



**Final Investigation Report on accident involving Cessna 172-S aircraft
bearing registration VT-FSF operated by FSTC Flying School Private Limited
at Bhiwani on 17th June 2023.**

**Aircraft Accident Investigation Bureau
Government of India
Ministry of Civil Aviation**

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/Incident shall be the prevention of accidents and incidents and not to apportion blame or liability. The investigation conducted in accordance with the provisions of the 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
AFI	Assistant Flight Instructor
AGL	Above Ground Level
AME	Aircraft Maintenance Engineer
ARC	Airworthiness Review Certificate
ATC	Air Traffic Control
AUW	All Up Weight
BA test	Breath Analyser test
BHP	Brake Horse Power
CAR	Civil Aviation Requirements
CCTV	Close Circuit Television
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CFI	Chief Flying Instructor
CG	Center of Gravity
CPL	Commercial Pilot Licence
DFT	Directorate of Flying Training
DGCA	Directorate General of Civil Aviation
ELT	Emergency Location Transmitter
FOB	Flying Order Book
FRTOL	Flight Radio Telephone Operator's Licence
fpm	Feet per minute
ft	Feet
FTO	Flight Training Organisation
HCAD	Haryana Civil aviation Department
Hrs	Hours
IAS	Indicated Air Speed
INMCC	Indian Mission Control Center
Kgs	Kilograms
Kts	Knots
L&T	Load and Trim
MFD	Multi-Functional Display
MRO	Maintenance Repair Overhaul
MTOW	Maximum Take Off Weight
PDR	Pilot Defect Report
PFL	Practice of forced landing
POD	Pilot on Duty
SMS	Safety Management System
SPL	Student Pilot License
SPWD	State Public Works Department
RESA	Runway End Safety Area
RT	Radio Telephony
SB	Service Bulletin
TPM	Training and Procedures manual
UTC	Universal Time Coordinated
VHF	Very High Frequency

SYNOPSIS

On 17th June 2023, at around 09:11 UTC, a Cessna 172S aircraft bearing registration VT-FSF and operated by FSTC Flying School Private Limited was involved in an accident at Bhiwani Aerodrome wherein while carrying out a training flight the aircraft exited the runway and hit a paver machine engaged in runway extension work.

The flight was a training flight for the purpose of carrying out simulated engine failure exercise. The flight was operated by an Assistant Flight Instructor, who held valid license and ratings. The student pilot had 22.5 hrs of training flying experience and met the requirement for undergoing the said training.

As the aircraft approached Runway 12 after carrying out the training exercises, a delayed touchdown was carried out with inadequate residual runway length available to stop the aircraft. The aircraft exited the runway end and hit a paver machine and another vehicle about 36 feet from the end of runway 12.

The occurrence was classified as an Accident as per Aircraft (Investigation of Accidents and Incidents) Rules, 2017 investigation into circumstances of this accident was ordered vide order no. INV.11011/1/2020-AAIB dated 20th June 2023, under Rule 11(1) of Aircraft (Investigation of Accidents and Incidents) Rules, 2017.

SUMMARY

Final Investigation Report on accident involving Cessna 172-S aircraft bearing registration VT-FSF operated by FSTC Flying School Private Limited at Bhiwani on 17th June 2023.

1.	Aircraft	Type	Cessna 172 S
		Nationality	Indian
		Registration	VT-FSF
2.	Owner		FSTC Flying School Private Limited
3.	Operator		FSTC Flying School Private Limited
4.	Pilot in Command		CPL Holder
5.	Co-Pilot		SPL Holder
6.	No. of Persons on board		02
7.	Date & Time of accident		17 th June 2023, 09:11 UTC
8.	Place of accident		Bhiwani Aerodrome
9.	Co-ordinates of Accident Site		28°50'5.42"N, 76°11'1.72"E
10.	Last point of Departure		Bhiwani Aerodrome
11.	Intended landing place		Bhiwani Aerodrome
12.	Type of Operation		Instructional Flying
13.	Phase of operation		Landing
14.	Occurrence Category		Abnormal Runway Contact Runway Excursion Runway Incursion Aerodrome
15.	Extent of Injuries		NIL

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

1. Factual Information

1.1 History of Flight

On 17 June 2023, routine flying training exercises were being carried out at Bhiwani Aerodrome by FSTC Flying School Private Limited. A total of 12 training flights for the day were authorized as per the record available in the Flight Authorization Book and flying had commenced at 0525 UTC.

As per the details available in the Authorization Book, a Cessna 172-S aircraft with registration VT-FSF was planned to operate three training sortie on that day and was released for flight after satisfactory pre-flight inspection by an authorized AME.

First two flights were operated by the Dy. CFI with two different student trainees for planned general flying and circuit and landing exercise respectively. VT-FSF took-off for the first flight at 0525 UTC and landed back at 0550 UTC. The second flight by VT-FSF took-off at 0722 UTC and landed back at 0807 UTC. No abnormality or defect was reported during any of these flights and the flights were uneventful.

The third flight on VT-FSF was planned to carry out simulated engine failure demonstration exercise for a student cadet by an Assistant Flight Instructor (AFI) on board. The AFI had undergone Breath Analyzer (BA) test at 0351 UTC before starting his flying duties for the day and the Student Pilot underwent BA test at 0356 UTC before proceeding for the simulated engine failure exercise.

The AFI was rostered for carrying out three flights on the day. Prior to operating the flight that ended in an accident, the AFI had operated two flights on different aircraft. The first flight by the AFI was for imparting General Flying Training and was operated on VT-FSK. The aircraft was chocks off at 0517 UTC and chocks on at 0607 UTC. The second flight by the AFI was for imparting Circuit and Landing Training and was operated on aircraft VT-FSJ. The aircraft was chocks off 0717 UTC and was chocks on at 0802 UTC. As per the statement of the AFI, no obstruction was noticed on runway during any of these flights.

The third flight by the AFI was on aircraft VT-FSF. After completing the preflight checks, flight instructor initially lined up the aircraft on runway 30 and performed a simulated engine failure during the take-off roll. After bringing the aircraft to a stop, the aircraft was repositioned to line up with runway 12. Once aligned with runway 12, power was applied and engine failure was simulated during the take-off roll once again.

Following this, aircraft was repositioned to line up with runway 30 and exercise was repeated during take-off roll. The aircraft came to a stop once more. Aircraft was realigned with runway 12 and a take-off was executed. At mid-crosswind, an engine failure was simulated and then resumed normal.

Within the same circuit pattern involving runway 12, AFI simulated an engine failure again, this time at mid-downwind, before making an approach for runway 30 and a go-around was initiated to proceed for next circuit.

Continuing the circuit for runway 30, AFI simulated an engine failure at the beginning of the downwind leg and then approached runway 12 and initiated another go-around. After the go-around from runway 12, AFI practiced simulating an engine failure again at the end of the downwind leg for runway 12 and approached runway 12 for landing. The AFI stated to have made a call on VHF seeking clearance to land while on finals, however, the call was not acknowledged. AFI assumed it was due some RT interference

which is common at Bhiwani since the VHF frequency is shared by five flying schools in the vicinity. The aircraft continued with approach and landing.

The crew made a delayed touched down on the runway 12 and stated to have noticed a Paver Machine at the runway end. The distance covered from 50 ft AGL to touchdown was approximately 3018 feet as per the software application being used by the FTO for Flight Data Monitoring. Hard braking was attempted but the aircraft could not stop and continued its roll beyond runway end marking and entered the extended portion of runway where work for laying final layer of asphalt was underway. The aircraft collided with Paver Machine and came to a halt.

