



सत्यमेव जयते

FINAL INVESTIGATION REPORT
ON
ACCIDENT INVOLVING CESSNA 172 R AIRCRAFT VT-CAF
OPERATED BY M/S CHIMES AVIATION ACADEMY
AT DHANA ON 3RD JANUARY 2020.

AIRCRAFT ACCIDENT INVESTIGATION BUREAU
MINISTRY OF CIVIL AVIATION
GOVERNMENT OF INDIA

FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an accident shall be the prevention of accidents and incidents and not to apportion blame or liability. The investigation conducted in accordance with the provisions of above said rules shall be separate from any judicial or administrative proceedings to apportion blame or liability.

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examination of various components. Consequently, the use of this report for any purpose other than for the prevention of future accidents or incidents could lead to erroneous interpretations.

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GLOSSARY	
AAIB	Aircraft Accident Investigation Bureau, India
ACS	Air Safety Circulars
Ad_PRaT	Target Value of common Rail Fuel Pressure
Ad_DC	Integral Part of the Rail Pressure Regulator
AGL	Above Ground Level
AIP	Aeronautical Information Publication
ALT	Altitude
AMSL	Above Mean Sea Level
ARC	Airworthiness Review Certificate
ATC	Air Traffic Control
ATS	Air Traffic Services
C of A	Certificate of Airworthiness
CAA	Chimes Aviation Academy
CAR	Civil Aviation Requirements
CFI	Chief Flight Instructor
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
DGCA	Directorate General of Civil Aviation
ECU	Engine Control Unit
ELT	Emergency Location Transmitter
ETA	Estimated Time of Arrival
FADEC	Full Authority Digital Engine Control
FI	Flight Instructor
FOB	Flying Order Book
FRP	Fiber Reinforced Polymers
FRTOL	Flight Radio Telephone Operators License
FTO	Flying Training Organization
GND	Ground
HDG	Heading
Hrs	Hours
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organization
IST	Indian Standard Time
LAT	Latitude
Load	Load Lever Position
LONG	Longitude
MAP	Manifold Air Pressure
MFD	Multi Function Display
MSL	Mean Sea Level
NLG	Nose Landing Gear
NM	Nautical Miles
PFD	Primary Flight Display
PIC	Pilot In Command
Pbaro	Barometric Pressure
POH	Pilot Operating Handbook
Poil	Engine Oil Pressure
Prail	Common Rail Fuel Pressure
PPL	Private Pilot License
RA	Radio Altitude
Revs	Engine Speed
SB	Service Bulletin
SOP	Standard Operating Procedure

SPD	Speed
SPL	Student Pilot License
Tair	Turbo Charger Air Temperature
Tgear	Gear Oil Temperature
TH2O	Coolant Water Temperature
Toil	Oil Temperature
TPM	Training and Procedure Manual
UTC	Coordinated Universal Time
Vbatt	FADEC Supply voltage
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

**FINAL INVESTIGATION REPORT ON ACCIDENT AT DHANA
ON 3RD JAN 2020 INVOLVING CESSNA 172 R AIRCRAFT VT-CAF OPERATED
BY CHIMES AVIATION ACADEMY**

- | | | | | |
|-----|-------------------------------|--------------------|---|--|
| 1. | Aircraft | Type | : | Cessna 172 R |
| | | Nationality | : | Indian |
| | | Registration | : | VT-CAF |
| 2. | Owner | | : | M/s Chimes Aviation Pvt. Ltd. |
| 3. | Operator | | : | M/s Chimes Aviation Academy |
| 4. | Pilot | | : | CPL Holder |
| | | Extent of Injuries | : | Fatal |
| 5. | Co- Pilot | | : | SPL Holder |
| | | Extent of Injuries | : | Fatal |
| 6. | No. of Persons on board | | : | 02 |
| 7. | Date & Time of Accident | | : | 3 rd Jan 2020, 1545 UTC |
| 8. | Place of Accident | | : | East of Dhana Aerodrome |
| 9. | Co-ordinates of Accident Site | | : | Lat. : 23°45'23" N
Long. : 78°51'25" E. |
| 10. | Last point of Departure | | : | Dhana Aerodrome |
| 11. | Intended landing place | | : | Dhana Aerodrome |
| 12. | Type of Operation | | : | Night Cross Country Training Flight |
| 13. | Phase of operation | | : | Landing |
| 14. | Type of Accident | | : | Controlled Flight into Terrain |

(All the timings in this report are in UTC unless otherwise specified)

SYNOPSIS

On 3rd Jan 2020, Cessna 172 R aircraft VT-CAF operated by M/s Chimes Aviation Academy met with an accident near Dhana Aerodrome at District Sagar, Madhya Pradesh while carrying out a cross country night flying training on sector Dhana - Mahoba - Dhana.

The training flight was under supervision of a Flying Instructor holding valid ratings with more than 4000 Hrs of flying experience. Student Pilot had 177:50 Hrs of flying experience and was qualified to operate the said flight.

Aircraft took off from Dhana at about 1330 UTC in visibility below 5 Km. Due to fog, the visibility kept reducing as night progressed. The aircraft reported its position at regular intervals and was cautioned of dropping visibility at Dhana while on the return leg. Aircraft was also advised to divert to Bhopal. The aircraft attempted to land on runway 35 but carried out a missed approach. Aircraft was again advised to divert to Bhopal but Flight Instructor informed that he will make an attempt for runway 17. Few minutes later the aircraft crashed on east side of runway outside periphery of Dhana Aerodrome.

Director General, AAIB appointed Sh. Jasbir Singh Larhga, Deputy Director, AAIB as Investigator – In – Charge & Sh. Amit Kumar, Safety Investigator Officer, AAIB as Investigator to investigate into the probable cause(s) of the accident, vide Order No. INV.11011/1/2020-AAIB dated 6th Jan 2020 under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017.

1 FACTUAL INFORMATION

1.1 HISTORY OF THE FLIGHT

On 3rd Jan 2020, routine flying training exercises were being carried out at Dhana Aerodrome by M/s Chimes Aviation Academy (CAA). A total of 39 training flights for the day were authorized as per the record available in the Flight Authorisation Book and flying commenced at 0430 UTC (1000 IST).

Cessna 172-R aircraft with registration VT-CAF was to operate three cross country flights on that day and was released for flight after satisfactory pre-flight inspection by an authorized AME. All three flights were to be operated by the same Flight Instructor. Two Cross Country Flights (Instrument Flying) were planned for one trainee and one 120NM Night Cross Country Flight (Dhana-Mahoba-Dhana) was planned for another trainee.

VT-CAF took-off for first flight at 0720 UTC and landed back at 0920 UTC. The second flight by VT-CAF took-off at 0950 UTC and landed back at 1130 UTC. No abnormality or defect was reported during any of these flights. At about 1315 UTC visibility was observed to be dropping and all solo flights were cancelled. However, VT-CAF continued for 120 NM Night Cross Country Flight as dual pilot flight with instructor on board were permitted as per Training and Procedures Manual (TPM).

The Flight Instructor had undergone Breath Analyser (BA) test at 0418 UTC before operating first flight of his day and Student Pilot underwent BA test at 1239 UTC before proceeding for the cross-country flight. As per the statement of personnel manning the ATC tower, Flight Instructor requested start-up permission at about 1320 UTC for 120 NM cross country flight (Dhana-Mahoba-Dhana) and got airborne at about 1330 UTC after getting permission.

The personnel manning ATC stated that the aircraft reported its position/location while at 20NM, 40NM, 60NM, 80NM out bound of Dhana and similarly reported its position/location while inbound Dhana at regular intervals as required by procedures. While aircraft was at 32NM, ATC personnel at Dhana noticed that visibility was reducing and hence advised VT-CAF to expedite its arrival. When VT-CAF reported its position at 10NM inbound to Dhana, ATC personnel informed VT-CAF to expect diversion to Bhopal due to reduced visibility.

ATC personnel, advised VT-CAF to divert to Bhopal as Dhana was not suitable for landing because of poor visibility but Flight Instructor replied that he will try an approach for Runway 35. Sometime later, VT-CAF reported its position at 3NM on finals to Runway 35. ATC personnel acknowledged the same. Thereafter, aircraft was noticed by ATC personnel flying along the left edge of Runway 35 at a height of about 300 feet and going around. Due to near zero visibility, personnel present in ATC tower were not able to see the aircraft after it passed the ATC tower. VT-CAF was again advised to divert to Bhopal, but Flight Instructor replied that he will try an approach for Runway 17.

There was no contact with the aircraft thereafter. The ATC personnel stated to have obtained weather from Bhopal over telephone. The visibility at Bhopal was reported to be 2000 m. When no contact could be made with VT-CAF for some time, ATC personnel also contacted Bhopal to check if aircraft was in its contact.

Sometime later, ATC personnel and other instructors in ATC tower observed that ambulance and crash crew team were rushing out. On enquiry, they were informed that VT-CAF had crashed outside aerodrome periphery.

1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Others
Fatal	02	NIL	NIL
Serious	NIL	NIL	NIL
Minor/-None	NIL	NIL	NIL

1.3 DAMAGE TO AIRCRAFT

The aircraft was destroyed due to impact.



Figure 1: Aircraft wreckage

Nose Section of the aircraft was severely damaged. Upper and lower firewall separated at the RH side (Zone 121 and 123). Both upper and lower firewall were found crumbled and ripped at several pieces. The Nose gear was found separated from firewall. Engine cowling was found ripped off from the right side and had separated from the aircraft. Engine got separated from airframe as the tubular members of mount structure got broken at several places.



Figure 2 : Aircraft wreckage viewed from front

Propeller blades were found sheared off from the blade root ferrule. FRP Spinner was found ripped open and spinner forward bulkhead had got separated from hub. Spinner rear bulkhead was found deformed and attached to the hub.



Figure 3 : Aircraft Engine

Fuselage suffered major damage. The door was found stuck between RH wing and wing strut as the wing was folded backwards due to broken forward fuselage box beam. RH rear door was found sheared at middle. RH rear attachment point was found sheared from wing. RH strut Lower attach point was found ripped off from fuselage.



Figure 4: Fuselage RH side

RH and LH door windows were found detached. LH door was found fully thrown outside. Forward wind shield was found broken. LH & RH rear wind shield plexi was found totally broken due to deformation of baggage area. Rear windshield was also found totally broken into pieces.



Figure 5 : Fuselage LH Side

Tail cone was found crushed near the attachment point to fuselage. Tail cone was also found buckled at several places. LH tail plane & elevator were found bent upwards from middle. RH tail plane leading edge got partially detached, and tip was found crushed. Fin fairing to dorsal fin was found cracked in the middle.



Figure 6 : Fuselage and Tailcone

A portion of LH wing got sheared off due to impact with the tree. The leading edge was found caved inwards with maximum displacement up to 2.5 feet.

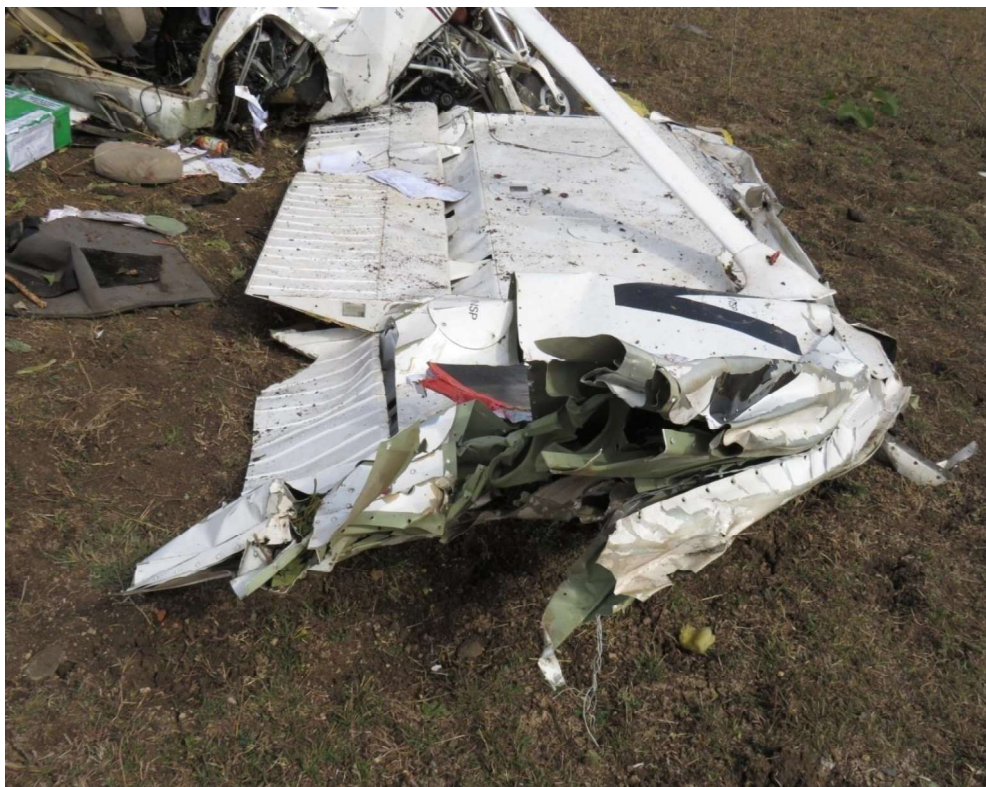


Figure 7: LH Wing

The flaps were found severely buckled. Inboard portion of LH aileron was found ripped and buckled. Outboard portion of aileron attached to the separated piece of wing was also found buckled. The separated portion of wing was retrieved from near the point of impact with the trees.



