



FINAL INVESTIGATION REPORT ON ACCIDENT
TO PIPER SENECA PA-34 AIRCRAFT
VT-BCA OF M/s THE BOMBAY FLYING CLUB
AT DHULE ON 01/12/2017

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.

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
AMSL	Above Mean Sea Level
ARC	Airworthiness Review Certificate
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
AUW	All Up Weight
C of A	Certificate of Airworthiness
CAR	Civil Aviation Requirements
COI	Committee of Inquiry
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DFDR	Digital Flight data Recorder
DGCA	Directorate General of Civil Aviation
F/O	First Officer
FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Training Manual
FRTOL	Flight Radio Telephone Operators License
hrs	Hours
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
LLZ	Localizer
MEL	Minimum Equipment List
MLG	Main Landing Gear
NDB	Non-Directional Beacon
NLG	Nose Landing Gear
Nm	Nautical Miles
PIC	Pilot in Command
QRH	Quick Reference Handbook
SB	Service Bulletin
SEP	Safety and Emergency Procedures Manual
VFR	Visual Flight Rules
VOR	VHF Omni directional Range
UTC	Coordinated Universal Time

**FINAL INVESTIGATION REPORT ON ACCIDENT TO M/s THE
BOMBAY FLYING CLUB PIPER SENECA PA-34 AIRCRAFT VT-
BCA AT DATARTI VILLAGE, NEAR DHULE,
MAHARASHTRA ON 01/12/2017**

- | | |
|------------------------------|--------------------------------------|
| 1. Aircraft Type | : Piper Seneca PA-34 |
| Nationality | : Indian |
| Registration | : VT –BCA |
| 2. Owner & Operator | : The Bombay flying Club |
| 3. Flight Instructor | : ATPL holder on type, |
| Extent of injuries | : Minor |
| 4. Student Pilot | : Student Pilot, |
| Extent of injuries | : Minor |
| 5. Place of Accident | : Near Datarti Village, Dhule, |
| Maharashtra | |
| 6. Date & Time of accident | : 1 st Dec 2017, 1435 UTC |
| 7. Last point of Departure | : Surat Airport, Gujarat |
| 8. Point of intended landing | : Dhule Airport, Maharashtra |
| 9. Type of operation | : Training Flight |
| 10. Passengers on Board | : 04 (Student Pilots) |
| Extent of injuries | : 02 Minor & 2 None |
| 11. Phase of operation | : Enroute |
| 12. Type of Accident | : Forced landing |
| 13. Coordinates of Site | : 20° 57' 41 N, 74° 21' 36 E |

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SYNOPSIS

On 01.12.2017, The Bombay Flying Club PA34 aircraft VT-BCA while operating a training flight from Surat to Dhule was involved in an accident at 1435 UTC near Datarti village, Dhule, Maharashtra. There were four trainee pilots occupying the passenger seats and two crew members on board the aircraft. All passengers had security check in through Surat.

The aircraft took off from Surat for a cross country flight at 1339 UTC for home base Dhule and climbed to Flight Level 70. When the aircraft was about 45 to 50 miles outbound of Surat, aircraft encountered clouding. Subsequently, crew deviated to the left in order to avoid enroute weather. Crew continued deviation for a while, however, aircraft could not come out of the weather. Finally, crew deviated to the right with a climb, from their track to avoid bad weather.

When the aircraft came out of weather, crew turned the aircraft to left to intercept Dhule and called Dhule ATC to communicate that they had deviated to the right due to bad weather. After capturing Dhule track, the crew realized that aircraft was a little low on fuel and as per procedure, CFI again leaned the mixture for both engines going a little more towards yellow arc. Due to low fuel available onboard, CFI executed final approach track for RW 09 of Dhule Airport on GPS so as to make a “straight in approach”.

The CFI requested Dhule ATC for priority landing and also informed that the aircraft was right of the assigned track and communicated its current distance from the Dhule airport. The AFI approved runway 09 for a straight in approach.

During approach, initially the left engine failed. Immediately, the CFI took over the controls and feathered the left engine. Subsequently, the right engine also failed. CFI lowered the nose of the aircraft, reduced its speed to about 80 Knots and turned to his right to avoid residential area. The CFI informed Dhule ATC that they are carrying out forced landing as both engines have failed.

The CFI was continuously monitoring the altimeter reading. As per CFI, after assessing presence of the inhabited areas which were lighted, he manoeuvred the aircraft to the right avoiding a well-lit village exactly on their

flight path. It was later realized that the name of the village was Datarti. The aircraft touched on its belly as the CFI had decided to keep the landing gear retracted. While attempting force landing, the aircraft hit an electric wire and windshield of the aircraft broke. Aircraft came to a halt and settled on its belly on the ground.

The CFI directed all occupants including the co-pilot to evacuate from the rear door the aircraft. Before leaving the aircraft, all electrical switches were switched off. Accident was survivable, however, aircraft got substantial damages. Four of the six occupants on board suffered minor injuries.

Occurrence was classified as Accident as per the Aircraft (Investigation of Accidents and Incidents) Rules, 2017. DG, AAIB issued an Order vide file No.15013/08/2017-AAIB dated 4th Dec, 2017 appointing Mr. Raje Bhatnagar, Assistant Director as an Investigator-in-Charge and Mr. Dinesh Kumar, Air Safety Officer as Investigator.

The Probable cause of the accident was *“Accident occurred as the aircraft had taken off with lesser fuel than required because of erroneous fuel planning and suffered substantial damages while carrying out forced landing due to both engines flaming out in flight”.*

1. FACTUAL INFORMATION

1.1 HISTORY OF FLIGHT

On 01/12/2017, Piper Seneca PA-34 aircraft VT-BCA owned by “The Bombay Flying Club” operating a cross country flight from Surat to its home base, Dhule, was involved in an accident while carrying out forced landing near Datarti village, Dhule, Maharashtra. There were two cockpit crew and four trainee pilots on board the aircraft. The aircraft was under the command of CFI qualified on type and a student pilot was Pilot Monitoring.

This was the fifth sortie of the day. Before commencing the flight, CFI asked for Dhule weather on telephone which was reported to be above weather minima. Pilot monitoring was briefed about the sortie by the CFI and aircraft took-off from runway 04. The aircraft got airborne from Surat at 1339 UTC and climbed to FL070 assigned by the Surat ATC. As per CFI’s statement, when the aircraft was somewhere between 45 and 50 miles away from Surat, aircraft encountered bad weather. As per the procedures, crew deviated to the left to avoid bad weather and tried to look out of the cockpit to anticipate the extent of weather but could not see much as the aircraft was already in clouds. Pilot Flying decided to continue the deviation for a while so as to come out of the bad weather. However, no information was passed to Surat ATC in respect of deviation taken. Finally, the crew decided to deviate to the right from their designated route thinking that right side might be clear of weather. They were able to make contact with Dhule ATC when they were at about 65 NM. Crew found out that while Dhule ATC was reading them, however, they were unable to read back Dhule ATC. Notwithstanding this development, the crew passed the information regarding deviation and present position.