After the collision, the flight instructor observed fuel flowing outside and promptly switched off the engine. Meanwhile, the student pilot opened the door by kicking it and quickly exited the aircraft. The emergency vehicle rushed towards the aircraft and assisted the crew. None of the crew received any serious injuries and both crew were taken to hospital for medical examination. There was no fire.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor	Nil	Nil	Nil

1.3 Damage to Aircraft



Figure 1

The aircraft suffered significant damage due to impact with paver machine. The wing's port side, the outboard section and areas near the engine installation were broken. The wing itself was extensively damaged, along with the left-side aileron and flap. Similarly, the starboard side of the wing, the wingtip, wing root and flap were damaged.



Figure 2

The engine side exhibited a damaged cowling, a fully damaged propeller, and broken landing gear on the port side. The nose landing gear, windshield, and door/window on the port side were also damaged. The cockpit incurred full damage. Total fuselage was damaged. Integral fuel tank area was damaged



Figure 3

and a fuel leak beneath the integral fuel tank area was observed. Other damages included a broken baggage door, damaged landing gear on the starboard side, and damaged horizontal stabilizers on both sides, a fully damaged left-side elevator and rear windshield.

1.4 Other Damage

There was minor damage to the paver machine.

1.5 Personnel Information

1.5.1 Assistant Flight Instructor

Nationality	Indian
Age	28 years
License	CPL
Date of Issue	04.06.2020
Valid up to	03.06.2025
Date of Class I Med. Exam.	09.08.2022
Class I Medical Valid up to	19.08.2023
Date of issue FRTOL License	04.06.2020
FRTOL License Valid up to	03.06.2025
Endorsements on the aircraft	C-152 & C-172
Total flying experience	677:05 Hrs.
Total flying experience on type	22:25 Hrs
Total flying experience during last 1 year	430:00 Hrs.
Total flying experience during last 6 Months	190:00 Hrs.
Total flying experience during last 30 days	27:55 Hrs.
Total flying experience during last 07 Days	08:50 Hrs.
Total flying experience during last 24 Hours	03:10 Hrs.

The AFI was granted AFI (Aero plane) rating by DGCA on 02 May 2022 and the ratings are valid till 01.05.2024 The AFI had earlier flown for another Flying School for about 10 months as AFI and joined FSTC Flying School Private Limited on 10 April 2023. After undergoing instructor acceptance checks by Dy.CFI on 14 April 2023, she was cleared for Instructor flying on 16 April 2023. All these acceptance checks were graded as satisfactory.

1.5.2 Student Pilot

Nationality	Indian
Age	23 years
License	SPL
Date of Issue	14.04.2023
Valid up to	13.04.2033
Date of Class I Med. Exam.	03.02.2023
Validity of Class I Medical	02.02.2024
Date of issue FRTOL License	15.05.2023
Validity of FRTOL License	14.05.2033
Total flying experience	22:25 Hrs.
Total flying experience on type	22:25 Hrs.
Total flying experience during last 1 year	22:25 Hrs.
Total flying experience during last 6 Months	22:25 Hrs.
Total flying experience during last 30 days	12:20 Hrs.
Total flying experience during last 07 Days	01:25 Hrs.
Total flying experience during last 24 Hours	00:30 Hrs.

Trainee was issued a Student Pilot License on 14 April 2023 by FSTC Flying School Private Limited after having met the criteria for issue of SPL laid in Section B of Schedule II of Aircraft Rules, 1937. On scrutiny of flying trainee's progress report, it was observed that he had started flying on 21 April 2023 and had

logged total of 22.25 flying hours. All his training flights were graded as satisfactory by the Flight Instructors

1.6 Aircraft Information

1.6.1 General Description: Cessna 172-S

Cessna 172S is a four seater, high wing monoplane of all metal semi-monocoque construction, nose mounted single- engine and is designed for general utility and training purposes. The aircraft is equipped with fixed tricycle type landing gear with tubular spring steel main landing gear struts. The Nose Landing Gear is steerable and equipped with an air/oil shock strut. The aircraft is powered by normally aspirated direct drive air-cooled, fuel injected, horizontally opposed, four-cylinder engine with 360.0 cubic inch displacement. The Engine is an AVCO-Lycoming Model IO-360 L2A with a Horse Power rating of 180 BHP at 2700 RPM.

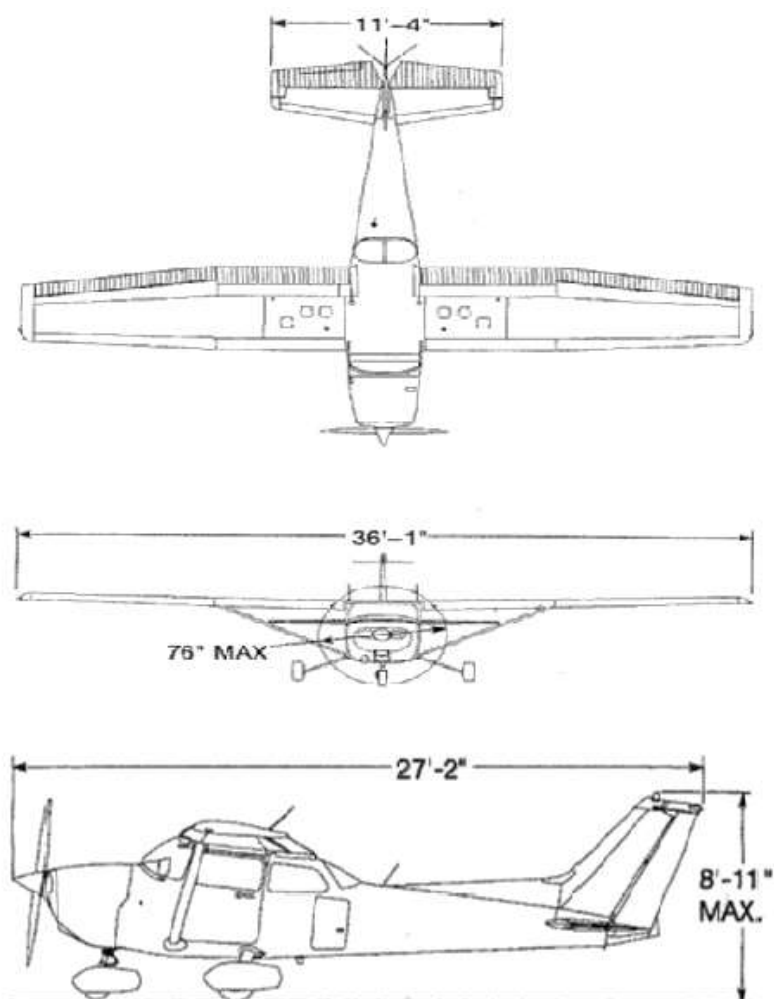


Figure 4: Aircraft Dimensions

The aircraft is equipped with a two blade, fixed pitch metal Maculey Propeller Model 1A170E/JHA7660. The aircraft is certified for single pilot operation. Cabin doors are installed on each side of the airplane.

The airplane's flight control system consists of aileron, rudder and elevator control surfaces. The control surfaces are manually operated through cables and mechanical linkage using a control wheel for the ailerons and elevator and rudder/brake pedals for the rudder.

Aircraft has a manually operated elevator trim system and elevator trimming is accomplished through the elevator trim tab by utilizing the vertically mounted trim control wheel on the center pedestal.

The airplane has a single-disc, hydraulically actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (co-pilot's) set of rudder pedals, which are interconnected.

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.