Figure 8 : LH Wing portion separated due impact with the trees

RH wing was found folded backwards. The wing was bent and curved downwards with a vertical displacement of approximately 3 feet. RH wing tip fairing was found broken and separated from wing structure.



Figure 9 : RH Wing

RH wing Leading edge skin was ripped off. The front spar was found bent towards rear and the leading edge had caved inward approximately 12 inches. The upper strut attachment point was found sheared off. RH Flap and aileron was found attached to wing with severe buckling and cracks.

RH main gear bolt was found sheared. RH main gear wheel assembly along with axle was found separated from the gear spring and was lying about 90 feet away from the main wreckage.



Figure 10 : Wheel Assembly

Both PFD and MFD were totally shattered. Glare shield panel was found cracked into two pieces. Standby instrument panel was found deformed.

1.4 OTHER DAMAGE

The aircraft impacted three trees and hit the ground before coming to rest.



Figure 11: Closer view of trees hit by the aircraft

1.5 PERSONNEL INFORMATION

1.5.1 FLIGHT INSTRUCTOR

Nationality	Indian
Age	58 years
License	PPL, CPL
Date of Issue	08.04.2003
Valid up to	07.04.2023
Date of Class I Med. Exam.	07.09.2019
Class I Medical Valid up to	07.03.2020
Date of issue FRTOL License	02.07.2001
FRTOL License Valid up to	01.07.2023
Endorsements on the aircraft	Cessna 152, Pushpak, Cessna 172R, PA34
Total flying experience	4740:30 Hrs
Total flying experience during last 1 year	544:00 Hrs
Total flying experience during last 6 Months	399:00 Hrs
Total flying experience during last 30 days	109:25 Hrs
Total flying experience during last 07 Days	28:40 Hrs
Total flying experience during last 24 Hours	03:40 Hrs
Rest period before starting flying on 03 Jan 2021	11:00 Hrs

The copy of Flight Instructor's Licensing file was sought from DGCA. DGCA was unable to locate the said file and provided whatever records were available with it to AAIB. The details mentioned in the report are based on information made available by DGCA and CAA.

As per the available records, Pilot had acquired Private Pilot License (Aeroplane) in 1982. He was issued a Commercial Pilot License by DGCA with Cessna 152 endorsement in April 2003. Later, he obtained endorsement for Pushpak aircraft in Nov 2003 and endorsement for Cessna 172R and PA34 aircraft in Aug 2008. He was granted Assistant Flight Instructor's Rating (Aeroplane) by DGCA in 2004 and subsequently in 2006 he was granted Flight Instructor Rating (Aeroplane).

The Flight Instructor joined CAA on 1st April 2019, after having worked in two other Flying Training Organisations. CAA submitted his papers for renewal of IR and

FIR to DGCA vide its letter dated 07 June 2019. After obtaining necessary approvals, he started imparting flying training as a Flying Instructor.

1.5.2 STUDENT PILOT

Nationality	Indian
Age	35 years
License	SPL
Date of Issue	24.11.2016
Valid up to	23.11.2021
Date of Class I Med. Exam.	11.06.2019
Validity of Class I Medical	28.06.2020
Date of issue FRTOL License	06.04.2017
Validity of FRTOL License	05.04.2027
Total flying experience	177:50 Hrs
Total flying experience during last 1 year	87:35 Hrs
Total flying experience during last 6 Months	47:10 Hrs
Total flying experience during last 30 days	11:05 Hrs
Total flying experience during last 07 Days	09:15 Hrs
Total flying experience during last 24 Hours	NIL

Trainee was issued a Student Pilot Licence on 24 Nov 2016 by M/s Chimes Aviation Academy after having met the criteria for issue of SPL laid in Section B of Schedule II of Aircraft Rules, 1937. He was in final phases of his flying training and had clocked 177:50 hrs on the date of accident.

On scrutiny of Student Pilot's Log Book, it was observed that the trainee had 05:30 Hrs of night flying experience at Dhana since 04 Oct 2019 when he was provided Night Flying Familiarisation Training. In his recent flying within 07 days preceding accident, he had carried out three solo 300 NM cross country flights on 28 Dec 2019 on routes Dhana-Chhabra-Guna, Guna- Sehore -Bhopal and Bhopal - Damoh -Dhana. All these training flights were graded as satisfactory by the Flight Instructors in his Flying Trainee's Progress Report.

He had last flown on 30 Dec 2019 wherein he carried out 250 NM cross country training flights on routes Dhana – Chhabra- Guna and Guna – Dhana, with same Flying Instructor as the accident flight.

1.6 AIRCRAFT INFORMATION

1.6.1 AIRCRAFT GENERAL DESCRIPTION

Cessna 172R is a sub 2250 Kg aircraft with high wing, nose mounted single-engine tricycle landing gear and all metal construction. Aircraft is designed for general flying and training purposes. Three view dimensions of the aircraft as per the POH is shown in the figure below: -

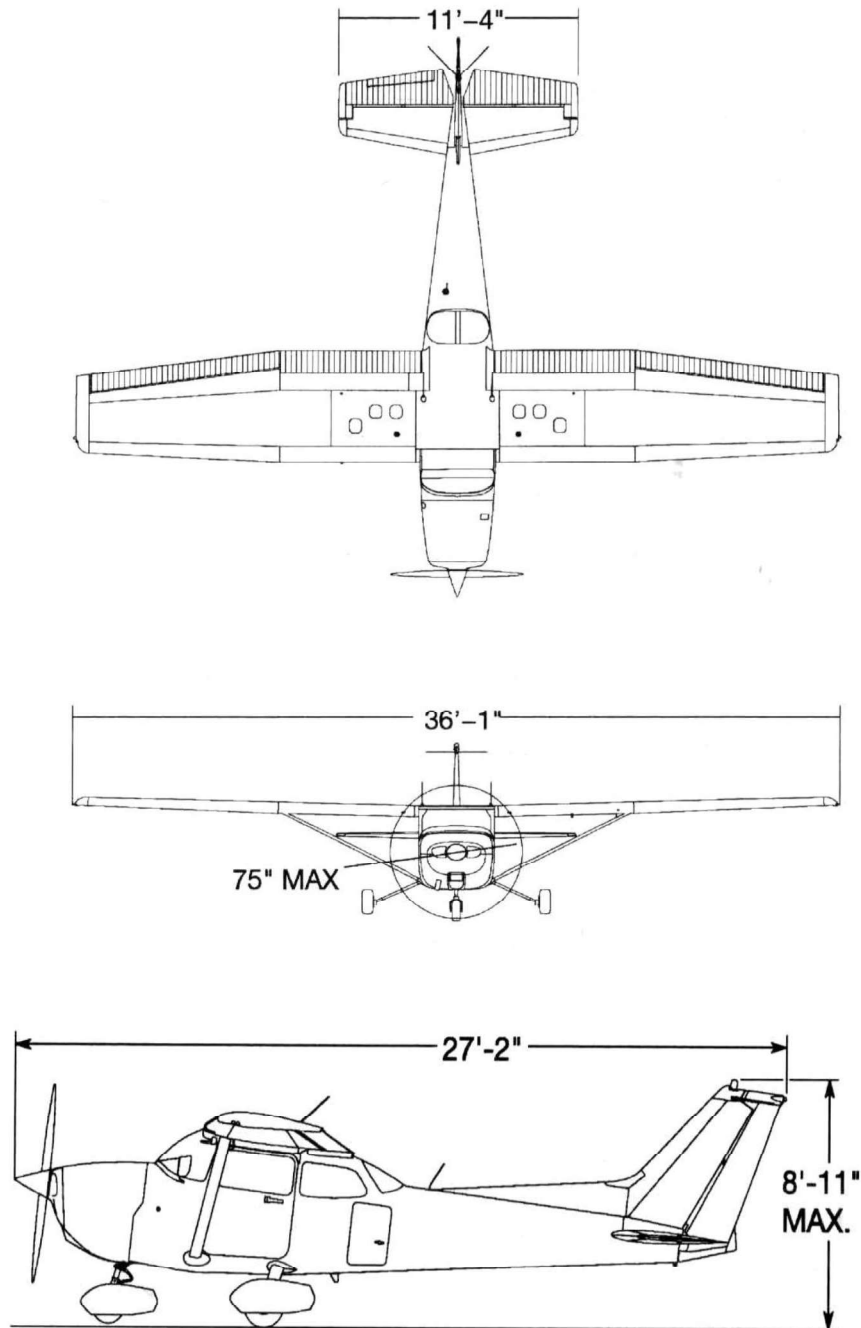


Figure 12: Three view dimensions of the aircraft.

Aircraft is fitted with **Garmin G1000** integrated flight instrument system composed of two display units, one serving as a primary flight display, and one as a multi-function display. G1000 system has a Flight Data Logging feature which automatically store critical flight and engine data on an SD data card (up to 8GB) inserted into the top card slot of the MFD.

The system allows about 1,000 flight hours to be recorded for each 1GB of available space on the SD data card. Data is written to the SD card at a rate of one reading per second while the MFD is powered on. All flight data logged for a specific flight is stored in a file named in a format *log_YYMMDD_XXXX.csv* where XXXX is the airport code. The file is created automatically each time the G1000 system is powered on, as long as an SD card has been inserted. “No Data Card” message is displayed on the system when SD Data Card is not inserted in the slot.

Aircraft is fitted with **TAE 125-02-99** engine manufactured by Technify Motors GmbH. Engine provides Take-off and Maximum continuous power of 99KW at 2300 RPM and has a displacement of 1991 ccm. Engine is liquid cooled in-line four-stroke 4-cylinder motors with DOHC (double overhead camshaft) and is direct diesel injection engines with common-rail technology and turbocharging. Engine uses ATF (JET A-1) but can also be operated using Diesel (DIN EN-590). The propeller is driven by a built-in-gearbox (i=1.69) with mechanical vibration dampening and overload release.

Engine is controlled by a FADEC system and requires an electrical power source for operation. If the main battery and alternator fail, the engine will only operate for a maximum of 30 minutes on FADEC backup battery power. Therefore, it is important to pay attention to indications of alternator failure.

1.6.2 VT-CAF SPECIFIC INFORMATION

Aircraft Model	Cessna 172 R
Aircraft S. No.	17281482
Year of Manufacturer	2007
Name of Owner	M/s Chimes Aviation Pvt Ltd
C of R	Certificate No. 3727 valid on date
C of A	Certificate No. 4036 valid subject to validity of ARC
Category	Normal, Passenger
Last A R C issued on	03.12.2019
ARC valid up to	03.12.2020
Aircraft Empty Weight	832.67 Kg
Maximum Take-off weight	1111.00 Kg
Date of Aircraft weighment	08.11.2014
Max Usable Fuel	134.40 Kg
Max Payload with full fuel	58.93 kg
Empty Weight C. G	101.88 cm Aft of Datum
Total Aircraft Hours	8653:50 Hrs
Last major inspection	Phase 3 - 600 Hrs / 01 year inspection carried out on 04.11.2019.

Engine Type	TMG TAE -125-02-99
Date of Manufacture	07.05.2019
Engine Sl. No.	02-02-04944
Total Engine Hours	354:35 Hrs
Propeller Type	MTV-6-A
Propeller Sl. No	131156
Date of Manufacture	16.12.2013
Total Propeller Hours	5404:20 Hrs

The Aircraft is registered in “Normal” category & Sub Division - “Passenger Aircraft”. The Certificate of Airworthiness (CoA) remains valid subject to validity of Airworthiness Review Certificate (ARC). Last ARC was issued at 8474:45 Hrs on 3rd Dec 2019, by DGCA, Sub Regional office, at Bhopal.

The Aircraft was holding a valid Aero Mobile License No. A-043/007-RLO (NR) at the time of accident. The Aero Mobile license was valid till 31st December 2023. The aircraft was being operated for purpose of flying training under Flying Training Organization Approval No. 4/2015 issued on 19th Oct 2015 and valid up to 20th April 2020.

The aircraft was initially weighed in Aug 2008 as per requirements laid in CAR Section 2, Series X, Part II. Subsequent to modification fitment of TAE 125-02-99 Engine on aircraft, the aircraft was weighed again on 8th November 2014 at Dhana, M.P India and weight schedule was duly approved by the office of Director of Airworthiness, DGCA, Mumbai. As per the approved weight schedule the Empty Weight of the aircraft is 832.67 Kgs and Maximum Take-Off Weight (MTOW) of the aircraft is 1111.00 Kgs. Maximum usable fuel quantity is 134.40 Kgs. Maximum payload with fuel tanks full is 58.93 Kgs. Empty weight CG 101.88 cm aft of datum.

Aircraft had logged 8653:50 hours till the date of accident. Last scheduled inspection carried out on the aircraft was Phase 1 inspection (50 Hours/01 Months) at 8644:35 airframe hours on 30th Dec, 2019. The last CRS (0094-06) was issued on 30th Dec, 2019. The aircraft had logged 09:15 Hrs since last scheduled inspection. Pre-flight inspection was carried out by the Cat B1 AME before the first flight on the day of accident. The aircraft had operated 02 flights and flown for 03:40 Hrs. earlier in the day before the accident flight without any reported snag.

