in the GPS, on a bearing of 283°, and determined the required altitude was 8500ft. He then raised concerns that the aircraft may not have enough fuel to reach the planned destination. Approximately two and a half minutes before the accident, the PIC initiated a descent, and the copilot advised against this.

As per CVR read out, last heading recorded by copilot, approximately one minute before the crash, was 280. The last one minute was a very critical phase of the flight during which PIC said I am entering (perhaps inside the cloud). At that time copilot called Bhairahawa Tower on his own and got latest Bhairahawa weather. While copilot was transmitting its last position report to Bhairahawa Control Tower (approximately 25 miles from Bhairahawa), PIC interrupted and declared to divert Bhairahawa. Bhairahawa Control Tower wanted the pilots to confirm their present position. But crews were very much occupied and copilot said STANDBY. Just few seconds before crash copilot had told PIC not to descend. Copilot also suggested PIC in two occassions - sir don't turn. Very unfortunately aircraft was crashed.

The geographical reference of the crash site is as given below:

N 27 deg 54’43’’ Latitude
E 83 deg 06’ 56" Longitude
Elevation: 7190 feet AMSL

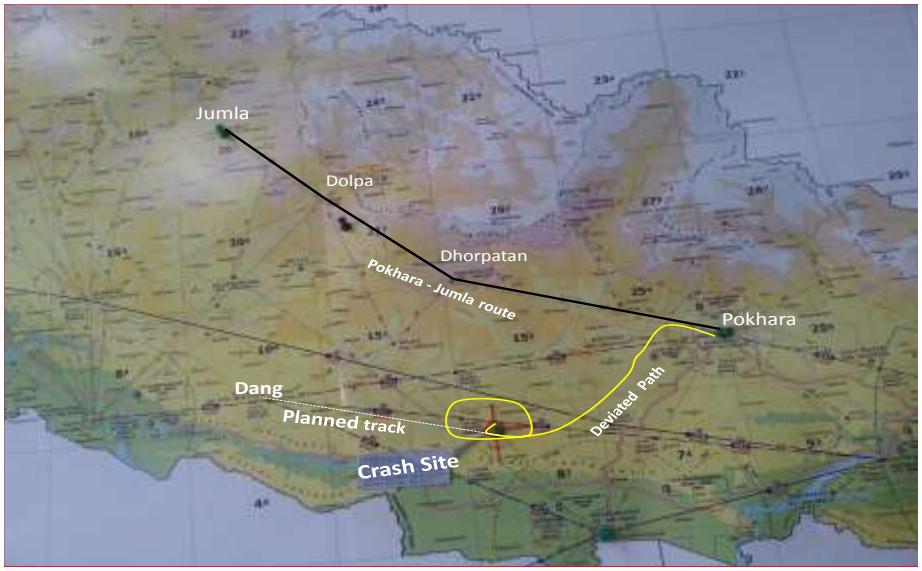


Fig 1: Flight Path and crash site

1.2 Injuries to Persons

Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	3	14+1	-
Serious	-	-	-
Minor/None	-	-	-

The descriptions of injuries of the individual bodies are given in Appendix.

Total No. of persons onboard aircraft	Nepali Adult	Nepali Infant	Foreigner	Crew (Cockpit+Cabin)
18	13	1	1	3

1.3 Damage to Aircraft

The aircraft was totally damaged and disintegrated. Some parts were completely burnt. Left wing and some parts were found in the west of the ridge whereas most of the aircraft parts were found scattered in pieces beyond the ridge.

1.4 Other Damage:

No damage to outside people and structures.

1.5 Personnel Information

1.5.1 Pilot-in Command (PIC)

Age	:	49 years
Gender	:	Male
Date of Birth	:	23 October 1964
License Issued by	:	CAAN
Commercial Pilot License	:	ATPL No 194 valid till January 2014
Aircraft Rating	:	DHC-6/300
Instrument Rating	:	N/A valid to
Previous accident or incident	:	one pole strike at Simikot airstrip
Limitation or Restriction	:	Nil
In-service training/courses	**:**	

Crew Resource Management Training	- 26 Feb. 2013
Dangerous Goods Regulation Training	- 18 Apr. 2013
Aviation Language Proficiency Level & Validity Level 4	- 31 Oct. 2013
Recurrent Ground Refresher Training	- Oct. 2013
Emergency Evacuation Training	- 15 Dec. 2013
DHC – 6/300 Refresher Training	- 20 Dec. 2013
Instrument Procedure Training	- 14-16 Jan. 2014
Route Check	- 25 Jan. 2014
Pilot Proficiency with Instrument Check (PPC)	- 27 Jan. 2014
Simulator Training	- Jan. 2014
Pilot Proficiency without Instrument Check (PPC)	- 24 Aug. 2014

Total hours flown	:	8373:05 hours 8131 hours
Total hours flown as P1	:	5176:00:
Flight hours in 3 months	:	251 hours
Flight hours in 30 days	:	43:40 hours
Flight hours in 7 days	:	7:40 hours
Flight hours in 24 hours	:	Nil
Total flight hours same day	:	50 minutes
Medical Certificate	:	Jan 2014 valid till Jan 2015
Limitation, Restriction	:	Nil

1.5.2. Copilot

Age	:	28 years
Gender	:	Male
Date of Birth	:	15 January 1086
License Issued by	:	CAAN
Commercial Pilot License	:	CPL No 344 valid till 30.06.2014
Aircraft Rating	:	DHC-6/300
Instrument Rating	:	N/A valid to

Previous accident or incident	:	Nil
Limitation or Restriction	:	Glass for distance
In-service training/courses	**:**	
	Simulator Training	- 24 Jan. 2012
	Emergency Evacuation Training	- 26 Jan. 2012
	Recurrent Ground Refresher Training	- 26 Dec. 2012
	Route Check	- 25 Jun. 2013
	Pilot Proficiency without Instrument Check (PPC) :	- 27 Jun. 2013
	Crew Resources Management Training	- 04 Mar. 2013
	Dangerous Goods Regulation Training	- 15 Aug. 2013
	Emergency Evacuation Training	- 15 Dec. 2013
	DHC6/300 Refresher Training	- 20 Dec. 2013
	Pilot Proficiency with Instrument Check (PPC)	- 14 Jan. 2014
	Aviation Language Proficiency Level & Validity (ALPLV) 6 level	- 28 Nov. 2013
Total hour flown	:	365:35 flying hours by May 2013
Flight hours in 3 months	:	43:40
Flight hours in 30 days	:	11:35
Flight hours in 7 days	:	0
Flight hours in 24 hours	:	0

As per latest medical report, he is medically fit to fly.