After the aircraft came out of bad weather, they made a severe left turn to intercept track to Dhule. Subsequently, when the aircraft was at about 24 nm from Dhule airport, CFI found that the aircraft was little low on fuel. As per procedure, throttle was set to lean, a little more towards yellow arc. From this point onwards while the student pilot was flying the aircraft, CFI was constantly monitoring the fuel status on both the gauges.

In spite of leaning of fuel mixture, fuel was getting lower and CFI planned for “straight in” approach for RW 09 of Dhule Airport on GPS. Crew called Dhule ATC and requested for priority landing and also informed that they

were right of their assigned track. Dhule ATC acknowledged that RW 09 is available for straight in approach.

During approach, initially the left engine failed. CFI immediately took over the controls and feathered the left engine. Subsequently, the right engine also failed. Thereafter, the CFI took the right turn to avoid the residential area as he could see some lights at 12 O'clock position.



Fig: Aircraft final position at crash site

Finally, CFI prepared for a forced landing and instructed all trainees to fasten their seat belts as they are going to make an emergency landing. The last altimeter reading noticed by the crew was 2000 feet. Soon aircraft hit an electric wire and aircraft windshield broke. Thereafter, CFI raised the nose of the aircraft to an attitude parallel to ground and in a few seconds, aircraft suddenly impacted the ground. Aircraft landed on its belly at about 21 nm from the Dhule airport at approx. 1435 UTC After impact with the ground, aircraft stopped and then CFI told all occupants including the co-pilot to evacuate the aircraft through the rear door. All electrical switches were switched off and lastly CFI left the aircraft through the front door. There was no pre and post impact fire. Dhule ATC was informed about the forced landing and location of crash site was passed.

All onboard occupants moved away from the accident site upto a safe distance. Local authorities were informed by the CFI on their mobile phone requesting them to provide police assistance as local people had started gathering on the crash site.

In between CFI also called for ambulance, which arrived along with a few policemen and assisted all occupants to the nearest government Primary Health Centre in Sakri. They were checked for any injuries and were administered first aid. The reports were found normal. After the first aid and other medical tests, both crew members and two trainee pilots were released from the hospital.

1.2 INJURIES TO PERSONS

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR	02	02	Nil
NONE	Nil	02	Nil

1.3 DAMAGE TO AIRCRAFT

The aircraft had hit the wire and finally settled on its belly. The aircraft suffered damages mainly to its left wing, both propellers and the windshield. The windshield was found broken. However, all windows/ panes were found intact. Most of the damages were confined to both wings and propeller blades. Right wing suffered substantial damage caused by the crowd moving all over the aeroplane. Following are the damages observed on the aircraft:-

Left Hand Side: -

- a. LH propeller's two blades were found bent in the aft direction.
- b. LH engine cowling was found damaged.
- c. Deep cut on the leading edge of the wing near engine.
- d. Random wrinkles were found all along the wing.

Right Hand Side:-

- a. Wing was found broken from the mid section.
- b. Wing surface had significant dents & wrinkles.
- c. All propeller blades were found bent.

- Both wing surfaces were wrinkled and cracked. RH wing had suffered a deep cut. However, there were no signs of fuel leakage.

1.4 OTHER DAMAGE

One high-tension electrical line was broken

1.5 INFORMATION IN RESPECT OF INVOLVED PERSONNEL

1.5.1 Chief Flying Instructor (PIC)

Age	57 years
License	ATPL
Date of License Issue and Valid up to	06/10/2012 valid upto 05/10/2021
Category	Aeroplane
Class	Multi Engine Land
Endorsements as PIC	C-172, C-152, DA-40, DA-42, PA-34, ZLIN 242L
Date of Joining Company	15th May 2014
Date of Endorsement as PIC on type	20/08/2015
Instrument Rating	IR (ME) 13/04/2017 valid upto 12/04/2018
Date of Med. Exam & validity	25/08/2017 valid upto 29/02/2018
Date of Route Check	N/A
Date of Last Proficiency Check	13/04/2017
Total flying experience	5529:10
Total Experience on type	307:55
Total Experience as PIC on type	299:45
Last flown on type	30/11/2017
Total flying experience during last 01 Year	368:30
Total flying experience during last 180 days	144:00
Total flying experience during last 90 days	144:00
Total flying experience during last 30 days	74:30
Total flying experience during last 07 Days	30:45

Total flying experience during last 24 Hours	04:10
Rest period before the flight	13 hours

1.5.2 Student Pilot

Age	21 years
License	SPL
Date of License Issue and Valid up to	02/11/2015 TO 01/11/2020
Category	Aeroplane
Class	Single and Multi-Engine
Endorsements as PIC	N/A
Date of Joining Company	JUNE 2015
Date of Endorsement as PIC on type	N/A
Instrument Rating	N/A
Date of Med. Exam & validity	22/08/2017 Valid till 14/09/2018
Date of Route Check	N/A
Date of Last Proficiency Check	N/A
Total flying experience	193 Hours.
Total Experience on type	08 Hours.
Total Experience as PIC on type	0 Hours.
Last flown on type	30/11/2017
Total flying experience during last 01 Year	153 Hours.
Total flying experience during last 180 days	70 Hours 45 Minutes.
Total flying experience during last 90 days	55 Hours 20 Minutes.
Total flying experience during last 30 days	10 Hours 25 Minutes.
Total flying experience during last 07 Days	01 Hour 30 Minutes.
Total flying experience during last 24 Hours	01 Hour 30 Minutes.
Rest period before the flight	16 Hours 25 Minutes.

Both pilots were not involved in any serious incident/ accident in the past.