Aircraft was fitted with TAE 125-02-99 Engine (Centurion 2.0). The aircraft engine had logged 954:25 Hrs. since new. Last scheduled inspection carried out on the engine was Phase 1 inspection (50 Hours/01 Months) at 945:10 Hrs airframe hours on 30th Dec, 2019.

All concerned Airworthiness Directives, mandatory Service Bulletins, and DGCA Mandatory Modifications on this aircraft and its engines were complied with as on date of event. The Last DGCA Mandatory Modification complied as per log book entry was DGCA/NEW MISC/10, FAR PART 121.317(b) at 8594:40 Hrs (Airframe) on 21st Dec 2019.

Scrutiny of the Technical Log Book and Pilot Defect Report (PDR) register revealed that there was no pending snag or no deferred maintenance on the aircraft prior to the accident flight. The last PDR entry made in PDR register was of 2nd Dec 2019. The corresponding rectification was done on 3rd Dec 2019.

1.7 METEOROLOGICAL INFORMATION

Bad weather constraints at Dhana Airport as per Para 4.6 (b) of the Training and Procedure Manual is quoted below.

“Dhana is located in central India and experiences moderate weather pattern typical of Indian climatology. Apart from fog in winters and monsoons when flying is partially affected, Dhana generally experiences good weather for the remaining part of the year. When the flying is not possible due to bad weather the time is utilized for conducting additional ground classes and professional videos are screened.”

There is no Airport Meteorological Station or Airport Meteorological Office of Indian Meteorological Department at Dhana Aerodrome. Aerodrome has a weather station which displays the current weather parameters and has ability to keep a log of weather parameters. METAR and weather for neighboring airports or flight area/routes is obtained from IMD's website as per the procedure mentioned in the para 5.17 of the Training and Procedure Manual.

A register is maintained to physically record instantaneous weather measurements from airport weather station which are obtained twice a day at 1000 Hrs and 1800 Hrs local time (IST). Weather parameter recorded in the register on 3rd Jan 2020 are given below.

Time	Wind Direction	Visibility (m)	Weather	Temp (°C)	QNH
0430 UTC (1000 IST)	080°/15 Knots	5000	HZ	22	1018
1230 UTC (1800 IST)	045°/10 Knots	5000	HZ	16	1019

The recorded log of weather station was also obtained. The last recording logged was at 17:37 IST (1207 UTC). The same is tabulated below: -

Parameter	Recorded Value	Parameter	Recorded Value
Indoor Temperature	15° C	Dew Point	10.9° C
Indoor Humidity	74%	Wind Chill	12.1° C
Outdoor Temperature	12.1° C	Wind Direction	38°
Outdoor Humidity	92%	Absolute Pressure	960.1 hPa
Avg. Speed	9.4 Knots	Relative Pressure	1019.5 hPa
Gust Speed	11.9 Knots	Rainfall Intensity	0 mm

The Jabalpur and Bhopal are nearest airports from Dhana. METAR of Bhopal Airport, which was planned as an alternate, was obtained for time period 1330 - 1530 UTC and is placed below.

Bhopal METAR					
Time (UTC)	1330	1400	1430	1500	1530
Wind	030° 03 Knots	040° 06 Knots	040° 04 Knots	050° 06 Knots	030° 05 Knots
Visibility (m)	2000	2000	2000	2000	2000
Weather	HZ	HZ	HZ	HZ	HZ
Clouds	SCT 10000 ft	SCT 10000 ft	SCT 10000 ft	SCT 10000 ft	FEW 10000 ft
Temp (°C)	17	15	15	15	14
Dew Point (°C)	13	14	14	13	12
QNH (hPa)	1017	1017	1018	1018	1018
QFE (hPa)	0956	0956	0956	0956	0956
Trend	NOSIG	NOSIG	NOSIG	NOSIG	NOSIG

The witnesses had stated that very low visibility and dense fog was prevailing during the night around the time of accident. The presence of fog was also observed in the photographs of aircraft taken by a witness on the night of accident shown in the following figures.



Figure 13 : Photo of wreckage taken by a witness during the night after the crash



Figure 14 : Photo of wreckage taken by a witness during the night after the crash

1.8 AIDS TO NAVIGATION

There are no radio navigation aids available at Dhana Aerodrome. The Dhana Aerodrome has got only one runway and is a “Visual Approach Runway” which is equipped with a “Wind Sock” installed near runway 35 side.

1.9 COMMUNICATIONS

Chimes Aviation Academy has set up an ATC tower with two VHF communication set operating on 122.6 MHz frequency. Two handheld sets are also available. Tower was manned by a Student Pilot at the time when VT-CAF took start-up permission and too-off. He was later relieved by a Flight Instructor who remained on RT till the time of accident. Both personnel had valid RTR License.

As per the statement obtained from the personnel manning the tower, VT-CAF was informed about poor visibility/weather and advised to divert to Bhopal three times. After VT-CAF carried a missed approach on Runway 35, it was firmly advised to divert to Bhopal. Flight Instructor informed tower that he will attempt another approach for Runway 17 and did not call or pass any distress signal thereafter. No response was received from VT-CAF to any call from tower either.

Aircraft was not in contact with Mumbai, Bhopal or Khajuraho ATC any time during the flight. The ATC tower at Dhana does not have facility for recording the RT communications. Tower personnel, as per directions from Deputy CFI, had called and obtained weather from Bhopal ATC over telephone. Later Bhopal ATC was again called to enquire if the aircraft was in its contact. These calls were on a recorded line at Bhopal ATC and the timings of the calls were 1547 UTC and 1559 UTC respectively.

1.10 AERODROME INFORMATION

Chimes Aviation Academy is carrying out its operations from Dhana Aerodrome located at District Sagar in Madhya Pradesh. The Aerodrome has been leased to Chimes Aviation Academy on 25 Aug 2007 by the Madhya Pradesh Government under agreement initially for a period of ten years which was later extended for another period of ten years on 21 Aug 2017.

ICAO Location Indicator Code for Dhana Airport is SDDA. It is an uncontrolled Airfield, managed & operated by Chimes Aviation for flying training activities. It has a 3180 ft (969 m) asphalt runway with orientation 17/35. The Airport Co-ordinates are 23°45'14" N, 78°51'21" E. The airport elevation is 1709 feet (521 meters) AMSL.

Airport is equipped with Night Operation facilities, Dhana Runway has electrical lighting system with electrical back -up. Night flying at Dhana has been approved by DGCA. Taxiways, apron and hangar have adequate lighting facility. The details of lighting available on runway and taxi tracks is placed at **Appendix A**.



Figure 15 : Satellite Map of Dhana Aerodrome

Properly lighted signal square with electrically lit landing 'T' and wind sock with electrical ring of lighted bulbs for it to be visible at night is available. Revolving Aerodrome Beacon has been fitted atop the ATC building.

1.11 FLIGHT RECORDERS

VT-CAF was not required to be fitted with Cockpit Voice Recorder (CVR) or Digital Flight Data Recorder (DFDR) as per the prevailing Civil Aviation Requirements. No Cockpit Voice Recorder (CVR) or Digital Flight Data Recorder (DFDR) were available on the aircraft.

However, **Garmin G1000** integrated flight instrument system fitted on the aircraft had Flight Data Logging feature which allowed critical flight and engine data to be recorded at one second interval on an SD data card inserted into the top card slot of the MFD. The SD data card was removed from the wreckage and data was successfully retrieved from the card. The data file containing the accident flight started recording at 13:23:12 UTC indicating that Garmin 1000 was powered at this time. The last recorded reading in the SD card was at 15:44:38 UTC.

The data was used to create flight path followed by aircraft and superimposed on the satellite map. The same is shown in the figure below.

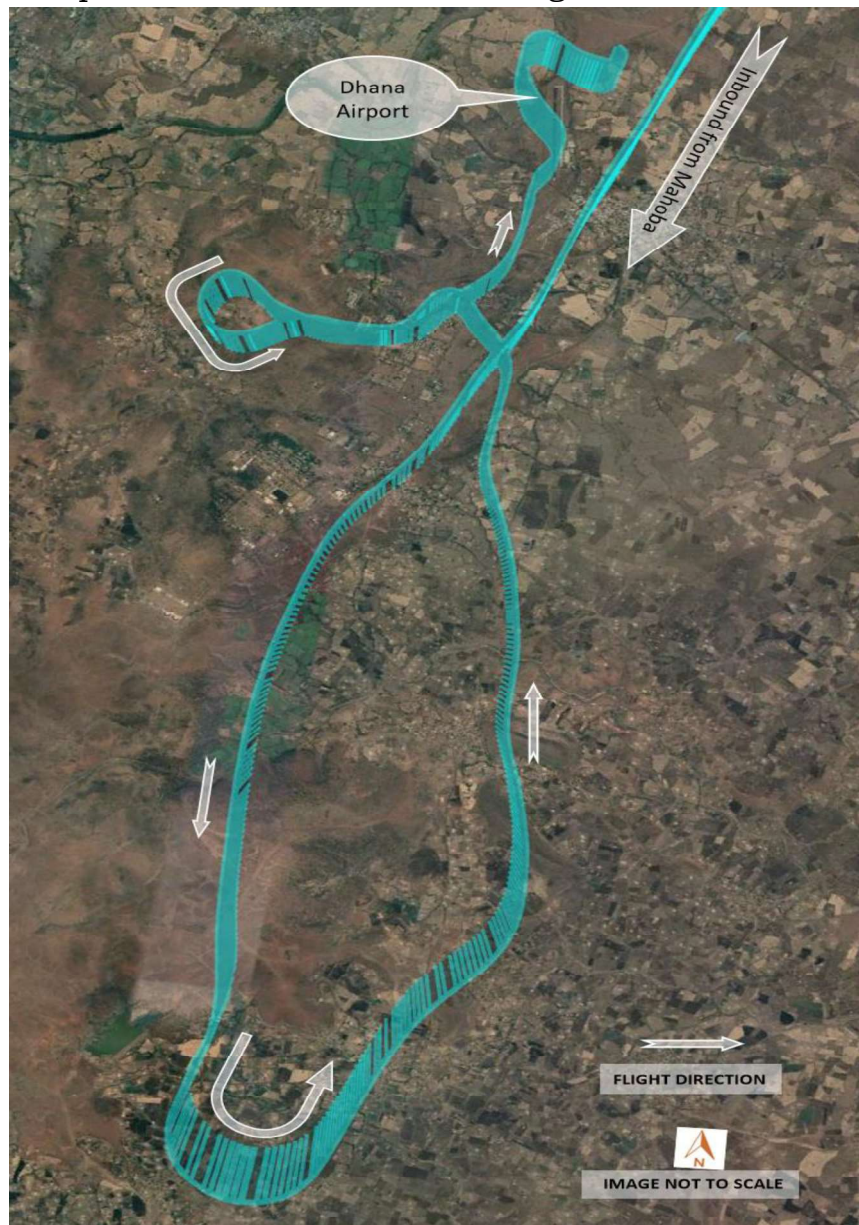


Figure 16 : Flight Path taken by VT-CAF created from Garmin recording

As the aircraft came inbound to Dhana from Mahoba it went about 6 NM south of Dhana Airport before turning back to join approach for Runway 35 at an altitude

of 3500 feet AMSL. At about 4NM aircraft started descend for approach. Aircraft descended to about 2000 feet AMSL but did not stabilize or maintain centre line. At about 1.25 NM the aircraft deviated by more than 90 degrees to left and started climbing again. The aircraft again attempted approach from left of Runway 35 and descended till about 1750 feet AMSL. A missed approach was carried out climbing 2000 feet AMSL.

The aircraft initially turned left of runway and attempted to approach Runway 17 by turning right and descending to 1850 MSL. However, it couldn't align the aircraft to Runway 17 and crossed the runway before again turning left for Runway 17 from east side of runway. The SD Data card did not record any parameter after 15:44:38 UTC indicating that the MFD was powered off. The last recorded position at 15:44:38 UTC was about 450 m away from the crash site.

Some relevant flight parameters recorded on Garmin 1000 at time 15:44:38 UTC when recording stopped is shown in the table below.

Data recorded in Garmin 1000 System at 15:44:38 UTC (21:14:38 IST)									
Alt Baro (ft)	Alt MSL (ft)	IAS (kt)	GND SPD (kt)	Vertical SPD (ft/m)	Pitch (deg)	Roll (deg)	Lateral Acc (G)	Normal Acc (G)	HDG (deg)
1843.6	1795.6	84.96	82.96	-1972.66	-10.32	-33.56	-0.13	0.87	254.5

At the point when Garmin 1000 recording stopped, the aircraft speed was 84.96 kt speed and aircraft was at approximately 86.6 ft altitude in air. Vertical speed (downward) of the aircraft was 1972 ft/min with negative pitch of 10.32 degree and at that time aircraft was tilted toward left with roll value of - 33.56 degree. Negative Roll value indicates left turn and negative pitch indicates nose down.