1.6.2 VT-FSF Specific Information

Aircraft Model	Cessna 172 S
Aircraft S. No.	172S9924
Year of Manufacturer	2005
Name of Owner	FSTC Flying school Private Limited
C of R	Certificate No. 5466 valid on date
C of A	Certificate No. 7579 valid subject to validity of ARC
Category	Normal, Passenger
Last A R C issued on	19.09.2022
ARC valid up to	18.09.2023
Aircraft Empty Weight	797.34 Kg
Maximum Take-off weight	1156.46 Kg
Date of Aircraft weighing	09.08.2022
Max Usable Fuel	144.43 Kg
Max Payload with full fuel	129.69 kg
Empty Weight C. G	42.26 Inches aft of Datum
Total Aircraft Hours	9861:44 Hrs
Last major inspection	Inspection Operation-4, carried out at 9780:09 Hrs on 27.05.2023.
Aero mobile License	Valid up to 17.05.2025
Engine Type	LYCOMING IO-360-L2A
Date of Manufacture (Engine)	21.11.2004
Engine Sl. No.	L-31780-51A
Total Engine Hours	1707:32 Hours since last Engine Overhaul
Propeller Type	Mc Cauley 1A170E/ JHA7660
Propeller Sl. No	AJF23036
Total Propeller Hours	733:26 Hours since last Propeller Overhaul.

Before the accident flight, all applicable Airworthiness Directives, mandatory Service Bulletins, and DGCA Mandatory Modifications for both the aircraft and its engines had been satisfactorily addressed. Furthermore, a thorough review of the Technical Log Book and the Pilot Defect Report (PDR) register confirmed the absence of any outstanding issues or postponed maintenance tasks on the aircraft.

Consequently, the aircraft was cleared for regular flight operations on the day of the accident. From scrutiny of the load and trim sheet, it was determined that the CG and MTOW were within the limits for the flight. However, it is observed in the multiple load and trim sheets of different flights that the arm distance of the empty weight used for calculating Load and Trim did not match the approved values.

1.7 Meteorological Information

A register is maintained to physically record instantaneous weather measurements from airport weather station which are obtained every hour from 0500 Hrs to 1300 Hrs. Weather parameter recorded in the register on 17th June 2023 are given below.

Time	Wind Direction	Visibility (m)	QNH	Temp (C)	Dew Point	Clouds
0500UTC (1030 IST)	210°/03 Knots	5000	1002	32	21	NSC
0600UTC (1130 IST)	210°/03 Knots	5000	1002	32	21	NSC
0700UTC (1230 IST)	210°/03 Knots	5000	1002	32	21	NSC
0800UTC (1330 IST)	130°/00 Knots	5000	1001	35	23	NSC
0900UTC (1430 IST)	220°/11 Knots	5000	999	31	21	NSC
1000UTC (1330 IST)	210°/10 Knots	5000	1000	31	21	NSC

1.8 Aids to Navigation

There are no radio navigation aids available at Bhiwani Aerodrome. The aerodrome features a single runway designed for visual approaches and is equipped with wind socks installed at two locations.

1.9 Communication

FSTC Flying School Private Limited has set up an ATC tower which is generally manned by a Student Pilot or Instructor holding a RTR license. At the time of accident, a student pilot was handling RT communication but he was not sitting in the ATC Tower and was sitting at the POD (Pilot on Duty) table available in the main building.

As per the statement obtained from the student pilot, he took over control of the VHF device at 09:00 UTC from an AFI who was also handling RT communication while sitting at the POD (Pilot on Duty) table. The AFI went for a lunch break after handing the VHF device to the Student Pilot.

Whereas, the ATC tower has full view of the Runway. Only partial view of the runway is available from the POD Table. The Runway 30 side is not visible to the RT controller from the POD Table. As per the statement of FTO personnel, the RT communications are normally undertaken from the POD table and not the ATC tower as the ATC tower is not comfortable to sit due to poor air-conditioning.

On the day of accident, all RT controllers who handled the VHF gave take-off and landing clearances to aircraft without ascertaining if the runway and operational area was clear of any obstruction.

As per the Student Pilot who was handling the RT communication, VT-FSF transmitted status while it was simulating engine failure on right downwind of Runway 12. VT-FSF was advised to contact tower on finals of runway 12. Thereafter, no communication was received from VT-FSF until it crashed. Later he handed over to Dy. CFI who rushed to the threshold of runway 30.

As per the statement of the AFI a call was made to seek clearance for landing, however, no response was received. AFI assumed it was due some interference which is common at Bhiwani since five FTOs in the vicinity are using the same frequency. Since AFI was aware of the traffic situation, landing was continued.

1.10 Aerodrome Information

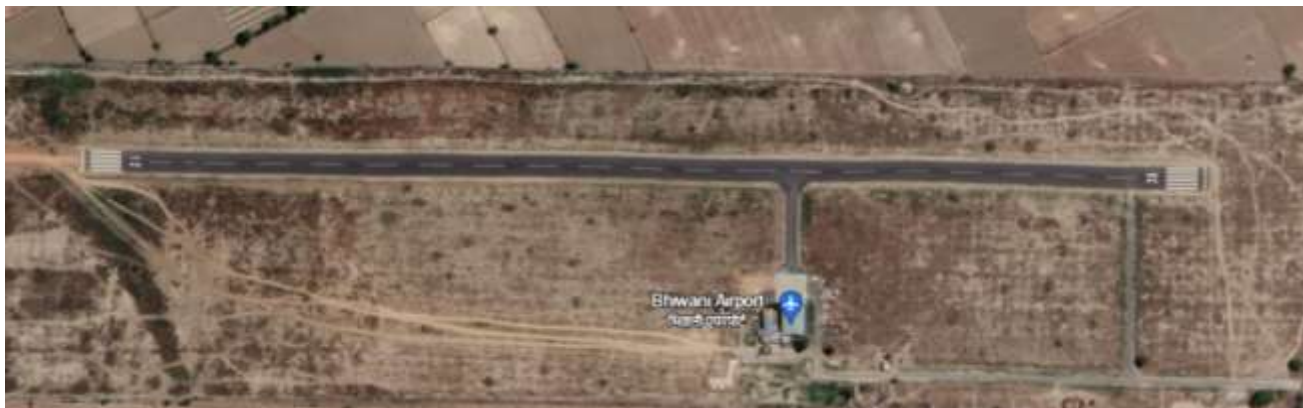


Figure 5: Aerodrome Layout before Runway extension work and other civil works at Bhiwani

Chaudhary Bansi Lal Airport, Bhiwani is owned by the Government of Haryana and leased to FSTC Flying School Private Limited for conducting Flying Training in accordance with FTO permit issued by DGCA. As per the details of Bhiwani aerodrome available in the Flying Order Book of the FTO, the aerodrome is owned and operated by Haryana Institute of Civil Aviation, Govt. of Haryana. The co-ordinates of the ARP are 28 50 12 N, 076 10 44E. The elevation of Aerodrome is 712 feet. Bhiwani Aerodrome is a VFR aerodrome and the runway dimensions are as below:

Runway 12	3500 feet X 75 feet
Runway 30	3500 feet X 75 feet

The aerodrome is not a DGCA licensed aerodrome. Standard runway markings for Designator, Threshold, Center Line and Runway edges etc were available. Marking for aiming point or touchdown zone are not provided. As a practice, the FTO has placed two flags on both side of the runway at middle of the runway length to provide indication to their crew to carry out missed approach in case the aircraft has not touched down till this point. However, due to growth of vegetation, visibility of both flag poles was obscured. On one side of the runway the flag itself was missing and only the pole was in place.



Figure 6 : Damaged Red Flags and Excessive vegetation growth around the Red Flag

1.10.1 Civil Works at Bhiwani Aerodrome.

The Government of Haryana was undertaking major civil works at the aerodrome including construction of hangars, construction of new taxi ways, Hard Shouldering/Extension of Runway and re-carpeting of Runway and Taxiways.