1.6 AIRCRAFT INFORMATION

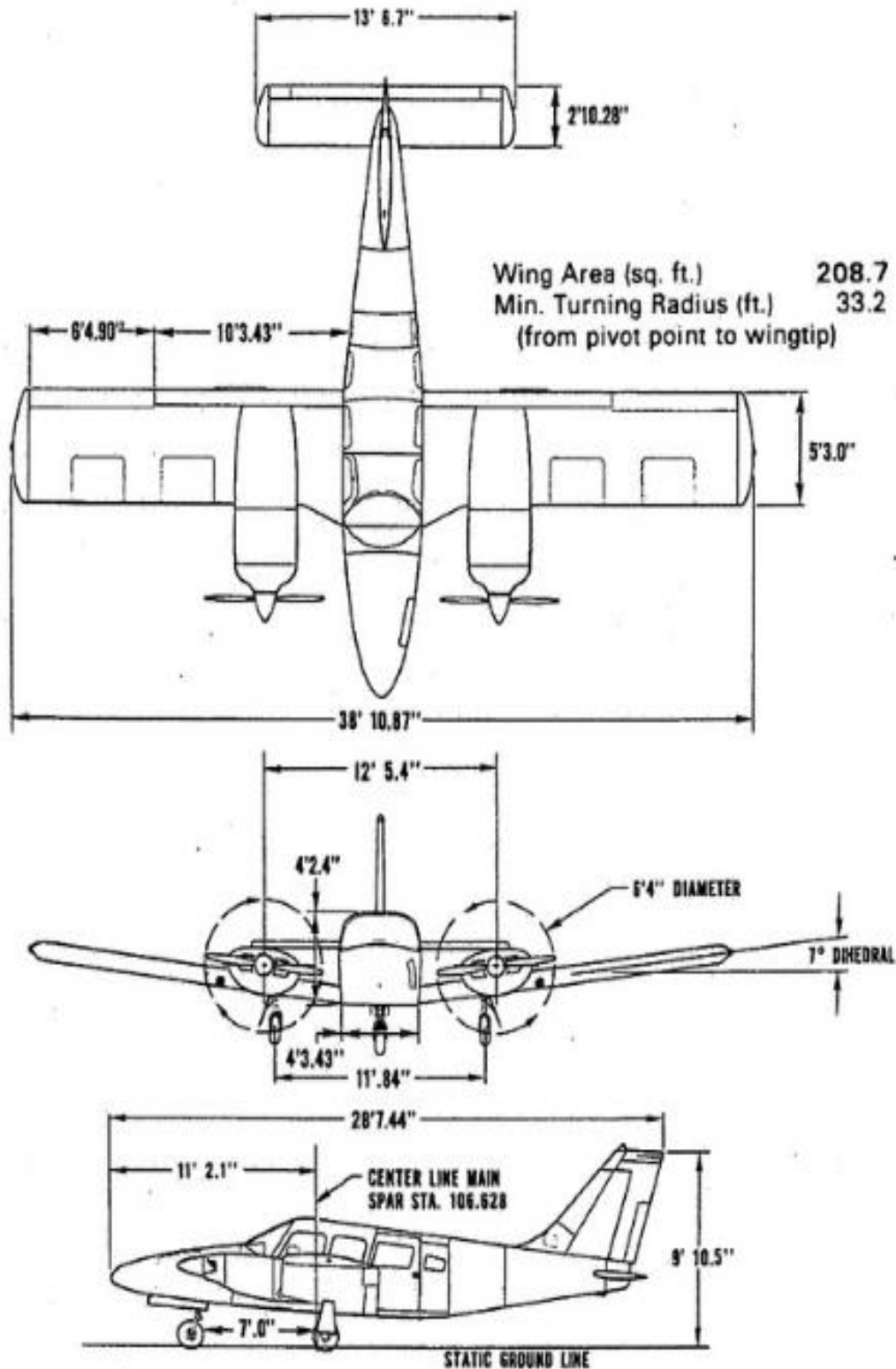


Fig: 3-Dimensional view of the aircraft

The Piper PA-34 Seneca is a twin-engine civil transport light aircraft. The aircraft is designed for operation with two pilots and has passenger seating

capacity of four. The aircraft has two piston engines manufactured by M/s Continental.

The aircraft is certified in Normal (Passenger) category, for day and night operation under VFR & IFR. The maximum operating altitude is 25000 feet and maximum take-off weight is 2160 Kg. The maximum aircraft landing weight is 2048 Kg. The Aircraft length is 28.7 feet, wingspan is 38.10 feet and height of this aircraft is 9.10 feet. The distance between main wheel centre is 11.84 feet. The distance between engines is 12.5 feet.

PA34 aircraft VT-BCA (MSN: 3448011) had been manufactured in 1990. The aircraft was registered with DGCA under the ownership of M/s The Bombay Flying Club on 03.09.2012. The aircraft is registered under Category 'A' and the Certificate of Registration No. is 4312.

The aircraft is fitted with two Mc Caulley 3AF32C508-B, 3AF32C509-B, constant speed, hydraulically activated, full feathering, three blade propellers

The Certificate of Airworthiness Number 6421 under "Normal category" subdivision Passenger was issued by DGCA on 16.10.2012. The specified minimum operating crew is one. At the time of accident, the Certificate of Airworthiness was current and ARC was valid upto 05.01.2018.

The aircraft was holding a valid Aero Mobile License No. A-022/003/ERLO-12 at the time of accident. As on 01.12.2017, the aircraft had logged 7570:55 Airframe Hours.

The aircraft and its engines were being maintained as per the maintenance programme consisting of calendar period/ flying Hours or Cycles based maintenance as per maintenance programme approved by Regional Airworthiness Office, Mumbai.

The last inspection 50 Hrs/ 90 days inspection check was carried out on 24.11.2017. Subsequently, all lower inspections (Night Halt checks, Layover Checks, Weekly Checks) were carried out as and when due before the accident.

The aircraft was last weighed on 28.11. 2015. As per the approved weight schedule, the Empty weight of the aircraft is 1447.2 Kgs. Maximum Usable fuel

Quantity is 348.36 Kgs. Maximum payload with fuel tanks full is 279.44 Kgs. Empty weight CG is 89.65". Prior to the accident flight, the weight and balance of the aircraft was well within the operating limits for Surat Dhule Flight. However, for Dhule Surat Flight, the aircraft was over loaded.

The left Engine S/N 901327 and right Engine S/N 314693 had logged 783:45 Hrs since overhauled on 06.10.2010. There was no defect reported on engines on the previous flight.

All concerned Airworthiness Directives, Mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engines had been complied with as on date of event.

1.7 METEOROLOGICAL INFORMATION

As per Daily Meteorological Record maintained at BFC, weather information for Dhule was collected at 0530 UTC before the commencement of the first sortie of the day. The reported weather as per the records was; surface wind direction 095° speed 03 Kts and visibility 6000 meters.

This flight took off at 1339 UTC from Surat airport (VASU). As per the weather obtained from Surat at 1330 UTC, surface wind direction 050° speed 04Kts and visibility 5000 m in Smoke and no significant clouds were reported. And Dhule weather at 1300 UTC was reported as surface wind direction 090° speed 04Kts, visibility 5000 m and no significant clouds.