1.6 Aircraft Information

1.6.1 General

The Twin Otter (DHC-6 series 300) 9N-ABB aircraft is an all metal, high wing monoplane semi-monocoque aircraft which has two wing mounted turbo shaft free turbines, each driving a three bladed, Hartzell HC-B3TN-3D metal reversible pitch, fully feathering propeller.

The aircraft carries a pilot, copilot and up to 20 passengers depending upon the seat configuration. It has installed crew oxygen system.

1.6.2 Airframe System

The flight controls are conventionally operated through pulley and cable systems and mechanical linkage by a control column, control wheel and rudder pedals. The ailerons lower with the wing flaps and their degree of movement increases proportionately with flap deflection. The ailerons move deferentially at any flap position. The left elevator, rudder and left aileron are equipped with flight

adjustable trim tabs, and the right elevator with a trim tab that is interconnected with the flaps. A geared tab is installed on each aileron and on the rudder.

Wing flaps consists of inboard and outboard for flaps and an inboard trailing flap on each wing. Wing flaps are operated hydraulically by an actuator in the cabin roof through a system of push pull rods, levers and bell cranks within a range of 0-37.5°.

The landing gear is a non-retractable type and comprises two main landing gear units and a nose landing gear.

The nose wheel is steerable by a steering lever over a range of 60° to the left and right of centre position.

The main landing gear wheels are equipped with hydraulically operated disc brakes which are applied independently by brake pedals integral with rudder pedals. A parking brake handle retains the brakes in the on condition when the pedals are depressed.

Hydraulic system operates wing flaps, nose wheel steering, and wheel brakes. This system has an electric motor driven pump, emergency hand pump, reservoir, accumulators etc.

Its fuel system is contained in a forward and aft fuselage tank located in the lower fuselage beneath the cabin floor. The fuel is delivered by booster pumps to the engine. Each tank contains two booster pumps. A fuel quantity indicating system of the capacitance type provides an accurate indication of the fuel level in each tank. It has stand by booster pumps for emergency operation. It has low level caution light system at 75 lb fuel remaining for forward tank and 110 lb fuel remaining for the aft tank.

This aircraft was equipped with windshield wiper system. This aircraft had no any other ice and rain protection system except Pitot tube heating.

1.6.3 Power Plant System

The power plant consists of two PT6A-27 engines, each mounted in a wing nacelle. Each engine has two independent turbines, one driving the engine compressor, fuel pump and accessory gearbox, and the other driving the propeller through a reduction gearing. A starter generator and a gas generator tachometer are mounted on the accessory gear box; Retractable intake deflectors for ice and

snow protection are installed in the engine air inlet ducts (in this aircraft this system was fixed in retracted position and electrically isolated permanently.).

The engine/propeller/fuel controls are mounted in the overhead console in the flight compartment and comprise power levers, propeller levers and engine fuel levers. Friction control knobs for the power and propeller levers are also located immediately aft of their respective levers.

Each engine fuel control system mainly comprises: (a) an engine driven fuel pump; (b) a fuel control unit which determines the proper fuel schedule for engine steady state operation and acceleration in response to power lever selection; (c) fourteen fuel nozzles through which fuel is delivered to the combustion chamber, (d) a fuel shut off valve which controls fuel delivering to the fuel manifold and is operated by the fuel lever. Control of the fuel control system is affected by pulley and cable systems which connect the power lever and fuel lever to the fuel control unit and fuel shut off valve respectively.

The starting system for each engine consists of a starter generator, a start switch (common to both engines) and two starter relays. When the dc master switch is on and the start switch is selected for the required engine, power is supplied to the starter generator, which rotates the gas generator turbine at sufficient speed to provide engine light up. When light up occurs and the engine has accelerated to idle speed and the switch is released, the starter relays de-energise the starter circuit.

Engine instruments are located on the engine instrument panel to the right of pilot's flight instrument panel. Each set comprises: (a) oil pressure indicator (b) torque indicator (c) oil temperature indicator (d) propeller rpm indicator (e) turbine temperature indicator (f) gas generator indicator and (g) fuel flow indicator.

Propeller has a pitch range of -15° (reverse) to + 87° (feather) and a low pitch setting of +17°. Beta range which is from +17° in the forward thrust range to -15° in the reverse thrust range is controllable by power lever. At idle the propeller blade angles are at approximately +11° at a gas generator speed of 51% rpm and propeller speed of 44% rpm when the power lever is retarded, beta control commences at approximately 75% rpm gas generator speed.

A propeller lever/power lever interlock mechanism is installed to prevent movement of the power levers beyond the idle stop if both propeller levers are

positioned at less than 91% propeller rpm. Individual operation of either propeller lever above 91% rpm disengages the interlock lever.

An automatic propeller feathering system is incorporated which automatically feathers the propeller of an under powered engine when a decrease in torque to 13-11psi is detected.