The work was contracted to a Civil Contractor by the State Public Works Department (SPWD). The State Public Works Department had written a letter dated 15.05.2023 to the Civil Aviation Department of Govt. of Haryana seeking 45-day runway closure to complete the extension work. However, the runway was not closed for operations.

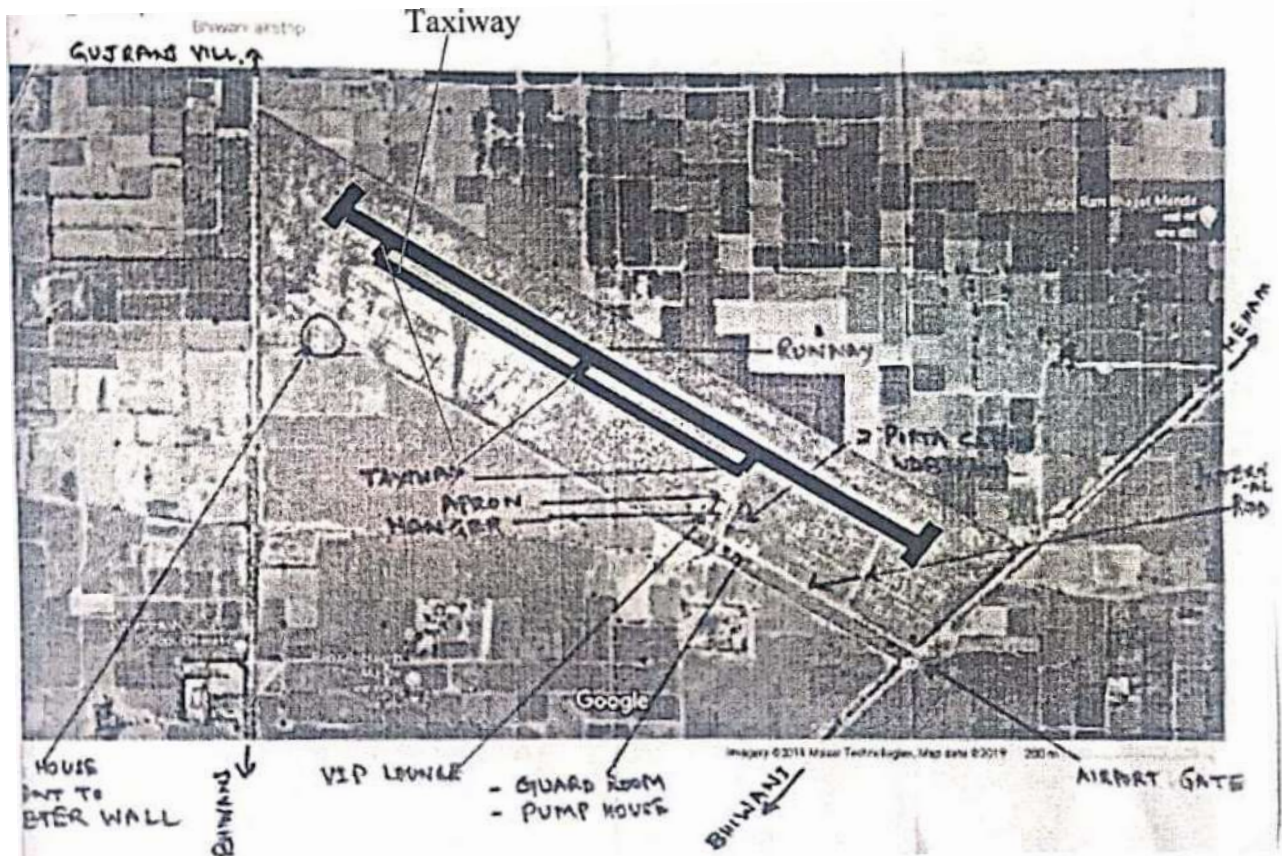


Figure 7: Aerodrome Layout of Bhiwani Airport after Runway Extension and other civil work as contained in the Flying Order Book of FTO

As per the statement of personnel from FTO and SPWD, an arrangement was worked out between FTO and the SPWD to prevent disruption of Flying Operations and it was decided to carry out civil works for runway extension during early morning and in the evening hours, so that flying operations are not affected. FTO or SPWD did not provide evidence of any formal SOP in this regard.

Another letter dated 12 June 2023 was written by the SPWD to Civil Aviation Department of Govt. of Haryana seeking closure of Runway w.e.f 18 June 2023, so that extension work of Runway could be carried out without any hindrance and work completed on time.

As per the actual status of work, the work for extension of Runway 30 was complete. Extension work at the end of Runway 12 was near completion on the day of accident. The work for re-carpeting of Runway was scheduled to be started from 18 June 2023.

On the day of accident, work for laying the final layer of asphalt on the extended portion of Runway 12 was underway. The physical condition observed by the Investigation team indicated that, final layering



Figure 8: Status of work on the extended runway

on about 3/4th width of extended portion was freshly carried out and the work for final layering on last 1/4th width was underway at the time of accident. The Paver Machine was about 36 feet from the end of runway laying asphalt on the last 1/4th width of Runway when the aircraft came and hit the paver machine. Paver Machine along with workers and other equipment and vehicles was operational at the time of accident.

1.11 Flight Recorders

VT-FSF was not required to be fitted with CVR or DFDR as per the prevailing Civil Aviation Requirements. No CVR or 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 aircraft and data was successfully retrieved from the card.

The FTO is using a software application for flight data monitoring and analysis. The data file containing the accident flight was analyzed using the said application. The recording of data in SD card for accident flight started at 08:42:25 UTC indicating that Garmin G1000 was powered at this time. The last recorded reading in the SD card was at 09:12:00 UTC, indicating that unit got powered off at this time. The data was used to create flight path followed by aircraft and superimposed on the satellite map. The same is

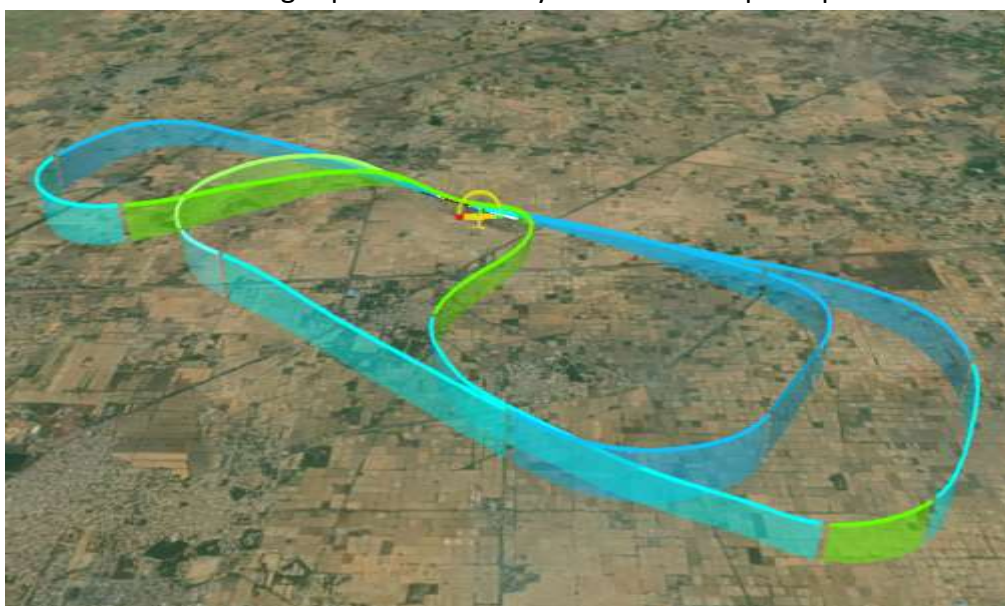


Figure 9: Flight track

shown in the figure 9. Further, as per the Garmin G1000 data, the sequence of events are as follows.