No significant trend was reported by ATC. The METAR indicated visibility above the weather minima which was 5 km from 1300 UTC to 1400 UTC. There were No Significant Clouds.

At both airports, weather was not significant.

1.8 AIDS TO NAVIGATION

Dhule Airport with Runway orientation 27/09 is a "Visual Approach Runway" and no other navigation aid or landing aid is installed. Aircraft was fitted with VHF, VOR/DME & ADF NAV aids.

As a practice, a hand held GPS was always carried on board the aircraft to aid navigation. This was done on the date of the accident also.

1.9 COMMUNICATIONS

The communication frequency available at Dhule is 123.45 MHz and aircraft was in positive communication with the ATC before the accident. The PIC had informed to Dhule ATC that he had deviated to the right due to bad weather. Later, the PIC informed the Dhule ATC that he was making a forced landing approximately 21 NM short of Dhule.

1.10 AERODROME INFORMATION

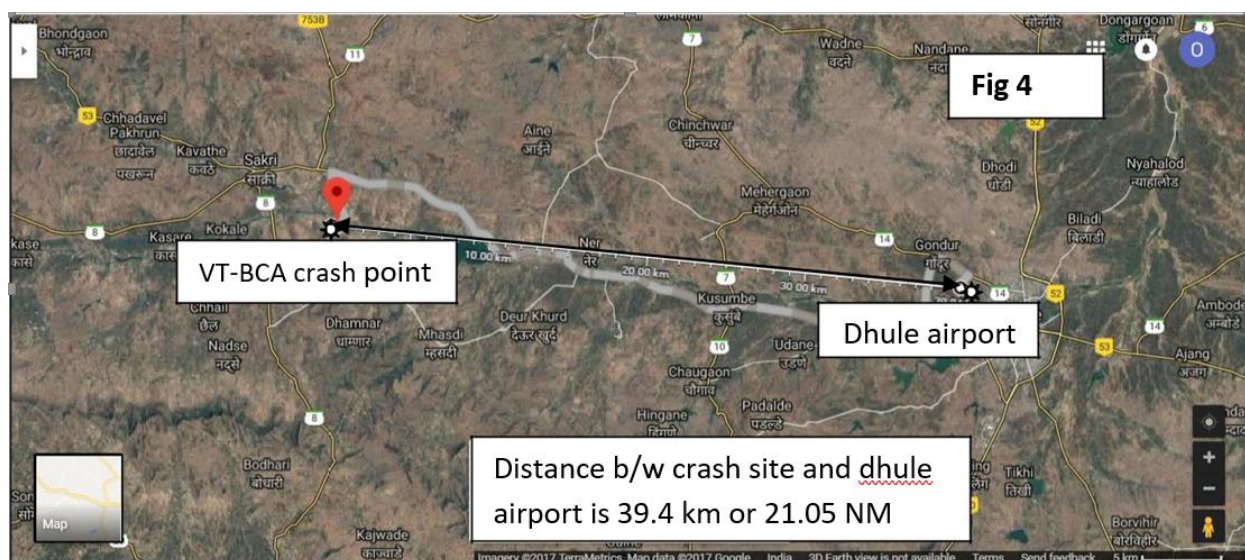
Dhule Aerodrome is operated under private category by M/s “The Bombay Flying Club” under a lease agreement with Maharashtra Airport Development Company. The IATA location Identifier code is DHL and ICAO location Indicator code is VA53. The aerodrome falls in the reference category of 1A.

The Airport Reference point is Lat: 20°55'35.34”N Long: 074°44'13.43”E. The elevation of the airport is 920 feet (280.416metres). The orientation of the runway is 09/27 and Magnetic Variation is ¼ ° west. Runway length is 4500 feet and width is 100 feet.

1.11 FLIGHT RECORDERS

The aircraft was neither fitted with Cockpit Voice Recorder nor with Digital Flight Data Recorder as these are not mandatory under the regulations specified for type.

1.12 WRECKAGE AND IMPACT INFORMATION



CFI took over the controls and prepared for a forced landing, however, crew could not assess the outside condition due to darkness. Aircraft speed was reduced to 80 knots and the last altimeter reading noticed by CFI was 2000 feet.

First the aircraft hit a high-tension electric wire which was approximately 24 feet above the ground which acted as an arrestor barrier and reduced the impact on ground. Due to impact with the high-tension wire, wind shield of the aircraft was damaged. All other damages on the aircraft were subsequential. After impact with the ground, aircraft came to a halt. ELT was not activated after the impact. There was substantial damage to the aircraft.

After force landing in an open field near Datarti village, the aircraft did not travel significantly. The aircraft touched levelled ground as evident by both wing tips, nose and tail of the aircraft remained unaffected. Both propellers contacted ground and were damaged.

On 02.12.2017, Investigator In-Charge reached on the site and checked for fuel quantity in both fuel tanks. It was observed that port as well as starboard side fuel tanks were empty.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

- Pre-flight medical was carried out by the CFI at Dhule airport and were found negative.
- For the accident flight, pre-flight medical was not carried out at Surat Airport.
- As per CAR Section 5 Series F Part -III, after every accident crew must undergo post flight medical examination.
- Blood samples of both CFI and trainee pilot had been collected on 03.12.2017 by Government Medical College only after written request from the Investigation team was made. The reports did not indicate any signs of alcohol in body.

1.14 FIRE

There was no pre or post impact fire.

1.15 SURVIVAL ASPECTS

The accident was survivable.

1.16 TESTS AND RESEARCH

Nil.

1.17 ORGANISATION AND MANAGEMENT INFORMATION

The Bombay Flying Club is society formed under the Societies Act and approved by the Directorate General of Civil Aviation. The Bombay flying club (BFC) was established in 1928.

Bombay Flying Club had a fleet of Cessna 152A (01), Cessna 172 (04) and Piper Super Cub PA-18 (01) excluding accident aircraft VT-BCA Piper Seneca PA-34. The Flying Club shifted part of its Training operations to an Airport near Dhule in 2009 from Mumbai. The Club leased the airstrip from the Maharashtra Airport Development Company in order to carry out its training activities at Dhule.