1.6.4 Airframe Information

Operator	**: Nepal Airlines Corporation**
Owner	: Nepal Airlines Corporation
Manufacturer	: De Havilland Canada
Model/Type	: DHC6-300
Type of flight	: VFR/IFR
A/C MSN	: 302
Year of manufacture	: June 1971
Number and type of engines	: 2 (Two)
Total Times since New	: 43947 Hrs
Total Cycles since New	: 74217 cycles
Initial Issue of Certificate of Registration (C of R)	: 02/08/1999
Validity Date of Certificate of Airworthiness (C of A)	: 28/04/2014
Validity Date or Radio Mobile Licence (RML)	: 28/04/2014
Validity of Maintenance Release Certificate	: 43961FH or 13 /03/2014, whichever is earlier.

1.6.5 Engine Information

Manufacturer	**:**	**Pratt and Whitney, Canada**
Model/Type	:	PT6A-27
Number of Engine	:	2(Two)
Engine Serial Number	:	Port : PC-E 40287 Stbd : PC-E50001
Engine Total hours/cycles since New	:	Port : 31735/53412 Stbd : 8807 /9077
Engine Hours/Cycle since Overhaul	:	Port : 3864 /6718 Stbd : 367 /637

1.6.6 Propeller Information

Manufacturer	:	Hartzell
Model/Type	:	HC-B3TN-3D/T10282
Propeller Serial Number	:	Port : BUA21844 Stbd : BUA21296
Time since Overhaul	:	Port : 2869 Stbd :2570

1.6.7 Maintenance History

This aircraft has undergone standard maintenance as per maintenance programme approved by CAAN.

The aircraft flight log page and aircraft, engine, propeller log books reveal that the maintenance has been carried out at scheduled intervals.

1.7 Meteorological Information

Kathmandu Airport Weather Report (METAR)

METAR	Day & Time in UTC	Weather	Remarks
1135	160550Z	00000KT 3000 DZ FEW015 SCT025 OVC090 09/06 Q1016	
12:05	160620Z	12005KT 2500 DZ FEW015 SCT025 OVC090 09/06 Q1016	
12:35	160650Z	00000KT 3000 DZ FEW015 SCT025 OVC090 10/06 Q1015	
13:05	160720Z	00000KT 4000 DZ FEW015 SCT025 OVC090 10/06 Q1015	
13:35	160750Z	00000KT 4000 DZ FEW015 SCT025 OVC090 11/06 Q1015	

Pokhara Weather

METAR	Day &Time in UTC	Weather	Remarks
11:35	160550Z	26003KT 5000 FEW015 SCT040 BKN070 13/10 Q1016	
12:35	160650Z	09003KT 6000 FEW020 SCT040 BKN070 14/09 Q1016	
13:35	160750Z	09004KT 8000 SCT040 15/09 Q1014	

Bhairahawa Weather

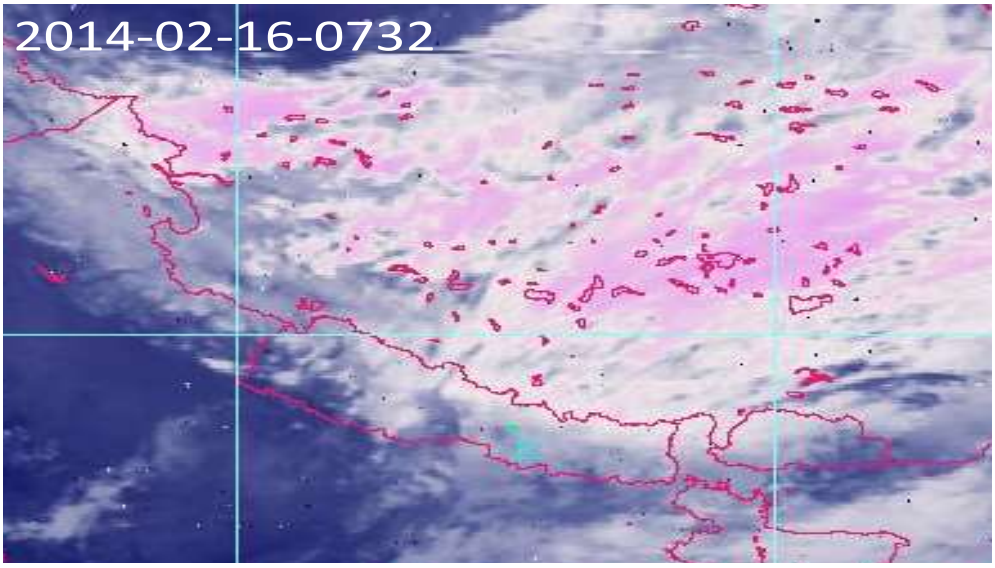
METAR	Day & Time in UTC	Weather	Remark
11:35	160550Z	10003KT 3000 HZ FEW015 SCT030 BKN080 16/14 Q1015	
12:35	160650Z	32002KT 4000 HZ FEW015 SCT030 BKN080 18/14 Q1014	
13:35	160750Z	17006KT 6000 FEW020CB SCT040 20/13 Q1013	CB TO W

Jumla Weather

0130 UTC (07:15 LT)
Visibility Nil, all around covered up airport closed.

0632 UTC (12:17 LT)
Wind calm, visibility 3000 m light snowing, airport closed.

0646 UTC (12:31 LT)
Calm, 7 km, cloud FEW 050, SCT 070, VFR NML



Local weather as stated by the security guard of the telecommunication tower close to accident site was as follows:

- Light rain and hail storm in the morning
- Snowing since around 10:00 AM
- Thunder, dark cloud, all around covered up and visibility was low.

Though the weather at Jumla since the morning was not suitable for flight, by afternoon the weather improved and reported suitable for VFR flights.

The satellite imageries indicated the possibilities of embedded CB cloud development in isolated pocket over crash site. Thus the area of the convective activities might be very limited. The occurrence of hail and thundershowers activities from the early morning supported this fact. Light to moderate turbulence may have occured on the air route between Pokhara–Jumla-Bhairahawa. As per the OLR and cloud temperature analysis, the possibilities of icing can be ruled out on the air crash site or surrounding areas.