After completing preflight checks, at 08:50:30 UTC AFI initially lined up with runway 30 and performed a simulated engine failure during the

take-off roll. After bringing the aircraft to a stop, AFI then repositioned to line up with runway 12. At 08:52:45 UTC, once aligned with runway 12, AFI applied power and practiced simulating an engine failure during the take-off roll once again.

Following this, aircraft was repositioned to line up with runway 30 at 08:54:14 UTC and the exercise of practicing an engine failure during take-off roll was repeated and the aircraft came to a stop once more.

The aircraft was then realigned with runway 12 and took-off at 08:57:50 UTC. At mid-crosswind, engine failure was simulated and then resumed normal (Figure 10). Within the same circuit pattern involving runway 12, engine failure was again simulated at mid-downwind, before making an approach for runway 30. The aircraft was high (307 ft AGL approx.) on the threshold and at 09:02:46 UTC, a go-around was carried out.



Figure 10 : Flight Track, take-off from runway 12 and approach to runway 30

Continuing the circuit from runway 30, AFI simulated an engine failure at the beginning of the downwind leg and then approached runway 12 (Figure 11). At the time of crossing the threshold, the speed was 91.4 knots and altitude was approximately 161 ft AGL. At 09:06:19 UTC another go-around was initiated.



Figure 11: Circuit from runway 30 continued and approach for runway 12

After the go-around from runway 12, an engine failure was again simulated at the end of the downwind leg for runway 12 at an altitude of about 1148 ft AGL and airspeed was 75 knots. As aircraft again approached runway 12 it was high (Figure 12). This time aircraft was pitched down in an attempt to land and airspeed increased from 75.44 knots to 89.44 knots. The recommended approach speed with flaps is 65 kts and without flaps is 70 kts. The vertical speed also increased and went upto -1104.47 feet per minute.



Figure 12: Circuit from runway 12 and final approach

At that time 09:11:13 UTC, the aircraft crossed threshold. The altitude was 81 feet AGL and Airspeed was 89 knots. Aircraft continued its approach and made a delayed touched down with the airspeed at 54 knots. The distance covered from 50 ft AGL to touchdown was approximately 3018 feet as per the software application being used by the FTO for Flight Data Monitoring. Aircraft continued its ground roll and exited the runway 12 as it was not able to stop within the remaining runway length. Aircraft entered extended portion of runway at 09:11:40 UTC and airspeed was 35.24 knots. The speed abruptly reduced to zero indicating collision with obstacles in the extended portion of runway. Also, the recorded parameters found to be erratic and incomplete. Hence, rest of the data were omitted for the analysis.

1.12 Wreckage and Impact Information

The crew in their statement did not provide any information of the work going on the runway or regarding manpower and equipment available in that area. None of the personnel of FTO interviewed



Figure 13: Freshly laid surface and paver machine loaded with asphalt

confirmed if any work was underway in the extended portion of runway or not on the day of accident. Neither any of the FTO personnel confirmed having witnessed presence of any manpower, machinery or equipment at the accident site.

The freshly laid layer of Asphalt on 3/4th of extended runway surface and the fact that paver machine was loaded with asphalt

indicated that paving work was in progress at the site when the flying operations were being carried out. Although, none of the FTO personnel conformed presence of any manpower, machinery or equipment at the site, the contractor confirmed that the work was underway and all necessary machinery, equipment and manpower was available at the site when the accident happened. As per the contractor, the personnel engaged in work at the site also assisted the crew before arrival of emergency and rescue personnel of FTO.

The investigation team was able to identify the marks of aircraft tyres on the runway. The marks could be traced back to about 375 ft from the end of runway 12. The tyre marks indicated that the aircraft remained slightly right of the centerline after a late touchdown and crossed over to the left of the centerline about 140 feet before the end of Runway 12.



Figure 14: Tyre Marks

The aircraft exited the runway and hit the paver machine. The left-hand wing's outer portion impacted the machine, altering the aircraft's momentum. As a result, the aircraft rotated counterclockwise, causing the propeller to hit the ground during the turn. Simultaneously, the left-hand side elevator made contact with the ground and RH wing impacted another equipment/machinery/vehicle which was not identified.

This sequence of events caused significant damage to the wing, fuselage, elevator, and propeller. The aircraft came to a halt, with impact and its wreckage was mainly located at the final resting position. No signs of pre-impact disintegration were observed.

ELT was also activated as a result of impact during the accident. ELT signal was detected by INSAT 05 at 0912 UTC. After detection of initial signal, alert was transmitted to user by Indian Mission Control Center (INMCC) at 0914 UTC.

1.13 Medical and Pathological Information

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

1.14 Fire

There was no Fire.

1.15 Survival Aspects

The aircraft hit the paver machine about 36 feet ahead of the end of Runway 12 in the extended portion of Runway. The presence of paver machine, vehicles, equipment and personnel in the extended portion of runway while the flight operations were being undertaken could have led to serious injuries or fatalities both to occupants of the aircraft and other personnel on ground.

The damages to the aircraft are indicative of high impact forces but the aircraft cabin had escaped crashing into the paver machine or other vehicle/equipment, thus allowing occupants to escape without any serious injuries. A safety vehicle immediately reached the spot after seeing the crash. Both pilots were able to exit the aircraft after pushing the left-side door which had got stuck.

There was no report of any personnel working in the extended portion of Runway getting hit or injured during the accident.

1.16 Tests and Research

Not relevant to the Investigation

1.17 Organizational and Management Information

1.17.1 FSTC Flying School Private Limited

FSTC Flying School Private Limited is a DGCA approved flying training organization and possesses FTO (A) approval valid until 09.10.2026. The school conducts flying training from two primary bases: Chaudhary Bansi Lal Airport, Bhiwani, Haryana, and Narnaul Airstrip, Haryana.

The school is authorized to provide training services for PPL, CPL, IR, AFIR, FIR, and extension of Single Engine / Multi Engine aircraft ratings on Aeroplanes in accordance with its approval scope. Its operational fleet includes Cessna 172R, Cessna 172S, and Technam P2006 aircraft, facilitating day-to-day operations. The Organisation Chart of the FTO is placed below:-

