



सत्यमेव जयते

**FINAL REPORT ON ACCIDENT**

**INVOLVING**

**CESSNA 152 AIRCRAFT VT-PTD**

**OPERATED BY**

**FALCON AVIATION ACADEMY**

**ON 26/04/2018 AT FAIZABAD**

**Jasbir Singh Larhga**  
**Investigator In-Charge**

**Dinesh Kumar**  
**Investigator**

## ***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 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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**FINAL REPORT ON ACCIDENT INVOLVING CESSNA 152 AIRCRAFT**  
**VT-PTD OPERATED BY M/s FALCON AVIATION ACADEMY, FAIZABAD**  
**ON 26/04/2018 AT FAIZABAD**

- |                              |   |                                       |
|------------------------------|---|---------------------------------------|
| 1. Aircraft Type             | : | Cessna 152                            |
| Nationality                  | : | INDIAN                                |
| Registration                 | : | VT –PTD                               |
| 2. Owner/ Operator           | : | Falcon Aviation Academy, Faizabad     |
| 3. Pilot – in –Command       | : | CPL holder on type,                   |
| Extent of injuries           | : | Nil                                   |
| 4. First Officer             | : | SPL Holder                            |
| Extent of injuries           | : | Nil                                   |
| 5. Place of Accident         | : | Saryu River bed, Faizabad             |
| 6. Date & Time of Accident   | : | 26 <sup>th</sup> April 2018, 0600 UTC |
| 7. Last point of Departure   | : | Faizabad Airport                      |
| 8. Point of intended landing | : | Faizabad Airport                      |
| 9. Type of operation         | : | Training Sortie                       |
| 10. Crew on Board            | : | 02                                    |
| 11. Phase of operation       | : | Approach Circuit                      |
| 12. Type of Accident         | : | Forced landing, Non-Fatal             |

(ALL TIMINGS IN THE REPORT ARE IN UTC)

## **SUMMARY**

On 26.04.2018, M/s Falcon Aviation Academy Cessna 152 aircraft VT-PTD while performing an instrument flying sortie was involved in a forced landing on Saryu River bed, Faizabad at about 0600 UTC.

The flying instructor and the trainee pilot were scheduled for local flying in sector south. This was the third sortie of the day. After pre-flight checks on the aircraft, engine was started and aircraft took off at 0521 UTC from runway 12.

Initially, the aircraft climbed to 1000 feet in sector south to carry out GPS assisted 05 NM arc approach for Runway 12. While the aircraft was on final approach course, at approximately 0550 UTC, crew observed engine vibrations. Subsequently, the aircraft engine stopped. Thereafter, instructor made some attempts to reignite the engine, however, the engine did not come live. Finally, PIC decided for forced landing of the aircraft. The aircraft was diverted towards the Saryu river.

PIC executed the forced landing, after assessing the river bed area and its surroundings. Aircraft touched down on its main landing gears and continued to roll for approximately 213 feet. As the nose landing gear came in contact with the river bed, aircraft toppled and came to a halt. Both crew evacuated the aircraft and information was transmitted to the local ATC to activate 'Search and Rescue'. None of the occupants received any injury. There was no fire but aircraft was substantially damaged.

Occurrence was classified as Accident as per the Aircraft (Investigation of Accidents and Incidents) Rules, 2017. Aircraft Accident Investigation Bureau vide its Order No. 02/2018-Accident dated 01<sup>st</sup> May, 2018 appointed Mr. Jasbir Singh Larhga, Assistant Director as an Investigator-in-Charge and Mr. Dinesh Kumar, Air Safety Officer as Investigator .

Initial Notification of the occurrence was sent to ICAO and the NTSB, USA on 27<sup>th</sup> April 2018 as per requirement of ICAO Annex 13. No Accredited Representative was appointed by the NTSB.

## **1. FACTUAL INFORMATION**

### **1.1 History of the flight:**

On 26.04.2018, Cessna 152 aircraft VT-PTD belonging to Falcon Aviation Academy was scheduled to operate in sector south for local flying. The flight was an Instrument Flying sortie, to be operated by a Flight Instructor and a Student Pilot as part of flying training exercise for the student pilot.

As per the Flight Report Book, a total of 03 training sorties were planned to be operated by VT-PTD on 26.04.2018. The first departure of the day by the aircraft was at 0150 UTC and the aircraft landed back 0300 UTC. The second departure was at 0330 UTC and aircraft landed back at 0440 UTC. No snag or abnormality was reported by the crew during any of these flights. The third departure was at 0515 UTC and expected duration of the flight was 40 minutes.

As per the statement obtained from the crew, the student pilot completed the pre-flight preparations under the supervision of Flight Instructor and started the engine at 0515 UTC after ATC clearance. Aircraft took-off from Rwy 12 at 0521 UTC after getting clearance for sector south. A GPS assisted 05NM approach for Rwy 12 was planned to be carried out during the sortie.

After take-off, as the Flight Instructor monitored engine parameters and flight instruments, no abnormality was observed. Student pilot was on controls and aircraft attained an altitude of 1000 feet in sector south to carry out the planned GPS assisted 05 NM approach for runway 12 at Faizabad airport.

Crew stated that while approaching final approach course for runway 12 at about 0550 UTC, engine vibrations and drop in RPM were observed. The control was thereafter taken over by the Instructor. As the Instructor tried to bring engine vibrations and RPM in control, the engine stopped. Efforts were made by the Instructor to restart the engine; however, the engine did not start.

As per the crew statement, the aircraft was losing height and they decided to go for forced landing and headed the aircraft towards the Saryu riverbed to execute a forced landing. As per the laid down emergency procedures, pre forced landing checklist was carried out and the aircraft speed was regulated at 65 Kts approximately. Aircraft glided and managed to touchdown on the riverbed with

rear wheels touching the sandy ground first. Aircraft kept rolling in this attitude for about 213 feet. As the aircraft lost speed and aircraft weight fell on its wheels, nose wheel also touched the sandy ground. The nose wheel started sinking in the sand which caused the aircraft to topple. Thereafter, the aircraft came to a halt.



Fig 1: Aircraft lying toppled at crash site

Subsequently, Flight Instructor instructed the student pilot to evacuate from the aircraft. Both the crew were able to evacuate from the aircraft after releasing the safety harness. None of the crew suffered any injury.

Flight Instructor immediately passed the information to CFI, Accountable Manager and Military Liaising Unit(MLU) at 0602 UTC and maintained a safe distance from the aircraft till arrival of search and rescue team from Falcon Aviation Academy.