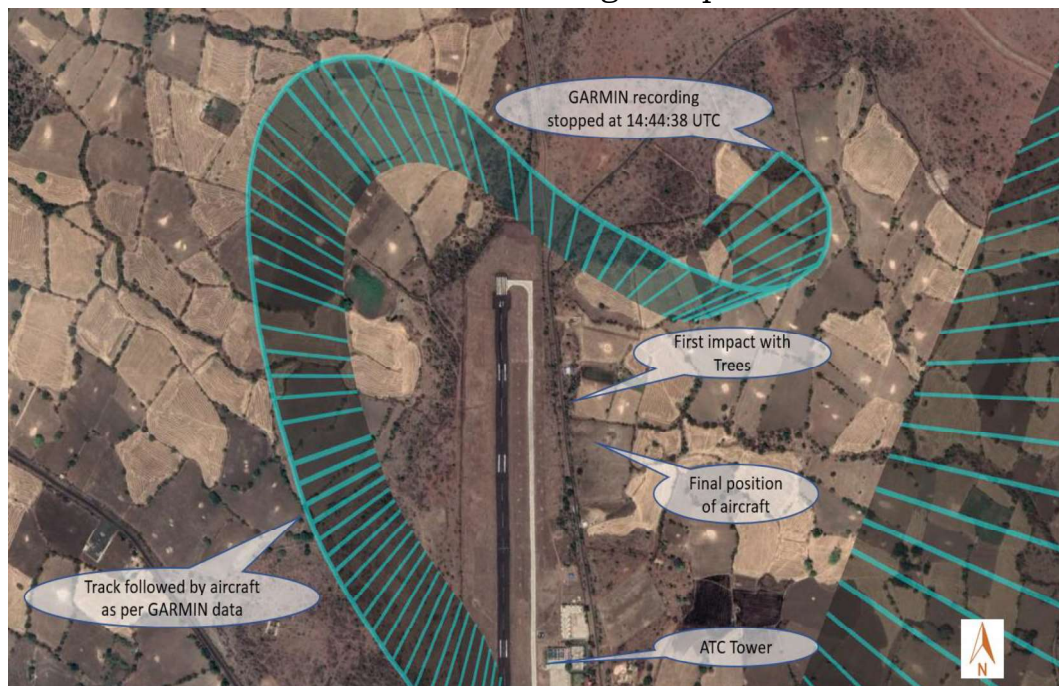


Figure 17 : Final Phase of Flight Path taken by VT-CAF

Data recorded on Garmin 1000 system showed that vertical speed oscillated excessively in the last 10 min of flight. The data also showed excessive oscillation of indicated air speed, altitude and pitch with Air speed reaching stall speed more than

2-3 times. The last recorded value of fuel in LH and RH wing was 11.39 gallon and 8.28 gallon respectively. The figure 17 gives the closer view of flight path after missed approach on Runway 35.

The aircraft was equipped with **TAE 125-02-99** engine which is controlled by a FADEC. The FADEC was recovered from the aircraft wreckage and assistance of OEM was sought to retrieve the data. FADEC has two ECU cards which are equipped with internal clocks. Both clocks are not synchronized to each other or any other source (e.g. GPS). The data from FADEC was downloaded and files named **FADEC_4154_A.xlsx** and **FADEC_4154_B.xlsx** was retrieved. Data from **FADEC_4154_A.xlsx** was used for analysis and corroborated with the data on the Garmin 1000 SD data card with assistance from the OEM. The data recording on FADEC for accident flight started at 13:23:04 UTC, indicating the time when the engine was powered and stopped at 15:45:36 UTC, indicating the time of aircraft impact with the ground. The FADEC data of the flight showed that the engine responded to the power lever inputs (Load) in a normal manner. RPM, MAP and rail pressure were also maintained at normal values. Actual rail pressure (PRail) and target rail pressure (AdPRaTa) did not show much variance. FADEC data did not indicate any engine malfunction. The FADEC kept recording beyond 15:44:38 UTC when the Garmin 1000 stopped recording. Relevant engine parameters recorded at this instance are tabulated below and indicate that the engine was running fine, when Garmin 1000 stopped recording.

Data recorded in FADEC at 15:44:38 UTC (21:14:38 IST)					
Revs [RPM]	Load [mbar]	MAP [°C]	PRail [mbar]	PBaro [mbar]	AdPRaTar[%]
3717	91.3	2106	1136	961	1158

The last recorded engine parameters in the FADEC at 15:45:36 UTC which can be presumed as time of impact with the ground are given below.

Last recorded Data of 15:45:36 UTC (21:15:36 IST) retrieved from FADEC							
Revs [RPM]		Load [mbar]	MAP [°C]	PRail [mbar]	PBaro [mbar]	Ad PRaTar [%]	
3791		96.2	2195	1237	963	1239	

TH2O [°C]	TAir [°C]	Toil [°C]	POil [mbar]	VBatt [V]	Adj_DC_PRaInt [%]	Adjusted Prail valve duty cycle [%]	Tgear Box [°C]
86	50	86	4143	27.9	-0.1	21.7	89

At the time of impact, the Engine RPM, Load & Manifold Absolute Pressure (MAP) indicates that the Engine was running at nearly full power. At the same time Engine Oil Temperature, Oil Pressure & Rail Pressure (For Delivery of Fuel to the injectors & Cylinders) indicate that Engine was running in Good Condition.

Relevant parameters from Garmin and FADEC data were plotted against time and are placed in the **Appendix B**.

1.12 WRECKAGE AND IMPACT INFORMATION

After a missed approach on Runway 35, the aircraft was not visible to the personnel manning the ATC tower. VT-CAF had informed that it will make another attempt for Runway 17. The aircraft did not follow correct procedure for go-around and attempted another landing on Runway 17 after making a sharp right turn towards Runway 17. The aircraft crossed to the east side of runway and again attempted to come on runway 17 making a left turn.

The aircraft impacted a group of trees at a height of about 30 feet on the east side of airfield before impacting the ground. A portion of LH wing sheared and fell near the trees indicating that the initial impact was mainly borne by the LH wing.



Figure 18 : Flight Path taken by VT-CAF

As the aircraft dropped, its RH wing and RH wheel made their first contact with the ground at about 100 feet ahead of the trees. The resulting impact caused the RH wheel to break away and damaged the RH wing causing it to bend.

The aircraft bounced further and its nose hit the ground a little further. The forward momentum caused the aircraft to topple and travel further before coming to rest at about 223 feet from the group of trees that bore the first impact.



Figure 19 : Final resting position of the aircraft

The wreckage was primarily confined to the path, from the point of first impact with the trees to the final resting position. There were no indications of any pre-impact disintegration.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

The crew had undergone pre-flight medical at dedicated facility in Chimes Aviation Academy before departure as per requirement of CAR Section 5, Series F, Part III. The test result was satisfactory for both crew.

The viscera and blood samples were preserved during the post mortem as per ACS 6 of 2010. Report on analysis was later made available by the local authorities. As per the information made available, the samples did not indicate signs of poisoning based on lab examination carried out.

1.14 FIRE

There were no signs of fire on the aircraft wreckage.

1.15 SURVIVAL ASPECTS

The crash site was in the vicinity of airport and information about the aircraft crash was received from locals within few minutes at CAA. The personnel manning the ATC tower stated that they saw the ambulance rushing out within 2-3 minutes after the aircraft carried out a missed approach. As no video footage of activities at Aerodrome was available, the exact time of ambulance rushing out of aerodrome is not available.

Both Pilots received fatal injuries in the accident. As per the statement of the witnesses, Instructor had possibly died on the spot, whereas trainee succumbed to the injuries and possibly died on the way to the hospital. The damages to the aircraft are indicative of high impact forces, which made the accident difficult to survive.

ELT was also activated as a result of impact during the accident. ELT was detected by Medium Earth Orbiting Local User Terminal (MEO LUT) of the French Mission Control Center (FMCC) at 1545 UTC. After near real time detection by the MEO system of FMCC the ELT signal was detected at 1556 UTC by SARSAT 11 which was the next immediate visible Low Earth Orbiting satellite. After detection of signal, initial alert was transmitted by Low Earth Orbiting Local User Terminal (LEO LUT) of Indian Mission Control Center (INMCC) at 1605 UTC.

1.16 TESTS AND RESEARCH

Approximately 70 litres of fuel were retrieved from the aircraft wreckage. Sample of fuel collected from the aircraft was sent to DGCA lab at New Delhi to determine the samples specification. As per Lab Test Report, the fuel sample passed the specification test.

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION

Chimes Aviation Academy (CAA) is a DGCA approved flying training organization (FTO) situated at Dhana, District Sagar, Madhya Pradesh. CAA started operations after grant of approval by DGCA vide its letter no. AV. 22011/6/2001-FG dated 21st April 2008. CAA is permitted to provide training services for issue of PPL, CPL, IR, AFIR, FIR and extension of Single Engine / Multi Engine aircraft ratings on Aeroplanes as per scope of approval. It has a fleet of Cessna 172R, Cessna 172S, Piper Seneca PA-34 and Diamond DA 42 aircraft for carrying out its day-to-day operations. Organisation Chart of CAA is shown in the following figure.

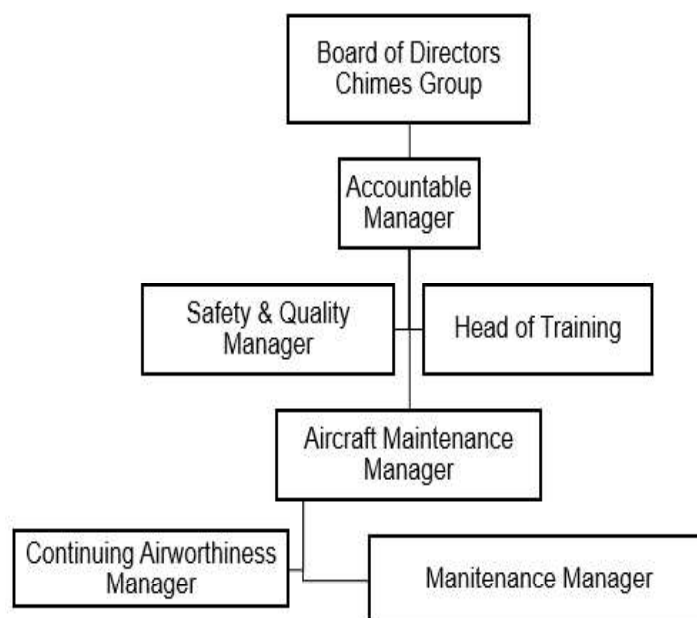


Figure 20 : Organisation Chart

Accountable Manager has been nominated by the FTO as per DGCA requirements. He reports to the Board of Director and is responsible for management and operation of Organization related activities. He is assisted by a team of professionals. Safety & Quality Manager, Heading of Training and Aircraft Maintenance Manager extend their support to the Accountable Manager. Aircraft

Maintenance Manager is being assisted by Continuing Airworthiness Manager and Maintenance Manager.

CAA operates from an un-controlled airfield. In Dec 2011, CAA had requested DGCA for permission to carry out Night Flying at Dhana Aerodrome. DGCA examined the proposal and after carrying out inspection of facilities available at Dhana granted permission to carry out Night Flying at Dhana vide its letter AV.22011/6/2007-FG (Pt) dated 02.03.2012. The copy of permission granted by DGCA is placed at **Appendix C**. The directions contained in the said letter was made part of CAA Standing Order No. 3.

After Night Flying permission was granted by DGCA, CAA also started carrying out Night Cross Country flights from 15 Mar 2012. After gaining sufficient experience in conduct of Night Flying at Dhana, CAA submitted a formal request in May 2013 to DGCA for expanding the scope of Night Flying at its academy to include:

- (a) Night Flying on Multi-Engine aircraft PA-34 Seneca.
- (b) Night Cross-country flights on both Single and Multi-engine aircraft.

Later in June 2013, CAA also applied for permission to conduct Flight Test at Dhana Airstrip. Both proposals were examined on file by the DGCA and it was discussed that

- CAA should submit revised SOP for cross country flights before commencement of such operations.
- Circular for Day and Night Checks has been issued.
- Circular for conducting Night Flying Training by FTOs was already in place.

DGCA asked CAA to submit Standard Operating Procedure for Night Cross country in July 2013, so that same can be examined/incorporated in TPM. CAA stated to have submitted the SOP vide its letter dated 19 July 2013. The copy of SOP is placed at **Appendix D**. No formal approval for SOP was granted by DGCA. Operator continued to carry out Night Cross Country flights from Dhana Aerodrome and had conducted 369 night cross country flights from Dhana till the day of accident.

The FTO approval granted to Chimes Aviation Academy was periodically renewed as and when due based on the satisfactory compliance of prevailing DGCA regulations until October 2015. In October 2015 after revision in CAR and approval procedures, CAA was granted Flight Training Approval no. 04/2015 which was valid upto 20 April 2020. Training and Procedure Manual of CAA was also originally approved by DGCA in July 2015. TPM was later revised and approved by DGCA in Mar 2017 as Amendment/Revision 01/2017.

During an Audit by DGCA in Dec 2018, CAA was directed to get its TPM amended in accordance with the revised CARs. CAA in its Action Taken Report dated 23 Dec 2019 submitted that its TPM was already under review and would be amended as per revised CARs by mid-Jan 2019 and all concerned personnel were made aware of revised CARs. There was no formal communication from DGCA regarding closure of Audit Finding based on the Action Taken Report submitted by

CAA but there was no repetition of such observation in Audit of Nov 2019 either. The observations of DGCA in its Dec 2019 Audit were as below: -

1. AAIB officer's number not updated and displayed on board.
2. Firefighting Trolley (i.e tool box) was not found as per DGCA circular.
3. Notification of occurrences not been displayed
4. Library books record & issue register needs to be revised.
5. Procedure to maintain BA Test record needs to be reviewed.