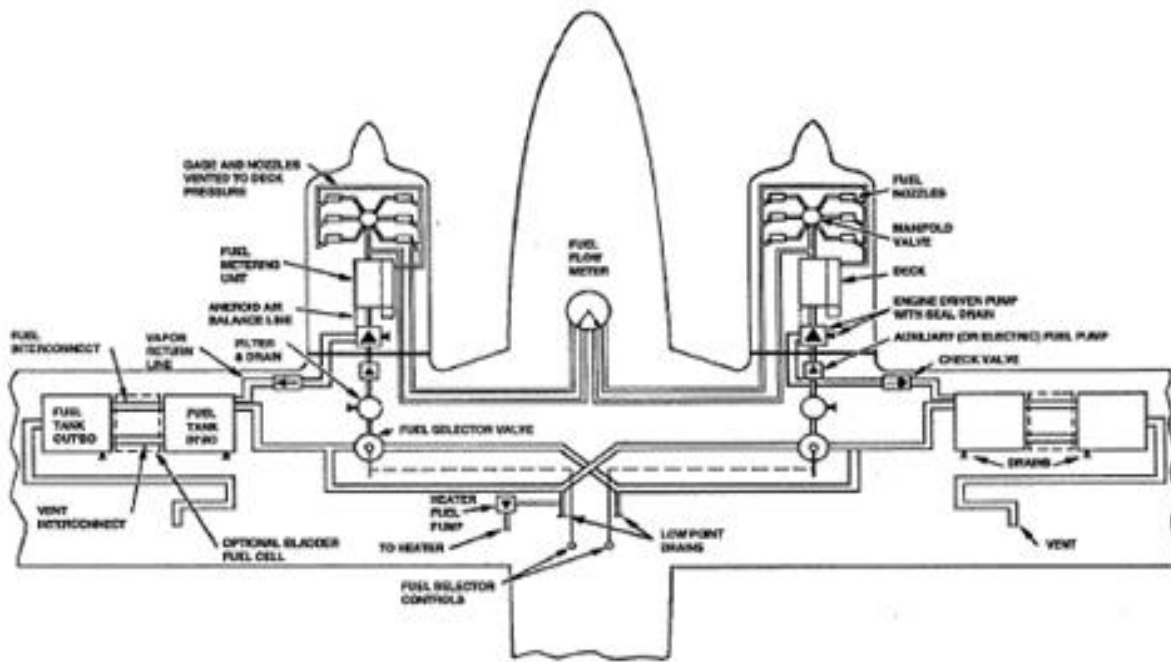
The BFC conducts ab-initio pilots' ground and flying training. The organisation is headed by Accountable Manager of M/s The Bombay Flying Club who reports directly to the President of the organisation.

1.18 ADDITIONAL INFORMATION

1.18.1 Aircraft Fuel System

Fuel is stored in two wing tanks and each wing tank has an inboard and outboard tank. This particular aircraft has an additional 'bladder' fuel cell fitted between the two main tanks. Fuel is fed by gravity system from the outboard tanks to the inboard tanks and then to the engines. The total fuel capacity of the aircraft is 128 US gallons, with 5 US gallons unusable.

Fuel is fed from the inboard tank to the selector valve and each engine can be supplied from same fuel tank (NORMAL) or from the opposite wing tank (CROSSFEED). When the X FEED position is selected, the engine draws fuel from the tanks on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. The OFF position shuts off the fuel flow from a side.



FUEL SYSTEM SCHEMATIC

The fuel injection system is a "continuous flow" type and utilizes a vapour return line which provides a route back to the tanks for vapour laden fuel that has been separated in the injector pump swirl chamber. Each engine has an engine-driven fuel pump that is a part of the fuel injection system. An auxiliary fuel system is also provided and the purpose of the electrically powered auxiliary fuel system is to supply fuel to the engine in case of engine-driven fuel pump shaft fails or malfunctions.

As per POH, in case of a failed engine-driven fuel pump, high auxiliary fuel pressure should be selected then only adequate pressure and fuel flow will be supplied to the engines. Manual leaning to the correct fuel flow will be required at altitudes above 15,000 feet and for engine speeds less than 2300 RPM. An absolute pressure switch automatically selects a lower fuel pressure when the throttle is reduced below 21" Hg manifold pressure and the High auxiliary fuel pump is on.

It is instructed in POH that when one engine is inoperative and the fuel selector for the operating engine is on X FEED, the selector for the inoperative engine shall be in OFF position.

1.18.2 Fuel System Examination

During examination of the aircraft, no evidence of fuel leakage from the aircraft fuel lines or fuel system components was found. Both fuel tank caps were securely fitted with no evidence of in-flight seepage.

The manufacturer did not specifically impose any caveats on the flight profile or types of manoeuvre performed with low fuel loads for this aircraft, other than advising that the unusable fuel listed was applicable under 'reasonable flight conditions.

1.18.3 Aircraft Fuel Consumption As per POH:

As per Manufacturer's Pilot's Operating handbook, Sec 5, PERFORMANCE, Fig. 5-47, the Fuel consumption per hour is as under:-

S. No.	Operation	RPM	Fuel Consumption Gal/Hr/ per engine	Fuel Consumption Ltr/Hr/per engine	Fuel Consumption Ltr/Hr/both engines
1.	Economy Cruise power	2400	9.9	37.4	74.8
		2500	10.0	37.8	75.7
		2600	10.2	38.5	77
2	Recommended Cruise Power	2400	13.1	49.5	99
		2500	13.4	50.6	101.2
		2600	13.5	51.0	102
3	Maximum Cruise Power	2500	14.8	55.9	111.8
		2600	15	56.7	113.4

The Pilot's Operating handbook, Sec 5, PERFORMANCE, Fig. 5-47 is appended below.

POWER SETTING TABLE (I.S.A. + 10° C)
T.C.M. TSIO-360K SERIES
PA-34-220T

Press Alt. Feet	Outside Air Temp.		Economy Cruise Power			Recommended Cruise Power			Maximum Cruise Power	
	°F	°C	2400	2500	2600	2400	2500	2600	2500	2600
S.L.	77.0	25.0	29.5	28.6	27.8	34.4	33.4	32.5	34.9	33.8
2000	69.9	21.0	28.9	28.0	27.2	34.1	33.1	32.1	34.6	33.6
4000	62.7	17.1	28.3	27.5	26.7	33.8	32.8	31.7	34.4	33.3
6000	55.6	13.1	27.7	26.9	26.1	33.5	32.4	31.3	34.1	33.1
8000	48.5	9.2	27.1	26.3	25.5	33.2	32.1	31.0	33.8	32.8
10000	41.3	5.2	26.5	25.7	25.0	32.9	31.8	30.8	33.6	32.6
12000	34.2	1.2	25.8	25.1	24.4		31.5	30.7	33.3	32.6
14000	27.1	-2.7	25.6	24.9	24.2		31.2	30.6		32.6
16000	19.9	-6.7	25.4	24.7	24.0			30.5		32.5
18000	12.8	-10.7		24.5	23.8			30.3		
20000	5.7	-14.6		24.3	23.6					
22000	-1.5	-18.6			23.4					

Mixture ←----- 25° F Rich of Peak EGT -----→ EGT 1525° F
Peak EGT 1650° F Max.