### 1.2 Injuries to Persons:

| <b>INJURIES</b> | <b>CREW</b> | <b>PASSENGERS</b> | <b>OTHERS</b> |
|-----------------|-------------|-------------------|---------------|
| FATAL           | Nil         | Nil               | Nil           |
| SERIOUS         | Nil         | Nil               | Nil           |
| MINOR/NONE      | 02          | Nil               | Nil           |



### 1.13 Damage to Aircraft:

The aircraft suffered damages mainly to its Nose Landing Gear, Engine Mount, Wings, Tail Cone and Tail Fin.



Fig 2: Nose Landing gear bent due to bending of its mounting

Nose cowling of the aircraft received dents and Nose Landing Gear had tilted to one side due to bending of its mounting. Nose wheel right hand steering rod was also broken.

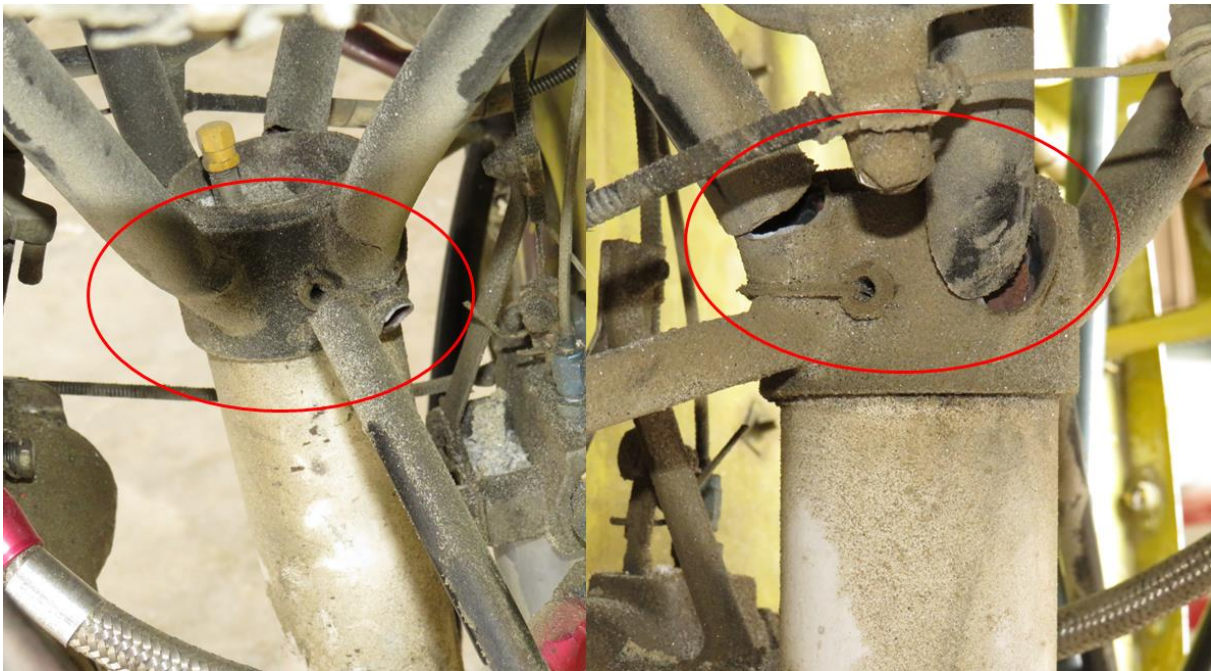


Fig 3: Engine Mounts broken

The engine mount assembly was found broken at three points.



Fig 4: Damages to LH and RH wing

Starboard wing had bulged at L.E near to the tip. Multiple wrinkles were observed on both starboard & port wing on upper as well as lower surface.



Fig 5: Damages to Tail Fin and Tail Cone

Tail cone had cracked and bulged at two places approximately 2 feet from rudder trailing edge. Tail fin was also severely damaged at approximately 1 foot from the top.

#### 1.4 Other damage:

NIL

## **1.5 Personnel Information:**

### **1.5.1 Instructor Pilot**

|  |   |  |
|--|---|--|
| Age  | : | 49 years 06 months                                     |
| License                                      | : | CPL Holder   |
| Category                                     | : | Aeroplane  |
| Validity of License                          | : | 07.03.19   |
| Endorsements as PIC                          | : | Pushpak, Cessna-152, Cessna 172R<br>&Piper Seneca PA34 |
| Date of Medical Exam                         | : | 06.02.2018   |
| Validity of Medical Exam                     | : | 05.08.2018   |
| FRTTO License Validity                       | : | 07.03.2019   |
| FIR issued on                                | : | 03.05.2007   |
| FIR validity                                 | : | 14.10.2018   |
| Total flying experience                      | : | 4524:30 Hrs  |
| Experience on type                           | : | 3612:30 Hrs  |
| Experience as PIC on type                    | : | 3521:25 Hrs  |
| Total flying experience during last 365 days | : | 604:35 Hrs   |
| Total flying experience during last 180 days | : | 417:05 Hrs   |
| Total flying experience during last 30 days  | : | 83:45 Hrs  |
| Total flying experience during last 07 days  | : | 17:50 Hrs  |
| Total flying experience during last 24 hours | : | 04:45 Hrs  |

The instructor had been flying for Falcon Aviation Academy since 2016 and had flown as Assistant Flight Instructor and Flight Instructor for around 18 years with various organisations including Falcon Aviation Academy.

### **1.5.2 Trainee Pilot**

|                  |   |                        |
|------------------|---|------------------------|
| Age              | : | 28 years 10 months     |
| License          | : | SPL Holder             |
| Category         | : | Aeroplane              |
| Validity         | : | 30.04.2022             |
| Aircraft Ratings | : | Cessna 152, Cessna 172 |

|  |              |
|--|--------------|
| FRTTO License Validity                       | : 18.05.2027 |
| Date of Med. Exam                            | : 03.04.2018 |
| Med. Exam valid upto                         | : 09.04.2019 |
| Total flying experience                      | : 162:55 Hrs |
| Experience on type                           | : 95:30 Hrs  |
| Total flying experience during last 365 days | : 162:55 Hrs |
| Total flying experience during last 180 days | : 101:35 Hrs |
| Total flying experience during last 30 days  | : 23:10 Hrs  |
| Total flying experience during last 07 Days  | : 10:20 Hrs  |
| Total flying experience during last 24 Hrs   | : 04:05 Hrs  |

Co-pilot joined the Falcon Aviation Academy in Jan 2018 to undergo flying training for grant of CPL. He had earlier done 67.25 Hrs of flying in another flying club before coming to Falcon Aviation Academy. He commenced flying in May 2017 and had operated his first solo flight in July 2017.