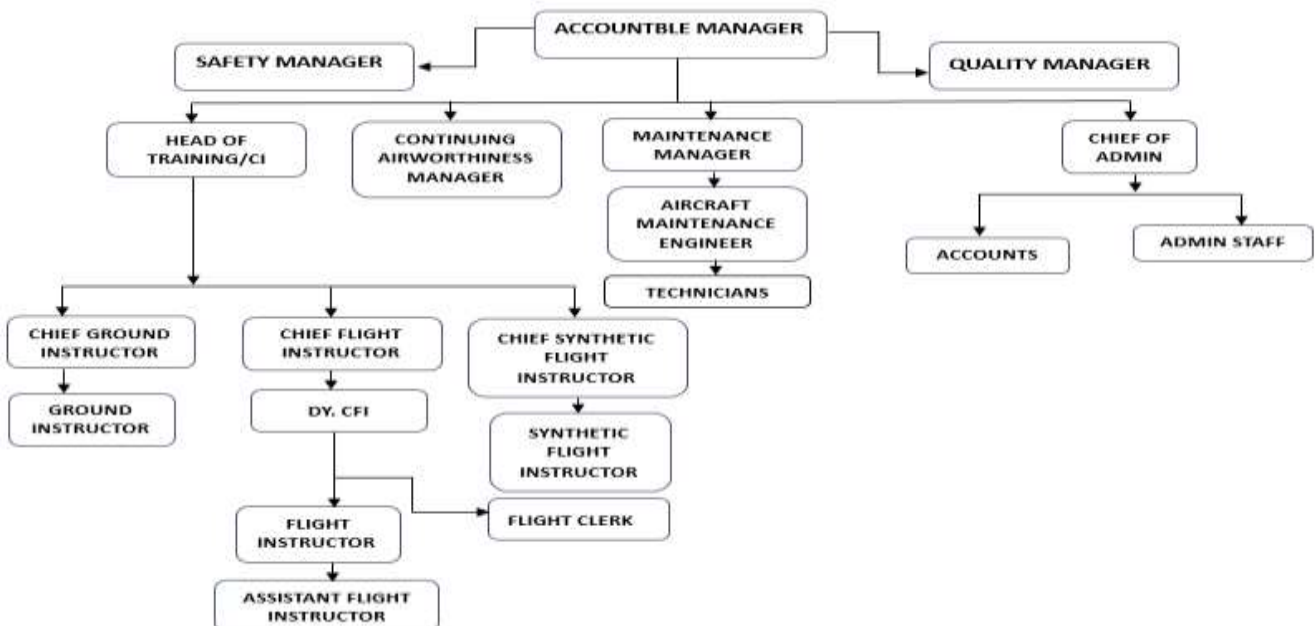


Figure 15: Organisation Chart

1.17.1.1 Flying Orders

Flying Orders are issued by the FTO for day to day operations and compiled in the Flying Order Book (FOB) maintained for this purpose. The Flying Order Book was initially issued on 20 Sept 2021. Three amendments were made in the Flying Order Book in April 2022, May 2023 and June 2023.

All Flight Instructors and Student Pilots are required to sign an undertaking that they have read and understood the content of the Flying Order Book. The record of declarations was obtained from the FTO. The declaration from the AFI and the Student Pilot involved in the accident was not available in the record indicating that latest copy of Flying Order Book may not have been circulated to all concerned.

The Flying Order Book contained order for Practice Forced Landings at Section 2 Order 6. The content of the order is quoted below:-

“Section 2 order 6

F. Practice forced landing

6.1 Pilot/student shall practice forced landing (PEL) on prepared surfaces/runways under the supervision of an instructor only. Flying Instructor as solo pilot may execute a PFL for the purpose of maintenance and consolidation flight. Prior to flight and before the commencement of PFL, Pilot/Student is to be briefed for the force landing checks and procedures to be followed for the day’s flight by CFI/Dy.CFI/Instructor. No PFL is to be executed in night flying.

6.2 The briefing for PFL shall include the following: -

- i. Minimum altitude and distance (from the intended landing airfield) for commencing of PFL for training.*
- ii. Location of commencement of PFL.*
- iii. Selection of the field. Once the field is selected, it shall not be changed.*
- iv. Engine warming (after every loss of 1000ft height-exercise throttle to check power variation and engine response in flight).*
- v. A straight-in approach is to be executed as far as possible below 300 feet AGL using an appropriate selection of flap settings.*
- vi. The PFL should not be carried out at less than 2000ft above ground level and aircraft should be in the gliding distance from the airfield at the time of commencement of the PFL.*
- vii. Repeated PFL shall not be carried out during the same flight.*
- viii. PFL is not to be carried out in solo flights by trainee pilot/student unless in an actual emergency.”*

The order for Go-Around Actions is contained in Section 2 Order 9 of the Flying Order Book. The content of respective orders is quoted below:-

“Section 2 Order 9

1. Go-around action

9.1 Pilot shall initiate go-around action if unsettled on approach below 300 feet AGL. For landing safely on Runway. Go-around action be initiated when: -

- i. On approach aircraft is not aligned with runway centre line.*

- ii. *The Approach speed is more than plus 10 minus 0 knots than the prescribed approach speed.*
- iii. *Perspective is grossly overshooting or undershooting.*
- iv. *Close to ground, in the process of float and touchdown, if the aircraft is drifting either side of runway centre line.*
- v. *If encounters a wind shear during the process of round off and touchdown.*
- vi. *The cross-wind component exceeds aircraft limitations.*
- vii. *In the event of a bounced landing or pilot induced oscillation.*
- viii. *When instructed by Air Traffic Controller.*

9.2 *In the event of a go-around, the pilot shall:*

- i. *Open full throttle and go around*
- ii. *Maintaining shallow climb attitude.*
- iii. *Get T/O Attitude, speed 60 knots.*
- iv. *At safe height, raise flaps to take off settings.”*

The order on procedure for Takeoff and Landing at Bhiwani Aerodrome is contained in Section 8 Order 9 of the Flying Order Book. The content of respective orders is quoted below:-

“ Section 8 Order 9

I. TAKE – OFF AND LANDING AT BHIWANI BASE

- i. *During Take off student/instructor strictly follow the ground roll and speeds as per take-off roll distance chart which is mentioned in Section 2 Limitations & Section 5 Performance of respective Aircraft POH.*
- ii. *While approaching for landing runway 12/30, students/ instructors should not touchdown beyond the red flag placed both sides at middle of the runway.*
- iii. *If any Trainee/Instructor is not able to touchdown before that Red flag that is placed on both sides at middle of the runway. He/She has to follow MISSED APPROACH PROCEDURES as mentioned Section 2, Order 9 in this FOB.”*

1.17.1.2 Training and Procedures Manual

FSTC Flying School Private Limited has issued Training and Procedures Manual (TPM). The TPM was last revised on 17 April 2023 and approved by DGCA. The TPM at Para 11.1 and 11.12 states:-

“11.1 Proper Airport Perimeter Fencing with Adequate Watch and Ward for Preventing Runway Incursion During Aircraft Operation:

The aerodrome perimeter is well fenced and adequately secured. Check of perimeter Fencing is also carried periodically by the security personnel during flying operations.”

and

“11.12 Airport Perimeter Fencing with Adequate Watch and Ward for Preventing Runway Incursion During Aircraft Operation:

Check of perimeter fencing is also carried periodically by the security personnel during Flying operations.”

As per the TPM, regular monitoring of the Aerodrome perimeter during flying operations is carried out to prevent Runway Incursion during aircraft operations. The work for extension of Runway 12 was going on close to the perimeter of the aerodrome.

1.17.1.3 Compliance of Flying Training Circular 1 of 2022 by the FTO.

1.17.1.3.1 CCTV Recordings

DGCA has issued Flying Training Circular 1 of 2022 for the monitoring of training in Flying Training Organizations (FTOs) with the objective of enhancing the surveillance of flying activities conducted in FTOs. According to the circular, the FTO is required to ensure the installation of surveillance cameras to cover the following areas and functionalities (during flying activities). Apron area

- Hangar
- Taxiway and runway
- Classrooms
- Examination Room
- The area where flights are authorized in the Flight Authorization register

The camera feed must be displayed in the Chief Flying Instructor (CFI), Deputy Chief Flying Instructor (Dy. CFI), and Flying Instructor rooms. In case the cameras or any other monitoring device is non-functional, the FTO should promptly inform the Directorate of Flight Training (DFT) via email and take action to restore functionality within 15 days.

During the investigation team's visit, it was observed that while some security cameras were installed to cover the end of runway 12 and the Runway End Safety Area (RESA), they were reported to be inoperative, and the footage from these cameras was not made available to the Investigation Team. It was also noted that this information was not communicated previously to the DGCA. The available CCTV



Figure 16 : Aircraft afloat near the Apron as observed from the CCTV footage

footage shows that the aircraft was still gliding above the runway while it was crossing the taxiway that connects to the apron.