1.8 Aids to Navigation

Pokhara airport is equipped with a DME navigation facility. The destination airport Jumla is not equipped with any navigation facility. Jumla is an AFIS airport. There is no navigation equipment installed till and hence no instrument procedure has been established for this airport. Bhairahawa, one of the controlled airport of Nepal has the facility of VOR/DME and instrument approach Procedure.

Pilots were flying entirely based on GPS Navigation that was equipped in the aircraft. But this GPS had not contained the facility of displaying terrain mode. The aircraft was not fitted with weather radar and EGPWS.

1.9 Communications

Pokhara is a controlled Airport. ATC Service is provided within Pokhara Control Zone. Pokhara Control Tower has VHF and HF Communication facility. Besides it has a link with AMHS Network to exchange Aeronautical Information between Pokhara, Kathmandu, Bhairahawa, Nepalganj, Janakpur, Dhangadhi, Simra, Biratnagar and Lukla. Pokhara also has a reliable telephone connection with most of the domestic airports.

After leaving Pokhara Control Zone 9N ABB was provided Flight Information Service by Kathmandu Area Control Centre (ACC) on 124.7 MHZ. At 0721 UTC aircraft reported its position over THARA maintaining 10500 to Kathmandu ACC and informs that it will be changing over to Nepalganj Information. However, one minute after that, cockpit communication between PIC and copilot shows that they were still 15 miles to THARA. Though 9N ABB informed Kathmandu ACC that they will be changing over to Nepalganj Information, they did not call Nepalganj. At 0728 UTC copilot called Bhairahawa Control Tower on VHF requesting

weather Bhairahawa and also provided latest position report. Bhairahawa Control Tower was the last ATS Unit with which 9N ABB made its contact before accident.

Jumla airport is uncontrolled airport. It provides Aerodrome Flight Information Service (flight information and alerting service) to air traffic. The airport Tower is equipped with the communication facilities which include VHF, HF and telephone. There was no reported or known communication difficulty in any of the above mentioned ATS Units.

1.10 Onboard GPS

GPS Information:

Nomenclature	:	GPS 155XL GPS Airborne RNAV System and GNC 300XL GPS Airborne RNAV/ Comm. System
Type/Model/Part No.	:	011-00412-00(GPS 155XL), 011-00433-00 (GNC 300XL)
GPS TSO	:	C129a Class A (1)
Manufacturer	:	Garmin International
Date of installation on 9NABB	:	25 April 2013
Total A/F Hours 25 Apr 2013	:	43068:38
Total A/F Hours 16 feb 2014	:	43947:06

As confirmed by the accredited representative from TSB Canada, Earl Chapman, this model of GPS is an older unit and does not have the ability to store previous track information. As such the commission could not get the help from GPS to find out the actual flying track of the aircraft.

1.11 Airport information

1.11.1 Origin Airport Station

Airport	:	Pokhara Airport (VNPK)
ARP	:	E083058' 54" N 280 12' 00"
Elevation	:	2696ft. AMSl
Runway Designation	:	04/22
Runway Dimension	:	4700ft.X98ft.

Wind Sock	:	Available on both sides of the runway
Landing/take off	:	Both way
Runway Surface	:	Bitumin (Asphalt)

1.11.2 Destination Airport Station

Airport	:	Jumla Airport (VNJL)
Aerodrome Reference Point	:	E0820 11' 23" N290 16' 26"
Elevation	:	7815ft. (2382m) AMSL
Runway Designation	:	09/27
Runway Dimension	:	2200 ft. X 100 ft. (670 X 30m)
Wind Sock	:	Available at o6
Landing/take off	:	Bitumin (Asphalt)
Operation Hours	:	0100 to 1215 UTC
Service	:	AFIS

1.11.3 Airport of intended Diversion:

Airport	:	Gautam Buddha Airport (VNBW)
ARP	:	E083 25'05" N 27 30' 26"
Elevation	:	105m/ 344ft. AMSl
Runway Designation	:	10/28
Runway Dimension	:	1524*30 m
Wind Sock	:	Available on both sides of the runway
Landing/take off	:	Both way
Runway Surface	:	Bitumin (Asphalt)
Approach and Runway Lighting System	:	Avbl
Radio Navigation Aids	:	VOR/DME
Type of ATS service	:	ATC Service, within controlled zone

1.12 Flight Recorder

1.12.1 Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR)

The crashed aircraft was equipped with Fairchild Cockpit Voice Recorder (CVR), part number 93A100 33 and serial number 475; which was installed on

11/02/2014 in rear fuselage of aircraft 9N-ABB. The CVR recovered with its case intact without any significant damage to the content of its tape quality though externally fire had discolored and blackened it. The CVR had almost 30 minutes of audio recording. The aircraft was not equipped with Flight Data Recorder (FDR).

1.13 Impact and Wreckage Information

1.13.1 Impact Information:

The crash site was on the slope of hill. It was mostly rocky with shrubs and few scattered trees. After careful study of the crash site it was found that the first impact had occurred during the maneuvered flight. The aircraft first slashed a small tree and then heading forward in cruising speed hit the ground by the left wing and frontal part almost head on producing very high impact force. Then the aircraft toppled over the other side of the ridge encountering several subsequent impacts on both side of the hill. One of the tips of the propeller blade found to have penetrated and stuck deep inside the ground near the impact area.

The occupants all sustained fatal injuries consistent with the aircraft impacting the ground at high speed. The accident was not survivable. In some distal part of limbs were fractured and in few they were missing.

1.13.2 Wreckage Information:

On site observation carried out by the investigation commission reveals that the wreckage of the aircraft were in scattered condition. It can be well estimated that, after the first impact subsequent several impacts caused the disintegration of different aircraft parts were found scattered beyond the ridge. Some parts were not burnt where as other parts were completely burnt such as emergency locator transmitter, cabin sidewall furnishings, seat coverings, passenger belongings and aircraft documents including manuals. The wreckage were scattered around 2 kilometers. The distribution of the wreckage is illustrated in the symbolic diagram given in appendix.