Both pilots were not involved in any serious incident/ accident in the past. Both pilots were current in flying and had adequate rest as per the Flight Duty Time Limitations (FDTL) requirement prior to operating the accident flight.

### **1.6 Aircraft Information:**

Cessna 152 aircraft is an all-metal, two-place, high-wing, single-engine airplane equipped with tricycle landing gear and designed for general utility purposes. The construction of the fuselage is a conventional formed sheet metal bulkhead, stringer, and skin design referred to as semi monocoque.

The aircraft structure mainly consists of the following: -

- The front and rear carry-through spars to which the wings are attached.
- A bulkhead and forgings for main landing gear attachment provided at the base of the rear doorposts.
- A bulkhead with attaching plates at the base of the forward door posts for the lower attachment of the wing struts.
- Four engine mount stringers attached to the forward doorposts. The stringers extend forward to the firewall.

- Fuel Tanks are contained in the externally braced wings and consist of a front and rear spar with formed sheet metal ribs, doublers, and stringers.

The aircraft is equipped with a Lycoming O-235-N2C engine. The Lycoming O-235-N2C engine is four cylinder, direct drive, horizontally opposed, wet sump, air-cooled model.

The maximum operating altitude for the aircraft is 14700 feet and maximum take-off weight is 757Kgs. Aircraft length is 7.3 metres, wingspan is 10.2 metres and height of this aircraft is 2.6 metres.

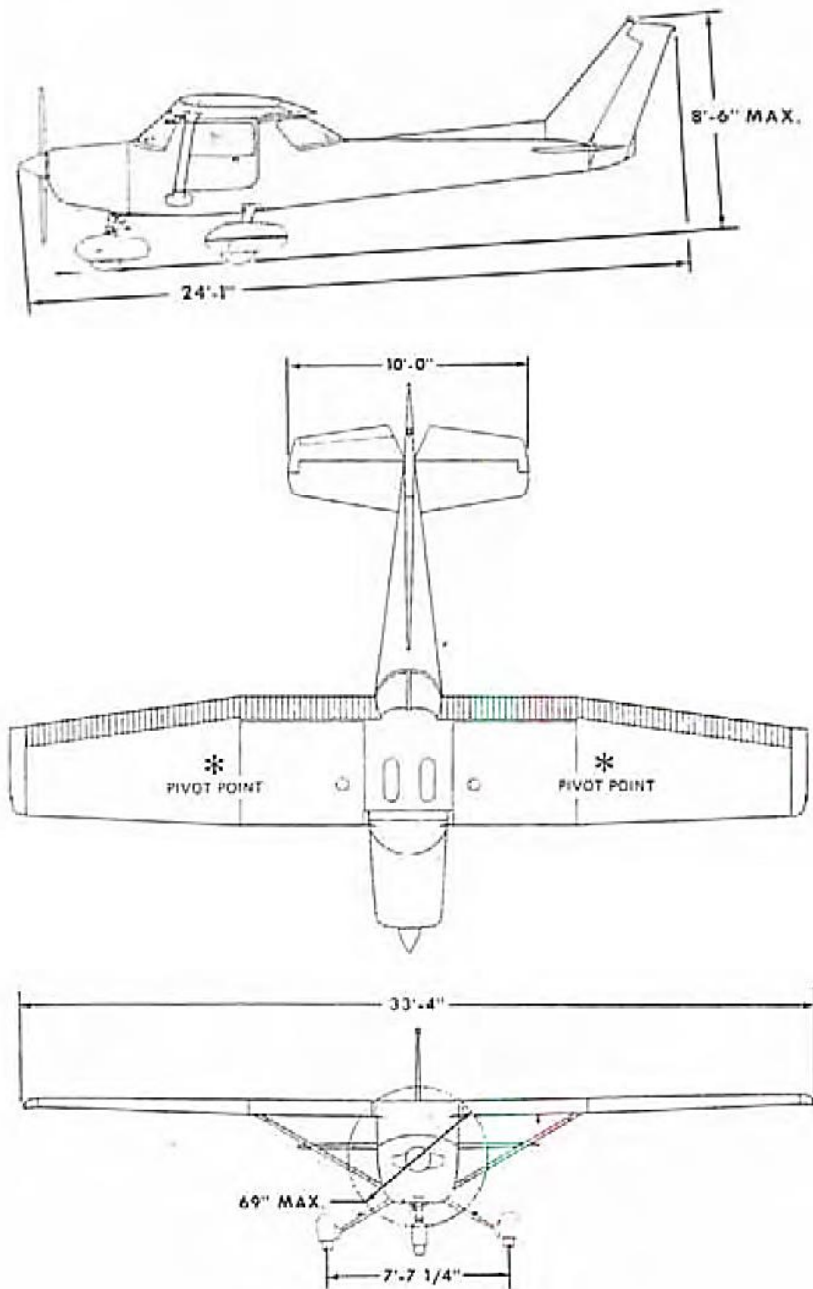


Fig 6: Aircraft Layout

Aircraft **VT-PTD (MSN 15285798)** was manufactured in year 1983. The aircraft is registered with DGCA under the ownership of M/s Falcon Aviation Academy. The aircraft is registered under Category 'A' and issued with Certificate of Registration Number 4214 on 21.06.2011.

The Certificate of Airworthiness (CoA) Number 6323 under "Normal category" subdivision "Passenger" was issued by DGCA on 11.02.2013. As per the CoA, the specified minimum operating crew is one and AUW is 757 Kgs. At the time of accident the CoA was current and valid until unless suspended/cancelled subject to validity of ARC. ARC was issued on 28.03.2018 and was valid upto 28.03.2019.

The Aircraft was holding Aero Mobile License No A-114/004-RLO (NR) at the time of accident which was valid upto 31.05.2019.

The aircraft and its engines are being maintained as per the 'Maintenance Program' consisting of calendar period/ flying Hours or Cycles based maintenance as per maintenance program approved by DGCA's Regional Airworthiness Office, Delhi.

Accordingly, the last major inspection undertaken on aircraft was "200 hrs/12 months inspection" and was carried out on 18.04.2018. Subsequently, all lower inspections (Pre-flight checks, Service Checks, Weekly Checks) were carried out as and when due before the accident.

The aircraft was last weighed on 05.03.2013 at Falcon Aviation Academy, Faizabad. The weight schedule was prepared and duly approved by the office of Director of Airworthiness, DGCA, Delhi. As per the approved weight schedule the Empty Weight of the aircraft is 528.43 Kgs. Maximum Usable Fuel Quantity is 61.20 Kgs. "Maximum Payload" with fuel tanks full is 82.86 Kgs. Empty weight CG is 80.23 cm aft of datum.