Necessary action was taken by CAA on all above observation and Action Taken Report was submitted to DGCA in Dec 2019. The TPM submitted by CAA was finally approved by DGCA in Aug 2020 as Amendment/Revision 01/2020. The investigation was provided with controlled copy of the said TPM by DGCA in response to its request. The TPM 01/2017 approved in Mar 2017 was also obtained from the CAA. As per TPM 01/2017, Flying curriculum for single engine aircraft for PPL, CPL and CPL with IR is given in Para 4.4 and is quoted below:-

“QUOTE

<i>Sr.</i>	<i>License</i>	<i>Total Flight Time Hrs</i>	<i>Total PIC Hrs</i>	<i>Cross-country PIC Hrs</i>	<i>Total Instrument Flying</i>	<i>Maximum IF on Simulator</i>
<i>1</i>	<i>PPL</i>	<i>40:00</i>	<i>20:00</i>	<i>05:00</i>	<i>Nil</i>	<i>Nil</i>
<i>2</i>	<i>CPL</i>	<i>200:00</i>	<i>100:00</i>	<i>20:00</i>	<i>20:00</i>	<i>10:00</i>
<i>3</i>	<i>CPL with IR</i>	<i>200:00</i>	<i>100:00</i>	<i>50:00</i>	<i>40:00</i>	<i>20:00</i>

Night Flying requirements

<i>Sr.</i>	<i>License</i>	<i>Total PIC Hrs</i>	<i>Night Cross-country Hrs</i>	<i>Night Solo Take-off /Landings</i>
<i>1</i>	<i>PPL</i>	<i>40:00</i>	<i>20:00</i>	<i>05:00</i>
<i>2</i>	<i>CPL</i>	<i>200:00</i>	<i>100:00</i>	<i>20:00</i>

Other Cross-country Requirements

PPL- a Cross Country Flight of 150 NM with full stop landings at 2 different Aerodromes

CPL- a Cross Country Flight of 300 NM with full stop landings at 2 different Aerodromes

UNQUOTE”

Copy of TPM 01/2020 obtained from DGCA was also studied for amendments carried out in accordance with the CARs. With respect to Flying curriculum, it was

observed from the scrutiny of TPM01/2020 that “Other Cross-country Requirements” mentioned at Para 4.4 of TPM 01/2017 have been replaced with the following: -

<i>NIGHT CROSS-COUNTRY ROUTES</i>				
<i>No.</i>	<i>Route (Turning Point & Distance)</i>			<i>Total Distance</i>
<i>1</i>	<i>Bhopal</i>	<i>Bobet 80</i>	<i>Bhopal 80</i>	<i>160</i>
<i>2</i>	<i>Nagpur</i>	<i>Gondia 74</i>	<i>Nagpur 74</i>	<i>148</i>
<i>NOTE: The Routes for Night Cross Country originating from Bhopal/Nagpur can be changed by Bhopal/Nagpur ATC as per Traffic.</i>				

The Weather Minima for training flights is laid in Para 9.4 and 9.5 of the TPM and is quoted below.

“9.4 Weather minima (flying instructors). All flying operations at CAA are to be conducted under VFR. Limitations for Flying Instructors are given below:

- i. Maximum crosswind component - 15 Knots – Or as per Aircraft Flight Manual for C-172/PA-34/DA 42*
- ii. Maximum tailwind component - 5 Knots*
- iii. Maximum wind speed - 30 Knots*
- iv. Minimum visibility - > 1.5 Km (Special VFR)*
- v. Minimum Cloud base - >1500 feet AGL for circuits*
- vi. - >2500 feet AGL for all other flying.*
- vii. - as per VFR For cross-country*

9.5 Weather minima (students: at various stages of training). All flying operations at CAA are to be conducted under VFR. Weather minima laid down have been derived from Aircraft Flight Manual, Standard VFR conditions with additional safety margin. For students the minima are given below :-

- i. Maximum crosswind component – 15 Knots (depending upon the experience and competency of the student pilot at the recommendation of his instructor the limit of 15 Knots may be reduced especially for initial solo flights.*
- ii. Maximum wind speed - 20 Knots*
- iii. Minimum visibility - 5 Km*
- iv. Minimum Cloud base for circuit flying - 1500 feet AGL*
- viii. Minimum cloud base for all other flying - 2500 feet AGL.*
- ix. For cross-country - as per VFR*

Note: The above limitations have been arrived at by considering POH limitations, VFR criteria and experience gained during training for the last 7 years.”

Chimes Aviation Academy also maintained a Flying Order Book in accordance with prevailing regulations. Order 9/2 dated 08 Aug 2015 lays out procedure to be followed for Go-arounds and Mis-Landings. The same is quoted in the following para.

“ORDER 9/2

GO-AROUND AND MIS-LANDING

Pilots shall initiate go-around/miss landing action if there is any doubt regarding the ability to land the aircraft safely. In particular, go-around/miss landing action shall be initiated:

- a) If the landing area is obstructed.*
- b) The approach path or speed is unsatisfactory.*
- c) The prevailing wind or weather exceeds his limits or ability.*
- d) When initiated by Air Traffic Control*
- e) In the event of a balloon, bounced landing or pilot induced oscillation*

Actions In the event of a go-around C-172 Aircraft.

- a) Apply full power (Nose will pitch up & must be controlled to maintain correct go around attitude)*
- b) Establish a safe climb attitude on take-off heading*
- c) All landings at CAA on C-172 are carried out with 20° flaps. During a go-around flaps are to be left at 20° but remember there will be a noticeable pitch-up when full power is applied. This pitch-up must be controlled by forward pressure on control column to maintain correct attitude for climb. Subsequently, trim the aircraft to maintain correct attitude.*
- d) Climb on take-off heading*
- e) Once above 300ft AGL Retract the flaps in stages to zero degrees.*
- f) Advise ATC through a radio call.*
- g) Complete another circuit and land.*

Actions In the event of a go-around Multi-Engine Aircraft

- a) Apply full power*
- b) Establish a safe climb attitude on take-off heading*
- c) Remove drag flaps*
- d) Select gear up*
- e) Climb on take-off heading*
- f) Once above 300ft AGL Retract the flaps in stages to zero degrees.*
- g) Advise ATC through a radio call.*
- h) Complete another circuit and land.”*

Circuit Re-joining procedure and Diversion Procedure to be followed at Dhana are laid in the Para 4 and Para 7 respectively of CAA Standing Order no. 13 and same is quoted in the following paras.

“4. Circuit Rejoining Procedure. Before leaving the training area the aircraft are to obtain clearance from Dhana ATC and set latest QNH. After being cleared by the ATC aircraft are to descend to 3500 feet AMSL. At 3500 feet AMSL aircraft are to report overhead along the runway in use, then turn left to join circuit if runway 17 is in use and turn right if runway 35 is in use. Descent to circuit altitude is to be done only after clearance from ATC and after making visual contact with the circuit aircraft immediately ahead.”

“7. Diversion Procedure. In event of Dhana Aerodrome becoming unsuitable for landing, CFI or DFI is to initiate diversion of aircraft to suitable aerodrome depending on weather, position, endurance of aircraft. Our main diversionary aerodromes are Bhopal, Jabalpur, and Khajuraho within their watch hours. Dhana ATC is to find out prevailing weather at these aerodromes and pass this information to the CFI/DFI and all aircraft. The decision about impending diversion is to be passed to the aircraft either directly by Dhana ATC or through ATCs at Bhopal, Jabalpur, or Khajuraho. Thereafter aircraft are to be diverted to the most suitable aerodrome. Information regarding diversion is to be relayed to the concerned aerodromes by landline.”

Sample flight profile of some earlier flights operated by VT-CAF showing the aircraft re-joining circuit after cross country flight is shown in the **Appendix E**.

1.18 ADDITIONAL INFORMATION

1.18.1 VFR CRITERIA AS PER AERONAUTICAL INFORMATION PUBLICATION

Criteria for VFR is given at Para ENR 1.2 of Part 2 of AIP, India. As per the AIP, the VFR flights shall be conducted so that the aircraft is flown in conditions of visibility and distance from clouds equal to or greater than those specified visual meteorological conditions visibility and distance from cloud minima given below, except when operating as a special VFR flight.

Altitude Band	Airspace Class	Flight Visibility	Distance from Cloud
At and above 3050 m (10000 ft) AMSL	A*** B C D E F G	8 Km	1500 m horizontally 300 m (1000 ft) vertically
Below 3050 m (10000 ft) AMSL, or above 300 m (1000 ft) above terrain, whichever is the higher	A*** B C D E F G	5 Km	1500 m horizontally 300 m (1000 ft) vertically
At and below 900 m (3000 ft) AMSL, or 300 m (1000 ft) above terrain, whichever is the higher	A*** B C D E	5 Km	1500 m horizontally 300 m (1000 ft) vertically
	F G	5 Km**	Clear of cloud and with the surface in sight

* When the height of the transition altitude is lower than 3050M AMSL (10000 Ft AMSL), FL100 should be used in lieu of 10000 Ft.

** Further in Class F and Class G airspace flight visibilities reduced to not less than 3000 m may be permitted, when so prescribed by the appropriate ATS authority, for flights operating:

- 1) at speeds that, in the prevailing visibility, will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; or
- 2) in circumstances in which the probability of encounters with other traffic would normally be low, e.g. in areas of low volume traffic and for aerial work at low levels.

1.18.2 FLYING TRAINING ADVISORY CIRCULAR 1 OF 2013

DGCA has issued a Flying Training Advisory Circular 1 of 2013 for Installation of real time camera in Flying Training Organisation with an objective to enable better surveillance of flying activities conducted in FTOs so as to help in controlling the false and fraudulent log book entries. The installation was also expected to help the students/instructor in analysis of the flying exercise. All FTOs were directed to install cameras to provide real time view through internet. As per the circular

(i) The camera's should be installed to cover the following view :

- ♣ Approach of both ends of the runway (In case of uncontrolled airfield)
- ♣ Apron area (In case of uncontrolled airfield)
- ♣ Classrooms
- ♣ Examination Room

(ii) The camera installed should be of high resolution to ensure proper visibility.

During the visit of investigation team, it was informed that the said facility was not fully functional at CAA. The real time view through internet was not available. Some security cameras were installed but were not functional on the day of accident and no relevant footage was available. It was also informed that none of the FTOs are able to comply with the said requirement.

1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES

Nil.

2. ANALYSIS

2.1 SERVICEABILITY OF AIRCRAFT

The aircraft had current and valid Certificate of Registration, Certificate of Airworthiness and Aero Mobile License as per applicable regulation on the day of accident. The aircraft was last weighed on 8th November 2014 at Dhana, M.P India and duly approved by the office of Director of Airworthiness, DGCA, Mumbai.

Aircraft had logged 8653:50 hours till the date of accident. Last scheduled inspection on Aircraft and its Engine (Phase 1 - 50 Hours/01 Month) was carried out at 8644:35 Hrs and 945:10 Hrs respectively on 30th Dec, 2019 as per approved Aircraft Maintenance Schedule and the aircraft had logged 09:15 Hrs since last scheduled inspection. The propeller installed on the aircraft had logged 5404:20 Hrs. as on date of accident.

No snag or defect was reported in any of the flights preceding the accident flight on the day of accident. The crew did not report any technical problem or give any distress signal to ATC any time during flight. The data from Garmin 1000 and FADEC does not indicate any malfunction or problem with the aircraft or its engine. Serviceability of the aircraft was not a causal or contributory factor in the accident.

2.2 OPERATIONS

2.2.1 CREW QUALIFICATIONS FOR FLIGHT.

The flight was operated to conduct 120 NM Cross Country Training for the Student Pilot who was in final phases of his training. Both the crew were qualified as per the applicable DGCA regulations and policy laid in the Training and Procedure Manual to undertake the flight. The flight took-off in conditions below VMC, but within the applicable limits defined in the TPM for dual flights with Flight Instructor on board.

2.2.2 SOP FOR NIGHT CROSS COUNTRY FLIGHT

CAA was granted DGCA approval for carrying out Night Flying at Dhana Airport in 2012 as per the prevailing practice. The order did not specifically mention Night Cross Country Flight operations but CAA was carrying out Night Cross Country Flight since 2012. CAA also applied for formal permission from DGCA to carry out Night Cross Country Flights in May 2013. DGCA asked CAA to submit SOP for Night Cross Country Flight which could be incorporated in the TPM after formal approval. CAA submitted an SOP for Night Cross Country Flight to DGCA in July 2013 but no record of matter being perused further in DGCA file was found. CAA also did not follow-up the case with DGCA and continued to conduct Night Cross Country Flight as per the SOP. A total of 369 Night Cross Country flights have been safely carried out from Dhana till the date of accident.

The TPM 01/2017 did not have any separate or specific requirement to be followed for conducting Night Cross Country Flight, but in TPM 01/2020, which was approved by DGCA in Aug 2020, specific conditions were introduced under which all Night Cross Country Flights are now required to be carried out from Bhopal or

Nagpur on predefined routes. DGCA has also introduced Flying Training Circular 04 of 2020 wherein clear guidelines have now been issued for conducting Night Cross Country Flight.

As per the SOP being followed for Night Cross Country Flights, following Special Points were applicable.

(i) No Radio Silencing in Flight

(ii) Bhopal to be taken as diversion only if the ETA back at Dhana after night cross country is 2100 Hrs or earlier. Otherwise, Nagpur is to be taken as the diversion.