1.14 Medical and Pathological Information

Both pilots were in good health and did not have any disease or illness. They did not have any significant physical or psychological problems in the history. There was no obvious incident or event that could degrade their performance like stress,

fatigue, lack of sleep or food, mishap, etc. Their regular medical examinations were normal and accordingly certified.

A proper toxicological examination was not practicable.

1.15 Survival Aspects

The accident was not survivable.

1.16 Fire

There was a post crash fire probably from the ignition of spilled fuel. The clothes and bodies of only seven were charred and superficially burnt. The fire must have been extinguished by the rain and snow. The flight crew did not have any burn.

There were no soot particles in the tracheobronchial trees of the charred bodies confirming the post crash fire.

1.17 Tests and Research

The commission carried out the detail investigation of accident scenario along with the interview with the local people, related personnel, examination of all the technical logs and documents etc. The commission explored with the accredited representative about the possibility of GPS data tracking. In the response of the commission's query, the accredited representative replied that the Model of GPS installed in the aircraft was very old and it does not have the ability to store previous track information. So the analysis of GPS data could not be carried out.

The Commission also acquired information regarding the characteristic weather pattern along the flight path followed by the crashed aircraft from the National Atmospheric resource and environmental research laboratory (NARERL), Central Department of Physics, Tribhuvan University.

1.18 Organization and Management Information

1.18.1 Nepal Airlines Corporation (NAC)

The Nepal Airlines Corporation (NAC) is a Government owned Company established in 1 July 1958 under Nepal Airlines Corporation Act. It is a national flag carrier which provides domestic as well as international air services with the aircraft fleet such as DHC-6 Twin Otter (2) and Boeing 757, 200 (2). The process

of fleet expansion by Airbus 319 (2 narrow body) is in progress. Similarly, organization is also in process to acquire four Y12E and two MA 60 aircraft.

Among two MA60 aircraft NAC has recently acquired an MA60 Aircraft but it has not yet entered into commercial service. There is shortage of pilot and engineers required for the operation of Airbus, Y12 AND MA60.

In course of discussion with higher executives of Nepal Airlines, it is observed that the airline has prepared a plan to train and develop required manpower to address the considerable expansion of its fleet within a short period. After two consecutive accidents in domestic sector, top management found to be very much committed to reform the existing situation. Consequently some initiatives have been taken in safety enhancement specially in the evaluation of cockpit crew by monitoring the pilots behavior, adherence to SOP, and performance of individual pilots. STOL clearance procedure has been reviewed and updated. Result of the engineering Audit was also encouraging as findings are significantly reduced. However, a lack of data mainly due to the poor reporting culture and the absence of hazard identification and risk management in the regular basis had resulted in an ineffective safety management system.

1.19 Search and Rescue (SAR) Operation

Based on the Log book of RCC (Rescue Coordination Centre) Details of Search and Rescue operation conducted after the aircraft reported missing is as follows:

16 Feb 2014	
UTC Time	**ACTIONS/ EVENTS**
0728	9N-ABB last contact with Bhairahawa Tower. Position 25 miles from Bhairahawa.
0800	RCC Activated. Information about the missing aircraft was informed to all concerned including Nepal Army, Nepal Police and Nepal Airlines
0858	9N AKA, a Fish Tail Air helicopter which departed Nepalganj at 0852 for Kathmandu was requested for search
	RCC requested Nepal Army to mobilize their helicopter for Search and Rescue of 9N ABB.
	Passenger Manifest was received. Among 18 persons on board including one infant, one foreign passenger identified.
0917	A big sound was reported to be heard around Khidim of Arghakhanchi
0927	9N AKA could not proceed to the suspected area due to heavy rain
1000	Fire was observed by the local people South East of Sandhikhark message received by Bhirawa Tower.

1005	RAN 45 (helicopter) departed for search rescue around Sandhikhark area but diverted to Pokhara due weather (thunder rain). On ground Pokhara at 1031.
1130	RAN 45 Pokhara to Bhairahawa for SAR purpose. On ground at Triveni due weather.
1220	A local lady reported by cell phone the accident site is in Khidim about 1 hour 30 minutes walking distance from her position
1250	As per the lady, local people who tried to precede the crash site returned back due to darkness and bad weather. Weather of the site was continuous rain and hail throughout the day.
17 Feb 2014	
	Rescue Helicopters were ready since early in the morning (04:55 LT). Army Ground Search Team were also moved towards suspected area early in the morning.
0134 UTC	RAN 45 departed Saljandi for SAR Operation. Search concentrated around 25 miles of Bharahawa between 340 to 020 Radial from Bhairahawa.
0156	9N AKF (helicopter) departed Kathmandu for SAR
0203	60 army personnel mobilized for ground search
0234	A local person reported by his cell phone 9807553578 crashed aircraft is found in Mashine Lek, Khanchikot near NCEL Tower. The condition of the aircraft is burnt and destroyed.
0255	RAN 45 which departed THADA Barrek at 0238 reported Bhairahawa Tower, crash site located. Elevation 7340, approximate coordinates 27 55 N 083 07 E. Khanchikot, Arghakhanchi district.
	By 0928 LT RAN 45, 9NAKF and RAN 53 (MI 17) were near crash site for Rescue Operation. Later RAN 38 also departed Chhauni Army Hospital at 0439 UTC for crash site
	7 to 8 feet snow at crash site
	All 18 dead body were collected and they were identifiable. 40 army personnel were mobilized in the crash site.
0700 UTC	All dead bodies were collected at Sandhikhark barrek through sling operation.
0905	CVR of 9N ABB collected.
0945	All dead bodies (corpses) dispatched to Hospital and RCC closed

Though the Search Operation of the missing aircraft was hampered on the first day due to bad weather, on the following morning the crashed aircraft was located by the search helicopter. Active participation and exemplary cooperation extended by the different parties involved in search and rescue operation was appreciable.