The aircraft was equipped with Lycoming O-235-N2C Engine Sr No RL-19324-15. The engine had logged 774 Hrs since last overhaul till the day of accident. The last major inspection undertaken on the engine was "200 hrs/12 months inspection" and was carried out on 18.04.2018.

All concerned Airworthiness Directive & Mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine were complied with as on the date of event.

### 1.7 Meteorological Information:

As per Daily Meteorological Record maintained at FAA, before the commencement of the first sortie of the day weather information for Faizabad was collected at 0100 UTC. The reported weather as per the records was; visibility 3500 meters in haze and 10 Kt winds with bearing 120°. Weather record was also being obtained from Lucknow, Gorakhpur and Varanasi. The weather reports are tabulated below.

| Place     | Time UTC | Winds      | Visibility | Clouds | Max/Min Temperature | QNH   | Forecast |
|-----------|----------|------------|------------|--------|---------------------|-------|----------|
| Faizabad  | 0100     | 120°/10Kt  | 3500HZ     | NSC    | ---                 |       | NOSIG    |
| Lucknow   | 0000     | VRB/02 Kt  | 3000HZ     | NSC    | 23/10               | Q1003 | NOSIG    |
| Lucknow   | 0530     | 070°/08 Kt | 3000HZ     | NSC    | 35/22               | Q1006 | NOSIG    |
| Gorakhpur | 0030     | 100°/07 Kt | 5000 BR    | SKC    | 25/21               | Q1006 | NOSIG    |
| Varanasi  | 0030     | 030°/04 Kt | 3000 HZ    | NSC    | 26/15               | Q1003 | NOSIG    |
| Varanasi  | 0500     | 040°/08 Kt | 3500 HZ    | NSC    | 33/14               | Q1006 | NOSIG    |

This flight took off at 0515 UTC. As per the weather obtained from VILK at 0530 UTC 08Kts winds with bearing 070° and visibility 3000 m in Haze were reported. Weather obtained from Varanasi for 0500 UTC indicated 08 Kts winds with bearing 040° and visibility of 3500 m in Haze. No Significant weather change was reported by any station.

The operations were being carried out under Special VFR as prescribed in the Section 9.4 of the DGCA approved Training and Procedure Manual of Falcon Aviation Academy.

### 1.8 Aids to Navigation:

Faizabad Airport with Runway orientation 30/12 is a “Visual Approach Runway” and no other navigation aid for landing is installed. VHF and Transponder were fitted on the aircraft for navigation purpose.

## 1.9 Communications:

The communication frequency available at Faizabad is 123.45 MHz and aircraft was in positive communication with the ATC before the accident.

## 1.10 Aerodrome Information:

Faizabad Aerodrome is operated under private category by M/s Falcon Aviation Academy under a lease agreement with the State Govt of Uttar Pradesh. The IATA Location Identifier code is FBD and ICAO location Indicator code is VI25.

There are no scheduled flights being operated at Faizabad. The airport is primarily utilized by FAA to impart flying training to student pilots and is not equipped with night operation facility.

The geographical co-ordinates of the airport are 26°45'04" N and 082° 09' 18" E. The elevation of the airport is 102 m (AMSL). The runway is 1735 m in length. The orientation of the runway is 12/30.



Fig 7: Layout of Faizabad Airport with incomplete mud pit highlighted

Faizabad airport is listed in AIC18 of 1986 issued by DGCA as “a State Government Aerodrome normally maintained in a serviceable condition”. The aerodrome can be used by civil aircraft subject to prior permission.

M/s Falcon Aviation had entered into an agreement with the State Government of Uttar Pradesh on 20.03.2009 to utilize Faizabad Airstrip for imparting flying training. As per the agreement, Falcon Aviation Academy is responsible for maintenance and security of the airfield. All expenses for maintenance or construction of any facility are to be borne by the operator.





Fig 8: Incursion of stray cattle and wild animals on the Runway

During visit of Investigation team to Faizabad airport, it was observed that the airport premises is not properly secured. Stray cattle and wild animals were seen grazing in the vicinity of the runway. A barbed wire had been put up on both sides of the runway strip to prevent incursion by the cattle and wild animals, but had proven adequate as is evident from the pictures above (Fig 8). Alternately, a pit was being dug on the side of runway to prevent stray cattle from approaching the runway, but the work was lying incomplete.

### 1.11 Flight Recorders:

Aircraft was not equipped with a DFDR or a CVR recorder.

### 1.12 Wreckage and Impact Information:

Aircraft forced landed on the bed of Saryu river and had travelled a distance of 213 feet approximately on main landing gear before it got toppled. The marks of tyre track could be seen in the picture taken immediately after the accident.



Fig 9: Wheel track marks

### **1.13 Medical and Pathological Information:**

The crew did not receive any injuries in the accident. The post flight medical examination was done on 26.04.2018 and 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:**

#### **1.16.1 Engine Strip Examination:**

The Engine of the accidented aircraft was uninstalled from the aircraft and subjected to detailed examination. General external inspection was carried out. The observations of the detailed inspection of the engine are enumerated below.

#### **Observations during General External Inspection:**

1. Dent was found on the engine cowling near nose section. One rivet of cowling at nose section was found missing.
2. Exhaust stag was found damaged. (Figure10)



Fig 10: Damage to the nose cowling and exhaust stag

3. Starter drive gear was found broken. (Figure 11)



Fig 11: Broken Starter Gear and Ring Gear teeth

4. Starter ring gear teeth were found damaged at different places and rubbing marks were present on the back of the ring gear. (Figure 11)
5. Air intake filter was found clogged with sand. (Figure 12)



Fig 12: Air intake filter and broken piece of starter gear

6. All gears of the starter were found broken and only one fourth of gear was present. (Figure 12)
7. Cracks were found on both sides of starter mounting points. (Figure 17)
8. All sparks plug from all the Cylinder heads were uninstalled for inspection and found intact. Blue colour deposit was observed on electrodes of top spark plug for Cylinder No. 1 and 3. Bottom spark plugs of cylinder No. 1 & 2 had yellow colour deposits on its electrodes. (Figure 13)



Fig 13: Spark Plugs

9. Ignition Harness was checked and found satisfactory.
10. The condition of Magnetos was found satisfactory.
11. Alternator was found satisfactory.