(iii) A close watch on weather at Dhana is to be maintained by the Flight Instructor i/c Night and if required, aircraft carrying out Night Cross Country are to be advised for diversions well in time.

In the present case, it was observed that the aircraft did not contact Bhopal, Mumbai or Khajuraho ATC anytime during the flight. It was only in contact with the Dhana ATC. Even though it is not causal or contributory factor for accident, aircraft may have maintained radio silence for significant portion of the flight. Dhana ATC cautioned VT-CAF of poor weather and visibility and also advised it to divert to Bhopal, which was closer alternate than Nagpur and had watch hours till 1700 UTC.

Weather was obtained from Bhopal ATC at 1547 UTC and later Bhopal was contacted at 1559 UTC to confirm if VT-CAF was in its contact. This contact with Bhopal was 02 minutes and 14 minutes after the possible time of crash indicating that assessment of personnel manning the Dhana ATC, about time when they came to know of the crash may not be accurate. In absence of any CCTV footage or recording of radio communication the same could not be correctly ascertained.

2.3 WEATHER

The outdoor air temperature logged by the weather stations at 1207 UTC (17:37 IST) was 12.1 C and was close to Dew point which was logged as 10.9 C. The weather conditions therefore were conducive of fog. The photographs of aircraft wreckage immediately after the crash provided by a witness also confirms presence of significantly dense fog.

The visibility at the time of take-off was stated to be 4500 m which was more than the limit of 1.5 Km prescribed in the DGCA approved TPM for carrying out training flights with Flight Instructors on board. The limit prescribed in the TPM is not in accordance with the Part 2 of AIP, which only permits Flight Visibilities to not less than 3000 m in Class F and Class G airspace under certain conditions

Aircraft took off at about 1330 UTC (1900 IST) and as time progressed and night settled in, fog became dense and visibility kept dropping. The personnel manning the ATC stated to have cautioned VT-CAF about the poor visibility conditions and advised it to divert, but in absence of any recording facility the same could not be ascertained. As per the weather information obtained from Bhopal ATC at 1547 UTC over telephone, the visibility at Bhopal was 2000 m which was better than near zero visibility conditions prevailing at Dhana.

VT-CAF was not able to maintain centre line and descended to about 1750 feet before turning left and climbing again at about 1.25 NM from Dhana. As it descended and approached Runway 35 again, it was possibly not able to sight the Runway and carried out a missed approach.

It is possible that, due to poor visibility, the crew would have dimmed the MFD and PFD to minimum brightness. As they could not sight the runway, MFD was later powered off so as to have better view of outside. This is the most possible reason for GARMIN 1000 recording stoozing about 58 seconds before the aircraft impact with the ground. From above discussion we may conclude that the weather was one of the contributory factors.

2.4 CIRCUMSTANCES LEADING TO ACCIDENT

Dhana normally experiences moderate weather pattern typical of Indian climatology and Flying activities are occasionally affected by fog or monsoons. On 03 Jan 2020, flying activity started at Dhana in the morning at 0430 UTC when the first flight took off.

Apart from the accident flight 33 flights out of total 39 planned on the day of accident were safely carried out. As evening progressed, the visibility started dropping below VMC. Four solo flights were cancelled and only VT-CAF was allowed to operate as it was a dual flight with Flight Instructor on board and permitted as per the DGCA approved TPM.

As per the record of weather available with investigation team, the weather at the time 1207 UTC was conducive of Fog and visibility at 1230 UTC was 4500 m. Crew carried out pre-flight checks and engine was started at about 1323 UTC and aircraft took off at about 1330 UTC after clearance from ATC. Crew reported its position to Dhana ATC as per procedure at regular intervals and did not report any abnormality. On its return leg, personnel manning ATC cautioned crew of dropping visibility and asked it to expedite its arrival.

The flight data from Garmin 1000 indicate that crew did not follow normal Circuit Re-Joining procedure to Dhana Runway 35. Aircraft started descending at about 04 NM from Dhana to approach Runway 35. However, the approach was not stabilized and aircraft was not able to maintain centre line. The aircraft deviated by 90 degrees from its path before making another attempt for Runway 35.

As per the statement of personnel manning ATC, the visibility at that time was near zero and VT-CAF was advised to divert to Bhopal. VT-CAF carried out a missed approach possibly because it was not able to sight the runway. Instead of following proper go-around procedure or diverting to alternate airport, VT-CAF attempted to land on runway 17 carrying out a short circuit. Aircraft crossed over to east of runway and crashed after hitting a group of trees at a height of about 30 feet.

The comparison of flight profiles of accident flight with flight profile of similar cross-country flights in the past indicate that the flight did not follow normal Circuit Re-Joining procedure to Dhana Runway 35 and crew was possibly disorientated and was not flying on instruments.

3. CONCLUSIONS

3.1 FINDINGS

1. Aircraft was maintained in accordance with the approved maintenance program and there was no deferred maintenance on the aircraft or its engine before undertaking the accident flight.
2. Both crew met the qualification requirements for operating the flight and were current on their licenses and ratings.
3. Organization had a valid approval for carrying out Flying training which was valid upto 20 April 2020.
4. DGCA had granted permission for carrying out Night Flying at Dhana Airport after satisfying itself with the Night Landing and Take-off facilities at Dhana.
5. Organization had a separate SOP for conducting Night Cross Country Flights and was carrying out Night Cross Country Flights since 15 March 2012. But there was no separate mention of conditions to be followed for Night Cross Country in the DGCA approved TPM.
6. The TPM permits dual pilot flights with Flight Instructor on board in conditions below VMC upto visibility of 1.5 Km. This is not in accordance with 3 Km permitted as per the AIP.
7. Chimes Aviation Academy is not complying with Flying Training Advisory Circular 1 of 2013, and it was informed that none of the FTOs in India are able to comply with the requirements laid in the circular with respect to installation of cameras for providing real time monitoring at DGCA through internet.
8. Dhana airport had weather station capable of providing instantaneous display and logging weather parameters, but weather parameters were not being logged after evening. The last entry of weather parameters on any given day in the register were being made at 1230 UTC (1800 Hrs IST) irrespective of any Night Flying activity.
9. The visibility at Dhana Airport had dropped significantly around the ETA of VT-CAF due to Fog. Crew attempted to land at Dhana in poor visibility condition rather than diverting to Bhopal in spite of having enough fuel on board to divert to alternate airfield.
10. After missed approach, Crew did not follow the SOP for Go-around laid in the policy documents and attempted to carry a short circuit for landing on Runway 17.
11. The ELT was activated and distress signal was first detected at 1545 UTC by a FMCC and later at 1556 UTC by the INMCC.
12. In absence of CCTV footage, or recording of VHF communication at Dhana ATC the exact chronology of events could not be corroborated with the statement of the witnesses.

3.2 PROBABLE CAUSE OF THE ACCIDENT

Accident was caused due to an attempt to land in visibility condition significantly below VMC and not following the correct go-around procedure.

4. SAFETY RECOMMENDATIONS

4.1 In view of the fact that DGCA approved TPM of the organisation permit Special VFR flights up to a visibility of 1.5 Km, DGCA may revisit its approval to ensure that criteria for conducting training flights below VMC should be in accordance with the AIP at all Flying Training Organisations.

4.2 Apart from statements from personnel manning ATC, there is no evidence of positive RT communication. Due to unavailability of RT recordings investigation team could not recreate exact timelines of various events. DGCA should issue CAR/Circular mandating FTOs to have infrastructure for recording RT communication with necessary storage and retrieval facility.

4.3 DGCA should ensure that Flying Training Advisory Circular 1 of 2013 is implemented by all FTOs. In case of shortcoming, DGCA may consider relaxing requirement for live monitoring over internet to increase compliance.

4.4 Chimes Aviation Academy should ensure that all training activities are carried out as per DGCA approved TPM and all SOPs are made part of TPM or FOB.

4.5 Chimes Aviation Academy should ensure recording of weather parameters throughout the period of operations and ensure that weather monitoring is continued into night in case of Night Flying and entries are also made in the register.

4.6 Chimes Aviation Academy should re-iterate to all its Flight Instructors the importance of correct Go-around procedure and Diversion to suitable alternate in case Dhana is not suitable for landing due to any reason.