Approx. Fuel Flow per Engine GPH	9.9	10.0	10.2	13.1	13.4	13.5	14.8	15.0
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EXAMPLE:
Cruise Altitude: 10000 ft. Mixture Setting: 25° F rich of peak EGT
Cruise Power: Economy Manifold Press.: 25.7 in Hg
Engine Speed: 2500 rpm Approx Fuel Flow: 10 GPH

SECTION 5
PERFORMANCE
PIPER AIRCRAFT CORPORATION
PA-34-220T, SENECA III

REPORT: VB-1257
S-34
POWER SETTING TABLE - ISA +10°C
Figure 5-47
ISSUED: SEPTEMBER 13, 1989
REVISED: MARCH 1 2008

- As per Pilot statement, in-flight, during ascend & descend, at times for coming out of cloud, the mixture control lever was moved from Lean to Rich power.

1.18.4 Minimum Fuel Requirement for General Aviation aircraft as per CAR

As per DGCA CAR Section 8 Series O Part III dated 24th July 2017, following are the requirements: -

Para 2.2.3.6 on “Fuel and Oil Requirements”

- when the flight is conducted in accordance with night VFR, flight to the aerodrome of intended landing and thereafter have a final reserve fuel for at least 45 minutes at normal cruising altitude.

Para 2.2.4.7 on “In-flight fuel management” states that

- The pilot-in-command shall monitor the amount of usable fuel remaining on board to ensure that it is not less than the fuel required to proceed to an aerodrome where a safe landing can be made with the planned final reserve fuel remaining.

- The pilot-in-command shall advise ATC of a minimum fuel state by declaring MINIMUM FUEL when, having committed to land at a specific aerodrome, the pilot calculates that any change to the existing clearance to that aerodrome, or other air traffic delays, may result in landing with less than the planned final reserve fuel.
- The pilot-in-command shall declare a situation of fuel emergency by broadcasting ‘MAYDAY MAYDAY MAYDAY FUEL’, when the calculated usable fuel estimated to be available upon landing at the nearest aerodrome where a safe landing can be made is less than the planned final reserve fuel.

Para 3.4.3.5 on “**Fuel requirements**” states the following requirements: -

- I. An aeroplane shall carry sufficient amount of usable fuel to complete the planned flight safely and to allow for deviations from the planned operation.
- II. The amount of usable fuel to be carried shall, as a minimum, be based on:
 - a) fuel consumption data:
 - provided by the aeroplane manufacturer; or
 - if available, current aeroplane-specific data derived from a fuel consumption monitoring system; and
 - b) the operating conditions for the planned flight include: -
 - anticipated aeroplane mass
 - current meteorological reports or a combination of current reports and forecasts
 - air traffic services procedures, restrictions and anticipated delays

Where no specific fuel consumption data exists for the precise conditions of the flight, the aircraft may be operated in accordance with estimated fuel consumption data.

1.18.5: Actual Fuel and Oil Uplift As Per Flight Sector Report

Scrutiny of Flight Report Book revealed that:-

(a) At the time of Take-off from Dhule:-

- On the day of accident, no fuel was uplifted from Dhule.

- 250 litres fuel was uplifted on the previous day after the flying was completed.
- Before commencing the first sortie of the day (Dhule to Surat), the aircraft had 480 Litres of fuel making both tanks full.
- As per CFI, he had visually seen the tanks full up to the brim.

(b) After landing at Surat:-

- Three local sorties were carried out.
- ATC Tapes revealed that two of these sorties involved touch and go.
- ATC Tapes revealed that in one of the sortie, the aircraft was allowed to climb and then was asked to descend and again climb due to Scheduled Traffic.
- ATC Tapes revealed that in between the last two sorties, the aircraft was taken to BAY and the engines were kept “ON”. During this period, crew change (Trainee Change) was also carried out.
- No fuel uplift was carried out between these sorties.

(c) At the time of take off from Surat:-

- No Fuel was uplifted from Surat.
- The fuel checked by the CFI and Student Pilot, from the fuel gauges was 43 USG (163 Litres) before commencement of the accident sortie.

- ✓ The columns “Fuel in Tanks” before each sortie or flight in ‘Flight Sector Report’ were found blank. However, the quantity of fuel uplifted by the aircraft had been jotted in the ‘Flight Sector Report’ in the respective column.
- ✓ At the accident site, no fuel was found in fuel tanks. No oil was charged on 01 Dec 2017. However, both engines had 8 Qts oil each.

1.18.6 Fuel Consumption of VT-BCA Based on the Flying Carried out During Last 10 Days

Sl No	ATD	ATA	HOURS	ROUTE		FUEL UPLIFTED (Ltrs)	AVERAGE FUEL CONSUMPTION PER DAY
				FROM	TO		
1	07:05	08:05	01:00	DHULE	DHULE	In tank before flight 480	83.79 LTRS/HOUR
2	08:30	10:00	01:30	DHULE	DHULE		
3	11:00	12:00	01:00	DHULE	DHULE	220	
4	12:30	13:00	00:30	DHULE	DHULE		
5	13:45	14:45	01:00	DHULE	DHULE	125	
6	15:00	16:30	01:30	DHULE	DHULE		
7	18:40	20:10	01:30	DHULE	DHULE	205	
8	20:25	22:05	01:40	DHULE	DHULE		
9	10:05	11:35	01:30	DHULE	DHULE	260	84.39 LTRS/HOUR
10	12:00	13:00	01:00	DHULE	DHULE	140	
11	13:15	14:15	01:00	DHULE	DHULE		
12	15:40	17:20	01:40	DHULE	DHULE	165	
13	17:45	19:10	01:25	DHULE	DHULE		
14	19:10	20:10	01:00	DHULE	DHULE		
15	10:00	11:30	01:30	DHULE	DHULE	335	85.55 LTRS/HOUR
16	12:05	12:50	00:45	DHULE	DHULE		
17	14:10	14:55	00:45	DHULE	DHULE	200	
18	15:15	16:45	01:30	DHULE	DHULE		
19	09:05	10:35	01:30	DHULE	DHULE	185	85.71 LTRS/HOUR
20	10:50	11:50	01:00	DHULE	DHULE		
21	14:00	15:00	01:00	DHULE	DHULE		
22	11:45	13:15	01:30	DHULE	DHULE	300	84.70 LTRS/HOUR
23	13:30	15:00	01:30	DHULE	DHULE	135	
24	15:30	17:00	01:30	DHULE	DHULE		
25	18:30	20:05	01:35	DHULE	DHULE	250	
26	20:30	21:30	01:00	DHULE	DHULE		
27	08:35	09:50	01:15	DHULE	VAOZ	215	86.15 LTRS/HOUR
28	09:55	10:55	01:00	VAOZ	VAOZ		
29	11:10	12:10	01:00	VAOZ	DHULE		
30	20:30	21:30	01:00	DHULE	DHULE	280	95.0 LTRS/HOUR
31	08:35	10:05	01:30	DHULE	DHULE	95	88.88 LTRS/HOUR
32	12:30	13:15	00:45	DHULE	DHULE		
33	09:00	09:45	00:45	DHULE	DHULE	200	85.0 LTRS/HOUR
34	10:00	10:45	00:45	DHULE	DHULE		
35	11:00	12:00	01:00	DHULE	DHULE	135	
36	18:30	19:30	01:00	DHULE	DHULE		
37	22:15	23:45	01:30	DHULE	DHULE	165	
38	12:20	13:20	01:00	DHULE	DHULE	125	
39	15:05	15:50	00:45	DHULE	DHULE	95	84.80 LTRS/HOUR
40	16:05	17:35	01:30	DHULE	DHULE		
41	18:35	20:05	01:30	DHULE	DHULE	185	