12. Fuel supply lines and Fuel filter were checked and found satisfactory.

Engine ground run was given after general inspection and cleaning of spark plugs and air filter. The broken starter was also replaced with a serviceable one. No abnormalities were observed in engine performance. After the Engine Ground run, dismantling of the engine was carried out to see if any internal damage existed which could have caused the engine shutdown. The observations of Engine Strip Examination are given below.

**Observations during Strip Examination of the Engine:**

1. Both magnetos, oil filter, R.P.M drive gear and ignition harness were uninstalled from the engine and found satisfactory.
2. Accessory cover was removed and found satisfactory.
3. All induction pipes, oil return lines and oil sump removed and found satisfactory.
4. All cylinders including pistons and connecting rods were dismantled. Scoring marks were observed on cylinder No. 1 inner wall as well as on piston. Rest all the three cylinders were found satisfactory. (Figure 14)



Fig 14: Scoring marks on Cylinder No 1 and its Piston

5. Bluish deposit was found on Cylinder no.1 piston head and heavy amount of lead deposit was observed on all the piston heads. (Figure 15)Piston rings, Push rods and connecting rods were dismantled from all cylinders and found satisfactory.



Fig 15: Blue Colour deposit and Lead deposit on the pistons

6. Carburettor was removed and inspected. It was found that fuel accelerating jet nozzle was not properly installed in the carburettor which would result into a lower jet pressure than the standard pressure. (Fig 16). The jet nozzle was fitted during the last overhaul and is not inspected in any schedule maintenance checks.



Fig 16: Fuel Accelerating Jet Nozzle

7. Crankcase and oil sump was found satisfactory.

### 1.16.2 Engine Starter Lab Examination:

The failed engine starter was sent to DGCA Lab for examination and to ascertain the cause of failure. Visual and macro examination of failed part under the stereo-microscope up to a magnification of 50X was carried out and the observations are as follows: -

#### a) Drive End Head Assembly:

The drive end head assembly removed from the aircraft had visible cracks as is shown in Figure 17.

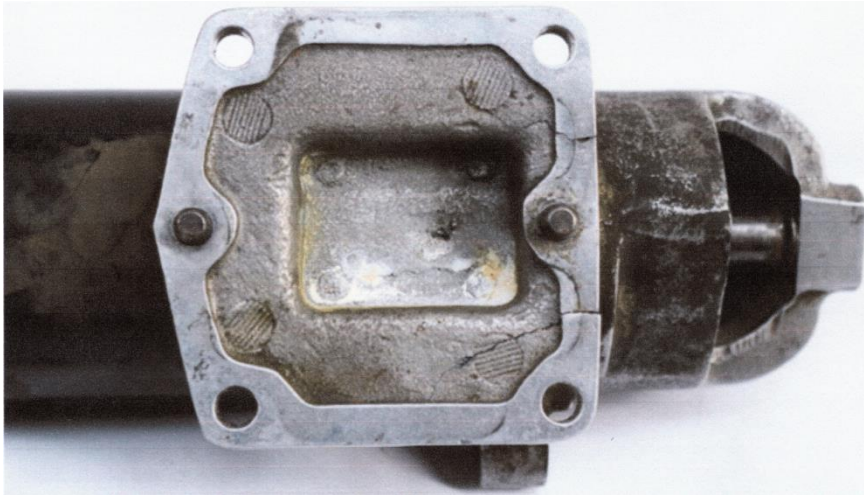


Fig 17: Drive end head assembly

The crack was opened up and examined, the surface of the crack is shown in Figure 18.

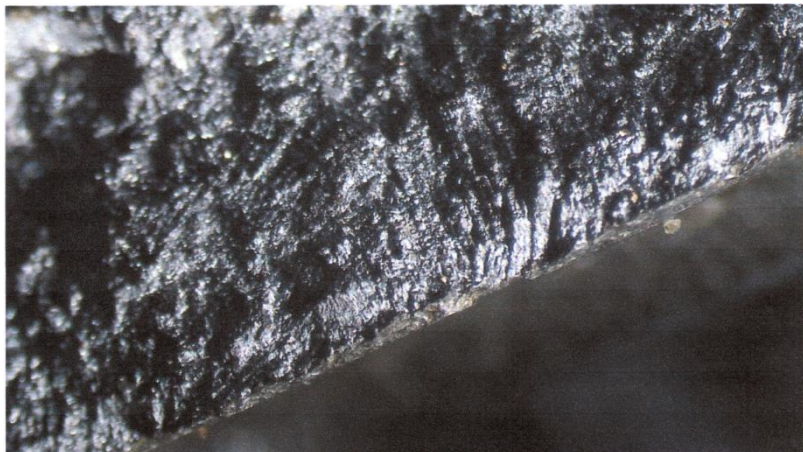


Fig 18: Beach marks on cracked surface

Light beach marks were noticed on the fracture surface. Rubbing Marks were noticed on the fracture surface. Rubbing marks were also noticed on the mounting holes of the head assembly as shown in Figure 19

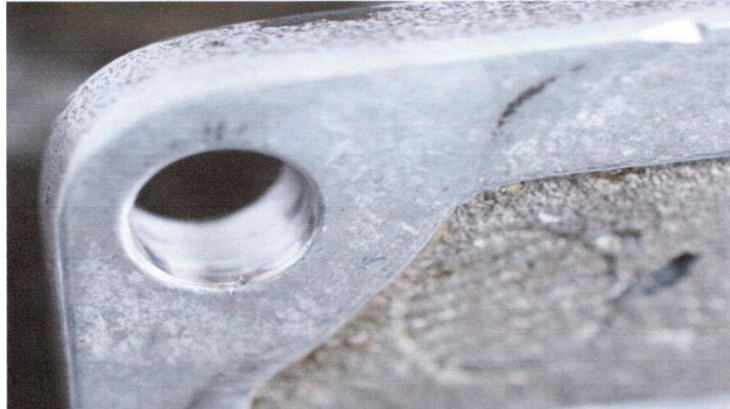


Fig 19: Rubbing marks on mounting holes

b) Bendix Drive:

Only small portion of the gear was available for examination. Rest of the portion could have fallen during take-off or in air, after the gear was broken during engine start-up. Pitting was noticed on the gear flank as shown in Fig 20.



Fig 20: Pitting on the gear

Shaft of the gear was found corroded and slightly bent as shown in Fig 21.