1.20 Accident Site Visit

The members of the Commission visited the accident site at Dihidanda, Masinalek and spent whole day to collect the available evidence and information regarding the accident. The accident site was in a difficult terrain with stiff slope. It took more than an hour to reach the crash site from the helipad. The Commission had physically examined the tree which the aircraft had first hit, then the first impact point on the sloppy terrain, where one of the propeller blade of the left wing had penetrated deep inside the terrain. Distance from the tree and the impact point was around 40 feet. The crashed aircraft is found to have toppled over beyond the ridge after the impact. Apart from the left wing and few other parts, most of the aircraft parts were scattered 2 kilometers down slope beyond the ridge.

1.21 Interview and Statements

No local eye witness was found for the interview. The security guards of the nearby telecommunication tower were interviewed. On duty security guard at the time of accident mentioned that the weather was pretty bad on that day with continuous rain and hail since morning. He heard a big sound but could not venture to come outside and see what had happened because of the extreme weather condition and being alone. Statement of the Nepal Airlines Domestic flight Operation Chief (Deputy Director), Domestic Chief Pilot, Dispatchers, AMEs, marketing staffs, duty officers of Pokhara and Jumla Tower and Nepal airlines on duty staffs of Pokhara airport were collected.

From the organization side, the responsible key officials like: Engineering Director, Flight Safety/QA Director, Operations Director, Deputy Directors of Flight Safety and Quality Assurance of NAC were interviewed with questionnaires. The commission had also conducted meeting and interaction with the Director General of CAAN, Managing Director NAC, and concerned officials of CAAN.

2. Analysis

2.1 Introduction

The analysis of the events which led to the accident began with the careful scrutiny of the factors such as technical defects, unlawful interference, explosions, pilot incapacitation, and lack of training/qualification/experience which could have contributed to the accident.

The primary cause and contributory factors to this accident derived from the analysis of the facts and evidences gathered in this context are narrated hereunder.

2.2 Methodology

In order to determine the situation and probable cause of the accident of 9N- the following methodology was employed:

2.3 CVR Readout

The Commission had successfully copied the cockpit conversation and analyzed from different angle. The CVR record was found very helpful in analyzing the cockpit scenario before and during the last phase of accident.

2.4 Study and Analysis of Log Books, Records, Documents and Manuals

Airframe, engine and aircraft technical log books were reviewed and examined to assess any discrepancy and malfunctioning of the aircraft wheel and brake system. Operations Manual, Flight Safety Manual, Aircraft Flight Manual, Standard Operating Procedure, Pilot records were checked and reviewed. CAAN approved FOR, NCAR, AOCR, AIP were also reviewed. Similarly, the relevant documents were reviewed and discussed with concerned personnel.

2.5 Observation and Analysis

2.5.1 Analysis of CVR information:

Following are the crucial parts of cockpit communication which provide the actual flying environment :

- PIC decided to conduct the flight via South of direct track due weather.
- PIC was aware of icing possibilities and hazardous weather.

- Copilot was not acknowledging properly to PIC (it was observed 15 times). Cause may be his disagreement in the PIC's decision and action.
- Aircraft climbed up to 10500 with OAT minus 6 degree Celsius. PIC instructed copilot to take a look for possible icing.
- PIC ultimately descended to the outside atmospheric condition of zero degree temperature. PIC expressing sense of relief (being out of icing condition).
- In one occasion, copilot commented that the track was worst.
- In another occasion, copilot was suggesting in line with PIC's intention to proceed ahead at any cost penetrating the bad weather ahead.
- Some of the PIC's words indicated that he was not aware of his position, may be because of unfavorable weather conditions.
- Perhaps copilot had assessed the hazardous weather condition, so called Bhairahawa for latest weather without consulting PIC.
- Copilot was monitoring the flight instruments and reminding PIC not to descend and not to turn.
- Approximately one minute after the PIC declared entering the cloud; he reacted abruptly and declared to divert Bhairahawa.
- When aircraft started descend from 8500 to crash altitude is not available in cockpit communication.
- The last heading recorded in CVR read out was 280.
- From pilots communication it can be assumed that weather was not good. However, there is no indication of aircraft performance impaired by the weather phenomena.
- Approximately 70 seconds after the heading 280, PIC declared to divert.
- After 35 seconds of declaring diversion CVR went blank.

2.5.2 Human Factor and Latent unsafe Conditions:

2.5.2.1 Pilots

Copilot was with Nepal Airline Corporation since almost last 5 years, though Captain has joined NAC only 2 years before. This team has done many trips together. This flight was a usual routine flight. They were no strangers or unknown to each other. However, the communication between Captain and Copilot was found not optimal and not in accordance with the rule and practice. Copilot does not acknowledge the captain’s information, or instruction in several occasions. Copilot seemed to be unconcerned and Captain not authoritative,

especially when the latter needed feedback and advice from non flying copilot as they were facing problem with weather, and concerned about icing.

2.5.2.2 Crew Resource Management (CRM) and Team Work

A. Failed to Brief at Crucial Moment:

In the initial phases of flight the PIC was conscious and briefing to the copilot on his intended action to proceed via south of track, level to climb, temperature and possibility of icing. The PIC briefed copilot on climbing to 10500 FT AMSL, OAT being - 6 degree Celsius and again descend to 8500, where temperature called out by PIC was zero degree and out of icing possibility. The noticeable fact here was the absence of PIC's briefing before leaving 8500 to lower level. Copilot also could not object strongly but just told PIC not to descend in feeble voice. Copilot was also helping PIC in maintenance of heading by saying not to turn. The flight at the particular time of accident was being conducted below VFR minima and into the cloud.