42	20:30	22:00	01:30	DHULE	DHULE	250	
		After this uplift of 250 Ltrs, there was a total of 480 Ltrs available in tanks.					
50:05				4745 Ltrs			94.74 LTRS/HOUR

The flight time shown above in the table is from “Chocks off to Chocks On”. This includes the taxi time too.

- The Fuel consumption as mentioned in the Aircraft and Engine documents will be from Take off to Touch down and will not include Taxi Time.

Further, the entries as mentioned in the Fuel Oil Register were analysed and it was observed that the **Average Fuel Consumption of the aircraft is approx 95 Ltrs per Hour.**

Pertinent to mention that this flight time recorded is from “Chocks OFF to Chocks ON”.

It shows that “Taxi Time” was also not included during the fuel calculation.

1.18.7 Minimum Fuel Required for Surat – Dhule Flight

Taking flight time from **SURAT – DHULE** as 01 Hour10minutes (Average of last few sectors for Surat-Dhule as per Journey Log Book), the minimum fuel required for **SURAT – DHULE** flight is calculated as under:-

1. Taxi in & out fuel= 5 ltr
2. Fuel for flight (01 hr10minutes x 95 ltr/hr) = 110.833litres
3. Reserved fuel for 45 min = 71.25 litres approx.

Minimum fuel required for flight = 182 litres (48 US Gallon approx.)

This fuel consumption can increase depending upon:-

- Direction of wind
- Wind Speed
- Mix Lever setting
- Throttle/Power Lever setting and ambient temp will also have marginal effect.

1.18.8 Actual Fuel Available Onboard for Surat – Dhule Flight

As per PIC, the fuel available for the flight was 162.77 Litres

The gauges are “Analogue Gauges” and the quantity of fuel of 43 US Gallons was noted by both pilots.

1.18.9: En-route Weather

As per the statement of CFI, aircraft encountered bad weather in the form of clouds from Surat to Dhule on the day of accident. However, before undertaking the flight from Surat to Dhule, the satellite pictures of the enroute showed no bad weather on the day of accident.

1.18.10 Weight & Balance Calculations

During investigation, it is evident that the DGCA approved weight schedule was not followed as per the stipulated requirements.

As per the calculation shown below, using empty weight of aircraft and standard weight of Pilot, Co-pilot and other four Trainees, the aircraft was found to be over loaded by 102.8 Kg at the time of take-off from Surat.

Empty Weight of Aircraft	1447.2 Kgs.
Standard Weight of PIC	85 Kg
Standard Weight of Co-Pilot	85 Kg
No of Trainees in cabin	04
Weight of Trainees in cabin (75x4)	300 Kg
Weight of 480 ltrs of AVGAS (0.72 ltrs/Kg)	345.6 Kg
Actual AUW	2262.8 Kg
Maximum All up Weight of Aircraft as per weight Schedule	2160 kg
Difference (Over weight at take-off)	102.8 Kg

1.19. Useful or Effective Investigation Techniques

NIL.

2. ANALYSIS

2.1 SERVICEABILITY OF AIRCRAFT

Aircraft had current Certificate of Airworthiness and ARC was valid up to 05/01/2018. Aircraft held a valid Aero Mobile License which was valid up to 31/08/2019. Till 1st Dec 2017, the aircraft had completed 7570:55 Airframe hours. Engine # 1 had logged 783.45 Hrs and Engine # 2 had also logged 783.45 Hrs since overhaul. The last major inspection undertaken on the engine was “50 hrs/90 days inspection” which was carried out on 24/11/2017. The aircraft had flown 06:15 hours after the last major inspection till the date of accident. Aircraft was released with ‘NIL’ snag and no active MEL on relevant system or component was entered into the tech log on 01/12/2017. There was no snag reported on the aircraft prior to the accident flight.

Serviceability of aircraft is not a factor to the accident.

2.2 WEATHER

Before commencing local flying, Dhule weather was recorded on the basis of local observations by The Bombay Flying Club. For the cross country training flight, the crew obtained the weather of Dhule by telephone. First observation of the day at Dhule was recorded at 0530 UTC which showed surface winds as 095°/03 Knots and visibility of 6000 m in clear weather with no significant clouds. Surface temperature was 24°C and QNH 1011 hPa.

The crew had also obtained Surat local weather recorded at 1330 UTC which showed surface wind direction 050° and speed 04 Knots, visibility 5000 m in Smoke with no significant clouds, surface temperature 27°C and QNH 1009 hPa. The crew had also obtained Dhule weather recorded at 1300 UTC which showed surface wind direction 090° and speed 04 Knots, visibility 5000 m in clear weather with no significant clouds, surface temperature 22°C and QNH 1016 hPa. Certain other on-line sources, however, recorded passing

clouds around Dhule between the period between 1800 IST (1230 UTC) and 2400 IST (1830 UTC), which was the same time window as that of the accident sortie.

The crew circum-navigated the weather and had climbed requiring the fuel air mixture to be selected to “rich”. The fuel flow rate with mixture selected at rich position is higher than the fuel flow rate at lean position. This resulted in higher fuel consumption thereby aggravating the critical fuel situation on board the aircraft.