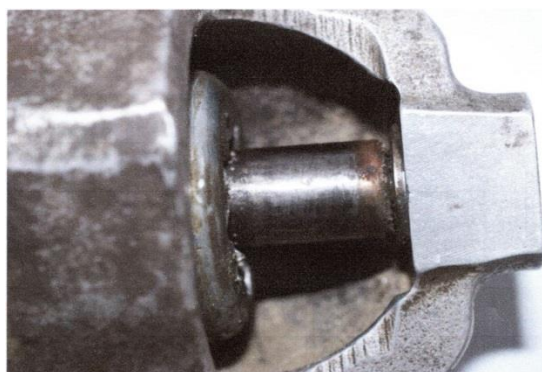


Fig 21: Starter shaft bent and corroded

The presence of light beach marks on the fractured surface and rubbing marks on the holes of head assembly indicated presence of cyclic load due to vibrational stress. Bending of the shaft and signature of corrosion on it indicates that there was some restriction in rotation.

From the above observations, it is inferred that the base of the assembly had cracked due to corrosion fatigue which resulted from fluctuating load caused by vibration.

**1.17 Organizational and Management Information:**

**1.17.1 Falcon Aviation Academy** was established in 2006 and registered with DGCA as a Flying Training Organisation. Academy provides ab-initio training to pilots and it operates from Faizabad airport, Uttar Pradesh.

Falcon Aviation Academy had a fleet of 10 Cessna 152 (including VT-PTD), 02 PA34 aircraft and 01 R44 helicopter registered under private category at the time of accident. Academy has been established primarily to provide integrated flying and ground training to students towards obtaining Flying Licenses, Ratings and other flying qualifications.

The organisation chart of FAA is as given below;

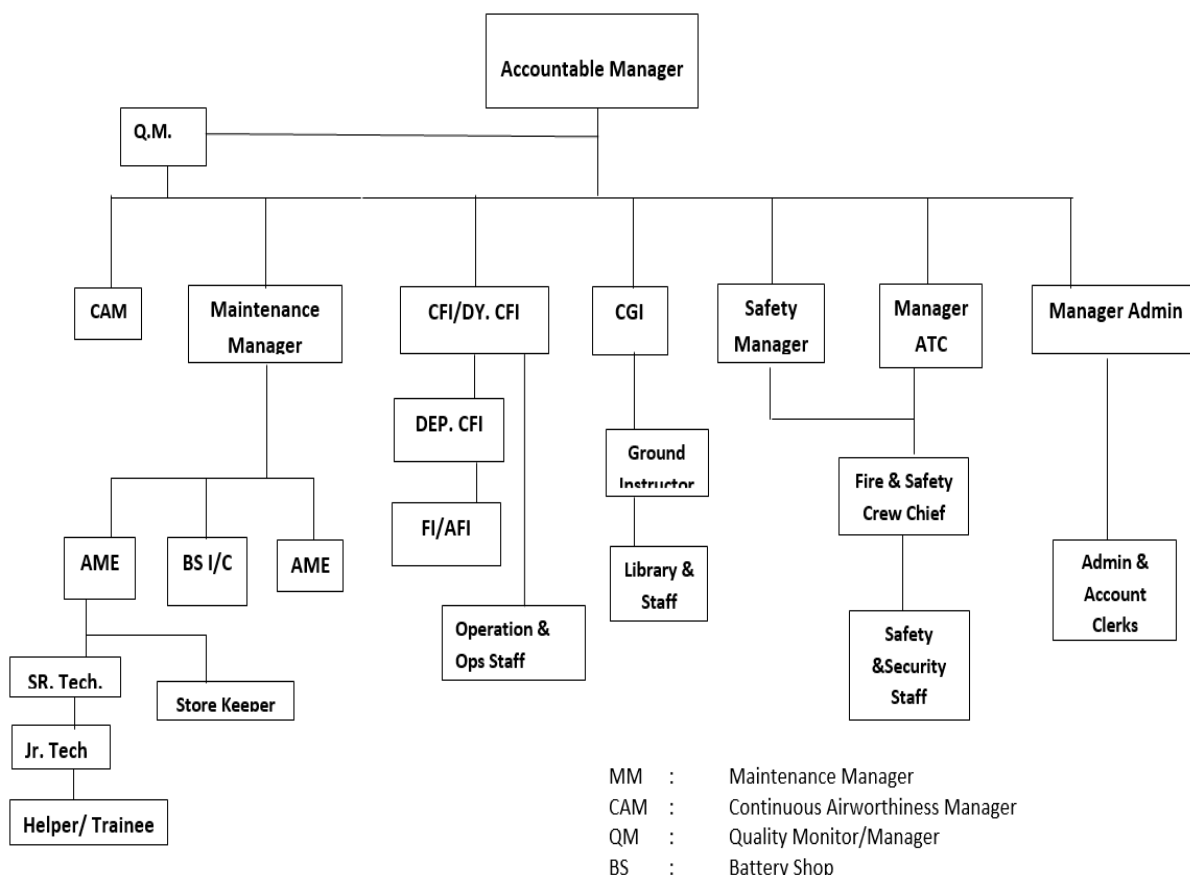


Fig: 22: FAA Organisation Chart



### **1.17.2 Training and Procedures Manual:**

Falcon Aviation Academy's Training and Procedure Manual was approved by DGCA on 03.03.2016. The weather Minima for Instructors and Crew is given in Section 9.4 of the manual and is quoted below.

*“All dual flights are governed by the weather minima specified in DGCA regulations. VFR flight training is carried out when visibility is 5km or above the weather minima. An AFI/PI may operate with special VFR subject to authorisation from CFI/Dy CFI.”*

Details of training exercises to be carried out at Falcon Aviation Academy are given in Section 5 of the Training and Procedure Manual. In para 21 of Section 5.1, following caution is given for practising Engine failure/emergencies during and after Take-off.

*“Caution: During practice, on the recovery, it is essential to avoid slam opening of the throttle: engine failure can occur if this advice is ignored.”*

The Flying Order Book has been maintained as a separate copy for easy reference by Falcon Aviation Academy as per Section 4 of the Training Procedure Manual. Requirement laid for all Instructors and Students to comply with the FOB is quoted below.

*“All members (Instructors and students) of FAA are required to comply with all the orders mentioned in FOB. These rules and regulations are established to encourage a high standard of flying discipline and ensure flight safety. They also lay down procedures for the efficient day to day operation of the Falcon Aviation Academy.*

*All members must read this Flying Order Book and sign to indicate that they have done so upon first joining the FAA and thereafter on an annual basis and when amended”*

Section 6.3 of the FOB gives amplified procedures to be followed for Rough Engine Operation or Loss of Power. Procedure to followed in case of spark plug fouling is quoted as below

*“A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.”*

### **1.17.3 Local Flying Area:**

FAA had obtained NOC for flying training at Faizabad Airport from the Airport Authority of India. As per the conditions of NOC the Local Flying Area for Faizabad Airport is defined as *“within 04NM of ARP at Faizabad Aerodrome with a vertical limit from ground to 1000 feet AGL.”*

### **1.18 Additional Information:**

#### **1.18.1 Pilot Operating Handbook:**

As per Section 3 of Pilot Operating Handbook of Cessna 152, emergency procedure for Rough Engine Operation or Loss of Power is quoted below.