Jasbir Singh Larhga
Investigator-in-Charge

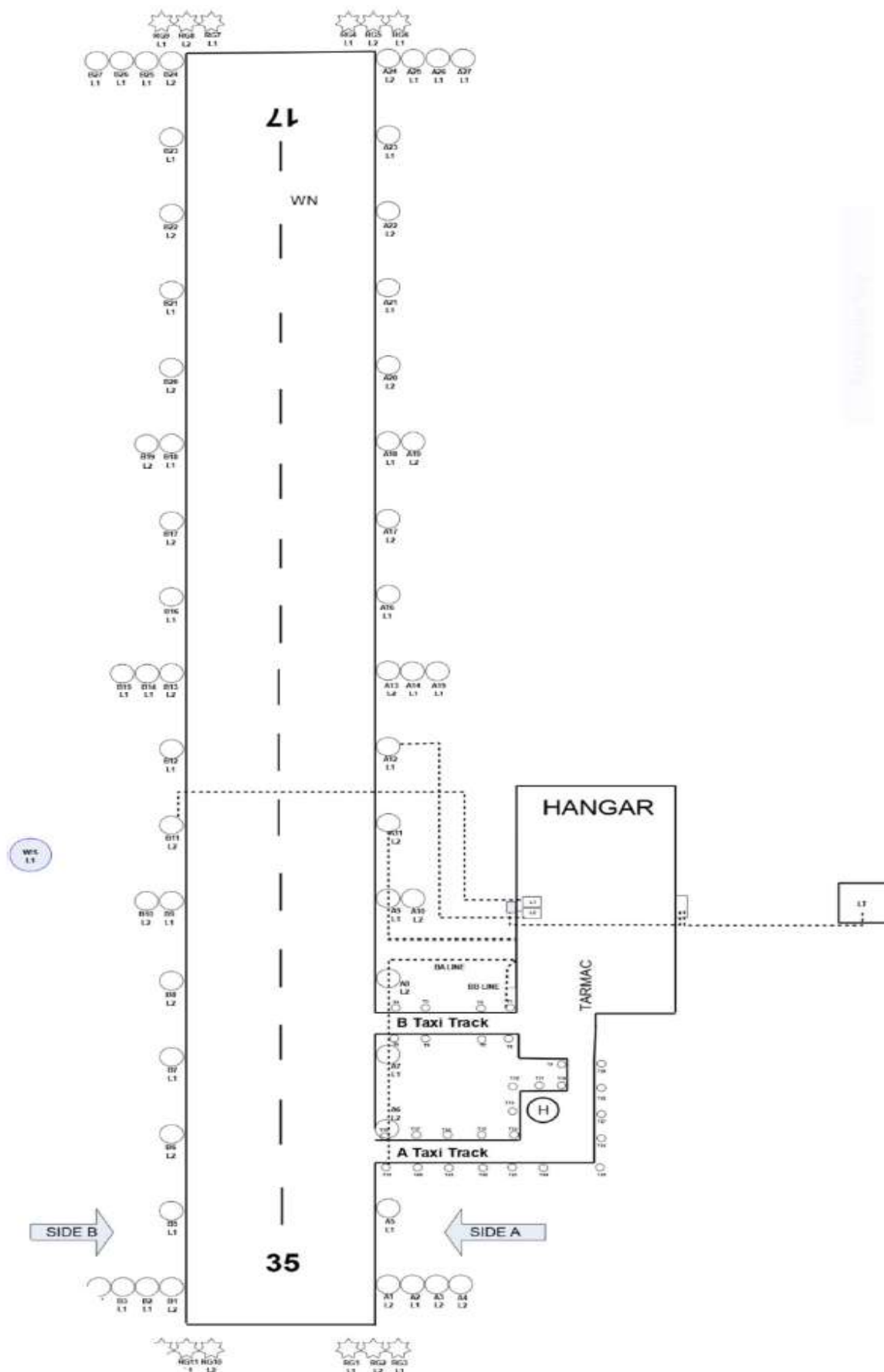


Amit Kumar
Investigator

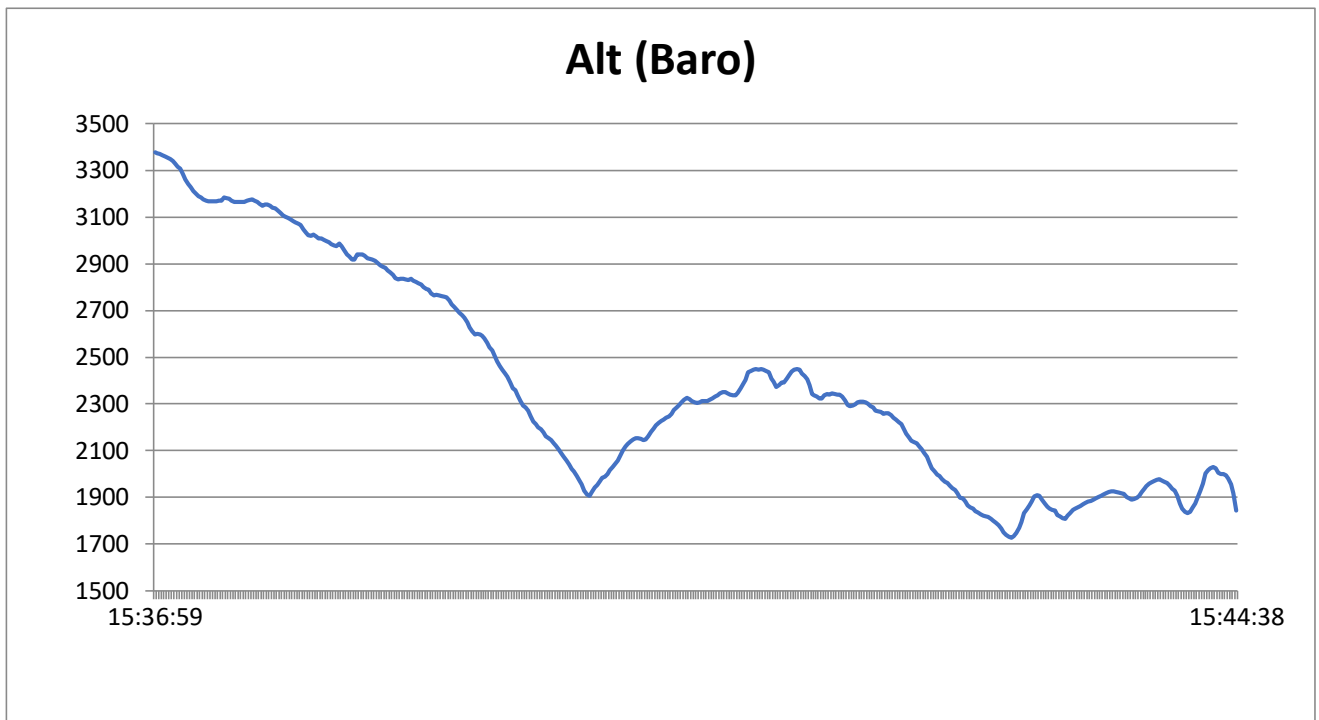
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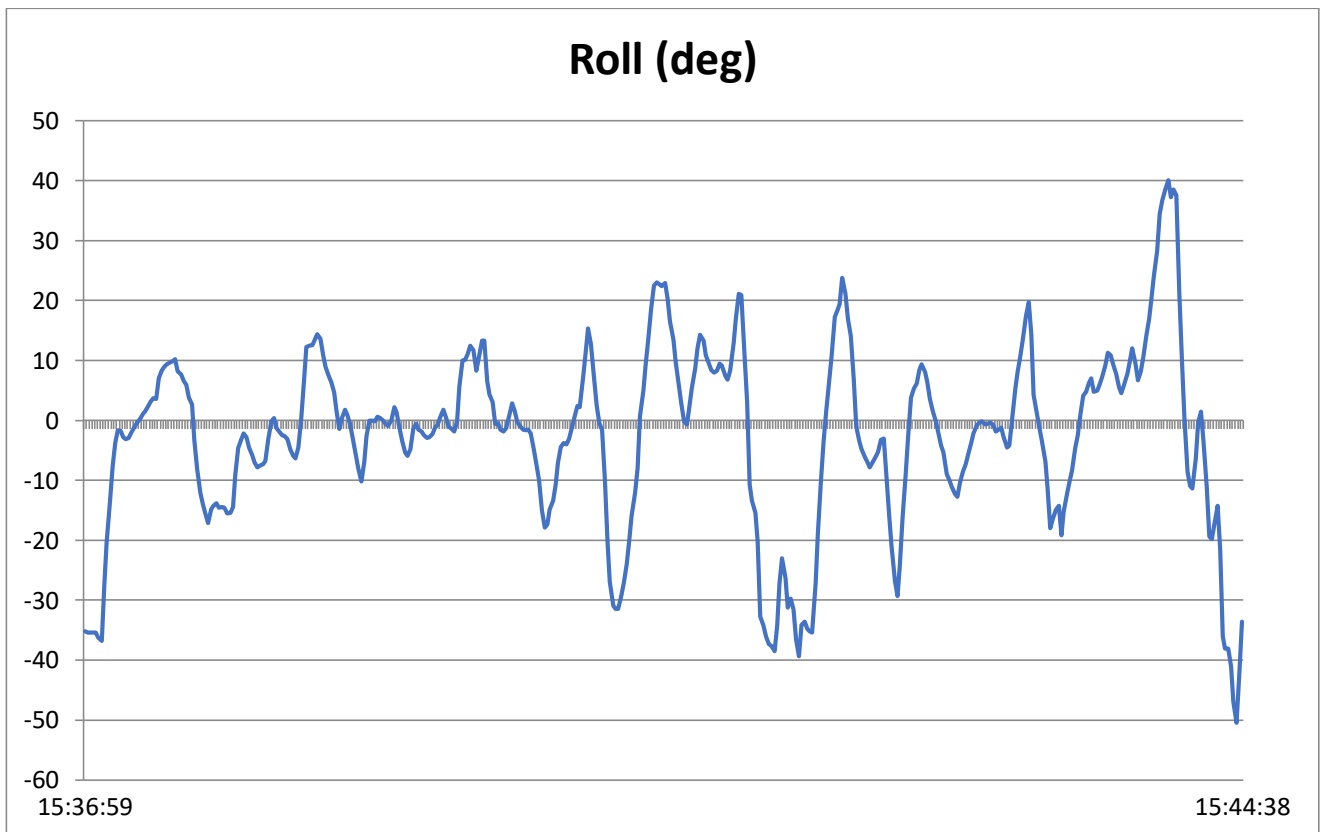
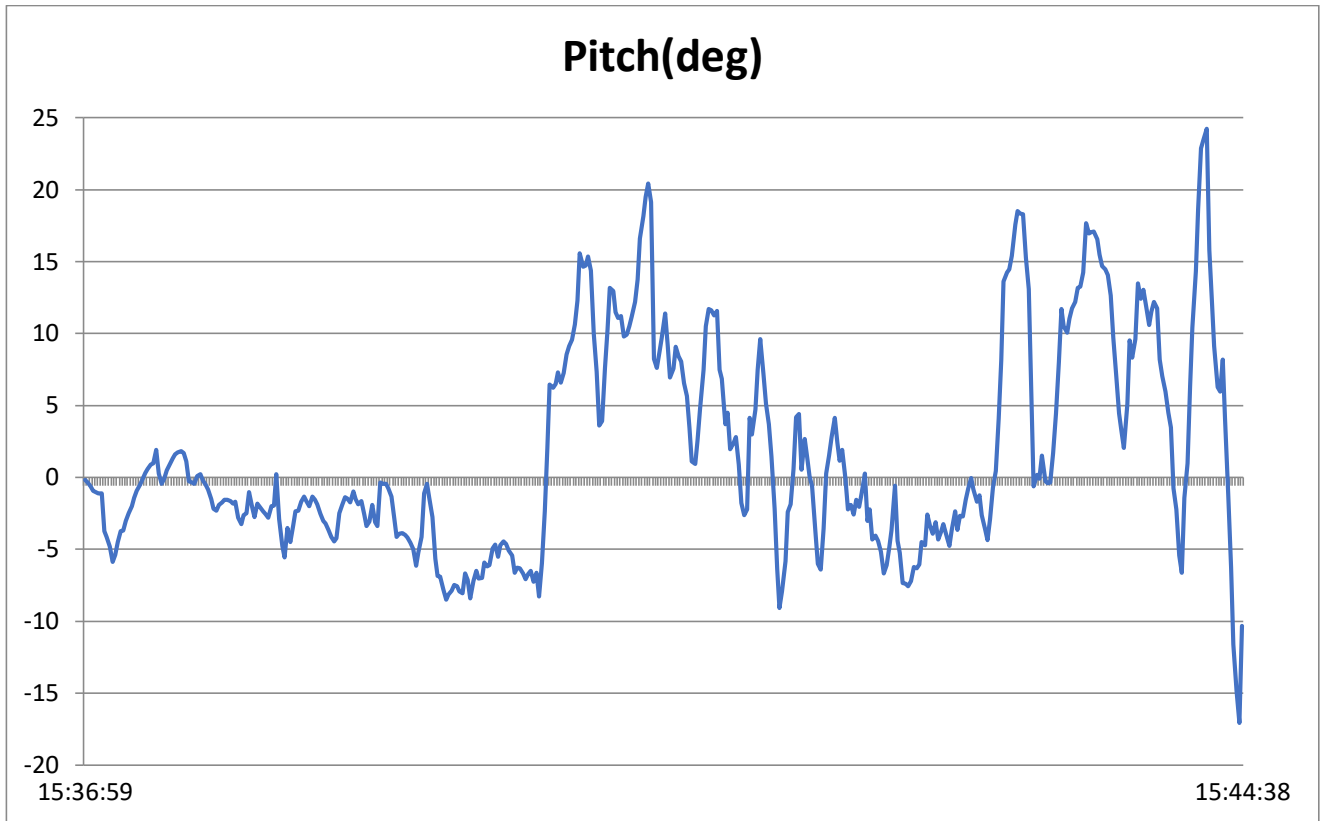
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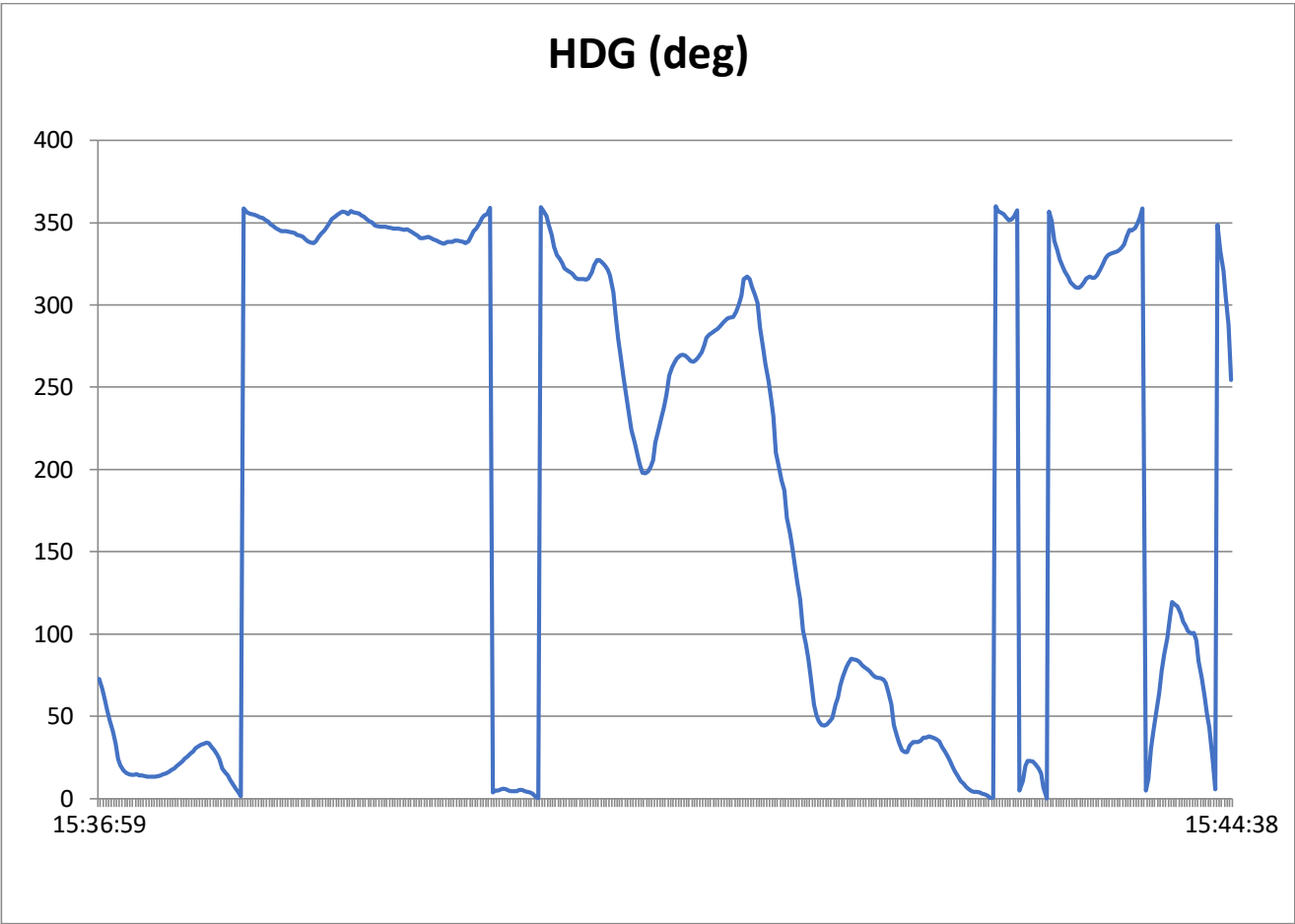
LAYOUT OF LIGHTING FACILITIES AT DHANA AERODROME



FLIGHT PARAMETERS PLOTTED W.R.T TIME







-619-

**GOVERNMENT OF INDIA
CIVIL AVIATION DEPARTMENT**



**OFFICE OF THE
DIRECTOR GENERAL OF CIVIL AVIATION
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भारत सरकार
नगर विमानन विभाग
महानिदेशक नगर विमानन का कार्यालय
सफदरजंग एयरपोर्ट के सामने
नई दिल्ली - 110 003

संख्या : AV.22011/6/2007-FG(Pt)
दिनांक : 02.03.2012

To,
The Accountable Manager,
Chimes Aviation Pvt Ltd.,
Dhana Airstrip PO Dhana,
Sagar Madhya Pradesh-470 228.