1.17.1.3.2 Flight Data Monitoring

Further as per Flying Training Circular 1 of 2022, the FTO is also responsible for ensuring that the recording of the glass cockpit, ADS (B), or any other monitoring device is operational during flying activities. The FTO has appointed a Safety Manager for conducting flight data analysis for at least 25% of the FTO's daily flights and maintaining records of the analysis.

Upon further examination of the records, it was revealed that the operator is using third-party software for flight data analysis, which includes preset data values for monitoring. These preset values can be customized to meet the operator's specific data monitoring requirements, however, the operator was using the default preset values without making any changes.

The FTO was carrying out flight data monitoring as required by the DGCA Circular. However, no deviation of any kind was detected by the FTO in any of the flights monitored. The analysis of a sample of these flights by the Investigation team showed various instances of deviation including late touchdowns beyond the middle of runway length. Since these deviations were not detected by the FTO, no safety action or training intervention was initiated. As per the FTO, the full-scale flight data monitoring and related safety actions were not being carried out as they were yet to receive acceptance of Safety Manager's nomination from DGCA.

Furthermore, as per information received from DGCA and FTO, the safety manager was appointed by FTO effective from 01 April, 2023. Thereafter, he underwent all training required for Safety Manager. His application for acceptance was submitted to DGCA on 01 May 2023, and was pending on day of accident.

1.17.2 Haryana Civil Aviation Department

As per the information made available by the FTO, the Bhiwani Aerodrome is under the ownership of the Haryana Civil Aviation Department (HCAD) and had an agreement with FSTC Flying School Private Limited, allowing them to set up and operate flight training organizations and/or engage in MRO activities at Bhiwani airport in Haryana on a non-exclusive basis.

As per the terms of the agreement, the government of Haryana's Civil Aviation Department is responsible for providing the necessary infrastructure for the runway/apron (on a non-exclusive basis), security boundaries, fencing, and airstrip maintenance.

Further, FSTC Flying School Private Limited shall have its own arrangement for the safety and security of its assets and equipment and ensure that mandatory services like Air traffic services, fire fighting, medical services and MET information are available for the conduct of aviation and other associated services. However, the perimeter /premises security of Bhiwani airport shall be provided by the arrangements of the Government of Haryana.

The State Public Works Department was contracted by the Haryana Civil Aviation Department for carrying out civil construction works at Bhiwani Aerodrome. State Public Works Department wrote to Haryana Civil Aviation Department for cessation of Flying Activities at Bhiwani Aerodrome for smooth

carriage of civil work. The construction activity however continued side by side with flying operations. AAIB sought details of any communication/direction from Haryana Civil Aviation Department to FTO or SPWD for continuation of construction and flying operations side by side. However, no response was received from them in this matter.

1.18 Additional Information:

Nil

1.19 Useful or Effective Investigation Techniques:

Nil

2. Analysis

2.1 Serviceability of Aircraft

The aircraft had a current and valid Certificate of Airworthiness, an airworthiness review certificate, and an Aero Mobile License as required by applicable regulations on the day of the accident. Prior to the accident flight, all applicable Airworthiness Directives, mandatory Service Bulletins, and DGCA Mandatory Modifications for both the aircraft and its engines had been satisfactorily addressed. Scrutiny of the Technical Log Book and the Pilot Defect Report (PDR) register confirmed the absence of any outstanding issues or postponed maintenance tasks on the aircraft.

The aircraft was cleared for regular flight operations on the day of the accident. No snags or defects were reported in any of the flights preceding the accident flight on that day. The crew did not report any technical problems or issue any distress signals to Air Traffic Control (ATC) at any time during the flight. Data from the Garmin G1000 did not indicate any malfunctions or issues with the aircraft or its engine.

It has been observed that the Load & Trim was prepared with an arm distance for empty weight different from the approved weight schedules, and this was not being verified by the instructors. However, it was established that the center of gravity (CG) and MTOW were within the acceptable limits.

2.2 Crew Qualification and Training

The flight was a dual pilot training flight operated for purpose of carrying out Simulated Engine Failure exercises. Both the AFI and Student Pilot had valid license and qualification to operate this flight. The AFI had experience of about 10 months carrying out Instructional Flying at another FTO before joining FSTC Flying School Pvt. Ltd. on 10 April 2023. After undergoing Standardization Check on 14 April 2023, the AFI was released for Instructional Flying on 16 April 2023. As a practice, new joined Instructors and Student Pilots are required to brief themselves with the TPM, FOB, Checklists and Other Operational Procedures of the organization. A declaration is obtained from the concerned personnel to certify that they have read and understood the content.

Similarly, whenever there is any amendment in the manuals, the amendments are circulated amongst all concerned personnel and declaration is obtained. Declaration from AFI and Student Pilot of having read and understood the content of FOB and SMS Manual was not available in the FTO's records.

The Flying Order Book of FTO contained guidelines on Practice Forced Landings, Go-Around Actions and Take-off/Landings from Bhiwani Airport. The guidelines stipulate that PFLs should not be carried out at an altitude of less than 2000 ft above ground level, and repeated PFLs should not be attempted during the same flight. Additionally, the guidelines prescribe that aircraft should not touch down beyond the red flags placed on both sides in the middle of the runway.

It is not established if the AFI and Student Pilot was provided means to go through the FOB at the time of joining or subsequently when amendments were made to it. Especially Section 2 Order 9 and Section 8 Order 9 of the FOB which concerned to Go-Around actions and directions to go around in case of inability to touch down before the red flags marking middle of runway. One of the Red flags indicating middle of Runway Length was missing and both flags were covered in vegetation which would pose difficulty for crew to notice them.

The standard procedure and guidelines to not continue with an un-stabilized approach or attempting a delayed touchdown was not followed out by the AFI in addition to guidelines for practice forced landings contained in the FOB.

2.3 Civil Construction at Airport

The State Public Works Department had written to the Haryana Civil Aviation Department to get the flying operations stopped so as to carry out civil works without any hindrance. However, an agreement was reached between the FTO and the SPWD to carry civil construction work during the Morning and Evening Hours when there are no flying operations. The fact that, the Paver Machine was operational during Flying Operations clearly indicate that the agreement was not adhered to by both parties.

Neither, FTO nor Haryana Civil Aviation Department could provide any evidence of a formal procedure devised for co-ordination between SPWD and the FTO or any circular/instructions issued by the FTO for carrying out flying activities in co-ordination with construction activities.

The FTO was required to carry regular monitoring of airport perimeter to prevent chances of runway incursion by any vehicle or personnel. Further, the safety of runway has to be ensured by any personnel manning the VHF before giving take-off and landing clearance. Both aspects were missing on the day of accident.

2.4 Operator's Safety Assurance

A scrutiny of the Garmin 1000 Flight Data Analysis register revealed that no deviations were detected by the FTO in the flight data monitoring of the flights. However, Garmin data analysis of VT-FSF and flights operated by the instructors revealed the instances of deviations. Flights were often conducted with late touchdowns beyond the midpoint of the runway, in contradiction with Flying Order Book Section 8 Order No. 9.

None of the FTO's personnel interviewed by the Investigation team, confirmed the presence of paver machine or other equipment and vehicles on the extended portion of runway when flying operations were going on. The involved crew also indicated that, they had seen the paver machine on the runway only after landing on runway. However, the statement from the civil contractor indicated that work was in progress at the site and various vehicle, equipment along with manpower were present at the site. Same was confirmed from the damages observed on aircraft especially on wings which indicated impact

with another vehicle as well apart from paver machine. The CCTV recording was however, not provided by FTO citing unserviceability of CCTV cameras facing the site.