#### ***“ROUGH ENGINE OPERATION OR LOSS OF POWER***

##### ***CARBURETOR ICING***

*A gradual loss of RPM and eventual engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle and pull the carburetor heat knob full out until the engine runs smoothly; then remove carburetor heat and readjust the throttle. If conditions require the continued use of carburetor heat in cruise flight, use the minimum amount of heat necessary to prevent ice from forming and lean the mixture slightly for smoothest engine operation.*

### **SPARK PLUG FOULING**

*A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.*

### **MAGNETO MALFUNCTION**

*A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrich the mixture to determine if continued operation on BOTH magnetos is practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs-*

### **LOW OIL PRESSURE**

*If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in this line will prevent a sudden loss of oil from the engine sump. However, a landing at the nearest airport would be advisable to inspect the source of trouble.*

*If a total loss of oil pressure is accompanied by a rise in oil temperature, there is good reason to suspect an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing field. Use only the minimum power required to reach the desired touchdown spot.”*

### 1.18.2 Fuel and Oil Uplift:

On the day of accident, before commencing the accident sortie, a total of 40 litres of fuel was uplifted and total fuel on board was 90 litres. At the accident site, fuel was drained from the aircraft wings and from the fuel strainer on 27.04.2018 in presence of officer from DGCA and AAIB. Total 45 litres of fuel was collected.

No oil was charged on 26.04.2018. However, 0.8 Qts oil was uplifted a day before after all 4 sorties. Oil was also drained at the accident site and approximately 5.5 litres of oil was collected from the aircraft.

### 1.18.3 Visual Flight Rules:

VFR Operating Minima requirement are given in the DGCA CAR Section 8, Series C, Part I and is shown in the table below.

**10. VFR OPERATING MINIMA**

An operator shall ensure that:

VFR flights are conducted in accordance with the Visual Flight Rules and in accordance with Table 2.

Special VFR flights are not permitted for commercial air transport aeroplanes.

**Table 2: Minimum Visibilities for VFR Operations**

| Altitude Band   | Airspace Class             | Flight Visibility | Distance from Cloud                               |
|---|----------------------------|-------------------|---|
| At or above 3050 m (10000 ft) AMSL  | A <sup>3</sup> B C D E F G | 8 km              | 1500 m horizontally<br>300 m (1000 ft) vertically |
| Below 3050 m (10000 ft) and above 900 m (3000 ft) AMSL, or above 300 m (1000 ft) above terrain, whichever is the higher | A <sup>3</sup> B C D E F G | 5 km              | 1500 m horizontally<br>300 m (1000 ft) vertically |
| At or below 900 m (3000 ft) AMSL, or 300 m (1000 ft) above terrain, whichever is the higher                             | A <sup>3</sup> B C D E     | 5 km              | 1500 m horizontally<br>300 m (1000 ft) vertically |
|   | F G                        | 5 km <sup>2</sup> | Clear of clouds and with the surface in sight     |

Fig 23: Snapshot of CAR Section 8, Series C, Part I

No Special VFR Flights are permitted for commercial aeroplane transport aeroplanes as per the CAR.

### 1.19 Useful or Effective Investigation Techniques:

Nil

## **2 ANALYSIS**

### **2.1 Serviceability of the Aircraft:**

Aircraft VT-PTD (MSN 15285798) had a current Certificate of Airworthiness and ARC valid up to 28.03.2019. The Aircraft held a valid Aero Mobile License which was valid up to 31.05.2019.

The last major inspection undertaken on aircraft and its engines was 200 hrs/12 month and was carried out on aircraft and engine on 18.04.2018, as per the information available from the log book. The aircraft had flown 32 hours after the last major inspection till the date of accident.

During the detailed examination of Engine, it was observed that the Engine had only external damages, which were mainly caused during the forced landing. No internal damage was visible at the time of dismantling. External damage to engine was mainly confined to starter gear and drive gear teeth wherein starter gear was found broken and some drive gear teeth were found damaged. In addition to this, two cracks were observed on starter base at holding positions.

The damaged starter and its broken gear were sent to DGCA Lab for examination and as per the result of examination, the base of the assembly had cracked due to corrosion fatigue which resulted from fluctuating load caused by vibration. The vibrational loads were possibly caused due to bending of shaft and improper engagement with the ring drive. It is evident that the crack had progressed over time and was not result of any impact during the accident.

The blue coloured deposit on piston heads and spark plug electrode was due to non-combustion of fuel in the cylinder. It can be safely presumed that the top spark plugs of Cylinder no.1 and 3 having blue deposit were not firing. Bottom Spark plugs of Cylinder no. 1 and 2 too were in poor condition due to excessive lead deposit on its electrodes.

The yellow coloured deposit observed on piston heads is a sign of lead deposit which is normally observed on engines received for overhaul with approximately 700 to 800 Hrs of running. Spark plugs too were found with high content of lead deposit which was indicating towards lack of maintenance during

scheduled inspections. Quantitatively that amount of deposit could not have accumulated in just 32 Hrs of engine running had 200 hrs inspection been properly carried out on 18.04.2018. Alternatively, such high deposits could also be caused because the aircraft was carrying out maximum of flying at low altitude (in local flying area) with rich mixture.

The accelerating fuel jet nozzle was not installed properly at its position which resulted into improper fuel discharge into the venturi and subsequent improper fuel air mixture composition. The effect would have amplified in case of slam opening of throttle.

The condition of Starter Motor and Spark plugs hinted at poor maintenance practices. The vibrations and loss of power during the accident flight was caused by fouling of the spark plugs. Crew was unable to re-start the engine as the starter gear teeth had broken possibly during last start up on ground.

The serviceability of the aircraft was a factor in the accident.

## **2.2 Crew Qualifications:**

The crew was qualified and authorised to operate the flight. Crew qualification is not a factor in the accident.

## **2.3 Weather:**

Falcon Aviation Academy obtained and recorded weather from Lucknow, Varanasi and Gorakhpur on the day of accident. At 0100 UTC, on the day of accident, visibility of 3500 meters in haze and 10 Kt winds with bearing 120° were reported at 0100 UTC at Faizabad Airport, with no significant change predicted. Visibility of 3000m in haze was reported by Varanasi airport at 0500 UTC and Lucknow Airport at 0530 UTC, with no significant change predicted.