Subject: - Permission to commence Night Flying at Dhana Airstrip, Sagar Madhya Pradesh.

Sir,

Reference may kindly be made to your letter No. Nil dated 24.02.2012 and this office letter No. AV.22011/6/2007-FG (Pt) on the above subject.

Your request for approval of Night Flying at Dhana Airstrip, Sagar Madhya Pradesh base for night flying training operations has been considered and permission to M/s Chimes Aviation Pvt Ltd, Dhana for carrying out night flying training activities is hereby granted as per the following terms and conditions :-

1. The approval of flying training institute remains valid in terms of the provisions of CAR Sections 7 Series D Part I.
2. The night flying training shall be carried out as per the standard operating procedures submitted to this vide letter referred to above.
3. The goosenecks flares to be used by the flying training institute in place of fixed light fittings at your flying training institutes for runway, apron and Taxi way lighting. The position of goosenecks shall be as per the provision of runway, taxiway and apron lighting as laid down in Car Section 4 Series B Part I.
4. All obstructions around the vicinity of the aerodrome should be lighted as per the provisions of CAR Section 4 Series B Part I.
5. Wind sock and signal square should be lighted as per the provisions of CAR Section 4 Series B Part I.
6. Aerodrome beacon should be available and serviceable.
7. Night flying training shall be restricted to the immediate vicinity of the aerodrome under VMC conditions at a height of not above 2500 feet above ground level and shall be restricted to 2 nautical miles from the perimeter of the aerodrome. (ref Rules of Air).

- 620 -

8. Nearest ATC Unit shall be informed on the before the commencement and after the termination of night flying training activities.
9. The flying training institute shall ensure provisions of adequate safety services such as fire fighting equipments, medical aids, etc.
10. Night flying operations shall be strictly carried out in the presence and direct supervision of Chief Flight Instructor/pilot instructor in-charge.
11. Before release of trainee pilot for night solo the trainee shall have undertaken a minimum one hour or more night flying training to the satisfaction of CFL.
12. Adequate watch ward arrangement shall be deployed to keep the operational area clear of stray animals/ unauthorized persons.
13. Signaling lamp should be available when the night flying training is in progress.
14. Positive to way communication between aircraft and ground stations shall be made available.
15. Local fire service provider shall be intimated before commencement of night flying training.
16. SOP may be reviewed accordingly.

The above permission is without prejudice to the compliance of Aircraft Rules and applicable Civil Aviation Requirements, AIC, Flying Training Circular etc. in this regard. The permission can be withdrawn/cancelled or revoked or suspended by the Director General without assigning any reason.

Yours faithfully,

REDACTED

For Director General of Civil Aviation

SOP FOR NIGHT CROSS COUNTRY
AT CHIMES AVIATION ACADEMY

SECTION 1

GENERAL

1. Night Flying at Chimes Aviation Academy, Dhana Airstrip, Dist. Sagar, MP, has been approved vide DGCA letter no. AV.22011/6/2007-FG(Pt) dated 02.03.2012. The conditions for Night Flying mentioned in the above quoted letter are to be followed strictly. Night cross country flying on both Single engine and Multi engine aircraft is to be conducted as per this SOP.

NIGHT FLYING BRIEFING

2. Prior to proceeding for night cross country a comprehensive briefing will be carried out by CFI/FI along with the Night flying briefing. The aim of this briefing is to ensure that every one involved in the Night flying is also aware of the Night cross country procedures. Night cross country programme is to be made at least one day in advance and conveyed to all staff personnel and students.

FORMAT FOR BRIEFING

3. Before commencement of Night cross country flying the following format is to be followed as guide for the briefing.
 - a. Roll Call
 - b. Flying Programs to include
 - i. Flight Instructor i/c Night
 - ii. Duty Flight Instructor
 - iii. Duty Engineering Personnel
 - c. Aircraft Allocation
 - d. Weather Brief and Sunset & Last landing time.
 - e. Refuelling
 - f. Airport lighting layout.
 - g. Light Signals to Ground Crew
 - h. Emergency Procedures
 - j. Planned diversions for Night cross country along with watch hours.
 - k. Special points for Night cross country flying.

LIGHT SIGNALS TO THE GROUND CREW

ACTION	LIGHT SOURCE	MEANING
Pre-Start	Nav Lights	ON
Start-Up	Hand Torch	Shine torch on Engine & Rotate
Chocks Away	Landing Light	Flash & leave ON
Dismiss Marshaller	Landing Light	Flash & leave ON
Taxi	Landing Light	ON

EMERGENCY PROCEDURES

1. All emergency procedures specific to Night cross country are to be covered during the briefing.

SPECIAL POINTS FOR NIGHT CROSS COUNTRY

- a. All aircrew are to carry a serviceable electric torch.
- b. Darkness adaptation is to be carried out
- c. Aircraft proceeding for Night cross country will be refuelled to full capacity.
- d. No radio silencing in flight
- e. Bhopal is to be taken as diversion only if the ETA back at Dhana after the night cross country is 2100 hrs or earlier. Otherwise, Nagpur is to be taken as the diversion.
- f. Approach plates for planned diversions are to be carried on board.
- g. Maps and log cards for the sortie are to be checked by the CFI/FI before the cross country flight.
- h. A close watch on weather at Dhana is to be maintained by the Flight Instructor i/c Night and if required, aircraft carrying out night cross country are to be advised for diversion well in time.

SECTION 2

NIGHT FLYING PROCEDURES

AIRPORT LAYOUT FOR NIGHT CROSS COUNTRY FLYING

The Airport layout for Night cross country flying would be the same as that for Night Flying. CFI/FI is to carry out airport inspection to ensure that the layout is correct prior to commencement of night flying.

PROCEDURES

1. Taxiing procedure to be followed is same as for day flying i.e. enter the runway via taxi track 'A' and exit the runway via 'B' whether the runway in use is 35 or 17.
2. All take-offs will be carried out from the beginning of Runway 35 & 17. For landing on Runway 35 Displaced Threshold indicated by 4 flares on either side is to be the aiming

point. Aircraft is to commence flare only after crossing the Displaced Threshold of Runway 35. For landing on Runway 17 no restrictions are placed.

3. After take-off turn for setting course is to be made at a minimum altitude of 500 feet AGL (2200 feet on altimeter). Later and/or vertical separation between aircraft proceeding on same route for night cross country is to be ensured and maintained.

PROCEDURE FOR OBTAINING ADC/FIC CLEARANCE FOR NIGHT CROSS COUNTRY

4. The flight plan for the night cross country is to be submitted to Mumbai FIC well in time.
5. ADC, FIC and flight level clearance are to be obtained telephonically before proceeding to the aircraft.

EMERGENCIES IN THE AIR

6. **Loss of lights.** Pilot shall advise ATC and proceed as instructed.
7. **Radio Failure.** Aircraft shall fly the route as per the flight plan so as to arrive overhead as per the given ETA. Once 10 nm inbound to Dhana, commence descend to 3500 ft on altimeter and approach overhead keeping a sharp lookout for other aircraft. Runway in use to be ascertained with the help of landing 'T' and other aircraft on circuit. Once sure of traffic and runway in use, descend to circuit altitude maintaining clear of other traffic and follow the normal circuit keeping a good lookout. On final approach level off over the runway at 300 feet AGL. Thereafter fly pass the tower maintaining 300 feet AGL, flashing the using the landing light three times. Then continue in the circuit pattern and land according to the following 'light signals from the tower.'

Steady Green	-	Clear to land
Steady Red	-	Overshoot and carry out another circuit.
Intermittent Red	-	Do not land continue round circuit until clearance is given.

8. **Total Electric Failure.** If on outbound leg from Dhana discontinue the cross country and turn back towards Dhana. If Inbound to Dhana, continue as planned. Once 10 nm inbound to Dhana, commence descend to 3500 ft on altimeter and approach overhead keeping a sharp lookout for other aircraft. Runway in use to be ascertained with the help of landing 'T' and other aircraft on circuit. Once sure of traffic and runway in use, descend maintaining clear of other traffic and carry out circuit at 800 feet AGL (2500feet on altimeter). On final approach level off at 300 feet over the runway. Fly past the ATC maintaining 300 feet AGL and attract attention by closing and opening throttle. Climb and continue with 800 feet AGL circuit. Land on receiving Green light on final approach or follow as per the light signals given above.
9. **Navigation/ Anti-Collision/ Strobe / Landing Light Failure.** Discontinue the cross country and land back at Dhana.
10. **Engine Failure.** In case of engine failure at night fly at best speed for glide i.e. 65 kts. Aim for dark area and avoid lighted areas. Put landing light on and carry out forced landing. Do not turn back if engine fails after take-off, plan to land straight ahead.
11. **Other Emergencies.** Pilot shall advise ATC of the nature of emergency and intention and proceed as instructed by ATC.

EMERGENCIES ON THE GROUND

12. **Loss of Lights.** Give a radio call to the ATC and follow ATC instructions to return to dispersal. Aircraft with any malfunction of lights are not to take-off..

13. **Radio Failure.** Proceed to the nearest exit from the runway and stop with the aircraft facing the tower. Attract the attention of the tower by flashing the landing light. Taxi according to light signals as below from the tower and return to the dispersal.

Steady Green	-	Clear to taxi
Steady Red	-	Hold
Intermit Red	-	Taxi clear of runway in use.

14. **Total Electrical Failure.** Proceed to the nearest exit off the runway and stop with the aircraft facing the tower and shut down the engine. Attract the attention of the tower by flashing the torchlight. Wait for assistance and do not leave the aircraft as an unlit obstruction.

15. **Other Emergencies.** Above emergencies are specific to Nigh Flying. All other emergencies are to be handled as per the Emergency Checklist of C-172 & PA-34 Piper Seneca.



REDACTED

19 June 2013

FLIGHT TRACKS SHOWING NORMAL PROCEDURE FOR RE-JOINING CIRCUIT



Figure 20 : Aircraft Re-Joining Circuit at Dhana after approaching from East



Figure 21 : Aircraft Re-Joining Circuit at Dhana after approaching from East

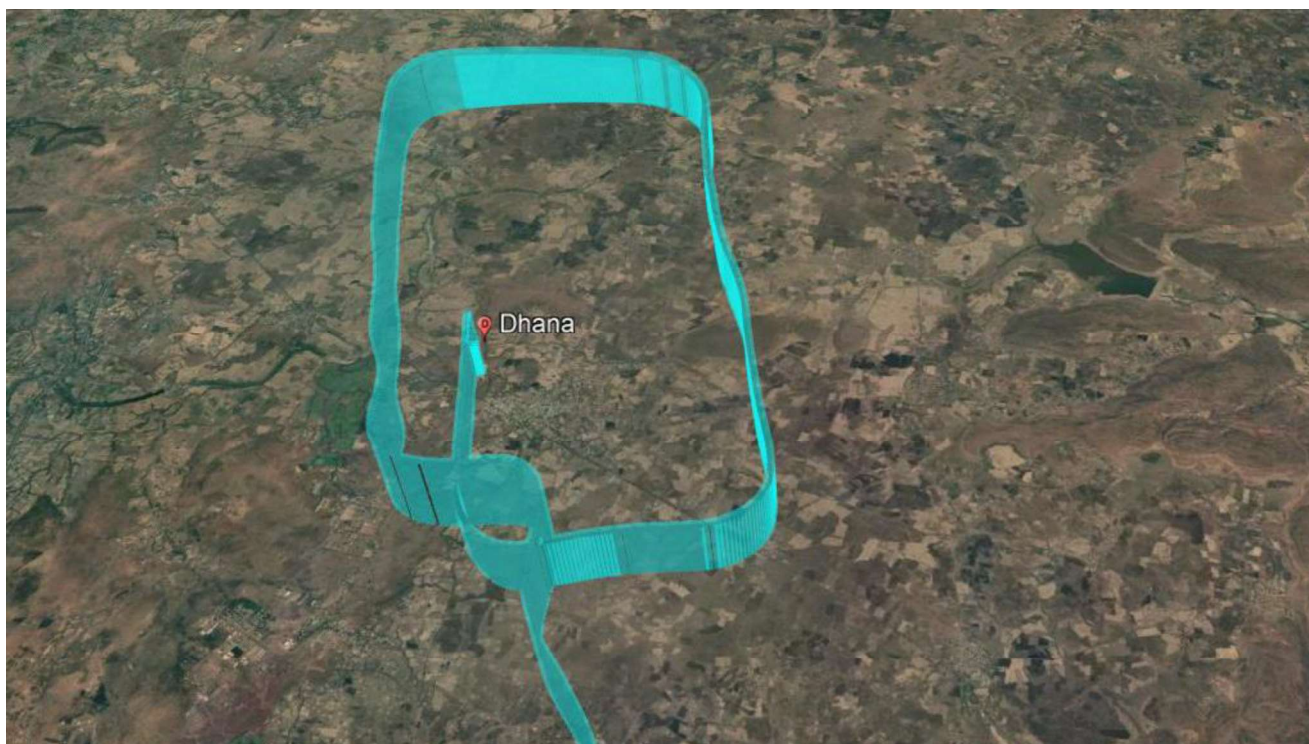


Figure 22 : Aircraft Re-Joining Circuit at Dhana after approaching from South



Figure 23 : Aircraft Re-Joining Circuit at Dhana after approaching from South

- End of Report -