2.3 FUEL PLANNING AND FUEL UPLIFTED

The investigation attempted to establish the amount of fuel on board prior to take-off on the basis of crew’s statements, fuel uplifted and hours flown after the last refueling.

As per the crew, fuel available in left/right tank was 21/22 USG i.e. a total of 43 USG at the time of taxi. They had not measured or visually seen the fuel available in each tank through the filler cap or by using a dipstick.

Each wing has significant dihedral and a single fuel filler cap for each wing is located in the outboard tank. When the aircraft is parked with wings level, it is just possible for a person of average height standing on the ground to look into the outboard tank after removing the filler cap. However, with an evenly balanced fuel load of 50% or less (as in the present case), the fuel is only in the two inboard tanks. Thus, with low fuel loads it is not possible to check the fuel in tanks visually. Similarly, since the single filler caps are located only in the outboard wing tanks, it is not possible to use a dipstick to check fuel quantity.

The fuel gauges in the cockpit provide a general indication of fuel on board but cannot be relied upon for fine tolerance readings, as these are analogue gauges.

As the aircraft was expected to land in night on VFR airport, the fuel requirement was the sum of fuel for the intended landing and a reserve of 45

minutes at normal cruising altitude. It was observed that the average fuel consumption for the aircraft was approximately 95 ltrs per hour, however, the fuel upliftment which was planned was erroneous as it took a figure of less than 80 ltrs per hour (as per POH for economy cruise power). which was very much on the lower side.

The engine manufacturers in general advise that there would be variation of fuel consumption because of ageing of engine and the airframe conditions. Various operators across the world, therefore, monitor the fuel consumption and accordingly increase the value for the purpose of fuel planning. Actual fuel consumption, in comparison with the POH figure also significantly depends on the mixture leaning technique used by the pilot and airframe condition.

At the time of take-off from Surat, the aircraft had less than 43 USG of fuel. Thus, “Improper Fuel Planning” was a factor in the accident. Also, the absence of a procedure for assessing realistic fuel consumption rate of an aged aircraft is also a contributory factor.

2.4 CIRCUMSTANCES LEADING TO THE ACCIDENT

The aircraft took off from Runway 04 of Surat at 1339 UTC for a training cross country flight from Surat to Dhule returning to the Bombay Flying Club’s base of operations. The weather at departure station and destination was reported to be good. However, the weather enroute could not be assessed accurately. The aircraft departed in clear weather and encountered turbulent weather about 50 NM outbound from Surat. Initially, the crew thought it must be a small patch but the clouds continued for a quite a while. The crew tried to manoeuvre the aircraft left, right, up and down. This not only took longer time but also consumed fuel at a rate far in excess of the rate required at normal cruise settings. The combined effect of the longer flight time and fully

rich mixture for a substantially long time, resulted in fuel consumption which was far more than expected.

When the aircraft eventually came out of the clouds, it was on the right of the track and reported so to the Dhule ATC on radio. Once out of the weather, the crew re-leaned the mixture but fell short of the requirement which led to fuel starvation.

The failed engine was feathered by the crew and continued the flight. Upon failure of second engine, the crew decided to carry out a forced landing. The Aircraft force landed at Datarti village, near to Dhule. During descent, the aircraft hit an electric wire before impacting the ground. The aircraft sustained substantial damages.

3. CONCLUSIONS

3.1 FINDINGS

1. The Certificate of Airworthiness, Certificate of Registration and Certificate of Flight Release of the aircraft were current/ valid on the date of accident.
2. Last inspection carried out by AME was on 24/11/2017 (50 hrs/90 days).
3. Pre-flight inspection was carried out before flight. The aircraft was serviceable and no abnormality was reported by the pilot.
4. The Cross-country sortie was planned from Surat for visual approach and landing at Dhule airport under night VFR conditions.
5. At the time of take-off from Surat, fuel in tank was not mentioned in the Flight Sector report. The crew stated that there was 43 US gallons (125 ltrs.) of fuel available but the actual fuel available at the time of take-off from Surat was less than that assessed by the Crew.
6. As per the MET report, the weather at the time of accident was visibility 5000 meters with winds 090°/03 knots at Dhule airport.
7. CFI observed aircraft low on fuel when it was at 24 nm from Dhule. He took over controls and decided for straight in approach.
8. The aircraft was cleared for landing on runway 09 by Dhule ATC.

9. When the aircraft was descending, initially the left engine flamed out.
10. Subsequently the right side engine also lost power.
11. CFI planned for forced landing.
12. Aircraft hit an electric wire which reduced impact with the ground.
13. Aircraft had hit the ground on its belly and came to halt at a distance of 21 nm from Dhule airport and sustained substantial damage.
14. On ground both the fuel tanks of the aircraft were found empty.
15. The actual fuel consumption of the aircraft was much higher than as per the computation made by the flight crew based on POH.
16. The mixture was fully rich for a substantially long time to come out of the weather resulting in higher fuel consumption.
17. M/s Bombay Flying Club is NOT in the practice of Jotting “Fuel in the Tank” after each sortie or flight and the column in Flight sector report was found blank. However, total fuel has been jotted in Flight sector report in the respective column.
18. The crew calculated rates of fuel consumption as per Pilot’s Operating Handbook. The performance information provided in the POH is for new aircraft at maximum take-off weight, and fuel consumption figures assume that the fuel mixture in the cruise is leaned such that the EGT is 25° C below the amber range.
19. There was no procedure established in the Flying Club for assessing actual fuel consumption for the purposes of fuel planning.
20. The absence of a procedure to estimate the difference between actual fuel consumption of an aged aircraft and that given in the performance charts of the Pilot’s Operating Handbook was a factor responsible for incorrect fuel planning and assessment for the task planned for the day.

3.2 PROBABLE CAUSE OF THE ACCIDENT

Accident occurred as the aircraft had taken off with lesser fuel than required because of erroneous fuel planning and suffered substantial damages while carrying out forced landing due both engines flaming out in flight.

4. SAFETY RECOMMENDATIONS

Flying training organisations

- Must maintain data of fuel consumption during training flights and periodically calculate actual fuel consumption for each aircraft so that the flight crew can carry out fuel planning on realistic values of fuel consumption.
- Advise the flight crew about the variation of actual fuel consumption and fuel consumption given in POH.



(Dinesh Kumar)

Investigator



(Raje Bhatnagar)

Investigator-In-Charge

Date: 28-06-2019

Place: New Delhi



Left Engine Propeller Blades



Right Engine Propeller Blades

Back View



Front View

Cut Mark



Damage on Left Engine