B. Crew Coordination and Team work:

The team work between the crew could not be considered satisfactory. It got worse when PIC Started descending from 8500 to lower level without briefing to Copilot and copilot did not resist the PIC to descend at that particular time. However he was functioning as a pilot monitoring and making PIC aware by expressing ("do not turn" and "do not descend"), but the aircraft has descended down to crash altitude approx. 7190 ft. from 8500 ft.

2.5.2.3 Failure of Leadership:

Though the PIC seemed to be confident and showing the quality of leadership in the initial phase of flight, but in later phase his presence of mind about his position and dilemma in actions did not display good leadership.

2.5.2.4 Weather (Environmental Factors):

Though the reported weather since morning was not suitable for VFR flights, by afternoon the weather was on improving trend in the airports in western Nepal. Satellite pictures provided by the Department of Hydrology and Meteorology also has shown the intensity of clouds being thinner. In spite of the adverse weather conditions, pilots were continuing the flight. There was no pressure from the management or from any passenger or any situation. The weather has definitely

affected the flying environment and has negatively contributed to efficiency of pilot on decision making.

2.5.3 Terrain and Altitude:

The aircraft descended from 8500 ft. to lower altitude without the pilots having sufficient knowledge about the terrain.

2.5.4 On Board Equipment:

The aircraft was equipped with VOR/DME receiver and GPS for navigation purposes. The GPS had no capability to display the terrain mode. The aircraft was not equipped with weather radar and GPWS.

2.5.5 Company Procedure & SOP

A. Operation in Bad Weather

Company Operation Manual explains about various conditions of meteorological phenomena which affect smooth flight operation. The Standard Operating Procedure (SOP) for DHC-6/300 Twin Otter aircraft warns that operation in known or forecast icing conditions is strictly prohibited unless the aircraft is equipped with the appropriate de-icing equipment. It further warns that even light icing can be hazardous.

B. Role of Dispatchers

Dispatch officers are properly trained and hold license as per regulation. Company's dispatch policy is reflected in the SOP whereas actual company practice is quite different from the SOP. Though the responsibility of the Dispatchers in the safe flight operation is highlighted in the SOP, their role is ignored in actual practice.

2.5.6 ATS Procedure:

ATC instructions were all normal and standard. However, in certain circumstances pilots were not reporting properly their positions and waypoints to concerned ATS units. Besides, level changes were also not reported to the ATS units properly.

2.6 Review Analysis

Various probable factors which could have contributed to the accident were reviewed and analyzed. Each of them is explained categorically. These factors have been reviewed separately and either accepted or ruled out accordingly.

2.6.1 Mechanical Failure:

After careful study of wreckage and the conversation between pilot and copilot in the recorded CVR, the possibility of mechanical failure of airframe and engine systems including structure is not observed. Even in the last phase of flight and just before impact also the failure of any system is not talked between pilots. The crash site geometry situation also does not support the occurrence of mechanical failure. So mechanical failure of airframe and engine system cannot be established and hence this possibility is ruled out.

2.6.2 Other Technical Problem of the Ageing Aircraft

Company has fulfilled all maintenance required for ageing aircraft, such as wing change, CPCP equivalent and structural inspection and so on.

2.6.3 Lightening Strike:

This is related to physical damage to the aircraft and its structure by the sudden act of lightening. After on spot study of wreckage we could not notice any substantial evidence of damage, burn spot and scoring at aircraft surface. Moreover the conversation between pilots at recorded CVR also does not give any indication of lightening strike.

2.6.4 Icing of Airframe:

Design wise there was no system capable to indicate and protect against eventual condition of ice formation on aircraft vital surfaces. Recorded CVR gives indication that both the pilots were aware of the possibility of icing by entering into icing environment and going beyond the flight manual and SOP procedure was quite unwanted. However the actual adverse effect on maneuvering capability of the aircraft was not noticeably experienced and talked between pilots and hence impairment & effect by the icing on the aircraft surfaces during that crucial flight is ruled out.

2.6.5 Icing of Engines:

Normally icing affects the performance of the engines. This will be indicated by vital engine parameters. CVR read out reveals that even during the last phase of flight, parameter fluctuation and power degradation was not noticed, experienced and talked between pilots. The impact site situation also does not indicate the possibility of engine failures, fall or sudden direction change. Hence the icing of engine is ruled out.

2.6.6 Weather Impact:

Available weather report, satellite imagery and numerical simulation of the weather data indicates that definitely the weather along the flight path of 9N ABB was not good. Even though the worst weather conditions like thunder, turbulence, wind shear, down draft/up draft and icing condition was anticipated. CVR read out does not demonstrate any indication of aircraft performance impaired by weather phenomena. Cockpit communication between PIC and copilot was going on smoothly and normally. There was no sign of panic, nervousness and stress in pilots. The aircraft was under the complete control of pilots even up to the last minute. This proves that the weather was not the cause of the occurrence and it was just the contributory factor.

2.6.7 Aircraft Weight

The regulated landing weight of DHC 6/300 Twin Otter aircraft is 12300 pounds. In the context of the present accident when the load sheet/trim sheet checked it was found out to be less than the maximum regulated landing weight. This indicates that aircraft was operated within the regulated landing weight limitation. So, the reason of weight factor could not be the cause of this accident.

2.6.8 Pilot Incapacitation and Pilot Cross Control

CVR read out revealed that the pilots were capable and there was no indication of cross control activities till the impact. As such the pilot incapacitation and pilot cross control is no longer an issue in relation to this accident.

2.6.9 Experience of PIC

The pilots were experienced to fly in Nepal. Captain has accumulated more than 8000 flying hours in Nepalese topography. The instructor pilot from Tara air and NAC has cleared Captain Shankar Shrestha in each STOL airfield in accordance

with FOR of CAAN. In this case, insufficient experience of PIC may be ruled out. However, procedure undertaken by PIC and the final decision taken in this flight were inappropriate.