The total airborne time of the accident flight after take-off lasted about 14 minutes. During this time, two go-around, and one landing were performed on the runway. The time gap between the last go-around and landing was approximately 5 minutes only. The condition of the tarmac on the extended side of Runway 12 and the positions of the paver machine with gravels suggest that the final asphalt layer had been freshly laid to a length of 36 feet and work was underway for significantly longer than 14 minutes of flight time after take-off.

It was therefore possible for FTO personnel including Instructors, Student Pilot and other personnel to notice the work being undertaken at the site. This indicates that whatever informal arrangements were agreed between FTO and SPWD for undertaking flying operations in parallel with civil works on the runway were not adhered to.

2.5 Circumstances leading to the Accident

Haryana Civil Aviation Department (HCAD) had contracted State Public Works Department for carrying out civil construction activities at Bhiwani Aerodrome. Contracted activities included, extension of runway, re-carpeting of runway, construction of new taxiways and hangars etc. SPWD wrote to HCAD for cessation of flying activities at Bhiwani aerodrome for unhindered civil construction work. However, the construction activities continued in parallel with flying operations without any formal arrangements for co-ordination being put in place. Work for runway extension was near completion when, SPWD wrote another letter to HCAD seeking closure of Runway from 18 June 2023, so as to carry out runway re-carpeting work.

An Assistant Flying Instructor, with about two months of experience in the FTO was detailed to carry out Simulated Engine Failure exercises for a Student Pilot on 17 June 2023. Meanwhile, work for laying final layer of asphalt on the extended portion of Runway 12 was also underway. A paver machine along with other vehicles, equipment and manpower were positioned at the site.

Regular monitoring of the perimeter of aerodrome is required by the TPM so as to prevent any unauthorized movement on the Runway thus preventing Runway Incursion. The monitoring would have detected the presence of Paver Machine and other vehicles in the operational area. The fact that same was not detected and mitigated indicates that the monitoring was either not being carried out or the presence of vehicle was ignored as a routine practice.

The ATC tower was available, however, it was not being used and the RT controller manning the VHF would sit on the POD table in main building while handling RT. The POD table does not provide visibility of Runway 30. The different RT controllers manning the VHF at different times gave take-off clearance to all aircraft that operated ten flights on the day of accident without being in position to ascertain if the Runway operational area was clear of any obstruction.

The aircraft being operated by the FTO were equipped with Garmin G1000 cockpit capable of recording Flight Parameters on a SD card. Although download and monitoring requirement stated in the DGCA

Flying Training Circular 1 of 2022 was stated to be met, the deviations including delayed touchdown were not detected. Consequently, no safety actions or training interventions were initiated.

On 17 June 2023, the AFI and Student Pilot prepared for the training flight and started the engine at about 08:50:30 UTC. Aircraft taxied from the apron and three repeated exercise for simulated engine failure during take-off roll were carried out. Thereafter, aircraft lined up on runway 12 and took-off at 05:54:49 UTC for the first circuit. At mid-crosswind simulated engine failure exercise was performed before resuming normal. Another simulated engine failure was performed at mid-downwind of the same circuit before approaching runway 30. A go-around was initiated and 2nd circuit pattern was continued. Simulated Engine Failure exercise was carried out at the beginning of downwind leg during this circuit before the aircraft again approached runway 12.

A go-around was carried out and 03rd circuit pattern was continued. Simulated Engine Failure exercise was carried out at AGL of about 1148 ft AGL and IAS 75 kts. Thereafter crew stated to have made a RT call for landing clearance, however, the same was not acknowledged. Being aware of the traffic situation and the fact that RT interference was common at Bhiwani, the crew continued with approach to runway 12. The aircraft was high and aircraft nose was pitched down to attempt landing. The airspeed increased to 89.44 kts and the vertical speed reached -1104.47 fpm. As the aircraft crossed threshold, the altitude was 81 ft AGL and IAS was 89 kts.

A delayed touchdown was carried out and distance from 50 ft AGL to touchdown was estimated to be about 3018 ft. The tyre marks on the runway indicated that the aircraft touched down at approximately 375 feet from the end of runway 12. The distance was insufficient to stop the aircraft and the aircraft exited the runway to hit the paver machine and other vehicle positioned in the extended portion of runway about 36 feet from the end of runway.

3. Conclusion

3.1 Findings

3.1.1 The aircraft was airworthy before the accident. It was the third flight of the day for both the aircraft and the instructor, while it was the first flight of the day for the student pilot.

3.1.2 Both AFI and Student pilot had valid license and ratings, and were qualified to operate the flight.

3.1.3 Flying operations were underway along with civil works for paving the extended portion of runway 12 on the day of accident.

3.1.4 CCTV cameras overlooking the runway 30 were reported to be non-functional. No communication in this effect had been made to the DGCA as required by DGCA Flying Training Circular 1 of 2022.

3.1.5 Though, ATC tower was available at Bhiwani Aerodrome, it was not being used by the RT controllers.

3.1.6 RT controllers were manning the VHF sitting at POD table in the main building which did not have the complete view of the operational area and runway, especially the runway 30 side.

3.1.7 Effective monitoring of Flight Data downloaded from the aircraft was not being carried out. Deviations that existed in the flights were not captured and consequently no safety action or training interventions were undertaken.

3.1.8 The flag poles on either side of runway indicating the middle of runway length were covered with vegetation. The flag on one side was missing.

3.1.9 AFI carried out three practice exercises simulating engine failure during take-off roll before taking off from runway 12. Three circuits were then carried out simulating engine failure during different phases of circuit pattern at height below 2000 feet AGL in variance with the requirement of 2000 feet AGL contained in the Section 2 Order 6 of FOB.

3.1.10 The approach speed during the final approach for runway 12 increased to 89kts with vertical speed at -1104.47 fpm. Crew did not anticipate perspective of overshooting and made a delayed touchdown not in line with go-around actions contained in Section 2 Order 9 of the FOB.

3.1.11 Flying orders and safety management system manual are not disseminated to all AFIs and student pilots.

3.2 Probable Cause of the Accident

Continuation of approach that was un-stabilized and delayed touchdown leading to unavailability of adequate distance to stop the aircraft within the available Runway Length.

The following factors were contributory to the accident:

- Obscured visibility of Red Flags placed to warn pilots to go-around in case of delay in touch down.
- Absence of any formal co-ordination mechanism to ensure that the construction activities do not obstruct the operational area.
- Failure of Instructors and Student Pilots manning the VHF to monitor the Runway for any obstruction before giving Take-off or Landing clearance.

4. Safety Recommendations

4.1 Recommendations to address findings of the Investigation

4.1.1 DGCA may take necessary action as required by the DGCA Flying Training Circular 1 of 2022 to ensure that CCTV cameras are monitored and recordings available at all times during flying operations.

4.1.2 DGCA may take action to sensitize all FTOs about the importance of SMS and Flight Data Monitoring and may enhance surveillance to ensure SMS is properly implemented and followed.

4.1.3 FTO should ensure effective Flight Data Monitoring and initiate safety or training interventions based on the results of Flight Data monitoring.

4.1.4 FTO should take necessary action to ensure that content of organization's policy manuals are disseminated to all concerned and record of the same is maintained.

4.1.5 FTO should take necessary action to ensure that, the flags placed to indicate middle of runway length are clearly visible at all times during flying operations.

4.2 Other Safety Recommendations and Actions

4.2.1 Installation of on-board audio/video recording device in the cockpit of trainer aircrafts needs to be implemented to enhance oversight of Flying Training Organization and to facilitate instructors in analyzing the performance of the trainee pilots post solo flights. This tool will also assist in investigations by DGCA and AAIB.

Date: 27 Mar 2024

- End of Report –