As per CAR Section 8 Series C, Part I, Special VFR operations are not allowed for any commercial air transport aeroplane. However, Special VFR flights subject to authorisation by CFI/Dy. CFI were allowed in the DGCA approved Training and Procedure Manual of Falcon Aviation Academy. The flight was operated under Special VFR as laid in Section 9.4 of the DGCA approved Training and Procedure Manual.

The Manual does not give any reference of any DGCA regulation, under which Special VFR operations can be permitted.

Weather, however, was not a contributory factor in the accident.

#### **2.4 Faizabad Aerodrome:**

Faizabad Aerodrome is operated under private category by M/s Falcon Aviation Academy under a lease agreement with the State Government of Uttar Pradesh. As per the agreement, the responsibility for maintenance and security of the airfield lies with Falcon Aviation Academy.

The airport is primarily utilized by Falcon Aviation Academy to impart flying training to student pilots. The airport is listed in AIC 18 of 1986 issued by DGCA as “a State Government Aerodrome normally maintained in a serviceable condition”. Although no scheduled flights take place, the aerodrome can still be used by civil aircraft subject to prior permission.

The airport premises is not properly secured and stray cattle and wild animals are able to approach the runway. A barbed wire fence installed by the operator was not an adequate deterrent and could be crossed by the cattle and wild animals. The work for a pit to prevent animals from approaching the runway was lying incomplete. The hazards present at airport were not a contributory factor in the accident but could pose a serious threat to flights operating from the Faizabad airport.

#### **2.5 Circumstances Leading to the Accident:**

The aircraft took off from Runway 12 at 0521 UTC for an instrument flying sortie in south sector under the command of Student Pilot. After getting airborne, Flight instructor monitored the engine parameters and flight instruments and no abnormality was noticed. Aircraft attained an altitude of 1000 feet in sector south and crew had planned for GPS assisted 05 NM approach for Runway 12. While the aircraft was on final approach for Runway 12, engine vibrations were felt and loss of power was observed.

As per the FOB, such vibrations and loss of power could be caused by fouling of spark plugs. The Flight Instructor immediately took over the controls

and tried to carry out corrective actions as per the emergency procedures given in the POH. While carrying out emergency procedure, the Engine stopped possibly due to inadvertent “leaning of fuel mixture” or “slam opening of throttle”. Efforts were made to restart the engine but as the starter gear teeth had broken during the last start up prior to take-off, the engine could not be restarted.

As per statement of crew, the aircraft was about 5 NM away from the airstrip and losing height. The crew decided to go in for forced landing and diverted the aircraft towards Saryu river bed which was about 01 NM away. Aircraft touched the river bed on its rear wheels and rolled for more than 200 feet before the nose wheel also touched the ground. As the aircraft weight fell on wheels, the nose wheel sank into the soft sand causing pileup of sand which lead to toppling of the aircraft. Both crew managed to evacuate themselves from the aircraft and suffered no injuries. There was no post impact fire.

### **3 CONCLUSIONS**

#### **3.1 Findings**

- 1) Aircraft had a valid Certificate of Airworthiness. As per aircraft and engine log books, the last major inspection (200 Hrs) was carried on 18.04.2018.
- 2) There were no pending or deferred snags on the aircraft before the accident flight. Engine parameters were checked and found satisfactory during the previous sortie as per the Flight Record Book.
- 3) Spark Plugs were found in poor condition during the detailed engine examination and the starter teeth were found broken. Crack was found on the body of starter as well.
- 4) Condition of engine and its accessories observed during the detailed examination, hinted at possibility of certification being done without carrying out the actual maintenance.
- 5) Fuel accelerating jet nozzle was fitted improperly in the last overhaul.
- 6) Both crew were qualified and authorised to operate the flight.



- 7) On day of accident, visibility of 3500 meters in haze and 10 Kt winds with bearing 120° were reported at 0100 UTC at Faizabad Airport, with no significant change predicted. Visibility of 3000m in haze was reported by Varanasi airport at 0500 UTC and Lucknow Airport at 0530 UTC, with no significant change predicted. The flight was operated under Special VFR.
- 8) The Local Flying Area for Faizabad Airport is defined as 1000 Feet, 04NM from the ARP.
- 9) Training Exercise for GPS assisted 05 NM approach to Runway 12 was planned during the accident flight, however no flight plan was filed by the operator.
- 10) The engine vibration and loss of power was caused by “fouling of spark plugs”
- 11) Instructor took over the controls and carried out emergency procedure as per POH. While the crew was carrying out POH prescribed procedure, the engine stopped.
- 12) Crew attempted to restart the engine, but the engine did not start as the Starter gear teeth had failed. Thereafter, crew decided to ‘forceland’.
- 13) The aircraft landed on the river bed with rear wheel touching the ground first. As the lift dropped and aircraft weight started coming on wheels. And as the nose wheel touched the ground and it started sinking in the sand which caused the aircraft to topple.
- 14) Aircraft rolled for a distance of approximately 213 feet on ground before toppling.
- 15) From the quantity of fuel and oil drained from the aircraft at the accident site, it is evident that sufficient quantity of fuel and oil was available in the aircraft for operating the flight.
- 16) No fire was reported on aircraft and crew suffered no injuries in the accident.

### **3.2 Probable Cause of the Accident:**

The accident was probably caused by inadvertent “Leaning of Mixture” or “Slam opening of the Throttle”, while following the emergency procedure for Rough Engine Operations or Loss of power due to Spark Plug Fouling.

Poor Maintenance practices, broken gear of the starter motor and improperly installed fuel jet nozzle were contributory factors.

### **4. Safety Recommendations:**

**4.1.** Operator should reiterate the importance of caution, mentioned in the TPM related to “slam opening of throttle” to all its Instructors and Trainees.

**4.2.** Operator should ensure that it’s AMEs carry out all maintenance on aircraft meticulously.

**4.3.** Operator should ensure that the observation regarding fuel accelerating jet nozzle is communicated to the organisation carrying out the engine overhaul

**4.4.** Operator should ensure that runway is secured from incursion of wildlife.

**4.5.** DGCA should audit the maintenance practices of Falcon Aviation Academy.

**4.6.** DGCA should ensure that the relevant regulations are quoted in the Training and Procedure Manual of all Flying Training Organisations, where ever Special VFR operations are being permitted.



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Dinesh Kumar  
Investigator

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Place : New Delhi