2.6.10 Unlawful Interference and Explosives

Study of the crash site and minute examination of wreckage reveals that no explosive detonation was responsible for this tragic event. Additionally the cockpit voice recorder conversation does not indicate the presence of any unlawful interference.

3. Conclusion

3.1 Findings

1. The pilots were certified and qualified in accordance with the existing Nepalese aviation regulations. Both the pilot and copilot were in normal health condition and were certified as fit to fly.
2. The crew had adequate rest and the duty times within the accepted guidelines.
3. The aircraft was maintained as per the existing rules and regulation. Pre-impact failure and other mechanical malfunction were also not found.
4. There was no evidence of engine failure before impact.
5. CVR was found in good condition and all the cockpit conversation was recorded.
6. The GPS installed was of old model and it does not have capability of storing previous track data.
7. The 9N-ABB had departed Kathmandu to Pokhara (where technical landing for refueling was planned) even when the weather at destination airport Jumla was below VFR Minima.
8. Pilots encountered unfavorable enroute weather in the direct track deviated to South with the way points aiming JULIET and THARA.

9. PIC had penetrated the visible moisture without having proper anti-icing and De-icing facility equipped in aircraft in violation to SOP as well as flight manual of DHC 6 – 300.
10. Aircraft climbed up to 10500 ft with OAT -06 degrees Celsius and again went down to 8500 ft whereby they ultimately encountered zero degree temperature i.e. without icing conditions.
11. PIC found to be focused on completing the mission in spite of adverse weather.
12. PIC did not brief copilot on descending from 8500 ft to the lower level. Copilot had suggested PIC not to descend but did not insist. Insistence on that particular time was very necessary.
13. While descending to altitude lower than 8500 ft and maneuvering to get out of the adverse weather, 9N-ABB was flying inside the visible moisture with no in-flight visibility.
14. PIC had started losing his situational awareness as a result of which, he inadvertently started descent making turns. Copilot, now monitoring, was suggesting again to PIC not to descend and not to make turn.
15. While initiating turn the aircraft was on north easterly heading, initially slashed a small tree and then hit the sloppy ridge with the huge impact.
16. Based on the evident it was concluded that nature of accident was a 'Controlled Flight into Terrain'.
17. Serious lacking in crew coordination especially in the last critical part of the flight. PIC's faulty decision, inability on the part of copilot to strongly intervene the PIC's wrong action led to the catastrophic accident.
18. Company's Dispatch Policy as reflected in DHC6 SOP is not implemented properly.
19. From pilots communication it can be assumed that weather was not good. However, there is no indication of aircraft performance impaired by the weather phenomena.

3.2 Causes

After detail investigation and thorough analysis of the circumstances and evidences, the Commission has determined that the most probable causes of the accident is the

"Losing situational awareness on the part of PIC while flying into instrument meteorological weather condition to the extent of Collision with terrain."

The contributing factors to the occurrence are;

- Deteriorated weather associated with western disturbance, unstable in nature and embedded CB.

- Inappropriate and insufficient crew coordination while changing course of action,

4. Safety Recommendations

4.1. Interim Safety Recommendation:

During the initial phase of investigation the commission has forwarded interim safety recommendation to the concerned (Directed to all airlines companies) to strengthen safety taking into consideration of the accident scenario which would prevent the reoccurrence of such accident as follows:

"Operators shall immediately develop and implement an appropriate surveillance mechanism to ensure the effective monitoring of the flying behaviors of the pilots and their adherence to SOP including the violation of the VFR rules."

4.2. Safety Recommendations

As a result of thorough investigation of the accident, the Commission has made the following safety recommendations directed to the concerned organizations.

A. Recommendations to the Government of Nepal, Ministry of Culture, Tourism and Civil Aviation (MoCTCA)

MoCTCA should establish an independent and effective aircraft accident investigation mechanism with the provision of adequate resources under the Ministry of Culture, Tourism and Civil Aviation (MoCTCA) for the effective

investigations and also for the continuous monitoring of the implementation and compliance-status of remedial safety measures.

B. Recommendation to the Department of Hydrology and Meteorology

Department of Hydrology and Meteorology in coordination with CAAN should develop a mechanism to obtain the weather data not only of the airport stations but also from other parts of the country for the information and analysis of en-route weather.

C. Recommendations to the Civil Aviation Authority of Nepal (CAAN)

1. CAAN should further strengthen its surveillance and monitoring function focusing on the critical safety areas including violation of SOP, proper application of CRM, CFIT, and ensure effective enforcement mechanism by collecting information on flight operation activities on daily basis.

2. CAAN should ensure that all fleets operated by AOC holders are equipped with the appropriate Terrain Awareness Warning System (TAWS) in accordance with the provisions of Annex 6.

3. CAAN in coordination with Department of Hydrology and Meteorology should develop a mechanism to obtain the real time weather data not only of the airport stations but also from other parts of the country for the information and analysis of en-route weather.

4. Encourage airlines to install onboard aircraft equipment that will help for real time tracking of the aircraft in flight.

D. Recommendations to the Nepal Airlines Corporation (NAC)

1. NAC should review and strengthen the training requirements on Crew Resource Managements (ground and in flight), with special attention to the importance of close coordination and cooperation between PIC and Copilot and also emphasizing the situations requiring interventions from copilot.

2. In view of the significant fleet expansion in process, NAC should systematically identify the hazards, changes in system, operational environment and consequential safety risk especially in the process of recruitment and training of the operational and engineering personnel.

3. NAC should enhance the flight dispatcher's capability to enable them to fulfill their responsibility as per the provisions of company SOP.
4. NAC should develop special program and policy for the prevention of CFIT accidents.
5. NAC should review and further strengthen the effective implementation of SMS process especially in the areas of improved reporting system, hazard identification and risk mitigation.

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